MONITORING OF MARINE MAMMALS IN HONG KONG WATERS (2017-18)

FINAL REPORT
(1 April 2017 to 31 March 2018)

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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 2017 to March 2018.

During the one-year study period, 194 line-transect vessel surveys with 5,793.0 km of survey effort were conducted among ten survey areas in Hong Kong. In total, 201 groups of 569 Chinese White Dolphins and 119 groups of 294 finless porpoises were sighted during vessel and helicopter surveys. In 2017-18, the dolphins were sighted frequently to the west of Lantau Island, and to a moderate extent to the north and south of the island. Notably, the coastal waters of West Lantau have been the only area where there were consistent and frequent occurrences of dolphins throughout the past six years, highlighting the urgent need to protect this remaining important dolphin habitat in Hong Kong. On the other hand, most of the finless porpoise sightings in 2017-18 were concentrated in waters around Shek Kwu Chau and Tai A Chau, and between these two islands.

In 2017, important dolphin habitats were located along the coast of West Lantau, extending from Tai O Peninsula toward Fan Lau and Kau Ling Chung. In the past seven years, dolphin habitat use patterns were mostly consistent in WL, but their usage there has progressively diminished in 2016 and 2017. In North Lantau region, dolphin occurrence has greatly diminished in recent years, and was largely confined to the area around Lung Kwu Chau in 2016 and 2017. For finless porpoises, their important habitats were mostly located around Shek Kwu Chau, to the south of Tai A Chau, the offshore waters between the two islands, and to the south of Cheung Chau during the dry seasons of 2013-17. On the contrary, porpoise densities were higher around the Po Toi Islands, and at the juncture of Po Toi and Ninepins survey areas during the wet seasons.

In 2017, the combined estimate of dolphin abundance in Hong Kong waters in the four survey areas comprising SWL, WL, NWL and NEL was 47 (the combined estimates for the last six years, i.e. 2011 to 2016, were 88, 80, 73, 87, 65 and 47 respectively). Significant declines in dolphin abundances were detected in each of the three survey areas in NEL, NWL and WL, as well as the combined abundance from the four main areas of dolphin occurrences in NEL, NWL, WL and SWL.

In 2017-18, 148 individual dolphins with 384 re-sightings were identified, and nearly half of these were made in West Lantau waters. A total of 52 new individuals were added to the photo-ID catalogue. A number of year-round residents that were frequently sighted in Hong Kong waters in the past have disappeared or occurred rarely during the present study period. Changes in the utilization pattern of individual dolphins in Hong Kong waters, as detected in the past two monitoring periods, were noted again upon analysis of their range use. Out of the 59 individuals from the northern social cluster, 20 of them have shifted part or all of their ranges from North Lantau to WL, and eight of them even shifted their range use to include SWL waters. However, nine individuals have reversed such range shifts in 2017. For the southern social cluster, more than half of the 55 individuals examined have utilized SWL waters progressively more in recent years, and 14 individuals have shown clear range shifts from WL to SWL waters, with several reversing such shifts in 2017.

From the examination of 294 individual dolphins on their life span using the long-term photo-identification data, 27 individuals were estimated to be at least 25 years old, while two-third of them were estimated to be at least 12 years old, which should all be sexually mature adults. The minimum periods of 88 female-calf associations ranged from 2-135 months (with an average of 34.7 months), while the maximum calving intervals between 47 births ranged from 3-120 months (with an average of 37.9 months). Over 40% of the 149 confirmed births of newborns were observed only once with their mothers before and disappeared thereafter, suggesting a low survival rate of dolphin calves. Even though most dolphins in Hong Kong enjoy a relatively long life span, but with the low survival rate of newborns, the low fecundity of reproductive females, and the relatively long calving intervals, this raises serious concern for the future survival of dolphins in Hong Kong waters, in light of the worrisome declining trend in their abundance in the past decade.

During the present monitoring period, HKCRP researchers delivered 14 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 2017 年 4 月至 2018 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 194 次樣條線船上調查，在全港十個調查區共航行了 5,793.0 公里，並觀察到共 201 群中華白海豚 (總數達 569 隻) 及 119 群江豚 (總數達 294 隻)。在 2017-18 年間，中華白海豚主要在大嶼山西面水域一帶出沒，卻較少在大嶼山北面及南面水域活動。在過去六年期間，大嶼山西面水域是香港唯一持續錄得較多海豚出沒的地點，足證保護此僅存之重要海豚生境的迫切性。另一方面，在 2017-18 年間，江豚的目擊記錄主要集中於大鴉洲及石鼓洲一帶、及此兩島之間的水域。

中華白海豚在 2017 年的重要棲身地，主要集中在大嶼山西面、由大澳半島伸延至分流及狗嶺涌一帶的近岸水域。在過去七年，海豚在大嶼山西面水域的棲息地運用最為穩定，但其使用量在 2016 及 2017 年期間已逐漸減少。在北大嶼山水域，海豚於近年的使用率大幅下降，並於 2016 及 2017 年間只集中使用龍鼓洲一帶水域。此外，在 2013-17 年期間，在枯水期被確認為重要的江豚生境，包括石鼓洲附近、大鴉洲以南、大鴉洲與石鼓洲之間一帶離岸水域、以及長洲以南水域；另一方面，江豚在豐水期間使用量較高的生境，則集中在蒲台群島一帶、及蒲台與果洲兩個調查區域交界之水域。

在 2017 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 47 隻（2011 至 16 年的年度數目分別為 88、80、73、87、65 及 47 隻）。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。

研究員於 2017-18 年間辨認出 148 隻個別海豚、共 384 次的目擊紀錄，其中近半均出現在大嶼山西面水域；共有 52 隻新的個別海豚亦於此年間被加入相片辨認名錄。過去一些經常出沒於香港水域的海豚個體，卻於近年不見所蹤，或只有零星的出沒紀錄。在上兩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，20 隻個體已將部份及整個活動範圍由大嶼山北面水域轉移至西面水域，其中八隻的活動範圍更伸延至大嶼山西南面水域；但於 2017 年間，卻共有九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。而 55 隻屬南面社群的海豚中，超過一半的個體近年已逐漸增加使用大嶼山西南面水域，有 14 隻海豚更在過去數年明顯地由大嶼山西面轉移到大嶼山西南面水域

活動；但到了 2017 年，少數個體的活動範圍轉移卻同樣出現逆轉。

利用長期相片辨認的數據，研究員分析了294條中華白海豚的存活狀況，發現多達27隻海豚個體的壽命已屆廿五歲或以上，而佔整體三份之二的海豚壽命亦屆十二歲或以上，即均是已達至性成熟的成年個體。此外，有關88條雌性海豚與其幼豚聯繫的研究發現，海豚母子的最短聯繫時間，由兩個月至107個月不等 (平均數為34.7個月)，而47個雌性海豚產幼間隔的最長時間，由三個月至120個月不等 (平均數為37.9個月)。在149個獲確認的產子記錄中，共超過四成與母豚有緊密聯繫的初生幼豚，於首次被發現後便不知所蹤，因而推斷香港初生海豚的存活率處於偏低水平。雖然於香港水域生活的海豚之壽命較長，但其偏低的幼豚存活率、雌性海豚較低的繁殖能力、及較長的海豚產幼間隔，再加上過去十數年海豚數字不斷下降，均為本地海豚的存活前景帶來警號，情況令人憂慮。

在本年度，研究員為本地中小學主持了共十四場講座，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 and NGOs, aiming to provide critical scientific information to the Hong Kong SAR Government for formulation of sound management and conservation strategies for the local populations of dolphins and porpoises.

In addition, HKCRP has been extensively involved in numerous environmental consultancy studies to assess potential impacts of marine construction works on cetaceans in Hong Kong waters and the Pearl River Estuary, and to provide suggestions and guidance on mitigation measures to lessen the pressures of the development projects on dolphins and porpoises. Results from these integrated studies have been used to establish several systematic databases, which can be used to estimate population size, to monitor trends in abundance, distribution, habitat use and behaviour over time, and to keep track of levels and changes in mortality rates of local cetaceans (e.g. Hung 2008, 2016, 2017; Jefferson et al. 2002, 2006, 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 is 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 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 2017 to 31 March 2018. This final report is submitted to AFCD for a summary on the latest status of this 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 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-ID 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 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 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 20 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (Hung 2005, 2017; 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 shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers were experienced in small cetacean survey techniques and identifying local cetacean species. Beforehand they 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. Shore-based Theodolite Tracking Work

During the present study period, the feasibility study on theodolite tracking of Indo-Pacific finless porpoises continued at the Shek Kwu Chau tracking station, as an extension from the previous monitoring studies (see Hung 2016, 2017). On each survey day, observers searched systematically throughout the study area for finless porpoises using the unaided eye and 7 x 50 handheld binoculars. A theodolite tracking session was initiated when an individual or group of porpoises was located, and focal follow methods were adopted to track the porpoise movement. Within a group, a focal individual was selected for the purposes of tracking the behaviour and movement of the group, based on its distinctive feature such as colouration or severe injury mark. The focal individual was then tracked continuously via the theodolite, with positions recorded whenever the porpoise surfaced. If an individual could not be positively distinguished from other members, the group would be tracked by recording positions based on a central point within the group when the porpoises surfaced.

Tracking would continue until animals were lost from view, moved beyond the range of reliable visibility (>5 km), or when environmental conditions obstructed visibility (e.g. intense haze, high sea state). Behavioural state data were also recorded every 5 minutes for the focal individual or group. This interval was long enough to allow for determination of the behavioural state, and short enough to capture behavioural responses to nearby activities (e.g. transiting vessels). Moreover, when multiple groups or individuals were present in the study area, attempts would be made to record the behaviours of all groups or individuals every 10 minutes, with spotters assisting in determining behaviour of the porpoises.

Positions of porpoises and boat activities were measured using a Sokkisha DT5 digital theodolite with ± 5-sec precision and 30-power magnification connected to a laptop computer running the program *Pythagoras* Version 1.2 (Gailey and Ortega-Ortiz 2002). This program calculates a real-time conversion of horizontal and vertical angles collected by the theodolite into geographic positions of latitude and longitude each time a fix is initiated. *Pythagoras* also displays positions, movements, and distances in real-time. When possible, the position of the focal porpoise was recorded at every surfacing with use of *Pythagoras*. The position, type, and activity of all vessels within 5 km of the focal individual were also recorded. An effort was made to obtain at least several positions for each vessel, and additional positions were acquired when vessels changed course or speed.

4.5. Data Analyses

4.5.1. 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.

4.5.2. 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.

4.5.3. 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:

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

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

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

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 2017, 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 by Dr. Gilbert Lui from the Department of Statistics and Actuarial Science of the University of Hong Kong, 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.

4.5.4. 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) x 100) / SA%

DPSE = ((D / E) x 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 2017 for both dolphins and porpoises, and in the past five years of monitoring (i.e. 2013-17) for finless porpoises.

4.5.5. 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.

4.5.6. 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.

4.5.7. 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. 2006-2017), 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 2017-18 monitoring period (i.e. April 2017 to March 2018), a total of 194 line-transect vessel surveys were conducted among ten survey areas in Hong Kong waters. These included 17 surveys in DB, 17 surveys in NEL, 18 surveys in NWL, 36 surveys in WL, 45 surveys in SWL, 31 surveys in SEL, 11 surveys in LM, nine surveys in PT, eight surveys in NP and two surveys in SK. The details of these survey effort data collected during the 12-month monitoring period 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 2017-18 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. Supplementary surveys have also been conducted in SWL survey area between March 2015 and May 2017 commissioned by the Highways Department through their Environmental Project Office (ENPO). 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 during the 2017-18 monitoring period.

In addition, four helicopter surveys were conducted with the Government Flying

Services through the arrangement of AFCD on May 17th, July 12th, August 9th and December 11th of 2017 during the study period. 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, 650.5 hours were spent to collect 5,792.99 km of survey effort during the AFCD vessel line-transect surveys from April 2017 to March 2018. The majority of these efforts (70.2% of total) were conducted among six areas where dolphins regularly occurred in the past, in which 18.1% of total effort were spent in NEL/NWL, 11.1% in WL, 35.2% in SWL/SEL and 5.7% in DB. In addition, 65.0% 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 noted that 93.5% 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 their encounter rates, habitat use, and to estimate the density and abundance of dolphins.

During the same 12-month monitoring period, a total of 6,248.1 km of survey effort was also conducted in NEL, NWL, WL and SWL under the HZMB-related EM&A dolphin monitoring surveys respectively. This brings the total survey effort to 9,059.5 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 191,689 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 52.5% of the total effort funded by AFCD. The survey effort in 2017 alone comprised 6.1% of the total survey effort collected since 1996.

5.1.2. Marine mammal sightings

Chinese White Dolphin - From the AFCD monitoring surveys alone, 201 groups of 569 Chinese White Dolphins were sighted during April 2017 to March 2018 (see

Appendix II). And with the additional sightings contributed from various HZMB-related EM&A surveys, a total of 362 groups of 1,101 dolphins were sighted altogether during the same 12-month period. Among these 362 dolphin groups from the combined dataset, 303 were sighted during on-effort line-transect vessel surveys, while the rest were made during off-effort search.

The majority of dolphin sightings made during the 12-month study period were in WL (183 sightings), NWL (96) and SWL (72) survey areas, comprising 97.0% of the total. On the contrary, dolphins occurred very infrequently in SEL (six sightings) and DB (two sightings). Two rare dolphin sightings were also made in NEL and LM survey areas respectively. For the group of five dolphins sighted near Siu Ho Wan in NEL during a HKBCF survey in early February of 2018, it was the first sighting made in this survey area since June 2016, and the third sighting made there since August 2014. On the other hand, the lone dolphin sighting made in LM was only the fourth one in this area since 2000. As in previous monitoring periods, no dolphin was sighted at all in PT, NP or SK survey areas, where porpoises primarily occur there on a regular basis.

<u>Finless porpoise</u> - During the 2017-18 monitoring period, 119 groups of 294 finless porpoises were sighted from vessel and helicopter surveys (see Appendix III). During on-effort search, a total of 97 porpoise sightings were made, which can be used in the encounter rate analysis and habitat use analysis. The porpoise groups were mainly sighted in SEL (50 groups), SWL (30), PT (17) and LM (14) survey areas. On the contrary, porpoises were rarely sighted in NP and SK survey areas, with only two and five porpoise sightings respectively.

As in the past, no porpoise was sighted in DB, NWL, NEL and WL survey areas where dolphins regularly occurred in the past. However, a very surprising finding from the recent passive acoustic monitoring study funded by AFCD revealed an extremely rare occurrence of porpoises with very low levels of activity near Tai Mo To in NEL in early morning (around 6 am) on December 30th, 2017. It is unknown why porpoises would occur in these waters unexpectedly, which would need further passive acoustic monitoring research to examine these extremely rare events.

5.1.3. Photo-identification of individual dolphins

From April 2017 to March 2018, over 25,000 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 2018, a total of 959 individual Chinese White Dolphins have been identified by HKCRP researchers in Hong Kong waters and the rest of the Pearl River Estuary. These included 52 new individuals being added to the catalogue, which were newly-identified in Hong Kong and eastern Pearl River Estuary (i.e. Lingding Bay) for the first time. In the current catalogue, 559 individuals were first identified within Hong Kong territorial waters, while the rest were first identified in Guangdong waters of the Pearl River Estuary. Moreover, 290 individuals have been seen 10 times or more; 223 individuals have been seen 15 times or more; 134 individuals have been seen 30 times or more; and 92 individuals have been seen 50 times or more. On the contrary, about 42.8% of the identified individuals have only been seen once or twice, with most of these being first identified in Guangdong waters (289 out of 410 individuals). Temporal trends in the total number of identified individuals, the total number of re-sightings made, and the number of individuals within several categories of number of re-sightings showed that good progress has been made in photo-identification works during the 2017-18 monitoring period (Figure 3).

During the present monitoring period (April 2017-March 2018), a total of 148 individual dolphins, sighted 384 times altogether, were identified during AFCD regular vessel surveys (Appendix IV). In addition, 143 individuals were identified 390 times from HZMB-related monitoring surveys in NWL, WL and SWL during the same 12-month period. Nearly half of the re-sightings of individual dolphins made during AFCD/HZMB surveys were in WL survey area, comprising 46.5% of the total, while re-sightings were also made regularly in NWL (30.2%) and SWL (20.6%) survey areas. On the contrary, only seven re-sightings of three individuals (NL306, WL62 and WL91) were made in SEL survey areas, while eight re-sightings of five individuals (NL12, NL224, NL233, NL280 and NL329) were made in DB survey area (Appendix IV). The lone dolphin group of five individuals sighted in NEL survey areas, including NL37, NL120, NL123, NL136 and NL226, were all well-known individuals that frequently occurred in Hong Kong waters in the past (Appendix IV).

Among the identified individuals sighted over the 12-month study period 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, during the relatively short study period. 11 individuals were re-sighted more than 10 times, while three individuals (CH34, NL136 and NL182) were re-sighted more than 15 times from the combined dataset. All of these frequently and repeatedly sighted individuals are considered year-round residents (see Section 5.7.1), with five individuals centered their range use in North Lantau waters and the other six centered their range use in WL and SWL waters.

As in recent monitoring periods, a number of year-round residents that were frequently sighted in Hong Kong waters in the past have only occurred very rarely, or even disappeared during the 2017-18 monitoring period. For example, among the 16 individuals disappeared from Hong Kong waters since 2014, NL139 and SL35 have both disappeared since July 2014 respectively, even though the two individuals were sighted 59 and 38 times respectively during 2012-14. Moreover, a total of 10 frequently sighted individuals (e.g. NL48, NL295, SL05, WL165) have disappeared from Hong Kong waters in 2017, and many of them were considered year-round or seasonal residents in the past.

Apparently some of them may have moved temporarily or even permanently into Mainland waters, or some could have already been dead. In fact, one of these disappeared individuals, NL214, was frequently sighted in Hong Kong in the past (23 re-sightings in 2012-15), but has disappeared from Hong Kong since December 2015. But this individual was sighted again in EPRE waters in December 2017 during a set of surveys conducted by the South China Sea Fisheries Research Institute (SCSFRI), and the sighting location was about 8 km further west from the Hong Kong western boundary. This demonstrates the importance of monitoring surveys to be conducted in EPRE waters, not only to provide information on cross-boundary movements of individual dolphins, but also to confirm whether an individual disappeared from Hong Kong is still alive across the border or not.

During the 2017-18 monitoring period, several notable cases of injuries suffered by individual dolphins were observed. On September 7th, 2017, an identified individual, SL60, was observed with a plastic rope entangled on the leading edge of its dorsal fin near Fan Lau. It was subsequently observed on November 8th, 2017, with the plastic rope being dragged even further into the dorsal fin with more barnacles grown on the heavily dragged rope. However, when it was observed again on December 6th, 2017, the rope disappeared, leaving behind a badly deformed dorsal fin. However, the animal appeared to be swimming normally, and has occurred multiple times in WL and SWL waters since then.

Another case of injury was observed from a newly identified individual in 2017, WL294, when it was found swimming in West Lantau waters on January 16th, 2018. The animal suffered a deep cut on the left ventral side of its body, leaving behind a large open wound with rotten flesh exposed on the body surface. WL294 was subsequently sighted a week later, apparently swimming normally among a large group of 14 dolphins near the territorial boundary in West Lantau, and again on March 18th during a dolphin research trip led by the Hong Kong Dolphin Conservation Society. During the last sighting, the large open wound has mostly healed up, and the animal was behaving normally.

A well-known individual (NL259) which has a long re-sighting history in Hong Kong waters, has also suffered an injury from net entanglement some time between March and September in 2017. On September 5th, NL259 was sighted with a rope heavily wrapped around its body. It was subsequently sighted a few times between November 2017 and March 2018, and was behaving normally. The last time it was sighted near Fan Lau by Hong Kong Dolphinwatch Limited during a dolphin-watching excursion on March 28th, 2018, it was engaged in repeated breaching behaviour, thereby showing a rope tightly wrapped around its body, even though the animal appeared to behave normally.

Another well-known individual (NL123) which has been a long-time year-round residents of Hong Kong, was also observed to sustain an injury on its dorsal fin in January 2018. When NL123 was observed on January 2nd, 2018, its external appearance was normal without any injury, but during its subsequent re-sighting three weeks later on January 25th, the upper portion of its dorsal fin was chopped off with open wounds. It was sighted again in February 1st during the rare sighting in NEL with four other year-round residents, and NL123 appeared to behave normally just like the other individual dolphins.

5.1.4. Shore-based theodolite tracking

In the previous monitoring periods, shore-based theodolite tracking works were conducted at Shek Kwu Chau as a feasibility study on the application of such tracking technique on finless porpoises. In 2017-18 monitoring period, several sessions of theodolite-tracking were conducted from Shek Kwu Chau station to assess whether the porpoises can be reliably tracked from this land-based station, and to study their behaviours and movements in southern waters of Hong Kong.

Between April 2014 and December 2017, a total of 21 sessions of theodolite tracking were conducted at Shek Kwu Chau, with 67 groups of finless porpoises sighted and 789 fixes of their positions collected from this site (Appendix V). Moreover, another 1,201 fixes were also made from locations of fishing boats and other types of vessels from this tracking station.

5.2. Distribution

5.2.1 Distribution of Chinese White Dolphins

During the 2017-18 monitoring period, Chinese White Dolphins were sighted frequently to the west of Lantau Island, and to a moderate extent to the north and south of the island during the AFCD monitoring surveys and HZMB-related surveys (Figures 4-5).

In 2017 alone, with the combined effort from AFCD and HZMB-related surveys, dolphin occurrence in North Lantau mainly clustered at the northwestern section of the region, especially around Lung Kwu Chau, Sha Chau and near Black Point (Figure 6). Dolphins were also observed numerous times to the southwest of the airport, as well as to the north of and adjacent to the Hong Kong Link Road. On the contrary, they were mostly absent from the central and eastern portions of North Lantau waters, particularly around the third runway system (3RS) work zone, the man-made island for HKBCF, as well as the entire alignment of Tuen Mun-Chek Lap Kok Link (TMCLKL) (Figure 6). Moreover, there was only one dolphin group sighted at the mouth of Deep Bay within this survey area from the entire year of monitoring.

Notably, no dolphin was sighted at all in NEL waters in 2017, even though a dolphin group was sighted near the boundary of NWL and NEL survey areas (Figure 6). However, some supplementary information shed lights that NEL waters have not been entirely abandoned by the dolphins at least in recent months. An anecdotal sighting of a lone individual dolphin was reported around The Brothers on December 19th, 2017, and a group of five dolphins was sighted near Siu Ho Wan in NEL during a HKBCF survey on February 1st, 2018. Moreover, the recent passive acoustic monitoring study (funded by AFCD and conducted by HKCRP team) at The Brothers Marine Park revealed that there has been on-going detections of Chinese White Dolphins at the three locations within this marine park (i.e. Siu Ho Wan, Spoon Island

and Tai Mo To) between June 2017 to March 2018, albeit at low levels. These detections mostly occurred during night time between dusk and dawn, with some infrequent usage of these waters during daylight hours, which coincided well from the visual survey data from the present monitoring study.

Certainly, the night-time usage of dolphins in this once-important habitat in NEL waters should not be overlooked, as it filled an important data gap to detect dolphin occurrence within this marine park, especially when there were only a few records of dolphin sightings there during the day. Such passive acoustic monitoring will be instrumental to determine the effectiveness of establishing this marine park, which is a compensation measure for the habitat loss resulting from the HZMB-related reclamation works with the goal of achieving some level of recovery in dolphin usage after a sharp decline in dolphin occurrence there in the past several years (Hung 2016, 2017).

In WL waters, dolphins occurred frequently along the stretch of waters from Tai O Peninsula to Fan Lau during the 2017 monitoring surveys (Figure 7). In particular, sightings of dolphins were more concentrated between Tai O Peninsula and Peaked Hill, as well as around the Fan Lau Peninsula, but they were less frequently sighted along the western territorial border and at the southern end of the survey area that overlapped with the high-speed ferry route (Figure 7).

Furthermore, even though dolphins were regularly sighted in SWL waters, most of these sightings clustered along the stretches of coastlines from Fan Lau to Kau Ling Chung as well as to the southwest and southeast of Shui Hau Peninsula. Only a handful of dolphin sightings were made around the Soko Islands, and the southwestern portion of the survey area, while dolphins were mostly absent along the high-speed ferry route as well as the southeastern portion of the SWL survey area (Figure 7). On the other hand, dolphins seldom occurred in SEL waters. Besides the extremely rare sighting made to the southeast of Shek Kwu Chau, they mainly occurred to the southwest of Chi Ma Wan Peninsula and southeast of Shui Hau Peninsula within SEL survey area (Figure 7).

Temporal change in annual distribution patterns (2012-17)

Using AFCD survey data alone, dolphin distribution patterns in the previous five years (i.e. 2012-16) were compared with the one in 2017. Several notable differences were observed for the temporal changes in dolphin usage around Lantau waters (Figure 8). The most striking change was the greatly diminished dolphin occurrence in NEL during the six-year period: dolphins frequently occurred in this area (especially around The Brothers) in 2012, but their occurrence there have progressively diminished starting from 2013 to the lowest point in 2015-17 when no dolphin was sighted at all (Figure 8). Such significant decline in dolphin usage in NEL waters as a result of the construction works of HZMB and increase in high-speed ferry traffic at the Sky Pier, have been reported in previous monitoring periods (Hung 2016, 2017), and apparently there was still no sign of recovery at all even though the marine works for the HZMB has been mostly completed in 2017. From the passive acoustic monitoring study as mentioned in the previous section, there were some encouraging signs in the past ten months that dolphins still occurred in NEL waters at low levels, but mostly during night-time. It remains to be seen whether eventually there will be some level of recovery in dolphin usage in this once-important dolphin habitat.

