MONITORING OF MARINE MAMMALS IN HONG KONG WATERS (2018-19)

FINAL REPORT
(1 April 2018 to 31 March 2019)

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

A longitudinal study on Chinese White Dolphins and Indo-Pacific finless porpoises has been conducted in Hong Kong since 1995. The present monitoring study represents a continuation of this long-term research study with the funding support from the Agriculture, Fisheries and Conservation Department of the Hong Kong SAR Government, covering the period of April 2018 to March 2019.

During the one-year study period, 192 line-transect vessel surveys with 6,055.6 km of survey effort were conducted among ten survey areas in Hong Kong. In total, 150 groups of 451 Chinese White Dolphins and 101 groups of 269 finless porpoises were sighted during vessel and helicopter surveys. In 2018-19, the dolphins were sighted frequently along the west coast of Lantau Island, but only to a moderate extent to the north and a lesser extent to the south of Lantau. On the other hand, the majority of porpoise sightings in 2018-19 were concentrated in South Lantau waters, especially around Tai A Chau, and between Shek Kwu Chau and the Soko Islands.

In 2018, the important dolphin habitats were mostly concentrated along the West Lantau coastline, mainly stretching from Tai O Peninsula toward Fan Lau, with the highest densities occurring near Kai Kung Shan, Peaked Hill and Fan Lau. In the past eight years, dolphin usage varied in West Lantau and Southwest Lantau waters, with higher densities recorded in 2014-15 but then followed by a decline in subsequent years. In the North Lantau region, dolphin occurrence has greatly diminished in recent years, and has been largely confined to the area around Lung Kwu Chau in the past three years, with no sign of recovery after the completion of Hong Kong-Zhuhai-Macau Bridge construction works.

For finless porpoises, their most heavily utilized habitats in 2018 were located a few kilometers to the east of Soko Islands, while moderate porpoise densities were also recorded near the southwest corner of Cheung Chau, around Tai A Chau and to the southwest of Lamma Island. Even though Shek Kwu Chau waters have been consistently identified as critical porpoise habitat in the past decade, their usage has sharply dropped to a very low level in 2018.

In 2018, the combined estimate of dolphin abundance in Hong Kong waters in the four main survey areas of dolphin occurrences (i.e. Southwest Lantau, West Lantau, Northwest Lantau and Northeast Lantau) was 32, the lowest number ever recorded (the combined estimates for the last seven years, i.e. 2011 to 2017, were 88,

80, 73, 87, 65, 47 and 47, respectively). Analysis of data from the last decade showed that significant declines in dolphin abundances were detected in each of the three survey areas in Northeast Lantau, Northwest Lantau and West Lantau, as well as the combined abundance from the four main areas of dolphin occurrences. Other notable observations from the vessel survey results in 2018 included the very low mean dolphin group size in Northwest Lantau, the lowest level of dolphin calf occurrence, and the lowest percentage of socializing activities recorded since 2002.

In 2018-19, 128 individual dolphins with 296 re-sightings were identified, and two-thirds of all re-sightings (including those from HZMB surveys) were made in West Lantau waters. A total of 125 new individuals have been added to the photo-ID catalogue, with the majority of them being contributed from surveys conducted across the border in Lingding Bay. Fifteen individuals that were frequently sighted in Hong Kong waters in the past disappeared in 2018, but four of them have been re-sighted across the border during the same year. Continuous monitoring in Mainland waters and collaborative studies on dolphins of the Pearl River Estuary would allow a better understanding on their spatial dynamics in a regional perspective. Steady decline in dolphin movements across West and Southwest Lantau survey areas, and across Northwest and West Lantau survey areas were evident in recent years.

Changes in the utilization pattern of Hong Kong waters by individual dolphins, as detected in the past three monitoring periods, were noted upon analysis of their range use. Out of the 59 individuals from the northern social cluster, 44 of them have shifted part or all of their ranges from North Lantau to West and Southwest Lantau waters. However, 29 of them have apparently reversed such shifts in 2017 and 2018, albeit with a much lower level of occurrence in North Lantau waters in these two years. For the southern social cluster, 60% of the 55 individuals examined have utilized Southwest Lantau waters progressively more in recent years. Even though a number of individuals have shown clear range expansions or shifts from West Lantau to Southwest Lantau waters several years ago, some of them have reversed such expansions and shifts in 2017 and 2018.

During the 2018-19 monitoring period, HKCRP researchers delivered 16 education seminars at local schools regarding the conservation of local dolphins and porpoises. Through this integrated approach of long-term research and publicity programme, the Hong Kong public can gain first-hand information from researchers.

行政摘要 (中文翻譯)

自 1995 年開始，一項有關本地中華白海豚及印度太平洋江豚的長期研究經已展開。此項為期一年 (由 2018 年 4 月至 2019 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 192 次樣條線船上調查，在全港十個調查區共航行了 6,055.6 公里，並觀察到共 150 群中華白海豚 (總數達 451 隻) 及 101 群江豚 (總數達 269 隻)。在 2018-19 年間，中華白海豚主要在大嶼山西面水域一帶出沒，在北面及南面的出沒卻只屬中度及偏低的水平。另一方面，江豚的目擊記錄主要集中於大嶼山南面水域，其中尤以大鴉洲附近、及石鼓洲與索罟群島之間水域的出沒最為頻繁。

中華白海豚在 2018 年的重要棲身地，主要集中在沿大嶼山西面、即由大澳半島伸延至分流的近岸水域，當中近雞公山、雞翼角及分流附近水域的海豚密度為最高。在過去八年，海豚在大嶼山西面及西南面水域之棲息地運用的變化較大，其使用量在 2014-15 年間達最高水平，但在隨後數年卻逐步減少。在北大嶼山水域，海豚於近年的使用率大幅下降，在過去三年只集中使用龍鼓洲一帶水域；在港珠澳大橋海上工程竣工後，並未有任何回復數年前較高使用量的跡象。

此外，江豚在 2018 年錄得最高使用量的棲身地，位處於索罟群島以東數公里外的海域，而長洲西南角、大鴉洲附近及南丫島西南面水域亦錄得中度使用量。在過去十年期間，石鼓洲附近水域一直被視為江豚最重要的生境，但牠們於 2018 年在該水域的使用量，卻大幅下降至很低的水平。

在 2018 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 32 隻 (2011 至 17 年的年度數目分別為 88、80、73、87、65、47 及 47 隻)。分析過去十多年所收集的數據顯示，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，亦錄得明顯下降趨勢。此外，由船上調查搜集的各項數據，其中數項值得特別關注，包括自 2002 年以來、2018 年在北大嶼山區域錄得最低的海豚群體平均數；而幼豚出沒比率及海豚進行社交活動的目擊比率，2018 年均為多年來的最低水平。

於 2018-19 年間，研究員辨認出 128 隻個別海豚、共 296 次的目擊紀錄，其中三分之二均出現在大嶼山西面水域；共有 125 隻新的個別海豚亦於此年間被加入相片辨認名錄，當中絕大部份是在伶仃洋水域被首次發現。過去一些經常出沒於香港水域的海豚個體，共有十五隻於 2018 年不見所蹤，但其中四隻卻在伶仃

洋出現。國內水域的持續監察及珠江口中華白海豚的合作研究有助進一步了解牠們於整個區域的空間動態。於大嶼山西面及西南面調查區之間、及於大嶼山西北面及西面調查區之間移動的個別海豚，其數量亦於近數年持續下降。

在過去三個監察報告中發現的本港水域內的海豚使用模式有所改變，亦再次透過分析個別海豚活動範圍而顯示出來。59 隻屬北大嶼山社群的海豚當中，44 隻個體曾將部份及整個活動範圍由大嶼山北面水域轉移至西面及西南面水域，但於 2017 及 2018 年，卻有 29 隻個體的活動範圍轉移出現逆轉，牠們並再次回到大嶼山北面水域生活，但在該水域出現的頻率已大不如前。此外，55 隻屬南面社群的海豚中，共六成的個體近年逐漸增加使用大嶼山西南面水域；雖然曾有不少海豚於過去數年明顯地由大嶼山西面的活動範圍擴張至西南面水域，但到了 2017 及 2018 年，部份個體活動範圍的擴張亦已同樣出現逆轉。

在本年度，研究員為本地中小學主持了共十六場講座，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

Since 1995, the Hong Kong Cetacean Research Project (HKCRP) has been conducting a longitudinal study on Chinese White Dolphins (also known as the Indo-Pacific humpback dolphin, *Sousa chinensis*) and Indo-Pacific finless porpoises (*Neophocaena phocaenoides*) in Hong Kong and the Pearl River Delta region. Such multi-disciplinary research study has been primarily funded by the Agriculture, Fisheries and Conservation Department (AFCD) as well as various government departments, 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, 2017, 2018; Jefferson et al. 2002, 2009, 2012).

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 was to collect systematic data for assessment of the distribution and abundance of Chinese White Dolphins and Indo-Pacific finless porpoises in Hong Kong, to take photographic records of individual dolphins, and to analyze the marine mammal monitoring data for better understanding of the various aspects of local dolphin and porpoise populations. The one-year project covers the period of 1 April 2018 to 31 March 2019. This revised draft final report is submitted to AFCD for the monitoring project, covering the entire one-year study period.

2. OBJECTIVES OF PRESENT STUDY

As a continuation of the previous marine mammal monitoring works commissioned by AFCD, 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 Chinese White Dolphins and Indo-Pacific finless porpoises 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 Chinese White Dolphins and Indo-Pacific finless porpoises 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 Chinese White Dolphins by their natural markings using photo-identification technique. This objective was achieved by taking high-quality photographic records of Chinese White Dolphins 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 finless porpoises 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 Chinese White Dolphins and finless porpoises 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 Chinese White Dolphins 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 Chinese White Dolphins for photo-identification analysis and update the photo-identification catalogue;

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

- to take photographic records of finless porpoises; 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 22 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (Hung 2005, 2018; 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), Lamma (LM), Po Toi (PT), Ninepins (NP) and Sai Kung (SK)) (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 through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea ahead of the vessel, between 270^{o} and 90^{o} (in relation to the bow, which is defined as 0^{o}). One to two additional experienced observers were available on 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 10*). 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 Chinese White Dolphins and finless porpoises in Hong Kong waters.

4.2. Helicopter Survey

Several helicopter surveys arranged by the Government Flying Service (GFS)

through AFCD were conducted during the study 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 Chinese White Dolphins and finless porpoises, 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 Chinese White Dolphins 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 may not be symmetrical. One to 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 over 950 identified dolphins in the PRE Chinese White Dolphin 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 computer database. Any new individuals were given a new identification number, and their data were also added to the catalogue, along with 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 was 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 details. 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 activities. Data from the long-term sighting databases were used to compare past distribution patterns of dolphins and porpoises in recent years to the one in 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 Chinese White Dolphins and finless porpoises (number of on-effort sightings per 100 km of survey effort) were calculated in each survey area in relation to the amount of survey effort conducted. The encounter rate could be used as an indicator to determine areas of importance to dolphins and porpoises within the study area.

4.4.3. Line-transect analysis

Density and abundance of Chinese White Dolphins were estimated by line-transect analysis using systematic line-transect vessel survey data collected under the present study. For the analysis, survey effort in each single survey day was used as the sample. Estimates were calculated from dolphin sightings and effort data collected during conditions of Beaufort 0-3 (see Jefferson 2000a), 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:

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

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

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

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. The model with the lowest values of Akaike's Information Criterion (AIC) was chosen as the best model and used to estimate f(0) and the resulting dolphin density and abundance (Buckland et al. 2001).

Besides estimating dolphin abundance for the four main areas of dolphin occurrences in 2018, 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 Chinese White Dolphins and finless porpoises 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 on each grid was calculated by examining the survey coverage on each line-transect survey to determine how many times the grid was surveyed during the study period. For example, when the survey boat traversed through a specific grid 50 times, 50 units of survey effort were counted for that grid. With the amount of survey effort calculated for each grid, the sighting density and dolphin/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 **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 can be useful in examining 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 2018 for both dolphins and porpoises, and in the past five years of monitoring (i.e. 2014-18) for finless porpoises.

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 on sighting datasheets. This 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.

4.4.6. Ranging pattern analysis

For the examination of individual ranging patterns, location data of identified dolphins with 10 or more re-sightings that were 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 with ArcView© 3.1 along with another extension Spatial Analyst 2.0. Using the fixed kernel method, the program calculated kernel density estimates based on all sighting positions, and provided an active interface to display kernel density plots. The kernel estimator then calculated and displayed the overall ranging area at 95% UD (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. 2007-2018), 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 2018-19 monitoring period (i.e. April 2018 to March 2019), a total of 192 line-transect vessel surveys were conducted among ten survey areas in Hong Kong waters. These included 18 surveys in DB, 19 surveys in NEL, 19 surveys in NWL, 33 surveys in WL, 39 surveys in SWL, 34 surveys in SEL, 14 surveys in LM, eight surveys in PT, six surveys in NP and two surveys in SK. The details of these survey effort data collected are presented in Appendix I.

As in recent monitoring periods, more survey effort were allocated to survey areas outside of North and West Lantau waters during the 2018-19 monitoring period, since additional surveys have been conducted in NWL, NEL and WL survey areas concurrently under the Hong Kong Link Road (HKLR) and Hong Kong Boundary Crossing Facilities (HKBCF) 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 survey methodology, HKCRP personnel and research vessels to ensure consistency and full compatibility with the AFCD long-term dolphin 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.

In addition, four helicopter surveys were conducted with the Government Flying Services through the arrangement of AFCD on June 20th, August 8th, October 3rd and December 3rd of 2018. These surveys mainly covered the eastern and southern waters of Hong Kong, and such off-effort data on local dolphins and porpoises collected from these surveys were also included in the distribution analysis and group size analysis.

Among the ten survey areas, a total of 638.5 hours were spent to collect 6,055.6 km of survey effort during the AFCD vessel line-transect surveys from April 2018 to March 2019. Seventy percent of total survey effort was conducted among six areas where dolphins occurred regularly in the past, which included 19.4% in NEL/NWL, 8.7% in WL, 36.1% in SWL/SEL and 5.6% in DB. On the other hand, 66.3% of total survey effort was allocated to survey areas in southern and eastern waters of Hong Kong (i.e. SWL, SEL, LM, PT, NP and SK) where porpoises regularly occurred in the past. It should be mentioned that 95.7% 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, a total of 5,541.6 km of survey effort was also conducted in NEL, NWL and WL under the HZMB-related EM&A dolphin monitoring surveys. This brings the total survey effort to 11,597.2 km for the combined dataset from AFCD and HZMB-related surveys among the four survey areas. Over 90% 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 a total of 230,895 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 46.1% of the total effort funded by AFCD. The survey effort in 2018 alone comprised 7.6% of the total survey effort collected since 1996.

5.1.2. Marine mammal sightings

Chinese White Dolphin - From the AFCD monitoring surveys alone, 150 groups of 451 Chinese White Dolphins were sighted from April 2018 to March 2019 (see Appendix II). And with the additional sightings contributed from various HZMB-related EM&A surveys, a total of 296 groups of 928 dolphins were sighted altogether during the same 12-month period. Among them, 247 were sighted during on-effort line-transect vessel surveys, while the rest were made during off-effort search.

During the 2018-19 monitoring period, the majority of dolphin sightings were made in WL (184 sightings), NWL (65) and SWL survey areas (38), comprising 97.0% of the total. In contrast, dolphins rarely occurred in SEL and DB survey areas with only four sightings each. One exceptionally rare sighting of a lone dolphin was also made in the Port Shelter of Sai Kung Peninsula, and this was one of the very few opportunistic dolphin sightings made in eastern waters of Hong Kong in the past two decades. Furthermore, despite the large amount of survey effort being conducted in NEL survey area, no sighting was made at all from the combined dataset during the entire 2018-19 monitoring period. As in previous monitoring periods, no dolphin was sighted at all in LM, PT or NP survey areas, where porpoises primarily occur there on a regular basis.

Finless porpoise – A total of 101 groups of 269 finless porpoises were sighted from vessel surveys during the monitoring period (see Appendix III). A total of 88 porpoise sightings 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 SEL (with 55 groups), SWL (22) and LM survey areas (16). In contrast, porpoises were rarely sighted in PT (with five groups), NP (1) and SK waters (2). Notably, over 75% of the porpoise sightings were made during the dry season (winter and spring months), while only 15 and 10 sightings were made in summer and autumn months respectively.

Even though no porpoise was sighted in DB, NWL, NEL and WL survey areas where dolphins regularly occurred in the past, there have been some surprising findings from the recent passive acoustic monitoring (PAM) studies also funded by AFCD, which revealed the rare presence of porpoises in West and Northwest Lantau waters. For example, the 2017-18 PAM study found that there were interesting unexpected detections of very low levels of possible finless porpoise activities at the sites of Tai Mo To and Lung Kwu Chau in North Lantau region during November to January (Wang and Hung 2018). Furthermore, preliminary results from the 2018-19 PAM study also detected porpoise presence unexpectedly at Peaked Hill in WL, even though they have never been sighted to the north of Fan Lau in more than two decades of visual surveys (AFCD unpublished data). However, at this time it is not 100% certain that the source of these clicks that were automatically classified as finless porpoises were indeed produced by porpoises, as the source could be from Chinese White Dolphins but misclassified by the classification algorithm (Wang and Hung 2018). It should also be reminded that even if these detections were finless porpoises, such rare events may have little biological significance. Nevertheless,

continued monitoring is needed before conclusions can be made about the occurrence of porpoises in these waters that have long been considered as areas that porpoises would not utilize.

5.1.3. Photo-identification of individual dolphins

From the 12-month monitoring period, over 19,000 digital photographs of Chinese White Dolphins 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. Significant amount of photo-identification data were also contributed from the HZMB-related surveys during the same 12-month period.

Up to January 2019, a total of 1,083 individual Chinese White Dolphins have been identified by HKCRP researchers in Hong Kong waters and the rest of the Pearl River Estuary. These included five newly identified individuals from Hong Kong waters, and another 120 newly identified individuals from Lingding Bay (from photo-identification data contributed by the South China Sea Fisheries Research Institute) being added to the catalogue in 2018. Currently, the catalogue contained 564 individuals being first identified within Hong Kong territorial and another 519 individuals being first identified in Guangdong waters of the Pearl River Estuary.

The catalogue summary revealed that 308 individuals have been seen 10 times or more; 239 individuals have been seen 15 times or more; 143 individuals have been seen 30 times or more; and 95 individuals have been seen 50 times or more. In contrast, 42.2% of the identified individuals have only been seen once or twice, with most of these being first identified in Guangdong waters (337 out of 457 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 have shown good progress being made in photo-identification works during the 2018-19 monitoring period (Figure 3).

Between April 2018 and March 2019, a total of 128 individual dolphins, sighted 296 times altogether, were identified during AFCD regular vessel surveys (Appendix IV). In addition, 138 individuals were identified 334 times from HZMB-related monitoring surveys in NWL and WL during the same 12-month period. About

two-third of the re-sightings of individual dolphins made during AFCD/HZMB surveys were in WL survey area, comprising 67.3% of the total, while re-sightings were also made regularly in NWL (18.9%) and SWL (11.7%) survey areas. In contrast, only eight re-sightings of six individuals were made in DB survey area, while four re-sightings of the same individual (NL306) were made in SEL survey area (Appendix IV).

Notably, a very rare incident occurred during the 2018-19 monitoring period, with a dolphin being reportedly sighted in Port Shelter of Sai Kung Peninsula on October 28th, 2018. AFCD was able to confirm the sighting on the subsequent day with photographic records, and the individual was identified as a known individual (CH27) by HKCRP researchers. However, the dolphin has disappeared in the following weeks, and has not been sighted in Port Shelter or elsewhere since then. Besides this extremely rare sighting, the last dolphin occurrence in Port Shelter can be traced back to 2000, when a lone dolphin (CH65) was sighted in Hebe Haven for about ten months.

Among the 170 identified individuals from the AFCD/HZMB combined dataset, most of them were re-sighted only a few times, but some have been repeatedly re-sighted, indicating their strong reliance of Hong Kong as an important part of their home range. For example, 48 individuals were re-sighted five times or more, while nine individuals were re-sighted ten times or more from the combined dataset during the relatively short study period. Notably, most of these repeatedly-sighted individuals are considered year-round residents from their pattern of occurrences (see Section 5.7.1).

A total of 19 individuals were sighted with their calves during the 2018-19 monitoring period, and some of these calves are actually in their juvenile stage that have already been identified as individuals in the photo-ID catalogue (e.g. the mother calf pairs of NL33-NL233 and WL28-WL288). The mothers that were re-sighted with their young calves (i.e. unspotted calf or unspotted juvenile) will be closely monitored, as their survival would be critical for the long-term viability of the dolphin population, especially in light of the dramatic decline in calf occurrence in recent years (see Section 5.4.2).

As in recent monitoring periods, a number of residents that were frequently sighted previously in Hong Kong waters have disappeared in 2018. For example, WL62 and WL173 were sighted 60 and 61 times respectively during the five-year

period of 2013-17 (including 14 and 12 re-sightings in 2017, respectively), but both individuals have abruptly disappeared in 2018 as well as in the first three months of 2019. Moreover, the mother-calf pair of NL264 and NL288 has also been sighted repeatedly in North and West Lantau waters since 2012, but both have disappeared in 2018. In total, 15 frequently sighted individuals in the past have disappeared in 2018 as well as in the first three months of 2019. Interestingly, four of them have been sighted across the border in Lingding Bay in 2018 during the surveys conducted by the South China Sea Fisheries Research Institute, so they may have temporarily or permanently shifted their range use away from Hong Kong waters into neighbouring waters. This demonstrates the importance of monitoring surveys to be conducted in the entire Pearl River Estuary, as this would not only provide information on cross-boundary movements of individual dolphins, but could also confirm if an individual that has disappeared from Hong Kong is still alive across the border.

5.2. Distribution

5.2.1 Distribution of Chinese White Dolphins

During the 2018-19 monitoring period, Chinese White Dolphins were sighted frequently along the west coast of Lantau Island, but only to a moderate extent to the north and a lesser extent to the south of Lantau (Figures 4-5). In 2018 alone, from the combined effort from AFCD and HZMB-related surveys, their occurrence mainly clustered at the northwestern section of North Lantau region, with a higher concentration around Lung Kwu Chau (Figure 6). In North Lantau waters, a number of dolphin sightings were also made near Black Point, at the mouth of Deep Bay, around Sha Chau, to the west of Chek Lap Kok Airport and near the HKLR alignment. Rare sightings were also made near Pillar Point, to the northwest of Chek Lap Kok Airport (or to the east of the third runway system (3RS) work zone), and near Siu Ho Wan to the south of the Brothers Islands (Figure 6). Apart from these sightings, dolphins were generally absent from the central and eastern portions of North Lantau region, including most of the peripheral area of the 3RS work zone, the man-made island for HKBCF, as well as the entire alignment of Tuen Mun-Chek Lap Kok Link (TMCLKL). In Deep Bay, the sightings were only located at the western end of the survey area, while dolphins appeared to avoid this area for the most part in 2018 (Figure 6).

Even though there was only one extremely rare sighting (a group of five dolphins) made in NEL during a February's HKLR survey during the entire year of 2018, some supplementary information from AFCD's passive acoustic monitoring study have revealed that dolphins have not entirely abandoned this area (especially around the

Brothers Islands where the C-POD units have been deployed) in recent years. Such acoustic study conducted since mid-2017 revealed that there have been on-going detections of Chinese White Dolphins within the Brothers Marine Park, albeit at very low levels (Wang and Hung 2018). Moreover, a few recent sightings of dolphins in this area made in December 2017 near Tai Mo To and February 2018 near Siu Ho Wan during visual surveys corroborated the low level of acoustic detections of dolphins by the C-POD units in this area. Notably, there was a strong diel pattern with significantly more dolphin detections at night than during the day within the Brothers Marine Park, with the lowest detections between 08:00 and 14:00 there (Wang and Hung 2018). Certainly, the night-time usage by dolphins of this once-important habitat should not be overlooked, and the PAM study results have filled an important data gap to detect dolphin occurrence within this marine park, especially when dolphin sightings have been extremely rare there during daylight hours.

In WL waters, the occurrences of dolphins were much more frequent throughout the region, with a higher concentration near Tai O Peninsula, Kai Kung Shan, Peaked Hill and Fan Lau Peninsula (Figure 7). Dolphins also occurred regularly along the western territorial border, while they were less frequently sighted at the northern end (i.e. to the north of HKLR alignment) and the southern end (overlapping with the high-speed ferry route) of the survey area (Figure 7). Furthermore, their frequent occurrences at Fan Lau Peninsula extended into SWL survey area. But for the rest of South Lantau region, the dolphins only occurred in a moderate extent near Kau Ling Chung, Shui Hau Peninsula and between the Soko Islands, while they were mostly absent to the west, south and east of Soko Islands as well as the inshore waters near Shek Pik (Figure 7). They also seldom occurred in SEL waters, with only a handful of sightings made in the coastal waters of Pui O Wan and Chi Ma Wan Peninsula.

<u>Temporal change in annual distribution patterns (2013-18)</u>

Using AFCD survey data alone, dolphin distribution patterns in the previous five years (i.e. 2013-17) were compared with the one in 2018 to determine if there were any notable changes in dolphin usage around Lantau waters. Among the different regions around Lantau waters, the coastal waters to the west of the island have been the only area where there were consistent and frequent occurrences of dolphins throughout the six-year period (Figure 8). This highlights the urgent need for protection of this remaining important dolphin habitat in Hong Kong, in light of the continuous development pressure and habitat degradation in North Lantau waters.

As mentioned in previous monitoring reports (Hung 2017, 2018), there has been a dramatic decline in dolphin occurrence in NEL since 2012 when dolphins still frequently occurred in this area (especially around the Brothers Islands). Such greatly diminished usage to complete absence of dolphins in NEL waters continued in 2018, as no dolphin was sighted there in the past four consecutive years during AFCD surveys (Figure 8). Such a significant decline in dolphin usage in NEL waters has been strongly linked to the construction works of HZMB and increase in high-speed ferry traffic to/from the Sky Pier as reported in previous monitoring periods (Hung 2016, 2017). Unfortunately, there was still no sign of recovery even though the marine works for the HZMB was completed in 2017. The lack of recovery in dolphins usage in this once-important dolphin habitat could also be related to the persistent disturbance of construction works in the nearby massive reclamation project for the 3RS works since 2016, and such disturbance will continue at least for several years which may continue to affect the potential recovery of dolphin usage in NEL waters.

The dramatic decline in dolphin usage of NWL waters since 2014 as reported in previous monitoring periods (see Hung 2017, 2018) has continued, but after reaching the lowest point in 2016, there have been slight rebounds in both 2017 and 2018 (Figure 8). Nevertheless, their infrequent occurrence in North Lantau waters in the past two years was still largely confined to the northwestern portion of NWL waters, the waters farthest away from the disturbance, and it remains to be seen whether the 3RS construction works with 650 hectares of habitat loss for the dolphins will continue to limit the occurrence of dolphins in this survey area as well as for the entire North Lantau region. In addition, dolphin occurrence adjacent to the HKLR alignment has been consistently low since 2013, as compared to their frequent occurrence before the bridge construction. Continuous monitoring would be critically needed to examine whether there is any sign of recovery of dolphin movement across the bridge alignment.

After a strong surge of dolphin usage in SWL waters for several years and reaching the highest level in 2015, their occurrence in this region has been declining gradually in the past few years to the lowest extent in 2018 (Figure 8). As reported in previous monitoring periods, individual dolphins have been extending their range use from WL to SWL waters as the bridge construction works have resulted in individual range shift in recent years (Hung 2016, 2017). The range shift and extension of individual dolphins is further examined in Section 5.7.3.

5.2.2. Distribution of finless porpoises

From April 2018 to March 2019, the majority of finless porpoise sightings were concentrated in South Lantau waters, especially around Tai A Chau, and between Shek Kwu Chau and the Soko Islands. Some porpoise groups were also sighted to the north and south of Shek Kwu Chau within Pui O Wan, and to the southeast of Cheung Chau. Other sightings were scarcely distributed to the southwest of Lamma Island, near Po Toi Islands, and the eastern offshore waters to the east of Po Toi Islands and Sai Kung Peninsula (Figure 9). They were generally absent from the western portion of South Lantau waters, to the south and east of Lamma Island, as well as in the Ninepins survey area.

Examination of temporal changes in porpoise distribution the past four years (2015-18) revealed that the waters between the Soko Islands and Shek Kwu Chau has been consistently and frequently used by porpoises in recent years, which should constitute the most important habitats for porpoises in Hong Kong (Figure 10). However, a closer examination on habitat use pattern (see Section 5.3.2) would reveal that porpoise usage around Shek Kwu Chau has been greatly diminished in 2018, and such change could be related to the recent reclamation works in association with the construction of the Integrated Waste Management Facilities.

Moreover, porpoises occurred to the south of Cheung Chau frequently in 2015 and 2016, but such occurrences have noticeably diminished in 2017 and 2018 (Figure 10). It is also noted that the porpoise occurrence in Lamma waters remained at low levels throughout the four-year period, even though this area (especially between Cheung Chau and Lamma Island) was once frequently visited by porpoises in winter and spring months (Hung 2005, 2008). Furthermore, porpoise occurrence in the eastern waters (especially around the Po Toi Islands) in 2018 was much more infrequent than the previous three years (Figure 10), despite more survey effort has been allocated to the eastern survey areas in recent years.

5.3. Habitat Use

5.3.1. Habitat use patterns of Chinese White Dolphins

The habitat use patterns of Chinese White Dolphins 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 2018. Such pattern is also compared to the annual patterns in the past six years.

In 2018, the majority of grids with high dolphin densities were concentrated along the WL coastline, mainly stretching from Tai O Peninsula toward Fan Lau, with the highest densities occurred near Kai Kung Shan, Peaked Hill and Fan Lau (Figure 11). Two grids on both sides of Lung Kwu Chau in NWL also recorded moderate dolphin densities, but only low to very low dolphin densities were recorded for the rest of North Lantau waters (including Deep Bay) and the entire South Lantau waters (Figure 11).

Temporal changes in dolphin habitat use patterns (2011-18)

A comparison was made among the habitat use patterns in the past eight years to examine the recent temporal changes in dolphin densities at their various important habitats in western waters of Hong Kong. In WL, dolphin habitat use has varied during the eight-year period, with high densities recorded in most grids in 2011, 2013-15. However, dolphin densities appeared to have progressively diminished in most parts of the WL survey area in 2016 and 2017, but there was a slight rebound in 2018 (Figure 12). Moreover, dolphin usage in the northern portion that overlapped with the HKLR09 alignment was consistently lower in recent years of 2015-17 when compared to the earlier years before HKLR construction, although their usage appeared to bounce back in 2018 (Figure 12).

In SWL waters, when compared to the earlier years (2011-13), dolphin usage was higher among many grids in 2014-15, and was more evenly spread in 2014-17. However, most grids in SWL only recorded low to moderate dolphin densities during the three consecutive years of 2016-18, which was in stark contrast to the habitat use patterns in 2014-15 when many grids recorded high to very high dolphin densities (Figure 12).

The temporal changes in dolphin habitat use pattern were even more prominent in the North Lantau region, with greatly diminished dolphin occurrence during the HZMB construction since 2013 (Figure 13). In the earlier years of 2011-12, dolphin usage was evenly spread throughout the North Lantau region, with high dolphin densities recorded around the Brothers Islands and Shum Shui Kok, Lung Kwu Chau and Sha Chau, as well as near Black Point, Pillar Point and to the west of the airport platform near Shum Wat (Figure 13). In contrast, dolphin usage in recent years has been largely confined to the western end of the North Lantau region, and their habitat use in 2016-18 further shrunk to mostly around Lung Kwu Chau, while the central and eastern portions of the region only recorded zero to very low dolphin densities (Figure 13). Even though most marine works associated with the HZMB

construction has been completed in 2016, there is still no sign of recovery in dolphin habitat use in North Lantau region after the significant decline. On the other hand, with the on-going massive reclamation works associated with 3RS construction commenced in mid-2016 which will continue for at least several more years, it can be reasonably assumed that the dolphin habitat use in North Lantau would remain at a low level in the foreseeable future.

Temporal changes in dolphin habitat use patterns at six key habitats (2004-18)

The temporal trends in dolphin usage at six key habitats were also examined for the 15-year period between 2004-18, which included the two existing marine parks around Sha Chau and Lung Kwu Chau as well as the Brothers Islands, the two proposed marine parks at Southwest Lantau and South Lantau, and two other "dolphin hot spots" at Tai O and Black Point where they regularly occurred in the past (Figure 14). To examine dolphin usage over these six key habitats that encompass a suite of grids, the number of on-effort sightings and unit of survey effort were pooled together from those grids, to calculate dolphin densities (DPSE) as a whole for each year during the 2004-18 period for examination of their temporal trends.

After a continuous decline in dolphin usage recorded within the Sha Chau and Lung Kwu Chau Marine Park (17 grids) from 2013 to 2016, there was a very small rebound in 2017, but then once again fell to the lowest level in 2018 (Figure 15). The alarming decline in dolphin usage within this existing marine park since 2004 raises serious concern, as this area has long been considered an important dolphin habitat in Hong Kong (Hung 2008). Even though at the historically lowest level of dolphin occurrence in 2018, the waters around Lung Kwu Chau remain the only habitat in North Lantau region that is still consistently utilized by dolphins at a moderate level. It should also be noted that the recent AFCD passive acoustic monitoring studies conducted within this marine park team has also revealed regular occurrence of dolphins to the south and north of Lung Kwu Chau throughout the 24-hour cycle (Wang and Hung 2018). A comparison of PAM data collected at Lung Kwu Chau recently from 2017-18 and from the past in 2013-14 revealed that there has actually been a significant increase in daily dolphin detections in recent years, while both datasets showed similar and clear diel patterns, with the lowest detections occurring between about 08:00 and 15:00 and the highest peak in the few hours just before sunrise (Wang and Hung 2018). Only with the supplementary information from the PAM study, can the long-term trend in dolphin usage within this marine park be comprehensively evaluated for its importance for dolphins in the long run.

Established in late 2016 as a compensation measure for the habitat loss in relation to the HKBCF reclamation works, the Brothers Marine Park (15 grids) recorded zero dolphin density in four consecutive years in 2015-18, after a dramatic decline in dolphin usage since 2011. Although dolphin usage was originally expected to recover after most marine works associated with HZMB construction was completed in 2017 and with the establishment of the marine park, their occurrence around the Brothers Islands has still remained to be extremely rare in the past few years. However, as discussed in Section 5.2.1, the AFCD passive acoustic monitoring study revealed a very low level of dolphin occurrence within this marine park, where the acoustic detections were mostly made during the night-time, possibly related to the lower amount of vessel traffic especially to and from the nearby Sky Pier (Wang and Hung 2018). It remains to be seen whether there will be any signs of recovery in dolphin usage in the foreseeable future. However, as discussed above, reclamation works for the 3RS project which is just a few kilometers to the west of the marine park, have commenced in mid-2016. Since the work area of the 3RS construction has served as an important traveling corridor for dolphins in the past to move between the Brothers Marine Park and Sha Chau and Lung Kwu Chau Marine Park (Hung 2014), the massive reclamation project would likely hamper the chance of recovery in dolphin usage around the Brothers Islands. Monitoring of dolphin usage within this marine park by both visual monitoring surveys and passive acoustic monitoring would be critical in the near future to confirm whether that is the case.

Even though the proposed Southwest Lantau Marine Park (15 grids) recorded the highest level of dolphin usage among all existing and proposed marine parks in western waters of Hong Kong during the 15-year period, there has been a noticeable decline in dolphin densities from 2014-17, with a very small rebound in 2018. Furthermore, an even more dramatic decline in dolphin densities from 2014-18 was detected in the proposed South Lantau Marine Park (30 grids), with the dropped level in 2018 reaching the second lowest since 2004, after a strong surge in dolphin occurrence around the islands in 2014 (Figure 15). It is crucial to continuously monitor dolphin usage in these two proposed marine parks that are scheduled to be established in 2019-20, as both include some important habitats for the dolphins and porpoises in the past. Moreover, the AFCD passive acoustic monitoring study has recently expanded further to cover these two proposed marine parks in 2018-19, and such study results will provide crucial insights on the long-term dolphin usage at various parts of these important habitats, including their diel patterns of occurrence. This will greatly supplement the overall knowledge of dolphin habitat use, including their night-time habitat use that is critically lacking for better assessment of the

importance of these marine parks to the dolphins. Moreover, it would also provide an opportunity to examine the extent of spatial and temporal overlaps between Chinese White Dolphins and finless porpoises within these two marine parks, where both resident species are known to occur in the past.

Once identified as a critical dolphin habitat in western waters of Hong Kong, the waters around Tai O Peninsula (four grids) have also recorded a steady decline in dolphin densities from the highest in 2009 to the lowest in 2017 and 2018 (Figure 15). Such a sharp decline also coincided with the decline in dolphin usage of the nearby proposed Southwest Lantau Marine Park. Moreover, the dolphin usage at Black Point (four grids) has greatly fluctuated in earlier years with no apparent trend, but they have consistently been absent there in the past three years of 2016-18 (Figure 15). As this area is situated at the border of a proposed large-scale reclamation site at Lung Kwu Tan, special attention should be paid to dolphin habitat use in this area in the near future.

5.3.2. Habitat use patterns of finless porpoises

The spatial pattern of porpoise habitat use revealed that their most heavily utilized habitats in 2018 were located a few kilometers to the east of Soko Islands (or the offshore waters at the juncture of SWL and SEL survey areas), while a few grids near the southwest corner of Cheung Chau, around Tai A Chau and to the southwest of Lamma Island also recorded moderate porpoise densities (Figure 16). On the other hand, a number of grids in LM, PT and NP recorded very high porpoise densities (Figure 16), but those results could be biased by the relatively low amount of survey effort conducted during the 12-month period, and therefore should be treated with cautions. One notable observation is that the grids near Shek Kwu Chau have recorded very low porpoise densities in 2018, even though this area has been consistently identified as critical porpoise habitats in the past decade with very high porpoise densities (e.g. Hung 2017, 2018). This issue will be further discussed below.

In order to increase the sample size, the survey effort and porpoise data collected from 2014-18 were pooled and analyzed for a longer period with sufficient amount of survey data, in order to provide a better presentation of porpoise habitat use pattern in southern and eastern waters of Hong Kong. Since finless porpoises in Hong Kong exhibited pronounced seasonal pattern 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 was further stratified into winter/spring (December

through May) and summer/autumn (June through November) to deduce habitat use patterns of porpoises for the respective dry and wet seasons.

For the examination of porpoise habitat use patterns during the dry season (winter and spring months) in 2014-18, in which the majority of survey effort was allocated to SWL, SEL and LM survey areas, the high density grids with porpoise occurrence were mostly located a few kilometers to the east of Tai A Chau (or at the juncture of SWL and SEL survey areas), to the southwest of Shek Kwu Chau, to the south of Tai A Chau, and to the south of Cheung Chau (Figure 17). In contrast, most grids toward the inshore waters of SWL, and the southern and eastern waters of Lamma Island only recorded low to moderately low densities of porpoises. They also generally avoided the western end of SWL survey area, the northern and southeastern portions of LM survey area, as well as the offshore area at the juncture of SEL and LM survey areas (Figure 17).

In comparison, more survey effort was allocated to the eastern survey areas instead during the wet season (summer and autumn months) of 2014-18, while the survey effort remained relatively consistent in SWL and SEL waters year-round, but with much fewer surveys conducted in LM waters. For the five-year period, porpoise densities were moderate near the Po Toi Islands, at the offshore waters in PT survey area, as well as at the juncture of PT and NP survey areas (Figure 18). Although porpoise densities at some grids in NP and SK waters were very high, these results could still be biased as the survey effort accumulated over the five-year period in this survey area was relatively low (less than 10 units of survey effort in total for most grids). On the other hand, even though porpoises occurred in South Lantau and Lamma waters during the wet season, their densities were generally low to moderate, with no particular habitat preference in these areas during that time of the year (Figure 18).

Temporal changes in porpoise habitat use patterns

To examine the recent temporal change in porpoise densities at various important habitats in southern waters of Hong Kong, another comparison was made on porpoise habitat use patterns across the past six years. It appeared that the most important porpoise habitats were consistently found to the south of Cheung Chau, near Shek Kwu Chau and around the Soko Islands, as well as the offshore waters between Shek Kwu Chau and Tai A Chau between the five-year period of 2013-17 (Figure 19). However, such consistent usage changed abruptly in 2018, when the porpoise densities around Shek Kwu Chau has considerably diminished, while the porpoises

used the waters near Cheung Chau and Tai A Chau to a lesser extent (Figure 19). On the other hand, porpoise usage to the west of Lamma Island varied greatly from year to year, with the more extensive and intense usage occurring in 2013 and 2015-17, while they were mostly absent from there in 2014 (Figure 19).

The temporal trends in porpoise usage at three key habitats in South Lantau waters were also examined for the 15-year period between 2004-18, which included the proposed South Lantau Marine Park, as well as Shek Kwu Chau and Pui O Wan where porpoises have occurred regularly (Figure 14). Similar to the Chinese White Dolphins, to examine porpoise usage over 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 during the 2004-18 period for examination of their temporal trends.

The porpoise usage has fluctuated greatly at the proposed South Lantau Marine Park (30 grids) in the past 15 years, starting with 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 proposed marine park, which reached the highest in 2014. However, in the past four years porpoise usage has become more unstable, but still maintained at similar levels throughout the past decade (Figure 20). As mentioned above, the recent PAM study within this marine park also funded by AFCD will provide supplementary information with valuable insights on how the porpoises have been utilizing these important habitats 24-hours a day, and also how they share the marine park with the Chinese White Dolphins spatially and temporally. The preliminary results from such PAM study have already indicated a very strong diel pattern of porpoise occurrence to the north of Siu A Chau, south of Tai A Chau and between the two islands. Most certainly, such PAM study will fill an important information gap on porpoise occurrence within this marine park, and provide an opportunity for a more comprehensive assessment on how important this marine park is for both the porpoises and dolphins.

The inshore waters of Pui O Wan (nine grids) have been consistently used by porpoises in the earlier years (see Hung 2005 also), and such usage has maintained at a higher level until 2010, when the porpoises began to use these waters infrequently between 2010-13 (Figure 20). However, porpoise usage has increased to a higher level between 2014-17, before another noticeable drop in 2018 which coincided with the dramatic decline in porpoise usage at the nearby Shek Kwu Chau (see below).

In the past decade, the waters around Shek Kwu Chau (eight grids) were considered to be a critical habitat for finless porpoises with consistently high porpoise usage since 2007. In recent years, there was a steady increase from 2013 to a much higher level in 2016, before falling back to moderate level in 2017 (Figure 20). However, there was a sharp decline in porpoise usage there in 2018, which was the lowest since 2007 (Figure 20). The dramatic decline in porpoise usage of this habitat and nearby waters at Pui O Wan (see above) can be possibly linked to the recent construction activities near Shek Kwu Chau in association with the reclamation works for the Integrated Waste Management Facilities (IWMF) Stage I, as the preparation works began in March 2018, while the reclamation works commenced in June 2018. With such sharp decline at this once-critical porpoise habitat, this should raise serious concerns as the waters around Shek Kwu Chau have served important functions for porpoises that regularly occur in Hong Kong waters, and their usage of the entire southern waters of Hong Kong could be potentially affected by the impacts of the IWMF construction works, including the permanent loss of important porpoise habitats. Temporal trend in their habitat use around Shek Kwu Chau as well as for the entire South Lantau waters should be closely monitored as the IWMF construction works will continue in the next several years.

5.4. Group Size, Calf Occurrence and Activities

5.4.1. Group sizes of dolphins and porpoises

From April 2018 to March 2019, group sizes of Chinese White Dolphins ranged from singles to 20 animals, with an overall mean of 3.1 ± 2.66 (n = 296). Among the five areas where dolphins occurred in 2018-19, the mean group size was the lowest in SEL (1.0, with four lone individuals among four sightings) and the highest in WL (3.6), while the ones in DB (2.3), NWL (2.4) and SWL (2.7) were all below the overall mean (Table 1a). Among the four seasons, mean group size was the highest in summer and autumn months (both resulted in 3.4 dolphins per group), while the ones in winter (2.7) and spring (2.9) months were very similar and below the overall mean. The majority of dolphin groups sighted during the 2018-19 monitoring period were quite small, with 54.7% of the groups composed of 1-2 animals, and 78.4% of the groups with fewer than five animals (Figure 21). Notably, only ten out of the 296 dolphin groups sighted in 2018-19 contained more than ten animals per group.

The examination of long-term trend in annual mean dolphin group sizes since 2002 revealed that the one in 2018 (3.24 dolphins per group) remained at the lowest level among all years (which was almost the same as in 2008, 2012 and 2017) (Figure 22). It is also notable that the mean group size in NWL survey area (2.66) was

exceptionally low among all years since 2002 (the previous low was 3.33 in 2012). It is uncertain whether the low overall mean group size in the three consecutive years of 2016-2018 as well as the very low mean group size in NWL in 2018 could be related to changes in dolphins' foraging strategies in response to increased disturbance from the construction activities in recent years, as a response to changes in prey distribution and overall prey resources in western waters of Hong Kong, or both. Such trend should be continuously monitored in the coming years.

Distribution of dolphins in different categories of group sizes in 2018 is shown in Figure 23. The large dolphin groups occurred predominantly along the coastline of WL survey area, with the very large groups of dolphins (10+ animals per group) mostly centered near Tai O Peninsula, Kai Kung Shan and Fan Lau (Figure 23). The other large groups were scattered to the north of Lung Kwu Chau, near Sha Chau as well as to the northeast of the airport in North Lantau region, while there were only two large groups occurring in South Lantau waters, both located between Siu A Chau and Shui Hau Peninsula (Figure 23). In contrast, the smaller groups were evenly distributed throughout the distribution range of dolphins around Lantau waters in 2018. Notably, the ones that occurred at the peripheral distribution range, including most groups in South Lantau waters, as well as all groups to the west of the airport platform and at the mouth of Deep Bay, were all smaller dolphin groups (Figure 23).

For the finless porpoises, their group sizes during the 2018-19 monitoring period ranged from singles to 13 animals, with an overall mean of 2.7 ± 1.98. The majority of the porpoise groups sighted during the 2018-19 monitoring period were very small, with 65.3% of porpoises groups composed of 1-2 animals, and all except 12 groups (or 88.1% of all groups) had less than five animals per group (Figure 24). The mean group sizes in SEL (3.1) was higher than the overall mean, while the ones in SWL (2.1), LM (2.3), PT (2.0) and SK (2.0) were all below the overall mean (Table 1b). Seasonal variation in mean group sizes was not evident during the 12-month monitoring period, with the ones among the four seasons all within the range of 2.4-2.8 animals per group.

5.4.2. Calf occurrence of dolphins

Of the 1,052 dolphins sighted in 2018, 73.7% of them were categorized into six age classes. And among these age classes, the spotted juveniles (25.8%) dominated the largest proportion of dolphins being identified with their age classes, which was similar to the previous monitoring periods. In contrast, only two unspotted calves (UC, or the newborn calf) and 14 unspotted juveniles (UJ, or the older calf) were

sighted during the 12-month period, with these young calves comprising 1.5% of the total. Such percentage was the lowest since 2002 (Figure 25). In fact, there has been a steady decline in the past five years in young calf occurrence in Hong Kong waters, falling from the annual percentage of 5.8% in 2013 to the lowest with 1.5% in 2018, with the previous two years also at a very low level of 1.8% (Table 2).

The rare calf occurrence of Chinese White Dolphins in the past three years as well as the continuous decline in the past 17 years is of great concern, as this casts a very worrying future for the local dolphin population with such low level of recruitment. In fact, the life history parameters deduced from the long-term photo-identification data also revealed high calf mortality and low fecundity of reproductive females in the past two decades of dolphin monitoring works in Hong Kong waters (see Hung 2018). As mother-calf pairs are more susceptible to anthropogenic disturbances, the exceptionally low percentages of young calves in recent years raised serious concerns about the suitability of Hong Kong waters for reproduction of calves and nursing activities for mother-calf pairs, in light of the adverse impacts of various coastal development projects and high level of vessel activities within their habitats around Lantau Island.

Distribution of young calves in 2018 is shown in Figure 26. They were mostly sighted in WL survey area with higher concentrations near Kai Kung Shan, Peaked Hill and to the north of Tai O Peninsula near the HKLR09 alignment (Figure 26). Moreover, a few young calves were also sighted to the west of Sha Chau, while the lone young calf sighted in South Lantau waters was located near Shui Hau Peninsula (Figure 26). Notably, both newborn calves sighted in 2018 were located to the west of Kai Kung Shan.

The examination of the temporal trends in distribution of UCs and UJs in 2012-18 revealed that such temporal changes resembled the changes in overall distribution of dolphins during the seven-year period, with the gradual disappearance of young calves from the NEL region starting in 2013-14, and then expanding to the entire North Lantau region thereafter (Figures 27-28). Moreover, such distribution further shrunk to the limited area of WL waters, with gradual decline in the frequency of occurrence for UCs even in this once-important habitat for nursing activities in the past (Figures 27-28). It should be noted that even though the UJs frequently occurred and evenly distributed in West Lantau in the past several years, their occurrence and distribution shrunk in 2018. This should be closely monitored in the future as this area was once considered an important habitat for mother-calf pairs.

5.4.3. Activities of dolphins

In 2018, a total of 33 and 8 groups of dolphins were observed to be engaged in feeding and socializing activities respectively, comprising 10.1% and 2.5% of all dolphin groups. Only one group was observed to be engaged in traveling activity, while none of the dolphin groups was engaged in milling/resting activity in 2018. Temporal trend in annual percentages of feeding and socializing activities revealed that both dropped to lower levels in recent years (Figure 29). In particular, the percentage of socializing activities in 2018 dropped to the lowest since 2002, while the percentage of feeding activities remained at a low level for three consecutive years of 2016-18. The diminished occurrence of both activities in recent years raises grave concern, as these activities serve important functions in the daily lives of the dolphins. This would also reflect the deterioration of the overall habitat quality in western Hong Kong waters for Chinese White Dolphins, as the anthropogenic disturbances continue to affect their different usage of Hong Kong waters.

Distribution of dolphins engaged in different activities in 2018 is shown in Figure 30. Besides a handful of dolphin groups sighted near Sha Chau and Lung Kwu Chau and one group to the northeast of the airport platform, most groups associated with feeding activities were found in WL waters, with even distribution of such sightings stretching from HKLR alignment to Fan Lau Peninsula (Figure 30). On the other hand, the sightings associated with socializing activities were sparsely distributed near the western territorial border in WL and NWL survey area, with no particular concentration (Figure 30). The lone dolphin group observed to be engaged in traveling activity was located to the west of Peaked Hill (Figure 30).

Temporal changes in distribution of dolphins engaged in feeding and socializing activities were examined across the seven-year period of 2012-18. For feeding activities, the temporal changes in sighting distribution patterns closely resembled the overall dolphin distribution during the same seven-year period. Feeding activities occurred frequently in North Lantau region (especially around the Brothers Islands) in 2012, but have quickly diminished first in NEL in 2013-2014, then distribution of such activities slowly shrunk throughout the entire North Lantau region in recent years (Figure 31). Moreover, feeding activities were frequently encountered from 2012-15 in WL waters, but such encounters have become less frequent in 2016-18 (Figure 31). In contrast, there were increasing occurrences of feeding activities in SWL waters in 2015-17, but such activity has once again become very rare in 2018, similar to the level in earlier years of 2012-13 (Figure 31).

The temporal changes in distribution of dolphin sightings engaged in socializing activities in 2012-18 were also similar to the ones for feeding activities, with regular occurrences in North Lantau in 2012-14, but such occurrences diminished noticeably in 2015-2018 (Figures 32). The occurrence of socializing activities remained regular in WL waters from 2012-17, but have also become very infrequent in 2018 (Figure 32). Socializing activities did not occur at all in South Lantau waters in 2012-13 and again in 2018, even though a few groups engaged in such activities were sighted in each year of 2014-17.

5.4.4. Dolphin associations with fishing boats

Among the 296 groups of dolphins sighted in 2018-19, only seven of them were associated with operating fishing boats (or 2.4% of all groups), including four groups associated with purse-seiners and three groups with gill-netters.

In 2018, the overall percentage of dolphin sightings associated with fishing boats has dropped to only 1.8%, which was the lowest among all years since 2002. All six dolphin groups sighted with fishing boats in 2018 were associated with purse-seiners, with four of them distributed along the west coast of Lantau, and the other two located to the north of Lung Kwu Chau and within Pui O Wan respectively (Figure 33).

5.5. Encounter Rate

5.5.1. Encounter rates of Chinese White Dolphins

To calculate the encounter rates of Chinese White Dolphins, only survey data collected in Beaufort 0-3 conditions was included in the analysis as in past monitoring periods. From April 2018 to March 2019, the combined encounter rates of dolphins from NEL, NWL, WL and SWL was 3.0, which was the lowest among all monitoring periods since 2002-03 (the previous lows were 4.0 in 2016-17 and 3.4 in 2017-18; Table 3). In fact, there has been a steady decline of dolphin encounter rates in the past ten monitoring periods, dropping from 7.7 in 2011-12 to only 3.0 in 2018-19 (Figure 34; Table 3).

As consistently recorded in the past 17 monitoring periods, dolphin encounter rate was the highest in WL (13.0) among the four survey areas, which was considerably higher than in SWL (2.0) and NWL (1.7) (Table 3). The encounter rate in NEL was once again zero, as no on-effort dolphin sighting was made out of the 2,228.7 km of survey effort. Similar to the previous five monitoring periods, dolphin encounter rate in 2018-19 was once again higher in SWL than in NWL, which was the opposite from the earlier years (Table 3).