Another notable difference was the dramatic decline in dolphin usage of NWL waters since 2014, reaching to the lowest point in 2016 but with a slight rebound in 2017 (Figure 8). In 2012 and 2013, dolphins regularly occurred in the waters within and around the Sha Chau and Lung Kwu Chau Marine Park, as well as the adjacent waters between Pillar Point and the airport platform. However, such occurrence has been greatly diminished in 2014-17, with dolphins mostly occurred only at the northwestern portion of NWL waters (Figure 8). It should also be noted that since the 3RS construction works commenced in mid-2016, dolphins have mostly disappeared from the waters within and adjacent to the work zone. Such construction works will continue to intensify in the next several years with at least 650 hectares of habitat loss for the dolphins, and such construction impacts on dolphin usage of North Lantau waters should be closely monitored in the near future.

Moreover, there was also another temporal change in dolphin distribution to the west of the airport platform in relation to HZMB construction, where dolphin occurrence has greatly diminished after 2012, coincided with the commencement of HKLR construction in 2013. This area at the juncture of NWL and WL survey areas have been identified as important traveling corridor for dolphins to move between the two areas before HKLR construction (Hung 2014). More importantly, this area also serves as an important habitat for individual dolphins from both northern and southern social clusters in Hong Kong to come into contact (Dungan et al. 2012). Even though there were a few more sightings adjacent to the bridge alignment in 2017, the level of dolphin occurrence was still considerably lower between Sham Wat and the western end of airport platform in recent years, which could be affected by the bored piling works of the HKLR construction in the past few years, as well as the physical presence of permanent bridge piers since the completion of piling works that may have obstructed their movements. Continuous monitoring of north-south movement of dolphins across the bridge alignment from shore-based theodolite tracking works and photo-identification of individual dolphins would be critical in the near future.

Furthermore, there was a strong surge of dolphin usage in SWL waters in 2014-15, which has somewhat diminished in 2016-17 (Figure 8). It also appeared that more dolphins occurred in SEL waters in 2017 than the previous five years of monitoring. Such temporal changes should be continuously monitored in the coming years, to determine whether there was any shift and expansion of individual dolphin ranges into South Lantau waters.

Finally, it should be emphasized that the coastal waters of WL has been the only area where there were consistent and frequent occurrences of dolphins throughout the past six years. This highlights the urgent need for protection of this remaining important dolphin habitat Hong Kong, in light of the continuous development pressure and habitat degradation in North Lantau waters.

5.2.2. Distribution of finless porpoises

During the 2017-18 monitoring period, most of the finless porpoise sightings were concentrated in waters around Shek Kwu Chau and Tai A Chau, and between these two islands (Figure 9). Some porpoise groups were also sighted in Pui O Wan, between Cheung Chau and Shek Kwu Chau, and around the Po Toi Islands. There were a handful of sightings made around Cheung Chau, near Lamma Island, at the offshore waters of SK survey area, and at the juncture of PT and NP survey areas. In addition, a very rare sighting was made in the southern part of Mirs Bay during a helicopter survey (Figure 9). On the contrary, the porpoises were mostly absent from the western portion of South Lantau waters, at the offshore waters to the south of Cheung Chau, and between Lamma Island and Po Toi Islands, where they have regularly occurred in the past.

Porpoise distribution pattern in 2017 was compared with the ones in the previous three years of 2014-16. Such comparison revealed that porpoises have frequently and consistently occurred between the waters of Soko Islands and Shek Kwu Chau, as well as to the south of Cheung Chau (but to a lesser extent in 2017) (Figure 10). Some of these areas are scheduled to be established as the South Lantau Marine Park in 2019, which will offer some protection on these important porpoise habitats.

However, the construction of IWMF which involves some reclamation works near Shek Kwu Chau will commence in mid-2018, and it is important to continuously monitor these areas to determine whether the porpoise distribution will change significantly in response to the impact of the IWMF construction activities and the loss of some important porpoise habitats.

Furthermore, it is noted that porpoise occurrence in Lamma waters remained at a low level throughout the four-year period (Figure 10), even though this area was once frequently visited by porpoises in winter and spring months (Hung 2005, 2008). On the other hand, their occurrence in the eastern waters of Hong Kong appeared to be more fluctuated, with slightly higher usage in 2015 and lower usage in 2016 (Figure 10).

5.3. Habitat Use

5.3.1. Habitat use patterns of Chinese White Dolphins

For the quantitative grid analysis on habitat use, the SPSE and DPSE values (i.e. sighting densities and dolphin densities respectively) were calculated in all grids among the six survey areas where Chinese White Dolphins regularly occurred during 2017, which was also compared to the annual patterns in the past six years.

In 2017, all grids with high dolphin densities were concentrated along the coast of WL extending from Tai O Peninsula toward Fan Lau and Kau Ling Chung, while several grids in SWL waters also recorded moderate densities (Figure 11). On the contrary, with the exception of one grid to the west of Lung Kwu Chau that recorded moderate density, the rest of the grids with dolphin occurrence only recorded low to very low density in North Lantau region in 2017 (Figure 11). In fact, almost all grids in the central and eastern regions of North Lantau waters as well as in Deep Bay did not record any dolphin occurrence at all for the entire year.

<u>Temporal changes in dolphin habitat use patterns (2011-17)</u>

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

On the other hand, dolphin usage in many grids of SWL waters were higher in 2014-15, and more evenly spread in 2014-17, than the earlier years of 2011-13. However, the majority of grids in 2016 and 17 only recorded low to moderate dolphin densities, which was largely contrasted with the habitat use patterns in 2014-15 with many grids recorded high to very high 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 2012-13 (Figure 13). In the earlier years of the seven-year period, dolphin usage was evenly spread throughout the North Lantau region, with high dolphin densities recorded around The Brothers 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). However, in 2015-17, dolphin usage was largely confined to the western end of the North Lantau region, and their habitat use in 2016-17 further shrunk to mostly around Lung Kwu Chau, with the majority of the region recording zero to very low densities (Figure 13). Even though most marine works associated with the HZMB construction has been completed in 2016, there was 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 and will continue for at least several more years, it remained to be seen whether the dolphin habitat use pattern in North Lantau would still be the same in the foreseeable future.

Temporal changes in dolphin habitat use patterns at six key habitats (2004-17)

The temporal trends in dolphin usage at six key habitats were also examined for the 14-year period between 2004-17, which included the two existing marine parks around Sha Chau and Lung Kwu Chau as well as The Brothers, the two proposed marine parks at Fan Lau (i.e. Southwest Lantau) and around the Soko Islands, 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 2004-17 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 slight rebound in 2017, but still remained at a very low level (Figure 15). The alarming decline in dolphin usage within this existing marine park since 2004 has been a serious concern, as this area has long been considered an important dolphin habitat in Hong Kong (Hung 2008). Even at the currently low level of dolphin occurrence, this area is still the remaining habitat in North Lantau region that is consistently utilized by dolphins. Notably, the recent AFCD-funded passive acoustic monitoring study conducted within this marine park by HKCRP team has also revealed regular occurrence of dolphins to the south and north of Lung Kwu Chau throughout the 24-hour cycle without any distinct diel pattern. A comparison between the recently collected PAM data and past PAM data at Lung Kwu Chau in 2013-14 will provide some additional insights on whether the acoustic detection of dolphins has maintained at the same level in recent years or has also significantly declined as shown from the visual monitoring survey data.

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 for three consecutive years in 2015-17, 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 has completed in 2017, their occurrence around The Brothers has still remained to be extremely rare in the past few years. However, as discussed in previous section, the AFCD passive acoustic monitoring study revealed a low level of dolphin occurrence within this marine park, where the acoustic detections were mostly made in night-time, possibly related to the lower amount of vessel traffic especially to and from the nearby Sky Pier. A few sightings were also made within this marine park in recent months. Therefore, it remains to be seen whether it will continue to show some signs of recovery in dolphin usage in the next several years. It should be noted also, that just a few kilometers to the west of The Brothers Marine Park, the reclamation works for the 3RS project 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 Cha 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. Monitoring of dolphin usage within this marine park by both means of visual monitoring surveys and passive acoustic monitoring would be critical in the near future to observe the dynamics of dolphin usage in the area.

Even though the proposed Southwest Lantau Marine Park (15 grids) recorded the highest level of dolphin usage among the existing and proposed marine parks in western waters of Hong Kong during the 14-year period, there has been a noticeable decline in dolphin densities from 2014-17. In fact, the dolphin usage there in 2017 was near the lowest level since 2004. Such usage should be continuously monitored after this marine park is established in 2018 as scheduled. Furthermore, similar decline in dolphin densities from 2014-17 was also detected in the proposed Soko Islands Marine Park (20 grids), with the dropped level in 2017 close to the averages in earlier years 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 will be established in 2018 and 2019, as both have covered some important habitats for the dolphins and porpoises in the past. Passive acoustic monitoring in these proposed marine parks, similar to the effort in the two marine parks in North Lantau region, should be implemented as soon as possible to detect dolphin and porpoises occurrence at night-time as well.

As one of the dolphin hot spots in western waters of Hong Kong, the waters around Tai O Peninsula (four grids) consistently recorded high dolphin densities throughout the past decade (Figure 15). However, after a gradual increasing trend from 2004 to the highest in 2009, dolphin usage of this important habitat has sharply declined to the lowest level in 2017, which also coincided with the decline in dolphin usage of the nearby proposed Southwest Lantau Marine Park (Figure 15). On the other hand, dolphin usage at Black Point (four grids) has greatly fluctuated with no apparent trend, and the dolphins have been absent there in both 2016 and 2017 (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 on dolphin habitat use in this general 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 2017 included the offshore waters between Shek Kwu Chau and Tai A Chau, as well as at the southwest corner of Cheung Chau (Figure 16). Several grids to the southwest of Lamma also recorded moderately high porpoise density. On the other hand, a number of grids in PT and NP survey areas recorded high to very high porpoise densities (Figure 16), but those results could also be biased by the relatively low amount of survey effort conducted during the 12-month period and should be treated with cautions.

In order to increase the sample size, the survey effort and porpoise data collected from 2013-17 were pooled and analyzed for a longer period with sufficient amount of survey data, for 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 period 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 2013-17, 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 around Shek Kwu Chau, to the south of Tai A Chau, the offshore waters between Shek Kwu Chau and Tai A Chau, and to the south of Cheung Chau (Figure 17). Porpoise density was moderately high at the southwest portion of LM waters, and around the Soko Islands (Figure 17). On the contrary, most grids toward the western end of SWL, the coastal waters between Fan Lau and Chi Ma Wan Peninsula, and the southern and eastern waters of Lamma Island only recorded low to moderately low densities of porpoises. They also generally avoided Fan Lau and Kau Ling Chung in SWL survey area, the northern portion of LM survey area, and the offshore area at the juncture of SEL and LM survey areas (Figure 17).

During the wet season (summer and autumn months) of 2013-17, more survey effort were allocated to the eastern survey areas instead, 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 generally higher around the Po Toi Islands, and 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 be biased as the survey effort accumulated over the five-year period in this survey area was still relatively low (less than 10 units of survey effort in total for most grids). On the other hand, even though some porpoises occurred in South Lantau and Lamma waters during the wet season, their densities were generally low to moderate (except the two grids to the southwest of Shek Kwu Chau and to the east of Tai A Chau with moderately high porpoise density), with no particular habitat preference in these areas during these months (Figure 18).

Notably, porpoise density to the southwest of Shek Kwu Chau was moderate in wet season and very high in dry season (Figures 17-18), indicating their year-round occurrence at relatively high levels at this important habitat. As the IWMF construction work will take place right in this area, habitat use of the porpoises will inevitably be affected there, and continuous monitoring would needed to understand the level of impact from these construction activities.

5.4. Group Size, Calf Occurrence and Activities

5.4.1. Group sizes of dolphins and porpoises

From April 2017 to March 2018, group sizes of Chinese White Dolphins ranged from singles to 16 animals, with an overall mean of 3.0 ± 2.53. Among the six areas where dolphins occurred in 2017-18, the mean group size was the lowest in LM and SEL, but the highest in NWL (3.3), DB (3.7) and NEL (5.0, but with only a single group sighted) (Table 1a).

Among the four seasons, mean group sizes were higher in autumn (3.2 dolphins per group) and spring months (3.1), while the ones in summer and winter months were both slightly below the overall mean. Most dolphin groups sighted during the 2017-18 monitoring period were quite small, with 55.5% of the groups composed of 1-2 animals, and 79.8% of the groups with fewer than five animals (Figure 19). Only 13 out of the 362 dolphin groups sighted in 2017-18 contained more than ten animals per group.

Distribution of dolphins in different categories of group sizes in 2017 is shown in Figure 20. The smaller groups were evenly found throughout the distribution range of dolphins around Lantau waters, and the ones occurring at the peripheral distribution range (e.g. all groups sighted in SEL, the southern part of SWL, and the central region of North Lantau waters) were dominated by these small groups (Figure 20). On the contrary, the large groups were found predominantly along the coastline of WL survey area, near Fan Lau and Shui Hau Peninsula, within the Sha Chau and Lung Kwu Chau Marine Park, and a few kilometres further north of Lung Kwu Chau (Figure 20). It is assumed that these larger aggregations could be related to better feeding opportunities for the dolphins.

The examination of long-term trend in annual mean dolphin group sizes since 2002 revealed that the one in 2017 (3.23 dolphins per group) was the lowest among all years (Figure 21). It is uncertain whether the smaller dolphin groups in the two consecutive years in 2016 and 2017 could be related to changes in the 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.

For the finless porpoises, their group sizes during the 2017-18 monitoring period ranged from singles to eight animals, with an overall mean of 2.5 ± 1.53. This mean group size was also the lowest in recent years of porpoise monitoring. The majority of the porpoise groups sighted during the monitoring period were very small, with 64.7% of porpoises groups composed of 1-2 animals, and all except 13 groups (or 89.1% of all groups) had less than five animals per group (Figure 22). The mean group size in SEL was very close to the overall mean, while the ones in SWL and PT were slightly higher than the overall mean (Table 1b). Distinct seasonal variation in mean group sizes was evident, with much lower mean group size in autumn and winter months.

5.4.2. Calf occurrence of dolphins

Of the 1,101 dolphins sighted during the 2017-18 monitoring study period, 76.2% of them were categorized into six age classes. And among these age classes, the spotted juveniles (26.4%) dominated the largest proportion of dolphins being identified with their age classes as in previous monitoring periods. On the contrary, only 22 unspotted juveniles (UJ, or the older calf) were sighted during the 12-month period, with these young calves comprised of 2.0% of the total. Only one unspotted calf (UC, or the newborn calf) was sighted from the combined dataset during the 12-month period.

Temporal trend in annual occurrence of young calves (UCs and UJs combined) revealed that the percentages in the consecutive years of 2016 and 2017 were the lowest since 2002, with only one UC and 20 UJs sighted during both years (Figure 23; Table 2). The paucity of young calf sightings in the past two years, as well as the continuous declining trend in their occurrence in the past 17 years is alarming, as this casts a very worrying future for the local dolphin population with very low level of recruitment. In fact, the life history parameters deduced from the long-term photo-identification data as discussed in Section 5.8 also revealed the high calf mortality rate and low fecundity of reproductive females in the past two decades of dolphin monitoring works in Hong Kong waters. As mother-calf pairs are more susceptible to anthropogenic disturbances, the exceptionally low percentages of young calves in recent years raised serious concerns on 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. This critical issue will be further discussed in Section 5.8.

Distribution of young calves in 2017 is shown in Figure 24. Almost all of them were sighted along the WL coastlines with even distribution between Tai O Peninsula and Fan Lau, while two young calves were also sighted near Sha Chau (Figure 24). The only newborn calf sighted during the year was located between Fan Lau and Peaked Hill. In contrast, no young calf was sighted further north or east of Sha Chau, or in South Lantau waters (Figure 24).

The examination of the temporal trends in distribution of UCs and UJs in 2012-17 revealed that such temporal changes resembled some similarities to the overall distribution of dolphins during the six-year period, with the gradual disappearance of young calves from the NEL region starting in 2013-14, and then to the entire North Lantau region in 2015-16 (Figures 25-26). 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 25-26). On the contrary, even though there was a resurgence of overall dolphin usage in SWL waters in recent years, the occurrence of young calves there was still very infrequent during the same period (Figures 25-26). Overall, the dramatically shrinking distribution of dolphin calves over the past six years is quite disturbing, as it may signal the significant degradation of dolphin habitats in western Hong Kong waters as suitable nursing habitats for mother-calf pairs of Chinese White Dolphins.

5.4.3. Activities of dolphins

During the 2017-18 monitoring period, a total of 29 and 16 groups of dolphins were observed to be engaged in feeding and socializing activities respectively, comprising of 8.0% and 4.4% of all dolphin groups. None of the dolphin groups sighted during the 12-month period was engaged in traveling or milling/resting activity at all.

Temporal trend in annual percentages of feeding and socializing activities revealed that after a slight rebound in the past few years, both percentages dropped to a lower point in 2016 and 2017 (Figure 27). In particular, the percentage of feeding activities remained at the lowest level in 2016-2017 since 2002, while the one for socializing activities in 2017 was well below the averages (6.6%) among all years. 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 2017 is shown in Figure 28. Besides a few groups sighted near Sha Chau and Lung Kwu Chau, most groups associated with feeding activities were found in WL and SWL waters, with higher concentration near Tai O Peninsula, Peaked Hill, and Fan Lau Peninsula. Moreover, half of the sightings made in Pui O Wan in SEL were associated with feeding activities (Figure 28). On the other hand, the sightings associated with socializing activities were located within and near the Sha Chau and Lung Kwu Chau Marine Park, between Tai O Peninsula and Peaked Hill, as well as near Kau Ling Chung and Shek Pik (Figure 28).

Temporal changes in distribution of dolphins engaged in feeding and socializing activities were examined across the six-year period of 2012-17. For feeding activities, the temporal changes in sighting distribution patterns closely resembled with the overall dolphin distribution during the same six-year period. Feeding activities occurred frequently in North Lantau region (particularly around The Brothers) in 2012, but have quickly diminished first in NEL in 2013-2014, then in the entire North Lantau region in 2015-2017, when the occurrence of such activity has become increasingly rare (Figure 29). Moreover, feeding activities were frequently encountered from 2012-15 in WL waters, but such encounters appeared to be less frequent in 2016-17 (Figure 29). On the contrary, there were increasing occurrences of feeding activities in SWL waters in 2015-17 (Figure 29).

The temporal changes in distribution of dolphin sightings engaged in socializing activities in 2012-17 were also similar to the ones for feeding activities, with regular occurrence in North Lantau in 2012-14, but with such occurrences diminished noticeably in 2015-2017 (Figures 30). The occurrence of socializing activities remained regular in WL waters throughout the six-year period, but with slightly higher occurrence in 2015 (Figure 30). Socializing activities did not occur at all in South Lantau waters in 2012-13, but 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 362 groups of dolphins sighted in 2017-18, 11 of them were associated with operating fishing boats (or 3.0% of all groups), including purse-seiners (eight groups), gill-netters (two groups), and a hand-liner (one group). After dropping to the lowest in the previous year, the percentage of dolphin sightings associated fishing boats has bounced back in 2017, which was higher than the previous four years, but still at a lower level when compared to the ones from the earlier years.

Spatial distribution of dolphin groups associated with different types of fishing boats in 2017 revealed that the purse-seine associations were evenly distributed among NWL, WL, SWL and SEL survey areas, with no particular concentration (Figure 31). The associations with gill-netters and hand-liner sparingly occurred at the offshore waters of WL, and inshore waters of SWL survey area. Both associations with trawlers (including a single trawler and a pair trawler) occurred near the Hong Kong territorial boundary (Figure 31).

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 2017 to March 2018, the combined encounter rates of dolphins from NEL, NWL, WL and SWL was 3.4, which was the lowest among all monitoring periods since 2002 (the previous lows were 4.7 in 2015-16 and 4.0 in 2016-17; Figure 32 & Table 3). In fact, there has been a steady decline of dolphin encounter rates in the past nine monitoring periods, dropping from 7.7 in 2011-12 to only 3.4 in 2017-18 (Figure 32; Table 3).

As consistently recorded in past monitoring periods, dolphin encounter rate was the highest in WL among the four survey areas in 2017-18, which was considerably higher than in SWL and NWL (Table 3). The encounter rate in NEL was 0.04 as only one on-effort dolphin sighting was made out of the 2,369.5 km of survey effort. Similar to the previous four monitoring periods, dolphin encounter rate in SWL was still higher than the one in NWL in 2017-18, which was the opposite from the earlier years (Table 3).

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

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 two main areas of dolphin occurrence in North Lantau and West/Southwest Lantau regions since 2002.

After reaching the lowest in 2016, the overall encounter rate of the combined areas still remained at a very low level in 2017 (Figure 33). In fact, there has been a sharp decline in the past three years, falling from 7.5 dolphin sightings per 100 km of survey effort in 2015 to only 5.3-5.6 in 2016-17.

For the entire North Lantau region (i.e. 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, with the encounter rate back to the 2015 level, or the second lowest since 2002 (Figure 33). Furthermore, 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, which were the lowest since 2002 (Figure 33).

Temporal changes in encounter rates in relation to HZMB and 3RS construction

The encounter rates of dolphins in each quarter of the seven-year period of 2011-17 were also calculated in NEL and NWL survey areas for the examination of any changes in dolphin occurrence associated with the marine works of HKBCF, HKLR and TMCLKL (the three main components of the HZMB construction) since 2012, as well as the 3RS reclamation works commenced in mid-2016.

In NEL, after the dramatic drops in dolphin encounter rates in all four quarters since 2012 to nearly zero in 2015, it remained at zero for all four quarters of 2016 and 2017 with no dolphin being sighted at all during the on-effort line-transect surveys (Figure 34). Furthermore, after a steady decline in dolphin encounter rates occurred in NWL during all four quarters in the past six years, the encounter rates rebounded slightly during the first, second and third quarters in 2017, but dropped to the lowest point in the fourth quarter in 2017 (Figure 34).

Apparently, the commencement of HKBCF, HKLR03 and TMCLKL construction works all coincided with a further drop in dolphin encounter rates in the respective quarter in NEL waters (Figure 34). Such drop was even more prevalent in 2015 and 2016, when dolphin encounter rate reached zero in most quarters in NEL (Figure 34). The commencement of HKLR09 piling works at the juncture of NWL and WL survey areas in the second quarter of 2013 also corresponded to a decline in dolphin encounter rate in NWL during the same period (Figure 34).

Moreover, the commencement of the Deep Cement Mixing (DCM) works for the

3RS construction during the third quarter of 2016 also corresponded to a further decline in dolphin encounter rate in NWL when compared to the previous years, and such drop was also consistent in the fourth quarter of 2016. After a slight rebound in dolphin encounter rate among the first three quarters in 2017, followed by a further drop in the final quarter in 2017, it remained to be seen whether the impact of the 3RS works in addition to the lingering effects from the HZMB works would continue to affect dolphin usage in NWL and the entire North Lantau region.

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 consistently much lower in Beaufort 3-5 conditions (1.0 porpoises per 100 km of survey effort) than in Beaufort 0-2 conditions (3.4) in the 2017-18 monitoring period. From April 2017 to March 2018, the combined porpoise encounter rate of SWL, SEL, LM and PT was 3.3 sightings per 100 km of survey effort, which was the second lowest monitoring period since 2007-08 (Table 4). Apparently, there was a continuous decline in porpoise encounter rate in the past six monitoring periods, falling from 6.4 porpoises per 100 km of survey effort in 2013-14 to only 3.3 in 2017-18 (Figure 35; Table 4)). Among the five survey areas, the porpoise encounter rates was the highest in SEL, while the one in SWL was also higher than the overall encounter rate (Table 4). On the contrary, the one in PT was slightly lower than the overall, and the ones in SK and LM were much lower than the overall (Table 4).

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 (similar to the low levels in 2010 and 2011), followed by another rebound in 2017 (Figure 36a). 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 37). However, there was a strong rebound in porpoise occurrence in SWL in 2017 after a noticeable decline during 2013-16, while there was also a steady increase in porpoise occurrence in SEL during 2015-17 after a dramatic decline from 2013-15 (Figure 37).

To take into the account of the potential frequent movements across SEL, SWL and LM in winter and spring months, the data from these three areas were pooled to calculate the annual porpoise encounter rate in southern waters of Hong Kong collectively for another examination of such temporal trend in the past decade. After the porpoise usage in the southern waters of Hong Kong has diminished to the lower level in 2016, there was a noticeable increase in 2017 (Figure 36b).

The temporal trend in porpoise usage should be closely monitored, as the southern waters of Hong Kong have long served as important habitats for the porpoises. Such monitoring is particularly important in light of several on-going and pending infrastructure projects (e.g. reclamation for Integrated Waste Management Facilities at Shek Kwu Chau, offshore LNG terminal to the east of Soko Islands) as well as the on-going threat of high-speed ferry traffic in South Lantau region that may affect the porpoise usage in these waters.

5.6. Density and Abundance

5.6.1. Estimates of dolphin density and abundance in 2017

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 2016, 2017). The annual estimates deduced from the 2017 monitoring data can be used to assess the long-term temporal trend in dolphin occurrence in Hong Kong. Only effort and sighting data collected from the four areas under Beaufort 0-3 conditions were used in the analysis, which included 7,875.3 km of survey effort and 249 dolphin groups from the four areas for the density and abundance estimations in 2017.

Among the survey areas, WL recorded the highest dolphin density in 2017, with 58.50 individuals/100 km^2, which was 3-4 times higher than the ones in NWL and SWL (Table 5a). But such figure in 2017 was the lowest in WL among all years since 2003. NWL recorded the second highest dolphin density among the four areas, with 24.23 individuals/100 km^2. Such figure in 2017 in NWL was higher than the ones in the previous two years, but was still at a very low level, and also the third lowest estimate since 2001 when annual estimates were generated annually for this survey area.

Even though the SWL estimate in 2017 was slightly higher than the one in 2016, it was still the second lowest among all years since 2010. As in 2015 and 2016, estimating dolphin density and abundance for NEL in 2017 was impossible, since there was no dolphin being sighted on-effort there for the entire year.