Temporal trend in annual encounter rate

Temporal trends in annual dolphin encounter rates 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 since 2002. In 2018, the overall encounter rate of the combined areas reached the lowest since 2002 (Figure 35). In fact, there has been a sharp decline in the past four years, falling from 7.5 dolphin sightings per 100 km of survey effort in 2015 to 5.3-5.6 in 2016-17, then further down to 4.0 in 2018.

For the entire North Lantau region (with NEL and NWL survey areas combined), after experiencing a dramatic decline in dolphin encounter rate from 7.7 dolphin sightings per 100 km of survey effort in 2011 to only 0.8 in 2016, there was a slight rebound in 2017 (1.4) and 2018 (1.7), but such rate still remained at a very low level (Figure 35). In contrast, after a three-year period of 2013-15 with relatively higher encounter rates (12.1-13.6), the combined dolphin encounter rate from the West/Southwest Lantau region dropped noticeably to only 8.7 in 2016 and 8.8 in 2017, then fell further to 5.5 in 2018, the lowest level since 2002 (Figure 35).

5.5.2. Encounter rates of finless porpoises

Encounter rates of finless porpoises were calculated using data collected in Beaufort 0-2 conditions as in past monitoring periods, since the porpoise encounter rate was also much lower in Beaufort 3-5 conditions (0.4 porpoises per 100 km of survey effort) than in Beaufort 0-2 conditions (2.9) in the 2018-19 monitoring period. From April 2018 to March 2019, the combined porpoise encounter rate of SWL, SEL, LM and PT was 2.9 sightings per 100 km of survey effort, which was the lowest among the past 12 monitoring periods since 2007-08 (Table 4). Apparently, there has been a continuous decline in the porpoise encounter rate in recent years, falling from 6.4 porpoises per 100 km of survey effort in 2013-14 to only 2.9 in 2018-19 (Figure 36; Table 4). Among the five survey areas, the porpoise encounter rates was the highest in SEL (5.1), while the one in SWL (2.9) was the same as the overall encounter rate (Table 4). In contrast, the one in LM (1.9) was considerably lower than the overall, and the one in PT (1.2) was much lower than the overall.

Temporal trend in annual porpoise encounter rates from the combined areas of SWL, SEL, LM and PT indicated that the overall porpoise usage of Hong Kong waters have fluctuated across different years since 2002. After a relatively stable period between 2012-15 (all within the range of 5.3-6.4 sightings per 100 km of survey effort), the porpoise encounter rate dropped noticeably in 2016 and again in 2018 (Figure 37a). Among the four survey areas, the inconsistency in porpoise

usage was even more evident, with no apparent long-term trend in any of these four areas (Figure 38). However, both SEL and SWL survey areas experienced a noticeable drop in porpoise encounter rates in 2018, while porpoise usage at both LM and PT survey areas also remained at a low level during the same year (Figure 38).

To account for potential frequent movements across SEL, SWL and LM in winter and spring months, data from these three areas were pooled to calculate the annual porpoise encounter rates in southern waters of Hong Kong collectively for another examination of such temporal trend in the past decade. In 2018, porpoise usage has dropped to the lowest level since 2007, after a noticeable increase in 2017 (Figure 37b).

From the encounter rate analyses, it is apparent that porpoise usage in Hong Kong waters, especially in South Lantau waters, has fallen to a historical low in 2018. As indicated in Section 5.3.2, the porpoise density around Shek Kwu Chau, a critical porpoise habitat, has also shown a marked decline in 2018, which could be linked to the recent reclamation works for the Integrated Waste Management Facilities Stage I. It remains to be seen whether such works in the next several years would continue to affect the overall porpoise occurrence in southern waters of Hong Kong. Notably, the offshore LNG terminal to the east of Soko Islands will also commence in 2019, and there are other on-going threats for the porpoises such as the high level of high-speed ferry traffic in South Lantau region, which may altogether contribute to the declining trend in their occurrences. Moreover, recent stranding data revealed that there were a total of 32 cases of finless porpoise stranding in 2018 alone, which was very close to the previous high (33 cases) in 2014, and was nearly twice as much as the cases in 2016 (17) and 2017 (18). Moreover, just between January and March in 2019, there have already been 22 cases of porpoise stranding recorded (AFCD unpublished data), which has exceeded the total number of cases in 2016 and 2017. Although it is difficult to draw any direct correlation between the decline in porpoise occurrence and the recent rise in their stranding numbers in 2018 and through the first quarter of 2019, both pieces of information should raise serious concerns on the future of finless porpoises in Hong Kong, and it is critical to closely monitor the temporal trend in porpoise usage in the upcoming years.

5.6. Density and Abundance

5.6.1. Estimates of dolphin density and abundance in 2018

Densities and abundance of Chinese White Dolphins were estimated for 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 2017, 2018). The annual estimates deduced from the 2018 monitoring data can be used to assess the long-term temporal trend in dolphin occurrences in Hong Kong. Only effort and sighting data collected from the four areas under Beaufort 0-3 conditions were used in the analysis, which included 8,239.7 km of survey effort and 227 dolphin groups from the four areas for the density and abundance estimations in 2018 (Table 5a).

Among the four survey areas, WL recorded the highest dolphin density in 2018, with 67.40 individuals/100 km^2, which was 6-10 times higher than the ones in SWL and NWL (Table 5a). But such figure in 2018 was the third lowest in WL among all years since 2003, with the lowest and second lowest recorded in 2017 and 2012 respectively. SWL recorded the second highest dolphin density among the four areas in 2018, with 11.05 individuals/100 km^2, but such estimate was also the lowest for this survey area since 2010.

The density estimate in NWL in 2018 was much lower than in SWL, with 6.35 individuals/100 km^2, and this was also the lowest estimate among all years since 2001. Furthermore, as in the previous three years, estimating dolphin density and abundance for NEL in 2018 was impossible, as there was only one dolphin group sighted on-effort for the entire year, which is not sufficient to estimate a mean and variance for cluster size measurement, or compute the estimate of f(0) by the DISTANCE program.

In 2018, the abundance estimates of Chinese White Dolphins were 19, 6 and 7 dolphins respectively in WL, NWL and SWL survey areas (and virtually zero in NEL survey area with only one on-effort dolphin sighting made during 2,460.9 km of survey effort), with a combined estimate of 32 dolphins from the four areas (Table 5b). The coefficient of variations (CVs) remained low to moderate for the 2018 estimates in WL (14%), NWL (15%) and SWL (32%) and therefore the abundance estimates for the year should be reliable (Table 5a). Notably, the combined abundance estimates in 2018 with only 32 dolphins dropped further to the historical low among all years, with the previous lows both recorded in 2016 and 2017 with 47 dolphins (Figure 39; Table 5b).

Chinese White Dolphins in Hong Kong constitute a minor portion of the population inhabiting the Pearl River Estuary (PRE) in which certain degree of connection and interchange of individuals occur across the boundary (See Section

5.7.1 and 5.7.2 below). A recent line-transect monitoring survey conducted by a Mainland research institute at the East PRE in 2017-18 (Chen 2018) showed that the estimated abundance in the East PRE region (excluding Hong Kong) was 990. Continuous monitoring and studies in Mainland waters of PRE would provide useful references to assess the status of dolphin assemblage in Hong Kong in a wider regional perspective and allow a better understanding on the spatial dynamics of the whole PRE dolphin population.

5.6.2. Temporal trends in dolphin abundance

Temporal trends of annual dolphin abundance in NWL and NEL (2001-18), SWL (2002-18) as well as WL (2003-18) 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. For SWL, temporal trend of annual estimates was only examined for the recent years (2010-18) but not for a longer period, as consistent survey effort (at least 500 km of survey effort per year) was not collected annually until after 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 first showed a marked decline from 30 dolphins in 2002-03 to only six dolphins in 2006-07 (Figure 40; Table 5b). Since then, the dolphin numbers remained at a lower level of 11-12 dolphins in the subsequent periods, before a noticeable rebound to a higher level of 26 and 24 dolphins in 2014 and 2015 respectively. Thereafter, the abundance estimates dropped to a much lower level in the three subsequent years, reaching the lowest in 2018 (Figure 40; Table 5b). It should be cautioned that the CVs of the biennial estimate in 2002-03 (45%) as well as the annual estimates in 2010 (67%) and 2012 (54%) were fairly high, while the other biennial and annual estimates should be more reliable for most years that were within the range of 22-40% for the associated CVs.

In WL, individual abundance has steadily decreased from 54 dolphins in 2007 to only 17 dolphins in 2012 (Figure 41; Table 5b). In subsequent years, the abundance estimate rebounded to 23 dolphins in 2013 and 36 dolphins in 2014. However, this was followed by another steady decline in 2015 and 2016 with 31 and 27 dolphins respectively, and then to the lowest levels in 2017 and 2018 with 16 and 19 dolphins respectively (Figure 41; Table 5b).

Dolphin abundance in the North Lantau region showed an even more pronounced decline in the past 18 years. In NEL, the decline was appalling, dropping from the highest in 2001 (20 dolphins) to the lowest in 2014 (one dolphin), and then virtually zero in four consecutive years of 2015-18 (Figure 41). On the other hand, dolphin abundance in NWL dropped steadily from the highest in 2003 (84 dolphins) to the lowest in 2018 (six dolphins), with a 93% decline in the past decade, or an 85% drop since 2012 (Figure 41).

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 (2001-18): the test statistic for the hypotheses was -8.4763 whose *p*-value was ≈ 0.0000 <5%. Therefore, the hypothesis H_0 is rejected at 5% level of significance, and the abundance data of dolphin in NEL was concluded to possess a significant downward sloping trend.

- NWL (2001-18): the test statistic for the hypotheses was -13.0659 whose *p*-value was ≈ 0.0000 <5%. Therefore, the hypothesis H_0 is rejected at 5% level of significance, and the abundance data of dolphin in NWL was concluded to possess a significant downward sloping trend.

- WL (2003-18): the test statistic for the hypotheses was -6.3726 whose *p*-value was ≈ 0.0000 <5%. Therefore, the hypothesis H_0 is rejected at 5% level of significance, and the abundance data of dolphin in WL was concluded to possess a significant downward sloping trend.

- SWL (2010-18): the test statistic for the hypotheses was 0.1861 whose *p*-value was 0.3502 >5%. Therefore the hypothesis H_0 is not rejected at 5% level of significance with the abundance data of dolphins in SWL not possessing a significant downward sloping trend.

- Combined estimates from SWL, WL, NWL and NEL (2010-18): the test statistic for the hypotheses was -5.7942 whose *p*-value was 0.0004 <5%. Therefore, the hypothesis H_0 is rejected at 5% level of significance, and the combined abundance data of dolphin from SWL, WL, NWL and NEL was concluded to possess a significant downward sloping trend.

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 decade. Even though a significant trend was not detected in SWL since 2010, there was a marked decline in 2016-18 after a prominent increase in dolphin numbers in 2014 and 2015. When the abundance estimates of SWL were considered together with the other three areas collectively, there was a significant downward trend in overall annual dolphin abundance to the lowest point in 2018, which was largely attributed to the dramatic decline in dolphin numbers in the North Lantau region in recent years.

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 individual range use of Chinese White Dolphins, the 95% kernel ranges of 147 individuals that occurred in Hong Kong survey areas in 2018 through photo-identification works were deduced using the fixed kernel method, and their ranging patterns are shown in Appendix V. In addition, 169 individual dolphins that were sighted ≥15 times and occurred during the past three years of 2016-18 were further examined for their range use and residency patterns (Table 6).

Among these individuals, all except two (i.e. CH84 and NL286) have occurred in WL in the past, while the majority of them have also occurred in NWL (72.8%) and SWL (65.7%), and to a smaller extent in NEL (23.7%) and DB (17.8%) (Table 6). In contrast, only ten and two individual dolphins have been sighted in SEL or EL survey area respectively as part of their historical range. Furthermore, 131 of these 169 individuals (or 78% of the total) occupied ranges that spanned from Hong Kong across the border to Mainland waters (Table 6), indicating some level of cross-boundary movements by many individual dolphins that occur regularly in Hong Kong waters.

Residency Pattern

The residency patterns of 157 individuals were further assessed by examining their annual and monthly occurrences in Hong Kong (Table 6). The other 12 individuals were identified and re-sighted only in the past few years, and therefore their annual occurrence could not be properly and reliably assessed. Overall, 88 and 56 individuals were identified as year-round and seasonal residents respectively, and 12 individuals were identified as seasonal visitors while only one (CH105) was identified as year-round visitor. Nearly 92% of the assessed individuals were considered residents in Hong Kong, as they have been sighted consistently in the past decade, or at least five years in a row. However, the proportion of visitors (8.3%)

that utilized Hong Kong 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 requirement on the number of re-sightings required for this analysis. Moreover, based on the monthly occurrences of these 157 individuals, 44% of them only occurred in Hong Kong during certain months of the year, while the rest occurred here year-round (Table 6).

In addition to their residency patterns, the 169 individuals were classified 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 44 individuals (26.0%) and 108 individuals (63.9%) belonged to the northern and southern social clusters respectively (Table 6). In addition, there were also 17 individuals that spanned their range use evenly across North and West Lantau waters with frequent occurrences in both waters, with the majority of them shifting their range use from North Lantau waters to WL and SWL waters in recent years.

Core Area Use

The core area analysis revealed that four major core areas of dolphin activities are located around Lung Kwu Chau, the Brothers Islands, in SWL waters, and along the west coast of Lantau, with the latter further subdivided into Tai O, Peaked Hill and Fan Lau (Table 6). Among the 169 individuals, 60 and 53 individuals occupied Lung Kwu Chau as their 50% and 25% UD core areas respectively, while only 12 and 9 individuals occupied the Brothers Islands as their 50% and 25% UD core areas respectively (Table 6). The majority of these individuals that utilized Lung Kwu Chau and the Brothers Islands as their core areas belonged to the northern social cluster.

In contrast, 131 and 121 individuals utilized the waters along the west coast of Lantau as their 50% UD and 25% UD core areas respectively, with most of them belonging to the southern social cluster (Table 6). As there has been a recent surge of individuals expanding or shifting their range use into SWL waters in recent years, there were also 13 and 10 individuals that have utilized South Lantau waters as their 50% and 25% UD core areas, respectively (Table 6).

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 2018-19 were broadly examined. During the 12-month period, 172 individuals were re-sighted a total of 696 times, with 135 individuals being sighted more than once (i.e. occurred at more than one location).

By examining their movement patterns between re-sightings, it was observed that 80 individuals moved across different survey areas around Lantau in 2018-19. For example, 28 individuals occurred across NWL and WL survey areas while 43 individuals were re-sighted in both SWL and WL survey areas (Table 7). Moreover, nine individuals occurred in all three areas of NWL, WL and SWL, covering extensive ranges during the 12-month monitoring period. However, observations from their ranging patterns revealed that most individual movements into SWL survey area were limited to the waters near the tip of Fan Lau Peninsula, or near the boundary of WL and SWL survey areas (see Appendix V). In contrast, as no sighting was made in NEL during the 2018-19 monitoring period, there was no individual movement covering this once-important habitat for many individual dolphins in the past.

With an extensive amount of photo-identification data being collected from different surveys during 2018-19, there was a significant portion of individual dolphins sighted repeatedly within just a single survey area only, but did not range into neighbouring areas. These included 49 individuals that occurred exclusively in WL survey area, while six individuals were only re-sighted in NWL waters during the 12-month period. Even though some of these animals (e.g. CH206, NL279, WL21, WL66) were confirmed to venture across the territorial border and utilized the Mainland waters as part of their ranges during the monitoring period, their restricted movements within Hong Kong waters could still be a concern, as this could be related to potential obstruction of movements across different survey areas as a result of human activities (e.g. high-speed ferry traffic) or infrastructure projects (e.g. reclamation, bridge construction).

The temporal trend in individual movement patterns across different survey areas was examined for the past nine monitoring periods, in order to provide any insight on the 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 due to the near-complete absence of dolphin occurrence in NEL, there were some notable changes, with continuous decline in dolphin movements across WL and SWL, as well as between NWL and WL during the past two monitoring periods (Figure 42). After a sharp increase in dolphin movement between WL and

SWL during 2010 to 2016, the three subsequent monitoring periods recorded a steady decline (Table 7), even though it still remained at a relatively high level when compared to the earlier monitoring periods. Moreover, the level of individual movements between NWL-WL also reached a lower level in two consecutive monitoring periods, and such level was the lowest since 2011-12 monitoring period (Figure 42; Table 7). Both declines in movements between NWL-WL and WL-SWL in 2018-19 coincided well with the lower abundance estimates in NWL and SWL in 2018, with fewer dolphins moving into these two areas from the neighbouring WL survey area. Such temporal trends should be continuously monitored to determine whether their movements have been affected by the on-going anthropogenic activities.

5.7.3. Temporal changes in range use of individual dolphins

As in the previous four monitoring periods, the examination of temporal changes in range use by individual dolphins continued in the present study. This included 114 individuals that have regularly occurred in Hong Kong waters among the seven periods of 2011-12 (baseline period before commencement of HZMB construction), 2013, 2014, 2015, 2016, 2017 and 2018, in order to gain a better understanding on the underlying dynamics behind the trends in dolphin occurrence in different parts of Lantau waters.

Among these 114 individuals, 59 and 55 of them were categorized as members of the northern and southern social clusters, respectively. As the individual range use patterns from the two social clusters can differ significantly (Dungan et al. 2012), with the northern ones focusing their range use primarily around the Brothers Islands as well as the Sha Chau and Lung Kwu Chau Marine Park, while the southern ones primarily along the west coast of Lantau, their changes in range use among the five time periods were examined separately. Several parameters were evaluated for such temporal changes in individual range use, which included the changes in level of utilization, changes in range use including expansion, shrinkage, shifts (either partial or complete shift to a nearby area) and reversal of shifts, and how such shifts have occurred from one area to another. For the southern social cluster's individuals, further examination would also be made to determine whether the individuals have shifted their range to avoid the HKLR09 alignment to the southwest of the airport.

Among the 59 individuals from the northern social cluster, 26 of them have already disappeared in the past few years (with three individuals in 2014, eight in 2015, 15 in 2016 and 19 in 2017). In addition, about two-thirds of them (40

individuals) have utilized Lantau waters progressively less since 2011-12, while 39 of them (or 66.1%) have utilized WL waters more across the seven periods, with a proportion of these (13 individuals) utilizing SWL waters more in recent years. Furthermore, the less frequent use of Lantau waters also resulted in range shrinkage for 49.2% of these individuals, in contrast to a range expansion by only 22.0% of these individuals in the past eight years.

The increased utilizations of WL and SWL waters in recent years have resulted in some range shifts and expansions by a good number of individual dolphins from the northern social cluster. In total, 38 of the 59 individuals have shifted their ranges away from NEL waters (with four occurring only once in 2018 in NEL after several years of absence), and such shifts have also resulted in a virtual absence of dolphin occurrence in NEL waters in 2015-18. Besides the range shifts away from NEL waters, 44 individuals have shifted part or all of their ranges from North Lantau waters to WL waters (with some even to SWL waters). However, 29 of these 44 individuals with range shifts in the past have apparently reversed such shifts in 2017 and 2018, albeit with a much lower level of occurrence in NWL waters when compared to the earlier years.

On the other hand, for the 55 individuals from the southern social cluster, 19 of them have already disappeared in the past few years (with seven individuals in 2015, 11 in 2016 and 15 in 2017). Moreover, 40% of the 55 individuals have progressively reduced their utilization of their ranges in Lantau waters since 2011, while only six dolphins have increased their usage of Hong Kong waters at the same time. During the same period, the number of individuals that have shrunk (36.4%) or expanded (38.2%) their ranges in Hong Kong waters were quite similar, while 12 individuals (21.8%) did not show any apparent change in range use during the eight-year span. Notably, even though the HZMB construction was completed in 2017 with the bridge piers in place for several years already, 23 of the 55 individuals still showed clear avoidance of the bridge alignment in the past several years with their range shifting to further south of the bridge alignment. In contrast, nine individuals did not show any signs of avoidance behaviour at all, and still ranged across the bridge alignment in recent years.

Furthermore, more than half of these individuals from the southern social cluster (60.0%) have utilized SWL progressively more in recent years, and eight individuals have shown clear range shifts or expansions from WL to SWL waters as a result of increased utilization of SWL waters. However, after shifting or expanding their

range use into SWL waters in the past few years, 13 of them have reversed such shifts and expansions in 2017 and 2018.

6. SCHOOL SEMINARS AND PUBLIC AWARENESS

During the 2018-19 monitoring period, HKCRP researchers continued to provide assistance to AFCD to increase public awareness on the conservation of local cetaceans. In total, HKCRP researchers delivered 16 education seminars at local primary and secondary schools regarding the conservation of Chinese White Dolphins and finless porpoises in Hong Kong.

For these school talks, a PowerPoint presentation was produced with up-to-date information on both dolphins and porpoises gained from the present long-term monitoring programme. The talks also 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. Their support will be vital to the long-term success in conservation of local cetaceans.

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Table 1a. Mean group size of Chinese White Dolphins among different survey areas in the past six 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

Table 1b. Mean group size of finless porpoises among different survey areas in the past six 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	Sai Kung
2013-14	2.3	2.8	1.9	2.6	N/A	1.3	N/A
2014-15	2.7	3.5	2.6	3.1	1.9	2.6	1.3
2015-16	3.1	3.1	2.9	4.4	2.5	1.7	1.3
2016-17	2.7	2.4	2.7	3.3	3.3	2.2	1.7
2017-18	2.5	2.8	2.5	1.9	2.7	1.5	1.2
2018-19	2.7	2.1	3.1	2.3	2.0	3.0*	2.0

Table 2. 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%

Table 3. Encounter rates of Chinese White Dolphins among different survey areas in the past 17 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

Table 4. Encounter rates of finless porpoises among different survey areas in the past 12 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

Table 5a. Line transects parameters and estimates of density and abundance for Chinese White Dolphins in western waters of Hong Kong in 2018

([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	2460.9	3553.9	1202.3	1022.6
Number of Sightings	1	75	130	21
Average Group Size	5.00	2.82	4.07	1.90
Encounter Rate[1]	0.04	2.11	10.81	2.05
Individual Density[2]	N/A	6.35	67.40	11.05
Abundance	N/A	6	19	7
95% C.I. (Abundance)	N/A	4-7	14-25	4-13
%CV	N/A	15.46	14.41	31.68

Table 5b. Annual abundance estimates of Chinese White Dolphins from each survey area in western waters of Hong Kong in 2003-18

(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

Table 6. Range use (50%/25% UD core areas and sighting coverage) and residency patterns of 169 individuals with 15+ sightings and appeared since 2016.

(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)

ID#	Last Sighted	# 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
CH12	06/12/18	84	F?	YR	WL					√	√		√				√	√					√	√	
CH34	03/12/18	167	F	YR	NL	√		√	√	√			√	√						√					
CH38	16/10/18	103	?	YR	WL					√	√		√				√	√					√	√	
CH84	27/03/18	15	F	SV	NL	√			√				√	√						√					
CH105	03/12/18	29	F	YV	WL				√	√			√			√						√			
CH108	06/12/18	115	F	YR	WL				√	√	√		√				√	√					√	√	
CH113	05/09/18	48	F	SR	WL				√	√	√		√			√	√					√			
CH153	27/03/18	27	?	SR	WL				√	√	√		√			√	√					√			
CH181	21/10/18	15	?	SV	WL					√			√				√	√					√	√	
CH206	06/10/18	16	?	SR	WL					√	√		√				√	√					√	√	
EL01	24/09/18	127	M*	YR	NL		√	√	√	√	√		√		√						√				
NL12	20/09/18	48	F	SR	NL	√		√	√	√	√		√	√						√					
NL33	11/09/18	149	F*	YR	NL			√	√	√	√			√	√						√				
NL37	29/11/18	77	?	YR	NL		√	√	√	√			√	√		√				√					
NL46	10/09/18	96	F*	YR	NL				√	√			√	√						√					
NL48	26/07/16	129	?	YR	NL	√		√	√	√				√						√					
NL49	02/08/18	67	F*	YR	NL			√	√	√	√			√		√				√					
NL80	29/11/18	41	F	SR	NL	√			√	√			√	√						√					
NL98	06/10/18	178	F*	YR	NL			√	√	√	√		√	√	√					√	√				
NL103	11/09/18	59	?	SR	NL	√			√	√	√		√	√						√					
NL104	27/11/18	141	F	YR	NL	√		√	√	√	√		√	√						√					
NL105	13/03/18	33	?	SR	NL/WL				√	√			√	√		√				√					
NL120	29/11/18	142	F*	YR	NL	√		√	√	√	√		√		√						√				
NL123	29/11/18	178	F	YR	NL	√		√	√	√	√		√	√	√						√				
NL136	18/10/18	157	F*	YR	NL	√		√	√	√				√						√					
NL145	26/10/18	65	F	YR	NL			√	√	√			√	√						√					
NL150	25/03/17	48	F	SR	NL	√		√	√	√	√		√	√						√					
NL156	09/08/18	57	?	YR	NL/WL				√	√	√			√		√	√					√	√		
NL165	23/06/17	92	?	YR	NL			√	√	√	√			√	√					√					
NL182	03/12/18	128	F	YR	NL	√		√	√	√				√						√					
NL202	03/12/18	139	F	YR	NL	√		√	√	√			√	√						√					
NL206	21/11/18	63	F*	YR	WL				√	√	√						√	√					√	√	
NL210	05/09/18	76	?	YR	NL			√	√	√			√	√						√					
NL212	09/10/18	62	F	YR	WL				√	√	√		√			√	√					√			
NL214	23/12/17	40	F?	SR	NL	√			√	√			√	√						√					
NL220	18/11/16	84	F	YR	NL	√		√	√	√				√						√					
NL224	12/03/18	73	?	SR	NL/WL	√		√	√	√	√		√	√		√	√			√		√			
NL226	16/11/18	89	?	YR	NL/WL	√		√	√	√	√		√	√	√	√				√	√				
NL233	29/11/18	69	F	YR	NL	√		√	√	√			√	√						√					
NL236	10/07/18	44	?	SR	NL				√	√			√	√						√					
NL242	29/11/18	93	F*	SR	NL			√	√	√			√	√	√					√					
NL247	23/10/18	28	?	SR	WL				√	√			√			√	√					√	√		
NL249	11/01/18	15	?	SV	NL/WL				√	√			√	√		√	√			√		√	√		
NL256	02/10/18	27	F	SR	NL/WL	√			√	√			√	√		√				√					
NL259	02/12/18	83	?	YR	NL			√	√	√				√		√				√					
NL260	29/11/18	71	?	YR	NL/WL			√	√	√	√		√	√	√	√				√	√	√			
NL261	06/11/18	104	M?	YR	NL	√		√	√	√			√	√	√					√	√				
NL264	11/01/18	71	F	SR	NL/WL			√	√	√			√	√		√				√		√			
NL269	01/12/18	59	?	SR	WL				√	√	√		√	√		√	√	√					√	√	
NL272	29/11/18	89	?	YR	NL	√		√	√	√	√		√	√						√					
NL279	02/08/18	29	?	SR	WL				√	√			√			√						√			

Table 6. (cont'd)

ID#	Last Sighted	# 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
NL280	03/09/18	31	?	YR	NL	√			√	√				√						√					
NL281	19/09/18	15	?	SV	NL				√	√			√	√						√					
NL284	03/01/17	79	?	YR	NL			√	√	√			√	√	√					√					
NL285	05/04/16	82	?	YR	NL			√	√	√				√	√					√	√				
NL286	29/11/18	108	?	YR	NL	√		√	√				√	√						√					
NL287	13/07/16	46	?	YR	NL				√	√	√		√	√						√					
NL288	13/11/17	60	?	SR	NL/WL			√	√	√			√	√		√				√		√			
NL293	27/11/18	39	?	SR	WL				√	√			√			√	√					√			
NL295	29/11/18	59	?	YR	NL/WL			√	√	√	√		√	√		√				√		√			
NL296	29/11/18	74	F?	YR	NL/WL			√	√	√	√		√	√		√	√			√					
NL299	10/07/18	29	F?	SR	WL	√			√	√	√		√			√	√					√	√		
NL301	13/06/18	30	?	SR	NL	√			√	√			√	√						√					
NL302	02/08/18	33	?	SR	NL/WL	√			√	√			√	√		√	√			√		√			
NL306	21/11/18	32	?	YR	WL				√	√	√	√		√		√	√	√	√				√	√	√
NL307	22/09/16	21	?	YR	NL				√	√	√		√	√						√					
NL311	25/07/18	28	?	SR	WL				√	√	√		√			√	√	√					√	√	
NL317	29/11/18	16	?	SV	NL/WL				√	√			√	√		√	√			√		√	√		
NL320	27/04/18	36	?	YR	NL				√	√			√	√						√					
NL321	27/11/18	30	?	YR	NL	√			√	√	√		√	√						√					
NL322	11/09/18	28	?	N.D.	WL				√	√	√			√		√	√	√	√	√			√	√	√
SL05	11/11/16	98	F	YR	WL					√	√		√				√	√						√	
SL40	11/10/18	85	F	YR	WL					√	√		√				√	√						√	
SL42	13/04/18	18	?	SR	NL/WL	√			√	√	√			√		√	√					√	√		
SL44	21/11/18	46	?	YR	WL					√	√		√			√	√						√		
SL47	28/06/17	34	?	SR	WL				√	√	√		√			√	√	√				√		√	
SL50	05/01/16	17	?	SR	WL					√	√	√						√	√						√
SL54	07/10/17	26	?	N.D.	WL					√	√					√	√		√				√		√
SL58	12/11/18	16	?	N.D.	WL					√	√						√	√	√				√		
SL59	29/11/18	24	?	N.D.	WL					√	√		√			√	√	√				√	√	√	
SL60	17/12/18	36	?	N.D.	WL					√	√							√	√					√	
WL05	17/10/18	107	F?	YR	NL			√	√	√			√	√		√				√		√			
WL11	29/11/18	71	F*	SR	NL			√	√	√			√	√		√				√					
WL15	21/11/18	117	M*	YR	WL			√	√	√	√					√	√	√						√	
WL17	27/11/18	47	?	YR	NL/WL			√	√	√	√	√	√	√		√	√	√		√					
WL21	26/10/18	77	F	SR	WL				√	√	√		√			√	√	√				√	√		
WL28	03/12/18	39	F	SR	WL				√	√	√		√			√						√			
WL29	29/11/18	49	F	SR	WL					√	√		√				√						√		
WL42	11/09/18	139	?	YR	WL				√	√	√		√				√	√					√	√	
WL44	29/12/17	53	F	YR	WL			√	√	√	√		√			√	√	√					√	√	
WL46	03/09/18	93	?	YR	NL/WL			√	√	√	√		√			√	√					√	√		
WL47	13/12/16	35	?	YR	WL	√			√	√	√	√	√			√	√	√				√	√	√	
WL58	04/06/18	21	?	SR	WL					√			√			√	√	√					√		
WL61	06/12/18	108	?	YR	WL				√	√	√						√	√						√	
WL62	15/12/17	95	F?	YR	WL				√	√	√	√	√			√	√	√						√	
WL66	26/10/18	25	F	SV	WL					√			√			√						√			
WL68	25/07/18	68	F*	YR	WL					√	√						√	√					√		
WL69	04/06/18	102	F	YR	WL					√	√	√	√				√	√						√	
WL72	02/12/18	121	F	YR	WL				√	√	√		√			√	√	√					√	√	
WL74	29/11/18	57	?	YR	WL					√	√		√				√	√					√	√	
WL76	29/11/17	15	F*	SR	WL					√			√			√	√	√				√	√		
WL79	11/09/18	86	?	YR	WL				√	√			√			√	√					√			
WL91	05/09/18	93	?	YR	WL					√	√	√	√				√	√						√	
WL92	29/11/18	43	?	SR	WL					√	√		√				√	√					√	√	
WL94	29/11/18	76	F	YR	WL					√	√		√					√						√	
WL97	21/12/17	16	?	SV	WL				√	√	√		√			√		√				√		√	
WL98	01/12/18	45	F	SR	WL				√	√	√		√			√	√					√	√		
WL109	09/10/18	107	?	YR	WL				√	√	√		√			√	√	√					√		
WL114	23/01/18	73	F?	YR	WL				√	√	√		√				√	√					√	√	
WL116	01/09/16	69	?	YR	WL				√	√	√		√				√	√					√	√	
WL118	30/10/18	71	F	YR	WL					√	√		√				√	√					√		
WL120	19/07/18	72	?	SR	WL				√	√			√			√						√			

Table 6. (cont'd)

ID#	Last Sighted	# 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
WL123	13/12/18	126	F?	YR	WL				√	√	√		√				√	√						√	
WL124	27/06/18	61	F	SR	WL				√	√	√		√			√	√					√	√		
WL128	29/11/18	58	?	YR	WL					√	√		√				√	√					√	√	
WL129	19/11/18	30	F	SR	WL					√	√		√				√	√					√	√	
WL130	21/11/18	88	?	YR	WL				√	√	√						√	√						√	
WL131	06/12/18	137	?	YR	WL				√	√	√		√				√	√					√	√	
WL137	02/12/18	77	F	YR	WL				√	√	√		√				√	√					√	√	
WL142	29/11/18	73	?	YR	WL					√	√		√					√						√	
WL144	26/10/17	32	?	SR	WL					√	√		√				√	√					√		
WL145	02/12/18	44	F	SR	WL				√	√			√			√						√			
WL152	06/12/18	101	?	YR	WL				√	√	√						√	√					√	√	
WL159	26/10/18	28	F	SV	WL				√	√			√			√						√			
WL165	29/02/16	65	?	YR	WL					√	√						√	√						√	
WL166	06/06/17	16	?	SR	WL					√	√						√						√		
WL167	26/10/18	17	F	SR	NL				√	√			√			√						√			
WL168	29/11/18	40	?	YR	WL					√	√		√			√	√	√				√	√	√	
WL171	21/11/18	32	F	SR	WL					√	√						√	√					√	√	
WL173	12/12/17	69	?	YR	WL					√	√		√				√	√						√	
WL177	29/11/18	15	F	SV	WL					√	√					√	√	√					√	√	
WL178	19/07/16	18	?	SV	WL				√	√	√	√	√			√	√					√			
WL179	21/09/18	40	F	SR	NL/WL				√	√			√	√		√	√	√				√	√		
WL180	13/12/18	92	F?	YR	WL					√	√		√				√	√						√	
WL188	12/07/18	19	?	SR	NL	√			√	√				√						√					
WL189	25/05/16	17	?	SR	WL				√	√						√	√					√			
WL191	06/10/18	30	?	YR	WL				√	√			√			√	√	√				√	√		
WL199	25/07/18	48	?	YR	WL				√	√	√		√				√	√					√		
WL207	07/08/18	24	F	SR	WL				√	√						√	√					√			
WL208	12/11/18	44	F	YR	WL				√	√	√					√	√	√					√	√	
WL210	22/09/18	28	?	SR	WL					√	√		√			√	√	√					√	√	
WL211	28/10/18	31	F	YR	WL					√	√		√				√						√		
WL213	25/07/18	16	?	SR	WL				√	√						√	√						√		
WL214	02/08/18	26	?	SR	WL				√	√			√			√	√					√			
WL215	26/03/18	56	?	YR	WL				√	√	√		√			√	√	√					√	√	
WL216	05/09/18	37	?	YR	WL				√	√	√		√			√	√	√				√	√		
WL217	22/10/18	23	?	SR	WL				√	√	√					√	√					√			
WL218	22/10/18	17	?	SV	WL				√	√	√		√			√	√					√	√		
WL220	13/12/18	58	?	YR	WL					√	√		√				√	√					√	√	
WL221	23/01/18	56	?	YR	WL				√	√	√		√			√	√	√	√			√		√	√
WL226	03/09/18	17	?	SV	WL					√			√			√	√					√			
WL229	29/11/18	25	?	SR	WL					√	√		√			√	√	√				√			
WL230	24/10/18	28	?	SR	WL				√	√	√		√			√	√	√					√	√	
WL231	25/05/16	17	?	N.D.	WL				√	√	√		√			√	√					√	√		
WL232	02/12/18	46	?	YR	WL				√	√	√		√			√		√	√			√			
WL233	23/07/18	16	?	N.D.	WL				√	√	√					√						√			
WL234	07/12/17	24	?	N.D.	WL				√	√	√					√	√	√	√				√	√	√
WL235	27/04/17	27	?	N.D.	WL				√	√	√					√	√	√	√			√			√
WL241	19/01/18	18	?	SR	WL				√	√	√		√			√	√	√				√	√	√	
WL243	16/11/18	47	?	YR	WL				√	√	√	√				√			√			√			√
WL245	09/08/18	16	?	SR	WL				√	√			√			√						√			
WL249	28/03/18	15	?	N.D.	WL					√			√				√	√					√		
WL250	02/12/18	28	F	SR	WL					√	√	√	√					√	√					√	√
WL254	02/12/18	21	F	YR	WL					√	√		√				√	√					√	√	
WL256	26/10/18	19	?	SR	WL					√	√		√				√	√					√	√	
WL260	24/09/18	29	?	YR	WL					√	√		√				√	√	√				√		√
WL268	21/11/18	16	?	N.D.	WL					√			√			√						√			
WL269	19/11/18	25	?	YR	WL					√	√		√				√	√					√	√	
WL273	29/11/18	21	?	N.D.	WL				√	√	√		√				√	√					√	√	

Table 7. 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

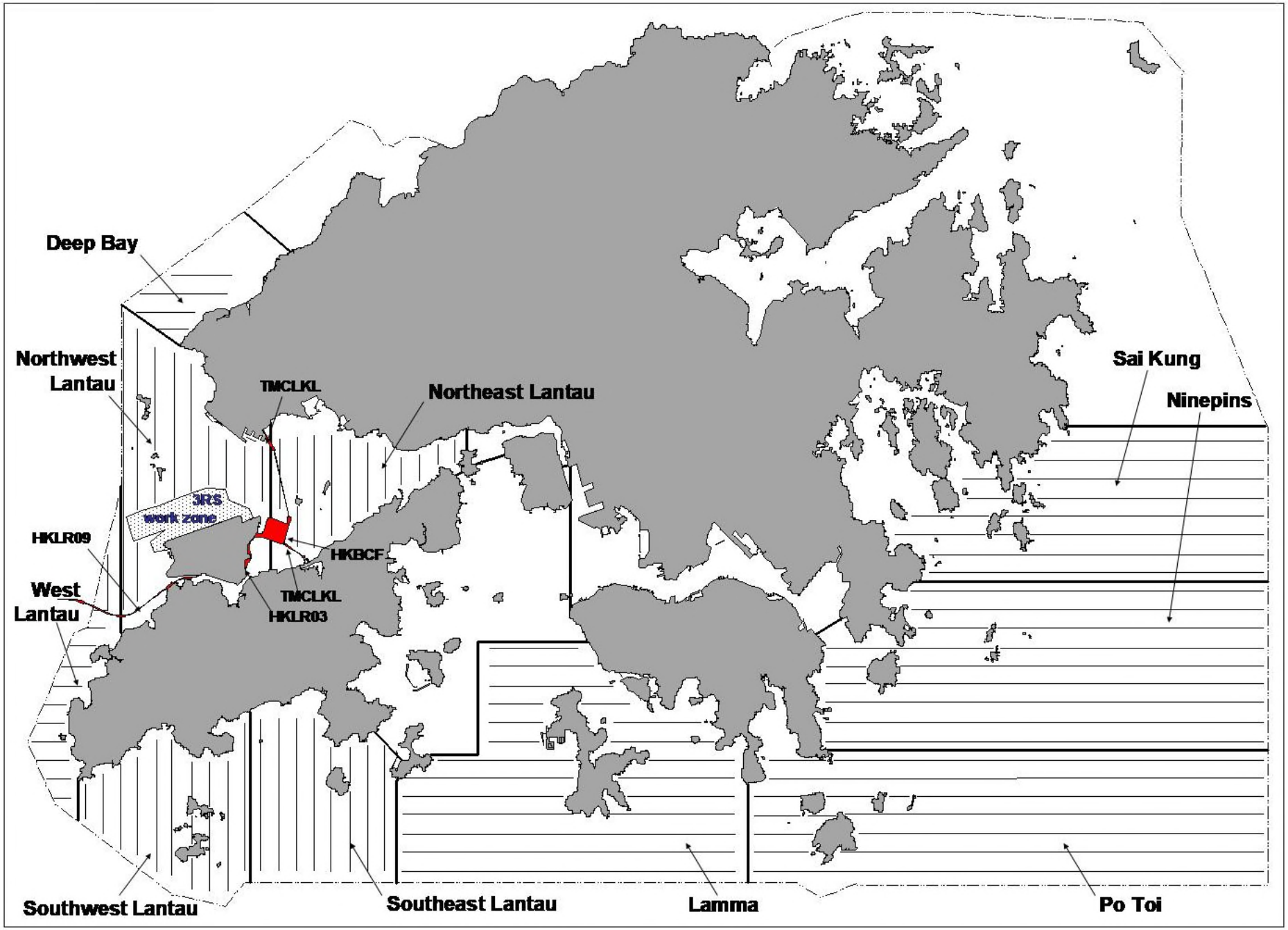


Figure 1. Ten Line-Transect Survey Areas within the Study Area for the 2018-19 Monitoring Study

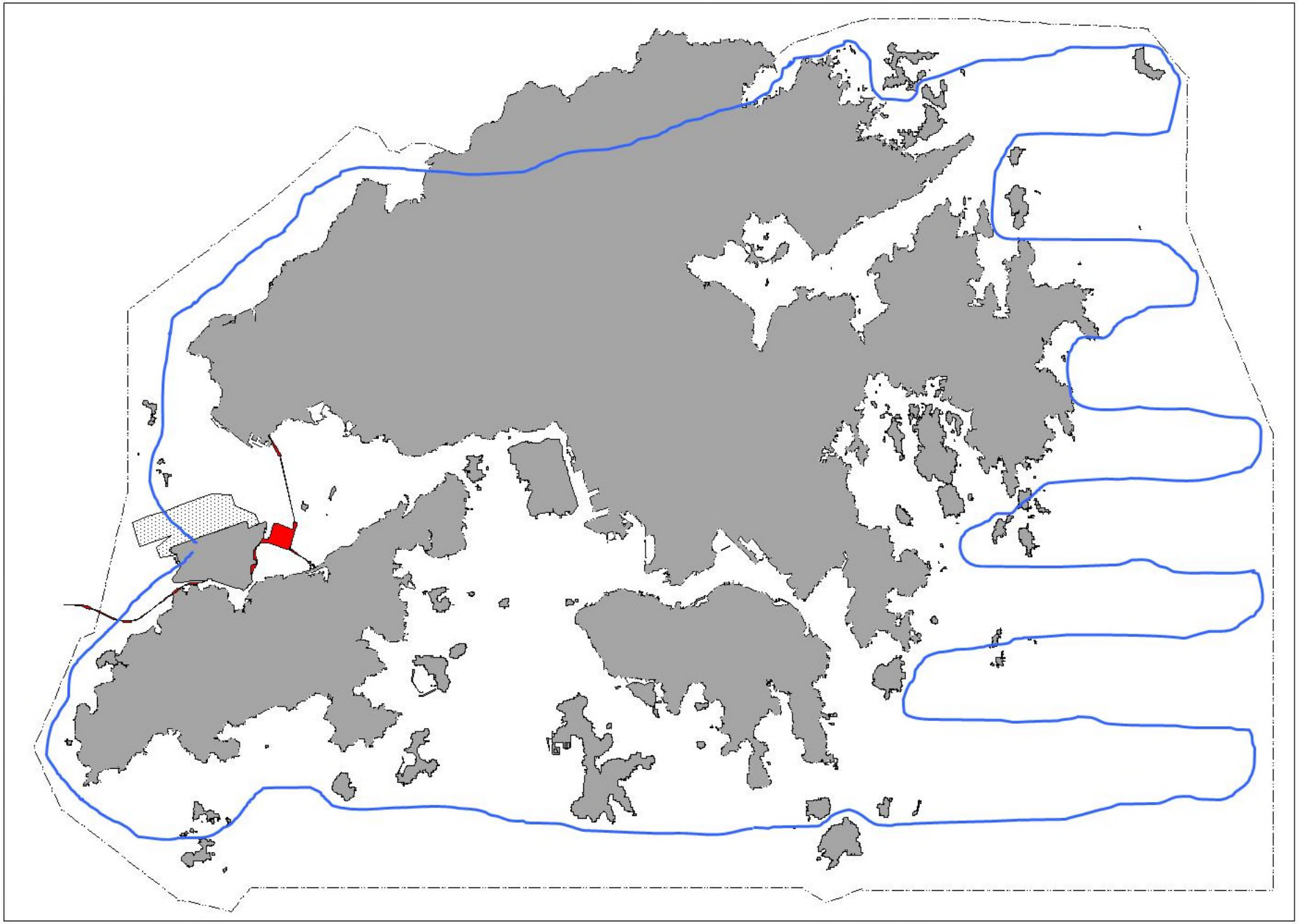


Figure 2. Indicative Survey Route for Helicopter Surveys in Eastern and Southern Waters of Hong Kong

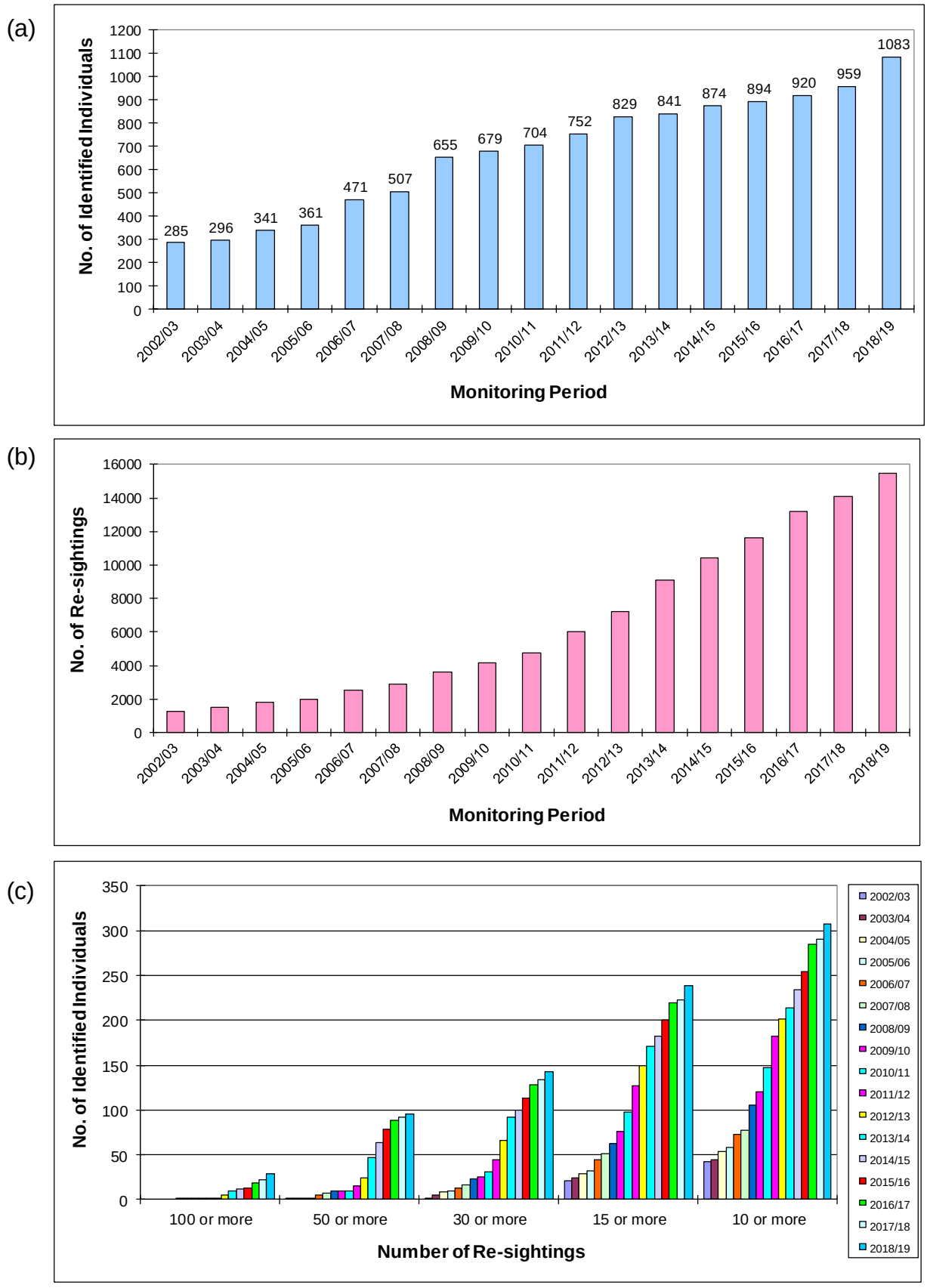


Figure 3. Temporal trends of (a) total number of identified individuals; (b) total number of re-sightings made; and (c) number of identified individuals within several categories of number of re-sightings in the past 17 monitoring periods since 2002

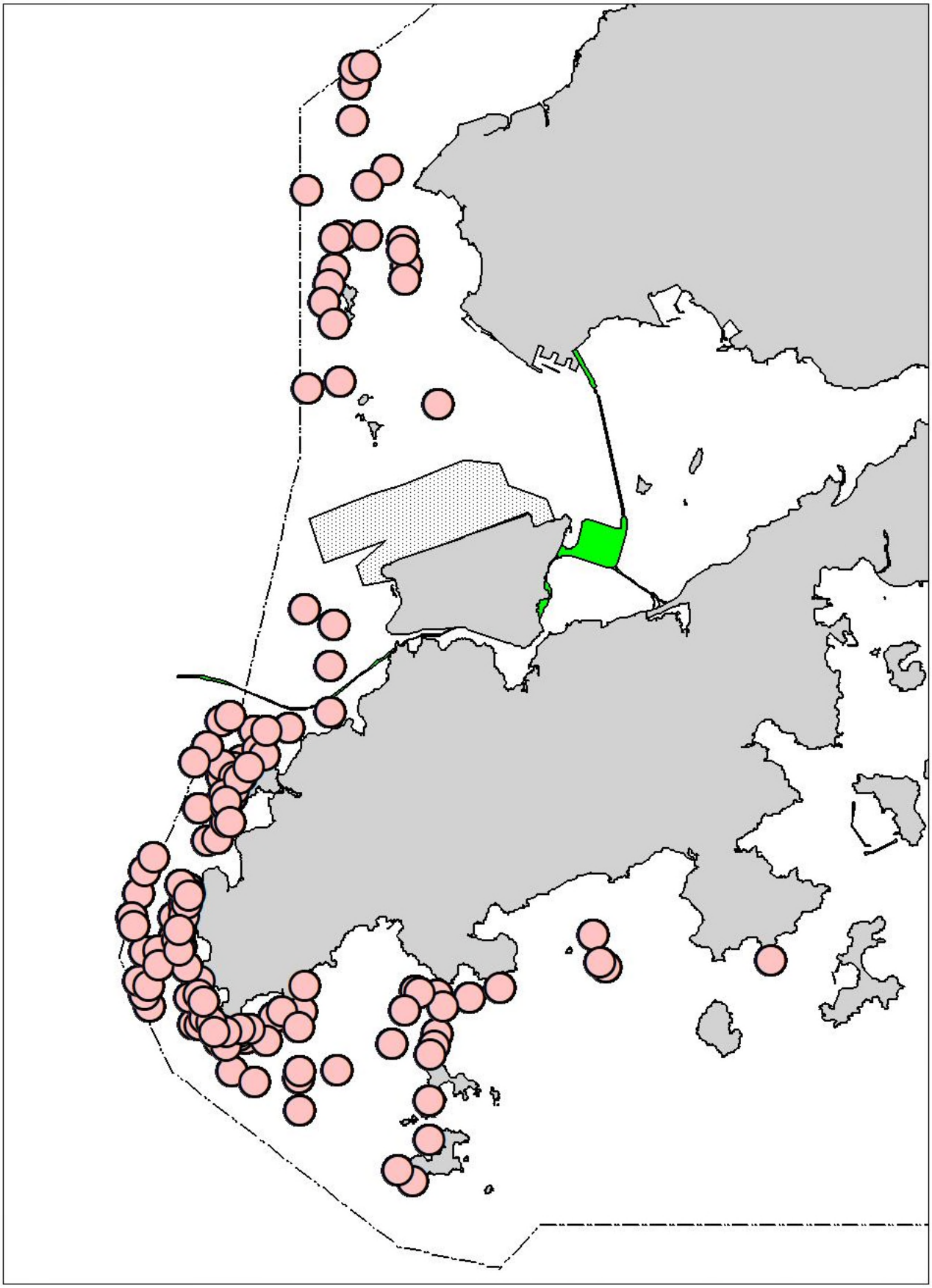


Figure 4. Distribution of CWD sightings in Hong Kong waters during AFCD monitoring surveys (April 2018 – March 2019)