In 2017, the abundance estimates of Chinese White Dolphins were 16, 21 and 10 dolphins respectively in WL, NWL and SWL survey areas (and zero in NEL survey area with no on-effort dolphin sighting made during 2,187.0 km of survey effort), with a combined estimate of 47 dolphins from the four areas (Figure 38; Table 5b). The coefficient of variations (CVs) remained low for the 2017 estimates in WL (13%), and moderate in SWL (28%) and NWL (34%), and therefore the resulted for the year should be reliable (Table 5a).

It should be noted that both combined abundance estimates in 2016 and 2017 were 47 dolphins, and both were also the lowest among all years (Figure 38; Table 5b). However, there was apparent difference between the two years. When compared to 2016, the abundance estimate in WL in 2017 dropped from 27 dolphins to 16 dolphins, and the one in NWL increased from 11 dolphins to 21 dolphins, while the ones in SWL were almost the same in 2016 and 2017 (Table 5b). It appeared that the changes in dolphin numbers in NWL and WL were offset by each other, and this could possibly be linked to individual dolphins utilizing NWL waters more (and less in WL) in 2017. As documented in previous monitoring periods, there have been some range shifts and expansions of individual dolphins from North Lantau to West Lantau waters in the past few years, and it is possible that some of such range shifts and expansions have already been reversed in 2017. This will be further examined in Section 5.7.4.

5.6.2. Temporal trends in dolphin abundance

Temporal trends of annual dolphin abundance in NWL and NEL (2001-17), SWL (2002-17) as well as WL (2003-17) 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 (2010-17) 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 39). Since then, the dolphin numbers remained at a lower level of 11-12 dolphins in the subsequent periods (i.e. 2008-09, 2010, 2011, 2012 and 2013), before a noticeable rebound to a higher level of 26 and 24 dolphins in 2014 and 2015 respectively (Figure 39).

Thereafter, the abundance estimates dropped to a much lower level in 2016 and 2017 with only nine and ten dolphins in those two years, which were also the lowest since 2010 (Figure 39). 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 40). 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 level in 2017 with 16 dolphins. Such estimate in 2017 was also the lowest estimate in WL since 2003 (Figure 40).

Dolphin abundance in the North Lantau region showed an even more pronounced decline in the past 17 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 2015-17 (Figure 40). The most noticeable decline in this area occurred between 2011 and 2014, with a 91% drop in just three years. On the other hand, dolphin abundance in NWL dropped steadily from the highest in 2003 (84 dolphins) to the lowest in 2015-16 (10-11 dolphins), with an 87-88% decline in the past decade (Figure 40). However, the dolphin number in NWL in 2017 (21 dolphins) has bounced back to the 2014 level, albeit still at a very low level when compared to the earlier years (Figure 40).

Using the 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 (2001-17): the test statistic for the hypotheses was -7.9791 whose *p*-value was $\approx 0.0000 < 5\%$. 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 (2001-17): the test statistic for the hypotheses was -11.5278 whose *p*-value was $\approx 0.0000 < 5\%$. 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 (2003-17): the test statistic for the hypotheses was -5.6844 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 (2010-17): for the annual estimates in 2010-17, the test statistic for the hypotheses was 0.1861 whose *p*-value was 0.5708 >5%. Therefore the hypothesis H_0 is not rejected at 5% level of significance with the annual abundance data of dolphins in SWL not possessing a significant downward sloping trend.

- Combined estimates from SWL, WL, NWL and NEL (2010-17): the test statistic for the hypotheses was -4.3117 whose *p*-value was 0.0025 <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, significant declines in 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 and 2017 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 dolphin abundance to the lowest point in both years of 2016 and 2017, which was largely attributed by the dramatic decline in dolphin numbers in the North Lantau region in recent years and also in the WL and SWL waters in 2017. To elucidate the reasons behind the dramatic decline in dolphin abundance in Hong Kong waters in the past decade, the occurrence of individual dolphins including their temporal changes in range use among different survey areas in recent years is closely examined in Section 5.7.

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 identified individuals that occurred in 2017 through photo-identification works were deduced using the fixed kernel method, and their ranging patterns are shown in Appendix VI.

In addition, 161 individual dolphins that were sighted ≥15 times and occurred during the past three years of 2015-17 were further examined for their range use and residency patterns (Table 6). Among these individuals, all except one (NL286) have occurred in WL in the past, while the majority of them have also occurred in NWL (75.2%) and SWL (67.7%), and to a smaller extent in NEL (26.7%) and DB (19.3%) (Table 6). On the contrary, only ten and two individual dolphins have been sighted in SEL or EL survey area respectively as part of their historical range. Moreover, 114 of these 161 individuals occupied range that spanned from Hong Kong across the border to Mainland waters (Table 6), indicating some cross-boundary movements by many individual dolphins that frequently occur in Hong Kong waters.

Residency Pattern

The residency patterns of 146 individuals were further assessed by examining their annual and monthly occurrences in Hong Kong. The other 15 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, 91 and 49 individuals were identified as year-round and seasonal residents respectively, and six individuals (i.e. CH105, WL66, WL97, WL159, WL178 and WL188) were identified as seasonal visitors. Nearly 96% 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 (4.1%) 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 146 individuals, about one third 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 146 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 41 individuals (28.1%) and 87 individuals (59.6%) belonged to the northern and southern social clusters respectively (Table 6). In addition, there were also 18 individuals that spanned their range use evenly across North and West Lantau waters with frequent occurrences in both waters, with the majority of them shifted 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, 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 146 individuals, 58 and 56 individuals occupied Lung Kwu Chau as their 50% and 25% UD core areas respectively, while only 12 and 9 individuals occupied The Brothers as their 50% and 25% UD core areas respectively (Table 6). The majority of these individuals that utilized Lung Kwu Chau and The Brothers as their core areas belonged to the northern social cluster.

On the contrary, 110 and 100 individuals utilized along the west coast of Lantau as their 50% UD and 25% UD core areas respectively, with the majority of them belonged to the southern social clusters (Table 6). Among the 100 individuals that occupied WL waters as their 25% UD core areas, 48%, 51% and 48% of them primarily utilized Tai O, Peaked Hill and Fan Lau respectively within West Lantau waters. As there has been a recent surge of individuals expanding or shifting their range use into SWL waters, there were also 12 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 2017-18 were broadly examined. During the 12-month period, 185 individuals were re-sighted a total of 774 times, with 146 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 97 individuals moved across different survey areas around Lantau in 2017-18. For example, 65 individuals were re-sighted in both SWL and WL survey areas, while 48 individuals occurred across NWL and WL survey areas (Table 7). Moreover, 17 individuals occurred in all three areas of NWL, WL and SWL, two individuals (NL37 and NL123) moved across NEL, NWL and WL survey areas, and one individual (NL226) has its range covered across all four survey areas of NEL, NWL, WL and SWL during the 12-month monitoring period (Table 7).

With an extensive amount of photo-identification data being collected from different surveys during 2017-18, there was still a significant portion of individual dolphins sighted repeatedly within just a single survey area only, but did not range into neighbouring areas. These included 29 individuals that occurred exclusively in WL survey area, while 14 and six individuals were only re-sighted in NWL and SWL waters respectively during the 12-month period. There is no doubt that some of these animals would have ventured across the territorial border and utilized the Mainland waters as part of their ranges, but 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 project (e.g. reclamation, bridge construction).

The temporal trend in individual movement patterns across different survey areas was examined for the past eight monitoring periods, in order to provide any insight on the temporal changes in their intensity of movements as a result of various anthropogenic factors (Table 7). Besides the dramatic decline in dolphin movements between NEL and NWL due to the near-complete absence of dolphin occurrence in NEL in recent monitoring periods, there were some notable changes (Figure 41). For example, after a sharp increase in dolphin movement between WL-SWL during 2010 to 2016, the two subsequent monitoring periods recorded a steady decline, even though it still remained at a relatively high level when compared to the earlier years (Table 7). Individual movement of dolphins between NEL-NWL was still a very low level in recent monitoring periods, coincided with the near absence of dolphins in NEL in several consecutive years (Table 7).

5.7.3. Temporal changes in range use of individual dolphins

As in the previous three monitoring periods, the examination on temporal changes in range use by individual dolphins continued for the present study. This included 114 individuals that have regularly occurred in Hong Kong waters among the six periods of 2011-12 (baseline period before commencement of HZMB construction), 2013, 2014, 2015, 2016 and 2017, in order to gain a better understanding on the underlying dynamics behind the trends in dolphin abundance in different parts of Lantau waters as examined in Section 5.6.2.

Among these 114 individuals, 59 and 55 of them were 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 focused their range use primarily around The Brothers 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 examined 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 away from the HKLR09 alignment (i.e. west of the airport).

Among the 59 individuals from the northern social cluster, 19 of them has already disappeared in the past few years (3 individuals in 2014, 5 in 2015, 4 in 2016 and 7 in 2017). In addition, more than two-thirds of them (41 individuals) have utilized Lantau waters progressively less since 2011, while 36 of them (61%) have utilized WL waters more during the six periods, with a proportion of these (13 individuals) starting to utilize SWL waters more in recent years. Furthermore, the less frequent use of Lantau waters also resulted in range shrinkage for 63% of these individuals, in contrast to a range expansion by only 10% of these individuals.

The increased utilization of WL and SWL waters has resulted in range shifts and expansions by a good number of individual dolphins from the northern social cluster. In total, 40 of the 59 individuals have shifted their ranges away from NEL waters, and such shifts have also resulted in a virtual absence of dolphin occurrence in NEL waters in 2015-17. Besides the range shifts away from NEL waters, 20 individuals have shifted part or all of their ranges from North Lantau waters to WL waters, and eight of them even shifted their range use to include SWL waters (see NL295 as an example in Figure 42). On the contrary, after shifting their range use from NL to WL in previous years, nine individuals (NL33, NL49, NL103, NL105, NL224, NL242, NL262, NL296 and WL11) have reversed such shifts and occurred mostly in NWL waters in 2017 (see NL33 as an example in Figure 43).

The above results indicated that since the construction of HZMB commenced in 2012, individual dolphins have dramatically reduced their usage in NEL waters by shifting their ranges to avoid this area. Some of them also started to extend their range use to WL and even SWL waters, and at the same time reduced their range use in NWL water in the past few years. However, there appeared to be a reverse of such range shifts for some individuals from WL back to NWL waters. Such reverse in range shifts may partly explain the lower and higher abundance estimates in 2017 in WL and NWL respectively when compared to the estimates in 2016, as discussed in

Section 5.6.1. It is remained to be seen whether such reverse would become more prevalent for more individuals in the coming years, in light of the increasing level of disturbances and habitat loss as a result of the 3RS construction activities in North Lantau region.

On the other hand, for the 55 individuals from the southern social cluster, 15 of them have already disappeared in the past few years (6 individuals in 2015, 4 in 2016 and 5 in 2017). Moreover, 17 individuals have progressively reduced their utilization of their ranges in Lantau waters since 2011, while six dolphins have increased their usage of Hong Kong waters at the same time. During the same period, more individuals have shrunk (37%) rather than expanded (27%) their ranges in Hong Kong waters, while 11 individuals (19%) did not show any apparent change in range use since 2011. Moreover, 27 of the 55 individuals have shown clear avoidance of the HKLR09 alignment in the past several years with their range shifting to further south of the bridge alignment. On the contrary, four individuals did not show such 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 (58%) have utilized SWL progressively more in recent years, and 14 individuals have shown clear range shifts or expansions from WL to SWL waters as a result of increased utilization of SWL waters (see WL91 as an example in Figure 44). On the contrary, after shifting or expanding their range use into SWL waters in the past few years, six of them have reversed such shifts and expansions in 2017 (see CH38 as an example in Figure 45).

From the examination of the temporal changes in range use among the southern social cluster individuals, apparently there were fewer changes in their range use than their counterpart from the northern social cluster, with most of them continuing to utilize WL waters at a high level as before the bridge construction. Nevertheless, these individuals have ventured less frequently into North Lantau waters across the HKLR alignment, while spending progressively more time in SWL waters. It is likely that individuals from the southern social cluster have been more affected by the HKLR construction with the presence of the physical structures of the bridge piers.

To further understand the correlation between the extent of range shifts by individual dolphins in Hong Kong and the trends in dolphin abundance among different survey areas, the level of utilization among different areas were broadly examined quantitatively for individuals that have occurred regularly in Lantau waters during the past decade. The candidates for such examination included 100 individuals that were re-sighted at least 30 times during on-effort surveys since 2003, which included 44 members from the northern social cluster and 46 members from the southern social cluster, as well as 10 individuals that utilized both North and West Lantau waters evenly and cannot be categorized into the two social clusters based on their ranging behaviour. It should be emphasized that only individual re-sightings made during on-effort survey effort were included in this analysis, as such re-sightings can be further normalized by the amount of survey effort collected in the respective year and survey area, since disproportionate amounts of survey effort across years and areas could affect the probability of individuals being re-sighted through photo-identification works during on-effort surveys.

To calculate the individual re-sighting rate, the number of on-effort re-sightings of each individual was counted for each year of 2007-2017 among each of the four main areas of dolphin occurrence (i.e. NEL, NWL, WL and SWL). Then these numbers of all 100 individuals included in the analysis were summed up for a total of individual re-sightings for each area per year, which were then further divided by the amount of survey effort for the corresponding area and year. The combined individual re-sighting rate, or the total number of re-sightings per 1,000 km of survey effort, can then be compared across different survey areas for each year, and across different years for the same survey area to examine any temporal changes in individual usage among different areas of Lantau waters.

Overall, the combined individual re-sighting rate for the 100 individuals in NEL has dramatically declined from the highest in 2011 to zero in 2016 and 2017 (Figure 46). Similar declining trends were also observed in NWL (between 2011 and 2016), in WL (between 2014 and 2017) as well as in SWL (between 2014 and 2017). Notably, these trends of occurrence of individual dolphins among NEL, NWL, WL and SWL largely resembled the trends in dolphin abundance as examined in Section 5.6.2, indicating that the examination of re-sighting rates of individual dolphins among different areas in different years can provide valuable insights to understand the changes in dolphin abundance over time among different survey areas.

Since the primary range use of members from the northern social cluster centered around NEL and NWL in the past, while the ones from the southern social cluster centered in WL and SWL waters (Dungan et al. 2012), it would also be insightful to examine the temporal trends in individual re-sighting rates among different survey areas independently for the two social clusters.

For the 44 individuals from the northern social cluster, the proportion of combined individual re-sighting rates in NWL appeared to be relatively stable (40-68% of the total from the four areas) in the past 11 years of 2007-17 (Figure 47). However, a more detailed examination revealed that such proportion in NWL was on a decline from 69% in 2013 to 43% in 2016, while the proportion in WL increased steadily from 6% in 2012 to 35-39% in 2015-16 and the proportion in SWL increased noticeably from 1% in 2014 to 22% in 2016 (Figure 47). These trends signaled the intensified shifts and expansions of individual ranges from North Lantau to West Lantau and even Southwest Lantau waters for the individual dolphins from the northern social cluster between 2013-14 and 2016. However, such trend has apparently been reversed in 2017, with a large increase in NWL (from 43% to 64%), and a slight decrease in WL (from 35% to 30%) and a large decrease in SWL (from 22% to 6%), which signaled a possible reverse in range shifts back to North Lantau region for these individuals (Figure 47). Such reverse in range use by the northern cluster individuals could provide explanation for the noticeable increase in dolphin abundance in NWL and decrease in WL in 2017 as detailed in Section 5.6.1.

For the 46 individuals from the southern social cluster, the proportion of individual re-sightings rates in WL and SWL has changed noticeably during the past decade. Firstly, the proportion of utilization was much larger in WL in the earlier years from 2007-09 (78-88%), then such proportion has been on a decline since then, ranging to the lower point in 2013-15 (63-67%) (Figure 48). However, such proportion in WL has once again risen to the highest in 2016-17 (83-86%). On the contrary, after a steady increase in proportion of individual re-sighting rates in SWL from 11% in 2008 to 37% in 2015, such proportion decreased markedly in 2016 and 2017 (14-16%), which coincided with the large increase in WL (Figure 48). These opposite trends signaled the increased amount of individual range expansion from WL to SWL waters from earlier years up to 2015, then apparently such increase has reversed in 2016 and 2017, with individuals spending more time in WL than in SWL. This also coincided well in the decline in dolphin abundance in SWL in both 2016 and 2017, with the southern social cluster individuals spending less time in SWL in the past two years.

It should be acknowledged that the limitation of this analysis was still restricted to 100 individuals that frequently occurred in Hong Kong waters, and may not reflect fully the overall usage of the 150-200 individuals that regularly occurred in Hong

Kong annually at various degrees. However, this analysis could still provide some quantitative measurements on the overall level of range utilization of individual dolphins and how that would affect the temporal trends in dolphin abundance across different survey areas. Such examination can also be insightful to understand how the range utilization would differ between the two social clusters as a result of different levels of anthropogenic disturbance that they experienced in their respective range.

5.8. Update on Life History Parameters of Individual Dolphins

In the past, information on life history parameters of Chinese White Dolphins in Hong Kong were mostly obtained from stranded specimens. However, these dolphin stranding events are opportunistic, and may have biases toward certain sex and age classes, or even ailing individuals. Therefore, using the long-term photo-identification data, several life history parameters of Chinese White Dolphins occurred in Hong Kong were preliminarily examined in Hung (2010), and again in greater details in Hung (2015). These results have been incorporated into an in-depth study on life history characteristics of Hong Kong dolphins (Jefferson et al. 2012). In light of the dramatic decline in calf occurrence of dolphins in Hong Kong waters in the past few years as discussed in Section 5.4.2, another updates on their life span, female-calf association as well as calf survival are examined in this report, as such analysis is further supplemented by a wealth of photo-identification data collected in recent years.

5.8.1. Individual life span

The sighting history of 294 individuals from the photo-ID catalogue collated since 1995 were examined for the analysis on estimated life span, and these individuals either have long sighting histories (more than five years) or were frequently sighted (10+ re-sightings) in Hong Kong waters since 1995. The ages of 22 individual dolphins were directly deduced from their sighting histories without the need of estimation, as they have been observed with their mothers since their birth during the study period. On the other hand, the ages of the other 267 individuals were estimated from their sighting histories and by making some assumptions of their ages when they were first seen (see Hung 2010, 2015). The assumed minimum age of each age class is as follow: mottled or SJ (at least three years old), speckled or SS (at least eight years old), SA (at least 10 years old), and UA (at least 15 years old). These assumed minimum ages in relation to their colour pattern were based on available information on their growth curve (age/length relationship) (see Jefferson 2007; Jefferson et al. 2012) and theory of their colour pattern development established in Hung 2010. The estimated age of identified individuals were then calculated by summing up the length of sighting history (number of years between the first and last sightings of that individual) and the minimum age of the individual based on its age class when it was first seen.

Among these 294 individuals, nine individuals (CH34, EL01, NL06, NL12, NL48, NL49, NL104, NL136 and SL05) were estimated to be over 30 years old, while another 18 individuals were estimated to be 25-30 years old. About two third of all examined individuals were estimated to be at least 12 years old, which should all be sexually mature adults (see Jefferson 2000; Jefferson et al. 2012). Moreover, the mean estimated age of known females (19.0, n=101) was very similar to the one of known males (20.7, n=6).

It is interesting to note that 51 spotted juveniles were assumed to be sexually mature adults, based on their estimated age. In fact, many of them have long sighting history in Hong Kong waters, ranging from 9.0 to 23.1 years, and certainly they are not "juveniles" as their age class category has suggested. Moreover, some of these "juveniles" have given births to young calves in the past, and many of them have only transitioned to the spotted subadult (or speckled) stage after a long period of time. Therefore, the age class categorization as first suggested in Jefferson (2000) should be viewed as arbitrary, and most often would not reflect the actual life stage of the individual dolphin.

Overall, it should be noted that many individual dolphins in the photo-ID catalogue are sexually mature (i.e. more than 12 years old) with a good proportion of them having survived well into their twenties or even thirties. These sexually mature adults are vital to the sustainability of a healthy population, and their continued survival with a relatively long life span would give the population a fighting chance against various threats faced in their habitats as described throughout the present report.

5.8.2. Female-calf association and calf survival

A total of 336 individual dolphins from the photo-ID catalogue were examined for any female that may have given birth to young calves. Among them, 90 were identified as females through confirmation from their calving histories (with repeated calf associations) or through biopsy results (14 individuals in total). Another 30 individuals were categorized as probable females, as they were only seen with their young calves (and for some cases only supporting a dead calf) in a single incident, but those calves disappeared shortly after, which were presumably dead. These probable females were excluded from further analysis. From the 90 confirmed females, 83 had calving histories, with 43 of them seen with one calf before, 31 with two calves before, and nine with three calves before. Most of the mothers are considered residents of Hong Kong with regular occurrence and relatively long sighting history.

A total of 88 calves with 73 females were sighted repeatedly, and the minimum periods of these female-calf associations were estimated between their first and last re-sightings. It should be cautioned that the estimated periods of female-calf associations were likely underestimates, as some calves were already unspotted calves (i.e. older calves) when first seen, or they might still be associated with their mothers for a period of time after their last re-sightings. Such minimum periods of female-calf associations ranged from 2-135 months, with an average of 34.7 ± 27.72 months (median = 30 months).

About 40% of the calves were associated with their mothers for fewer than 24 months, while there were also 27 calves associated with their mothers for at least four years or more. NL18, NL80 and NL202 were three notable exceptions. NL18 was first sighted with her calf in March 2000, and the calf was associated with her until January 2009, which has become a spotted juvenile at the time with its own identity as NL259. NL80 was first sighted with her calf NL301 in May 2007, and the calf was associated with her until January 2017. Moreover, NL202 was first sighted with her newborn in October 2006; since then the mother-calf pair has been frequently sighted together around the Lung Kwu Chau area. Such association of this mother-calf pair still persists at present (i.e. with over 11 years of association), and the calf has been identified as NL286. Such long periods of mother-calf associations were rather unusual for small cetaceans, and it is possibly related to the low fecundity of Hong Kong dolphins. In fact, calf production over the course of the long-term monitoring has been fairly low, as most female year-round residents consistently sighted in Hong Kong have only successfully produced 1-2 offsprings during the past two decades.

Moreover, for the females with records of two or three births since 1996, their calving intervals between giving births were estimated. Forty-seven calving intervals from 39 females were examined in details. It should be cautioned that the estimated calving intervals are likely overestimates, as the first calves may still be associated with their mothers after the last re-sightings, while the second calves may have already associated with the same females well before their first re-sightings made. Moreover, there were also possibilities that some females might have given another birth(s) during the calving interval but have gone unnoticed (or the calf was dead quickly as mentioned above). Nevertheless, the maximum calving intervals between births ranged from 3-120 months, with an average of 37.9 ± 27.58 (median = 31 months). For those females with short calving interval recorded (e.g. NL46, NL233), the associations of their first calves were relatively long, which may have overlapped with their subsequent pregnancy and resulted in seemingly short calving intervals. On the other hand, ten individuals recorded calving intervals of more than five years, and again they might have given another birth(s) but were not observed in between their re-sightings. Overall, most of the calving intervals were estimated to be about 1-3 years, and occasionally up to 4-8 years.

Notably, at least 61 of the 149 confirmed births of newborns since 1996 were observed only once with their mothers before. These included 21 newborns that were probably dead shortly after birth (i.e. newborn calves disappeared quickly in subsequent sightings of their mothers within a few weeks), and another five dead ones that were supported by their mothers at the time of discovery (a type of epimeletic behaviour as detailed in Hung 2014). For the other 35 newborns that were observed only once with their mothers, it was possible that their mothers do not occur in Hong Kong waters frequently enough to be re-sighted again during the period of female-calf association, or they were also dead within the first few months after birth. The observed low survival rate of calves was further supported by the stranding data in the past, with a high proportion of stranded animals being dead calves (Hung 2006; AFCD unpublished data).

Even though most dolphins in Hong Kong enjoy a relatively long life span, but with the low survival rate of newborns, the low fecundity of reproductive females, and the relatively long calving intervals, this should raise serious concern for the continuous survival of dolphins in Hong Kong waters, in light of the worrisome declining trend in their abundance in the past decade (see Section 5.6.2.), as well as the dramatic decline in calf occurrence (see Section 5.4.2.). It has long been speculated that mortality of young calves can be linked to the negative impacts of water pollution, as heavy load of pollutants (e.g. DDT, PCBs) have been found among some stranded dolphin calves in Hong Kong (Jefferson et al. 2006). Continuous habitat loss and degradation, as well as the increasing amount of acoustic disturbances from marine construction works and high-speed ferry traffic, may further compound the problem. Special attention should be made to alleviate these negative impacts, as the survival of calves is the most important element for the long-term survival of the dolphin population. Important habitats with high density of calves in the past, such as the entire west coast of Lantau, should receive urgent protection as marine protected area in order to safeguard the mother-calf pairs from further disturbances, and to provide them with sufficient prey resources to battle various threats in their living habitats. Moreover, the calving history and calving interval of known females should be closely monitored in future years of photo-identification work.