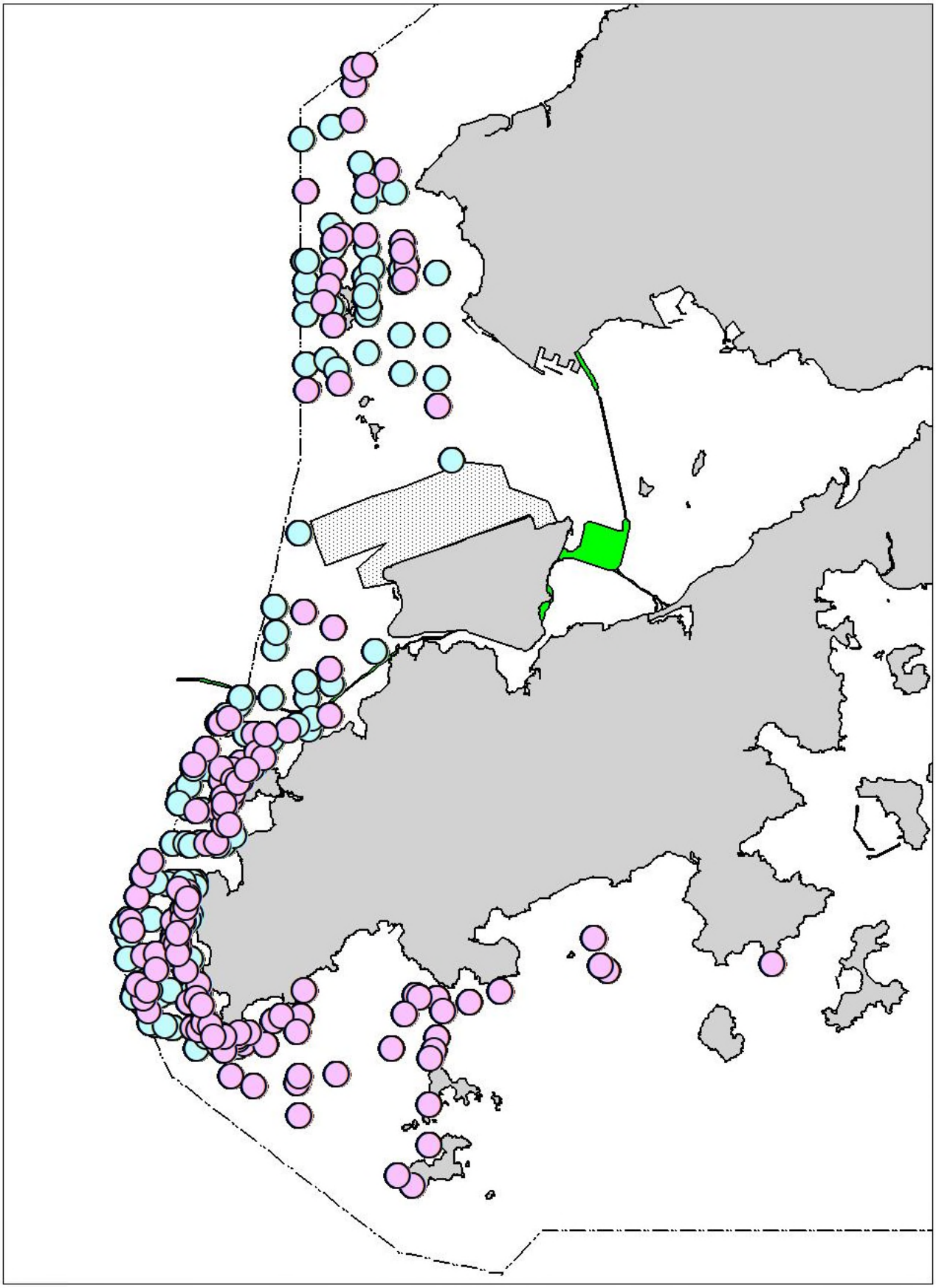


Figure 5. Distribution of all CWD sightings in Hong Kong waters in 2018-19
(purple dots: AFCD survey sightings; blue dots: HKLR survey sightings)

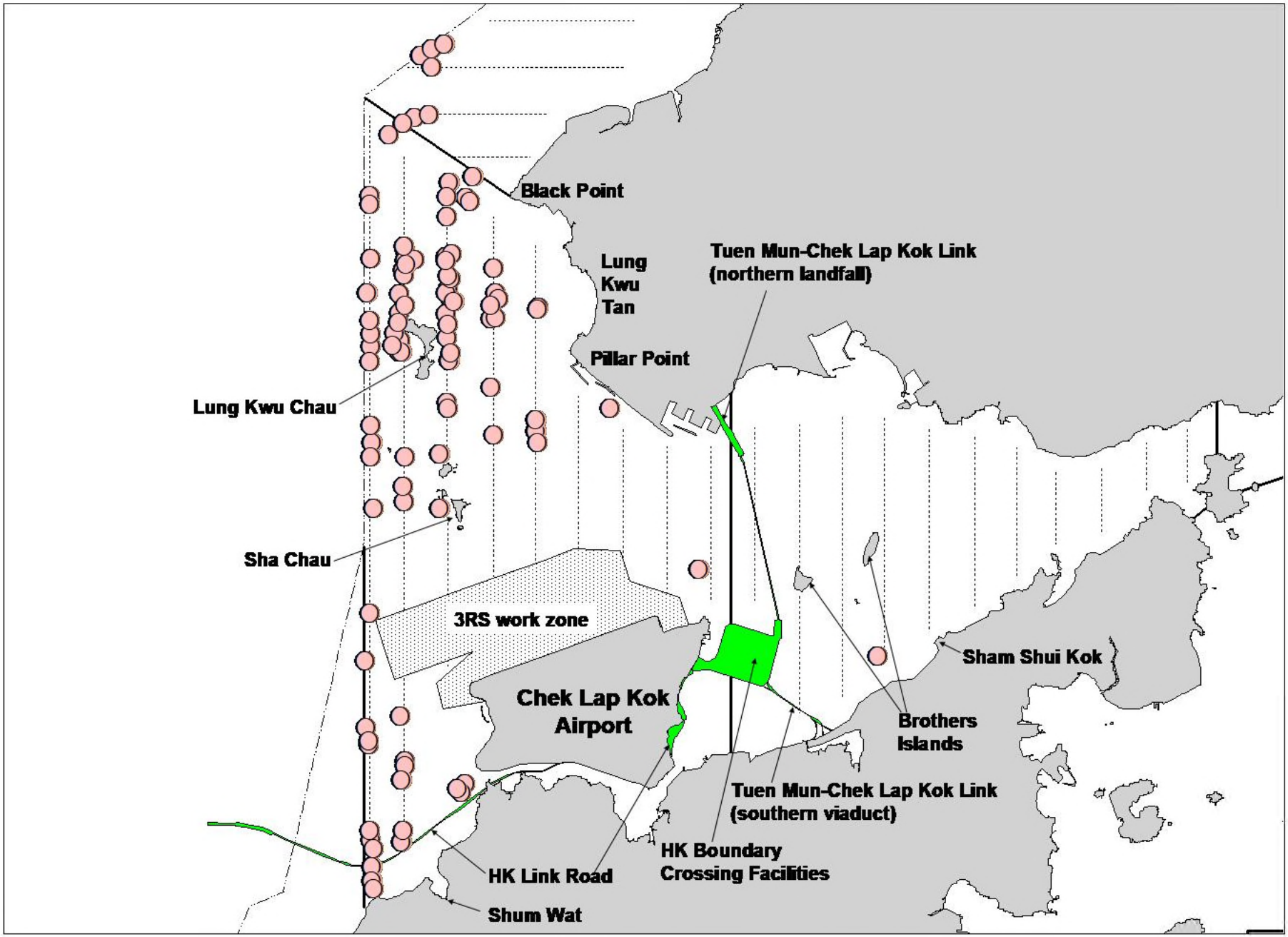


Figure 6. Distribution of Chinese White Dolphin sightings in North Lantau (2018)

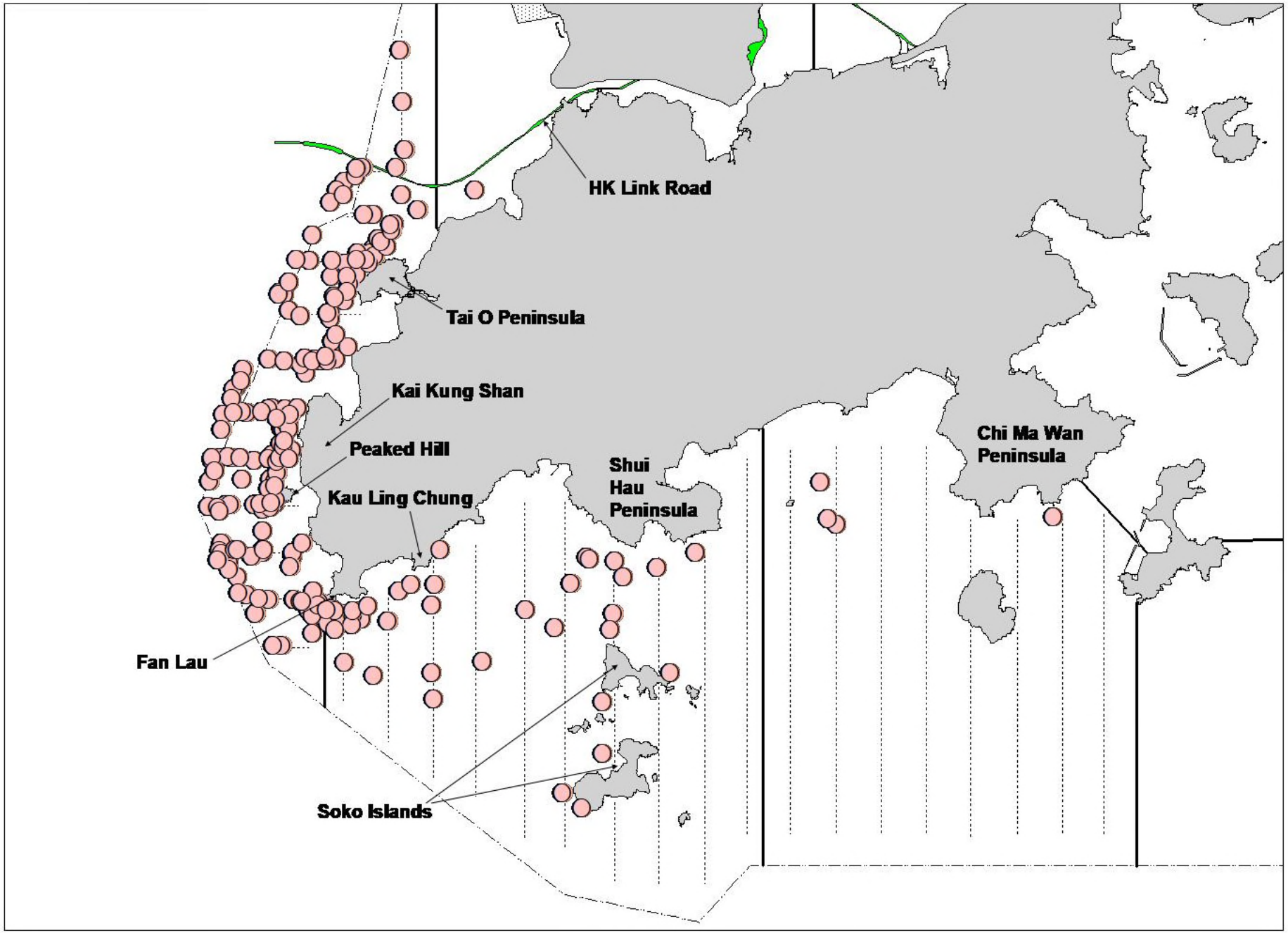


Figure 7. Distribution of Chinese White Dolphin sightings in West and South Lantau waters (2018)

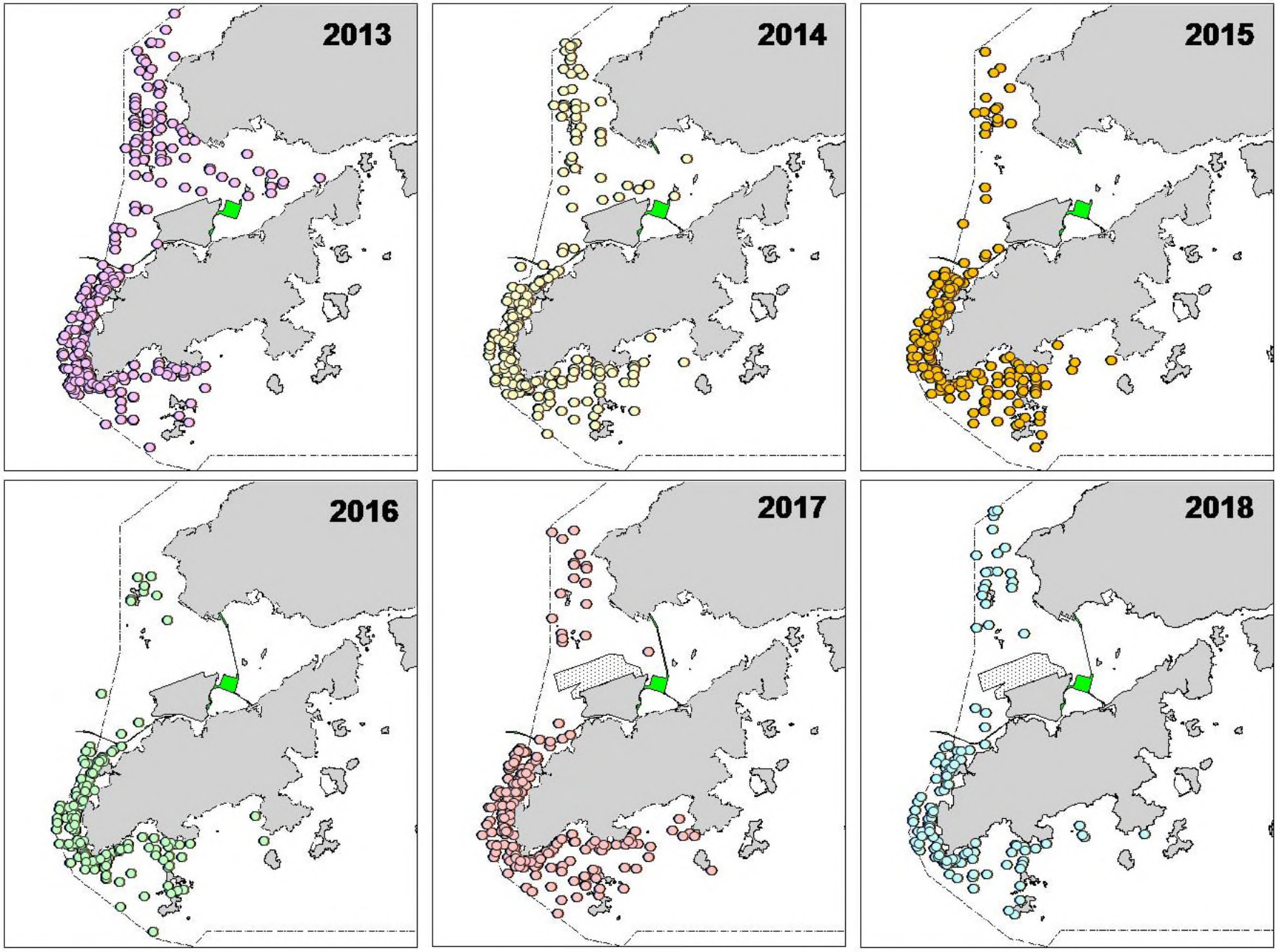


Figure 8. Comparison of dolphin distribution patterns from the past six years (2013-18)

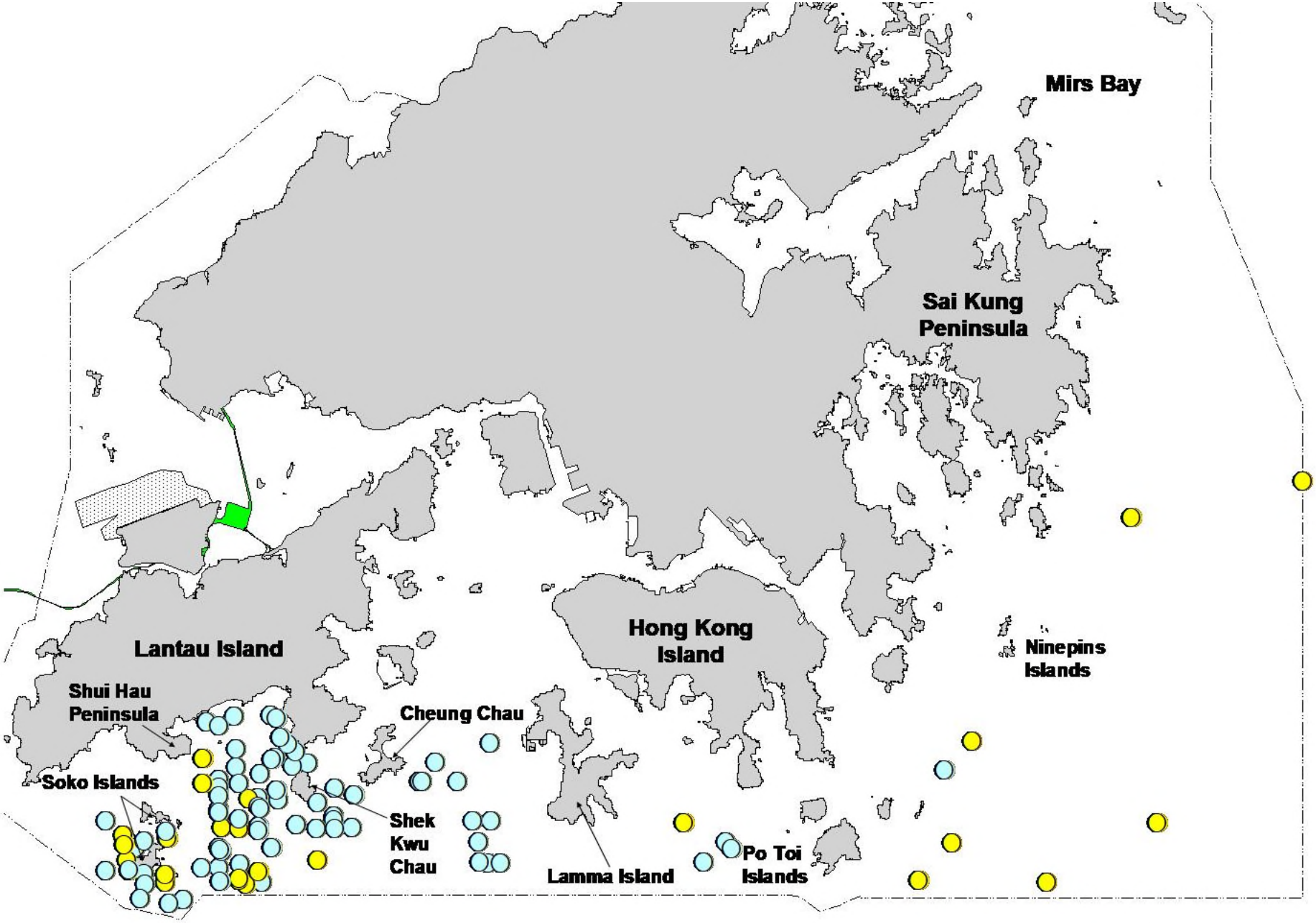


Figure 9. Distribution of finless porpoise sightings made during AFCD surveys (April 2018 – March 2019)
(yellow dots: sightings made during summer/autumn months)

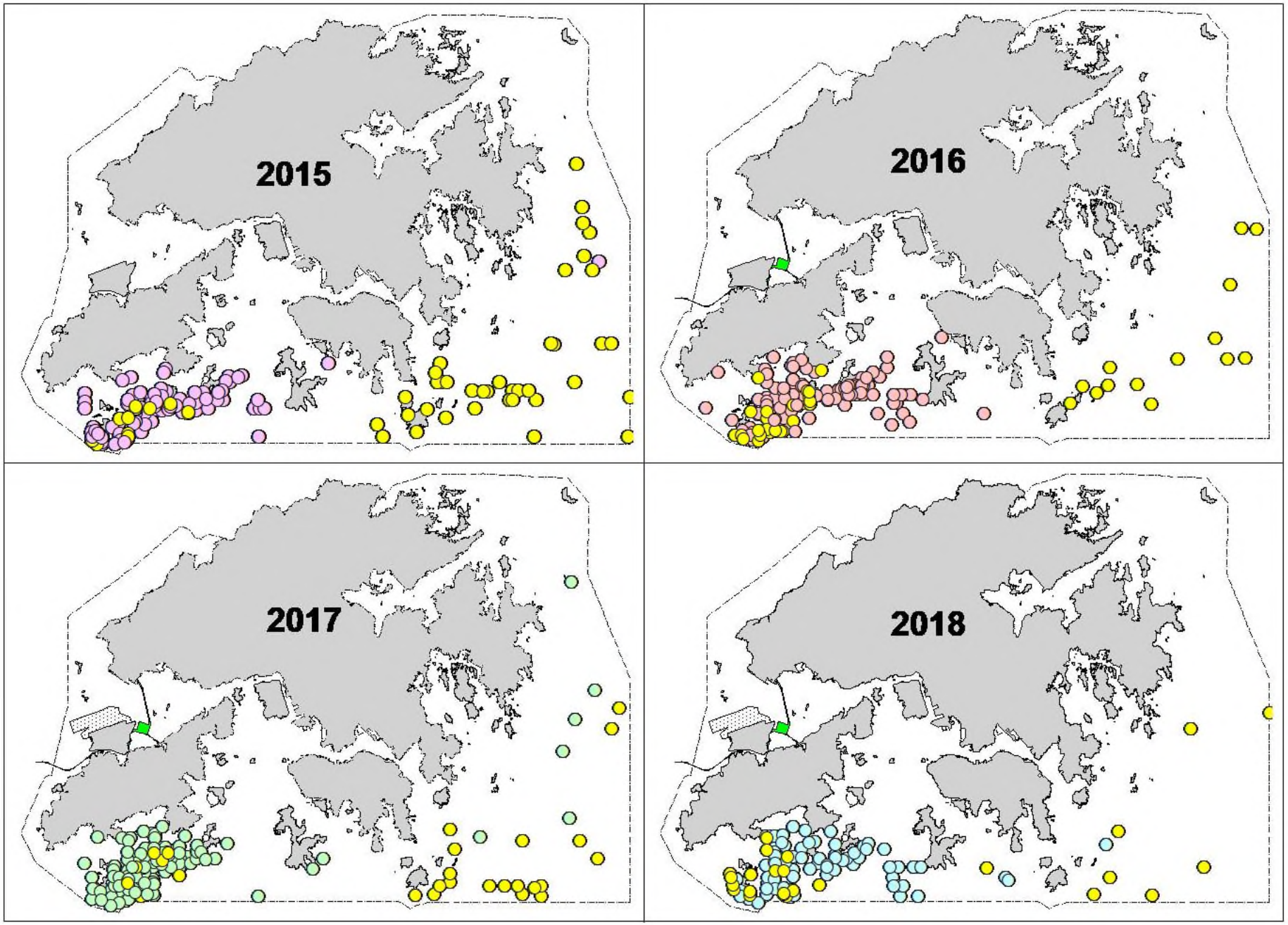
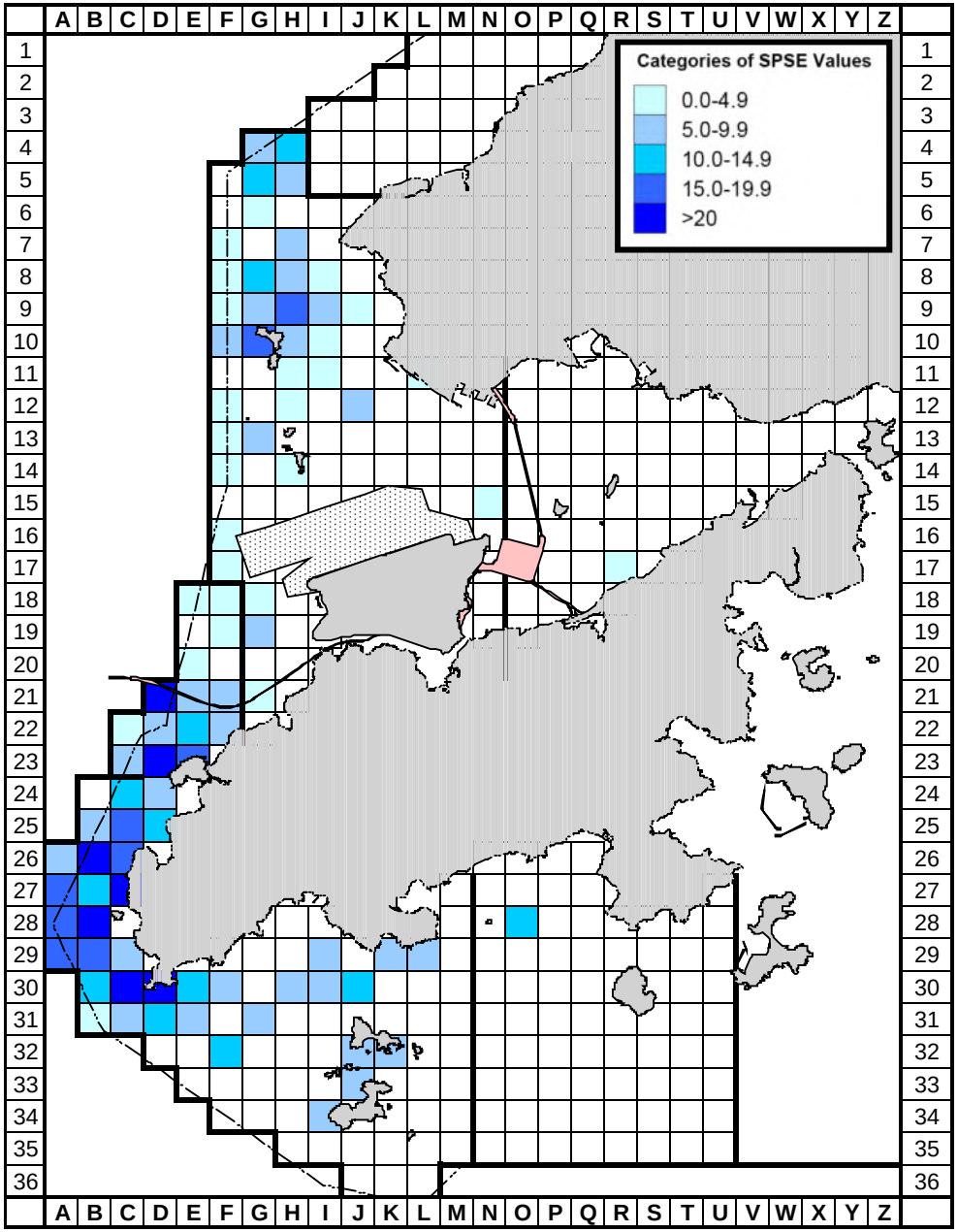


Figure 10. Comparison of annual porpoise distribution patterns from 2015-18
(yellow dots: sightings made during summer/autumn months)



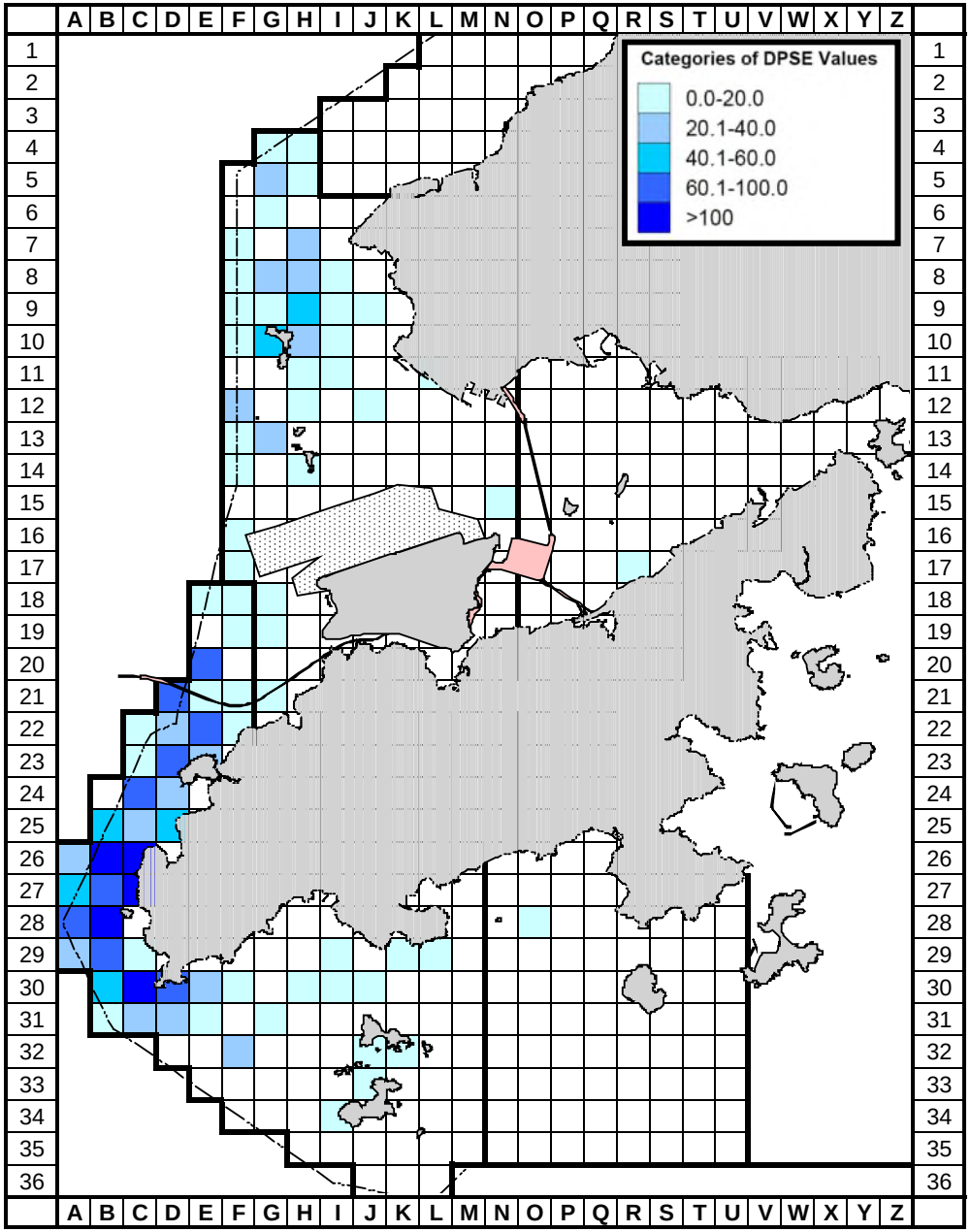


Figure 11. (left) Sighting density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island (number within grids represent "SPSE" no. of on-effort dolphin sightings per 100 units of survey effort) (using data from January - December 2018)

(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 2018)

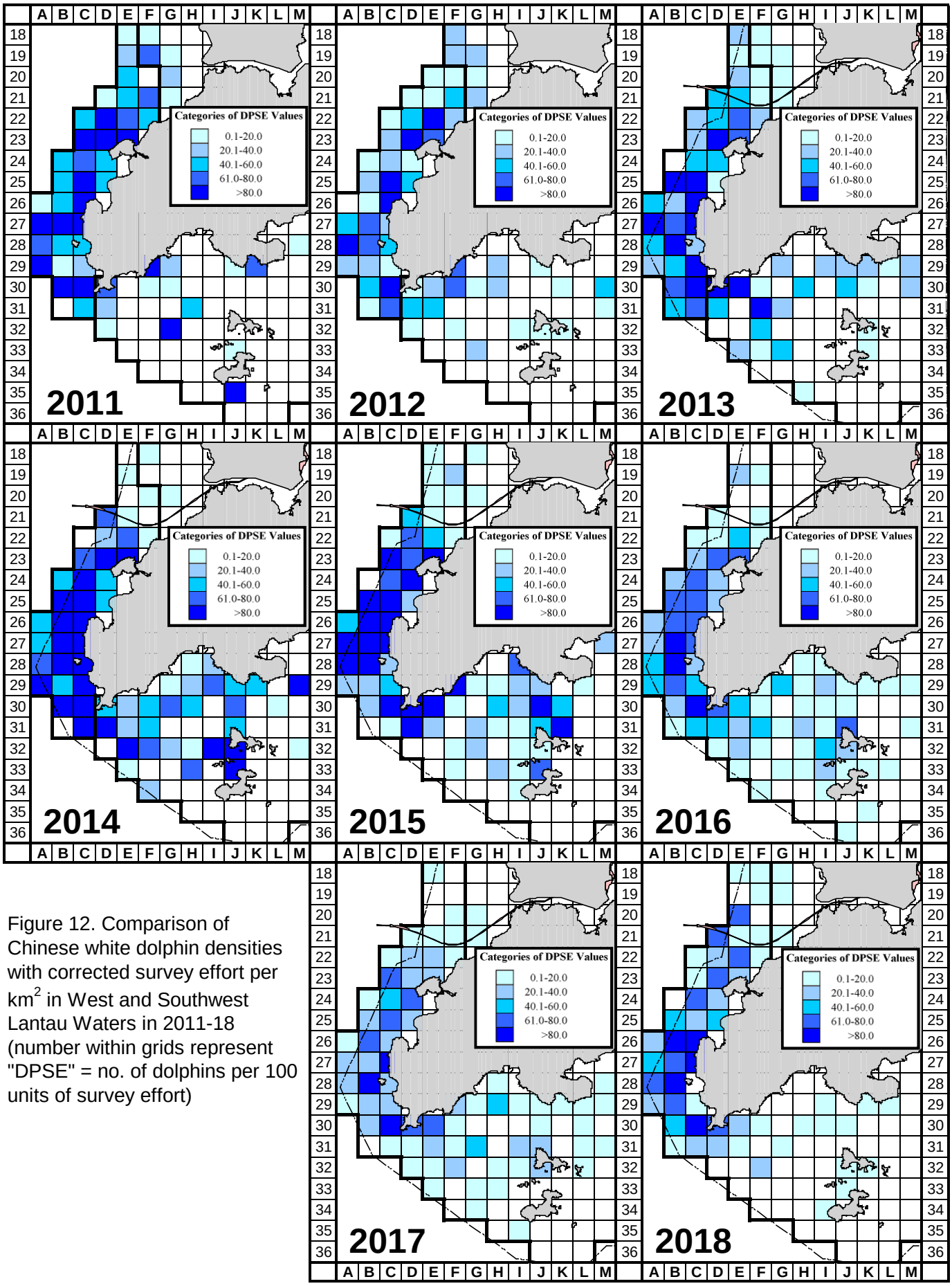


Figure 12. Comparison of Chinese white dolphin densities with corrected survey effort per km^2 in West and Southwest Lantau Waters in 2011-18 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)

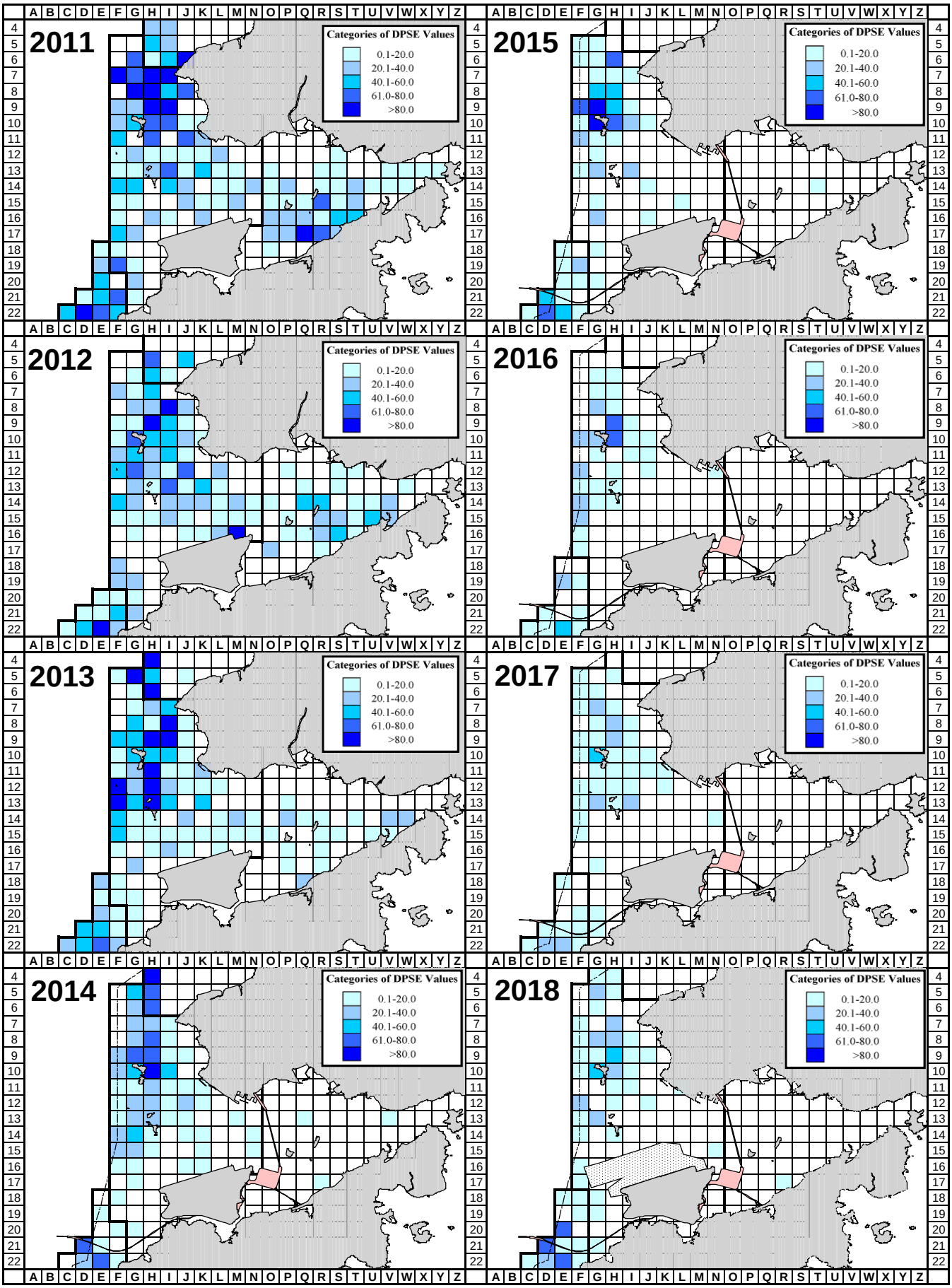


Figure 13. Comparison of dolphin densities with corrected survey effort per km^2 in North Lantau waters in 2011-18 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)

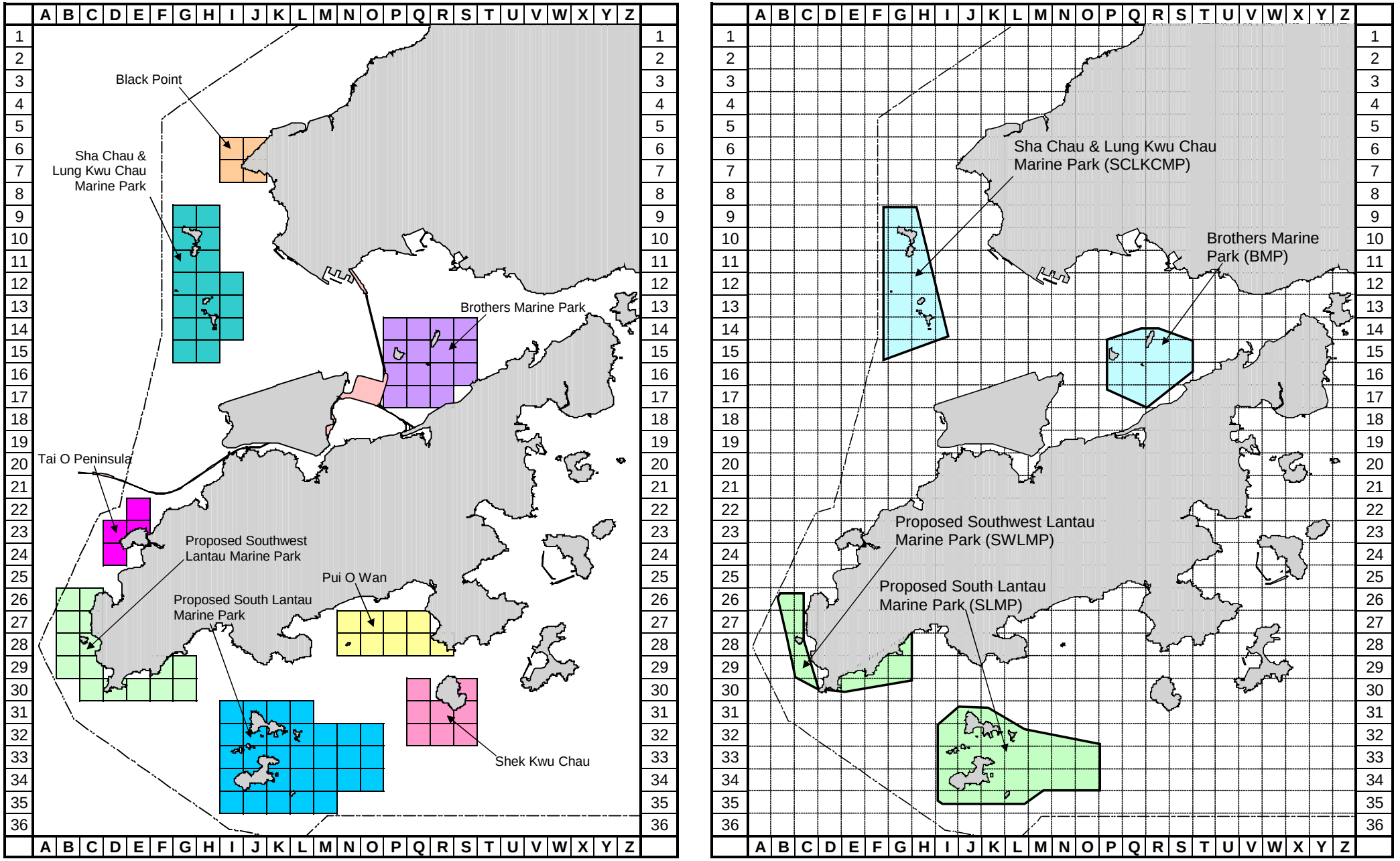


Figure 14. Grids of key marine mammal habitats in western HK waters that were examined for temporal trend in dolphin and porpoise densities

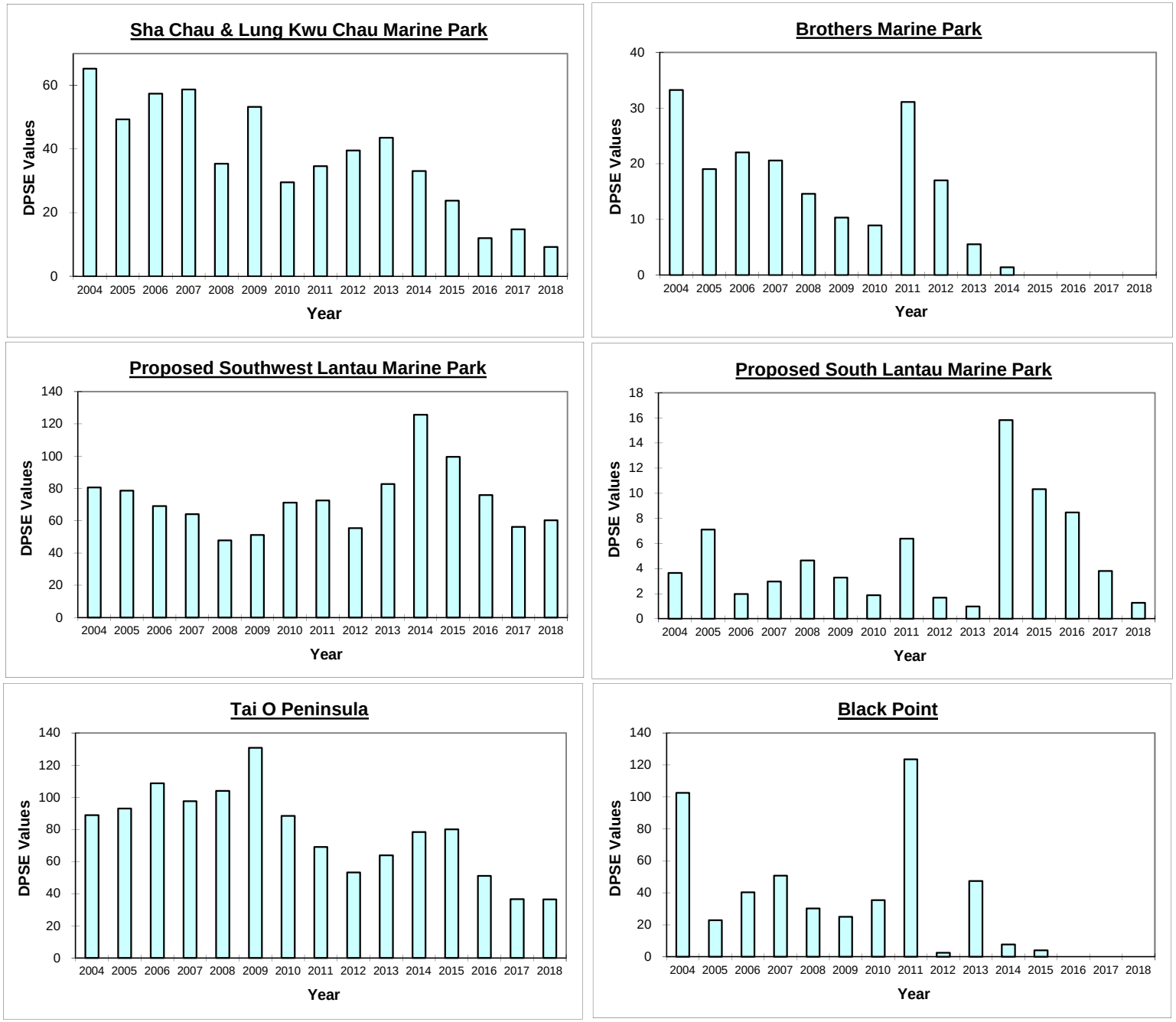


Figure 15. Temporal trend of dolphin densities (DPSE Values) at six key dolphin habitats in Lantau waters

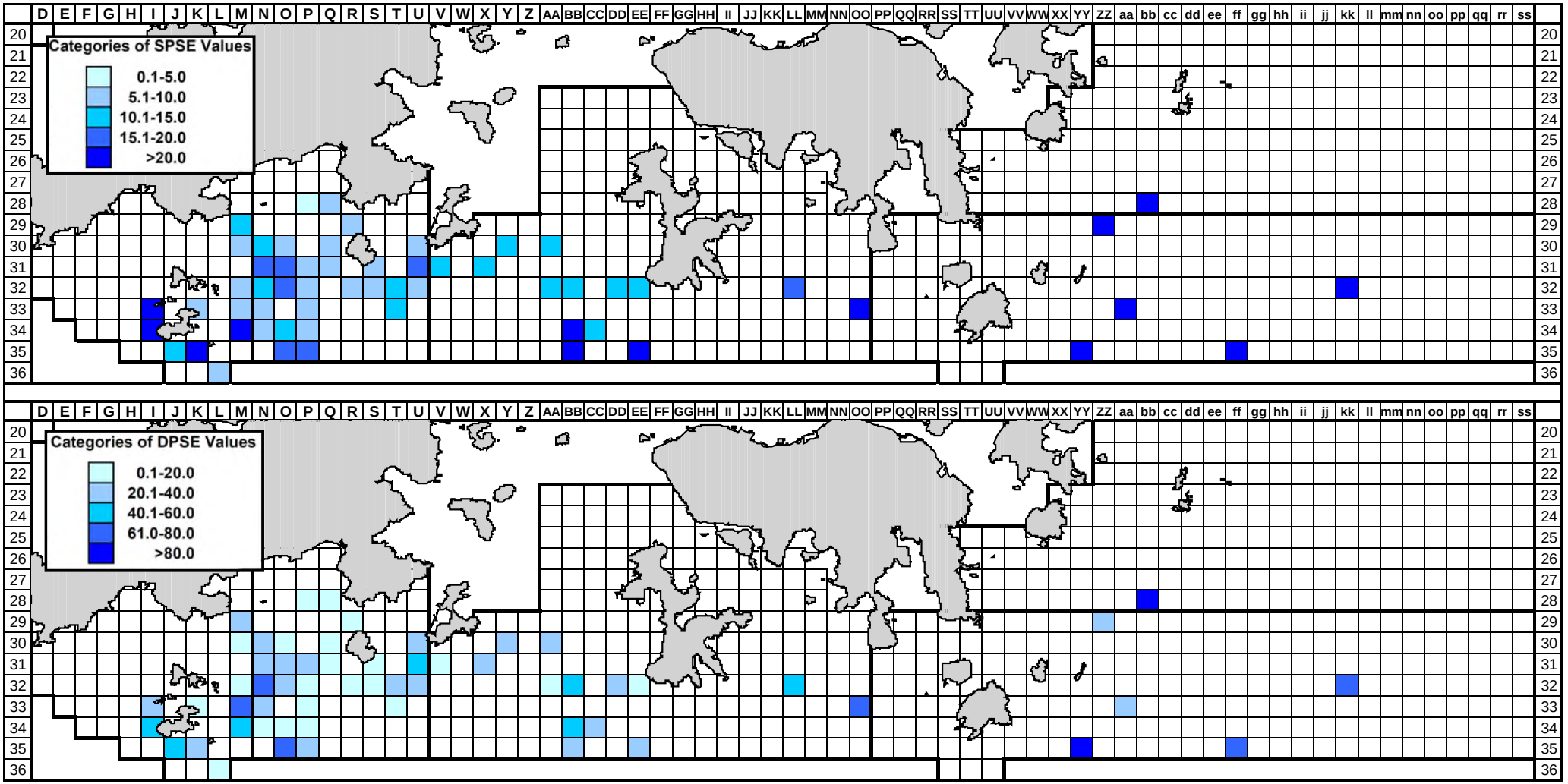


Figure 16. (top) Sighting density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong (number within grids represent "SPSE" = no. of on-effort porpoise sightings per 100 units of survey effort) (using data from January - December 2018)

(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 2018)

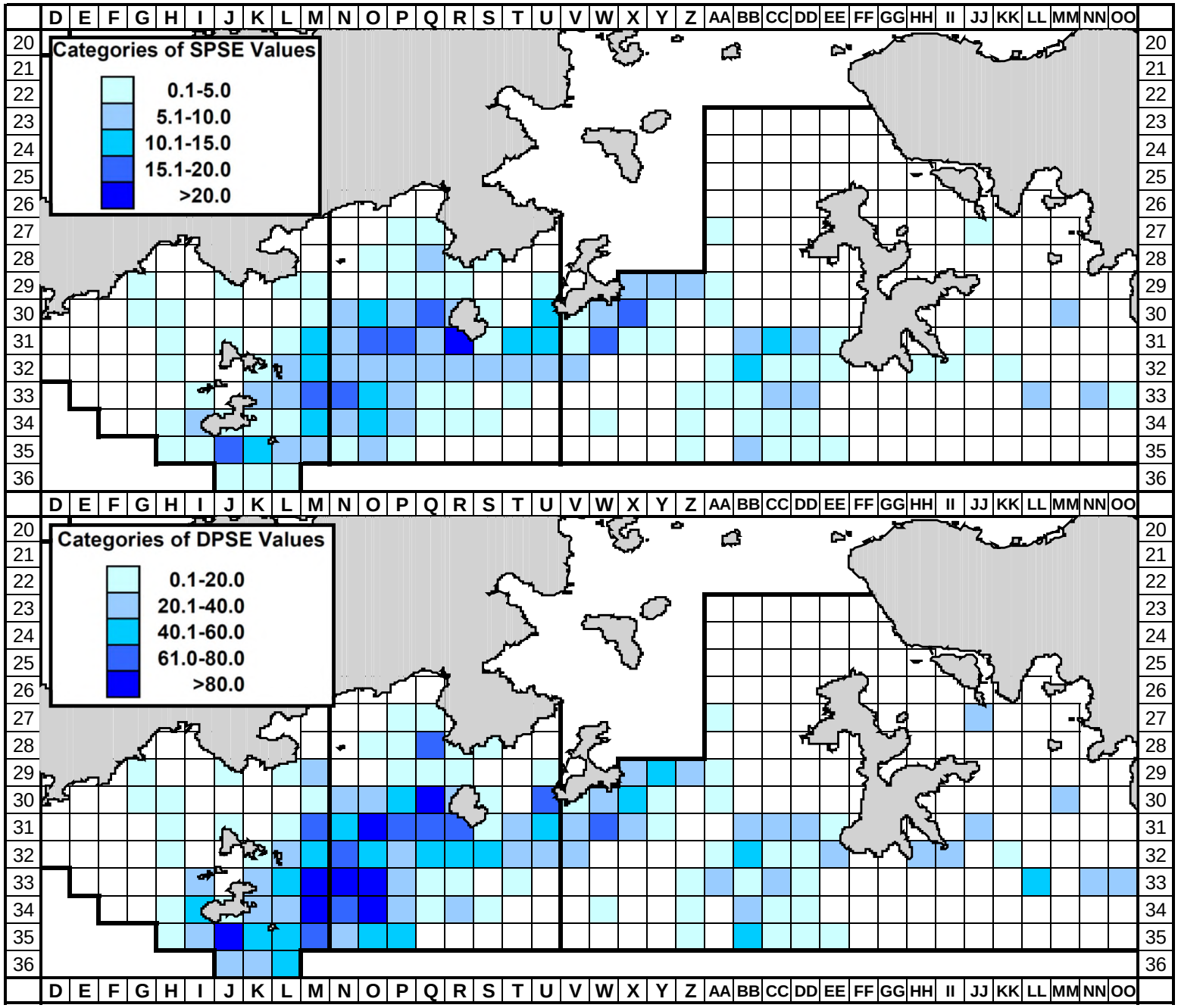


Figure 17. Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (December to May), using data collected during 2014-18 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort)