6. SCHOOL SEMINARS AND PUBLIC AWARENESS

During the 12-month 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 14 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 five 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

Table 1b. Mean group size of finless porpoises among different survey areas in the past five monitoring periods

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

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%

Table 3. Encounter rates of Chinese White Dolphins among different survey areas in the past 16 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

Table 4. Encounter rates of finless porpoises among different survey areas in the past 11 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

Table 5a. Line transects parameters and estimates of density and abundance for Chinese White Dolphins in western waters of Hong Kong in 2017

([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	2187.0	3169.7	1197.1	1321.5
Number of Sightings	0	62	142	45
Average Group Size	N/A	3.76	3.22	2.87
Encounter Rate[1]	N/A	1.96	11.86	3.41
Individual Density[2]	N/A	24.23	58.50	14.97
Abundance	N/A	21	16	10
95% C.I. (Abundance)	N/A	11-41	12-21	6-17
%CV	N/A	34	13	28

Table 5b. Annual abundance estimates of Chinese White Dolphins from each survey area in western waters of Hong Kong in 2003-17

(figures in red derived from biennial estimates; figures in blue indicate no 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

Table 6. Range use (50%/25% UD core areas and sighting coverage) and residency patterns of 161 individuals with 15+ sightings and appeared since 2015

(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= The Brothers; 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)

	Last				Primary	Occurrence in Survey Areas								50% UD Core Area						25% UD Core Area					
ID#	Sighted	# STG	Gender	Residency	Range	DB	EL	NEL	NWL	WL	SWL	SEL	CH	LKC	BR	TO	PH	FL	SL	LKC	BR	TO	PH	FL	SL
CH12	30/01/18	81	F?	YR	WL					√	√		√				√	√					√	√	
CH34	26/01/18	153	F	YR	NL	√		√	√	√			√	√						√					
CH38	23/01/18	100	?	YR	WL					√	√		√				√	√					√	√	
CH105	24/12/17	24	F	SV	WL				√	√			√			√						√			
CH108	29/12/17	109	F	YR	WL				√	√	√		√				√	√					√	√	
CH113	10/10/17	42	F	SR	WL				√	√	√		√			√	√					√			
CH153	20/08/17	26	?	SR	WL				√	√	√		√			√	√					√			
EL01	21/06/17	125	M*	YR	NL		√	√	√	√	√		√		√						√				
NL12	01/12/17	43	F	SR	NL	√		√	√	√	√		√	√						√					
NL33	02/01/18	148	F*	YR	NL			√	√	√	√			√	√						√				
NL37	13/11/17	72	?	SR	NL		√	√	√	√			√	√		√				√					
NL46	06/12/17	92	F*	YR	NL				√	√			√	√						√					
NL48	26/07/16	129	?	YR	NL	√		√	√	√				√						√					
NL49	17/11/17	66	F*	YR	NL			√	√	√	√			√		√				√					
NL80	13/09/17	38	F	SR	NL	√			√	√			√	√						√					
NL98	02/01/18	171	F*	YR	NL			√	√	√	√		√	√	√					√	√				
NL103	23/12/17	57	?	SR	NL	√			√	√	√		√	√						√					
NL104	22/12/17	135	F	YR	NL	√		√	√	√			√	√						√					
NL105	24/07/17	32	?	SR	NL/WL				√	√			√	√		√				√					
NL120	19/01/18	136	F*	YR	NL			√	√	√	√		√		√						√				
NL123	13/11/17	166	F	YR	NL	√		√	√	√	√		√	√	√						√				
NL136	19/01/18	142	F*	YR	NL	√		√	√	√				√						√					
NL145	06/12/17	55	F	YR	NL			√	√	√			√	√						√					
NL150	25/03/17	48	F	SR	NL	√		√	√	√	√		√	√						√					
NL156	19/01/18	50	?	YR	NL/WL				√	√	√			√		√	√					√	√		
NL165	23/06/17	92	?	YR	NL			√	√	√	√			√	√					√					
NL182	19/01/18	110	F	YR	NL	√		√	√	√				√						√					
NL188	06/07/15	84	F	YR	NL/WL			√	√	√	√			√		√	√			√		√	√		
NL202	06/12/17	131	F	YR	NL	√		√	√	√			√	√						√					
NL206	23/01/18	62	F*	YR	WL				√	√	√						√	√					√	√	
NL210	26/01/18	72	?	YR	NL			√	√	√			√	√						√					
NL212	03/01/18	54	F	YR	WL				√	√	√		√			√	√					√			
NL213	26/06/15	27	?	SR	NL	√			√	√				√						√					
NL214	23/12/17	40	F?	SR	NL	√			√	√			√	√						√					
NL220	18/11/16	84	F	YR	NL	√		√	√	√				√						√					
NL224	14/08/17	71	?	SR	NL/WL	√		√	√	√	√		√	√		√	√			√		√			
NL226	09/01/18	80	?	YR	NL/WL	√		√	√	√	√		√	√	√	√				√	√				
NL233	11/01/18	65	F	YR	NL	√		√	√	√			√	√						√					
NL236	13/09/17	42	?	YR	NL				√	√			√	√						√					
NL242	05/12/17	89	F*	YR	NL			√	√	√				√	√					√					
NL247	22/12/17	28	?	SR	WL				√	√			√			√	√					√	√		
NL256	19/10/17	23	F	SR	NL/WL	√			√	√			√	√		√				√					
NL259	29/12/17	81	?	YR	NL			√	√	√				√		√				√					
NL260	16/02/17	69	?	YR	NL/WL			√	√	√	√		√	√	√	√				√	√	√			
NL261	19/01/18	96	M?	YR	NL	√		√	√	√			√	√	√					√	√				
NL262	01/13/16	49	?	YR	NL	√			√	√	√			√						√					
NL264	13/11/17	70	F	YR	NL/WL			√	√	√			√	√		√				√		√			
NL269	02/01/18	45	?	SR	WL				√	√	√		√	√		√	√	√					√	√	
NL272	19/01/18	79	?	YR	NL	√		√	√	√	√		√	√						√					
NL279	19/08/17	25	?	SR	WL				√	√			√			√						√			
NL280	11/01/18	28	?	YR	NL	√			√	√				√						√					

Table 6. (cont'd)

	Last				Primary	Occurrence in Survey Areas								50% UD Core Area						25% UD Core Area					
ID#	Sighted	# STG	Gender	Residency	Range	DB	EL	NEL	NWL	WL	SWL	SEL	CH	LKC	BR	TO	PH	FL	SL	LKC	BR	TO	PH	FL	SL
NL284	03/01/17	79	?	YR	NL			√	√	√			√	√	√					√					
NL285	05/04/16	82	?	YR	NL			√	√	√				√	√					√	√				
NL286	02/01/18	100	?	YR	NL	√		√	√				√	√						√					
NL287	13/07/16	46	?	YR	NL				√	√	√		√	√						√					
NL288	13/11/17	60	?	SR	NL/WL			√	√	√			√	√		√				√		√			
NL293	19/08/17	35	?	SR	WL				√	√						√	√					√			
NL295	09/01/18	56	?	YR	NL/WL			√	√	√	√		√	√		√				√		√			
NL296	09/01/18	71	F?	YR	NL/WL			√	√	√	√		√	√		√	√			√					
NL299	28/06/17	28	F?	SR	WL	√			√	√	√		√			√	√					√	√		
NL300	28/07/15	20	?	SR	NL/WL			√	√	√				√		√				√		√			
NL301	13/09/17	29	?	SR	NL	√			√	√			√	√						√					
NL302	21/09/17	31	?	SR	NL/WL	√			√	√			√	√		√	√			√		√			
NL306	05/07/17	23	?	YR	WL				√	√	√	√		√		√	√	√	√				√	√	√
NL307	22/09/16	21	?	YR	NL				√	√	√		√	√						√					
NL311	02/01/18	22	?	SR	WL				√	√	√		√			√	√	√					√	√	
NL320	17/11/17	32	?	N.D.	NL				√	√			√	√						√					
NL321	22/12/17	26	?	N.D.	NL	√			√	√			√	√						√					
NL322	02/01/18	26	?	N.D.	WL				√	√	√			√		√	√	√	√	√			√	√	√
SL05	11/11/16	98	F	YR	WL					√	√		√				√	√						√	
SL27	29/06/15	52	M	YR	WL				√	√	√					√		√						√	
SL40	19/01/18	79	F	YR	WL					√	√		√				√	√						√	
SL42	18/12/15	17	?	SR	NL/WL	√			√	√	√			√		√	√					√	√		
SL44	23/01/18	39	?	YR	WL					√	√		√			√	√						√		
SL47	28/06/17	34	?	SR	WL				√	√	√		√			√	√	√				√		√	
SL50	05/01/16	17	?	SR	WL					√	√	√						√	√						√
SL54	07/10/17	26	?	N.D.	WL					√	√					√	√		√				√		√
SL59	07/10/17	18	?	N.D.	WL					√	√		√			√	√	√				√	√	√	
SL60	03/01/18	27	?	N.D.	WL					√	√							√	√					√	
WL04	30/12/15	52	F?	YR	NL/WL	√		√	√	√				√		√				√		√			
WL05	17/11/17	100	F?	YR	NL			√	√	√			√	√		√				√		√			
WL11	27/07/17	67	F*	YR	NL			√	√	√			√	√		√				√					
WL15	19/01/18	114	M*	YR	WL			√	√	√	√					√	√	√						√	
WL17	13/11/17	43	?	YR	NL/WL			√	√	√	√	√	√	√		√	√	√		√					
WL21	04/08/17	74	F	SR	WL				√	√	√		√			√	√	√				√	√		
WL28	25/10/17	33	F	SR	WL				√	√	√		√			√						√			
WL29	03/12/17	45	F	SR	WL					√	√		√				√						√		
WL42	23/01/18	136	?	YR	WL				√	√	√		√				√	√					√	√	
WL44	29/12/17	53	F	YR	WL			√	√	√	√		√			√	√	√					√	√	
WL46	17/08/17	91	?	YR	NL/WL			√	√	√	√		√			√	√					√	√		
WL47	13/12/16	35	?	YR	WL	√			√	√	√	√	√			√	√	√				√	√	√	
WL50	18/06/15	77	F*	YR	WL				√	√	√		√			√	√	√				√	√	√	
WL58	26/09/16	17	?	SR	WL					√			√			√	√	√					√		
WL61	19/01/18	100	?	YR	WL				√	√	√						√	√						√	
WL62	15/12/17	95	F?	YR	WL				√	√	√	√	√			√	√	√						√	
WL66	09/06/17	20	F	SV	WL					√			√			√						√			
WL68	23/01/18	61	F*	YR	WL					√	√						√	√					√		
WL69	22/11/17	96	F	YR	WL					√	√	√	√				√	√						√	
WL72	23/01/18	112	F	YR	WL				√	√	√					√	√	√					√	√	
WL74	04/08/17	50	?	YR	WL					√	√		√				√	√					√	√	
WL79	23/01/18	72	?	YR	WL				√	√			√			√	√					√			
WL91	07/12/17	90	?	YR	WL					√	√	√	√				√	√						√	
WL92	04/12/17	36	?	SR	WL					√	√		√				√	√					√	√	
WL94	31/10/17	67	F	YR	WL					√	√		√					√						√	
WL97	21/12/17	16	?	SV	WL				√	√	√		√			√		√				√		√	
WL98	29/11/17	34	F	SR	WL				√	√	√		√			√	√					√	√		
WL109	23/01/18	102	?	YR	WL				√	√	√		√			√	√	√					√		
WL114	23/01/18	68	F?	YR	WL				√	√	√		√				√	√					√	√	
WL116	01/09/16	69	?	YR	WL				√	√	√		√				√	√					√	√	
WL118	21/12/17	65	F	YR	WL					√	√		√				√	√					√		
WL120	25/09/17	71	?	SR	WL				√	√			√			√						√			
WL122	13/04/15	17	?	SR	WL				√	√	√		√			√						√			

Table 6. (cont'd)

	Last				Primary	Occurrence in Survey Areas								50% UD Core Area						25% UD Core Area					
ID#	Sighted	# STG	Gender	Residency	Range	DB	EL	NEL	NWL	WL	SWL	SEL	CH	LKC	BR	TO	PH	FL	SL	LKC	BR	TO	PH	FL	SL
WL123	23/01/18	120	F?	YR	WL				√	√	√		√				√	√						√	
WL124	07/09/17	58	F	SR	WL				√	√	√		√			√	√					√	√		
WL128	26/10/17	52	?	YR	WL					√	√		√				√	√					√	√	
WL129	02/01/18	26	F	SR	WL					√	√		√				√	√					√	√	
WL130	16/01/18	81	?	YR	WL				√	√	√						√	√						√	
WL131	29/12/17	125	?	YR	WL				√	√	√		√				√	√					√	√	
WL137	23/01/18	72	F	YR	WL				√	√	√		√				√	√					√	√	
WL142	04/08/17	68	?	YR	WL					√	√		√					√						√	
WL144	26/10/17	32	?	SR	WL					√	√		√				√	√					√		
WL145	26/01/18	39	F	SR	WL				√	√			√			√						√			
WL152	23/01/18	88	?	YR	WL				√	√	√						√	√					√	√	
WL159	04/07/17	24	F	SV	WL				√	√			√			√						√			
WL165	29/02/16	65	?	YR	WL					√	√						√	√						√	
WL166	06/06/17	16	?	SR	WL					√	√						√						√		
WL168	19/01/18	33	?	YR	WL					√	√		√			√	√	√				√	√	√	
WL170	29/06/15	28	?	SR	WL				√	√	√		√				√	√						√	
WL171	05/01/18	30	F	YR	WL					√	√						√	√					√	√	
WL173	12/12/17	69	?	YR	WL					√	√		√				√	√						√	
WL178	19/07/16	18	?	SV	WL				√	√	√	√	√			√	√					√			
WL179	09/11/17	33	F	SR	NL/WL				√	√			√	√		√	√	√				√	√		
WL180	23/01/18	84	F?	YR	WL					√	√		√				√	√						√	
WL188	12/10/17	17	?	SV	NL	√			√	√				√						√					
WL189	25/05/16	17	?	SR	WL				√	√						√	√					√			
WL191	08/08/17	27	?	YR	WL				√	√			√			√	√	√				√	√		
WL199	13/09/17	43	?	YR	WL				√	√	√						√	√					√		
WL207	28/06/17	22	F	SR	WL				√	√						√	√					√			
WL208	17/05/17	38	F	YR	WL				√	√	√					√	√	√					√	√	
WL210	04/08/17	24	?	SR	WL					√	√		√			√	√	√					√	√	
WL211	03/01/18	26	F	YR	WL					√	√						√						√		
WL214	22/12/17	24	?	SR	WL				√	√			√			√	√					√			
WL215	23/01/18	54	?	YR	WL				√	√	√		√			√	√	√					√	√	
WL216	07/09/17	33	?	SR	WL				√	√	√		√			√	√	√				√	√		
WL217	24/10/17	21	?	SR	WL				√	√	√					√	√					√			
WL220	29/12/17	49	?	YR	WL					√	√		√				√	√					√	√	
WL221	23/01/18	52	?	YR	WL				√	√	√		√			√	√	√	√			√		√	√
WL226	17/08/17	15	?	N.D.	WL					√			√			√	√					√			
WL229	23/01/18	18	?	SR	WL					√	√		√			√	√	√				√			
WL230	10/12/17	20	?	SR	WL					√	√					√	√	√					√	√	
WL231	25/05/16	17	?	N.D.	WL				√	√	√		√			√	√					√	√		
WL232	23/01/18	36	?	YR	WL				√	√	√					√		√	√			√			
WL234	07/12/17	24	?	SR	WL				√	√	√					√	√	√	√				√	√	√
WL235	27/04/17	27	?	YR	WL				√	√	√					√	√	√	√			√			√
WL241	19/01/18	18	?	N.D.	WL				√	√	√		√			√	√	√				√	√	√	
WL243	19/01/18	40	?	N.D.	WL				√	√	√	√				√			√			√			√
WL250	24/10/17	24	F	N.D.	WL					√	√	√	√					√	√					√	√
WL254	12/12/17	16	F	N.D.	WL					√	√		√				√	√					√	√	
WL256	04/08/17	16	?	N.D.	WL					√	√		√				√	√					√	√	
WL260	12/12/17	24	?	N.D.	WL					√	√		√				√	√	√				√		√
WL269	12/12/17	20	?	N.D.	WL					√	√		√				√	√					√	√	

Table 7. Number of individual dolphins involved in movements across different survey areas around Lantau in the 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

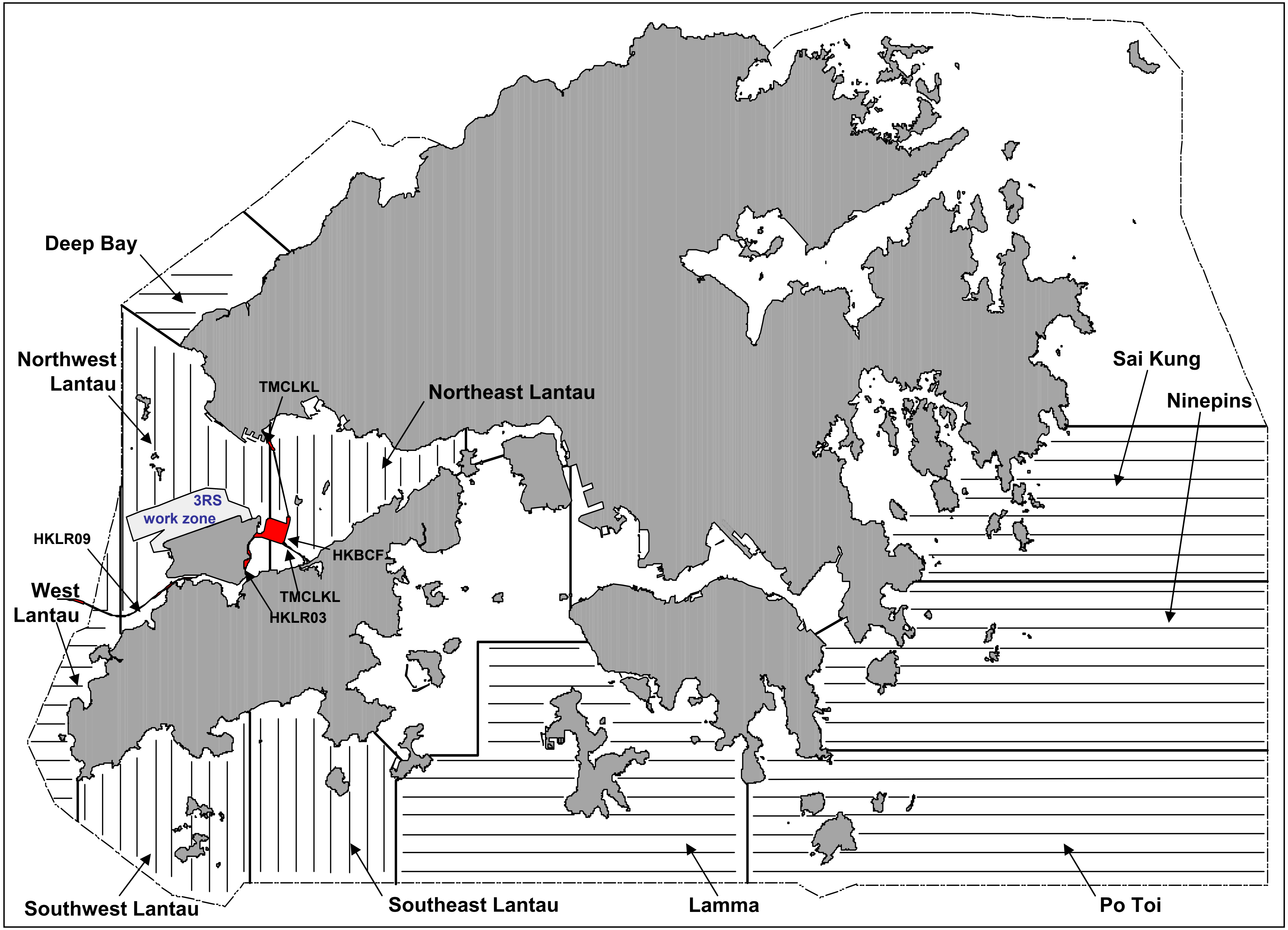


Figure 1. Ten Line-Transect Survey Areas within the Study Area for the 2017-18 Monitoring Study

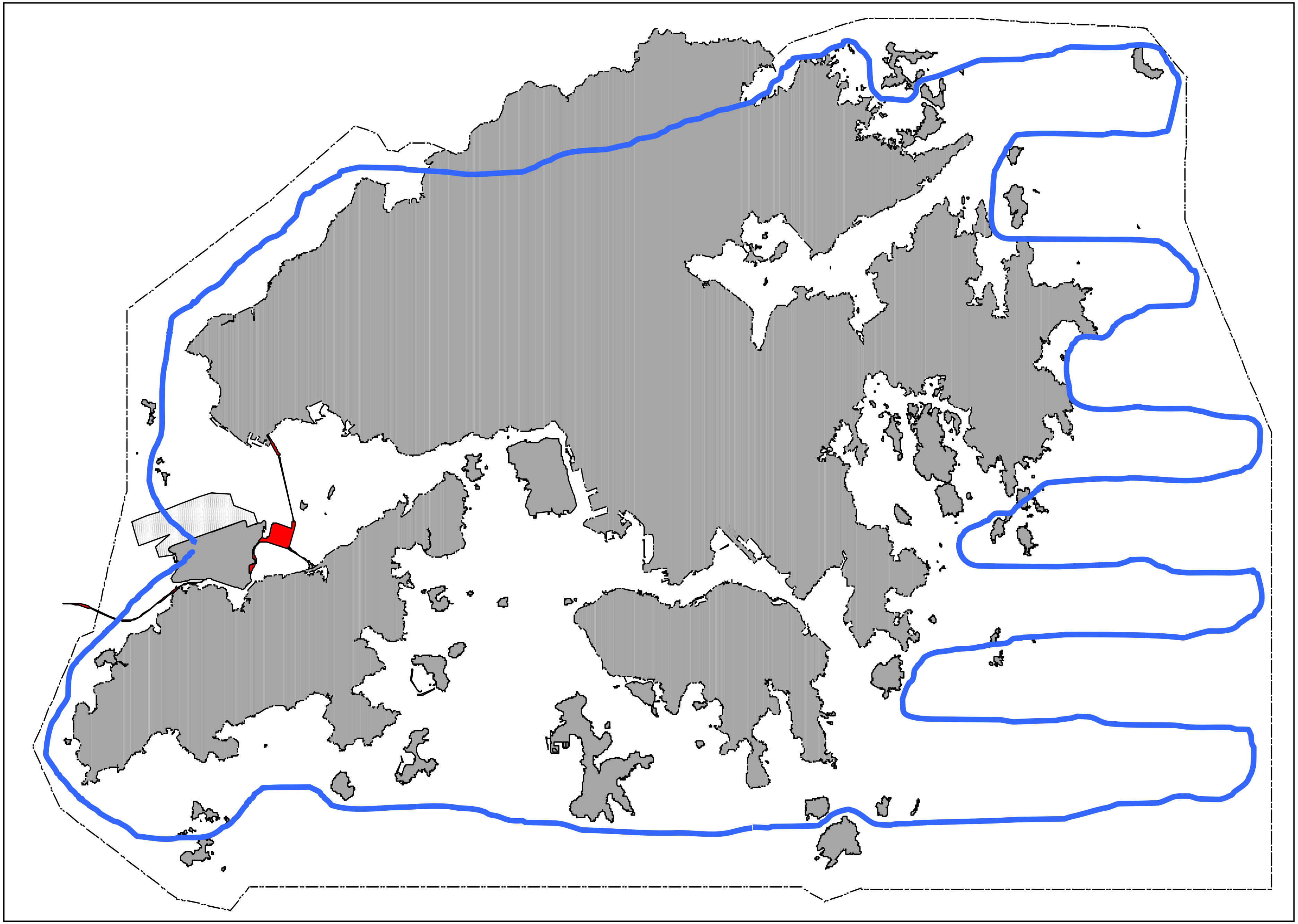


Figure 2. Indicative Survey Route for Helicopter Surveys in Eastern and Southern Waters of Hong Kong

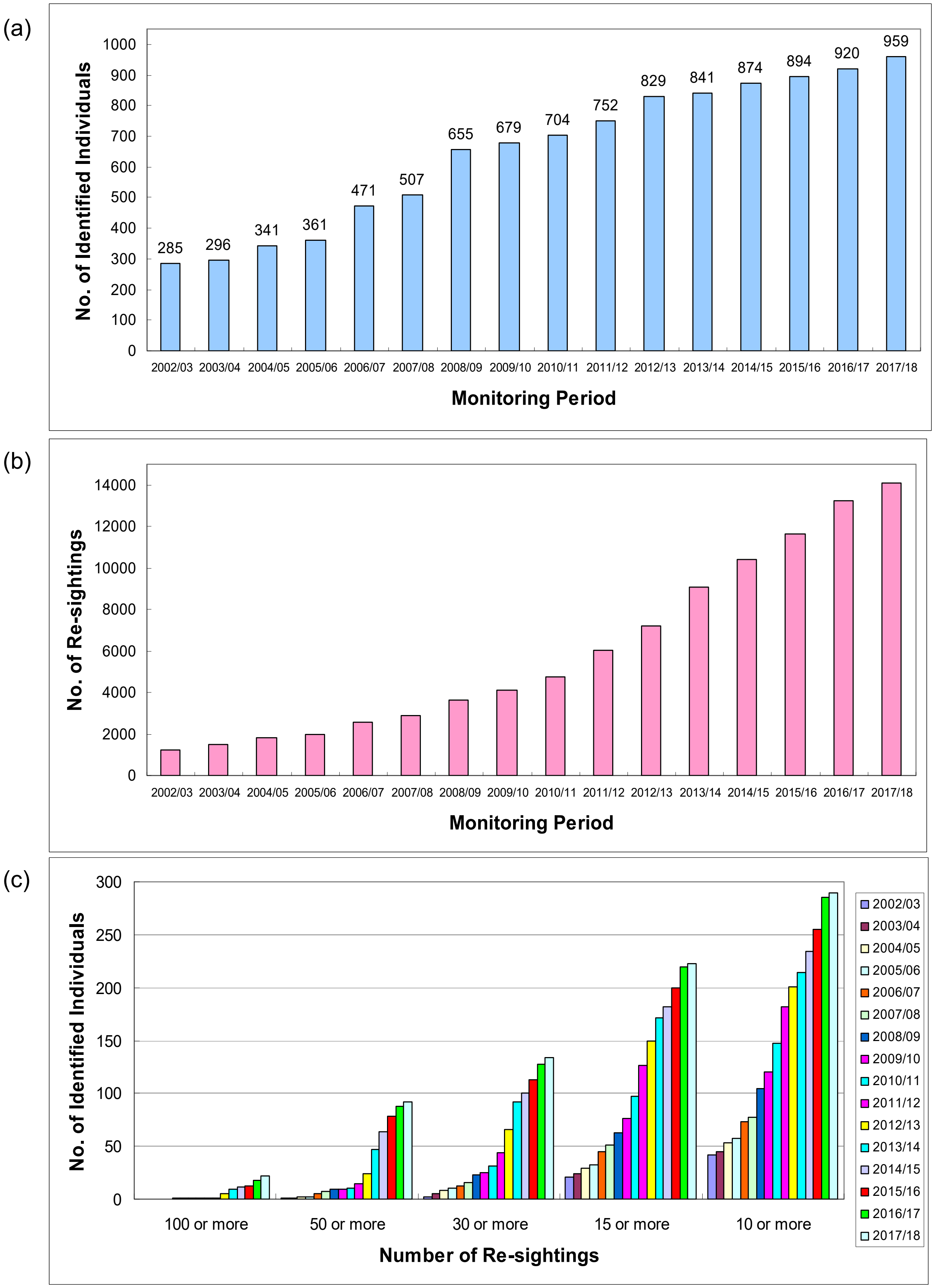


Figure 3. Temporal trends of (a) total number of identified individuals; (b) total number of re-sightings made; and (c) number of identified individuals within several categories of number of re-sightings in the past 16 monitoring periods since 2002