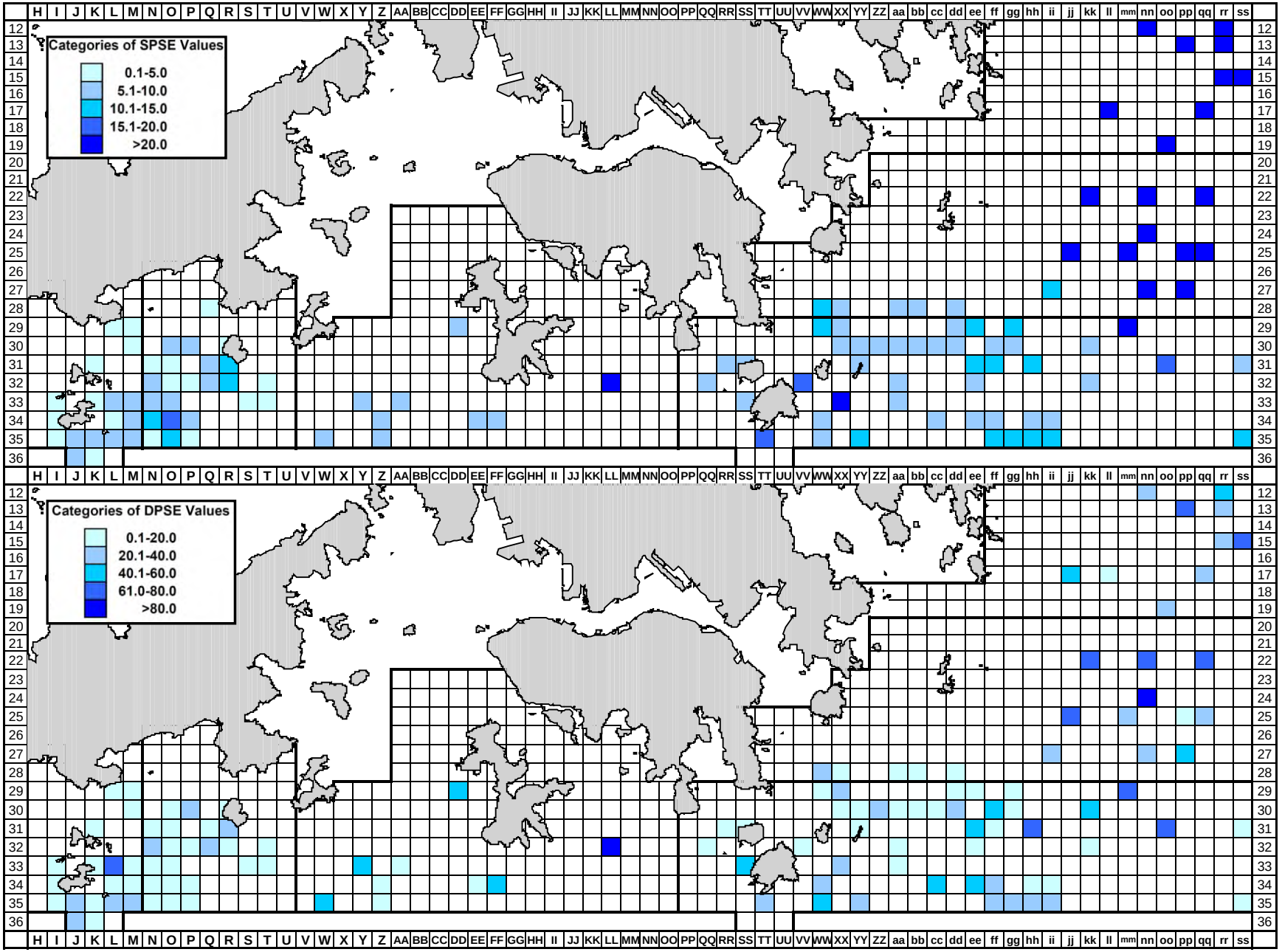


Figure 18. Density of finless porpoises with corrected survey effort per km^2 in southern and eastern waters of Hong Kong during wet season (June to November), using data collected during 2014-18 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort

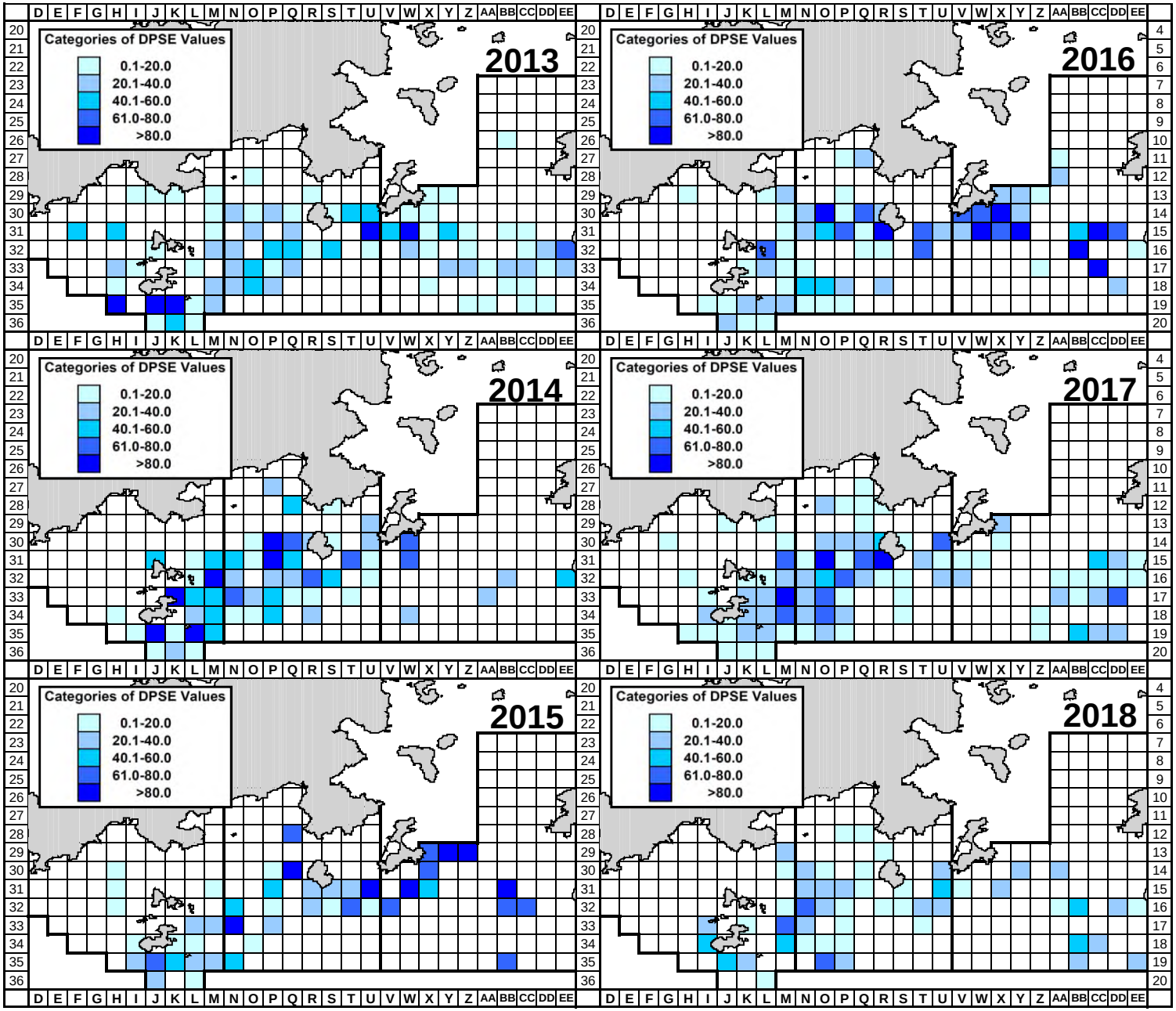


Figure 19. Comparison of porpoise densities with corrected survey effort per km^2 in South Lantau and Eastern Lamma waters in 2013-18 (number within grids represent "DPSE" = no. of porpoises per 100 units of survey effort)

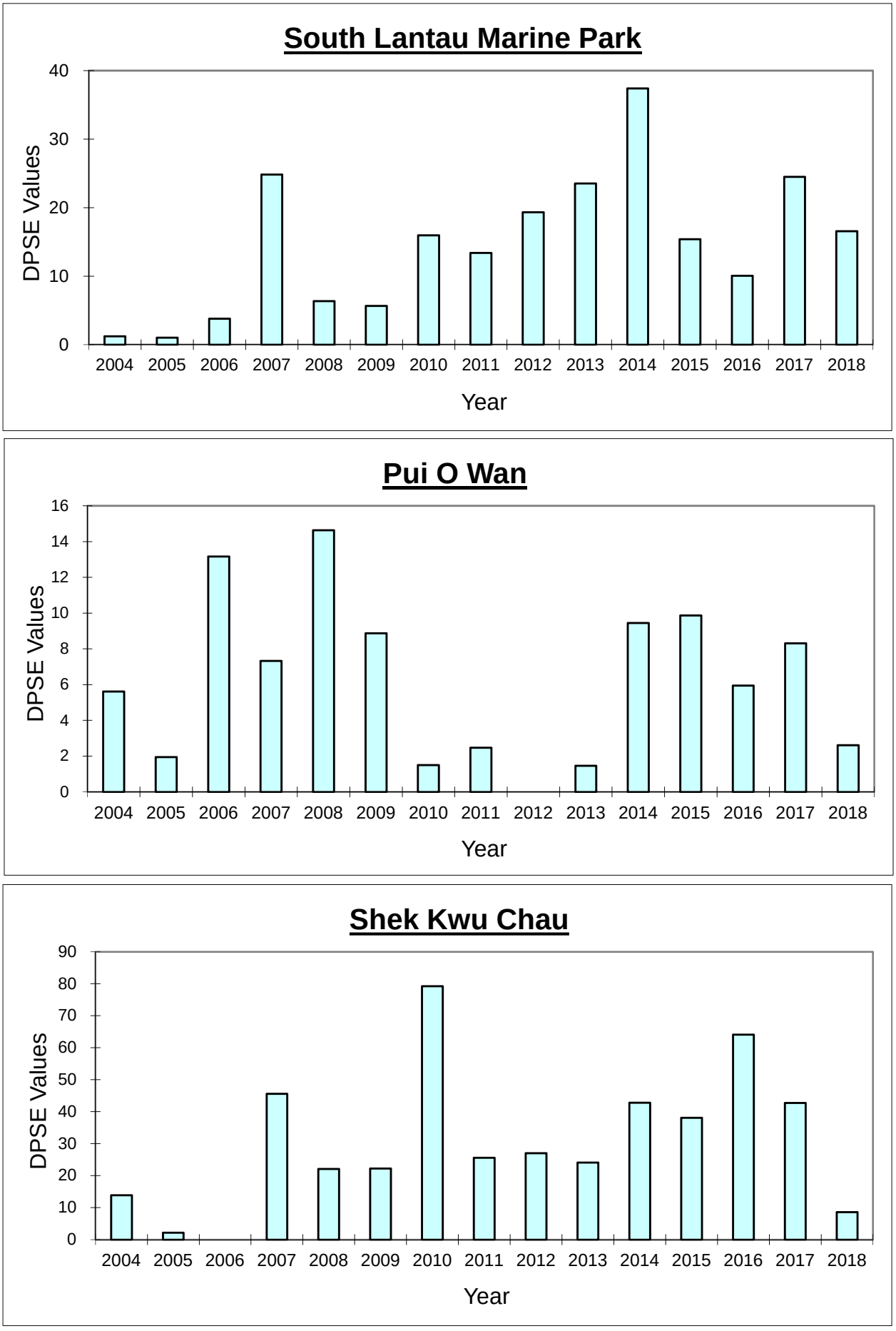


Figure 20. Temporal trend of porpoise densities (DPSE Values) at three key porpoise habitats in South Lantau waters

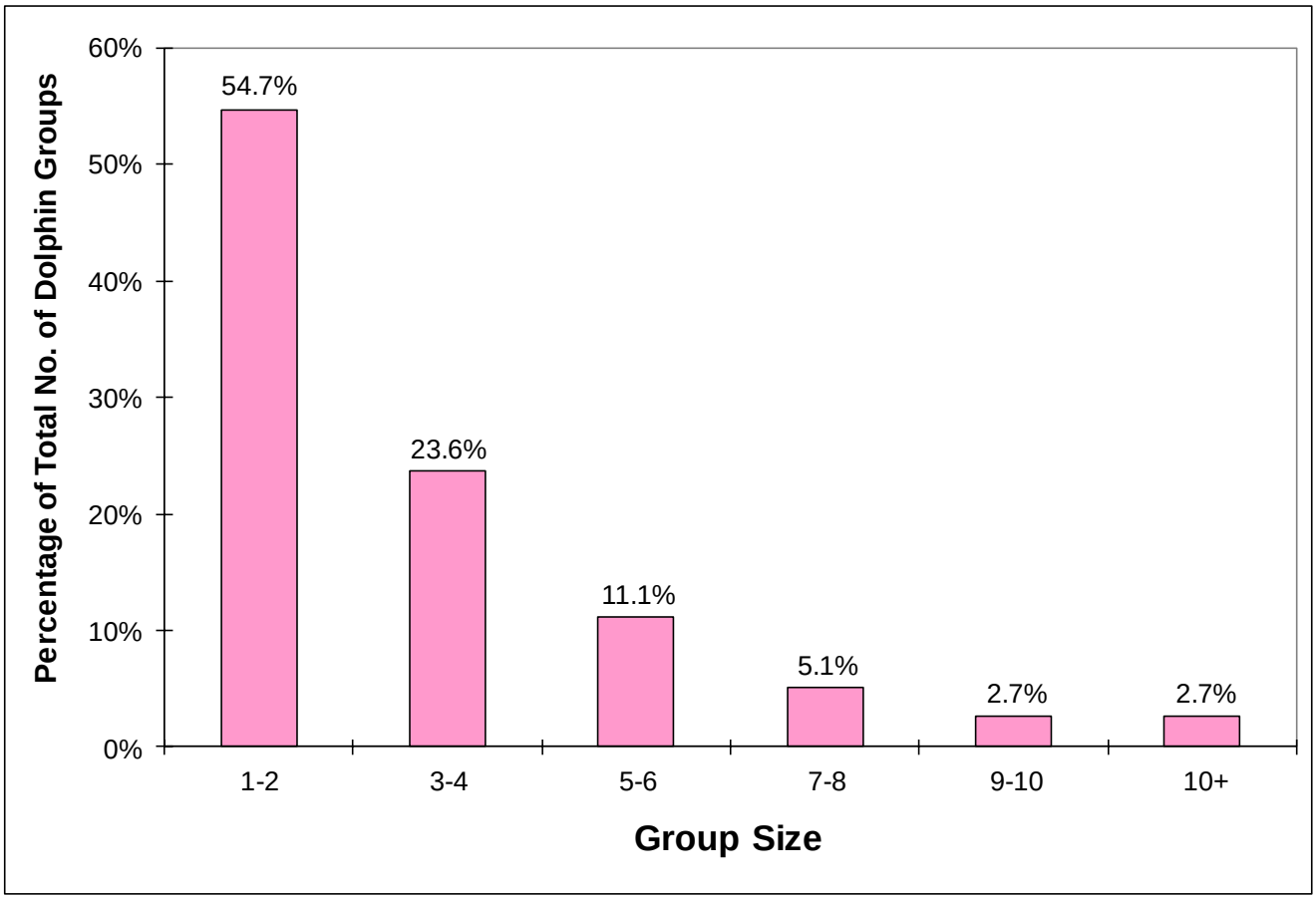


Figure 21. Percentages of different group sizes of Chinese white dolphins in Hong Kong during April 2018 to March 2019

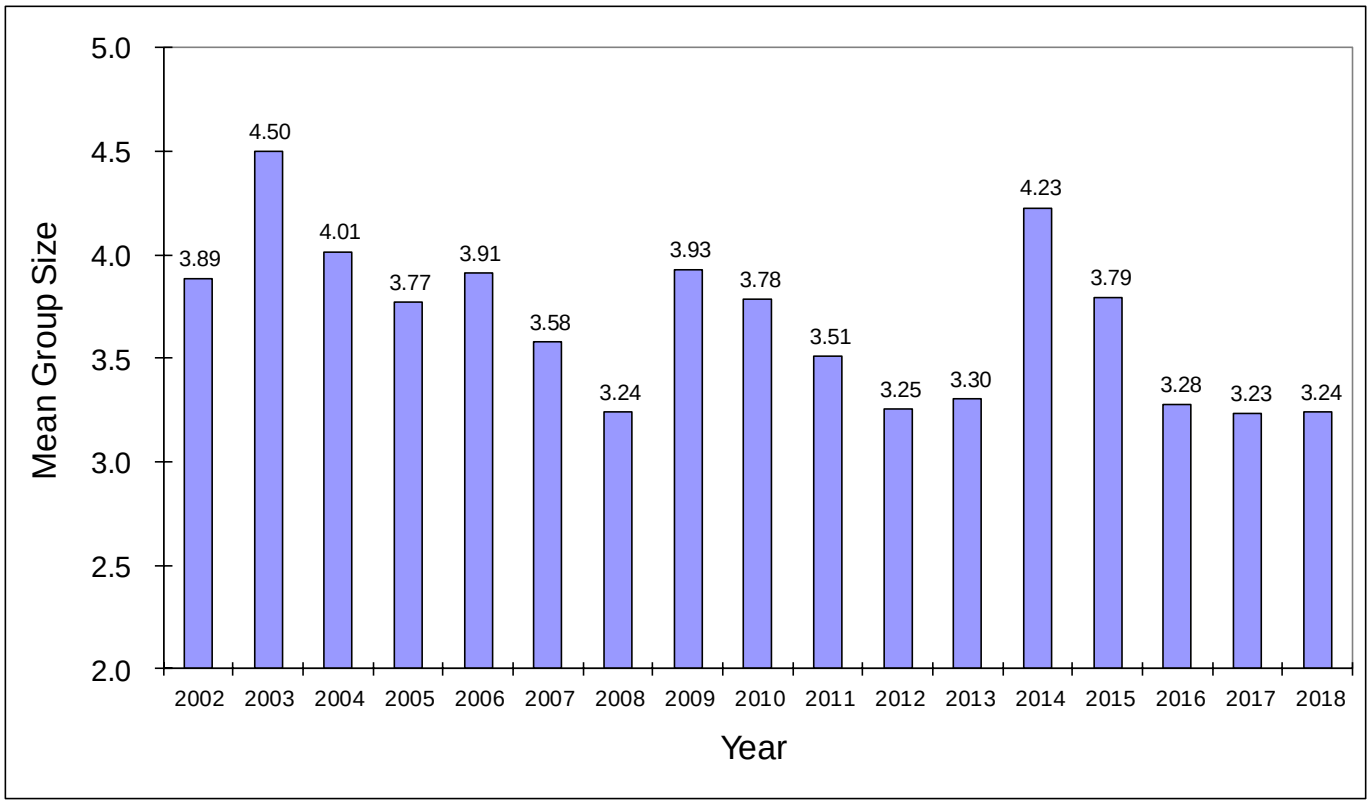


Figure 22. Temporal trend of mean dolphin group size in 2002-18

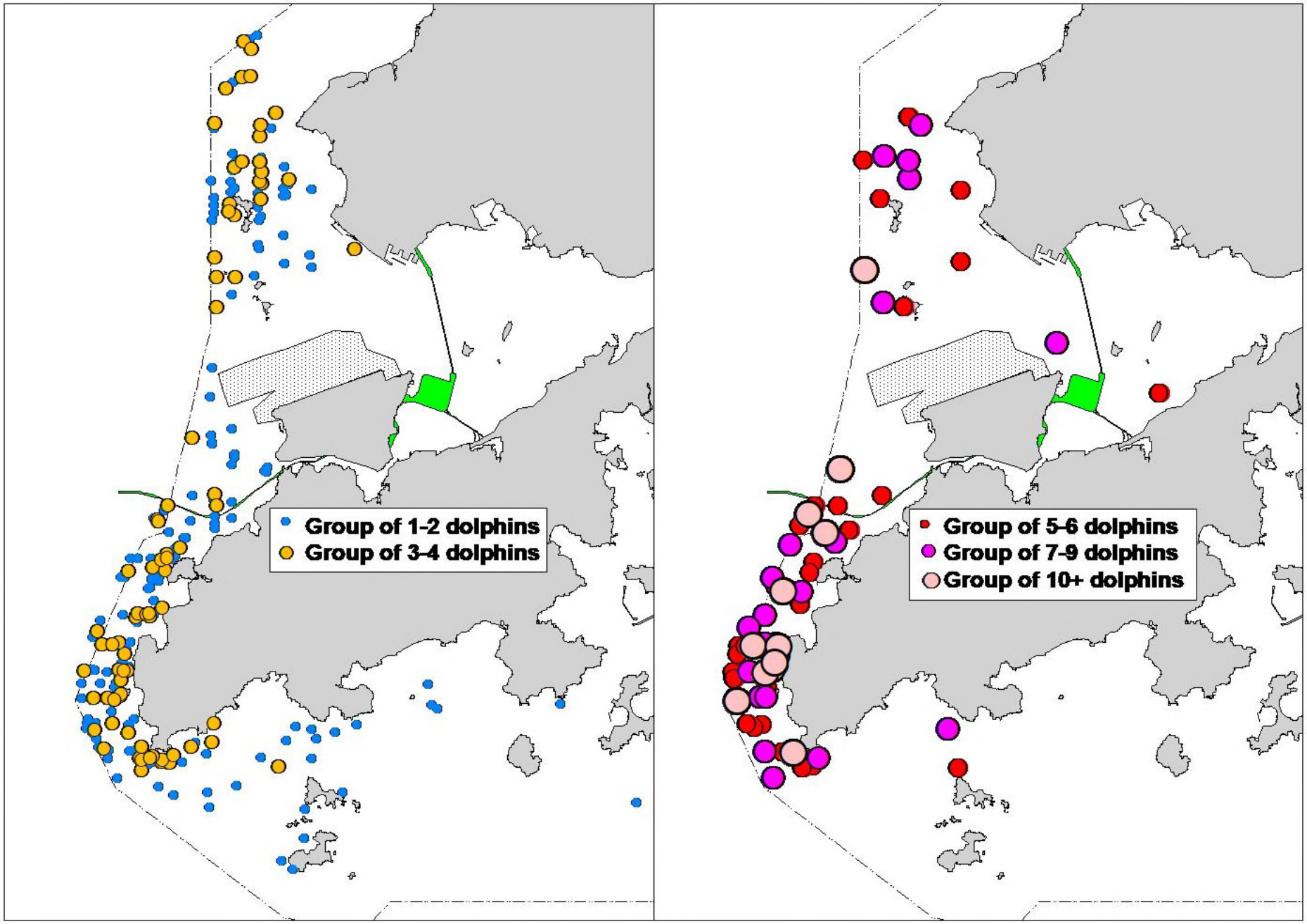


Figure 23. Distribution of Chinese White Dolphins with different group sizes in 2018

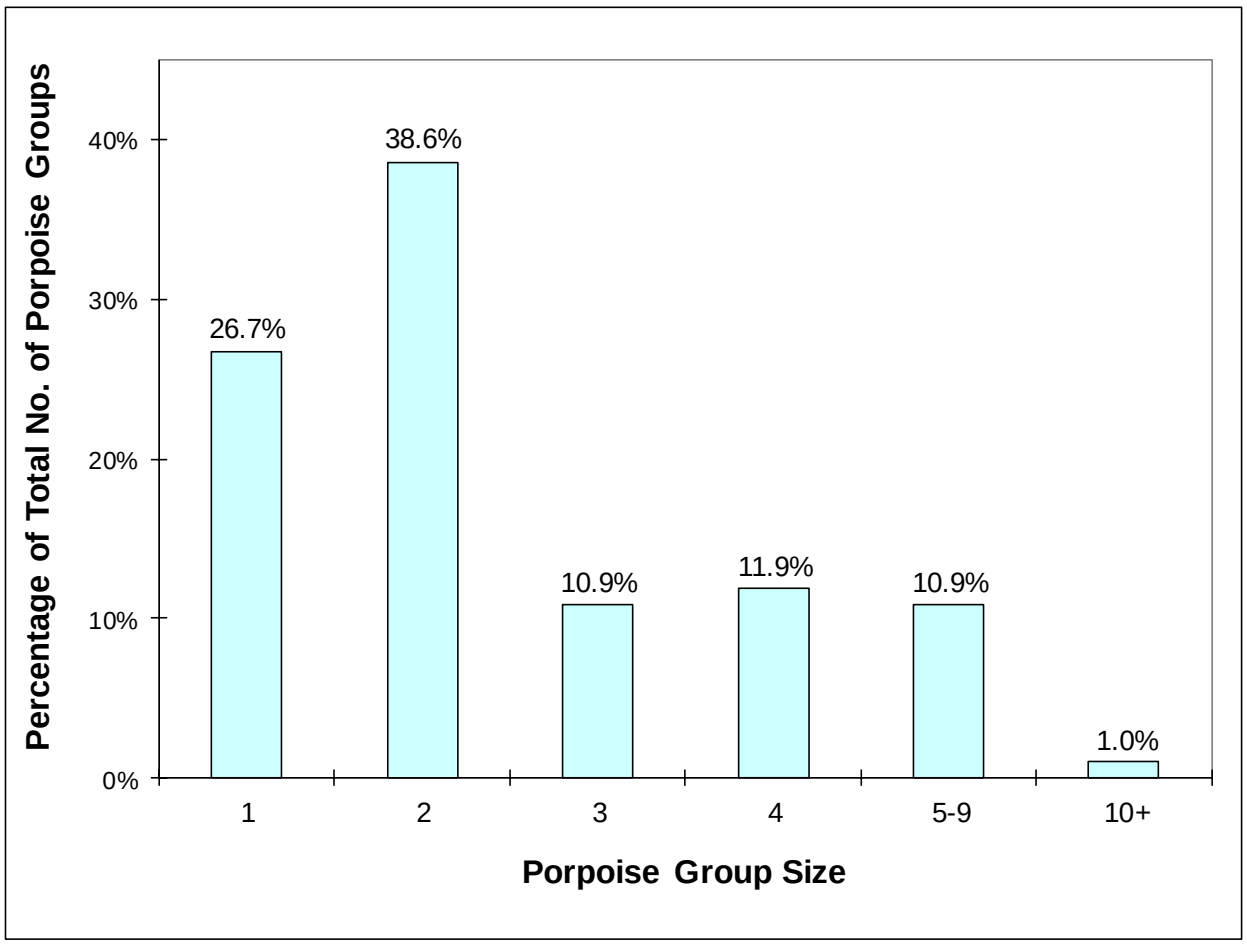


Figure 24. Percentages of different group sizes of finless porpoises in Hong Kong during April 2018 to March 2019

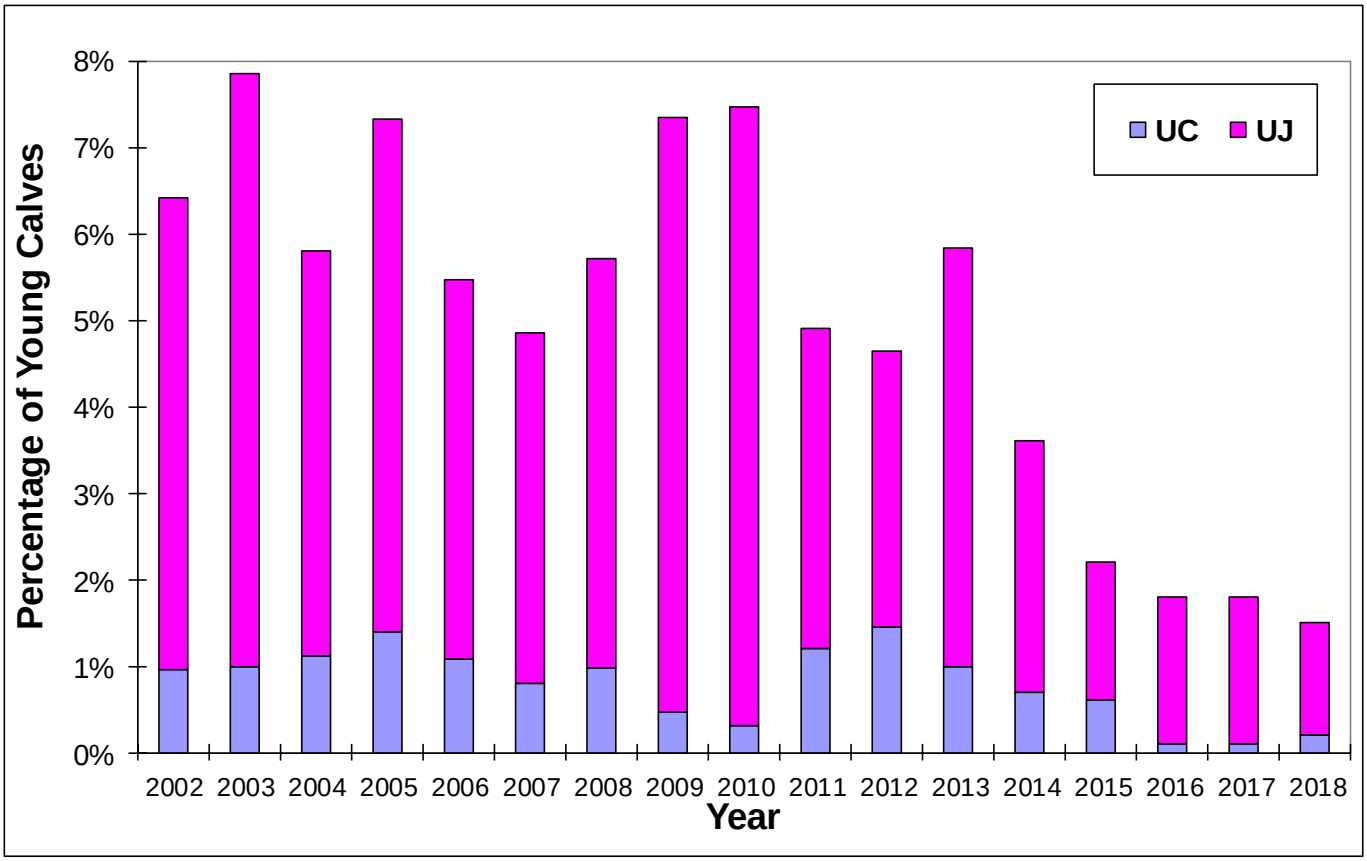


Figure 25. Percentages of young calves (i.e. Unspotted Calves (UC) and Unspotted Juveniles (UJ)) among all dolphin groups during 2002-18

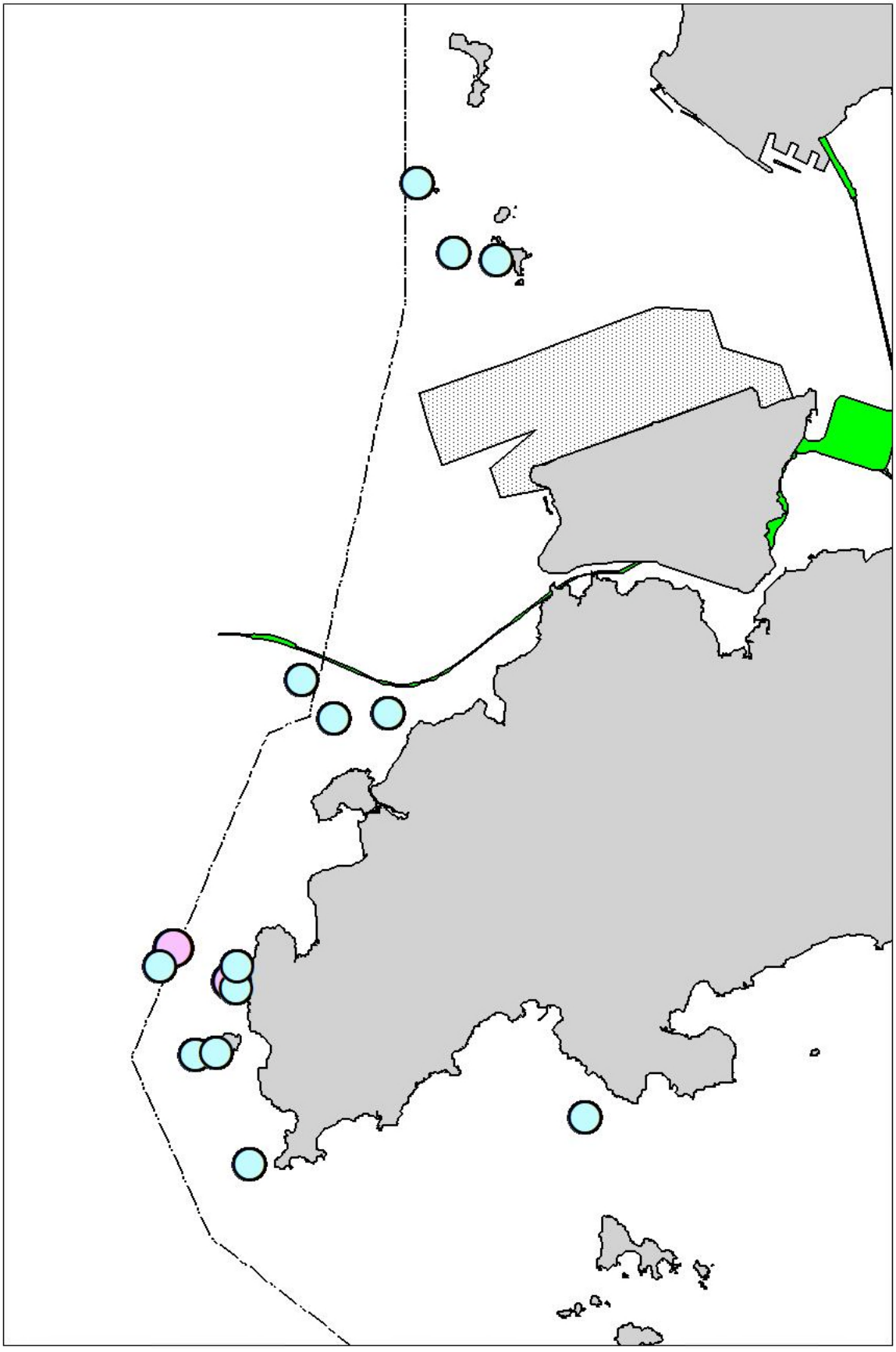


Figure 26. Distribution of Unspotted Calves (purple dots) & Unspotted Juveniles (blue dots) in 2018

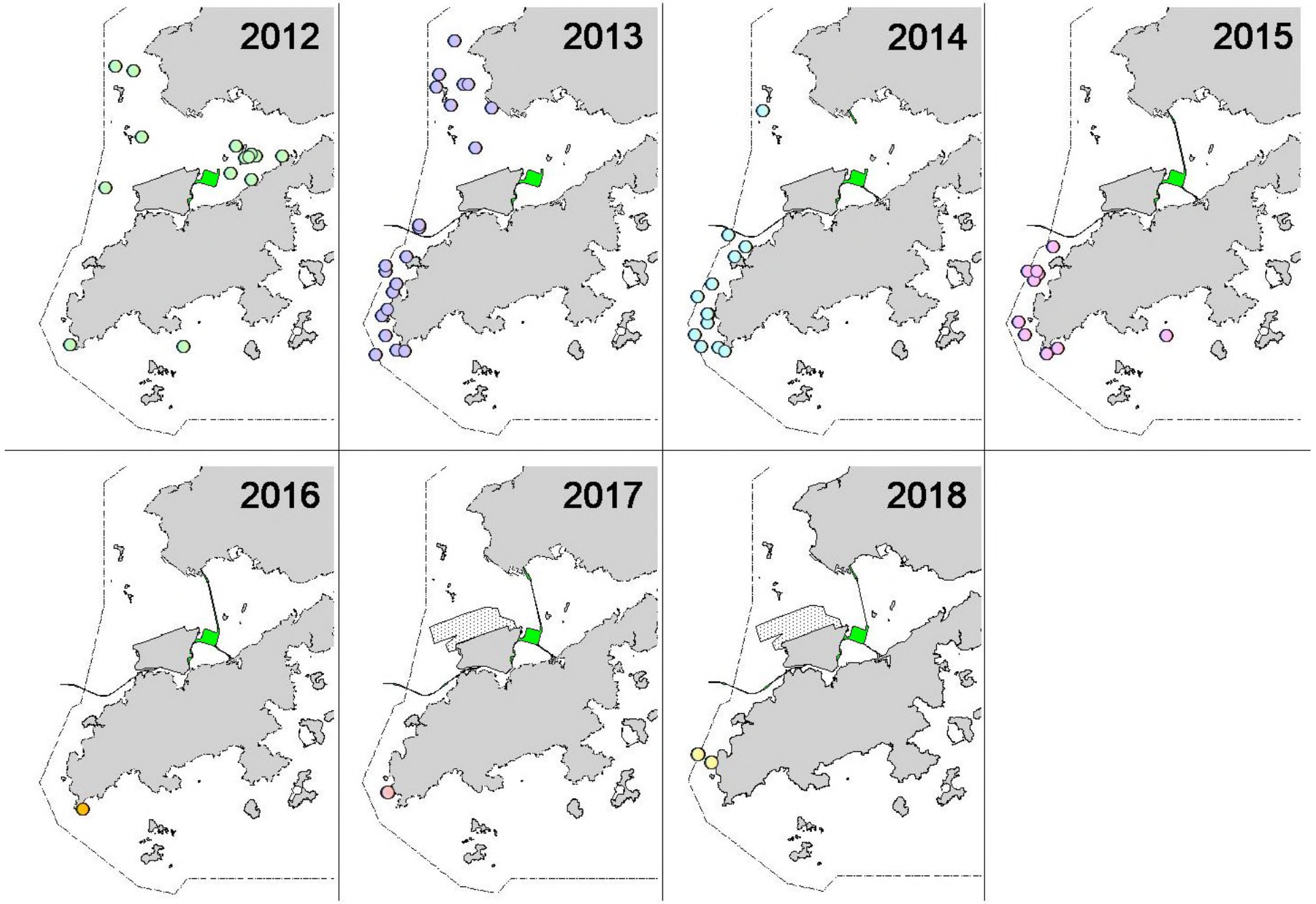


Figure 27. Temporal changes in distribution of unspotted calves (UCs) in 2012-18

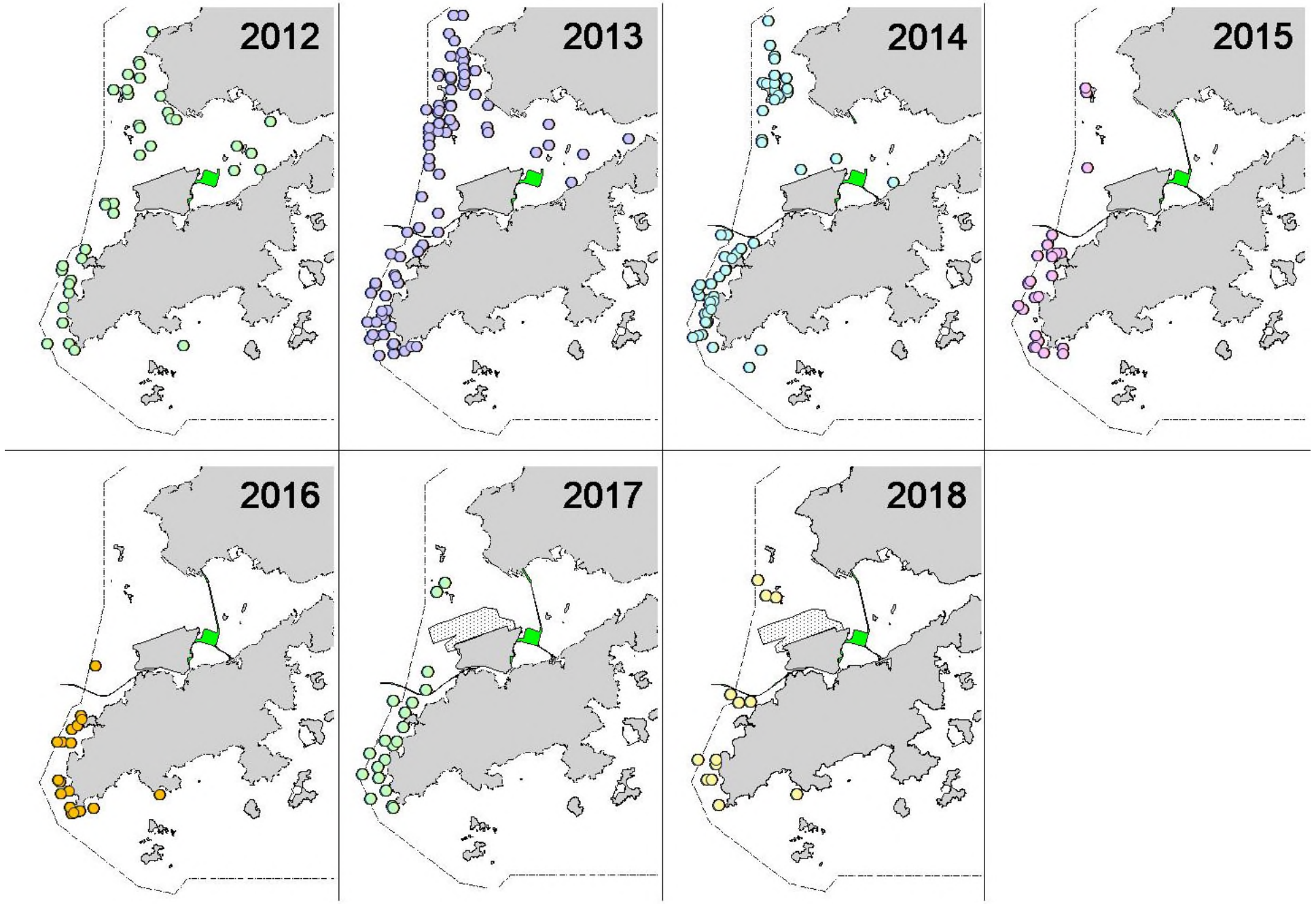


Figure 28. Temporal changes in distribution of unspotted juveniles (UJs) in 2012-18

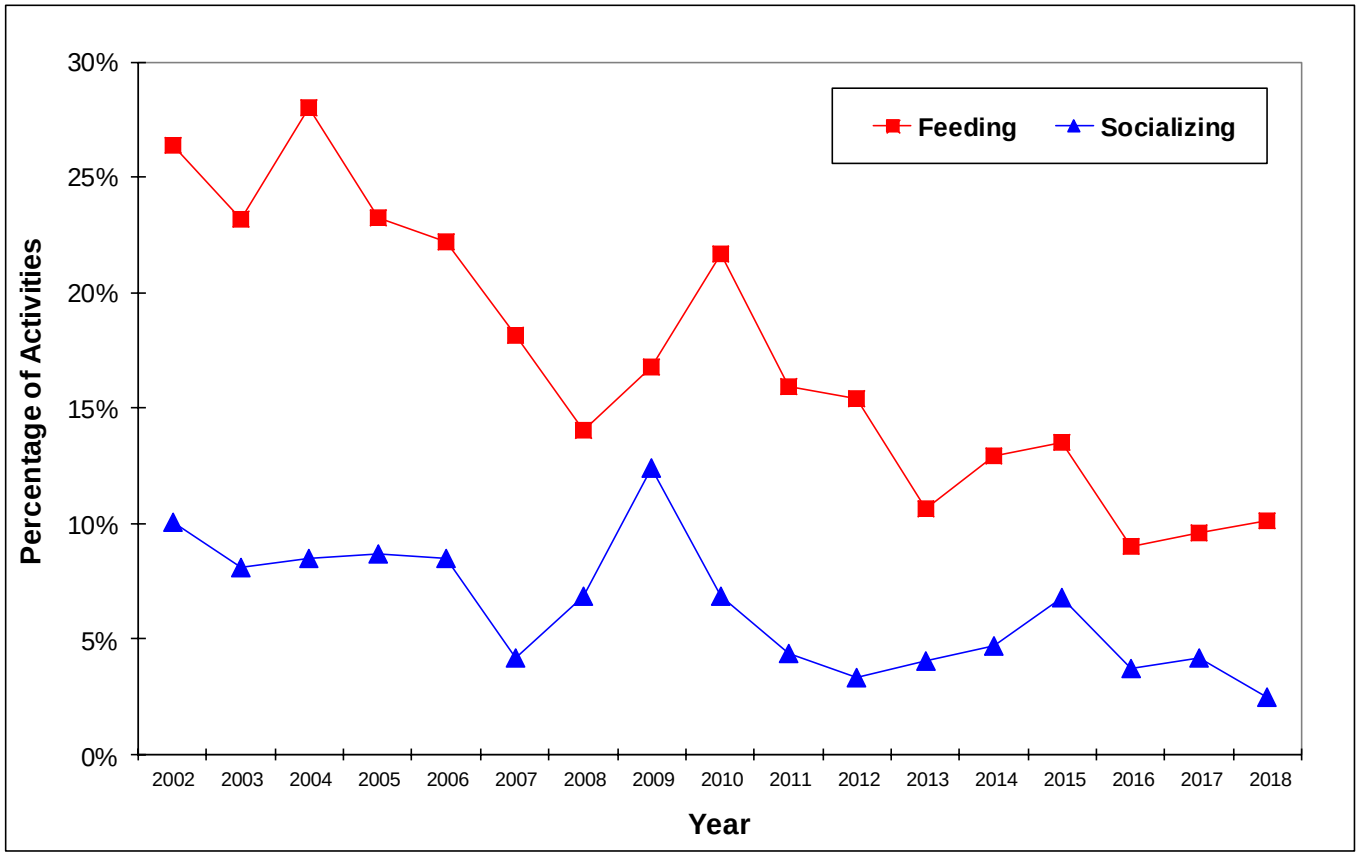


Figure 29. Percentages of feeding and socializing activities among all dolphin groups sighted in Hong Kong during 2002-18

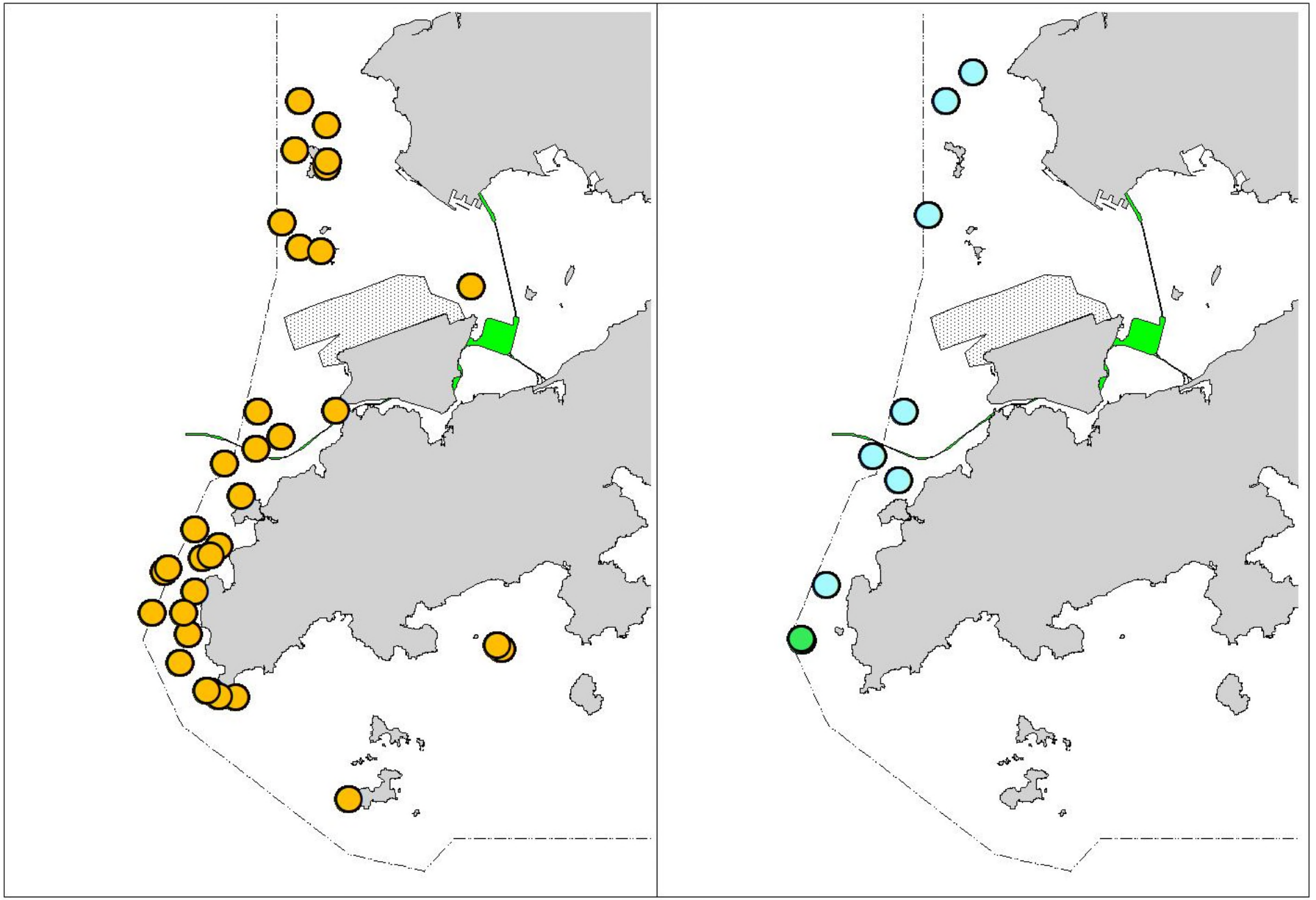


Figure 30. Distribution of Chinese white dolphins engaged in feeding (orange dots) and socializing (blue dots) activities in 2018

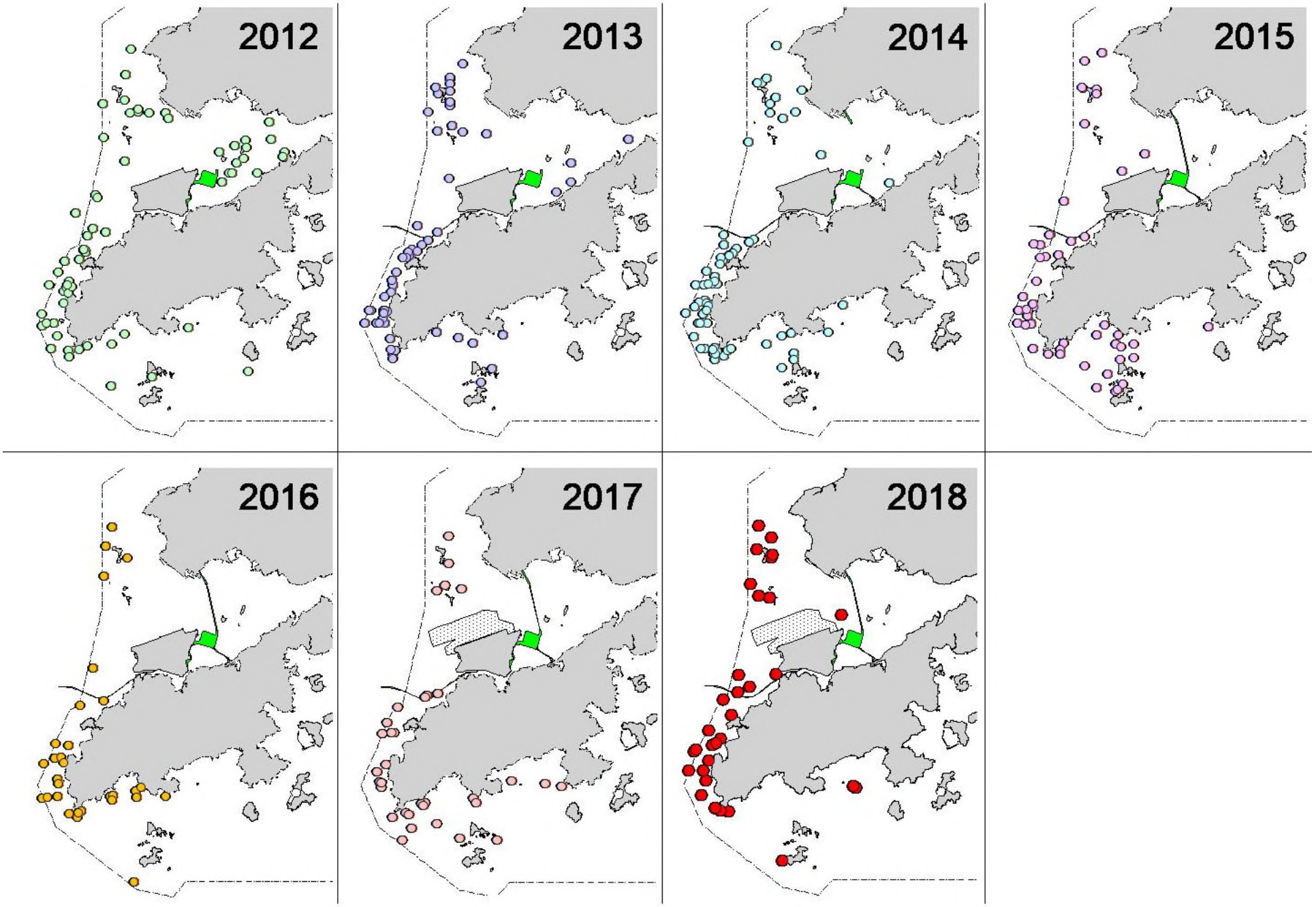


Figure 31. Temporal changes in distribution of dolphin groups engaged in feeding activities in 2012-18

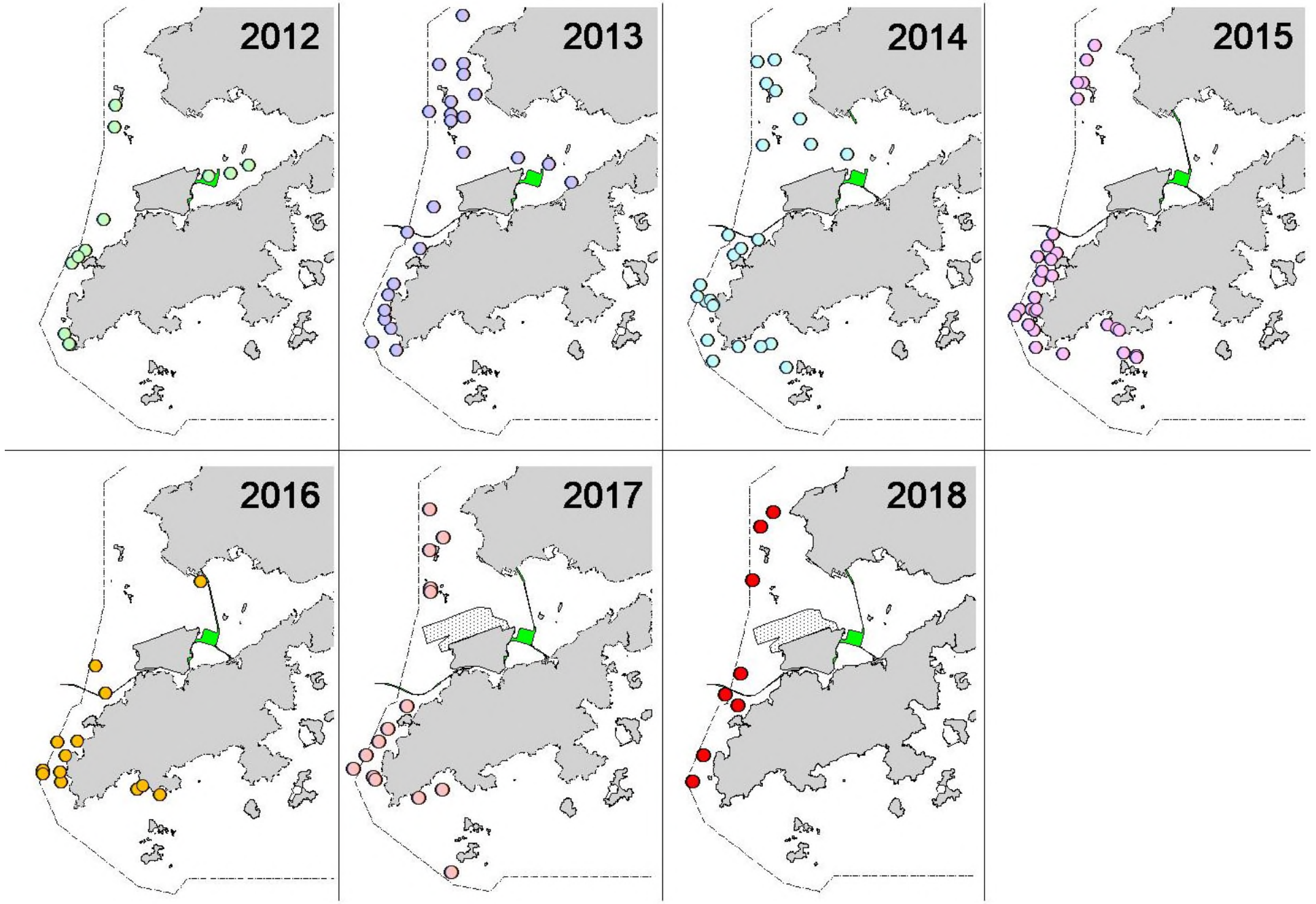


Figure 32. Temporal changes in distribution of dolphin groups engaged in socializing activities in 2012-18

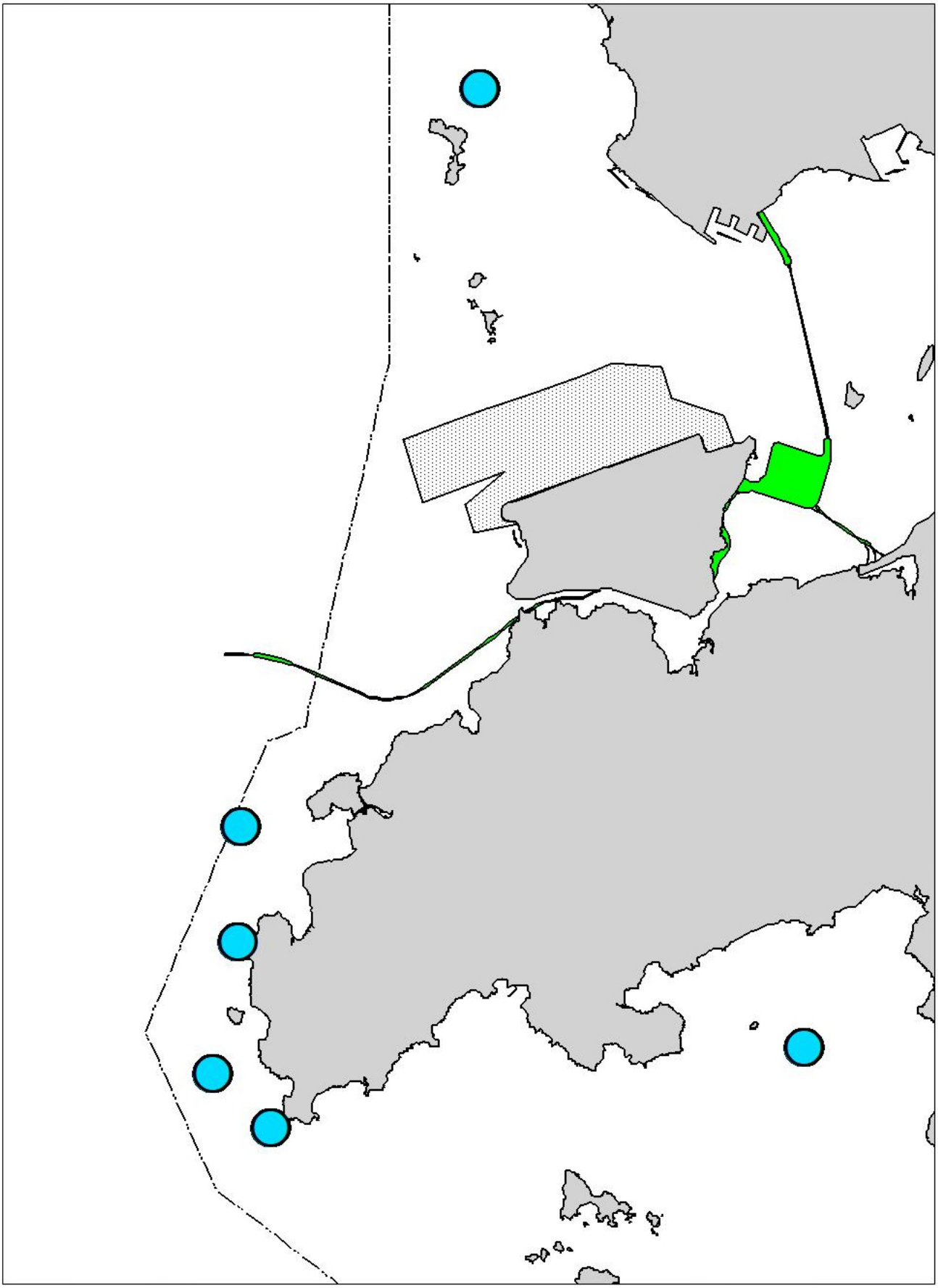


Figure 33. Distribution of dolphin sightings associated with fishing boats in 2018

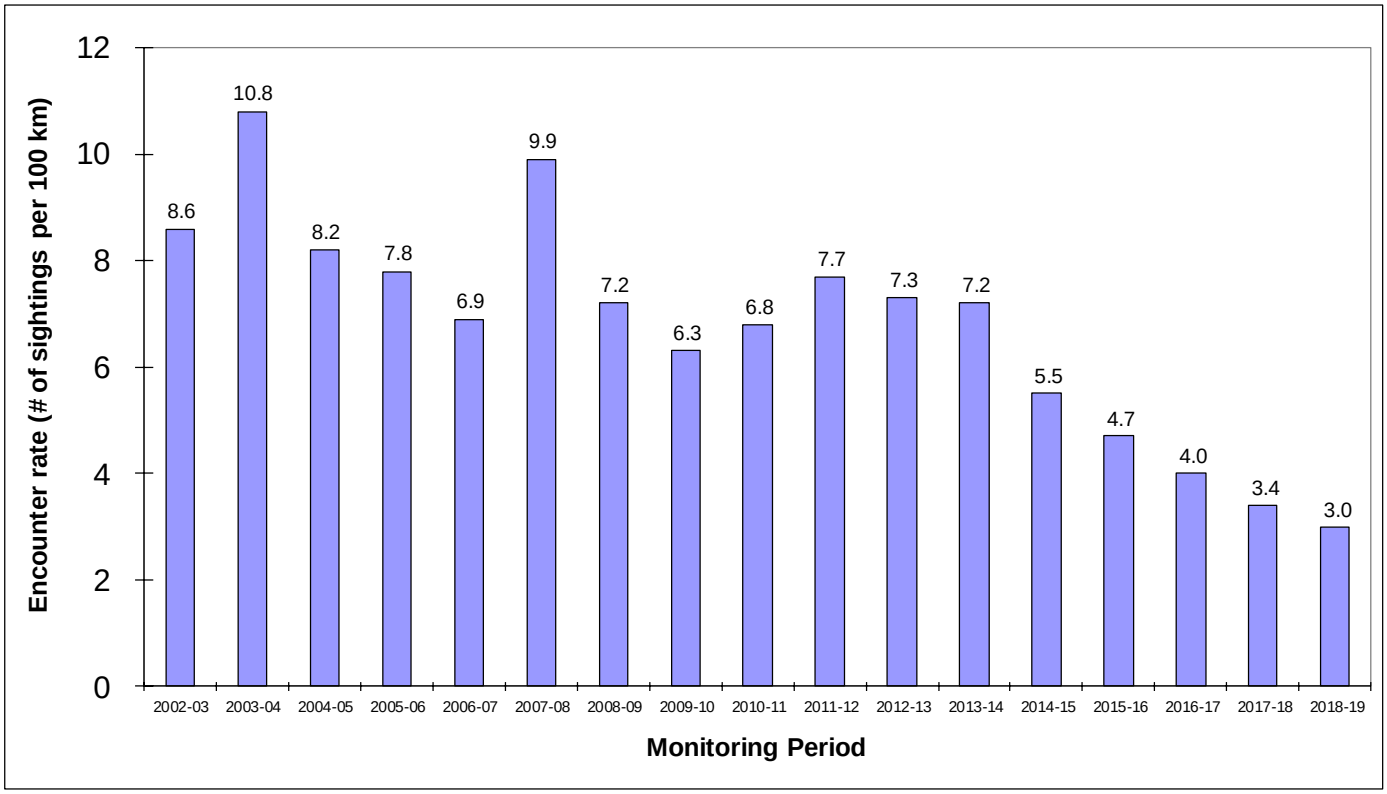


Figure 34. Temporal trend in encounter rates of Chinese white dolphins (combined from WL, NWL, NEL and SWL survey areas) in the past 17 monitoring periods from 2002-19

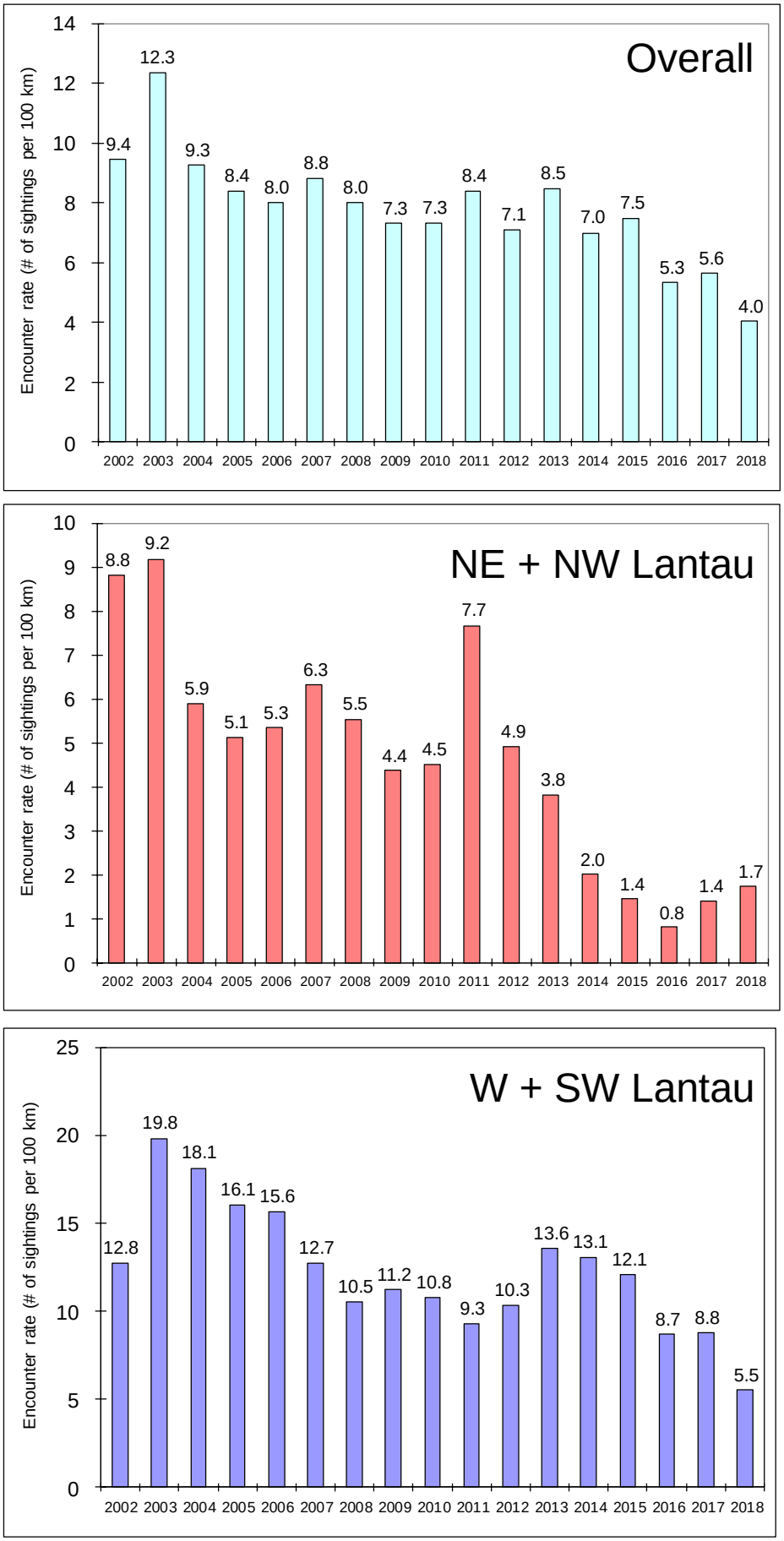


Figure 35. Long-term trends in annual dolphin encounter rates in different survey areas

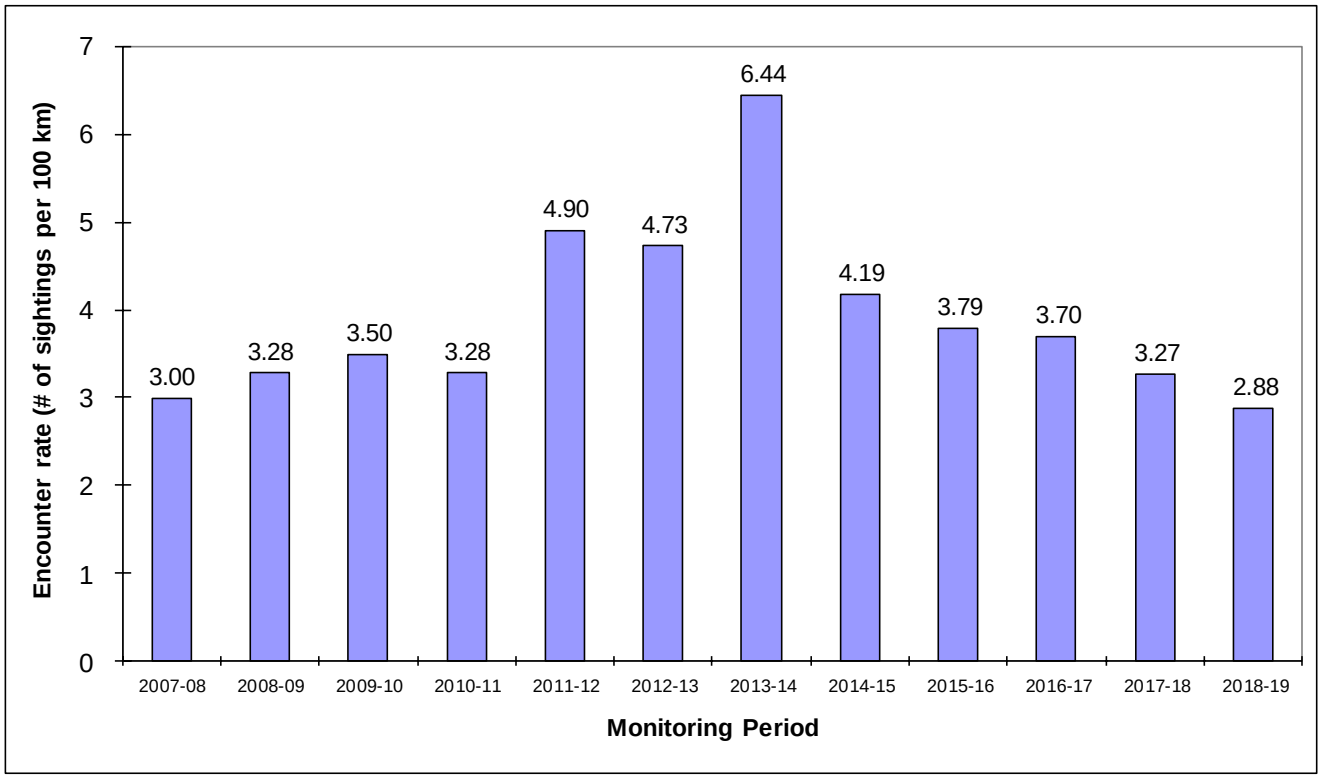


Figure 36. Temporal trend in encounter rates of finless porpoises (combined from SWL, SEL, LM and PT survey areas) in the past twelve monitoring periods from 2007-19

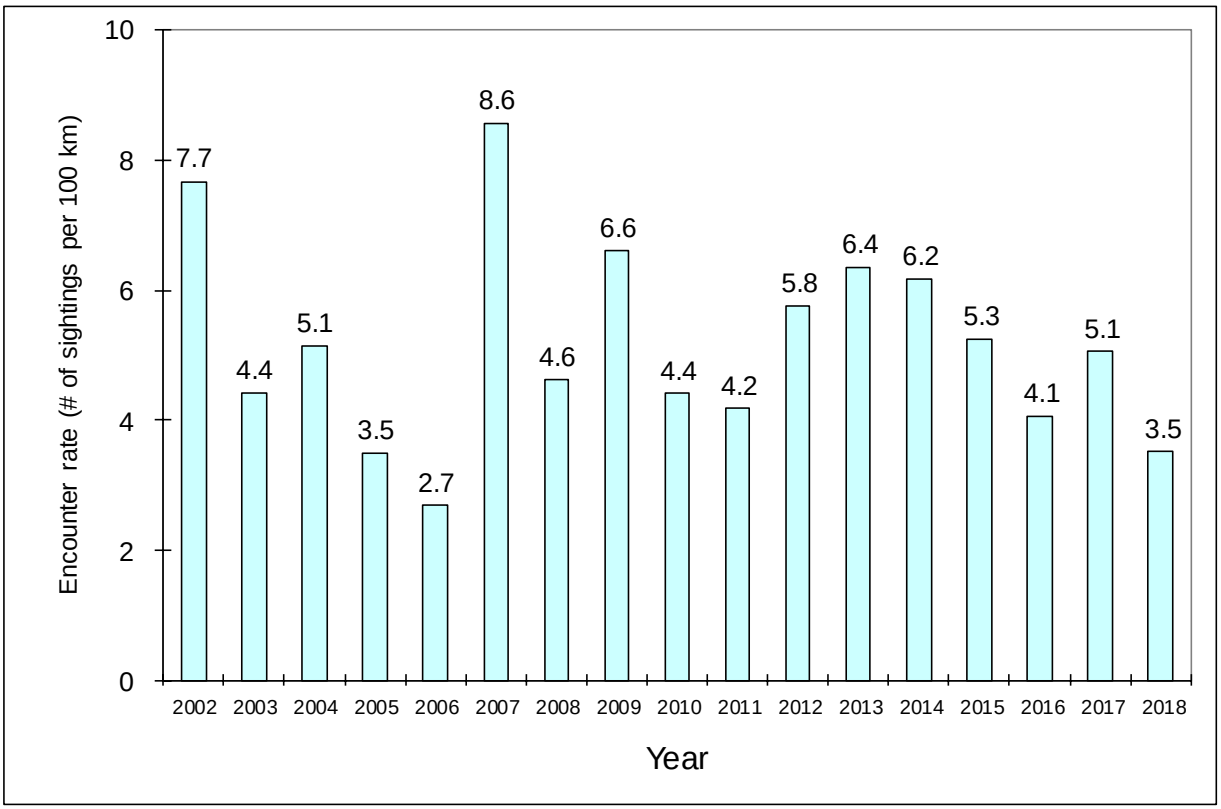


Figure 37a. Temporal trend of annual encounter rates of finless porpoises (combined from SWL, SEL, LM and PT survey areas) from 2002-18

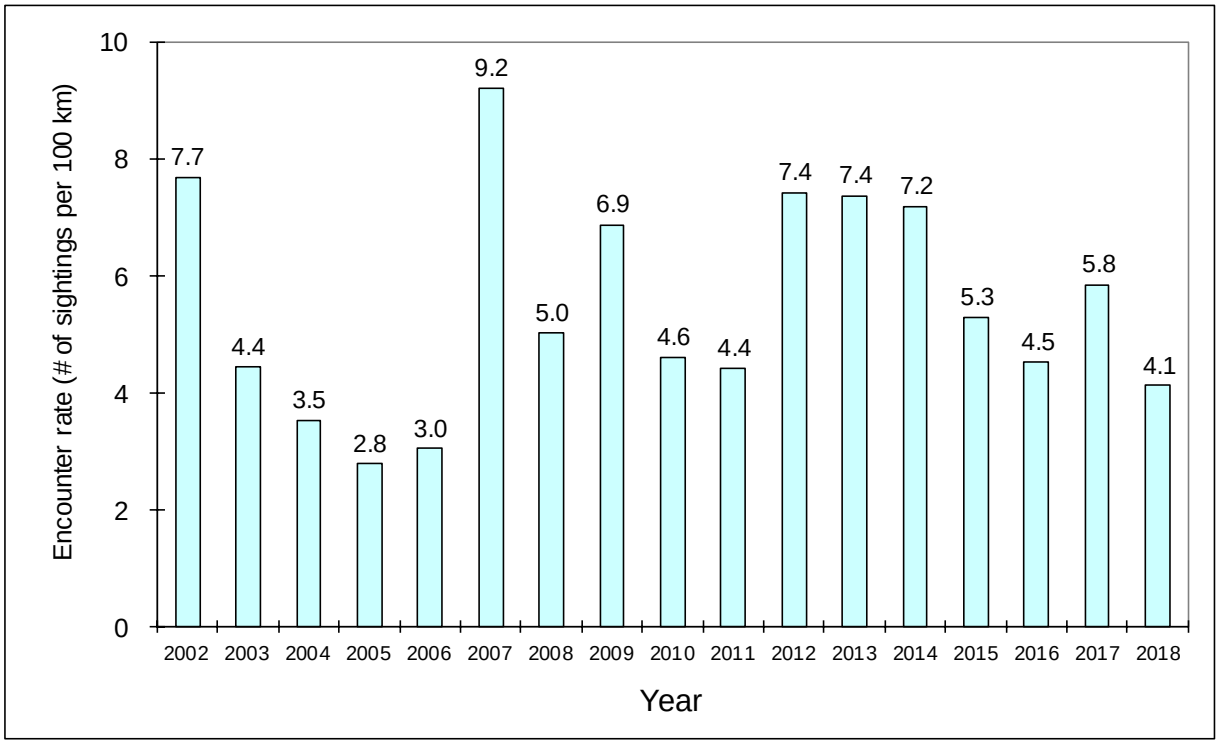


Figure 37b. Temporal trend of porpoise encounter rates in South Lantau and Lamma waters combined from winter/spring months of 2002-18

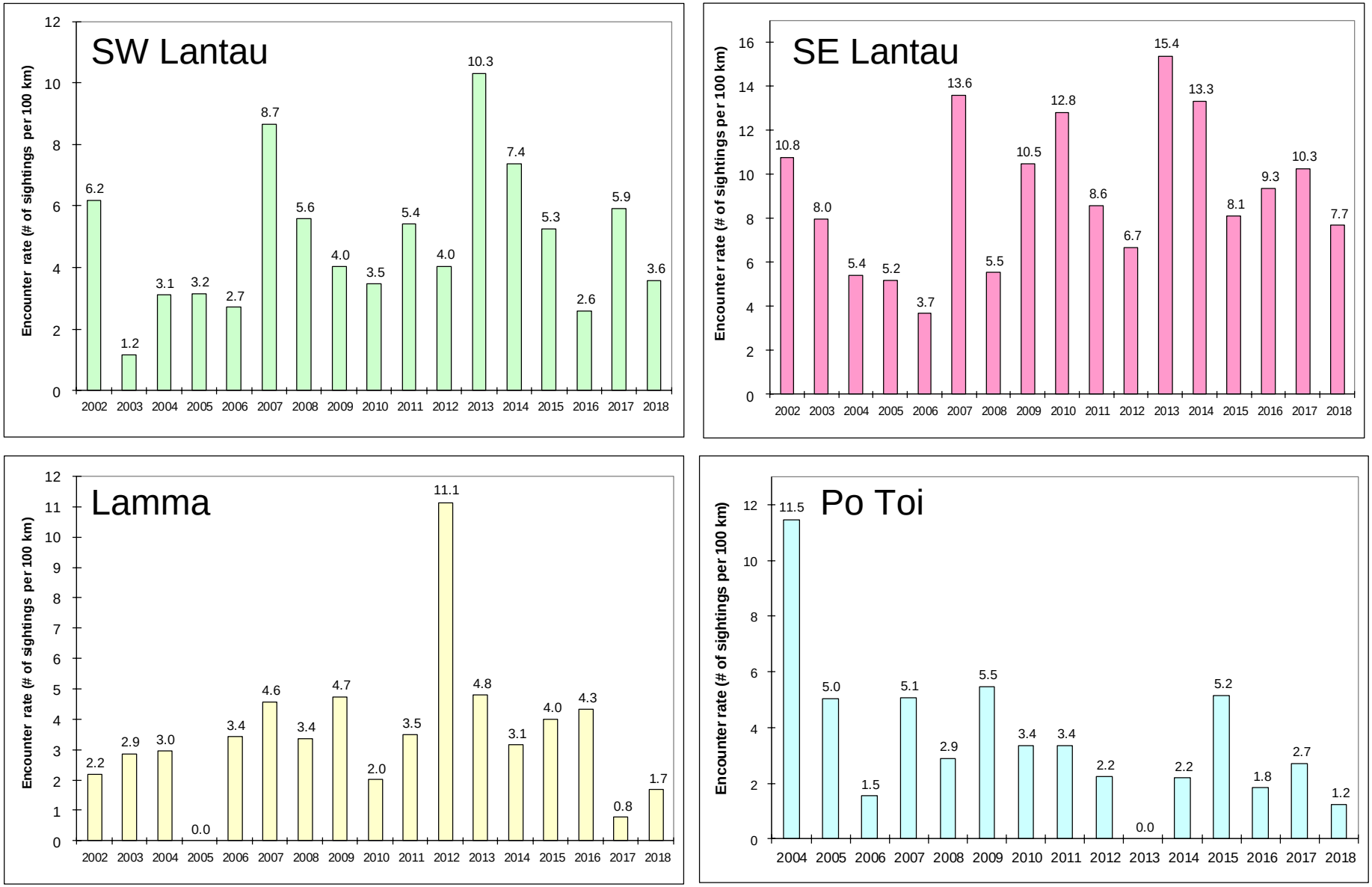


Figure 38. Temporal trends in annual encounter rates of finless porpoises among different survey areas

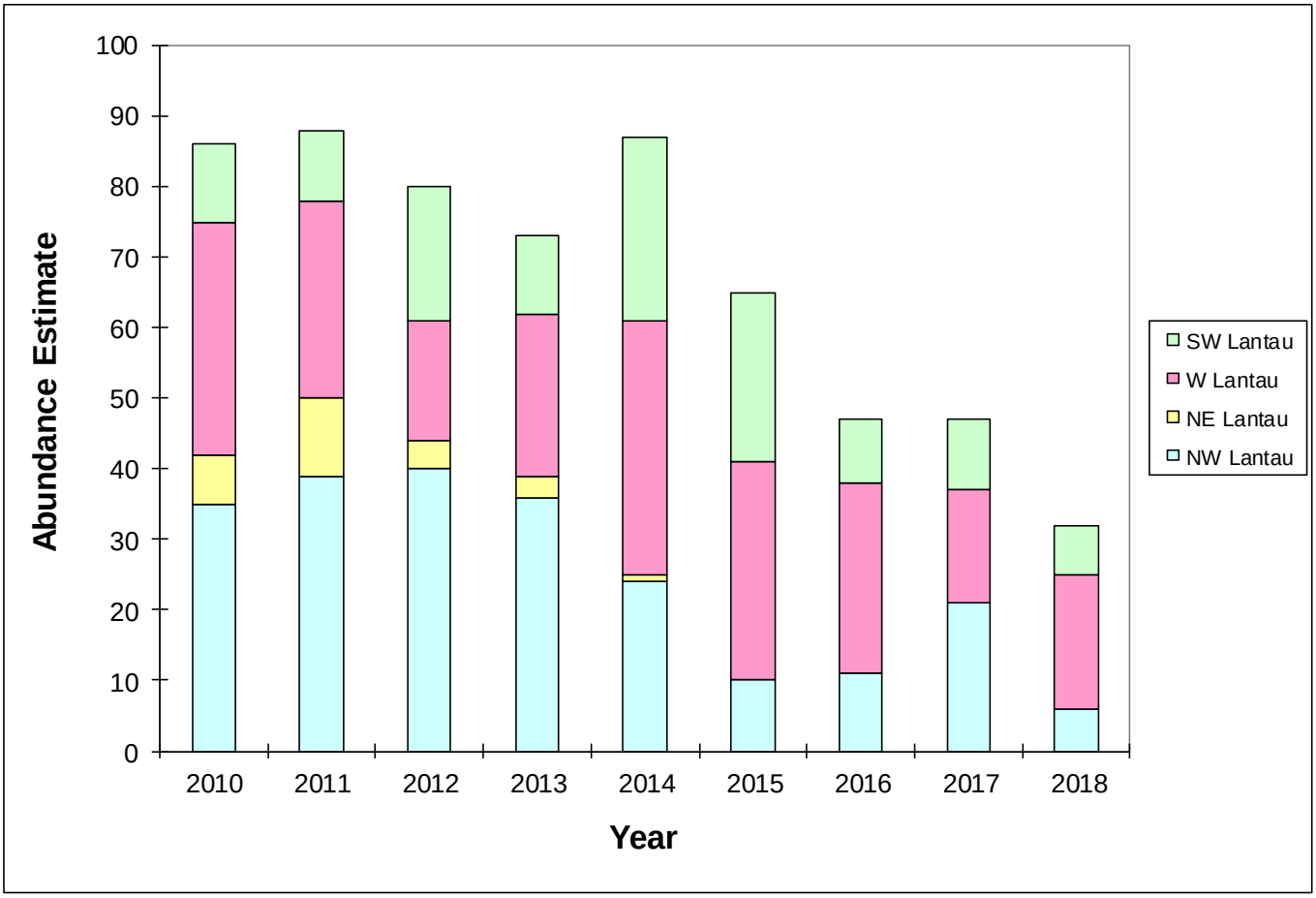


Figure 39. Temporal trends in combined abundance estimates of Chinese White Dolphins in Southwest, West, Northwest & Northeast Lantau from 2010-18

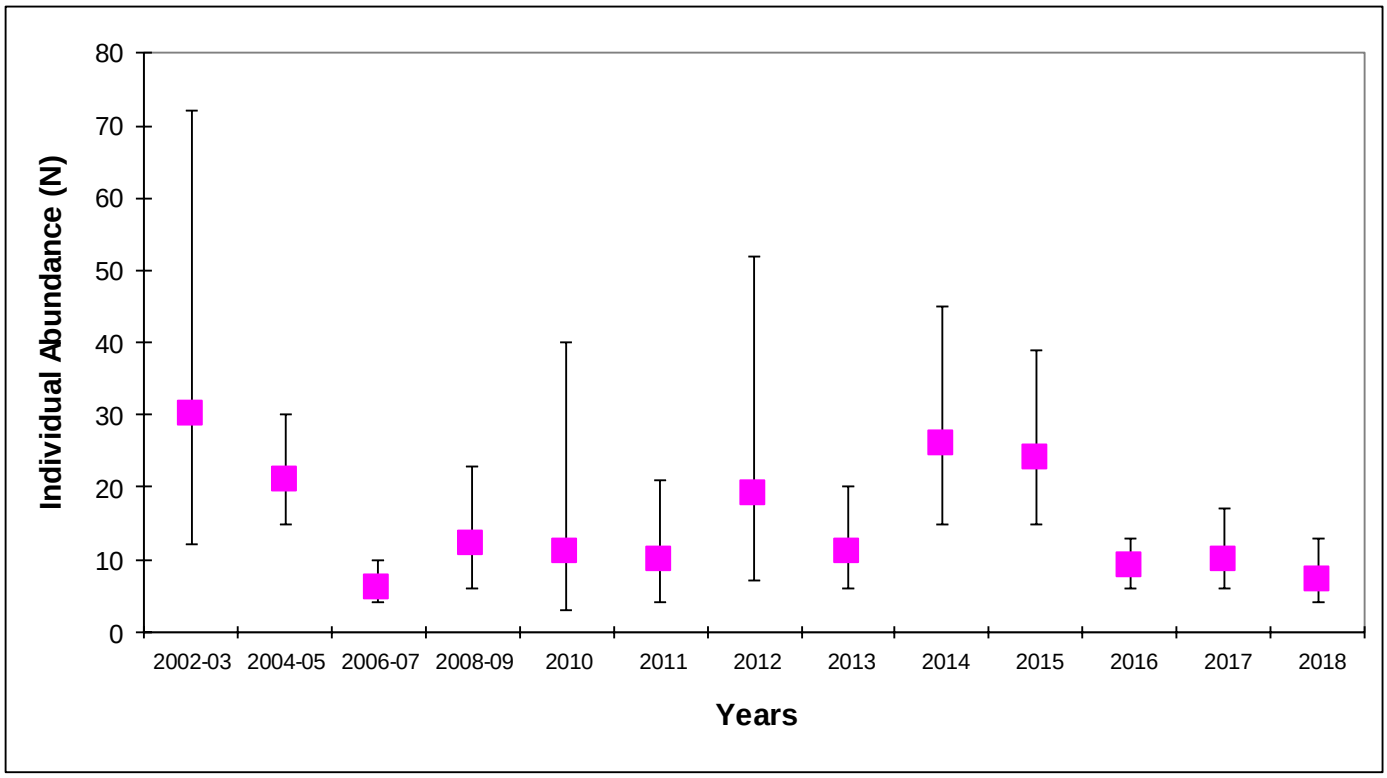


Figure 40. Temporal trend in abundance estimates of Chinese white dolphins in Southwest Lantau from 2002-18 (error bars: 95% confidence interval of abundance estimates)

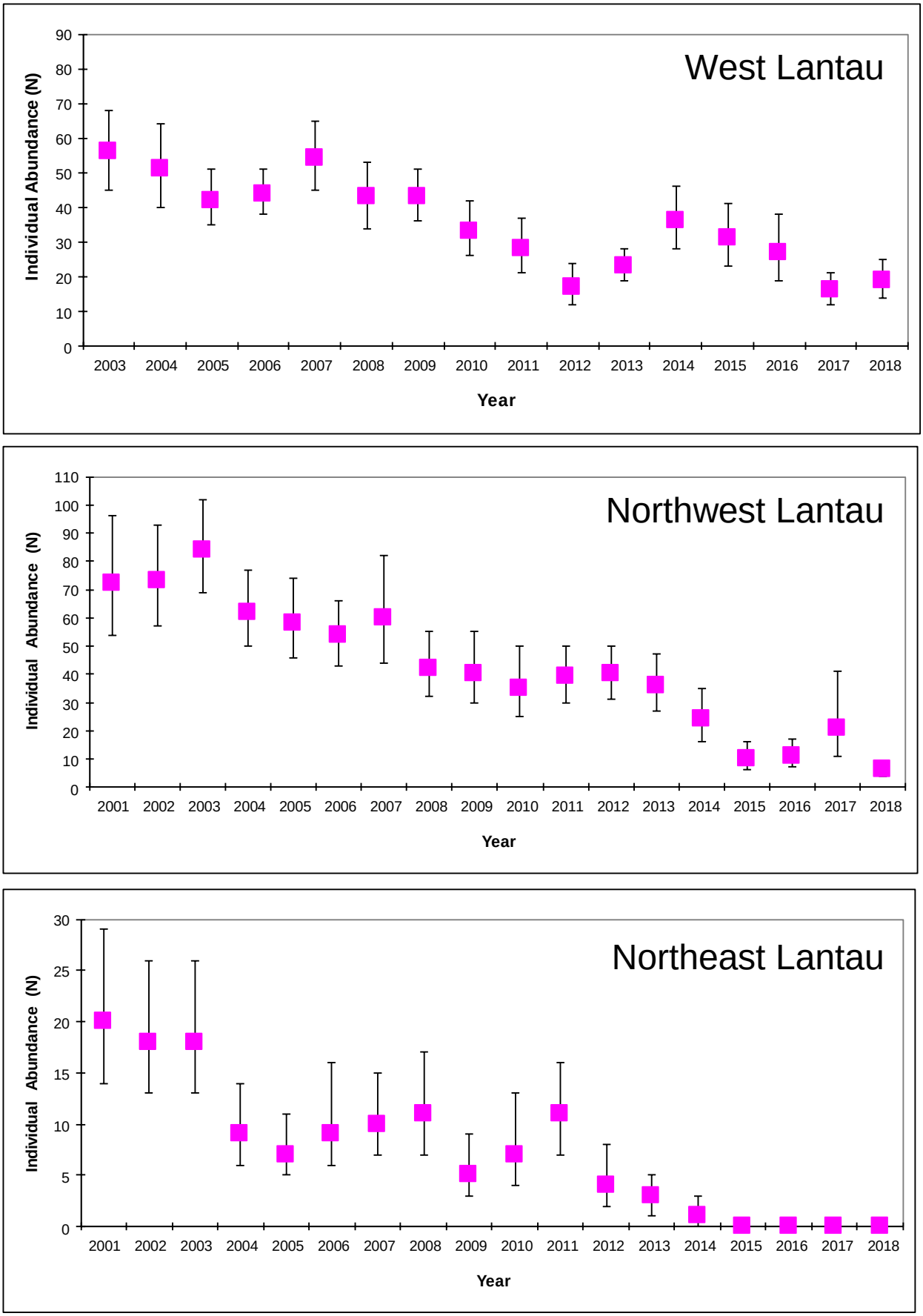


Figure 41. Temporal trends in annual abundance estimates of Chinese white dolphins in WL, NWL & NEL from 2001-18 (error bars: 95% confidence interval of abundance estimates)

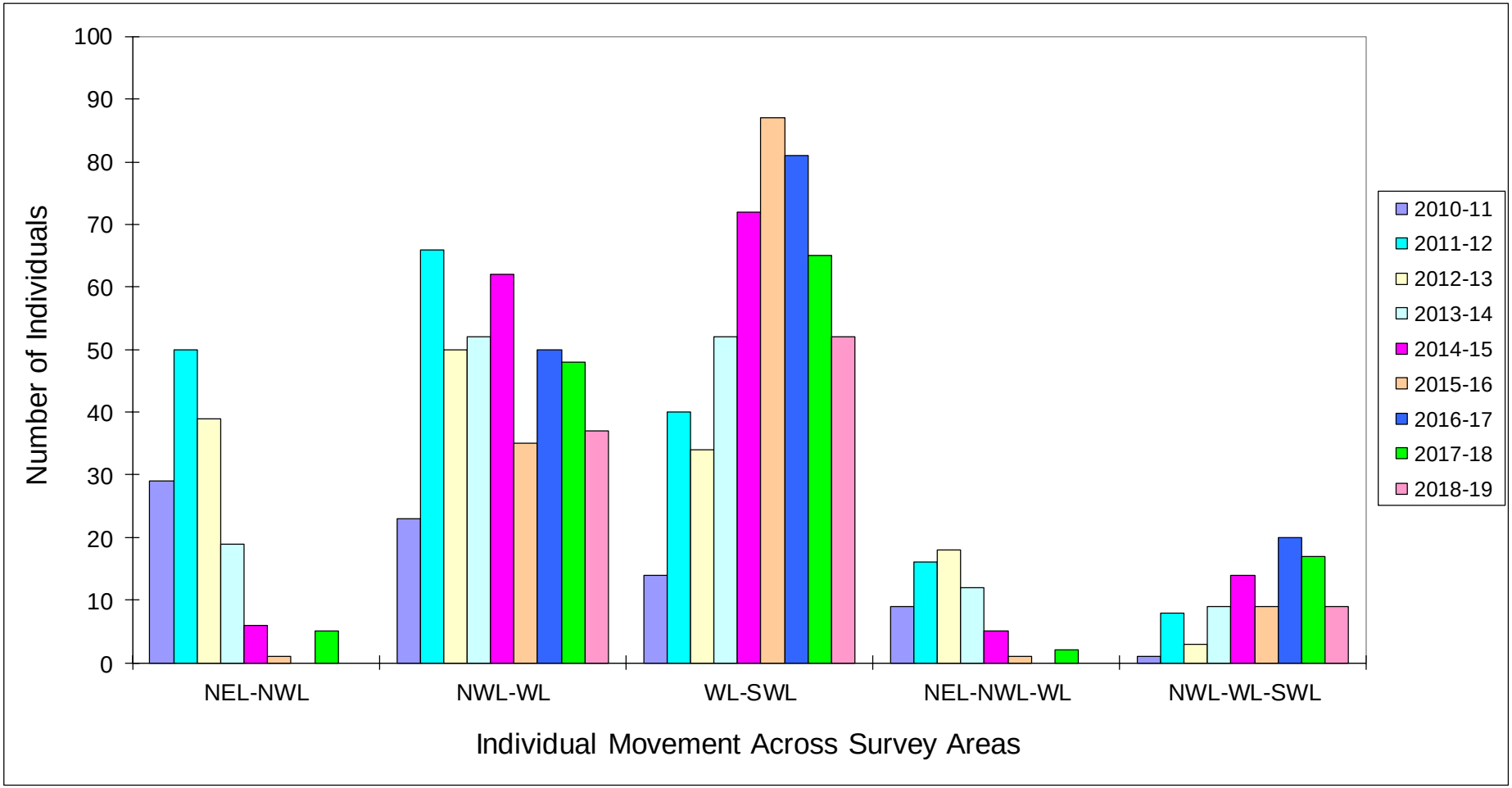


Figure 42. Temporal trends in number of individual dolphins involved in movements across different survey areas around Lantau in the past nine monitoring periods