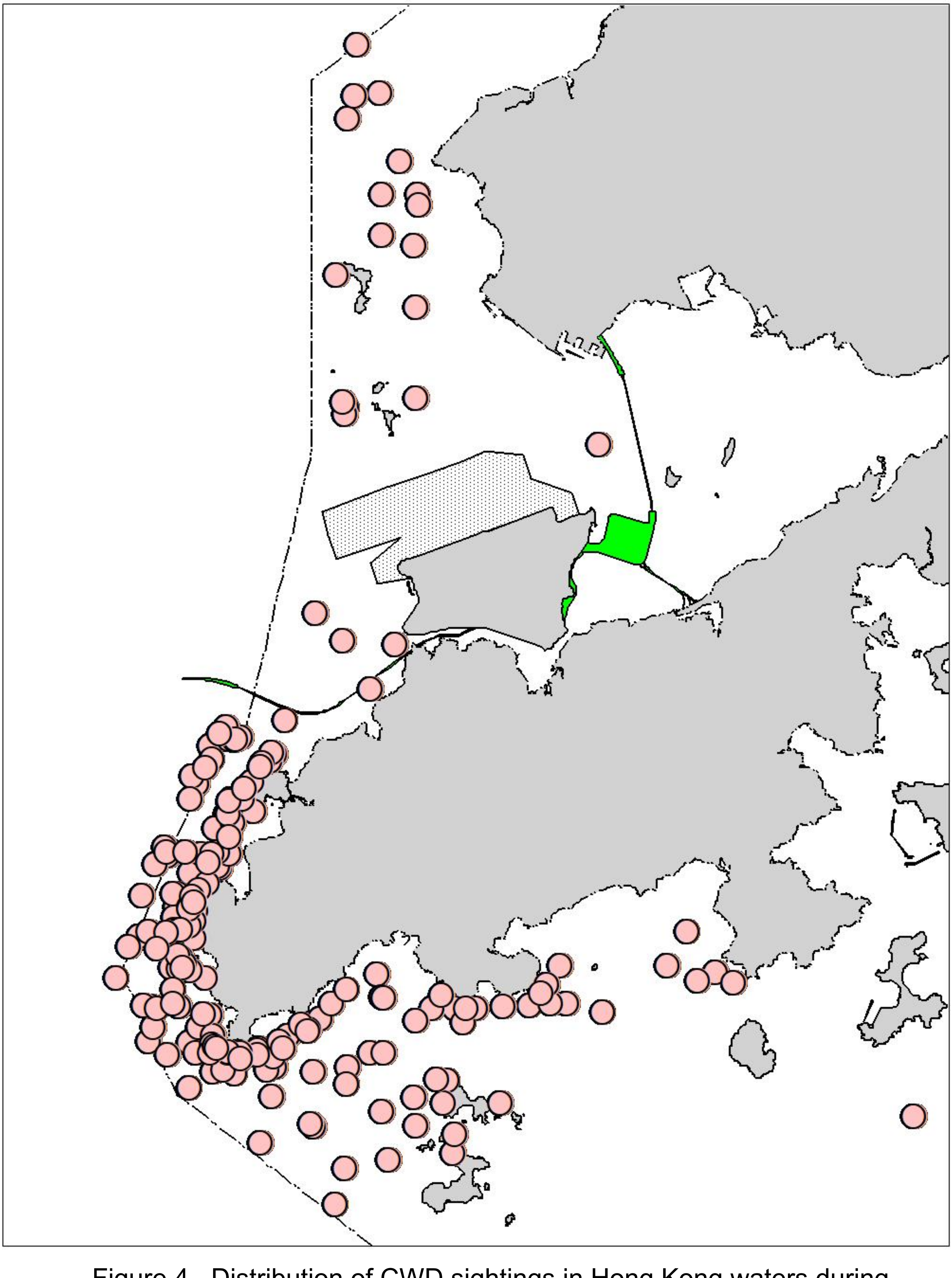


Figure 4. Distribution of CWD sightings in Hong Kong waters during AFCD monitoring surveys (April 2017 – March 2018)

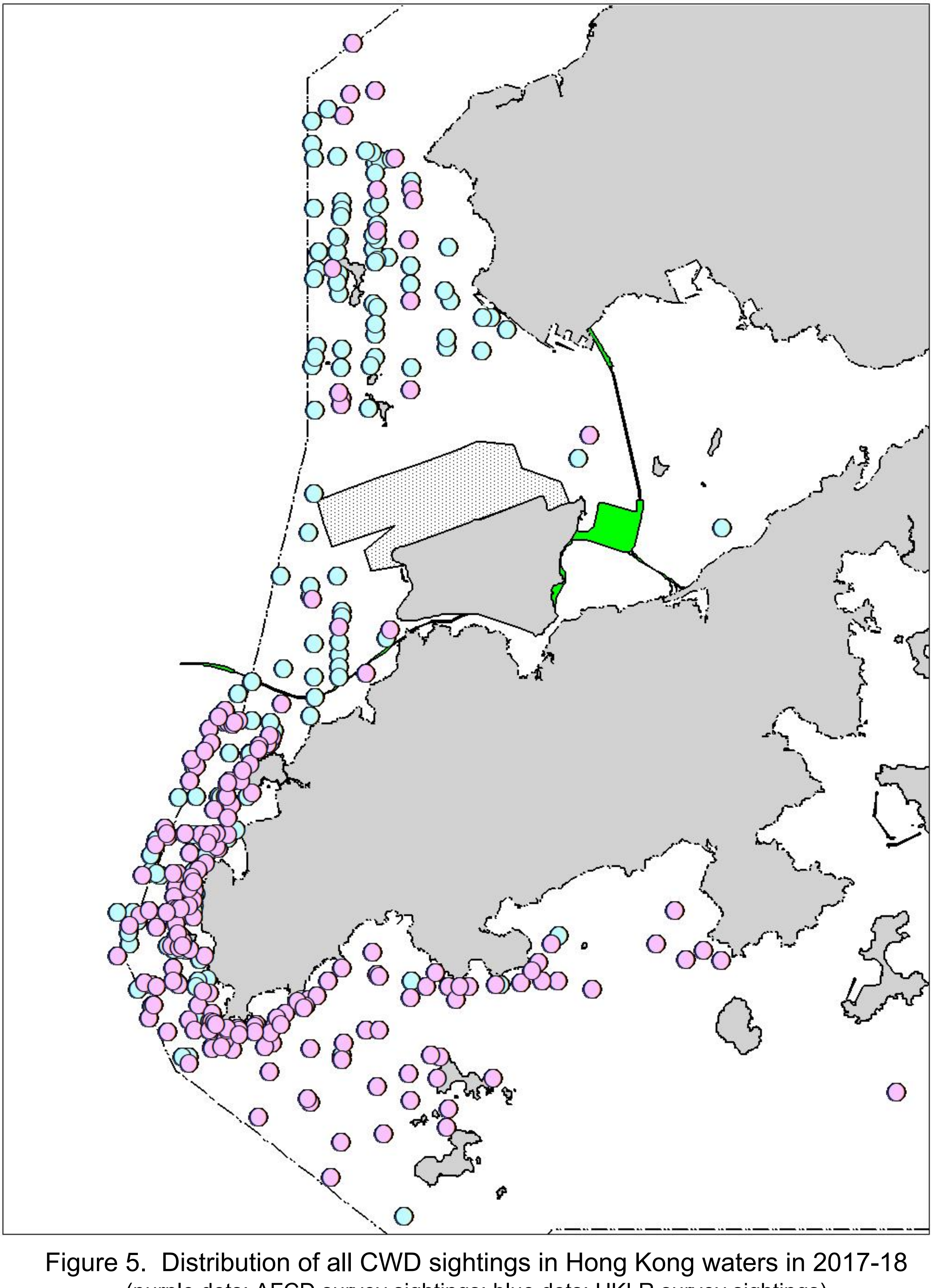


Figure 5. Distribution of all CWD sightings in Hong Kong waters in 2017-18
(purple dots: AFCD survey sightings; blue dots: HKLR survey sightings)

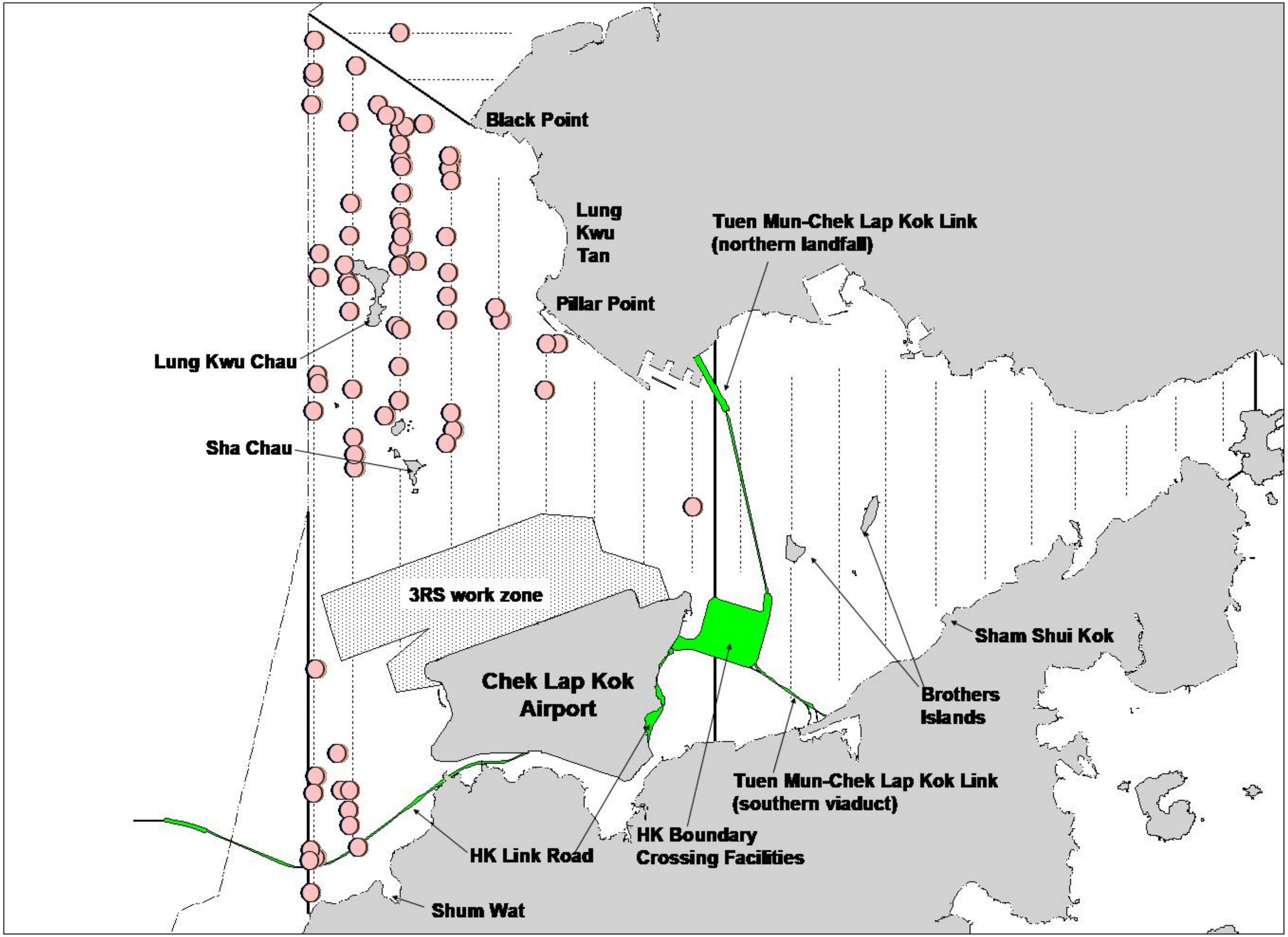


Figure 6. Distribution of Chinese White Dolphin sightings in North Lantau (2017)

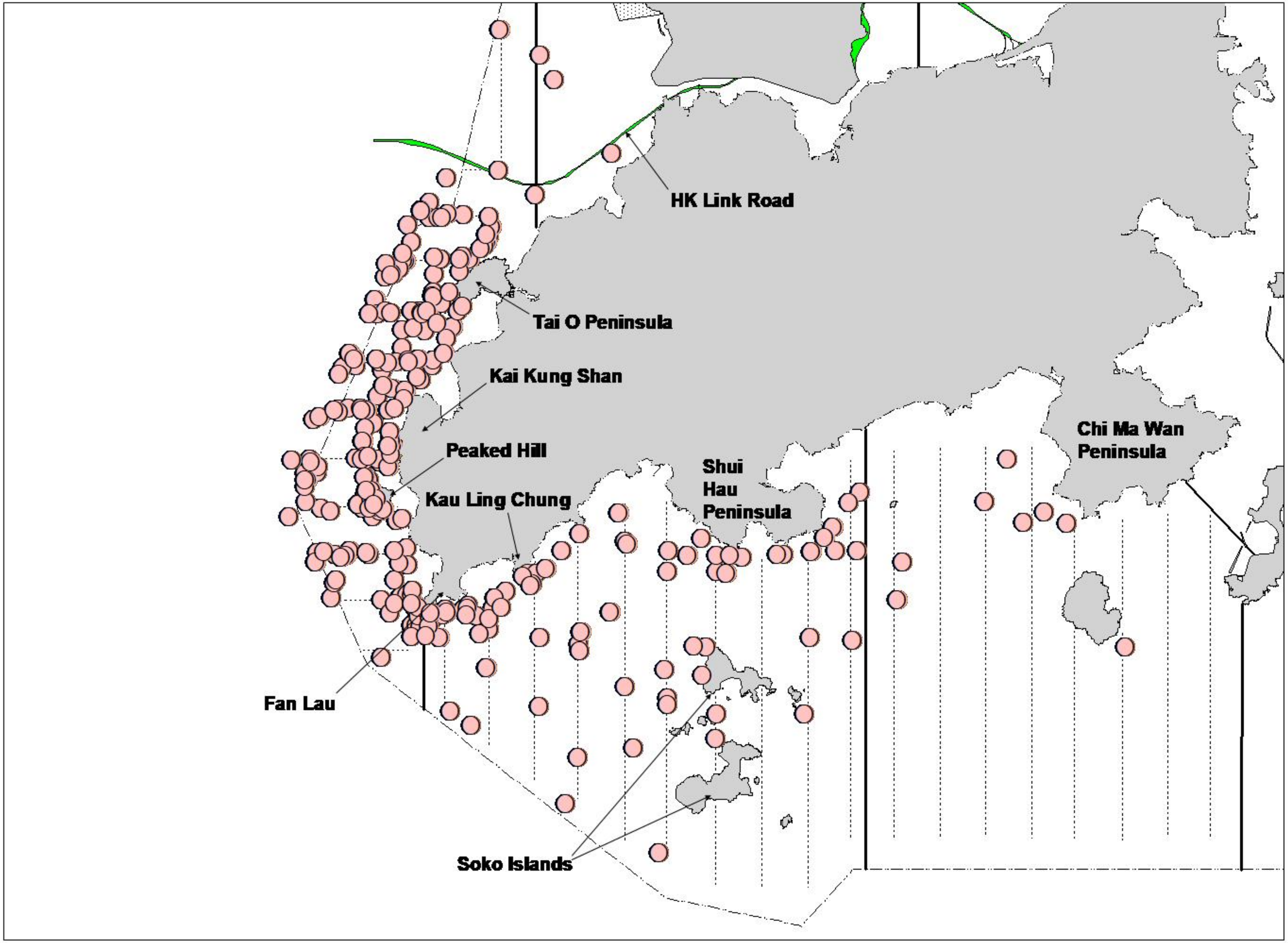


Figure 7. Distribution of Chinese White Dolphin sightings in West and South Lantau waters (2017)

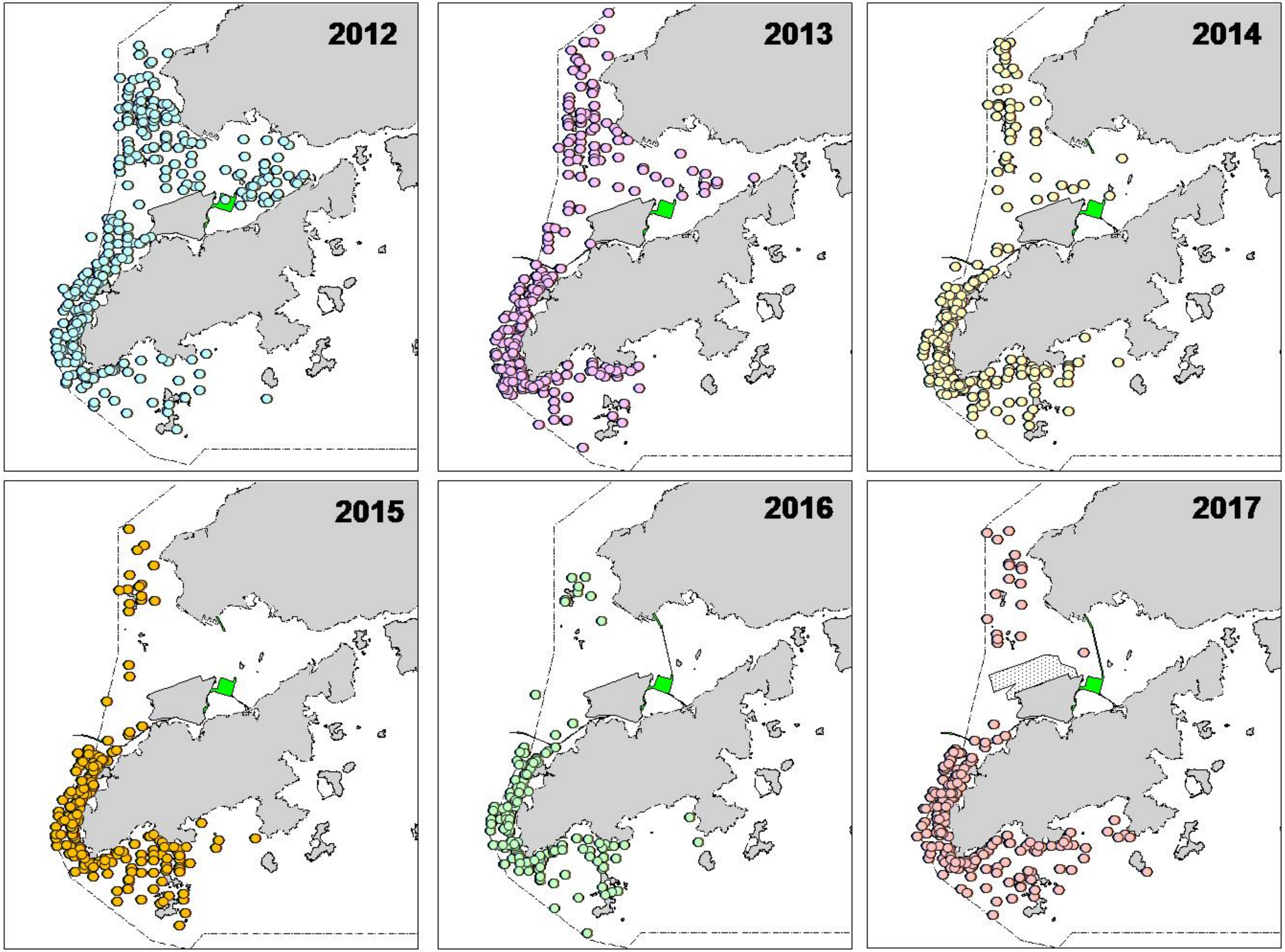


Figure 8. Comparison of dolphin distribution patterns from the past six years (2012-17)

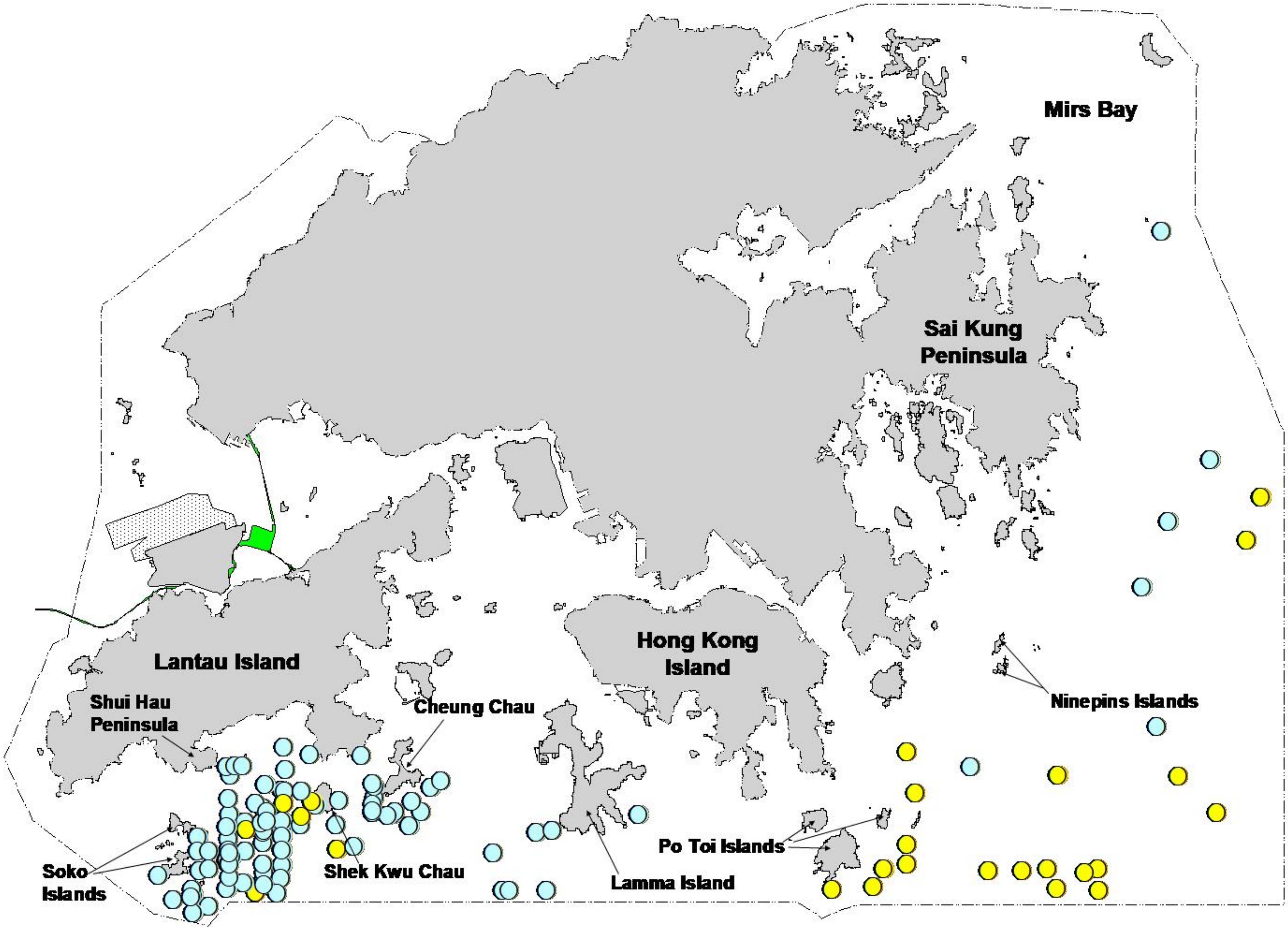


Figure 9. Distribution of finless porpoise sightings made during AFCD surveys (April 2017 – March 2018)
(yellow dots: sightings made during summer/autumn months)