Appendix I. HKCRP-AFCD Survey Effort Database (April 2018 - March 2019)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
6-Apr-18	SW LANTAU	3	3.41	SPRING	STANDARD33706	P
6-Apr-18	SW LANTAU	4	5.56	SPRING	STANDARD33706	P
6-Apr-18	SW LANTAU	5	2.90	SPRING	STANDARD33706	P
6-Apr-18	SW LANTAU	2	0.90	SPRING	STANDARD33706	S
6-Apr-18	SW LANTAU	3	2.60	SPRING	STANDARD33706	S
6-Apr-18	SW LANTAU	4	4.83	SPRING	STANDARD33706	S
10-Apr-18	W LANTAU	2	1.72	SPRING	STANDARD36826	S
10-Apr-18	W LANTAU	3	7.25	SPRING	STANDARD36826	S
10-Apr-18	SW LANTAU	2	12.67	SPRING	STANDARD36826	P
10-Apr-18	SW LANTAU	2	9.23	SPRING	STANDARD36826	S
11-Apr-18	DEEP BAY	2	10.51	SPRING	STANDARD36826	P
11-Apr-18	DEEP BAY	2	6.07	SPRING	STANDARD36826	S
11-Apr-18	NW LANTAU	2	4.55	SPRING	STANDARD36826	P
11-Apr-18	NW LANTAU	2	2.43	SPRING	STANDARD36826	S
12-Apr-18	LAMMA	2	40.83	SPRING	STANDARD36826	P
12-Apr-18	LAMMA	1	0.95	SPRING	STANDARD36826	S
12-Apr-18	LAMMA	2	9.28	SPRING	STANDARD36826	S
12-Apr-18	SE LANTAU	1	13.81	SPRING	STANDARD36826	P
12-Apr-18	SE LANTAU	2	10.30	SPRING	STANDARD36826	P
12-Apr-18	SE LANTAU	1	4.70	SPRING	STANDARD36826	S
12-Apr-18	SE LANTAU	2	4.80	SPRING	STANDARD36826	S
13-Apr-18	SW LANTAU	2	5.70	SPRING	STANDARD33706	P
13-Apr-18	SW LANTAU	3	2.96	SPRING	STANDARD33706	P
13-Apr-18	SW LANTAU	2	14.30	SPRING	STANDARD33706	S
19-Apr-18	W LANTAU	2	5.16	SPRING	STANDARD36826	P
19-Apr-18	W LANTAU	3	2.80	SPRING	STANDARD36826	P
19-Apr-18	W LANTAU	4	1.90	SPRING	STANDARD36826	P
19-Apr-18	W LANTAU	2	6.44	SPRING	STANDARD36826	S
19-Apr-18	W LANTAU	3	1.90	SPRING	STANDARD36826	S
19-Apr-18	W LANTAU	4	2.80	SPRING	STANDARD36826	S
23-Apr-18	PO TOI	1	13.04	SPRING	STANDARD36826	P
23-Apr-18	PO TOI	2	21.33	SPRING	STANDARD36826	P
23-Apr-18	PO TOI	1	6.81	SPRING	STANDARD36826	S
23-Apr-18	PO TOI	2	8.82	SPRING	STANDARD36826	S
23-Apr-18	LAMMA	1	16.76	SPRING	STANDARD36826	P
23-Apr-18	LAMMA	2	25.41	SPRING	STANDARD36826	P
23-Apr-18	LAMMA	1	1.00	SPRING	STANDARD36826	S
23-Apr-18	LAMMA	2	7.63	SPRING	STANDARD36826	S
24-Apr-18	W LANTAU	1	1.29	SPRING	STANDARD36826	S
24-Apr-18	W LANTAU	2	8.51	SPRING	STANDARD36826	S
27-Apr-18	NW LANTAU	2	25.38	SPRING	STANDARD33706	P
27-Apr-18	NW LANTAU	2	7.92	SPRING	STANDARD33706	S
27-Apr-18	DEEP BAY	1	0.90	SPRING	STANDARD33706	P
27-Apr-18	DEEP BAY	2	10.03	SPRING	STANDARD33706	P
27-Apr-18	DEEP BAY	1	0.80	SPRING	STANDARD33706	S
27-Apr-18	DEEP BAY	2	7.16	SPRING	STANDARD33706	S
27-Apr-18	NE LANTAU	1	2.70	SPRING	STANDARD33706	P
27-Apr-18	NE LANTAU	2	14.81	SPRING	STANDARD33706	P
27-Apr-18	NE LANTAU	1	2.80	SPRING	STANDARD33706	S
27-Apr-18	NE LANTAU	2	6.49	SPRING	STANDARD33706	S
30-Apr-18	SW LANTAU	2	4.67	SPRING	STANDARD36826	P
30-Apr-18	SW LANTAU	3	20.47	SPRING	STANDARD36826	P
30-Apr-18	SW LANTAU	2	0.50	SPRING	STANDARD36826	S
30-Apr-18	SW LANTAU	3	8.86	SPRING	STANDARD36826	S
30-Apr-18	SE LANTAU	2	29.71	SPRING	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
30-Apr-18	SE LANTAU	3	1.10	SPRING	STANDARD36826	P
30-Apr-18	SE LANTAU	2	5.05	SPRING	STANDARD36826	S
30-Apr-18	SE LANTAU	3	1.14	SPRING	STANDARD36826	S
2-May-18	SE LANTAU	2	12.51	SPRING	STANDARD36826	P
2-May-18	SE LANTAU	3	6.39	SPRING	STANDARD36826	P
2-May-18	SE LANTAU	2	9.96	SPRING	STANDARD36826	S
8-May-18	W LANTAU	2	9.29	SPRING	STANDARD36826	S
8-May-18	SW LANTAU	2	9.67	SPRING	STANDARD36826	P
8-May-18	SW LANTAU	1	2.73	SPRING	STANDARD36826	S
8-May-18	SW LANTAU	2	10.85	SPRING	STANDARD36826	S
8-May-18	SE LANTAU	2	30.04	SPRING	STANDARD36826	P
8-May-18	SE LANTAU	3	0.90	SPRING	STANDARD36826	P
8-May-18	SE LANTAU	2	10.27	SPRING	STANDARD36826	S
8-May-18	SE LANTAU	3	1.00	SPRING	STANDARD36826	S
10-May-18	NW LANTAU	2	0.70	SPRING	STANDARD36826	P
10-May-18	NW LANTAU	3	1.50	SPRING	STANDARD36826	P
10-May-18	NW LANTAU	4	10.36	SPRING	STANDARD36826	P
10-May-18	NW LANTAU	2	0.10	SPRING	STANDARD36826	S
10-May-18	NW LANTAU	3	3.52	SPRING	STANDARD36826	S
10-May-18	NW LANTAU	4	6.22	SPRING	STANDARD36826	S
10-May-18	DEEP BAY	3	5.29	SPRING	STANDARD36826	P
10-May-18	DEEP BAY	3	1.05	SPRING	STANDARD36826	S
14-May-18	NW LANTAU	2	4.85	SPRING	STANDARD36826	P
14-May-18	NW LANTAU	3	8.00	SPRING	STANDARD36826	P
14-May-18	NW LANTAU	2	5.98	SPRING	STANDARD36826	S
14-May-18	NW LANTAU	3	3.83	SPRING	STANDARD36826	S
15-May-18	W LANTAU	2	1.08	SPRING	STANDARD36826	S
15-May-18	W LANTAU	3	1.97	SPRING	STANDARD36826	S
15-May-18	W LANTAU	4	6.95	SPRING	STANDARD36826	S
15-May-18	SW LANTAU	2	3.82	SPRING	STANDARD36826	P
15-May-18	SW LANTAU	3	12.59	SPRING	STANDARD36826	P
15-May-18	SW LANTAU	2	7.27	SPRING	STANDARD36826	S
15-May-18	SW LANTAU	3	3.10	SPRING	STANDARD36826	S
15-May-18	SW LANTAU	4	2.45	SPRING	STANDARD36826	S
17-May-18	SE LANTAU	2	25.91	SPRING	STANDARD36826	P
17-May-18	SE LANTAU	3	4.47	SPRING	STANDARD36826	P
17-May-18	SE LANTAU	2	7.00	SPRING	STANDARD36826	S
17-May-18	SW LANTAU	2	9.58	SPRING	STANDARD36826	P
17-May-18	SW LANTAU	3	6.34	SPRING	STANDARD36826	P
17-May-18	SW LANTAU	2	3.54	SPRING	STANDARD36826	S
17-May-18	SW LANTAU	3	2.35	SPRING	STANDARD36826	S
21-May-18	LAMMA	1	24.37	SPRING	STANDARD36826	P
21-May-18	LAMMA	2	31.27	SPRING	STANDARD36826	P
21-May-18	LAMMA	3	26.50	SPRING	STANDARD36826	P
21-May-18	LAMMA	1	6.60	SPRING	STANDARD36826	S
21-May-18	LAMMA	2	5.84	SPRING	STANDARD36826	S
21-May-18	LAMMA	3	5.50	SPRING	STANDARD36826	S
23-May-18	PO TOI	2	39.67	SPRING	STANDARD36826	P
23-May-18	PO TOI	3	10.40	SPRING	STANDARD36826	P
23-May-18	PO TOI	2	5.23	SPRING	STANDARD36826	S
23-May-18	NINEPINS	2	19.10	SPRING	STANDARD36826	P
23-May-18	NINEPINS	3	13.50	SPRING	STANDARD36826	P
23-May-18	NINEPINS	3	2.00	SPRING	STANDARD36826	S
28-May-18	SE LANTAU	1	0.70	SPRING	STANDARD36826	P
28-May-18	SE LANTAU	2	28.80	SPRING	STANDARD36826	P
28-May-18	SE LANTAU	2	6.63	SPRING	STANDARD36826	S
28-May-18	SE LANTAU	3	0.70	SPRING	STANDARD36826	S
28-May-18	SW LANTAU	2	18.05	SPRING	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
28-May-18	SW LANTAU	3	1.74	SPRING	STANDARD36826	P
28-May-18	SW LANTAU	2	10.10	SPRING	STANDARD36826	S
28-May-18	SW LANTAU	3	2.12	SPRING	STANDARD36826	S
29-May-18	NE LANTAU	2	31.90	SPRING	STANDARD36826	P
29-May-18	NE LANTAU	3	0.61	SPRING	STANDARD36826	P
29-May-18	NE LANTAU	2	7.86	SPRING	STANDARD36826	S
29-May-18	NE LANTAU	3	1.83	SPRING	STANDARD36826	S
30-May-18	W LANTAU	2	0.40	SPRING	STANDARD36826	P
30-May-18	W LANTAU	3	3.28	SPRING	STANDARD36826	P
30-May-18	W LANTAU	2	2.24	SPRING	STANDARD36826	S
30-May-18	W LANTAU	3	6.22	SPRING	STANDARD36826	S
31-May-18	LAMMA	2	13.77	SPRING	STANDARD36826	P
31-May-18	LAMMA	3	35.63	SPRING	STANDARD36826	P
31-May-18	LAMMA	2	2.20	SPRING	STANDARD36826	S
31-May-18	LAMMA	3	2.20	SPRING	STANDARD36826	S
31-May-18	SE LANTAU	2	8.80	SPRING	STANDARD36826	P
31-May-18	SE LANTAU	3	13.44	SPRING	STANDARD36826	P
31-May-18	SE LANTAU	2	3.80	SPRING	STANDARD36826	S
31-May-18	SE LANTAU	3	2.96	SPRING	STANDARD36826	S
4-Jun-18	SW LANTAU	3	7.72	SUMMER	STANDARD36826	P
4-Jun-18	SW LANTAU	4	9.89	SUMMER	STANDARD36826	P
4-Jun-18	SW LANTAU	3	5.85	SUMMER	STANDARD36826	S
4-Jun-18	SW LANTAU	4	4.44	SUMMER	STANDARD36826	S
11-Jun-18	PO TOI	2	62.83	SUMMER	STANDARD36826	P
11-Jun-18	PO TOI	3	6.57	SUMMER	STANDARD36826	P
11-Jun-18	PO TOI	2	13.90	SUMMER	STANDARD36826	S
11-Jun-18	SE LANTAU	2	41.18	SUMMER	STANDARD33706	P
11-Jun-18	SE LANTAU	2	8.79	SUMMER	STANDARD33706	S
13-Jun-18	NE LANTAU	1	3.07	SUMMER	STANDARD36826	P
13-Jun-18	NE LANTAU	2	23.01	SUMMER	STANDARD36826	P
13-Jun-18	NE LANTAU	1	3.08	SUMMER	STANDARD36826	S
13-Jun-18	NE LANTAU	2	6.43	SUMMER	STANDARD36826	S
14-Jun-18	DEEP BAY	2	12.07	SUMMER	STANDARD36826	P
14-Jun-18	DEEP BAY	2	7.63	SUMMER	STANDARD36826	S
14-Jun-18	NW LANTAU	1	3.12	SUMMER	STANDARD36826	P
14-Jun-18	NW LANTAU	2	6.83	SUMMER	STANDARD36826	P
14-Jun-18	NW LANTAU	2	6.00	SUMMER	STANDARD36826	S
20-Jun-18	SW LANTAU	2	3.04	SUMMER	STANDARD36826	P
20-Jun-18	SW LANTAU	3	18.41	SUMMER	STANDARD36826	P
20-Jun-18	SW LANTAU	2	2.10	SUMMER	STANDARD36826	S
20-Jun-18	SW LANTAU	3	10.48	SUMMER	STANDARD36826	S
21-Jun-18	W LANTAU	2	3.81	SUMMER	STANDARD36826	S
21-Jun-18	W LANTAU	3	5.77	SUMMER	STANDARD36826	S
21-Jun-18	SE LANTAU	2	2.84	SUMMER	STANDARD36826	P
21-Jun-18	SE LANTAU	3	8.15	SUMMER	STANDARD36826	P
21-Jun-18	SE LANTAU	3	2.11	SUMMER	STANDARD36826	S
27-Jun-18	W LANTAU	3	5.29	SUMMER	STANDARD36826	P
27-Jun-18	W LANTAU	4	1.52	SUMMER	STANDARD36826	P
27-Jun-18	W LANTAU	3	6.40	SUMMER	STANDARD36826	S
28-Jun-18	PO TOI	2	13.41	SUMMER	STANDARD36826	P
28-Jun-18	PO TOI	3	38.12	SUMMER	STANDARD36826	P
28-Jun-18	PO TOI	2	2.37	SUMMER	STANDARD36826	S
28-Jun-18	PO TOI	3	3.90	SUMMER	STANDARD36826	S
28-Jun-18	NINEPINS	2	3.44	SUMMER	STANDARD36826	P
28-Jun-18	NINEPINS	3	23.16	SUMMER	STANDARD36826	P
28-Jun-18	NINEPINS	4	2.00	SUMMER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
28-Jun-18	NINEPINS	3	4.40	SUMMER	STANDARD36826	S
9-Jul-18	W LANTAU	2	3.50	SUMMER	STANDARD138716	P
9-Jul-18	W LANTAU	3	6.62	SUMMER	STANDARD138716	P
9-Jul-18	W LANTAU	4	2.61	SUMMER	STANDARD138716	P
9-Jul-18	W LANTAU	2	3.92	SUMMER	STANDARD138716	S
9-Jul-18	W LANTAU	3	4.05	SUMMER	STANDARD138716	S
9-Jul-18	W LANTAU	4	2.40	SUMMER	STANDARD138716	S
9-Jul-18	SW LANTAU	3	11.30	SUMMER	STANDARD138716	P
9-Jul-18	SW LANTAU	4	7.68	SUMMER	STANDARD138716	P
9-Jul-18	SW LANTAU	3	8.95	SUMMER	STANDARD138716	S
9-Jul-18	SW LANTAU	4	4.66	SUMMER	STANDARD138716	S
9-Jul-18	DEEP BAY	2	1.81	SUMMER	STANDARD36826	P
9-Jul-18	DEEP BAY	3	10.32	SUMMER	STANDARD36826	P
9-Jul-18	DEEP BAY	4	0.70	SUMMER	STANDARD36826	P
9-Jul-18	DEEP BAY	2	4.08	SUMMER	STANDARD36826	S
9-Jul-18	DEEP BAY	3	2.99	SUMMER	STANDARD36826	S
9-Jul-18	NE LANTAU	2	3.70	SUMMER	STANDARD36826	P
9-Jul-18	NE LANTAU	3	21.00	SUMMER	STANDARD36826	P
9-Jul-18	NE LANTAU	4	10.23	SUMMER	STANDARD36826	P
9-Jul-18	NE LANTAU	2	2.10	SUMMER	STANDARD36826	S
9-Jul-18	NE LANTAU	3	7.87	SUMMER	STANDARD36826	S
9-Jul-18	NE LANTAU	4	1.00	SUMMER	STANDARD36826	S
10-Jul-18	SW LANTAU	3	8.85	SUMMER	STANDARD36826	P
10-Jul-18	SW LANTAU	4	9.23	SUMMER	STANDARD36826	P
10-Jul-18	SW LANTAU	3	1.95	SUMMER	STANDARD36826	S
10-Jul-18	SW LANTAU	4	7.37	SUMMER	STANDARD36826	S
11-Jul-18	SAI KUNG	2	6.87	SUMMER	STANDARD36826	P
11-Jul-18	SAI KUNG	3	40.54	SUMMER	STANDARD36826	P
11-Jul-18	SAI KUNG	4	4.40	SUMMER	STANDARD36826	P
11-Jul-18	SAI KUNG	2	4.27	SUMMER	STANDARD36826	S
11-Jul-18	SAI KUNG	3	8.22	SUMMER	STANDARD36826	S
11-Jul-18	NINEPINS	3	16.00	SUMMER	STANDARD36826	P
16-Jul-18	NW LANTAU	3	21.35	SUMMER	STANDARD36826	P
16-Jul-18	NW LANTAU	2	1.12	SUMMER	STANDARD36826	S
16-Jul-18	NW LANTAU	3	11.93	SUMMER	STANDARD36826	S
19-Jul-18	SW LANTAU	3	9.86	SUMMER	STANDARD36826	S
20-Jul-18	DEEP BAY	2	9.18	SUMMER	STANDARD36826	P
20-Jul-18	DEEP BAY	3	3.74	SUMMER	STANDARD36826	P
20-Jul-18	DEEP BAY	2	5.06	SUMMER	STANDARD36826	S
20-Jul-18	DEEP BAY	3	0.62	SUMMER	STANDARD36826	S
20-Jul-18	NE LANTAU	2	9.16	SUMMER	STANDARD36826	P
20-Jul-18	NE LANTAU	3	8.58	SUMMER	STANDARD36826	P
20-Jul-18	NE LANTAU	2	6.50	SUMMER	STANDARD36826	S
20-Jul-18	NE LANTAU	3	1.86	SUMMER	STANDARD36826	S
23-Jul-18	W LANTAU	2	1.49	SUMMER	STANDARD36826	P
23-Jul-18	W LANTAU	3	3.85	SUMMER	STANDARD36826	P
23-Jul-18	W LANTAU	4	2.84	SUMMER	STANDARD36826	P
23-Jul-18	W LANTAU	2	2.27	SUMMER	STANDARD36826	S
23-Jul-18	W LANTAU	3	3.83	SUMMER	STANDARD36826	S
23-Jul-18	W LANTAU	4	2.55	SUMMER	STANDARD36826	S
25-Jul-18	W LANTAU	2	8.67	SUMMER	STANDARD36826	S
25-Jul-18	W LANTAU	3	1.71	SUMMER	STANDARD36826	S
25-Jul-18	SW LANTAU	2	7.94	SUMMER	STANDARD36826	P
25-Jul-18	SW LANTAU	3	2.40	SUMMER	STANDARD36826	P
25-Jul-18	SW LANTAU	2	12.96	SUMMER	STANDARD36826	S
25-Jul-18	SW LANTAU	3	0.20	SUMMER	STANDARD36826	S
25-Jul-18	SE LANTAU	2	14.13	SUMMER	STANDARD36826	P
25-Jul-18	SE LANTAU	3	19.42	SUMMER	STANDARD36826	P
25-Jul-18	SE LANTAU	2	7.55	SUMMER	STANDARD36826	S
25-Jul-18	SE LANTAU	3	4.00	SUMMER	STANDARD36826	S
30-Jul-18	PO TOI	1	5.83	SUMMER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
30-Jul-18	PO TOI	2	55.10	SUMMER	STANDARD36826	P
30-Jul-18	PO TOI	3	6.70	SUMMER	STANDARD36826	P
30-Jul-18	PO TOI	2	17.00	SUMMER	STANDARD36826	S
2-Aug-18	SW LANTAU	3	14.68	SUMMER	STANDARD36826	P
2-Aug-18	SW LANTAU	4	1.80	SUMMER	STANDARD36826	P
2-Aug-18	SW LANTAU	3	6.55	SUMMER	STANDARD36826	S
6-Aug-18	LAMMA	2	45.70	SUMMER	STANDARD36826	P
6-Aug-18	LAMMA	3	3.40	SUMMER	STANDARD36826	P
6-Aug-18	LAMMA	2	4.20	SUMMER	STANDARD36826	S
6-Aug-18	SE LANTAU	1	2.26	SUMMER	STANDARD36826	P
6-Aug-18	SE LANTAU	2	22.88	SUMMER	STANDARD36826	P
6-Aug-18	SE LANTAU	2	9.66	SUMMER	STANDARD36826	S
8-Aug-18	DEEP BAY	2	11.97	SUMMER	STANDARD36826	P
8-Aug-18	DEEP BAY	3	0.70	SUMMER	STANDARD36826	P
8-Aug-18	DEEP BAY	2	7.63	SUMMER	STANDARD36826	S
8-Aug-18	NE LANTAU	2	12.14	SUMMER	STANDARD36826	P
8-Aug-18	NE LANTAU	3	7.38	SUMMER	STANDARD36826	P
8-Aug-18	NE LANTAU	2	6.28	SUMMER	STANDARD36826	S
8-Aug-18	NE LANTAU	3	4.40	SUMMER	STANDARD36826	S
16-Aug-18	NW LANTAU	2	17.01	SUMMER	STANDARD36826	P
16-Aug-18	NW LANTAU	3	6.50	SUMMER	STANDARD36826	P
16-Aug-18	NW LANTAU	2	3.79	SUMMER	STANDARD36826	S
20-Aug-18	W LANTAU	1	2.76	SUMMER	STANDARD36826	P
20-Aug-18	W LANTAU	2	1.90	SUMMER	STANDARD36826	P
20-Aug-18	W LANTAU	1	5.90	SUMMER	STANDARD36826	S
20-Aug-18	W LANTAU	2	4.75	SUMMER	STANDARD36826	S
21-Aug-18	SW LANTAU	1	8.40	SUMMER	STANDARD138716	P
21-Aug-18	SW LANTAU	2	10.76	SUMMER	STANDARD138716	P
21-Aug-18	SW LANTAU	3	3.10	SUMMER	STANDARD138716	P
21-Aug-18	SW LANTAU	1	2.51	SUMMER	STANDARD138716	S
21-Aug-18	SW LANTAU	2	9.13	SUMMER	STANDARD138716	S
21-Aug-18	SW LANTAU	3	0.50	SUMMER	STANDARD138716	S
21-Aug-18	SE LANTAU	2	25.61	SUMMER	STANDARD138716	P
21-Aug-18	SE LANTAU	1	0.80	SUMMER	STANDARD138716	S
21-Aug-18	SE LANTAU	2	6.17	SUMMER	STANDARD138716	S
22-Aug-18	PO TOI	1	5.71	SUMMER	STANDARD36826	P
22-Aug-18	PO TOI	2	27.71	SUMMER	STANDARD36826	P
22-Aug-18	PO TOI	3	16.80	SUMMER	STANDARD36826	P
22-Aug-18	PO TOI	2	4.68	SUMMER	STANDARD36826	S
22-Aug-18	NINEPINS	2	3.05	SUMMER	STANDARD36826	P
22-Aug-18	NINEPINS	3	23.78	SUMMER	STANDARD36826	P
22-Aug-18	NINEPINS	2	2.10	SUMMER	STANDARD36826	S
23-Aug-18	SAI KUNG	2	31.44	SUMMER	STANDARD36826	P
23-Aug-18	SAI KUNG	3	11.66	SUMMER	STANDARD36826	P
23-Aug-18	SAI KUNG	2	4.10	SUMMER	STANDARD36826	S
23-Aug-18	SAI KUNG	3	2.00	SUMMER	STANDARD36826	S
23-Aug-18	NINEPINS	2	12.20	SUMMER	STANDARD36826	P
23-Aug-18	NINEPINS	3	18.50	SUMMER	STANDARD36826	P
23-Aug-18	NINEPINS	2	1.20	SUMMER	STANDARD36826	S
23-Aug-18	NINEPINS	3	2.00	SUMMER	STANDARD36826	S
28-Aug-18	W LANTAU	3	2.87	SUMMER	STANDARD36826	S
28-Aug-18	W LANTAU	4	7.72	SUMMER	STANDARD36826	S
28-Aug-18	SW LANTAU	1	3.98	SUMMER	STANDARD36826	P
28-Aug-18	SW LANTAU	2	13.23	SUMMER	STANDARD36826	P
28-Aug-18	SW LANTAU	3	3.62	SUMMER	STANDARD36826	P
28-Aug-18	SW LANTAU	1	1.11	SUMMER	STANDARD36826	S
28-Aug-18	SW LANTAU	2	8.22	SUMMER	STANDARD36826	S
3-Sep-18	W LANTAU	2	8.17	AUTUMN	STANDARD36826	S
3-Sep-18	SW LANTAU	2	24.29	AUTUMN	STANDARD36826	P
3-Sep-18	SW LANTAU	3	0.61	AUTUMN	STANDARD36826	P
3-Sep-18	SW LANTAU	2	13.05	AUTUMN	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
3-Sep-18	SE LANTAU	2	19.29	AUTUMN	STANDARD36826	P
3-Sep-18	SE LANTAU	2	8.81	AUTUMN	STANDARD36826	S
4-Sep-18	NW LANTAU	2	12.24	AUTUMN	STANDARD36826	P
4-Sep-18	NW LANTAU	3	7.70	AUTUMN	STANDARD36826	P
4-Sep-18	NW LANTAU	2	5.06	AUTUMN	STANDARD36826	S
4-Sep-18	NW LANTAU	3	4.90	AUTUMN	STANDARD36826	S
5-Sep-18	SW LANTAU	2	12.49	AUTUMN	STANDARD36826	P
5-Sep-18	SW LANTAU	3	0.90	AUTUMN	STANDARD36826	P
5-Sep-18	SW LANTAU	2	4.38	AUTUMN	STANDARD36826	S
6-Sep-18	PO TOI	2	18.03	AUTUMN	STANDARD36826	P
6-Sep-18	PO TOI	3	33.69	AUTUMN	STANDARD36826	P
6-Sep-18	PO TOI	2	1.41	AUTUMN	STANDARD36826	S
6-Sep-18	PO TOI	3	4.97	AUTUMN	STANDARD36826	S
6-Sep-18	NINEPINS	2	21.50	AUTUMN	STANDARD36826	P
6-Sep-18	NINEPINS	2	4.40	AUTUMN	STANDARD36826	S
11-Sep-18	SW LANTAU	2	14.15	AUTUMN	STANDARD36826	P
11-Sep-18	SW LANTAU	2	10.24	AUTUMN	STANDARD36826	S
14-Sep-18	W LANTAU	1	2.91	AUTUMN	STANDARD138716	P
14-Sep-18	W LANTAU	2	7.31	AUTUMN	STANDARD138716	P
14-Sep-18	W LANTAU	1	4.92	AUTUMN	STANDARD138716	S
14-Sep-18	W LANTAU	2	5.43	AUTUMN	STANDARD138716	S
19-Sep-18	W LANTAU	1	1.25	AUTUMN	STANDARD36826	P
19-Sep-18	W LANTAU	2	3.16	AUTUMN	STANDARD36826	P
19-Sep-18	W LANTAU	1	3.17	AUTUMN	STANDARD36826	S
19-Sep-18	W LANTAU	2	6.06	AUTUMN	STANDARD36826	S
20-Sep-18	DEEP BAY	2	2.20	AUTUMN	STANDARD36826	P
20-Sep-18	DEEP BAY	3	11.11	AUTUMN	STANDARD36826	P
20-Sep-18	DEEP BAY	2	7.09	AUTUMN	STANDARD36826	S
20-Sep-18	NE LANTAU	2	12.26	AUTUMN	STANDARD36826	P
20-Sep-18	NE LANTAU	3	0.70	AUTUMN	STANDARD36826	P
20-Sep-18	NE LANTAU	2	9.84	AUTUMN	STANDARD36826	S
21-Sep-18	PO TOI	1	22.00	AUTUMN	STANDARD138716	P
21-Sep-18	PO TOI	2	62.99	AUTUMN	STANDARD138716	P
21-Sep-18	PO TOI	1	2.00	AUTUMN	STANDARD138716	S
21-Sep-18	PO TOI	2	9.74	AUTUMN	STANDARD138716	S
27-Sep-18	LAMMA	2	43.98	AUTUMN	STANDARD36826	P
27-Sep-18	LAMMA	3	10.40	AUTUMN	STANDARD36826	P
27-Sep-18	LAMMA	2	9.40	AUTUMN	STANDARD36826	S
27-Sep-18	LAMMA	3	3.12	AUTUMN	STANDARD36826	S
27-Sep-18	SE LANTAU	2	16.41	AUTUMN	STANDARD36826	P
27-Sep-18	SE LANTAU	3	1.87	AUTUMN	STANDARD36826	P
27-Sep-18	SE LANTAU	2	6.32	AUTUMN	STANDARD36826	S
2-Oct-18	SW LANTAU	3	14.19	AUTUMN	STANDARD36826	P
2-Oct-18	SW LANTAU	4	5.23	AUTUMN	STANDARD36826	P
2-Oct-18	SW LANTAU	2	4.10	AUTUMN	STANDARD36826	S
2-Oct-18	SW LANTAU	3	6.20	AUTUMN	STANDARD36826	S
2-Oct-18	SW LANTAU	4	5.27	AUTUMN	STANDARD36826	S
3-Oct-18	SE LANTAU	2	35.47	AUTUMN	STANDARD36826	P
3-Oct-18	SE LANTAU	3	8.78	AUTUMN	STANDARD36826	P
3-Oct-18	SE LANTAU	2	12.45	AUTUMN	STANDARD36826	S
3-Oct-18	SE LANTAU	3	2.10	AUTUMN	STANDARD36826	S
3-Oct-18	SW LANTAU	2	6.41	AUTUMN	STANDARD36826	P
3-Oct-18	SW LANTAU	3	7.99	AUTUMN	STANDARD36826	P
3-Oct-18	SW LANTAU	2	2.10	AUTUMN	STANDARD36826	S
3-Oct-18	SW LANTAU	3	0.90	AUTUMN	STANDARD36826	S
8-Oct-18	NW LANTAU	2	23.39	AUTUMN	STANDARD36826	P
8-Oct-18	NW LANTAU	3	2.43	AUTUMN	STANDARD36826	P
8-Oct-18	NW LANTAU	2	7.67	AUTUMN	STANDARD36826	S
8-Oct-18	DEEP BAY	1	2.70	AUTUMN	STANDARD36826	P
8-Oct-18	DEEP BAY	2	10.62	AUTUMN	STANDARD36826	P
8-Oct-18	DEEP BAY	2	7.18	AUTUMN	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
8-Oct-18	NE LANTAU	2	19.35	AUTUMN	STANDARD36826	P
8-Oct-18	NE LANTAU	2	10.85	AUTUMN	STANDARD36826	S
9-Oct-18	SW LANTAU	2	6.12	AUTUMN	STANDARD36826	P
9-Oct-18	SW LANTAU	3	10.48	AUTUMN	STANDARD36826	P
9-Oct-18	SW LANTAU	4	4.33	AUTUMN	STANDARD36826	P
9-Oct-18	SW LANTAU	2	2.20	AUTUMN	STANDARD36826	S
9-Oct-18	SW LANTAU	3	2.20	AUTUMN	STANDARD36826	S
9-Oct-18	SW LANTAU	4	2.47	AUTUMN	STANDARD36826	S
10-Oct-18	LAMMA	1	1.26	AUTUMN	STANDARD36826	P
10-Oct-18	LAMMA	2	47.44	AUTUMN	STANDARD36826	P
10-Oct-18	LAMMA	3	0.60	AUTUMN	STANDARD36826	P
10-Oct-18	LAMMA	2	11.40	AUTUMN	STANDARD36826	S
10-Oct-18	SE LANTAU	2	3.32	AUTUMN	STANDARD36826	P
10-Oct-18	SE LANTAU	3	11.57	AUTUMN	STANDARD36826	P
10-Oct-18	SE LANTAU	2	1.05	AUTUMN	STANDARD36826	S
10-Oct-18	SE LANTAU	3	0.73	AUTUMN	STANDARD36826	S
10-Oct-18	SE LANTAU	4	1.30	AUTUMN	STANDARD36826	S
11-Oct-18	W LANTAU	2	2.91	AUTUMN	STANDARD36826	P
11-Oct-18	W LANTAU	3	3.85	AUTUMN	STANDARD36826	P
11-Oct-18	W LANTAU	2	4.67	AUTUMN	STANDARD36826	S
11-Oct-18	W LANTAU	3	6.11	AUTUMN	STANDARD36826	S
16-Oct-18	W LANTAU	2	2.32	AUTUMN	STANDARD36826	P
16-Oct-18	W LANTAU	3	8.28	AUTUMN	STANDARD36826	P
16-Oct-18	W LANTAU	2	6.79	AUTUMN	STANDARD36826	S
16-Oct-18	W LANTAU	3	3.01	AUTUMN	STANDARD36826	S
22-Oct-18	SE LANTAU	2	12.07	AUTUMN	STANDARD36826	P
22-Oct-18	SE LANTAU	3	15.55	AUTUMN	STANDARD36826	P
22-Oct-18	SE LANTAU	2	4.00	AUTUMN	STANDARD36826	S
22-Oct-18	SE LANTAU	3	6.28	AUTUMN	STANDARD36826	S
22-Oct-18	SW LANTAU	2	8.90	AUTUMN	STANDARD36826	P
22-Oct-18	SW LANTAU	3	13.27	AUTUMN	STANDARD36826	P
22-Oct-18	SW LANTAU	2	8.20	AUTUMN	STANDARD36826	S
22-Oct-18	SW LANTAU	3	3.93	AUTUMN	STANDARD36826	S
24-Oct-18	NW LANTAU	1	2.09	AUTUMN	STANDARD36826	P
24-Oct-18	NW LANTAU	2	30.57	AUTUMN	STANDARD36826	P
24-Oct-18	NW LANTAU	3	1.50	AUTUMN	STANDARD36826	P
24-Oct-18	NW LANTAU	1	2.40	AUTUMN	STANDARD36826	S
24-Oct-18	NW LANTAU	2	8.82	AUTUMN	STANDARD36826	S
24-Oct-18	DEEP BAY	1	0.30	AUTUMN	STANDARD36826	P
24-Oct-18	DEEP BAY	2	13.14	AUTUMN	STANDARD36826	P
24-Oct-18	DEEP BAY	1	2.60	AUTUMN	STANDARD36826	S
24-Oct-18	DEEP BAY	2	4.56	AUTUMN	STANDARD36826	S
24-Oct-18	NE LANTAU	2	7.97	AUTUMN	STANDARD36826	P
24-Oct-18	NE LANTAU	3	1.02	AUTUMN	STANDARD36826	P
24-Oct-18	NE LANTAU	2	8.21	AUTUMN	STANDARD36826	S
24-Oct-18	NE LANTAU	3	1.90	AUTUMN	STANDARD36826	S
30-Oct-18	W LANTAU	3	5.89	AUTUMN	STANDARD36826	P
30-Oct-18	W LANTAU	3	2.52	AUTUMN	STANDARD36826	S
30-Oct-18	W LANTAU	4	6.87	AUTUMN	STANDARD36826	S
30-Oct-18	SW LANTAU	2	21.04	AUTUMN	STANDARD36826	P
30-Oct-18	SW LANTAU	3	7.63	AUTUMN	STANDARD36826	P
30-Oct-18	SW LANTAU	2	7.19	AUTUMN	STANDARD36826	S
30-Oct-18	SW LANTAU	3	2.29	AUTUMN	STANDARD36826	S
30-Oct-18	SE LANTAU	2	14.39	AUTUMN	STANDARD36826	P
30-Oct-18	SE LANTAU	2	2.01	AUTUMN	STANDARD36826	S
5-Nov-18	SW LANTAU	3	9.50	AUTUMN	STANDARD36826	P
5-Nov-18	SW LANTAU	4	5.60	AUTUMN	STANDARD36826	P
5-Nov-18	SW LANTAU	2	1.95	AUTUMN	STANDARD36826	S
5-Nov-18	SW LANTAU	3	3.22	AUTUMN	STANDARD36826	S
5-Nov-18	SW LANTAU	4	4.13	AUTUMN	STANDARD36826	S
5-Nov-18	SE LANTAU	3	6.50	AUTUMN	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
5-Nov-18	SE LANTAU	4	4.03	AUTUMN	STANDARD36826	P
5-Nov-18	SE LANTAU	3	2.57	AUTUMN	STANDARD36826	S
7-Nov-18	W LANTAU	2	10.87	AUTUMN	STANDARD36826	P
7-Nov-18	W LANTAU	3	8.80	AUTUMN	STANDARD36826	P
7-Nov-18	W LANTAU	4	1.12	AUTUMN	STANDARD36826	P
7-Nov-18	W LANTAU	2	14.81	AUTUMN	STANDARD36826	S
7-Nov-18	W LANTAU	3	5.90	AUTUMN	STANDARD36826	S
7-Nov-18	NE LANTAU	2	14.41	AUTUMN	STANDARD36826	P
7-Nov-18	NE LANTAU	3	12.37	AUTUMN	STANDARD36826	P
7-Nov-18	NE LANTAU	2	8.29	AUTUMN	STANDARD36826	S
7-Nov-18	NE LANTAU	3	2.23	AUTUMN	STANDARD36826	S
12-Nov-18	SE LANTAU	2	20.25	AUTUMN	STANDARD36826	P
12-Nov-18	SE LANTAU	2	7.65	AUTUMN	STANDARD36826	S
13-Nov-18	DEEP BAY	2	11.83	AUTUMN	STANDARD36826	P
13-Nov-18	DEEP BAY	2	9.07	AUTUMN	STANDARD36826	S
13-Nov-18	NE LANTAU	2	3.53	AUTUMN	STANDARD36826	P
13-Nov-18	NE LANTAU	3	9.34	AUTUMN	STANDARD36826	P
13-Nov-18	NE LANTAU	2	5.30	AUTUMN	STANDARD36826	S
13-Nov-18	NE LANTAU	3	1.93	AUTUMN	STANDARD36826	S
19-Nov-18	W LANTAU	2	1.71	AUTUMN	STANDARD36826	P
19-Nov-18	W LANTAU	3	6.01	AUTUMN	STANDARD36826	P
19-Nov-18	W LANTAU	3	2.60	AUTUMN	STANDARD36826	S
19-Nov-18	SW LANTAU	2	21.57	AUTUMN	STANDARD36826	P
19-Nov-18	SW LANTAU	3	6.35	AUTUMN	STANDARD36826	P
19-Nov-18	SW LANTAU	4	1.98	AUTUMN	STANDARD36826	P
19-Nov-18	SW LANTAU	1	2.39	AUTUMN	STANDARD36826	S
19-Nov-18	SW LANTAU	2	4.51	AUTUMN	STANDARD36826	S
19-Nov-18	SW LANTAU	3	2.66	AUTUMN	STANDARD36826	S
19-Nov-18	SW LANTAU	4	2.33	AUTUMN	STANDARD36826	S
19-Nov-18	SE LANTAU	2	16.51	AUTUMN	STANDARD36826	P
19-Nov-18	SE LANTAU	2	2.09	AUTUMN	STANDARD36826	S
21-Nov-18	W LANTAU	2	7.27	AUTUMN	STANDARD36826	P
21-Nov-18	W LANTAU	3	1.66	AUTUMN	STANDARD36826	P
21-Nov-18	W LANTAU	2	14.07	AUTUMN	STANDARD36826	S
21-Nov-18	W LANTAU	3	4.15	AUTUMN	STANDARD36826	S
21-Nov-18	NW LANTAU	2	23.17	AUTUMN	STANDARD36826	P
21-Nov-18	NW LANTAU	2	7.40	AUTUMN	STANDARD36826	S
21-Nov-18	NW LANTAU	3	3.03	AUTUMN	STANDARD36826	S
22-Nov-18	NE LANTAU	2	6.40	AUTUMN	STANDARD36826	P
22-Nov-18	NE LANTAU	3	18.00	AUTUMN	STANDARD36826	P
22-Nov-18	NE LANTAU	4	6.13	AUTUMN	STANDARD36826	P
22-Nov-18	NE LANTAU	2	4.40	AUTUMN	STANDARD36826	S
22-Nov-18	NE LANTAU	3	4.45	AUTUMN	STANDARD36826	S
22-Nov-18	NE LANTAU	4	3.72	AUTUMN	STANDARD36826	S
22-Nov-18	NW LANTAU	2	9.21	AUTUMN	STANDARD36826	P
22-Nov-18	NW LANTAU	3	12.96	AUTUMN	STANDARD36826	P
22-Nov-18	NW LANTAU	2	6.83	AUTUMN	STANDARD36826	S
22-Nov-18	NW LANTAU	3	4.20	AUTUMN	STANDARD36826	S
28-Nov-18	SE LANTAU	2	21.94	AUTUMN	STANDARD36826	P
28-Nov-18	SE LANTAU	3	6.22	AUTUMN	STANDARD36826	P
28-Nov-18	SE LANTAU	2	7.90	AUTUMN	STANDARD36826	S
28-Nov-18	SE LANTAU	3	2.14	AUTUMN	STANDARD36826	S
28-Nov-18	SW LANTAU	2	20.45	AUTUMN	STANDARD36826	P
28-Nov-18	SW LANTAU	2	10.55	AUTUMN	STANDARD36826	S
29-Nov-18	NW LANTAU	2	20.77	AUTUMN	STANDARD36826	P
29-Nov-18	NW LANTAU	3	11.98	AUTUMN	STANDARD36826	P
29-Nov-18	NW LANTAU	2	2.12	AUTUMN	STANDARD36826	S
29-Nov-18	NW LANTAU	3	6.44	AUTUMN	STANDARD36826	S
29-Nov-18	DEEP BAY	2	12.00	AUTUMN	STANDARD36826	P
29-Nov-18	DEEP BAY	2	8.74	AUTUMN	STANDARD36826	S
3-Dec-18	W LANTAU	2	7.25	WINTER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
3-Dec-18	W LANTAU	3	1.69	WINTER	STANDARD36826	P
3-Dec-18	W LANTAU	2	9.58	WINTER	STANDARD36826	S
3-Dec-18	W LANTAU	3	1.07	WINTER	STANDARD36826	S
4-Dec-18	LAMMA	1	4.29	WINTER	STANDARD36826	P
4-Dec-18	LAMMA	2	65.89	WINTER	STANDARD36826	P
4-Dec-18	LAMMA	3	11.19	WINTER	STANDARD36826	P
4-Dec-18	LAMMA	1	0.90	WINTER	STANDARD36826	S
4-Dec-18	LAMMA	2	13.88	WINTER	STANDARD36826	S
4-Dec-18	LAMMA	3	2.35	WINTER	STANDARD36826	S
6-Dec-18	SW LANTAU	2	23.15	WINTER	STANDARD36826	P
6-Dec-18	SW LANTAU	3	6.90	WINTER	STANDARD36826	P
6-Dec-18	SW LANTAU	2	8.75	WINTER	STANDARD36826	S
6-Dec-18	SW LANTAU	3	2.30	WINTER	STANDARD36826	S
10-Dec-18	DEEP BAY	2	4.73	WINTER	STANDARD36826	P
10-Dec-18	DEEP BAY	3	7.67	WINTER	STANDARD36826	P
10-Dec-18	DEEP BAY	2	3.62	WINTER	STANDARD36826	S
10-Dec-18	DEEP BAY	3	4.28	WINTER	STANDARD36826	S
10-Dec-18	NE LANTAU	2	16.26	WINTER	STANDARD36826	P
10-Dec-18	NE LANTAU	2	10.14	WINTER	STANDARD36826	S
13-Dec-18	SE LANTAU	2	6.97	WINTER	STANDARD36826	P
13-Dec-18	SE LANTAU	3	12.41	WINTER	STANDARD36826	P
13-Dec-18	SE LANTAU	2	3.98	WINTER	STANDARD36826	S
13-Dec-18	SE LANTAU	3	2.05	WINTER	STANDARD36826	S
17-Dec-18	SW LANTAU	2	17.48	WINTER	STANDARD36826	P
17-Dec-18	SW LANTAU	3	3.72	WINTER	STANDARD36826	P
17-Dec-18	SW LANTAU	2	4.15	WINTER	STANDARD36826	S
17-Dec-18	SW LANTAU	3	2.25	WINTER	STANDARD36826	S
17-Dec-18	SE LANTAU	1	2.79	WINTER	STANDARD36826	P
17-Dec-18	SE LANTAU	2	24.87	WINTER	STANDARD36826	P
17-Dec-18	SE LANTAU	3	6.50	WINTER	STANDARD36826	P
17-Dec-18	SE LANTAU	4	3.30	WINTER	STANDARD36826	P
17-Dec-18	SE LANTAU	2	5.04	WINTER	STANDARD36826	S
17-Dec-18	SE LANTAU	4	0.90	WINTER	STANDARD36826	S
20-Dec-18	NW LANTAU	2	23.70	WINTER	STANDARD36826	P
20-Dec-18	NW LANTAU	2	13.30	WINTER	STANDARD36826	S
20-Dec-18	W LANTAU	2	9.61	WINTER	STANDARD36826	P
20-Dec-18	W LANTAU	1	2.73	WINTER	STANDARD36826	S
20-Dec-18	W LANTAU	2	6.66	WINTER	STANDARD36826	S
20-Dec-18	SE LANTAU	2	15.24	WINTER	STANDARD36826	P
20-Dec-18	SE LANTAU	2	2.14	WINTER	STANDARD36826	S
3-Jan-19	W LANTAU	2	5.30	WINTER	STANDARD36826	S
3-Jan-19	W LANTAU	3	5.00	WINTER	STANDARD36826	S
3-Jan-19	SW LANTAU	2	5.14	WINTER	STANDARD36826	P
3-Jan-19	SW LANTAU	2	5.56	WINTER	STANDARD36826	S
4-Jan-19	SW LANTAU	2	16.12	WINTER	STANDARD36826	P
4-Jan-19	SW LANTAU	3	7.45	WINTER	STANDARD36826	P
4-Jan-19	SW LANTAU	2	8.33	WINTER	STANDARD36826	S
4-Jan-19	SW LANTAU	3	2.30	WINTER	STANDARD36826	S
8-Jan-19	SW LANTAU	2	12.84	WINTER	STANDARD36826	P
8-Jan-19	SW LANTAU	3	6.10	WINTER	STANDARD36826	P
8-Jan-19	SW LANTAU	2	8.01	WINTER	STANDARD36826	S
8-Jan-19	SW LANTAU	3	3.10	WINTER	STANDARD36826	S
11-Jan-19	SE LANTAU	2	18.19	WINTER	STANDARD36826	P
11-Jan-19	SE LANTAU	3	1.60	WINTER	STANDARD36826	P
11-Jan-19	SE LANTAU	2	8.31	WINTER	STANDARD36826	S
11-Jan-19	SW LANTAU	2	16.00	WINTER	STANDARD36826	P
11-Jan-19	SW LANTAU	3	1.58	WINTER	STANDARD36826	P
11-Jan-19	SW LANTAU	2	9.02	WINTER	STANDARD36826	S
14-Jan-19	W LANTAU	1	3.89	WINTER	STANDARD36826	P
14-Jan-19	W LANTAU	1	6.33	WINTER	STANDARD36826	S
14-Jan-19	W LANTAU	2	2.00	WINTER	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
14-Jan-19	W LANTAU	3	1.50	WINTER	STANDARD36826	S
15-Jan-19	NW LANTAU	0	0.92	WINTER	STANDARD36826	P
15-Jan-19	NW LANTAU	1	4.77	WINTER	STANDARD36826	P
15-Jan-19	NW LANTAU	2	28.45	WINTER	STANDARD36826	P
15-Jan-19	NW LANTAU	3	1.50	WINTER	STANDARD36826	P
15-Jan-19	NW LANTAU	2	10.56	WINTER	STANDARD36826	S
15-Jan-19	DEEP BAY	2	12.72	WINTER	STANDARD36826	P
15-Jan-19	DEEP BAY	2	6.88	WINTER	STANDARD36826	S
15-Jan-19	NE LANTAU	2	12.97	WINTER	STANDARD36826	P
15-Jan-19	NE LANTAU	2	5.23	WINTER	STANDARD36826	S
17-Jan-19	W LANTAU	3	9.95	WINTER	STANDARD36826	S
17-Jan-19	SW LANTAU	1	0.70	WINTER	STANDARD36826	P
17-Jan-19	SW LANTAU	2	25.56	WINTER	STANDARD36826	P
17-Jan-19	SW LANTAU	3	0.17	WINTER	STANDARD36826	P
17-Jan-19	SW LANTAU	2	6.30	WINTER	STANDARD36826	S
17-Jan-19	SW LANTAU	3	2.27	WINTER	STANDARD36826	S
17-Jan-19	SE LANTAU	2	20.50	WINTER	STANDARD36826	P
17-Jan-19	SE LANTAU	3	0.90	WINTER	STANDARD36826	P
17-Jan-19	SE LANTAU	2	5.02	WINTER	STANDARD36826	S
22-Jan-19	SE LANTAU	2	14.96	WINTER	STANDARD36826	P
22-Jan-19	SE LANTAU	3	14.78	WINTER	STANDARD36826	P
22-Jan-19	SE LANTAU	4	5.79	WINTER	STANDARD36826	P
22-Jan-19	SE LANTAU	2	0.73	WINTER	STANDARD36826	S
22-Jan-19	SE LANTAU	3	3.96	WINTER	STANDARD36826	S
22-Jan-19	LAMMA	2	34.67	WINTER	STANDARD36826	P
22-Jan-19	LAMMA	2	8.43	WINTER	STANDARD36826	S
23-Jan-19	W LANTAU	2	5.98	WINTER	STANDARD36826	P
23-Jan-19	W LANTAU	3	3.78	WINTER	STANDARD36826	P
23-Jan-19	W LANTAU	2	10.32	WINTER	STANDARD36826	S
23-Jan-19	W LANTAU	3	9.41	WINTER	STANDARD36826	S
23-Jan-19	NE LANTAU	2	20.87	WINTER	STANDARD36826	P
23-Jan-19	NE LANTAU	2	11.03	WINTER	STANDARD36826	S
25-Jan-19	LAMMA	2	25.94	WINTER	STANDARD36826	P
25-Jan-19	LAMMA	3	58.37	WINTER	STANDARD36826	P
25-Jan-19	LAMMA	4	6.70	WINTER	STANDARD36826	P
25-Jan-19	LAMMA	2	5.81	WINTER	STANDARD36826	S
25-Jan-19	LAMMA	3	11.98	WINTER	STANDARD36826	S
25-Jan-19	LAMMA	4	0.80	WINTER	STANDARD36826	S
29-Jan-19	NW LANTAU	2	7.90	WINTER	STANDARD36826	P
29-Jan-19	NW LANTAU	3	10.79	WINTER	STANDARD36826	P
29-Jan-19	NW LANTAU	4	2.96	WINTER	STANDARD36826	P
29-Jan-19	NW LANTAU	5	2.40	WINTER	STANDARD36826	P
29-Jan-19	NW LANTAU	2	3.95	WINTER	STANDARD36826	S
29-Jan-19	NW LANTAU	3	4.17	WINTER	STANDARD36826	S
29-Jan-19	DEEP BAY	2	9.68	WINTER	STANDARD36826	P
29-Jan-19	DEEP BAY	2	10.72	WINTER	STANDARD36826	S
29-Jan-19	NE LANTAU	3	18.43	WINTER	STANDARD36826	P
29-Jan-19	NE LANTAU	2	2.20	WINTER	STANDARD36826	S
29-Jan-19	NE LANTAU	3	6.78	WINTER	STANDARD36826	S
29-Jan-19	NE LANTAU	4	1.39	WINTER	STANDARD36826	S
31-Jan-19	LAMMA	1	5.17	WINTER	STANDARD36826	P
31-Jan-19	LAMMA	2	83.52	WINTER	STANDARD36826	P
31-Jan-19	LAMMA	1	1.20	WINTER	STANDARD36826	S
31-Jan-19	LAMMA	2	15.96	WINTER	STANDARD36826	S
12-Feb-19	W LANTAU	1	6.19	WINTER	STANDARD36826	S
12-Feb-19	W LANTAU	2	4.68	WINTER	STANDARD36826	S
12-Feb-19	NW LANTAU	1	4.20	WINTER	STANDARD36826	P
12-Feb-19	NW LANTAU	2	14.23	WINTER	STANDARD36826	P
12-Feb-19	NW LANTAU	3	0.30	WINTER	STANDARD36826	P
12-Feb-19	NW LANTAU	1	1.90	WINTER	STANDARD36826	S
12-Feb-19	NW LANTAU	2	8.17	WINTER	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
12-Feb-19	NW LANTAU	3	2.37	WINTER	STANDARD36826	S
13-Feb-19	SE LANTAU	1	5.50	WINTER	STANDARD36826	P
13-Feb-19	SE LANTAU	2	21.62	WINTER	STANDARD36826	P
13-Feb-19	SE LANTAU	1	1.64	WINTER	STANDARD36826	S
13-Feb-19	SE LANTAU	2	8.62	WINTER	STANDARD36826	S
13-Feb-19	SW LANTAU	1	5.08	WINTER	STANDARD36826	P
13-Feb-19	SW LANTAU	2	10.22	WINTER	STANDARD36826	P
13-Feb-19	SW LANTAU	1	4.87	WINTER	STANDARD36826	S
13-Feb-19	SW LANTAU	2	3.37	WINTER	STANDARD36826	S
14-Feb-19	DEEP BAY	2	10.41	WINTER	STANDARD36826	P
14-Feb-19	DEEP BAY	2	9.09	WINTER	STANDARD36826	S
14-Feb-19	NE LANTAU	2	3.21	WINTER	STANDARD36826	P
14-Feb-19	NE LANTAU	3	11.29	WINTER	STANDARD36826	P
14-Feb-19	NE LANTAU	2	2.22	WINTER	STANDARD36826	S
14-Feb-19	NE LANTAU	3	9.18	WINTER	STANDARD36826	S
15-Feb-19	SW LANTAU	2	5.10	WINTER	STANDARD36826	P
15-Feb-19	SW LANTAU	3	22.43	WINTER	STANDARD36826	P
15-Feb-19	SW LANTAU	4	1.10	WINTER	STANDARD36826	P
15-Feb-19	SW LANTAU	3	11.27	WINTER	STANDARD36826	S
20-Feb-19	W LANTAU	2	2.57	WINTER	STANDARD36826	P
20-Feb-19	W LANTAU	3	4.38	WINTER	STANDARD36826	P
20-Feb-19	W LANTAU	2	3.24	WINTER	STANDARD36826	S
20-Feb-19	W LANTAU	3	6.06	WINTER	STANDARD36826	S
22-Feb-19	SE LANTAU	2	10.37	WINTER	STANDARD36826	P
22-Feb-19	SE LANTAU	3	7.32	WINTER	STANDARD36826	P
22-Feb-19	SE LANTAU	4	2.15	WINTER	STANDARD36826	P
22-Feb-19	SE LANTAU	2	3.00	WINTER	STANDARD36826	S
22-Feb-19	SE LANTAU	4	1.83	WINTER	STANDARD36826	S
22-Feb-19	LAMMA	2	48.20	WINTER	STANDARD36826	P
22-Feb-19	LAMMA	3	1.40	WINTER	STANDARD36826	P
22-Feb-19	LAMMA	2	11.50	WINTER	STANDARD36826	S
26-Feb-19	NW LANTAU	2	3.25	WINTER	STANDARD36826	P
26-Feb-19	NW LANTAU	3	20.82	WINTER	STANDARD36826	P
26-Feb-19	NW LANTAU	4	1.10	WINTER	STANDARD36826	P
26-Feb-19	NW LANTAU	3	7.83	WINTER	STANDARD36826	S
26-Feb-19	DEEP BAY	2	9.72	WINTER	STANDARD36826	P
26-Feb-19	DEEP BAY	3	1.02	WINTER	STANDARD36826	P
26-Feb-19	DEEP BAY	2	8.36	WINTER	STANDARD36826	S
8-Mar-19	NW LANTAU	2	6.37	SPRING	STANDARD36826	P
8-Mar-19	NW LANTAU	3	9.77	SPRING	STANDARD36826	P
8-Mar-19	NW LANTAU	4	8.39	SPRING	STANDARD36826	P
8-Mar-19	NW LANTAU	2	6.21	SPRING	STANDARD36826	S
8-Mar-19	NW LANTAU	3	3.20	SPRING	STANDARD36826	S
8-Mar-19	NW LANTAU	4	3.86	SPRING	STANDARD36826	S
8-Mar-19	W LANTAU	2	3.21	SPRING	STANDARD36826	P
8-Mar-19	W LANTAU	3	1.13	SPRING	STANDARD36826	P
8-Mar-19	W LANTAU	4	5.26	SPRING	STANDARD36826	P
8-Mar-19	W LANTAU	5	3.90	SPRING	STANDARD36826	P
8-Mar-19	W LANTAU	2	1.76	SPRING	STANDARD36826	S
8-Mar-19	W LANTAU	3	6.84	SPRING	STANDARD36826	S
8-Mar-19	W LANTAU	4	1.30	SPRING	STANDARD36826	S
8-Mar-19	W LANTAU	5	2.50	SPRING	STANDARD36826	S
11-Mar-19	W LANTAU	2	4.26	SPRING	STANDARD36826	S
11-Mar-19	W LANTAU	3	6.44	SPRING	STANDARD36826	S
11-Mar-19	SE LANTAU	2	15.59	SPRING	STANDARD36826	P
11-Mar-19	SE LANTAU	2	8.57	SPRING	STANDARD36826	S
18-Mar-19	W LANTAU	2	8.25	SPRING	STANDARD36826	S
18-Mar-19	SW LANTAU	2	16.22	SPRING	STANDARD36826	P
18-Mar-19	SW LANTAU	2	12.08	SPRING	STANDARD36826	S
19-Mar-19	LAMMA	1	11.77	SPRING	STANDARD36826	P
19-Mar-19	LAMMA	2	50.76	SPRING	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
19-Mar-19	LAMMA	3	18.00	SPRING	STANDARD36826	P
19-Mar-19	LAMMA	1	8.55	SPRING	STANDARD36826	S
19-Mar-19	LAMMA	2	9.77	SPRING	STANDARD36826	S
19-Mar-19	LAMMA	3	3.34	SPRING	STANDARD36826	S
20-Mar-19	SW LANTAU	2	17.08	SPRING	STANDARD36826	P
20-Mar-19	SW LANTAU	3	4.54	SPRING	STANDARD36826	P
20-Mar-19	SW LANTAU	2	5.7	SPRING	STANDARD36826	S
20-Mar-19	SW LANTAU	3	2.28	SPRING	STANDARD36826	S
21-Mar-19	LAMMA	1	1.40	SPRING	STANDARD36826	P
21-Mar-19	LAMMA	2	33.74	SPRING	STANDARD36826	P
21-Mar-19	LAMMA	1	0.50	SPRING	STANDARD36826	S
21-Mar-19	LAMMA	2	7.96	SPRING	STANDARD36826	S
21-Mar-19	SE LANTAU	1	8.15	SPRING	STANDARD36826	P
21-Mar-19	SE LANTAU	2	26.24	SPRING	STANDARD36826	P
21-Mar-19	SE LANTAU	1	4.10	SPRING	STANDARD36826	S
21-Mar-19	SE LANTAU	2	9.01	SPRING	STANDARD36826	S
25-Mar-19	NW LANTAU	2	19.81	SPRING	STANDARD36826	P
25-Mar-19	NW LANTAU	3	7.39	SPRING	STANDARD36826	P
25-Mar-19	NW LANTAU	2	6.99	SPRING	STANDARD36826	S
25-Mar-19	DEEP BAY	2	6.00	SPRING	STANDARD36826	P
25-Mar-19	DEEP BAY	3	6.81	SPRING	STANDARD36826	P
25-Mar-19	DEEP BAY	2	3.35	SPRING	STANDARD36826	S
25-Mar-19	DEEP BAY	3	2.74	SPRING	STANDARD36826	S
25-Mar-19	NE LANTAU	1	3.43	SPRING	STANDARD36826	P
25-Mar-19	NE LANTAU	2	16.61	SPRING	STANDARD36826	P
25-Mar-19	NE LANTAU	2	10.66	SPRING	STANDARD36826	S
26-Mar-19	W LANTAU	1	7.85	SPRING	STANDARD36826	S
26-Mar-19	W LANTAU	2	0.70	SPRING	STANDARD36826	S
26-Mar-19	W LANTAU	3	1.75	SPRING	STANDARD36826	S
26-Mar-19	SW LANTAU	3	24.64	SPRING	STANDARD36826	P
26-Mar-19	SW LANTAU	4	17.02	SPRING	STANDARD36826	P
26-Mar-19	SW LANTAU	2	0.60	SPRING	STANDARD36826	S
26-Mar-19	SW LANTAU	3	12.14	SPRING	STANDARD36826	S
26-Mar-19	SW LANTAU	4	9.10	SPRING	STANDARD36826	S

Appendix II. HKCRP-AFCD Chinese White Dolphin Sighting Database (April 2018 - March 2019)

(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
10-Apr-18	1	1335	3	W LANTAU	2	227	ON	HKCRP	813735	802802	SPRING	NONE	S
11-Apr-18	1	1403	3	DEEP BAY	2	ND	OFF	HKCRP	832421	806086	SPRING	NONE	
11-Apr-18	2	1432	2	DEEP BAY	2	175	ON	HKCRP	832819	806098	SPRING	NONE	S
13-Apr-18	1	1400	2	W LANTAU	2	ND	OFF	HKCRP	805963	802125	SPRING	NONE	
13-Apr-18	2	1411	3	SW LANTAU	2	71	ON	HKCRP	806635	803725	SPRING	NONE	S
13-Apr-18	4	1523	1	SW LANTAU	2	43	ON	HKCRP	802064	807801	SPRING	NONE	S
24-Apr-18	1	1449	5	W LANTAU	2	147	ON	HKCRP	813425	802730	SPRING	NONE	S
24-Apr-18	2	1458	4	W LANTAU	2	296	ON	HKCRP	813238	802204	SPRING	NONE	S
24-Apr-18	3	1522	1	W LANTAU	2	100	ON	HKCRP	810173	801197	SPRING	PURSE-SEINE	S
27-Apr-18	1	1108	1	NW LANTAU	2	63	ON	HKCRP	827284	805479	SPRING	NONE	P
27-Apr-18	2	1142	3	DEEP BAY	2	87	ON	HKCRP	831391	806043	SPRING	NONE	P
8-May-18	1	1037	2	W LANTAU	2	ND	OFF	HKCRP	808977	800843	SPRING	NONE	
8-May-18	2	1102	7	SW LANTAU	2	44	ON	HKCRP	806193	802879	SPRING	NONE	S
8-May-18	3	1145	1	SW LANTAU	1	5	ON	HKCRP	807335	807903	SPRING	NONE	S
8-May-18	4	1205	1	SW LANTAU	2	156	ON	HKCRP	804289	808269	SPRING	NONE	S
14-May-18	1	1107	4	NW LANTAU	3	63	ON	HKCRP	828247	805697	SPRING	NONE	S
14-May-18	2	1441	3	SW LANTAU	2	ND	OFF	HKCRP	806027	802889	SPRING	NONE	
14-May-18	3	1516	2	SW LANTAU	2	ND	OFF	HKCRP	807245	808522	SPRING	NONE	
15-May-18	1	1326	3	SW LANTAU	3	32	ON	HKCRP	806117	802611	SPRING	NONE	P
15-May-18	2	1525	2	SW LANTAU	2	47	ON	HKCRP	803215	808246	SPRING	NONE	S
15-May-18	3	1553	1	SW LANTAU	2	212	ON	HKCRP	806138	808509	SPRING	NONE	P
17-May-18	5	1425	2	SW LANTAU	2	299	ON	HKCRP	807122	809470	SPRING	NONE	P
28-May-18	5	1417	2	SW LANTAU	2	152	ON	HKCRP	806913	808707	SPRING	NONE	P
28-May-18	6	1543	4	SW LANTAU	2	ND	OFF	HKCRP	805853	807189	SPRING	NONE	
30-May-18	1	1125	3	SW LANTAU	2	ND	OFF	HKCRP	806766	804520	SPRING	NONE	
30-May-18	2	1142	2	W LANTAU	2	82	ON	HKCRP	806429	801374	SPRING	NONE	P
30-May-18	3	1151	1	W LANTAU	2	349	ON	HKCRP	806908	800106	SPRING	NONE	S
30-May-18	4	1155	3	W LANTAU	2	601	ON	HKCRP	807219	799932	SPRING	NONE	S
30-May-18	5	1201	1	W LANTAU	2	176	ON	HKCRP	807607	799747	SPRING	NONE	S
30-May-18	6	1214	1	W LANTAU	3	ND	OFF	HKCRP	808426	799955	SPRING	NONE	
30-May-18	7	1226	2	W LANTAU	3	ND	OFF	HKCRP	808944	800946	SPRING	NONE	
31-May-18	1	1621	1	SE LANTAU	2	ND	OFF	HKCRP	808183	818319	SPRING	NONE	
4-Jun-18	1	1400	2	SW LANTAU	3	188	ON	HKCRP	806767	803983	SUMMER	NONE	S

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
11-Jun-18	2	1413	1	SE LANTAU	2	54	ON	HKCRP	808012	813483	SUMMER	PURSE-SEINE	P
14-Jun-18	1	1524	1	NW LANTAU	2	12	ON	HKCRP	827401	807611	SUMMER	NONE	P
20-Jun-18	1	1532	1	SW LANTAU	2	1	ON	HKCRP	807442	810337	SUMMER	NONE	S
21-Jun-18	1	1353	3	W LANTAU	2	41	ON	HKCRP	809099	800988	SUMMER	NONE	S
21-Jun-18	2	1411	12	W LANTAU	3	43	ON	HKCRP	806384	801930	SUMMER	PURSE-SEINE	S
21-Jun-18	3	1456	7	SW LANTAU	3	ND	OFF	HKCRP	807291	807975	SUMMER	NONE	
27-Jun-18	1	1354	1	W LANTAU	3	113	ON	HKCRP	813204	802698	SUMMER	NONE	S
27-Jun-18	2	1417	6	W LANTAU	3	197	ON	HKCRP	810010	799753	SUMMER	NONE	S
27-Jun-18	3	1449	3	W LANTAU	3	54	ON	HKCRP	808545	800966	SUMMER	NONE	S
27-Jun-18	4	1511	4	W LANTAU	2	ND	OFF	HKCRP	806239	802198	SUMMER	NONE	
4-Jul-18	1	1314	3	SW LANTAU	2	ND	OFF	HKCRP	807485	804624	SUMMER	NONE	
4-Jul-18	2	1351	5	SW LANTAU	2	ND	OFF	HKCRP	805817	808416	SUMMER	NONE	
9-Jul-18	1	1125	9	W LANTAU	3	967	ON	HKCRP	809387	800803	SUMMER	NONE	P
9-Jul-18	2	1158	2	W LANTAU	3	144	ON	HKCRP	807614	801572	SUMMER	NONE	S
9-Jul-18	3	1239	4	SW LANTAU	4	ND	OFF	HKCRP	806128	802476	SUMMER	NONE	
9-Jul-18	4	1320	2	SW LANTAU	3	102	ON	HKCRP	804906	804444	SUMMER	NONE	P
16-Jul-18	1	1408	1	NW LANTAU	3	94	ON	HKCRP	827003	807548	SUMMER	NONE	P
23-Jul-18	1	1315	12	W LANTAU	3	1189	ON	HKCRP	814542	803144	SUMMER	NONE	P
25-Jul-18	1	1019	2	W LANTAU	2	627	ON	HKCRP	814011	803267	SUMMER	NONE	S
25-Jul-18	2	1024	1	W LANTAU	2	200	ON	HKCRP	813503	802699	SUMMER	NONE	S
25-Jul-18	3	1030	13	W LANTAU	2	123	ON	HKCRP	810040	801268	SUMMER	NONE	S
25-Jul-18	4	1104	3	W LANTAU	3	80	ON	HKCRP	806617	801797	SUMMER	NONE	S
2-Aug-18	1	1400	2	SW LANTAU	3	ND	OFF	HKCRP	806028	802414	SUMMER	NONE	
2-Aug-18	2	1442	1	SW LANTAU	3	95	ON	HKCRP	805136	805568	SUMMER	NONE	P
8-Aug-18	1	1553	3	W LANTAU	3	ND	OFF	HELI	807127	801282	SUMMER	NONE	
8-Aug-18	2	1553	1	W LANTAU	3	ND	OFF	HELI	809719	801072	SUMMER	NONE	
8-Aug-18	3	1556	4	W LANTAU	2	ND	OFF	HELI	813514	802524	SUMMER	NONE	
8-Aug-18	4	1556	1	W LANTAU	2	ND	OFF	HELI	813855	803431	SUMMER	NONE	
20-Aug-18	1	1414	1	W LANTAU	2	226	ON	HKCRP	813259	802760	SUMMER	NONE	S
20-Aug-18	2	1441	1	W LANTAU	1	457	ON	HKCRP	810652	799961	SUMMER	NONE	S
20-Aug-18	3	1501	5	W LANTAU	1	106	ON	HKCRP	809357	799555	SUMMER	NONE	S
20-Aug-18	4	1522	1	W LANTAU	2	328	ON	HKCRP	807473	800046	SUMMER	NONE	S
20-Aug-18	5	1530	1	W LANTAU	2	187	ON	HKCRP	806328	801920	SUMMER	NONE	S
28-Aug-18	1	1316	1	W LANTAU	4	186	ON	HKCRP	811478	801767	SUMMER	NONE	S

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
28-Aug-18	2	1344	2	SW LANTAU	2	ND	OFF	HKCRP	806105	802703	SUMMER	NONE	
3-Sep-18	1	1024	8	W LANTAU	2	87	ON	HKCRP	812363	802191	AUTUMN	NONE	S
3-Sep-18	2	1053	3	W LANTAU	2	12	ON	HKCRP	809431	801061	AUTUMN	NONE	S
3-Sep-18	3	1118	2	SW LANTAU	2	ND	OFF	HKCRP	806206	802291	AUTUMN	NONE	
3-Sep-18	4	1200	1	SW LANTAU	2	212	ON	HKCRP	806323	804426	AUTUMN	NONE	P
5-Sep-18	1	1427	1	SW LANTAU	2	9	ON	HKCRP	805982	803476	AUTUMN	NONE	P
11-Sep-18	1	1440	1	SW LANTAU	2	152	ON	HKCRP	806793	807552	AUTUMN	NONE	S
11-Sep-18	3	1609	1	SE LANTAU	2	ND	OFF	HKCRP	808899	813113	AUTUMN	NONE	
14-Sep-18	1	1312	1	W LANTAU	1	532	ON	HKCRP	812452	802119	AUTUMN	NONE	P
14-Sep-18	2	1405	2	W LANTAU	2	102	ON	HKCRP	806407	801570	AUTUMN	NONE	P
14-Sep-18	3	1511	1	SE LANTAU	2	ND	OFF	HKCRP	808134	813277	AUTUMN	NONE	
19-Sep-18	1	1336	6	W LANTAU	2	137	ON	HKCRP	814799	802186	AUTUMN	NONE	S
19-Sep-18	2	1355	2	W LANTAU	2	982	ON	HKCRP	813559	802225	AUTUMN	NONE	P
19-Sep-18	3	1403	6	W LANTAU	2	210	ON	HKCRP	813071	802605	AUTUMN	NONE	S
19-Sep-18	4	1423	4	W LANTAU	2	155	ON	HKCRP	811555	802066	AUTUMN	NONE	P
19-Sep-18	5	1458	1	W LANTAU	1	201	ON	HKCRP	808789	800812	AUTUMN	NONE	S
2-Oct-18	1	1334	1	SW LANTAU	4	64	ON	HKCRP	805120	802495	AUTUMN	NONE	P
3-Oct-18	1	1601	1	W LANTAU	2	ND	OFF	HELI	804842	803144	AUTUMN	NONE	
3-Oct-18	2	1603	1	W LANTAU		ND	OFF	HELI	812728	802491	AUTUMN	NONE	
8-Oct-18	1	1101	5	NW LANTAU	2	239	ON	HKCRP	826885	805324	AUTUMN	NONE	S
8-Oct-18	2	1111	1	NW LANTAU	2	317	ON	HKCRP	828147	805512	AUTUMN	NONE	P
8-Oct-18	3	1308	1	NW LANTAU	2	143	ON	HKCRP	828066	807499	AUTUMN	NONE	P
11-Oct-18	1	1418	7	W LANTAU	3	51	ON	HKCRP	811028	800199	AUTUMN	NONE	S
11-Oct-18	2	1455	5	W LANTAU	3	408	ON	HKCRP	808822	800946	AUTUMN	NONE	S
16-Oct-18	1	1406	5	W LANTAU	3	347	ON	HKCRP	809147	799596	AUTUMN	NONE	S
24-Oct-18	1	1055	4	NW LANTAU	2	475	ON	HKCRP	823985	804700	AUTUMN	NONE	P
24-Oct-18	2	1114	3	NW LANTAU	2	342	ON	HKCRP	826409	805178	AUTUMN	NONE	P
24-Oct-18	3	1144	1	NW LANTAU	2	170	ON	HKCRP	829467	804670	AUTUMN	NONE	P
29-Oct-18	1	1007	1	SAI KUNG	1	ND	OFF	HKCRP	826319	852194	AUTUMN	NONE	
30-Oct-18	1	1038	7	W LANTAU	3	584	ON	HKCRP	814091	801773	AUTUMN	NONE	S
30-Oct-18	2	1112	1	W LANTAU	4	410	ON	HKCRP	812008	802324	AUTUMN	NONE	S
30-Oct-18	3	1147	4	W LANTAU	4	26	ON	HKCRP	806217	802105	AUTUMN	NONE	S
19-Nov-18	1	1051	8	W LANTAU	3	355	ON	HKCRP	808468	800852	AUTUMN	NONE	S
19-Nov-18	2	1139	1	SW LANTAU	2	ND	OFF	HKCRP	806205	802683	AUTUMN	NONE	

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
21-Nov-18	1	1018	5	W LANTAU	2	214	ON	HKCRP	814629	804155	AUTUMN	NONE	S
21-Nov-18	2	1029	1	W LANTAU	2	1502	ON	HKCRP	813248	802564	AUTUMN	NONE	S
21-Nov-18	3	1045	11	W LANTAU	3	290	ON	HKCRP	809763	801154	AUTUMN	NONE	S
21-Nov-18	4	1222	12	W LANTAU	2	245	ON	HKCRP	812398	801511	AUTUMN	NONE	P
29-Nov-18	1	1033	1	NW LANTAU	2	728	ON	HKCRP	817861	804646	AUTUMN	NONE	P
29-Nov-18	2	1225	1	DEEP BAY	2	61	ON	HKCRP	832930	806376	AUTUMN	NONE	S
29-Nov-18	3	1316	3	NW LANTAU	2	ND	OFF	HKCRP	830049	807029	AUTUMN	NONE	
29-Nov-18	4	1329	3	NW LANTAU	2	186	ON	HKCRP	829629	806452	AUTUMN	NONE	P
29-Nov-18	5	1352	3	NW LANTAU	2	364	ON	HKCRP	828234	806408	AUTUMN	NONE	P
3-Dec-18	1	1400	2	W LANTAU	2	260	ON	HKCRP	814954	802465	WINTER	NONE	S
3-Dec-18	2	1423	1	W LANTAU	2	205	ON	HKCRP	812905	802564	WINTER	NONE	S
3-Dec-18	1	1606	5	SW LANTAU	2	ND	OFF	HELI	805829	802300	WINTER	NONE	
3-Dec-18	2	1610	1	W LANTAU	2	ND	OFF	HELI	810251	800991	WINTER	NONE	
3-Dec-18	3	1614	2	W LANTAU	2	ND	OFF	HELI	812773	802275	WINTER	NONE	
3-Dec-18	4	1616	1	W LANTAU	2	ND	OFF	HELI	815036	805403	WINTER	NONE	
13-Dec-18	1	1256	3	SW LANTAU	3	ND	OFF	HKCRP	806304	803003	WINTER	NONE	
17-Dec-18	1	1136	1	SW LANTAU	2	ND	OFF	HKCRP	802364	807358	WINTER	NONE	
3-Jan-19	1	1438	1	SW LANTAU	2	17	ON	HKCRP	806282	802745	WINTER	NONE	S
3-Jan-19	2	1502	10	SW LANTAU	2	71	ON	HKCRP	804031	804483	WINTER	NONE	P
8-Jan-19	1	1331	9	SW LANTAU	2	634	ON	HKCRP	805127	804485	WINTER	NONE	P
11-Jan-19	3	1347	1	SW LANTAU	2	68	ON	HKCRP	805585	808302	WINTER	NONE	S
14-Jan-19	1	1352	3	W LANTAU	1	153	ON	HKCRP	814520	803484	WINTER	NONE	P
14-Jan-19	2	1414	1	W LANTAU	1	96	ON	HKCRP	813649	801431	WINTER	NONE	S
14-Jan-19	3	1501	2	SW LANTAU	3	ND	OFF	HKCRP	806206	802312	WINTER	NONE	
15-Jan-19	1	1353	2	NW LANTAU	2	39	ON	HKCRP	823535	808551	WINTER	NONE	P
17-Jan-19	1	1035	1	W LANTAU	3	319	ON	HKCRP	809973	801237	WINTER	NONE	S
23-Jan-19	1	1009	2	W LANTAU	2	ND	OFF	HKCRP	816321	805405	WINTER	NONE	
23-Jan-19	2	1051	6	W LANTAU	2	759	ON	HKCRP	813204	802667	WINTER	NONE	S
23-Jan-19	3	1130	2	W LANTAU	2	827	ON	HKCRP	812462	802295	WINTER	NONE	P
23-Jan-19	4	1225	1	W LANTAU	2	379	ON	HKCRP	808447	800316	WINTER	NONE	P
23-Jan-19	5	1255	1	W LANTAU	3	ND	OFF	HKCRP	806705	801715	WINTER	NONE	
23-Jan-19	6	1258	1	W LANTAU	3	ND	OFF	HKCRP	807215	801489	WINTER	NONE	
23-Jan-19	7	1302	1	W LANTAU	3	55	ON	HKCRP	807980	801181	WINTER	NONE	S
23-Jan-19	8	1326	2	W LANTAU	2	542	ON	HKCRP	812606	802305	WINTER	NONE	S

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
23-Jan-19	9	1335	1	W LANTAU	3	0	ON	HKCRP	813513	802957	WINTER	NONE	S
29-Jan-19	1	1020	1	NW LANTAU	3	114	ON	HKCRP	817450	805469	WINTER	NONE	P
29-Jan-19	2	1055	10	NW LANTAU	3	165	ON	HKCRP	824171	805689	WINTER	NONE	P
12-Feb-19	1	1040	5	W LANTAU	2	348	ON	HKCRP	808745	800884	WINTER	NONE	S
12-Feb-19	2	1049	1	W LANTAU	2	772	ON	HKCRP	808026	800336	WINTER	NONE	S
12-Feb-19	3	1450	1	NW LANTAU	2	410	ON	HKCRP	825778	805466	WINTER	NONE	P
20-Feb-19	1	1359	6	W LANTAU	2	874	ON	HKCRP	812019	802469	WINTER	GILLNET	S
20-Feb-19	2	1452	1	W LANTAU	3	7	ON	HKCRP	808446	800956	WINTER	NONE	S
20-Feb-19	3	1506	4	W LANTAU	3	43	ON	HKCRP	806584	801683	WINTER	NONE	S
11-Mar-19	1	1340	6	W LANTAU	3	29	ON	HKCRP	806206	801992	SPRING	NONE	S
18-Mar-19	1	1346	3	W LANTAU	2	14	ON	HKCRP	809055	800947	SPRING	NONE	S
18-Mar-19	2	1359	7	W LANTAU	2	105	ON	HKCRP	807071	801623	SPRING	NONE	S
25-Mar-19	1	1247	1	NW LANTAU	2	51	ON	HKCRP	827833	807509	SPRING	NONE	P

Appendix III. HKCRP-AFCD Finless Porpoise Sighting Database (April 2018 - March 2019)

(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
10-Apr-18	2	1612	2	SE LANTAU	2	ND	OFF	808112	813328	SPRING	
12-Apr-18	1	1033	2	LAMMA	2	134	ON	806484	823009	SPRING	P
12-Apr-18	2	1126	4	LAMMA	2	104	ON	804554	826741	SPRING	P
12-Apr-18	3	1132	1	LAMMA	2	142	ON	804522	825813	SPRING	P
12-Apr-18	4	1230	2	LAMMA	2	68	ON	802473	826657	SPRING	P
12-Apr-18	5	1513	6	SE LANTAU	1	66	ON	805685	814500	SPRING	P
12-Apr-18	6	1556	3	SE LANTAU	1	264	ON	806608	812439	SPRING	P
12-Apr-18	7	1600	4	SE LANTAU	2	0	ON	805965	812397	SPRING	P
12-Apr-18	8	1605	2	SE LANTAU	1	131	ON	805135	812396	SPRING	P
12-Apr-18	9	1627	2	SE LANTAU	1	ND	OFF	807387	817112	SPRING	
13-Apr-18	3	1515	4	SW LANTAU	2	250	ON	801963	808461	SPRING	P
23-Apr-18	1	1038	1	PO TOI	1	253	ON	807049	850728	SPRING	S
23-Apr-18	2	1444	3	LAMMA	1	172	ON	803499	839159	SPRING	P
24-Apr-18	4	1623	4	SE LANTAU	1	ND	OFF	807237	813296	SPRING	
30-Apr-18	1	1146	1	SE LANTAU	2	117	ON	805562	815562	SPRING	P
2-May-18	1	1425	4	SE LANTAU	2	180	ON	806220	812428	SPRING	P
8-May-18	5	1218	1	SW LANTAU	2	288	ON	803238	807999	SPRING	S
8-May-18	6	1345	1	SE LANTAU	2	1	ON	805766	812448	SPRING	P
8-May-18	7	1351	4	SE LANTAU	2	17	ON	804947	812447	SPRING	P
8-May-18	8	1400	4	SE LANTAU	2	7	ON	803230	812434	SPRING	P
8-May-18	9	1407	2	SE LANTAU	2	214	ON	802189	812443	SPRING	P
17-May-18	1	1028	3	SE LANTAU	2	162	ON	804251	819418	SPRING	P
17-May-18	2	1108	2	SE LANTAU	2	86	ON	805460	817594	SPRING	P
17-May-18	3	1216	2	SE LANTAU	2	6	ON	801488	814711	SPRING	S
17-May-18	4	1229	1	SE LANTAU	2	73	ON	802376	813505	SPRING	P
21-May-18	1	1211	2	LAMMA	2	226	ON	802494	827276	SPRING	P
21-May-18	2	1220	2	LAMMA	2	320	ON	802528	826152	SPRING	P
28-May-18	1	1025	2	SE LANTAU	2	ND	OFF	804817	818470	SPRING	
28-May-18	2	1028	2	SE LANTAU	2	270	ON	804584	818459	SPRING	P
28-May-18	3	1328	1	SW LANTAU	2	107	ON	800653	810532	SPRING	P
28-May-18	4	1346	3	SW LANTAU	2	167	ON	801443	808501	SPRING	P
11-Jun-18	2	1348	1	PO TOI	2	192	ON	803428	851144	SUMMER	P
11-Jun-18	1	1326	9	SE LANTAU	2	73	ON	804227	812559	SUMMER	P
11-Jun-18	3	1439	2	SE LANTAU	2	117	ON	804181	813446	SUMMER	P
11-Jun-18	4	1458	2	SE LANTAU	2	67	ON	801423	813834	SUMMER	S
20-Jun-18	2	1608	1	SE LANTAU	3	ND	OFF	805642	813954	SUMMER	
11-Jul-18	1	1129	1	SAI KUNG	3	30	ON	821429	869651	SUMMER	P
11-Jul-18	2	1222	3	SAI KUNG	3	98	ON	819607	860577	SUMMER	P
30-Jul-18	1	1030	4	PO TOI	1	147	ON	801644	849361	SUMMER	P
30-Jul-18	2	1105	2	PO TOI	2	203	ON	801496	856087	SUMMER	P
6-Aug-18	1	1525	2	SE LANTAU	2	62	ON	801998	814516	SUMMER	P
21-Aug-18	1	1257	1	SW LANTAU	2	277	ON	802098	807677	SUMMER	S
21-Aug-18	2	1437	2	SE LANTAU	2	120	ON	801634	813453	SUMMER	P
22-Aug-18	1	1114	2	PO TOI	2	85	ON	804505	861993	SUMMER	P
22-Aug-18	2	1436	3	NINEPINS	3	188	ON	808479	852170	SUMMER	P
28-Aug-18	3	1533	1	SW LANTAU	1	2	ON	801507	809553	SUMMER	P
3-Sep-18	5	1314	6	SW LANTAU	2	115	ON	802596	807575	AUTUMN	S
11-Sep-18	2	1515	2	SW LANTAU	2	108	ON	801873	809544	AUTUMN	P
27-Sep-18	1	1047	3	LAMMA	2	343	ON	804485	836951	AUTUMN	P
30-Oct-18	4	1318	2	SW LANTAU	2	432	ON	803859	807360	AUTUMN	P
30-Oct-18	5	1323	2	SW LANTAU	2	70	ON	803394	807432	AUTUMN	P
30-Oct-18	6	1430	2	SW LANTAU	3	602	ON	806432	811583	AUTUMN	P
19-Nov-18	3	1338	2	SW LANTAU	2	120	ON	803711	809681	AUTUMN	P
19-Nov-18	4	1422	1	SW LANTAU	2	172	ON	807683	811564	AUTUMN	P
19-Nov-18	5	1500	3	SE LANTAU	2	ND	OFF	801678	813473	AUTUMN	
19-Nov-18	6	1631	2	SE LANTAU	2	ND	OFF	802592	817590	AUTUMN	
4-Dec-18	1	1137	2	LAMMA	2	74	ON	803156	839468	WINTER	S
4-Dec-18	2	1544	2	LAMMA	2	290	ON	806505	825030	WINTER	P

Appendix III. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	NORTHING	EASTING	SEASON	P/S
13-Dec-18	2	1532	1	SE LANTAU	2	24	ON	807255	816338	WINTER	P
13-Dec-18	3	1606	2	SE LANTAU	2	72	ON	804354	816499	WINTER	P
17-Dec-18	2	1317	1	SW LANTAU	2	56	ON	802202	811504	WINTER	P
3-Jan-19	3	1541	2	SW LANTAU	2	115	ON	802111	806439	WINTER	P
11-Jan-19	1	1018	2	SE LANTAU	2	ND	OFF	808019	816453	WINTER	
11-Jan-19	2	1226	6	SE LANTAU	2	ND	OFF	803042	812516	WINTER	
11-Jan-19	4	1403	1	SW LANTAU	2	385	ON	803591	808453	WINTER	P
17-Jan-19	2	1345	1	SW LANTAU	2	ND	OFF	809455	811763	WINTER	
17-Jan-19	3	1354	1	SE LANTAU	2	ND	OFF	809718	813176	WINTER	
17-Jan-19	4	1413	2	SE LANTAU	2	61	ON	806462	813460	WINTER	P
17-Jan-19	5	1424	4	SE LANTAU	2	114	ON	804679	813488	WINTER	P
22-Jan-19	1	1140	1	SE LANTAU	3	70	ON	804131	817551	WINTER	P
22-Jan-19	2	1157	1	SE LANTAU	2	60	ON	803237	815188	WINTER	S
22-Jan-19	3	1231	1	SE LANTAU	2	312	ON	809782	815176	WINTER	S
22-Jan-19	4	1455	1	LAMMA	2	247	ON	803492	826121	WINTER	P
25-Jan-19	1	1505	2	LAMMA	3	88	ON	807447	823876	WINTER	P
31-Jan-19	1	1128	3	LAMMA	2	51	ON	802503	838024	WINTER	P
31-Jan-19	2	1521	5	LAMMA	2	114	ON	806506	823102	WINTER	P
31-Jan-19	3	1638	1	LAMMA	2	95	ON	808452	826702	WINTER	P
13-Feb-19	1	1023	2	SE LANTAU	1	183	ON	806179	818544	WINTER	P
13-Feb-19	2	1037	2	SE LANTAU	1	141	ON	804130	818521	WINTER	P
13-Feb-19	3	1134	1	SE LANTAU	2	3	ON	808407	816072	WINTER	S
13-Feb-19	4	1139	4	SE LANTAU	2	90	ON	808685	815690	WINTER	S
13-Feb-19	5	1208	5	SE LANTAU	2	229	ON	805242	814510	WINTER	P
13-Feb-19	6	1217	6	SE LANTAU	2	123	ON	804301	814488	WINTER	P
13-Feb-19	7	1256	2	SE LANTAU	2	10	ON	805002	812437	WINTER	P
13-Feb-19	8	1318	4	SE LANTAU	1	99	ON	809265	812423	WINTER	P
13-Feb-19	9	1409	6	SW LANTAU	2	57	ON	800444	809737	WINTER	S
13-Feb-19	10	1430	3	SW LANTAU	2	54	ON	802120	807708	WINTER	S
13-Feb-19	11	1525	2	SW LANTAU	1	124	ON	804547	806433	WINTER	P
22-Feb-19	1	1119	4	SE LANTAU	2	108	ON	809671	815496	WINTER	P
22-Feb-19	2	1139	13	SE LANTAU	2	43	ON	806105	815470	WINTER	P
6-Mar-19	1	1538	8	SE LANTAU	2	ND	OFF	807722	815380	SPRING	
11-Mar-19	2	1458	5	SE LANTAU	2	183	ON	803130	812454	SPRING	P
11-Mar-19	3	1508	2	SE LANTAU	2	49	ON	801580	812473	SPRING	P
11-Mar-19	4	1531	2	SE LANTAU	2	7	ON	804113	814498	SPRING	P
11-Mar-19	5	1538	1	SE LANTAU	2	214	ON	805198	814562	SPRING	P
11-Mar-19	6	1546	2	SE LANTAU	2	222	ON	806870	814554	SPRING	P
18-Mar-19	3	1626	3	SE LANTAU	2	ND	OFF	807578	815204	SPRING	
19-Mar-19	1	1558	1	LAMMA	2	83	ON	807491	823814	SPRING	P
20-Mar-19	1	1519	1	SW LANTAU	2	87	ON	800746	808283	SPRING	S
21-Mar-19	1	1259	8	SE LANTAU	2	202	ON	805856	819544	SPRING	P
26-Mar-19	1	1412	2	SW LANTAU	4	3	ON	804010	809599	SPRING	S

Appendix IV. Individual dolphins identified during AFCD surveys (April 2018 to March 2019)

(***in bold & italics: new individuals***)

DOLPHIN ID	DATE	STG#	AREA
CH12	21/11/18	4	WL
	08/01/19	1	SWL
CH27	29/10/18	1	SK
CH34	11/04/18	1	DB
	27/04/18	2	DB
	15/01/19	1	NWL
	29/01/19	2	NWL
CH38	16/10/18	1	WL
	08/01/19	1	SWL
	20/02/19	1	WL
CH105	24/04/18	1	WL
	19/09/18	4	WL
	03/12/18	1	WL
CH108	03/01/19	1	SWL
	14/01/19	1	WL
	23/01/19	2	WL
	23/01/19	3	WL
	18/03/19	1	WL
CH206	09/07/18	1	WL
CH291	24/10/18	3	NWL
NL12	14/05/18	1	NWL
NL33	23/01/19	1	WL
	29/01/19	2	NWL
NL80	29/11/18	3	NWL
NL98	21/06/18	2	WL
	03/09/18	1	WL
NL104	14/06/18	1	NWL
	09/07/18	3	SWL
NL120	11/04/18	1	DB
	15/05/18	1	SWL
NL123	30/05/18	2	WL
	19/09/18	1	WL
NL136	10/04/18	1	WL
	11/04/18	1	DB
	29/01/19	2	NWL
NL145	21/06/18	2	WL
	20/08/18	4	WL
NL156	23/07/18	1	WL
	25/07/18	3	WL
	08/01/19	1	SWL
NL156	18/03/19	2	WL
NL182	11/04/18	1	DB
	27/04/18	2	DB
	14/05/18	1	NWL
	29/01/19	2	NWL
NL202	24/10/18	2	NWL
	29/01/19	2	NWL
NL206	21/11/18	3	WL
NL210	14/05/18	1	NWL
NL212	14/05/18	2	SWL
	23/07/18	1	WL
NL226	10/04/18	1	WL
	15/05/18	1	SWL
	29/01/19	1	NWL
	12/02/19	3	NWL
NL233	29/11/18	3	NWL
NL236	09/07/18	1	WL
NL256	23/07/18	1	WL
NL260	15/05/18	1	SWL
NL261	03/09/18	1	WL
	29/01/19	2	NWL

DOLPHIN ID	DATE	STG#	AREA
NL269	09/07/18	3	SWL
	03/01/19	2	SWL
	23/01/19	4	WL
NL272	29/11/18	2	DB
	29/01/19	2	NWL
NL276	23/07/18	1	WL
NL280	03/09/18	1	WL
NL281	19/09/18	1	WL
NL286	27/04/18	2	DB
	29/11/18	4	NWL
NL293	20/08/18	1	WL
	03/09/18	2	WL
NL303	30/05/18	1	SWL
NL306	17/05/18	5	SWL
	31/05/18	1	SEL
	11/06/18	2	SEL
	21/06/18	2	WL
	11/09/18	1	SWL
	11/09/18	3	SEL
	14/09/18	3	SEL
	21/11/18	3	WL
NL310	29/11/18	4	NWL
NL311	24/04/18	2	WL
	21/06/18	3	SWL
	23/07/18	1	WL
	25/07/18	3	WL
NL313	09/07/18	1	WL
NL316	21/06/18	2	WL
NL317	29/11/18	5	NWL
NL320	27/04/18	1	NWL
NL321	09/07/18	3	SWL
NL322	27/06/18	2	WL
	23/01/19	1	WL
	29/01/19	2	NWL
NL327	23/07/18	1	WL
NL328	24/10/18	2	NWL
NL329	29/11/18	3	NWL
NL330	24/10/18	1	NWL
SL40	08/05/18	2	SWL
	15/05/18	2	SWL
	28/05/18	6	SWL
	01/06/18	1	WL
	21/06/18	2	WL
	11/10/18	2	WL
	12/02/19	1	WL
	20/02/19	3	WL
SL44	20/02/19	2	WL
	14/05/18	2	SWL
	21/11/18	3	WL
SL58	24/04/18	2	WL
SL59	21/06/18	3	SWL
	21/11/18	4	WL
SL60	13/04/18	4	SWL
	16/10/18	1	WL
	17/12/18	1	SWL
	11/01/19	1	SWL
	18/03/19	2	WL
WL05	21/06/18	2	WL
	03/09/18	1	WL
	15/01/19	1	NWL
WL15	21/11/18	4	WL
	12/02/19	1	WL

DOLPHIN ID	DATE	STG#	AREA
WL21	09/07/18	1	WL
WL28	24/04/18	1	WL
	19/09/18	1	WL
	03/12/18	1	WL
WL29	21/06/18	2	WL
	21/11/18	3	WL
WL42	03/01/19	2	SWL
WL46	03/09/18	1	WL
WL61	21/06/18	3	SWL
WL66	09/07/18	1	WL
WL68	13/04/18	2	SWL
	25/07/18	3	WL
	20/02/19	1	WL
WL69	15/05/18	2	SWL
	01/06/18	1	WL
WL72	25/07/18	3	WL
	11/10/18	1	WL
	19/11/18	1	WL
	03/01/19	2	SWL
	08/01/19	1	SWL
	18/03/19	1	WL
WL74	30/10/18	1	WL
	21/11/18	3	WL
WL79	24/04/18	3	WL
	09/07/18	1	WL
	03/09/18	1	WL
	23/01/19	3	WL
	23/01/19	9	WL
WL91	25/07/18	3	WL
WL92	11/10/18	1	WL
	21/11/18	3	WL
WL94	27/06/18	3	WL
	27/06/18	4	SWL
	23/01/19	2	WL
WL98	21/06/18	3	SWL
	23/07/18	1	WL
	21/11/18	4	WL
WL100	21/06/18	3	SWL
	17/01/19	1	WL
	18/03/19	1	WL
WL109	08/05/18	2	SWL
WL109	18/03/19	2	WL
WL114	11/10/18	1	WL
	30/10/18	1	WL
WL118	09/07/18	1	WL
	09/07/18	3	SWL
	16/10/18	1	WL
	30/10/18	1	WL
WL120	23/01/19	2	WL
WL123	14/09/18	2	WL
	30/10/18	3	WL
	13/12/18	1	SWL
	03/01/19	2	SWL
	08/01/19	1	SWL
	20/02/19	3	WL
	11/03/19	1	WL
	18/03/19	2	WL
WL124	27/06/18	3	WL
	27/06/18	4	SWL
WL128	30/10/18	1	WL
WL129	19/11/18	1	WL

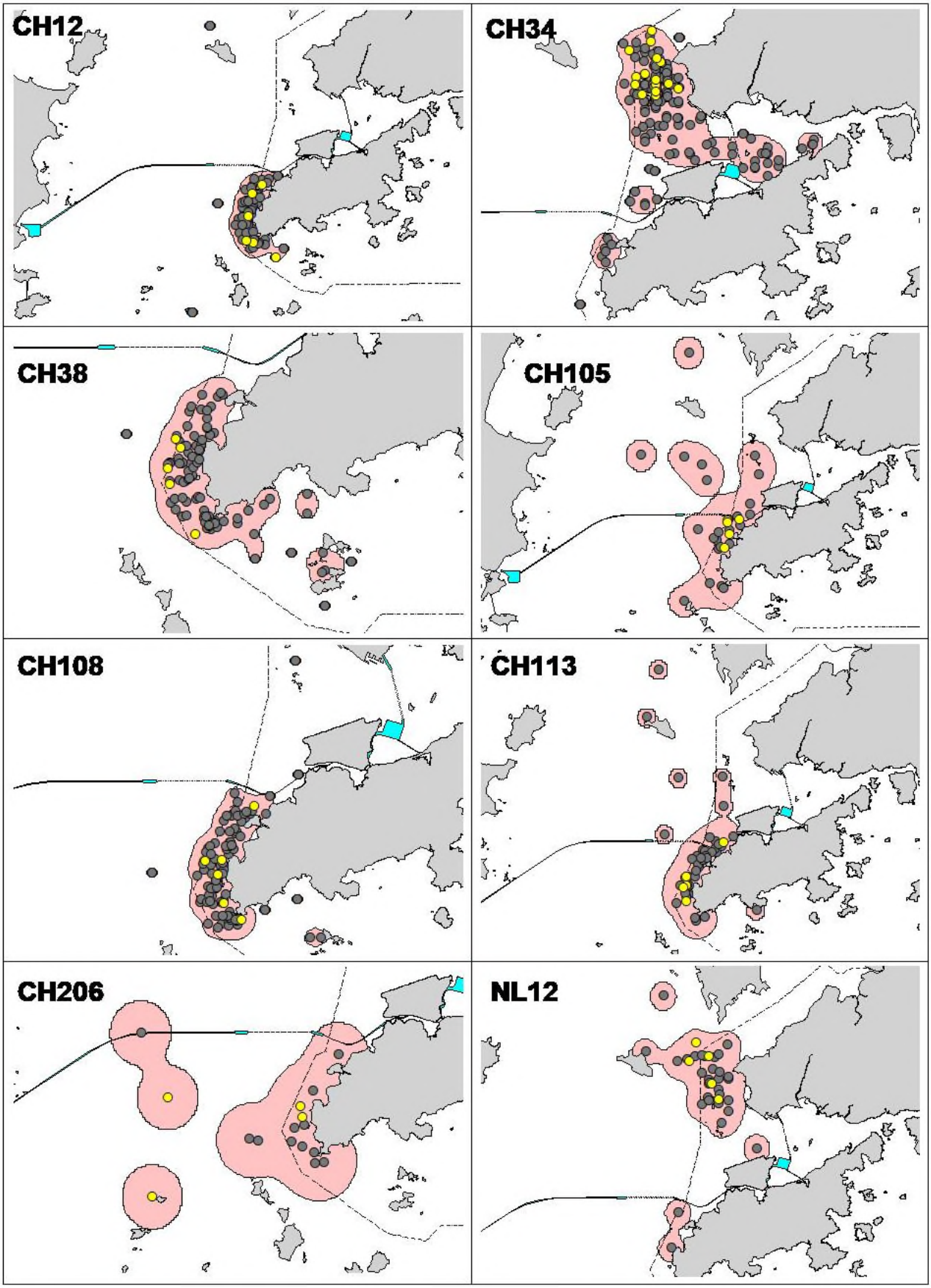
Appendix IV. (cont'd)

(***in bold & italics: new individuals***)

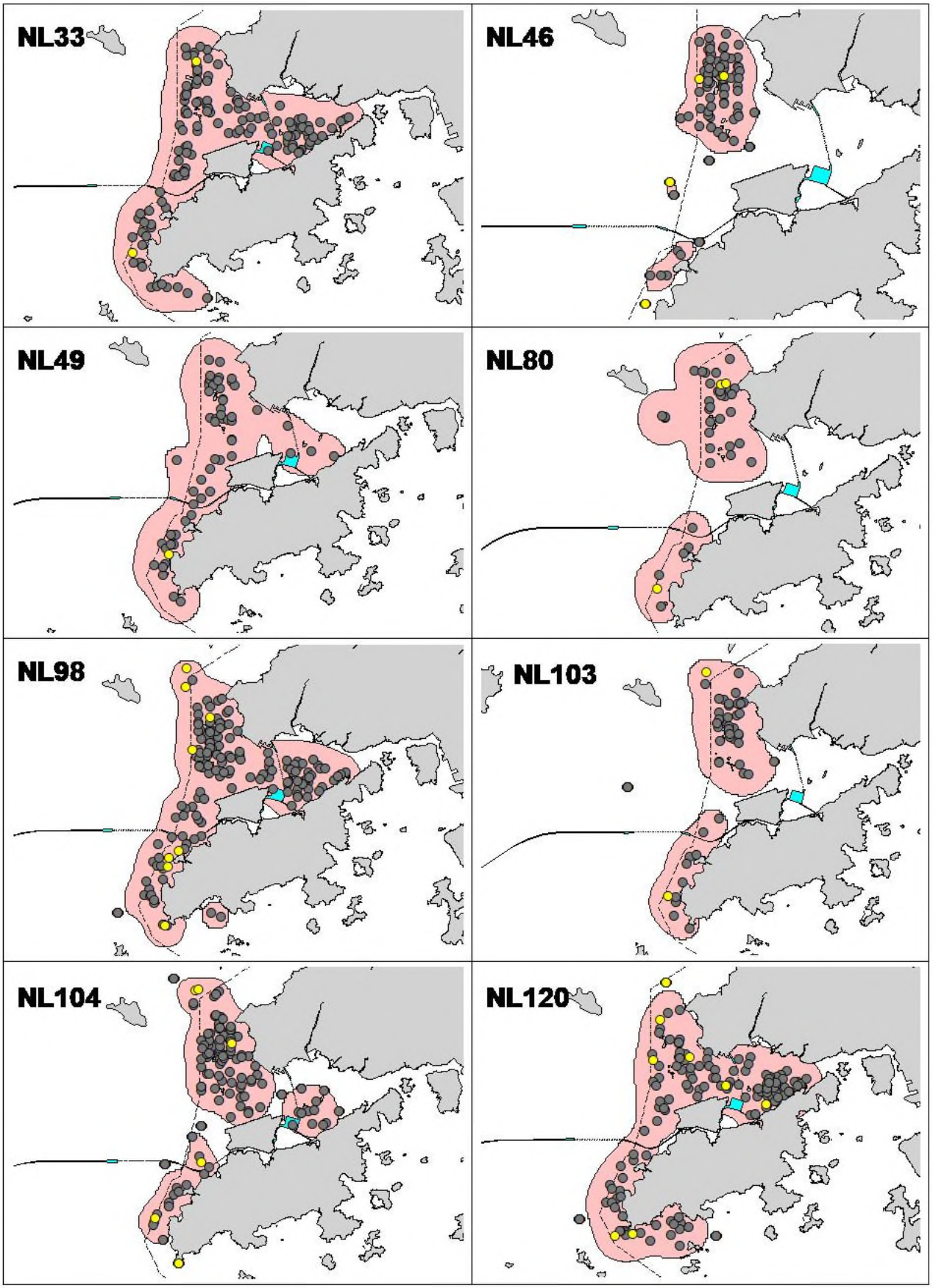
DOLPHIN ID	DATE	STG#	AREA
WL130	13/04/18	2	SWL
	21/06/18	2	WL
	30/10/18	3	WL
	21/11/18	3	WL
	14/01/19	3	WL
WL131	09/07/18	1	WL
	19/11/18	1	WL
	21/11/18	4	WL
	03/01/19	2	SWL
	08/01/19	1	SWL
	12/02/19	1	WL
WL142	11/10/18	1	WL
	21/11/18	3	WL
WL152	13/04/18	1	WL
	01/06/18	1	WL
	21/06/18	3	SWL
	30/10/18	3	WL
	19/11/18	1	WL
	03/01/19	2	SWL
	08/01/19	1	SWL
	20/02/19	3	WL
	18/03/19	2	WL
WL168	28/05/18	6	SWL
	21/06/18	2	WL
	11/10/18	2	WL
	03/01/19	2	SWL
WL169	21/06/18	2	WL
WL171	19/11/18	1	WL
	21/11/18	3	WL
WL179	03/09/18	2	WL
WL180	08/05/18	2	SWL
	01/06/18	1	WL
	13/12/18	1	SWL
	03/01/19	2	SWL
	08/01/19	1	SWL
	12/02/19	1	WL
	11/03/19	1	WL
	18/03/19	2	WL
WL191	20/02/19	1	WL
WL199	24/04/18	2	WL
	25/07/18	3	WL
WL208	24/04/18	2	WL
WL211	13/04/18	2	SWL
	09/07/18	4	SWL
WL213	23/07/18	1	WL
	25/07/18	3	WL
WL217	23/01/19	2	WL
	18/03/19	2	WL
WL218	09/07/18	3	SWL
	11/03/19	1	WL
WL220	08/05/18	2	SWL
	11/10/18	2	WL
	13/12/18	1	SWL
	03/01/19	2	SWL
	20/02/19	3	WL
WL221	08/05/18	4	SWL
	21/11/18	4	WL
	11/03/19	1	WL
	18/03/19	2	WL
WL226	03/09/18	1	WL
WL229	14/01/19	1	WL

DOLPHIN ID	DATE	STG#	AREA
WL230	25/07/18	3	WL
	03/09/18	3	SWL
	14/09/18	2	WL
	24/10/18	1	NWL
WL232	10/04/18	1	WL
	14/05/18	3	SWL
	28/05/18	5	SWL
	09/07/18	2	WL
	21/11/18	4	WL
WL233	23/07/18	1	WL
WL236	25/07/18	3	WL
WL243	14/05/18	3	SWL
	17/05/18	5	SWL
	28/05/18	5	SWL
	02/10/18	1	SWL
WL245	09/07/18	1	WL
WL250	21/06/18	2	WL
	11/10/18	2	WL
	12/02/19	1	WL
	20/02/19	1	WL
WL254	08/05/18	2	SWL
	19/11/18	1	WL
	23/01/19	2	WL
WL256	09/07/18	1	WL
WL259	11/10/18	1	WL
WL260	27/06/18	4	SWL
WL268	21/11/18	4	WL
WL269	08/05/18	2	SWL
	23/07/18	1	WL
	19/11/18	1	WL
WL272	24/04/18	1	WL
WL273	13/04/18	1	WL
	19/11/18	2	SWL
	21/11/18	3	WL
	29/01/19	2	NWL
WL274	30/10/18	1	WL
WL279	20/08/18	3	WL
WL281	03/09/18	4	SWL
	30/10/18	2	WL
WL283	19/09/18	3	WL
WL284	21/11/18	4	WL
WL286	09/07/18	3	SWL
	30/10/18	1	WL
WL288	24/04/18	1	WL
	19/09/18	1	WL
	03/12/18	1	WL
WL289	14/05/18	2	SWL
WL291	24/04/18	1	WL
WL294	08/01/19	1	SWL
WL295	***27/06/18***	***4***	***SWL***
	20/08/18	***3***	***WL***

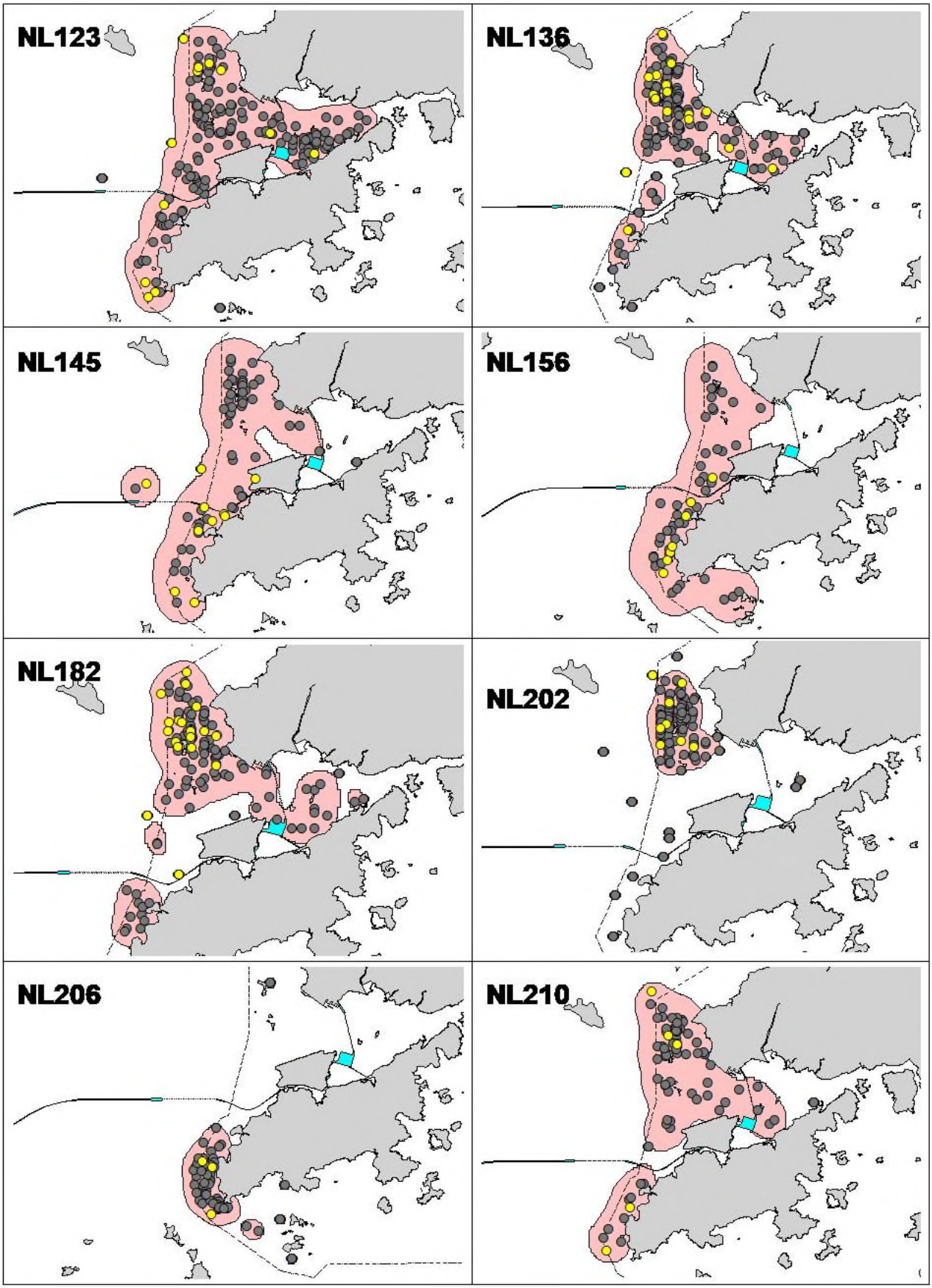
Appendix V. Ranging patterns (95% kernel ranges) of 147 individual dolphins with 10+ re-sightings that were sighted during 2018 (note: yellow dots indicates sightings made in 2018)



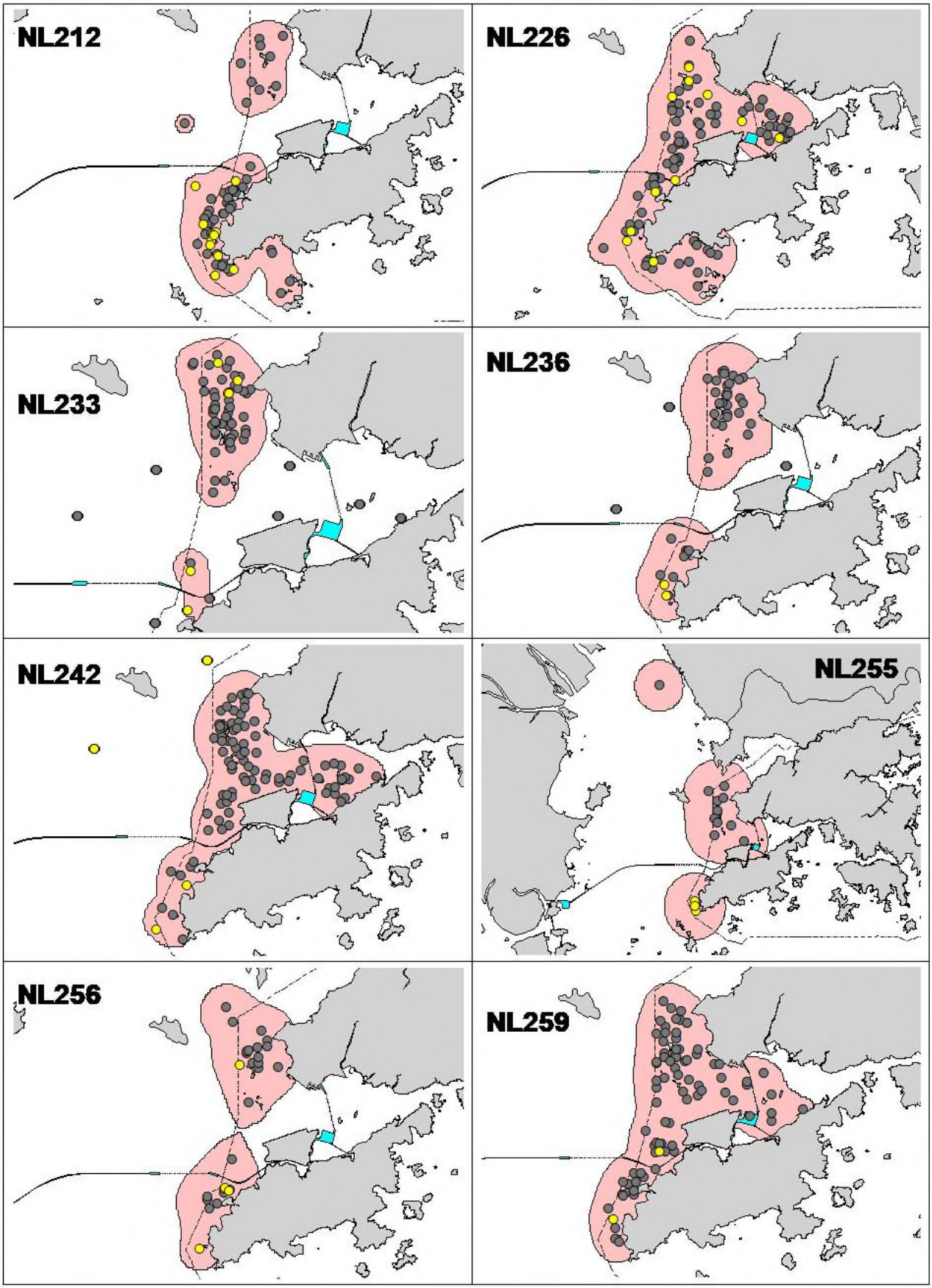
Appendix V. (cont'd).