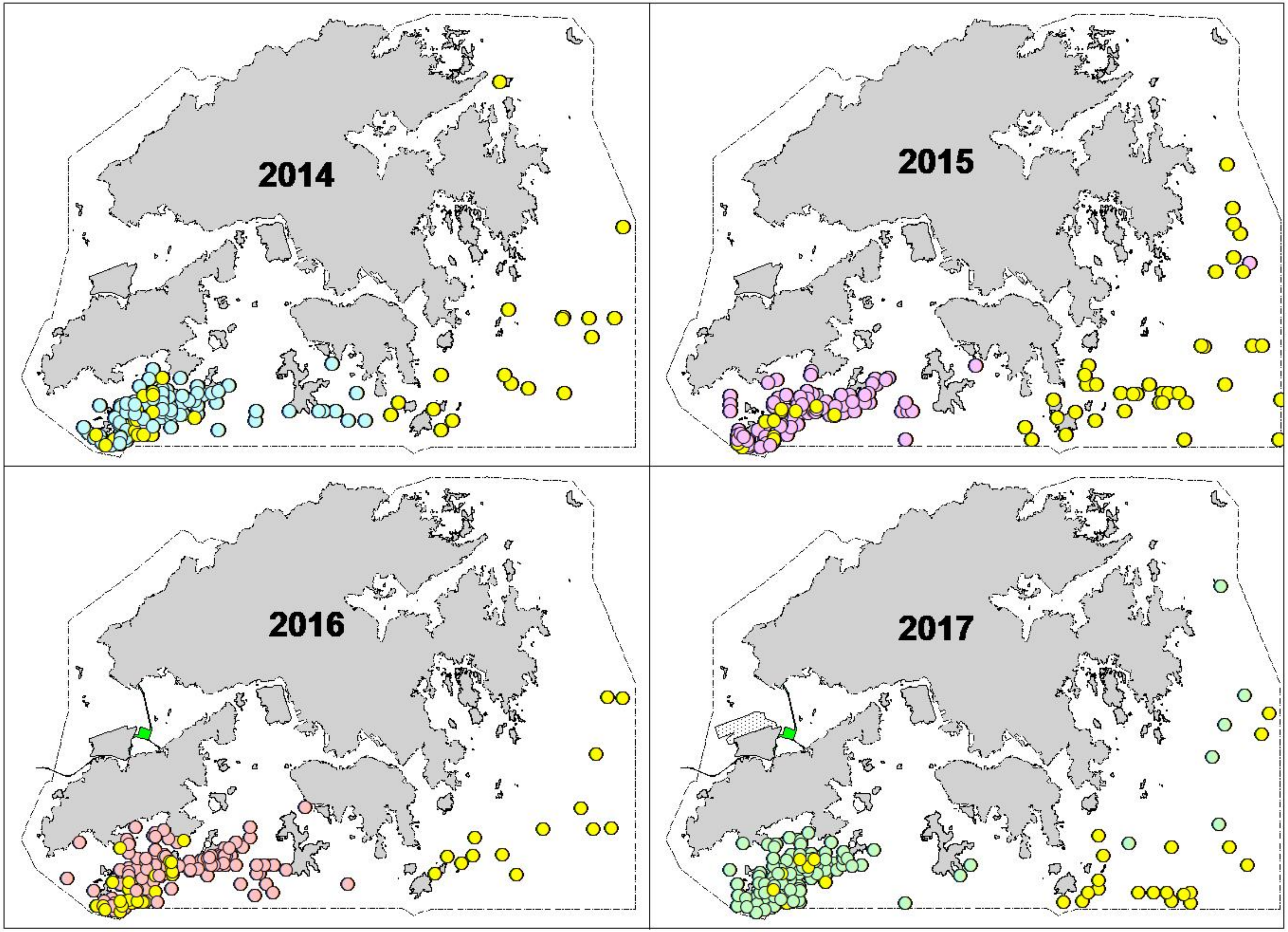


Figure 10. Comparison of annual porpoise distribution patterns from 2014-17
(yellow dots: sightings made during summer/autumn months)

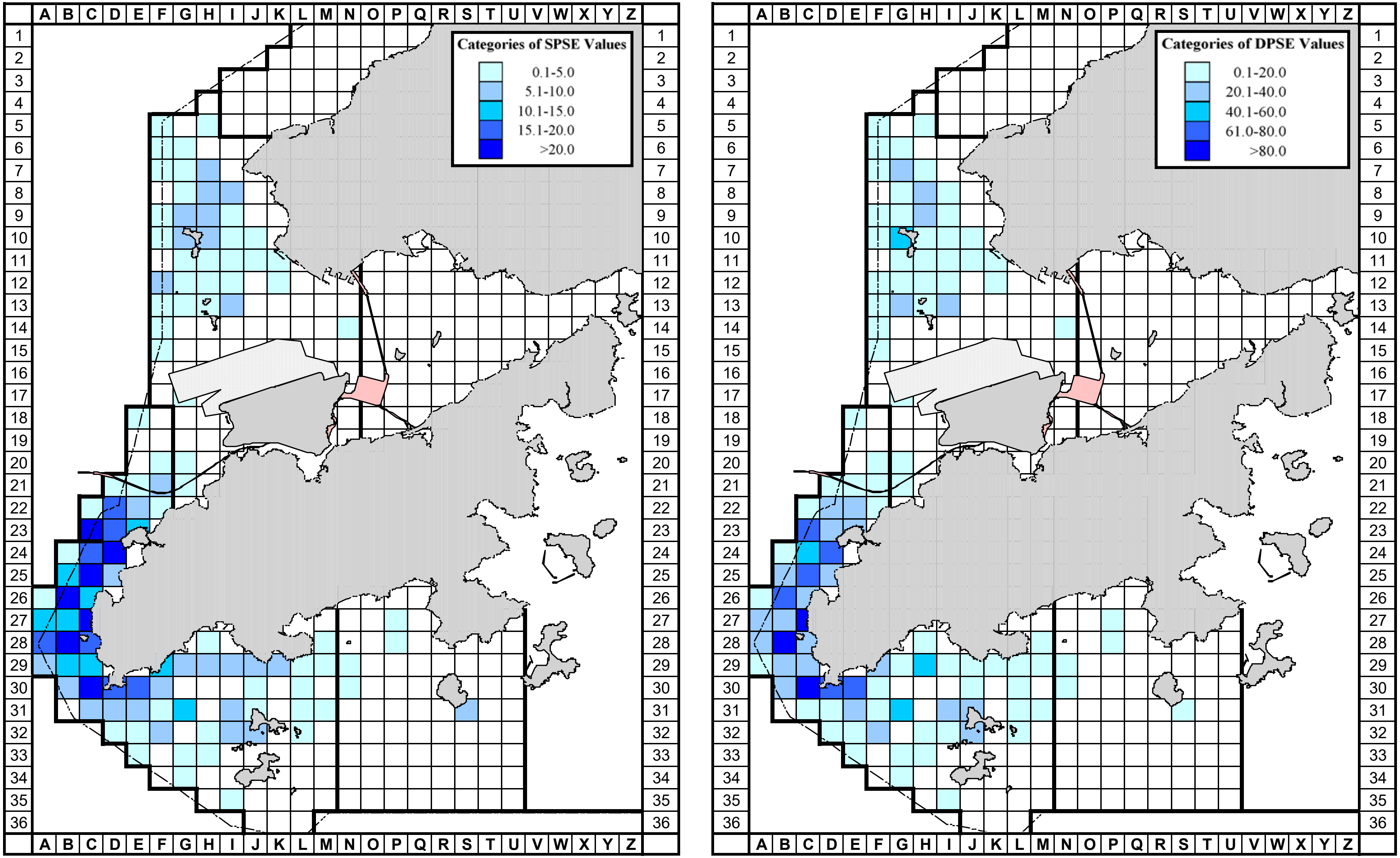
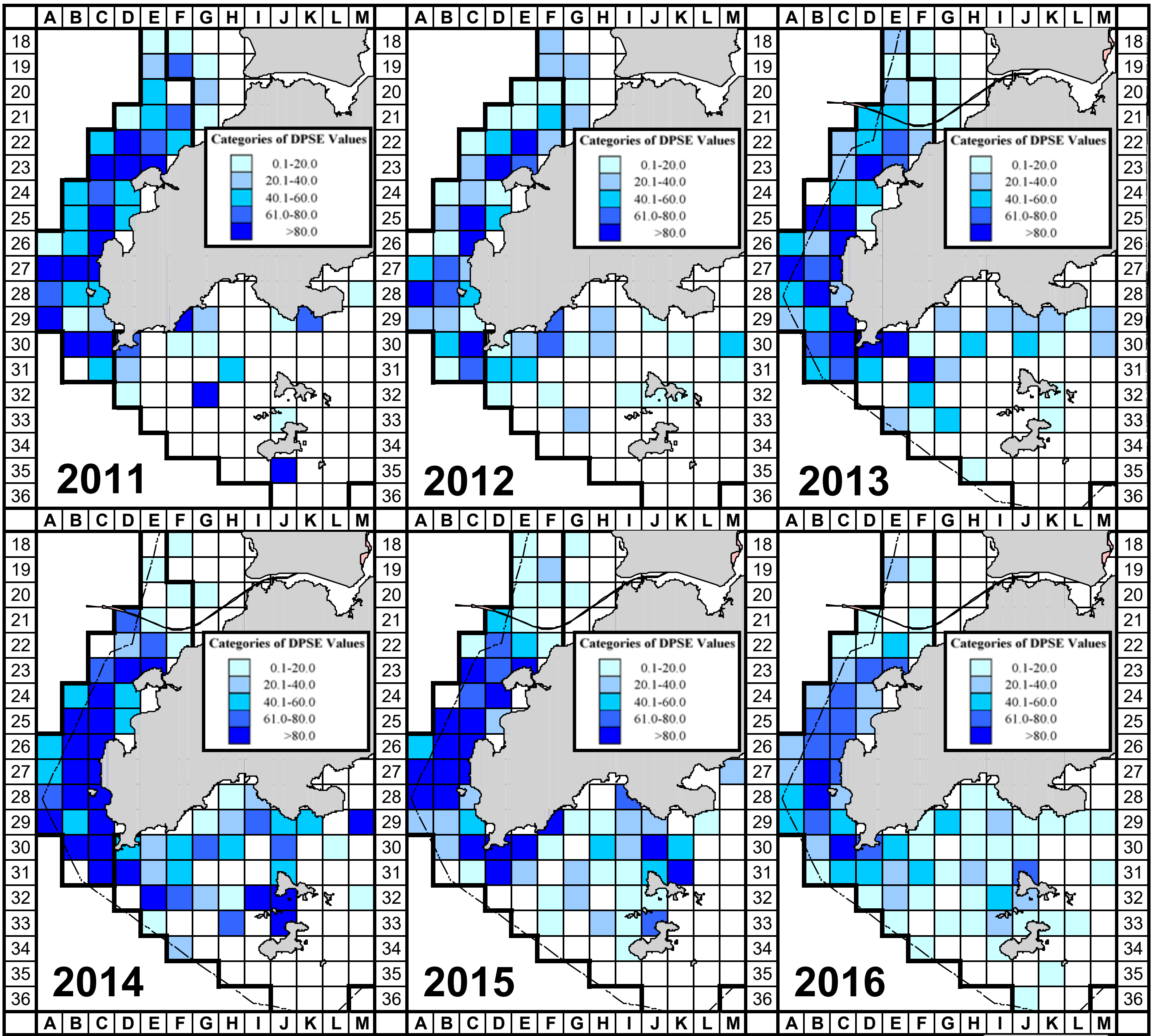


Figure 11. (left) Sighting density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island (number within grids represent "SPSE" = no. of on-effort dolphin sightings per 100 units of survey effort) (using data from January - December 2017)

(right) Density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort) (using data from January - December 2017)



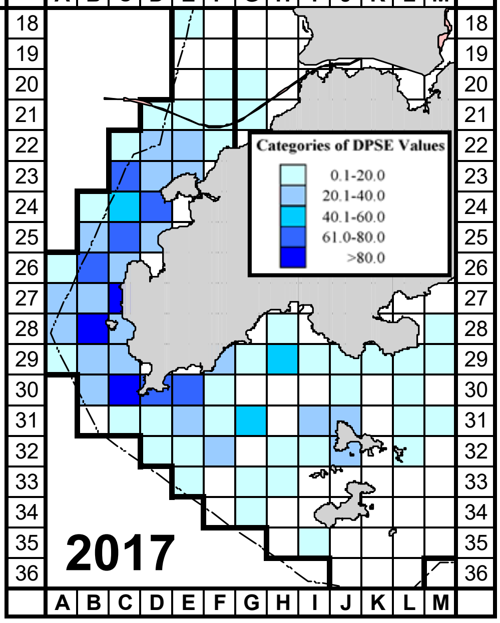
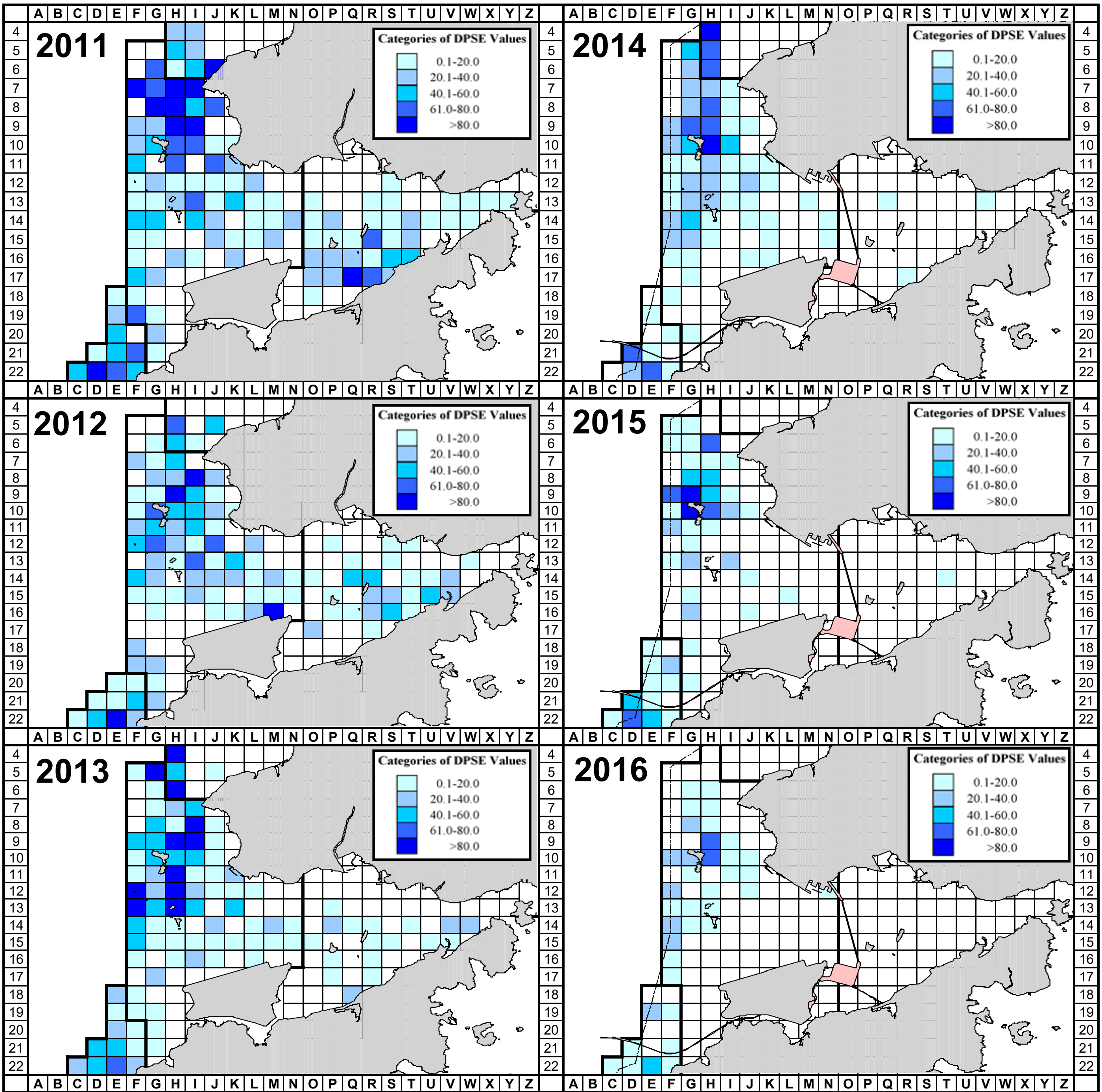


Figure 12. Comparison of Chinese white dolphin densities with corrected survey effort per km^2 in West and Southwest Lantau Waters in 2011-17 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)



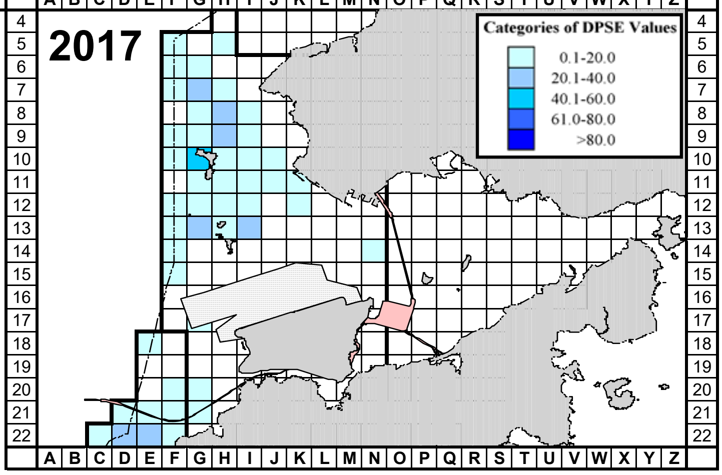


Figure 13. Comparison of dolphin densities with corrected survey effort per km^2 in North Lantau waters in 2011-17 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)

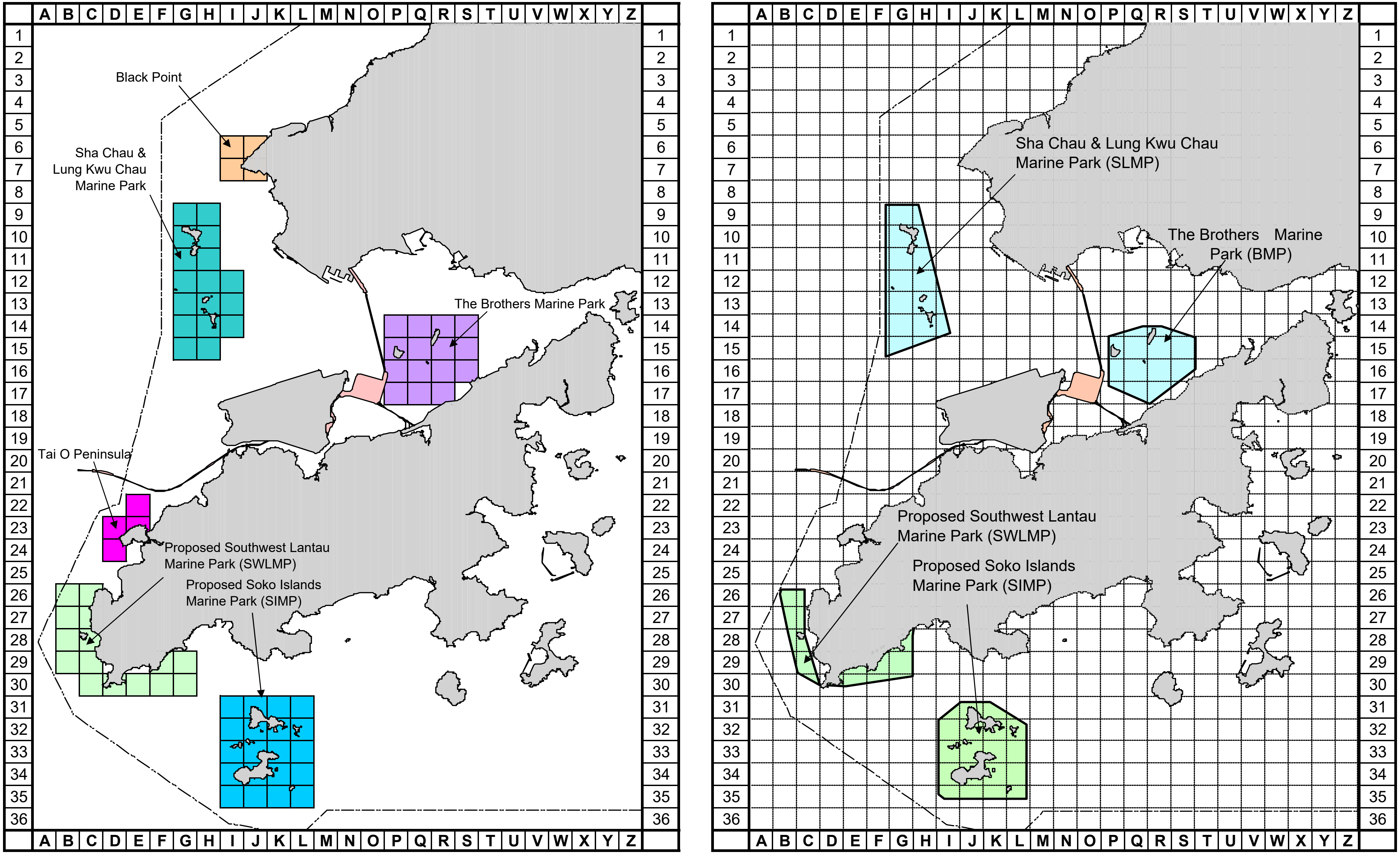


Figure 14. Grids of six key dolphin habitats that were examined for temporal trend in dolphin densities

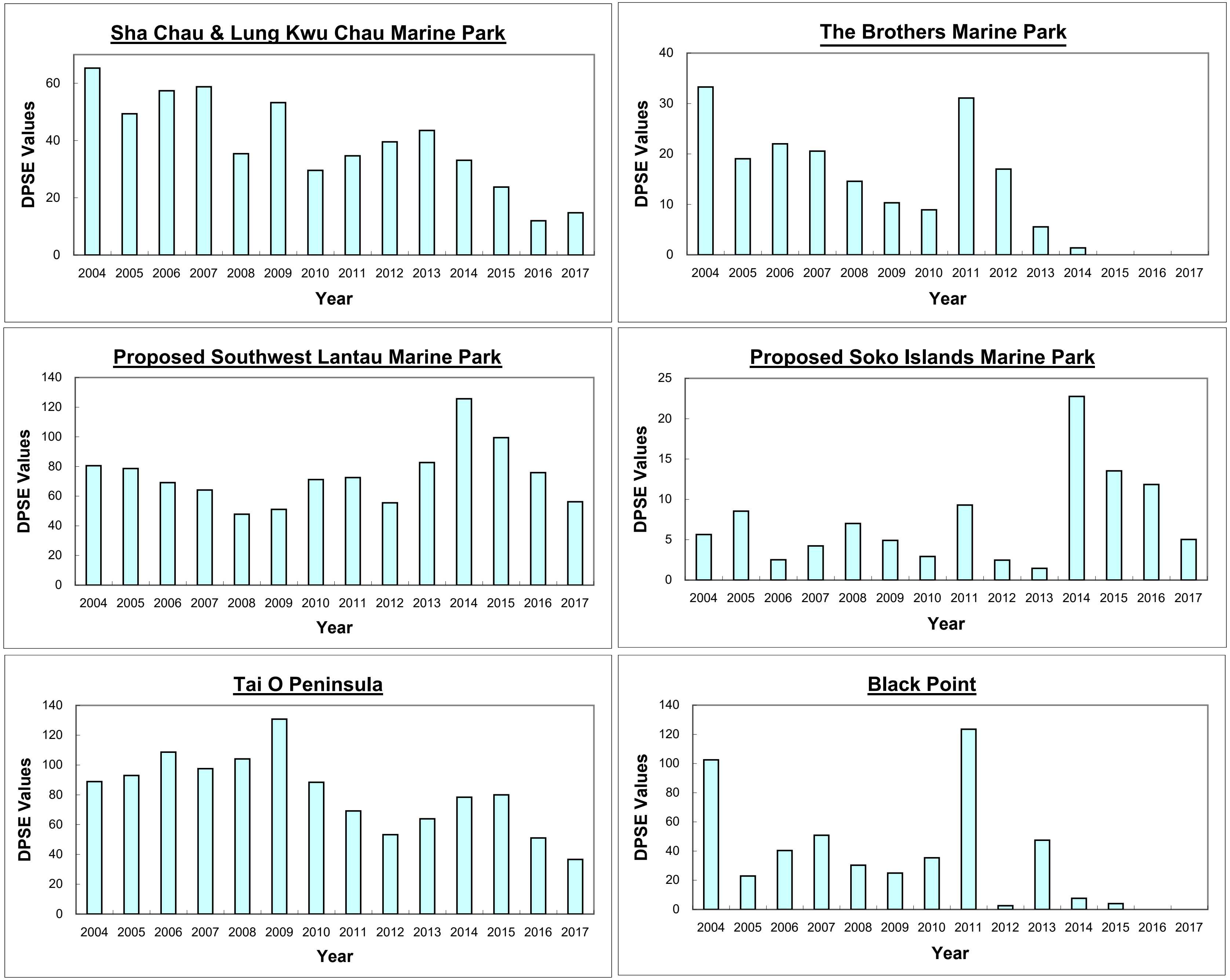


Figure 15. Temporal trend of dolphin densities (DPSE Values) at six key dolphin habitats in Lantau waters

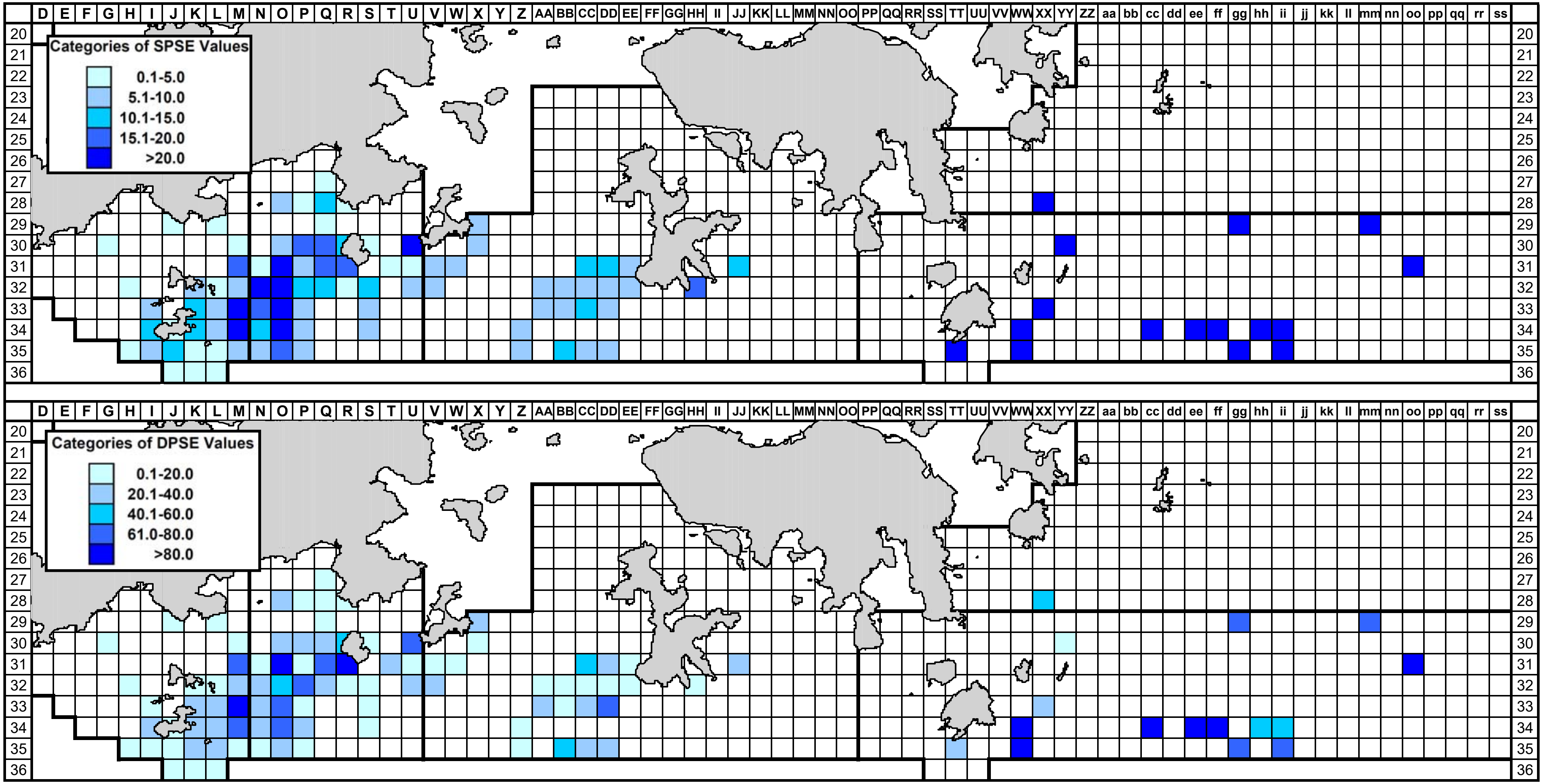


Figure 16. (top) Sighting density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong (number within grids represent "SPSE" = no. of on-effort porpoise sightings per 100 units of survey effort) (using data from January - December 2017)