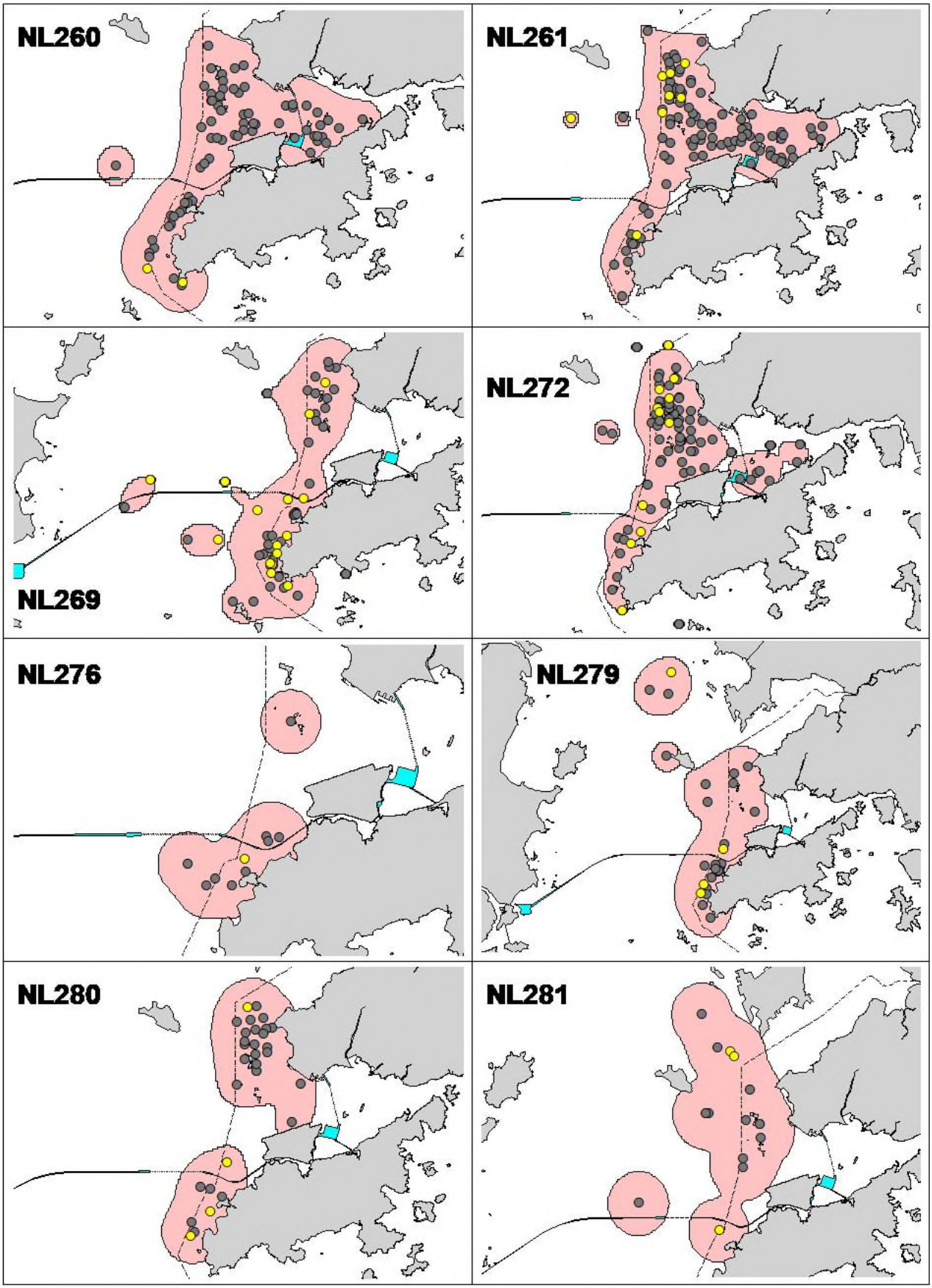
Appendix V. (cont'd).



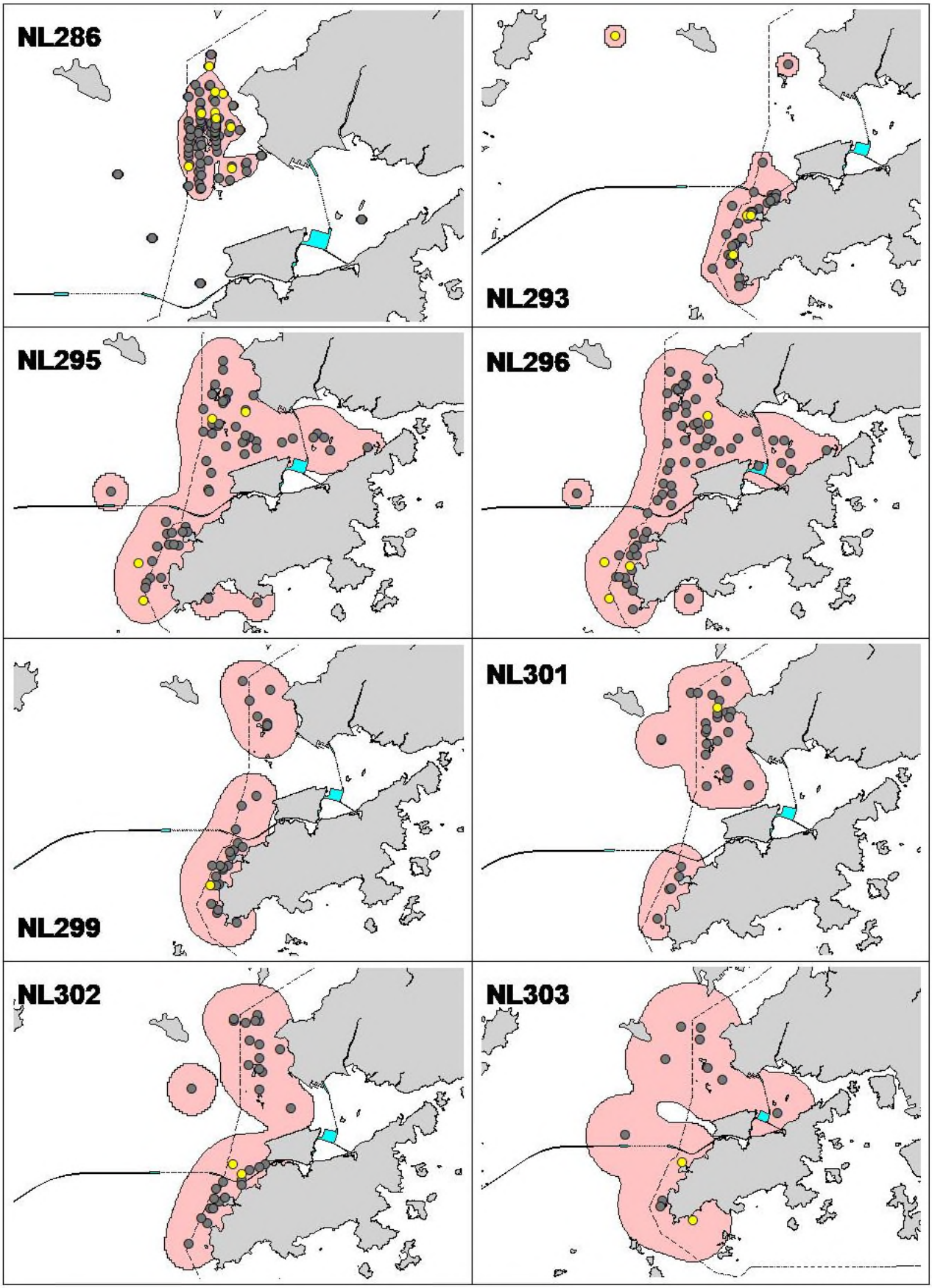
Appendix V. (cont'd).



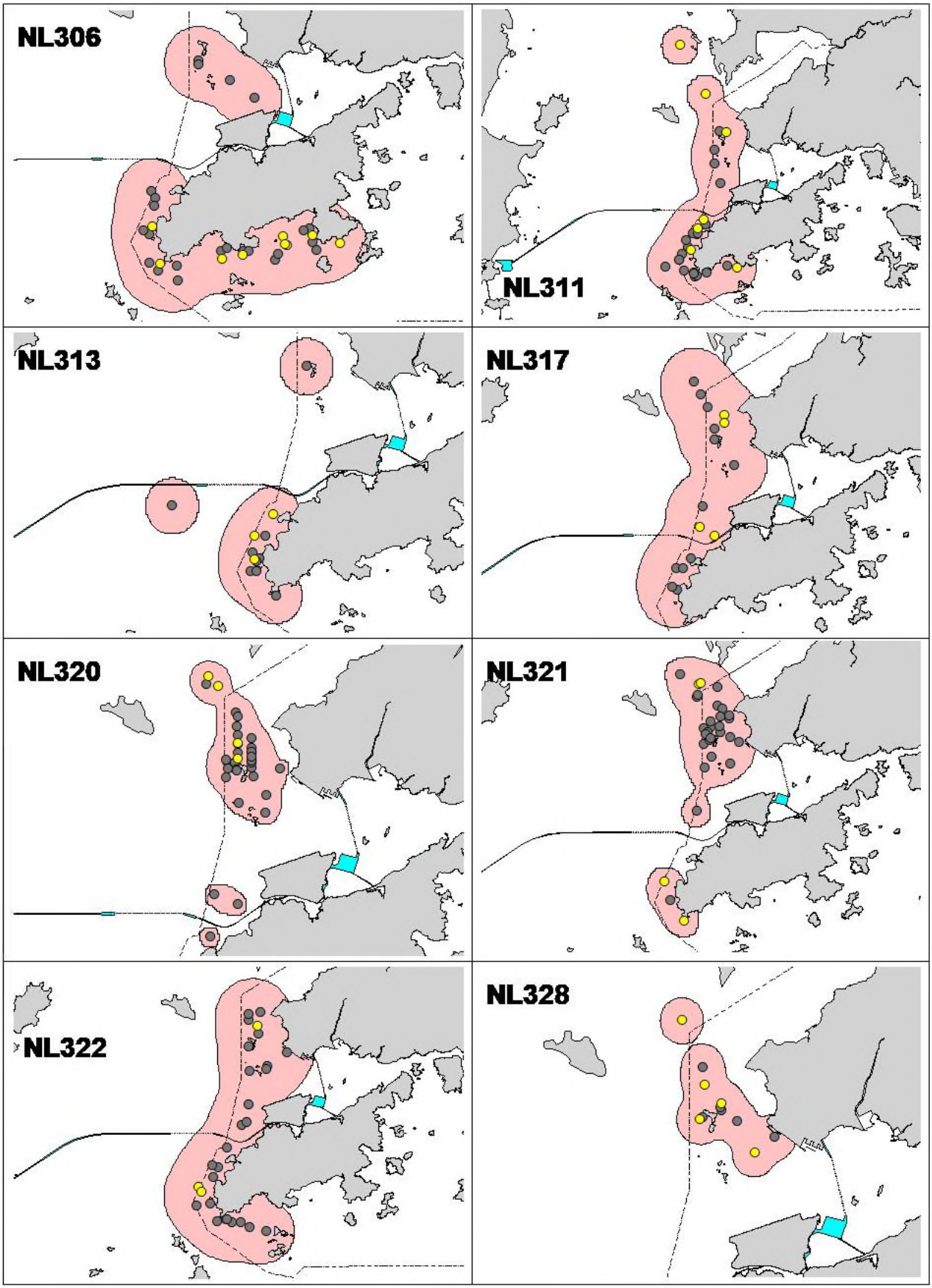
Appendix V. (cont'd).



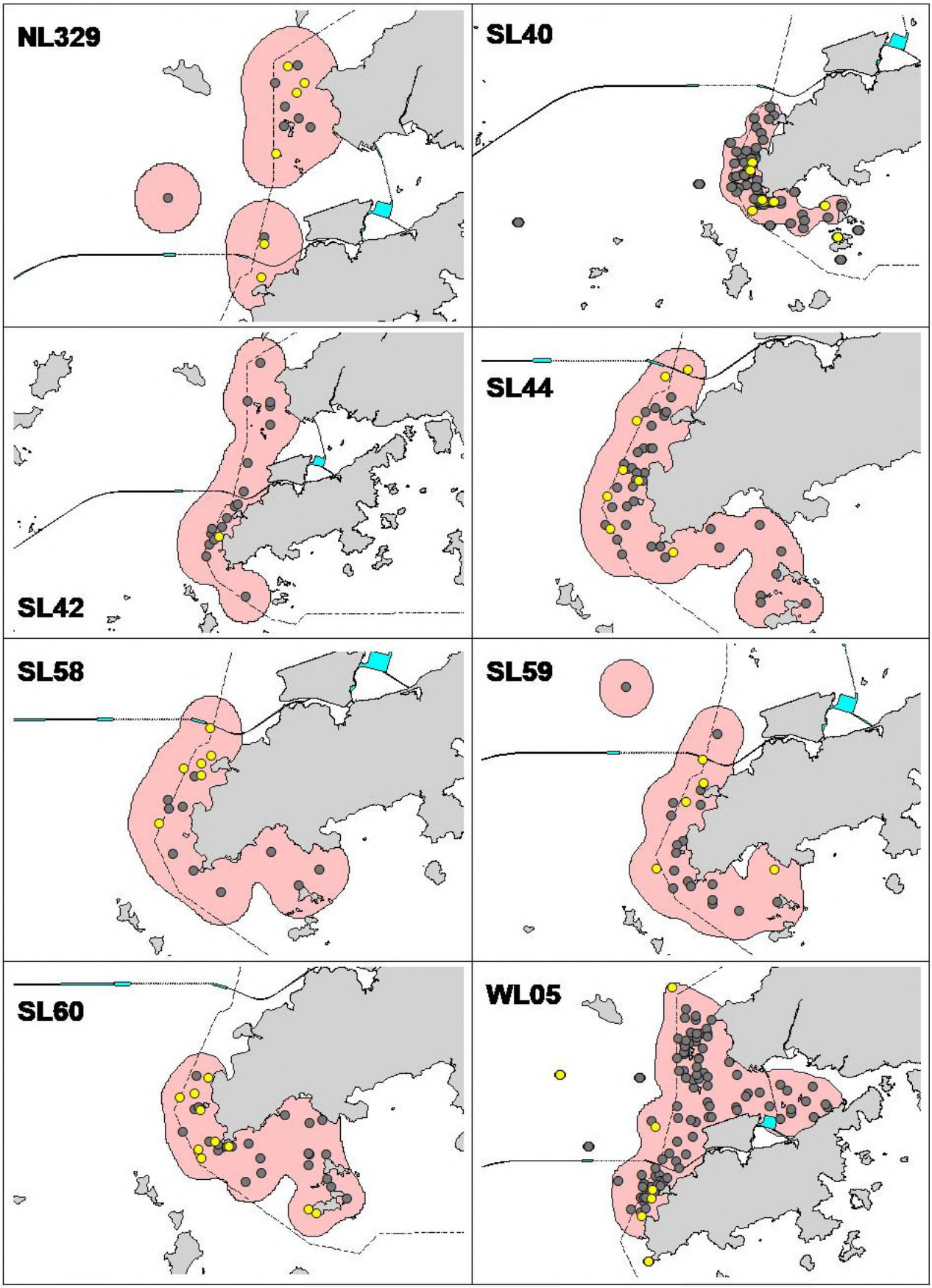
Appendix V. (cont'd).



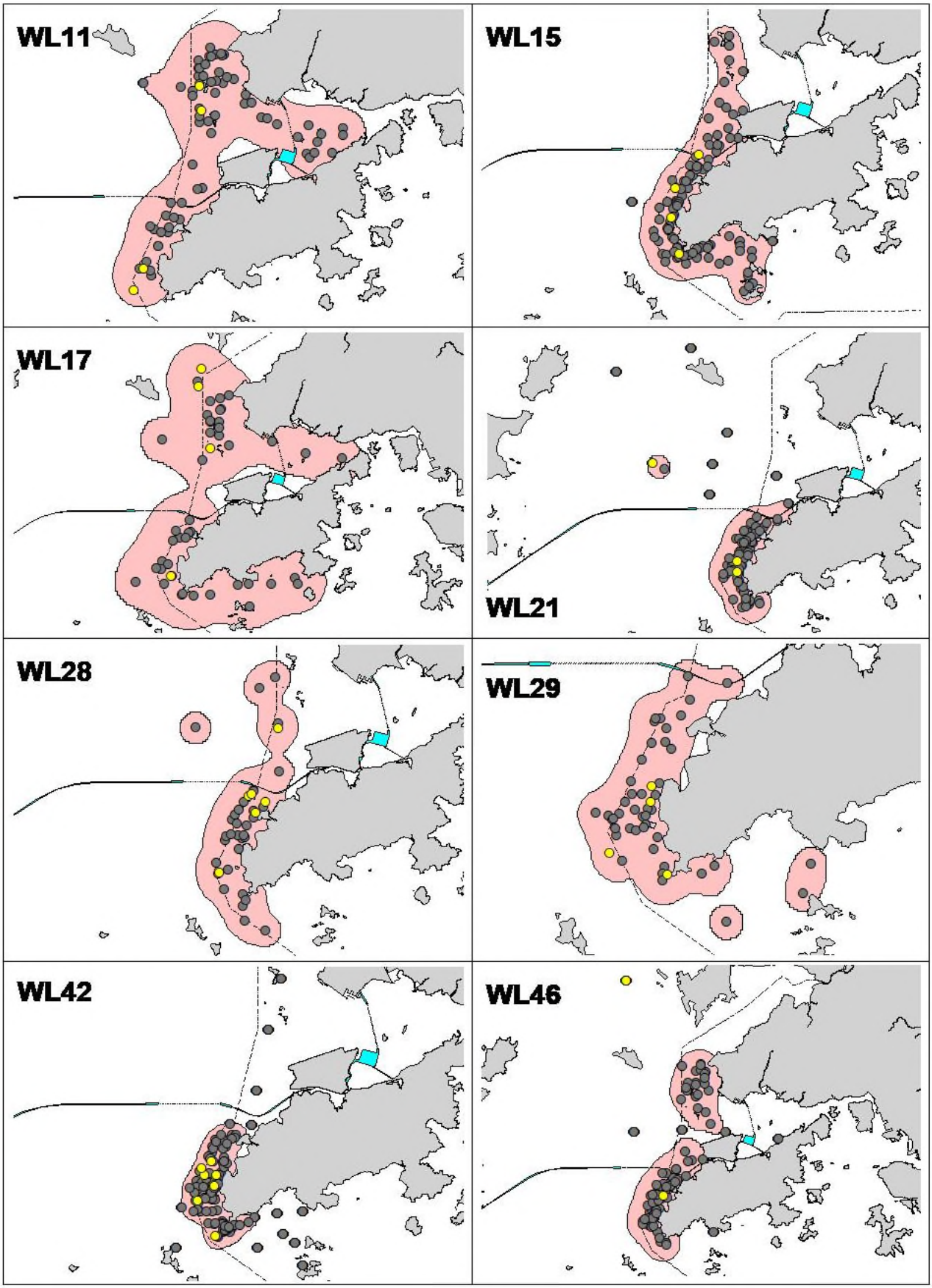
Appendix V. (cont'd).



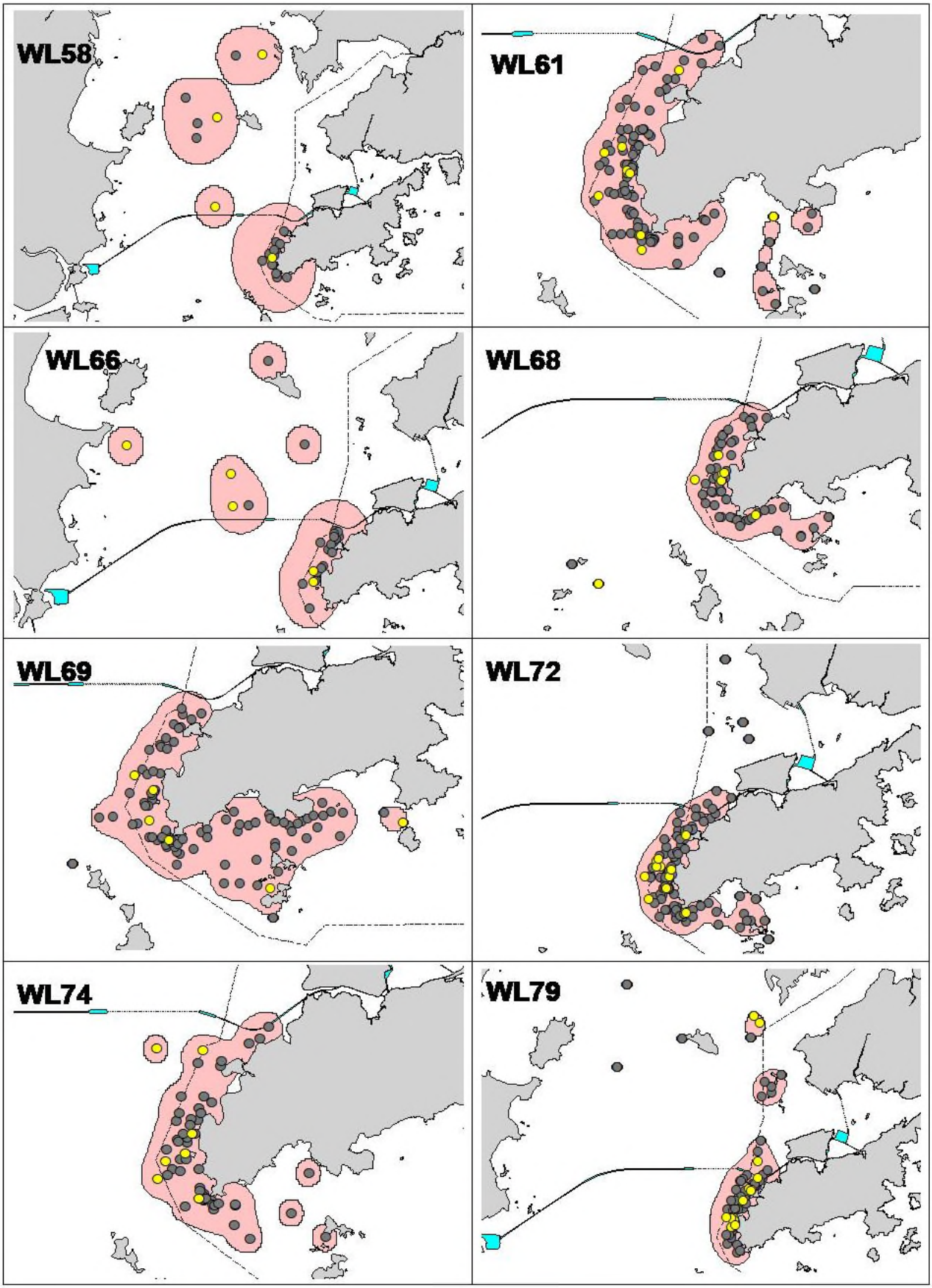
Appendix V. (cont'd).



Appendix V. (cont'd).



Appendix V. (cont'd).



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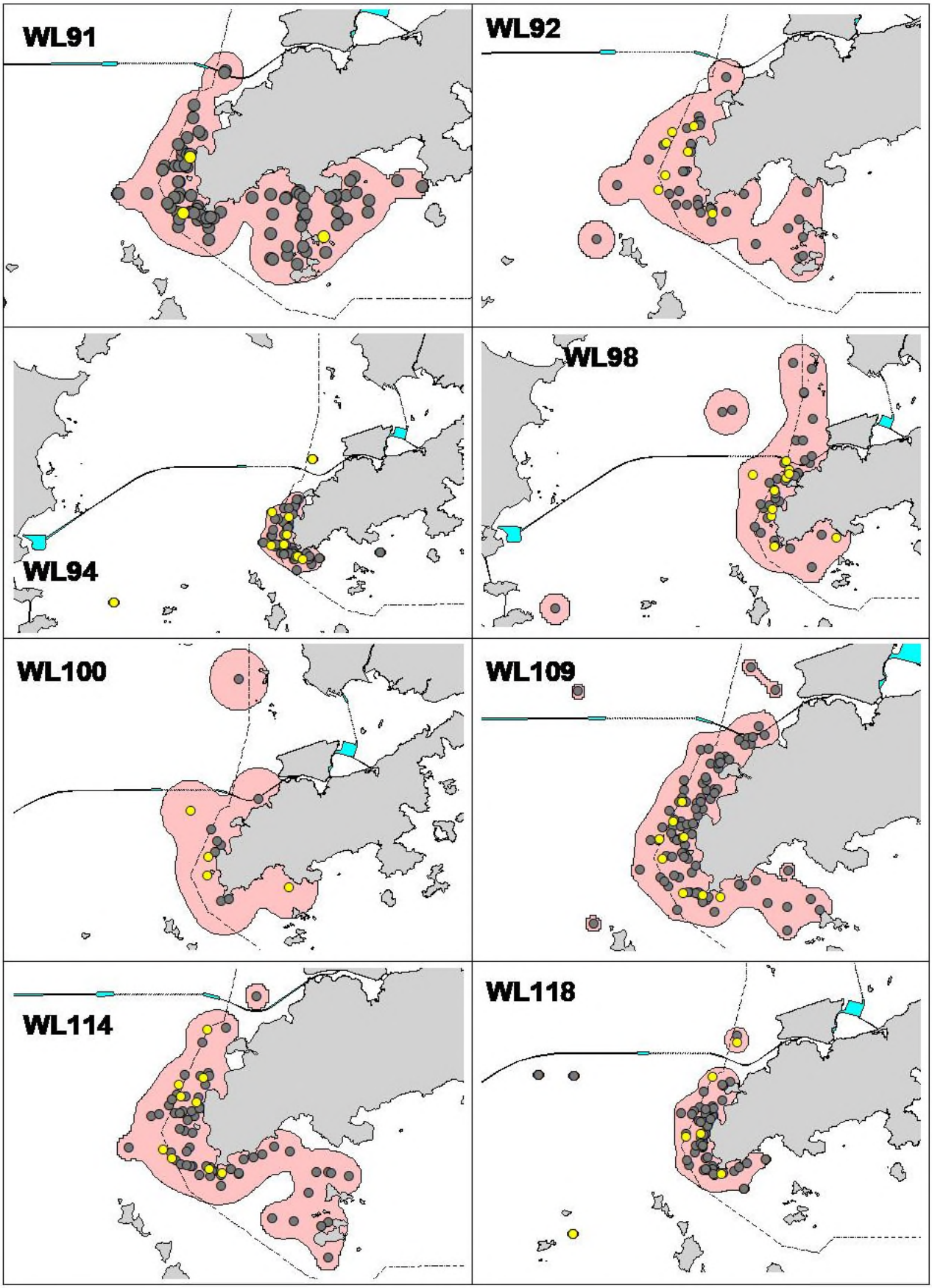
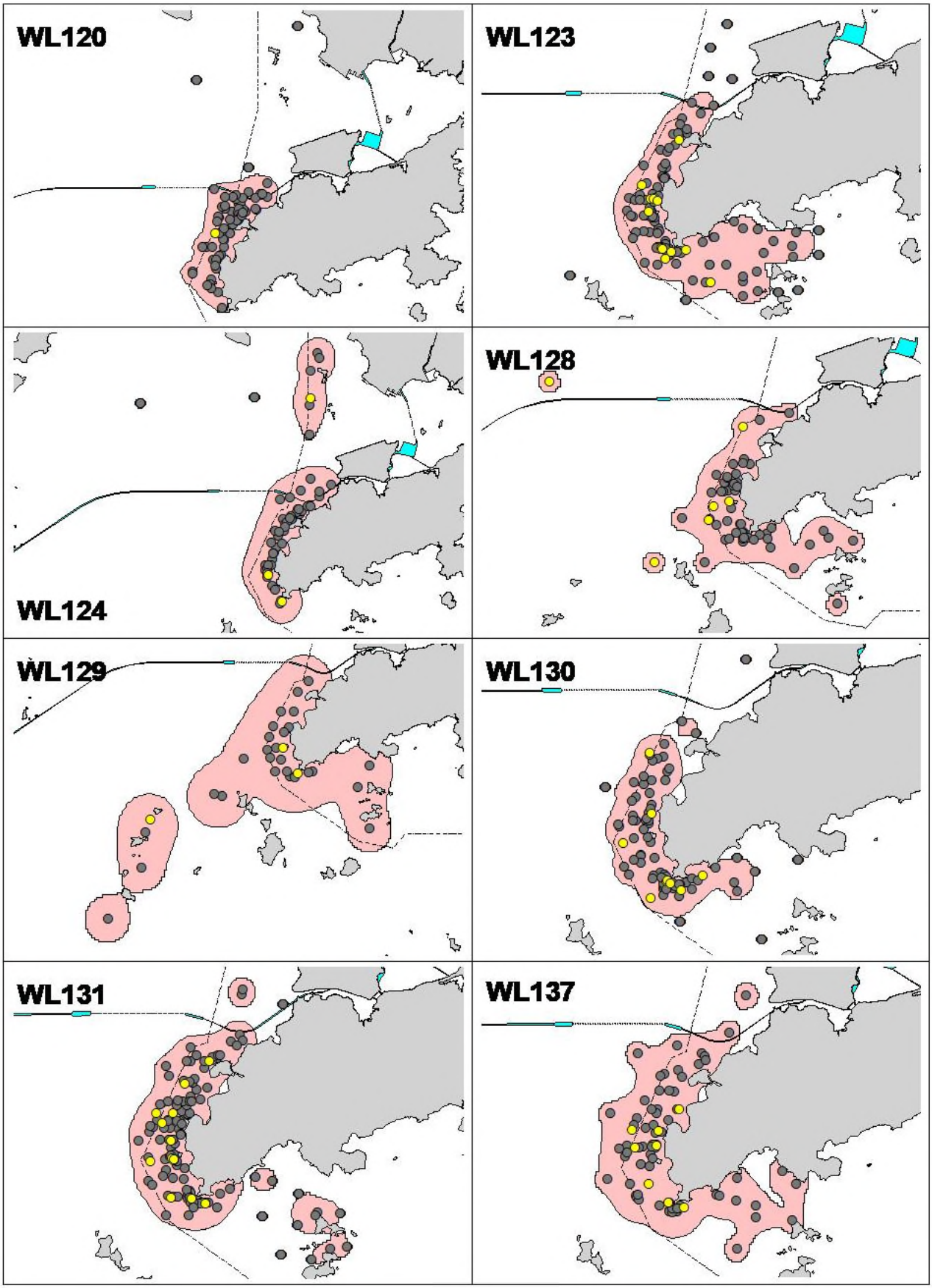


Appendix V. (cont'd).



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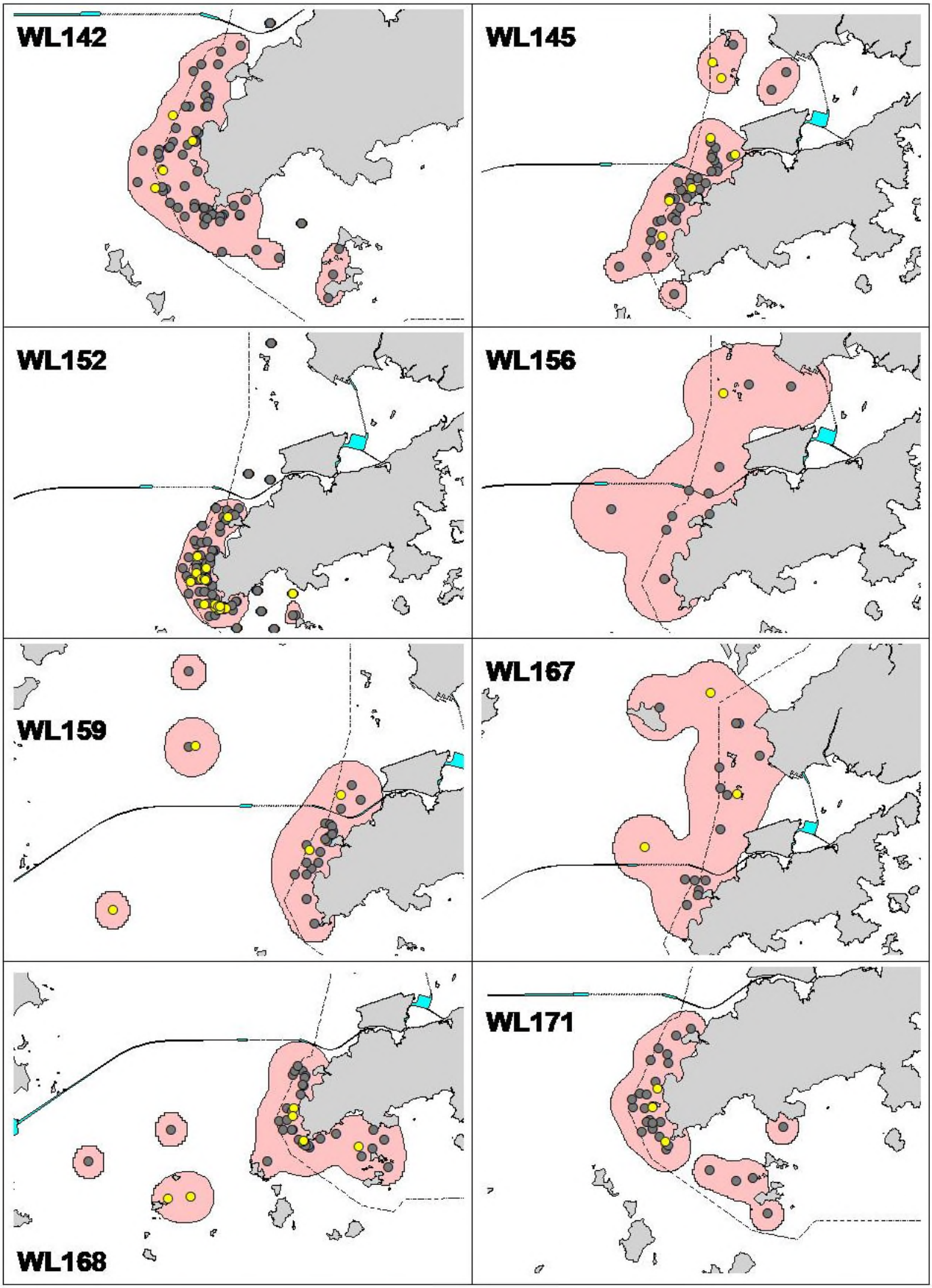
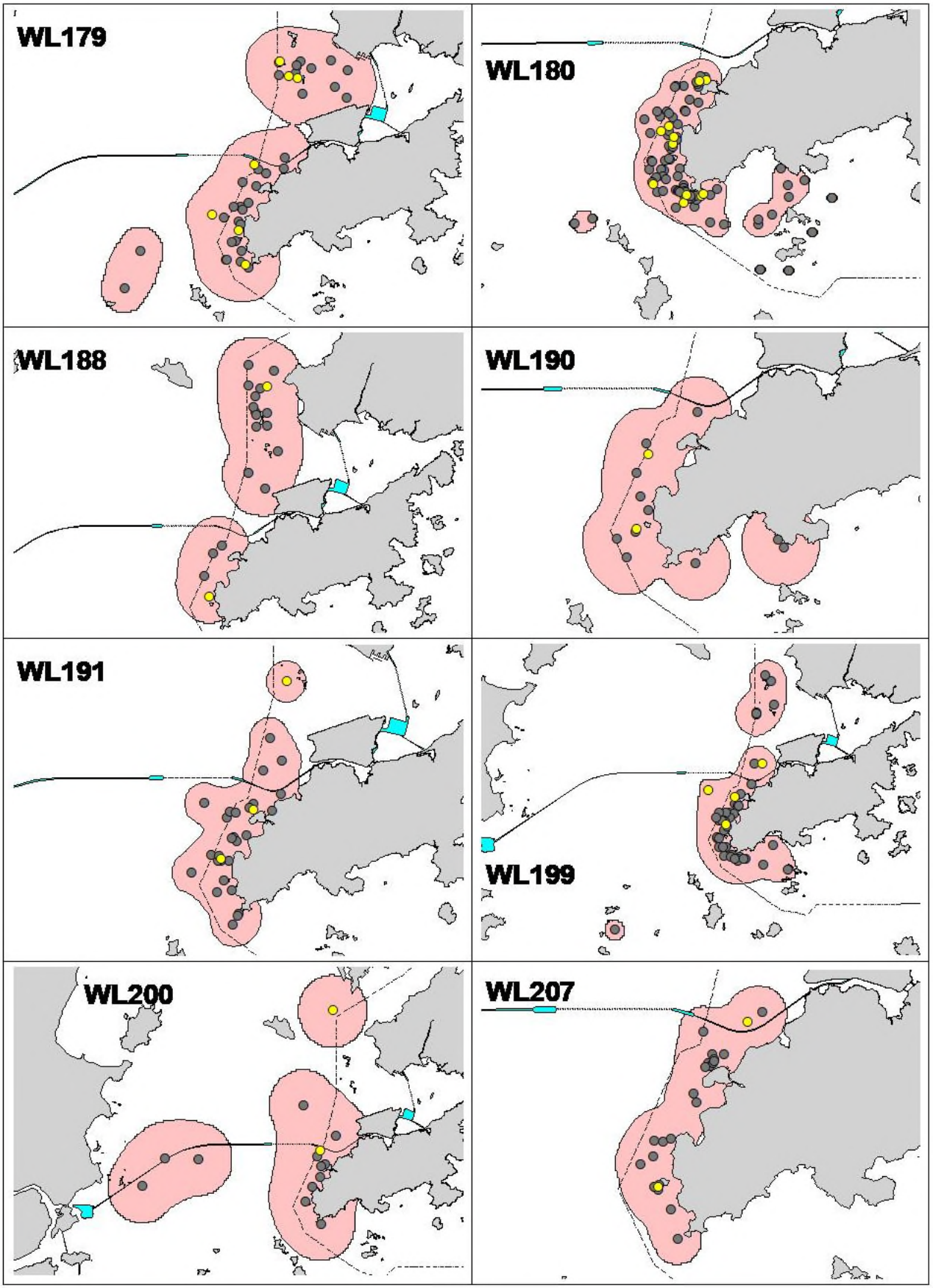
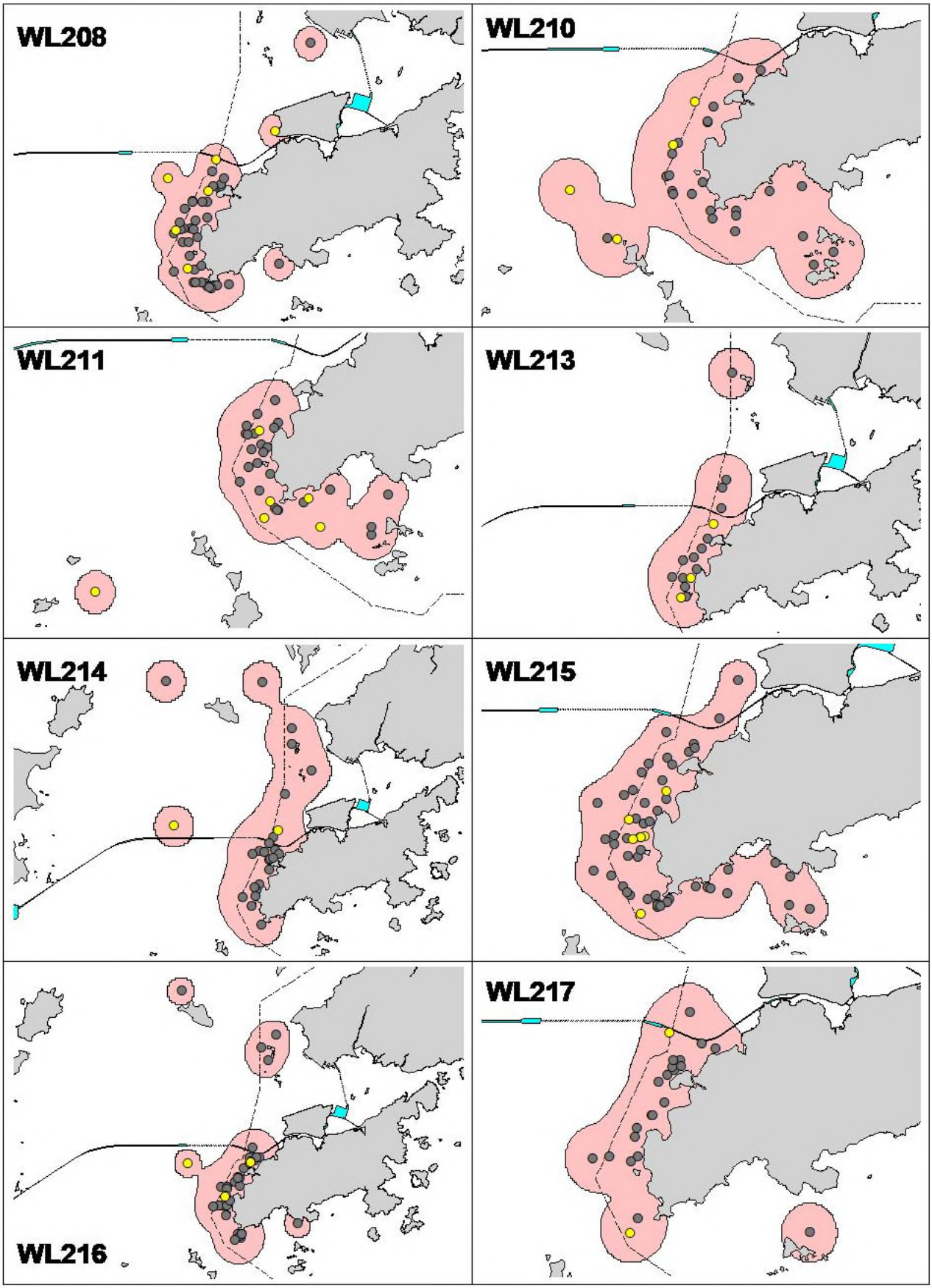


Appendix V. (cont'd).



Appendix V. (cont'd).



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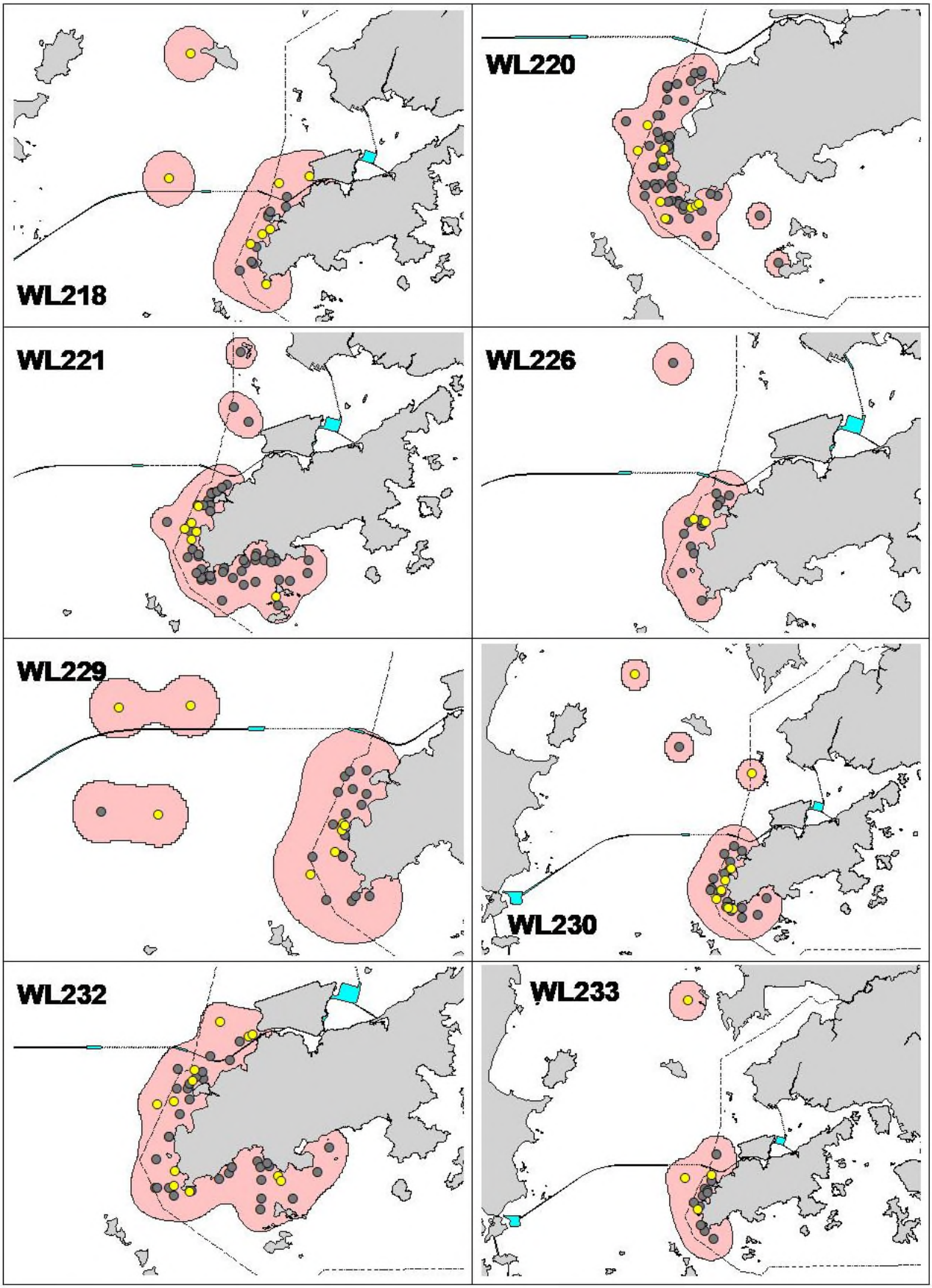

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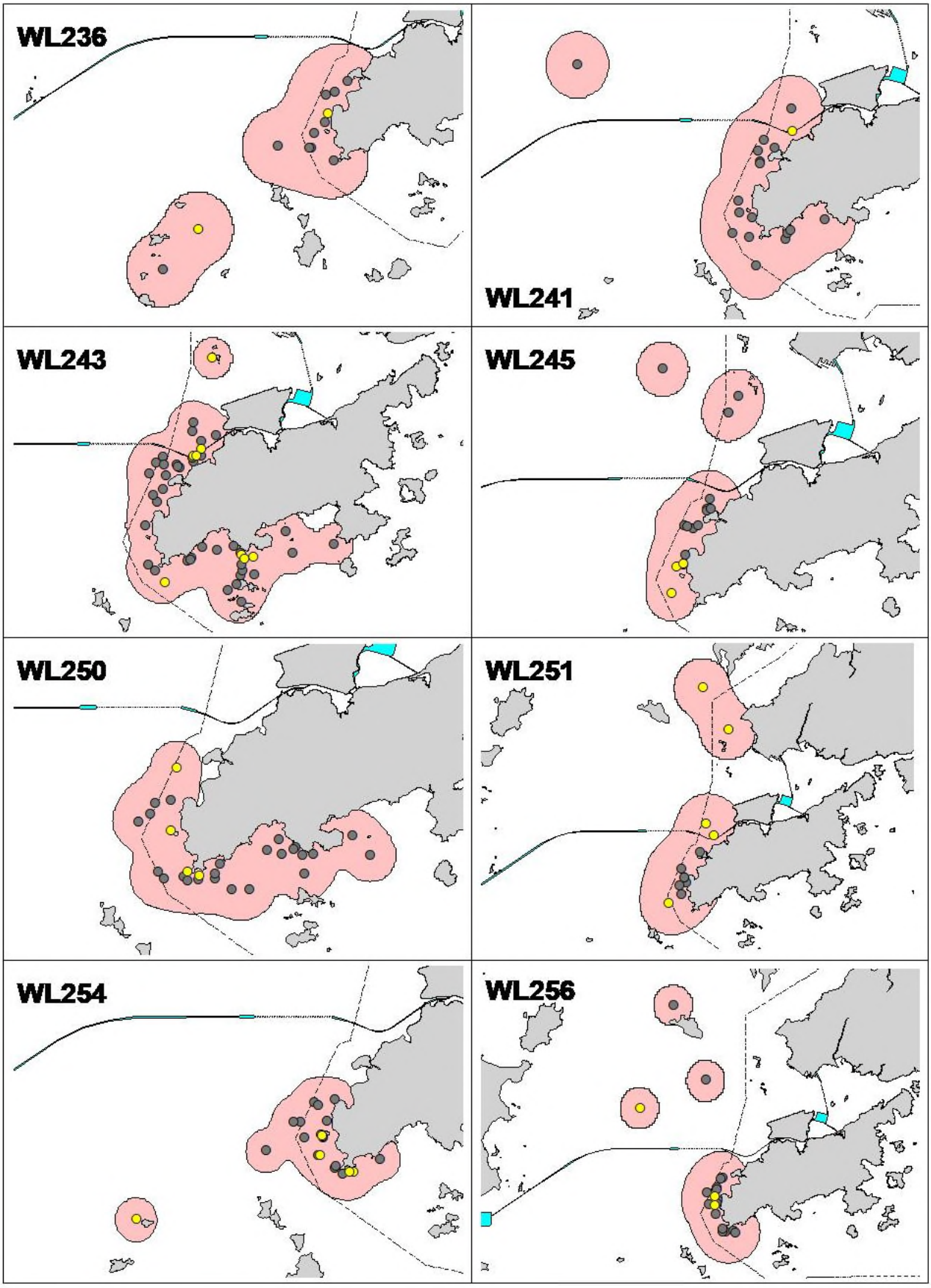
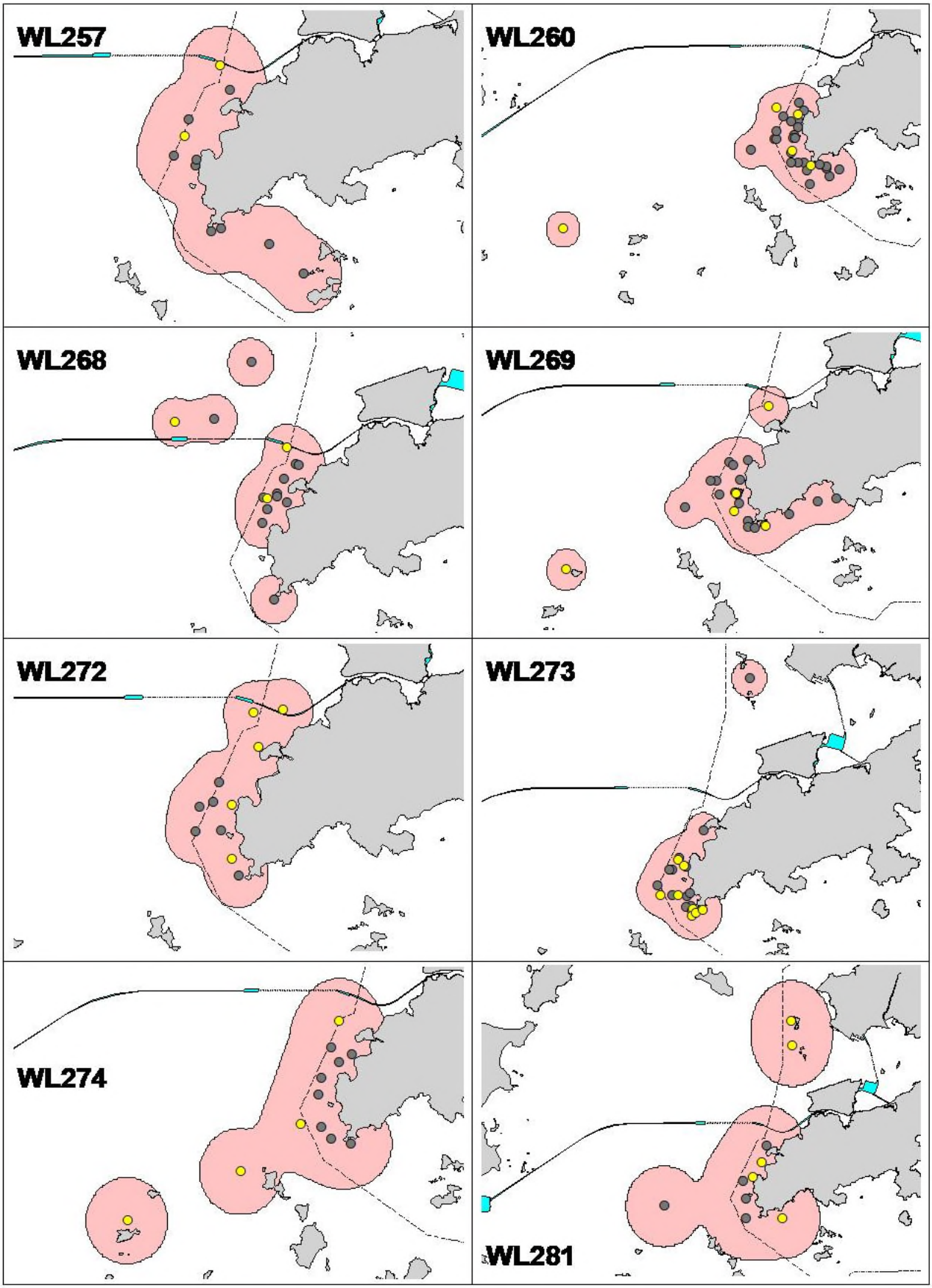


Appendix V. (cont'd).



Appendix V. (cont'd).