(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 2017)

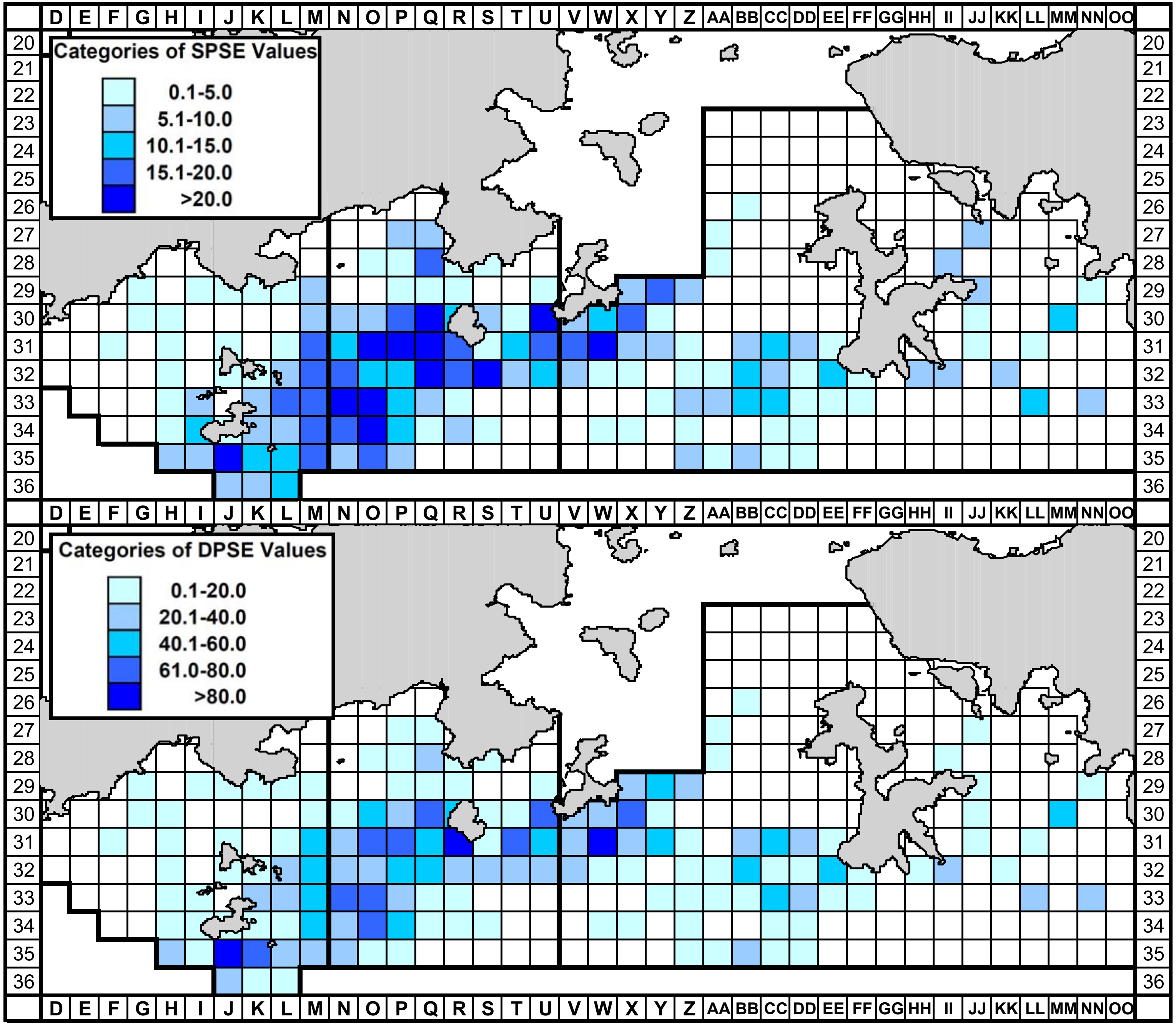


Figure 17. Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (December to May), using data collected during 2013-17 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effor

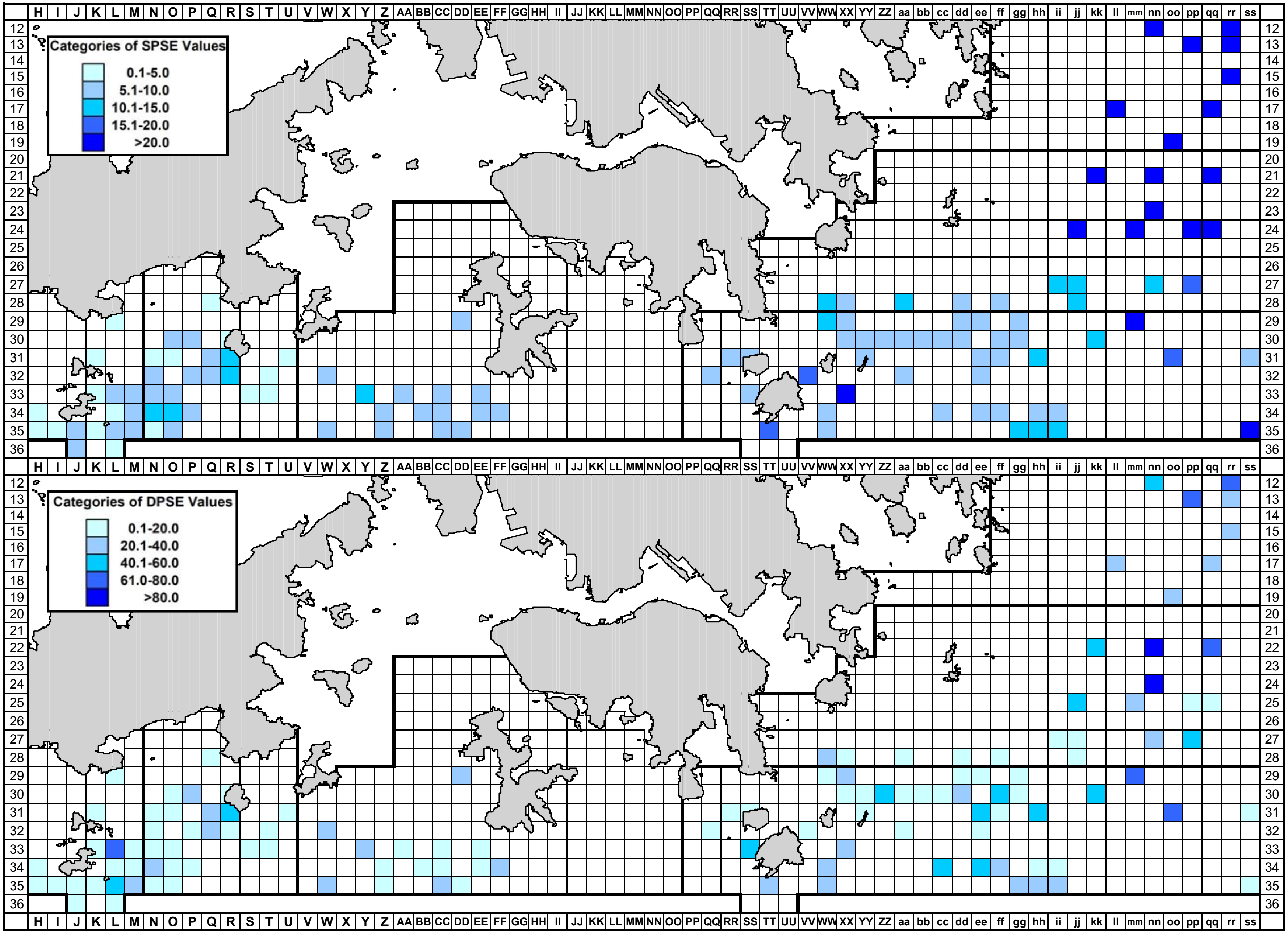


Figure 18. Density of finless porpoises with corrected survey effort per km^2 in southern and eastern waters of Hong Kong during wet season (June to November), using data collected during 2013-17 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort

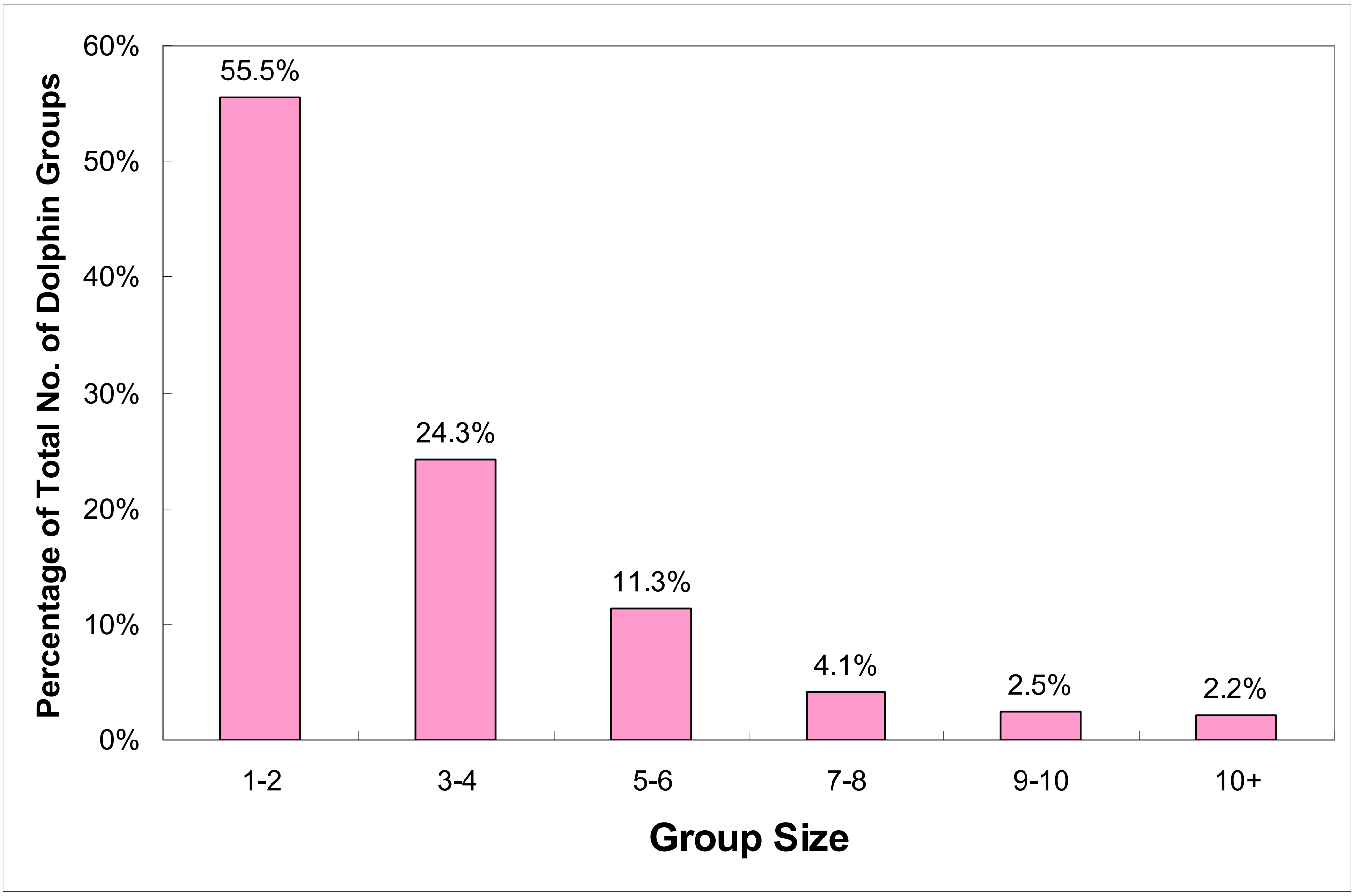


Figure 19. Percentages of different group sizes of Chinese white dolphins in Hong Kong during April 2017 to March 2018

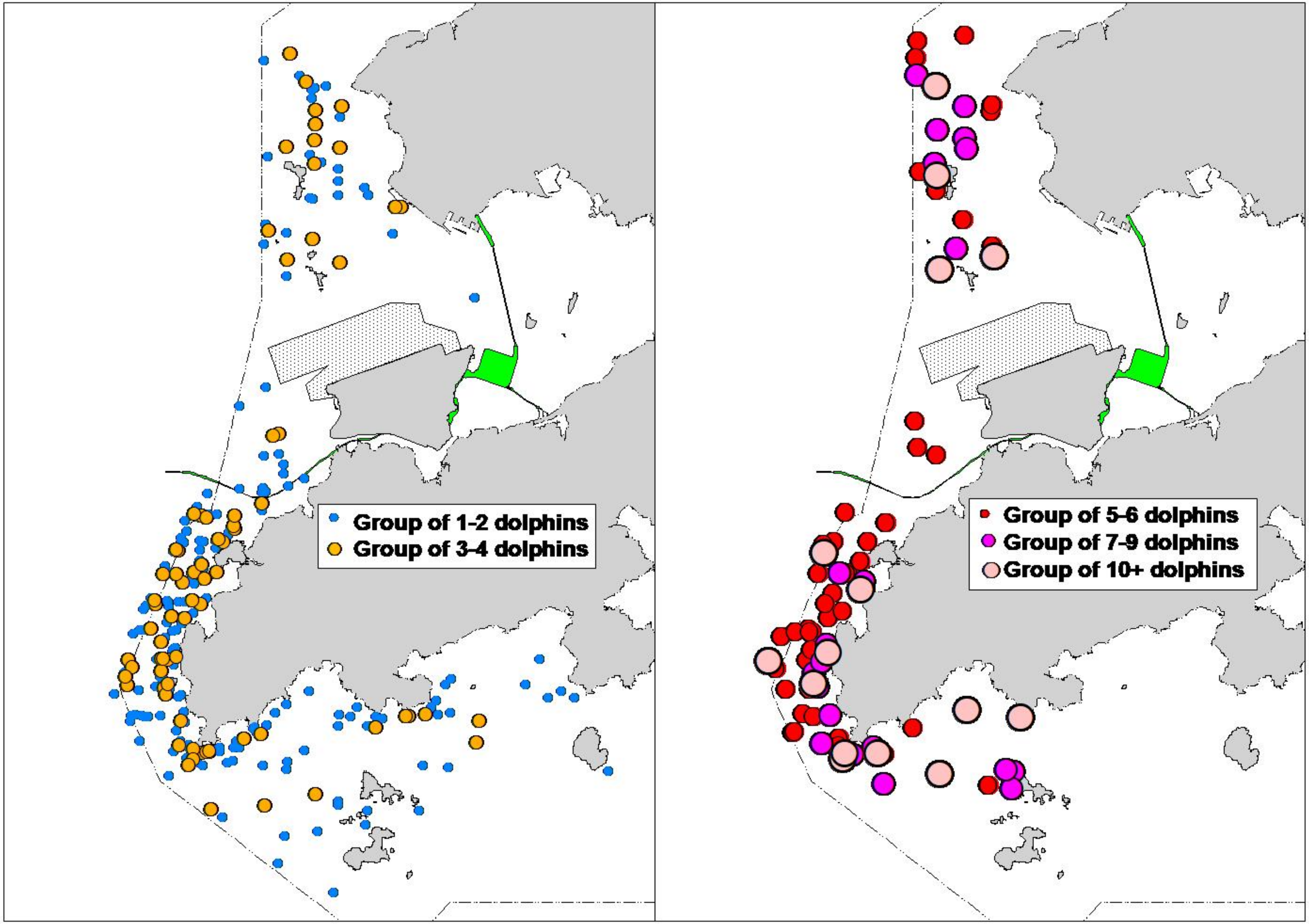


Figure 20. Distribution of Chinese White Dolphins with different group sizes in 2017

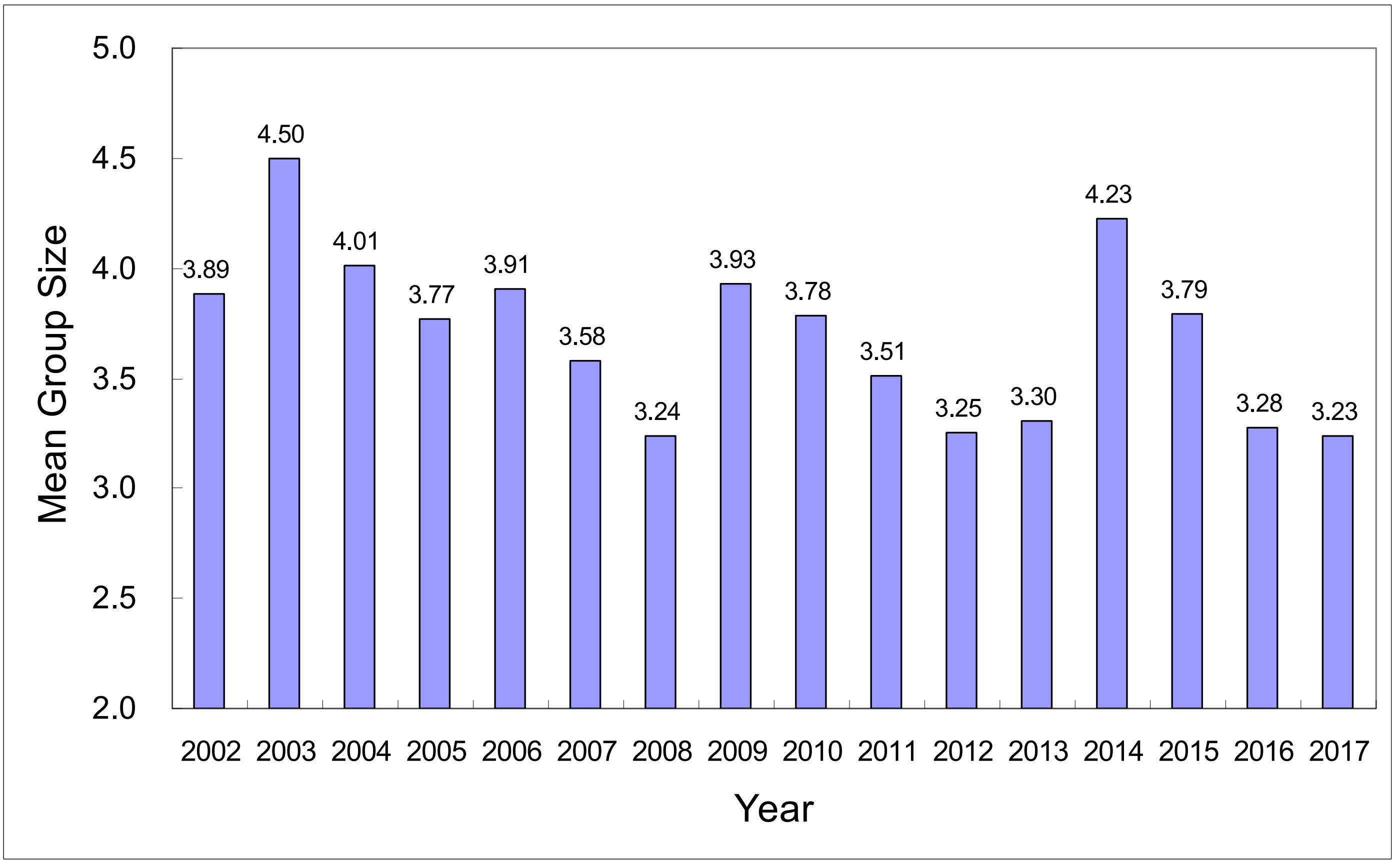


Figure 21. Temporal trend of mean dolphin group size in 2002-17

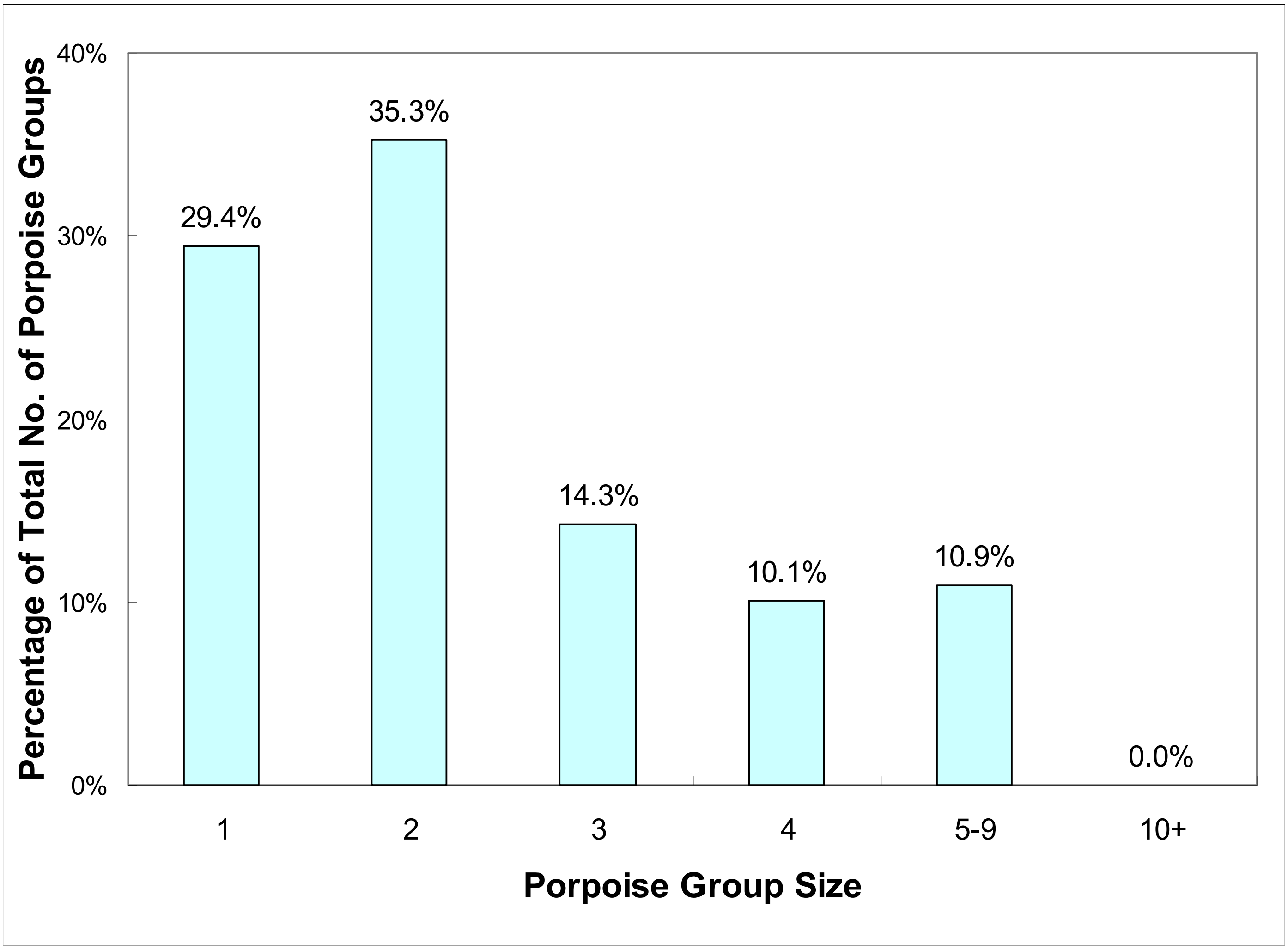


Figure 22. Percentages of different group sizes of finless porpoises in Hong Kong during April 2017 to March 2018

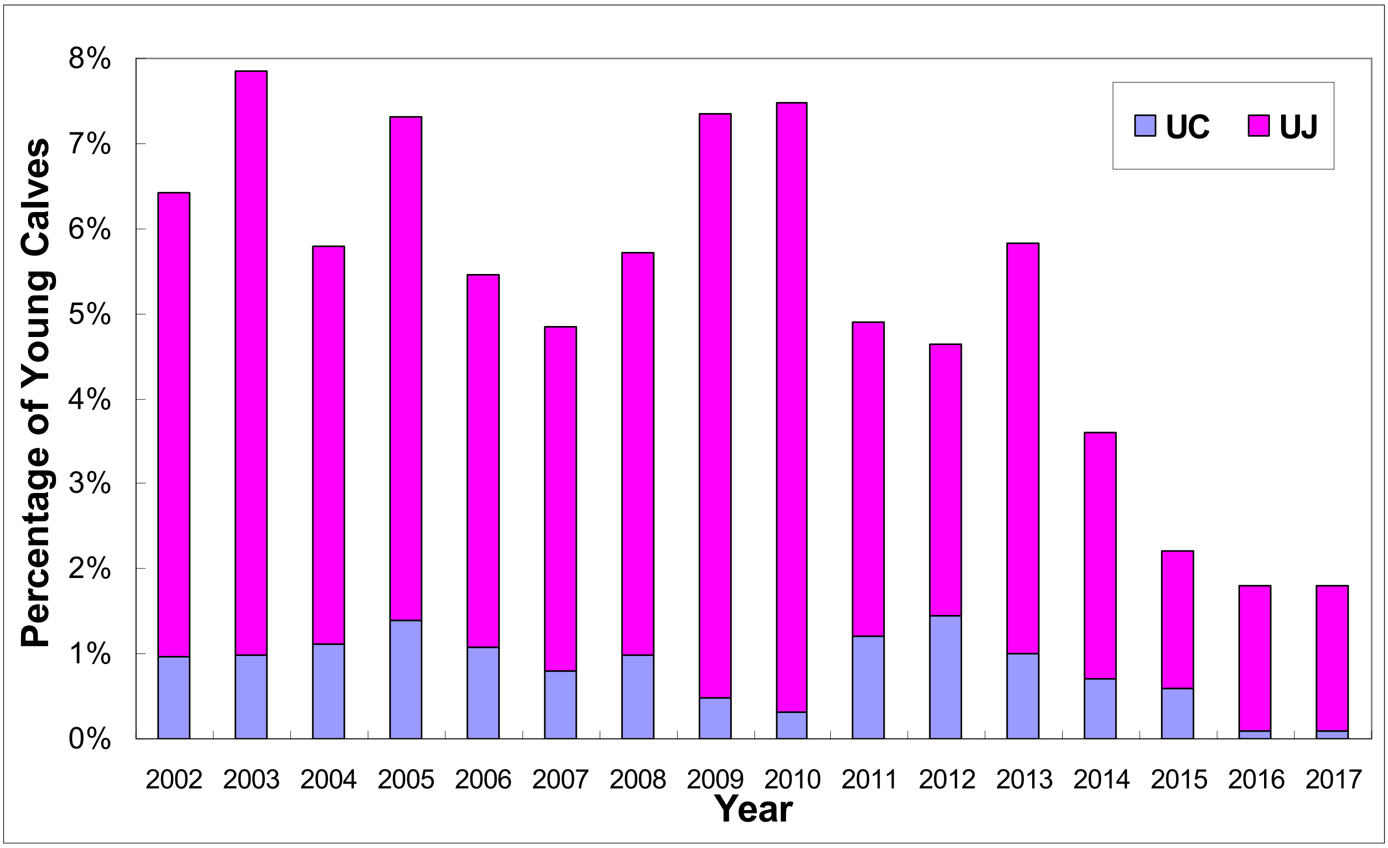


Figure 23. Percentages of young calves (i.e. Unspotted Calves (UC) and Unspotted Juveniles (UJ)) among all dolphin groups during 2002-17

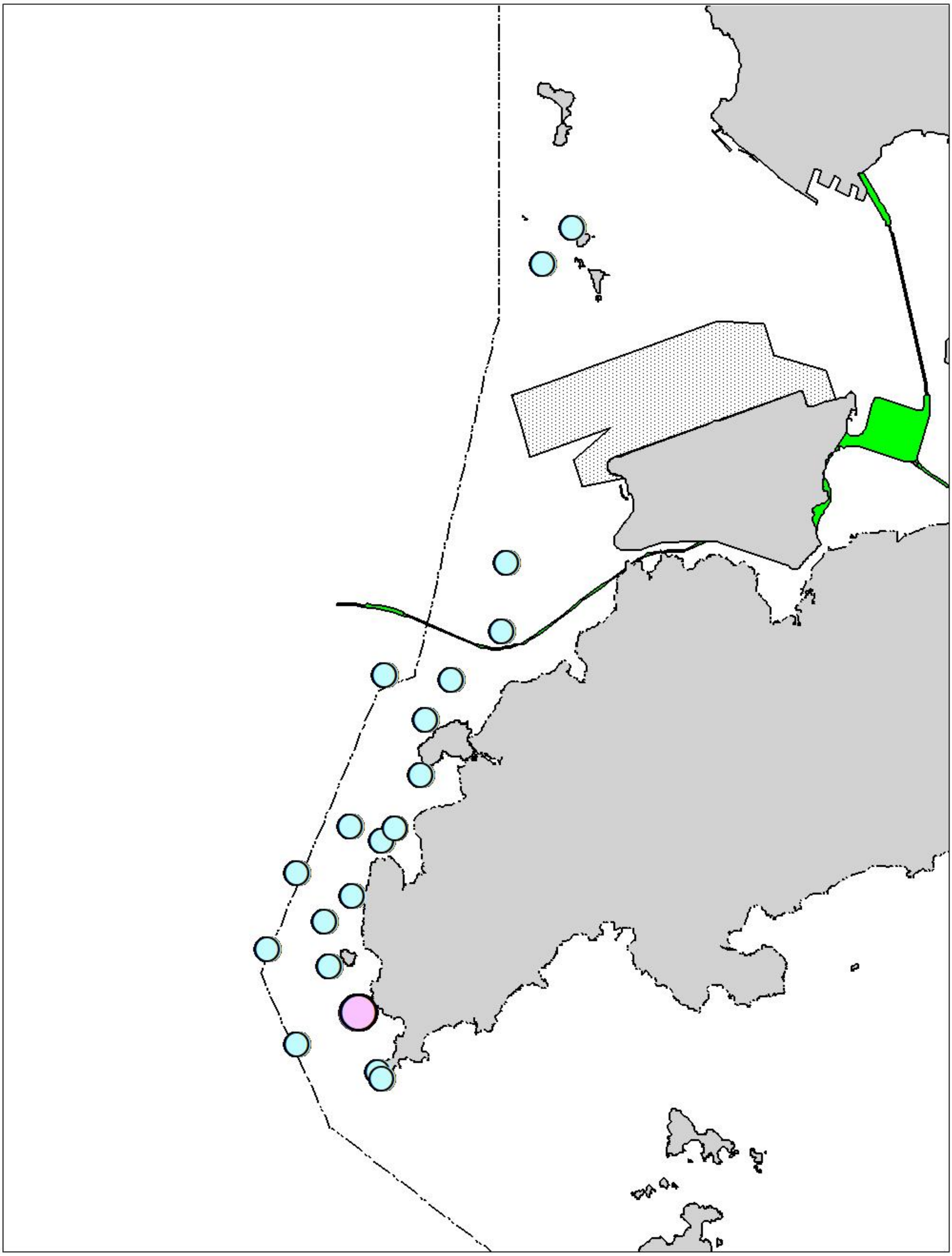


Figure 24. Distribution of Unspotted Calves (purple dots) & Unspotted Juveniles (blue dots) in 2017

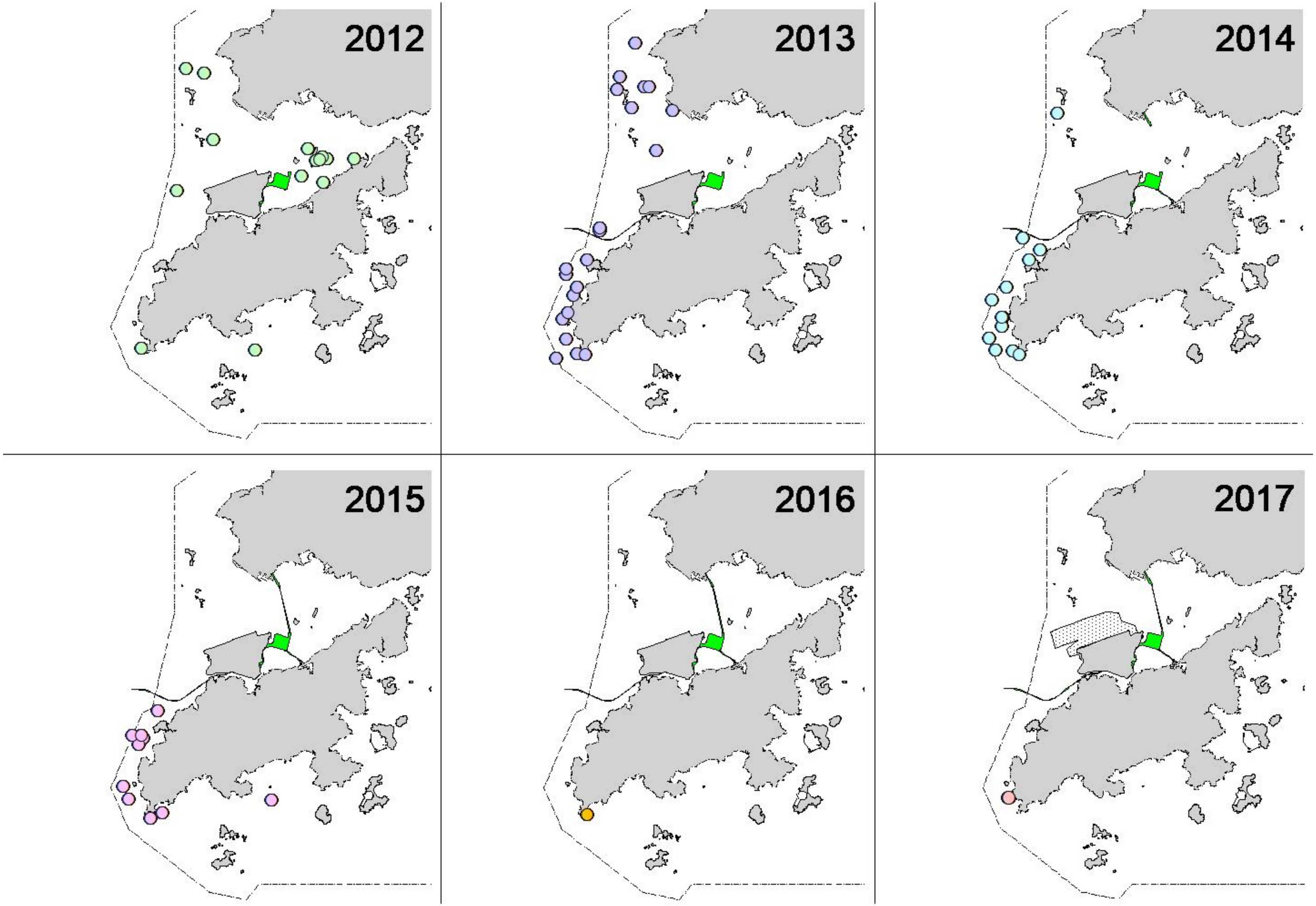


Figure 25. Temporal changes in distribution of unspotted calves (UCs) in 2012-17

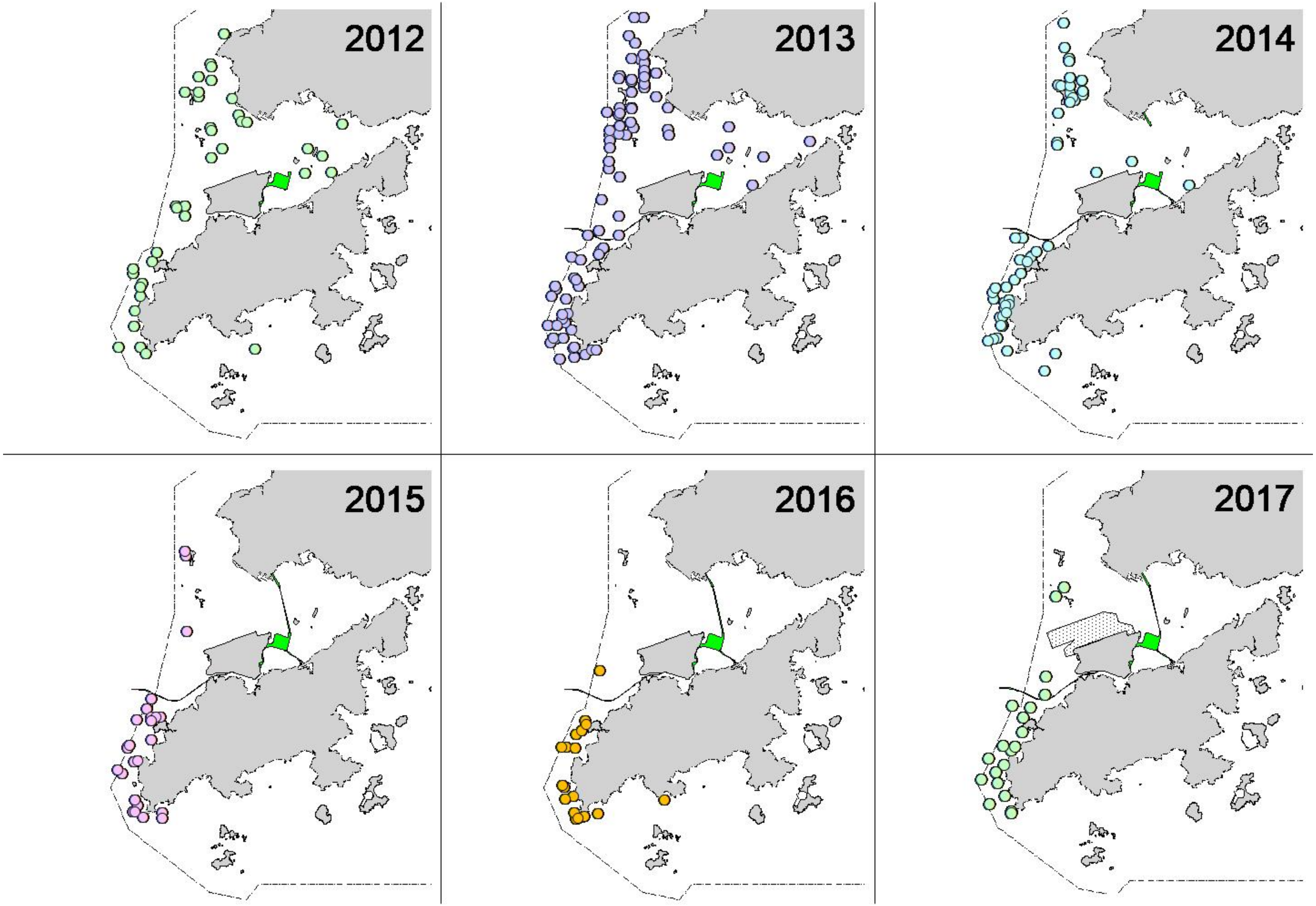


Figure 26. Temporal changes in distribution of unspotted juveniles (UJs) in 2012-17

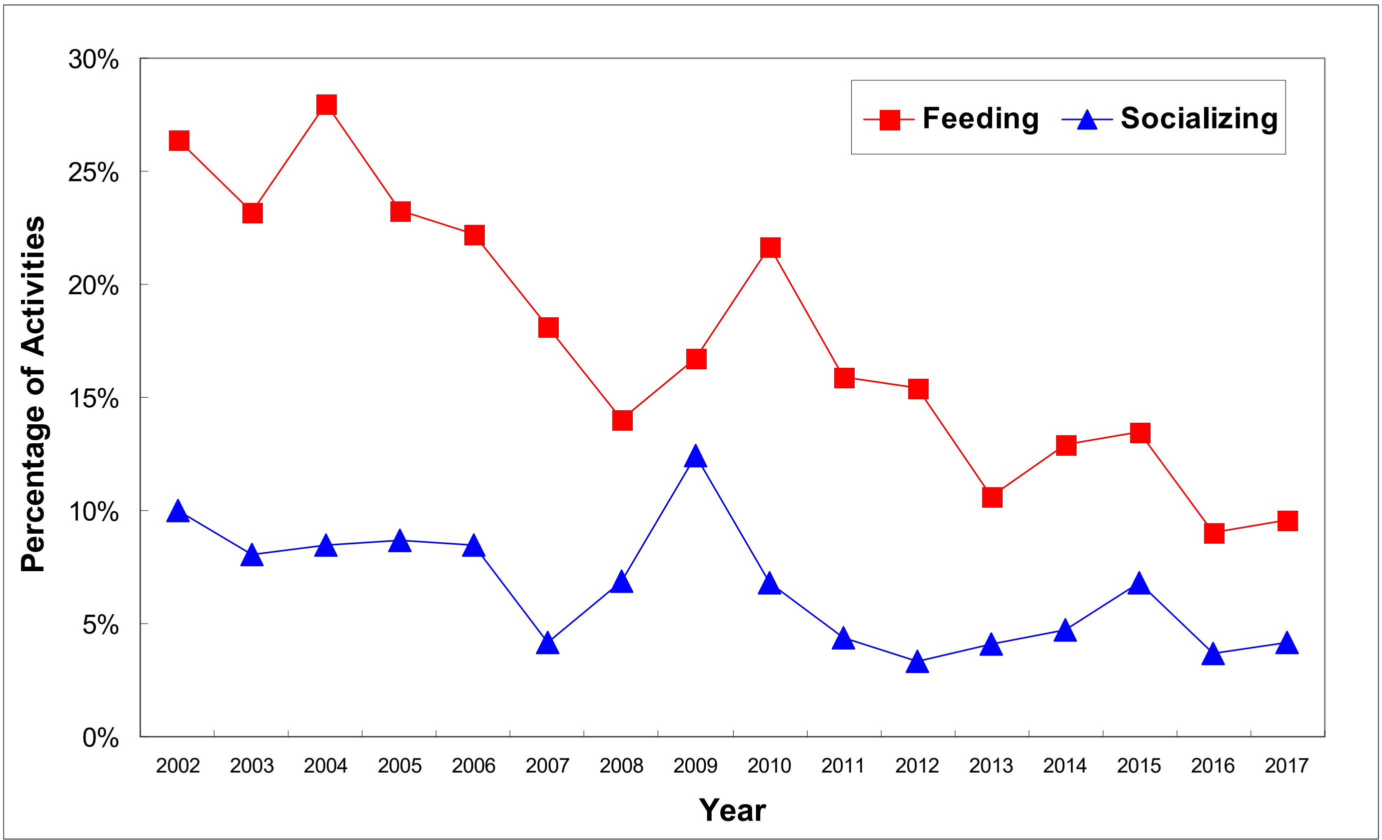


Figure 27. Percentages of feeding and socializing activities among all dolphin groups sighted in Hong Kong during 2002-17

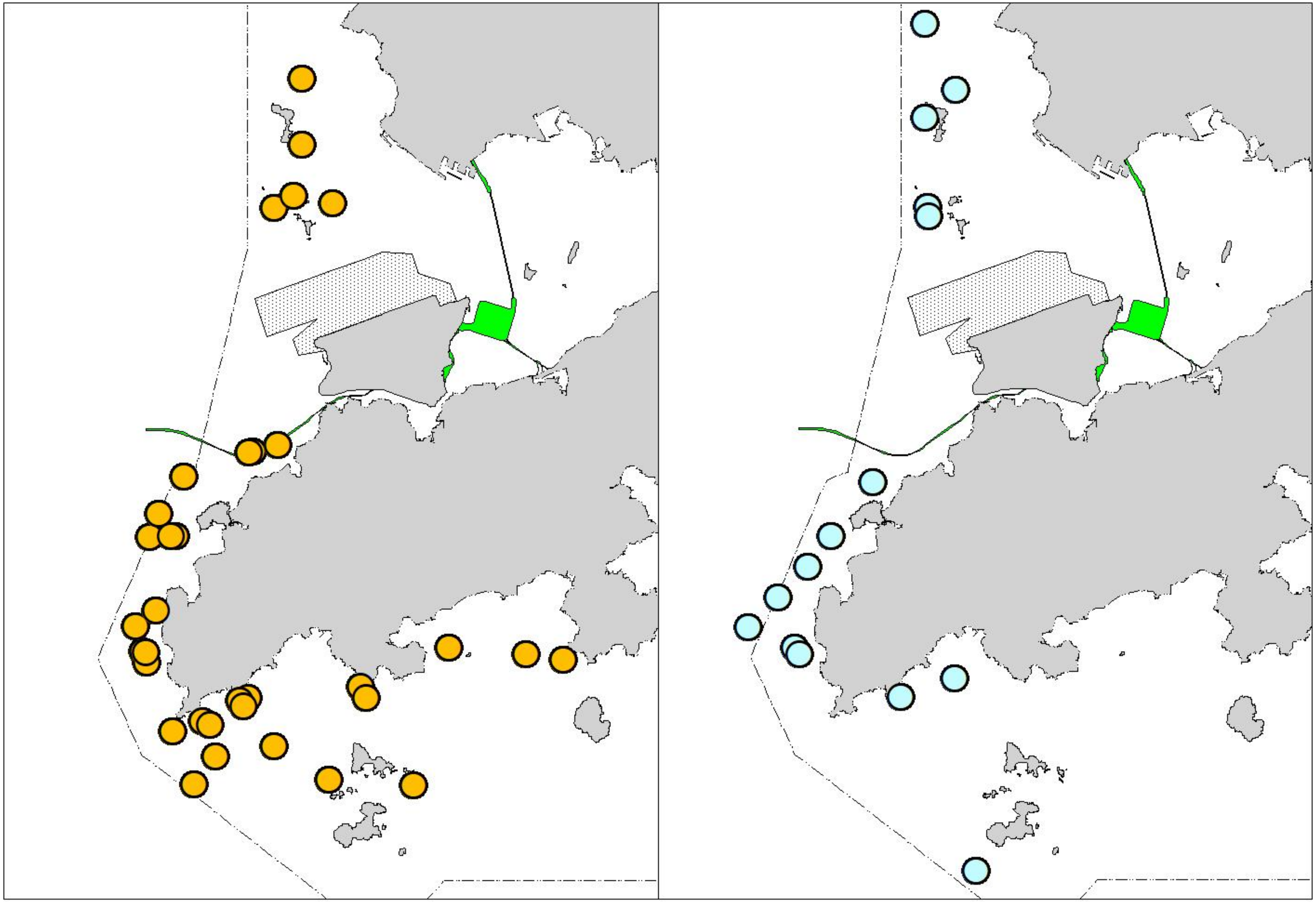


Figure 28. Distribution of Chinese white dolphins engaged in feeding (orange dots) and socializing (blue dots) activities in 2017

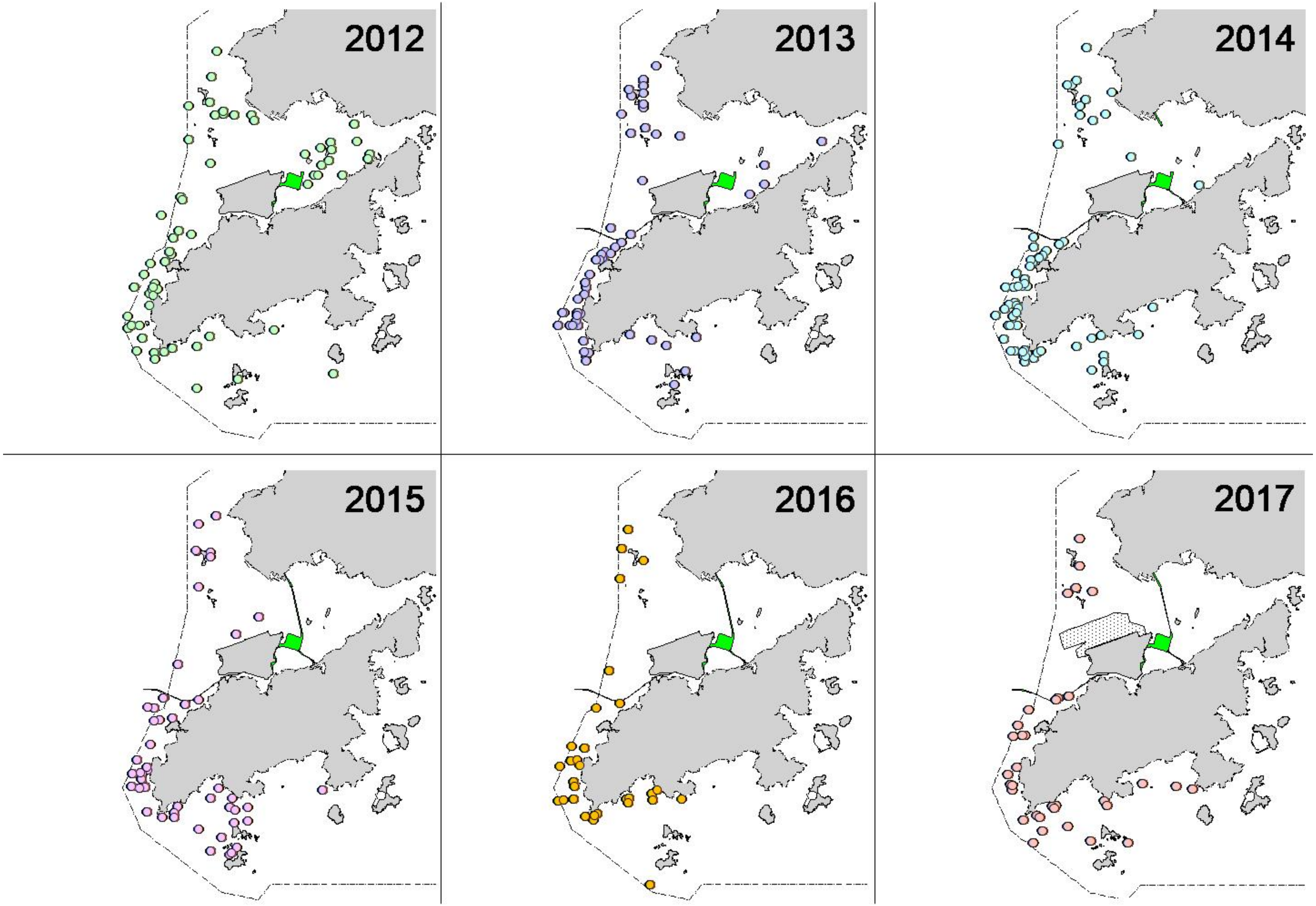


Figure 29. Temporal changes in distribution of dolphin groups engaged in feeding activities in 2012-17

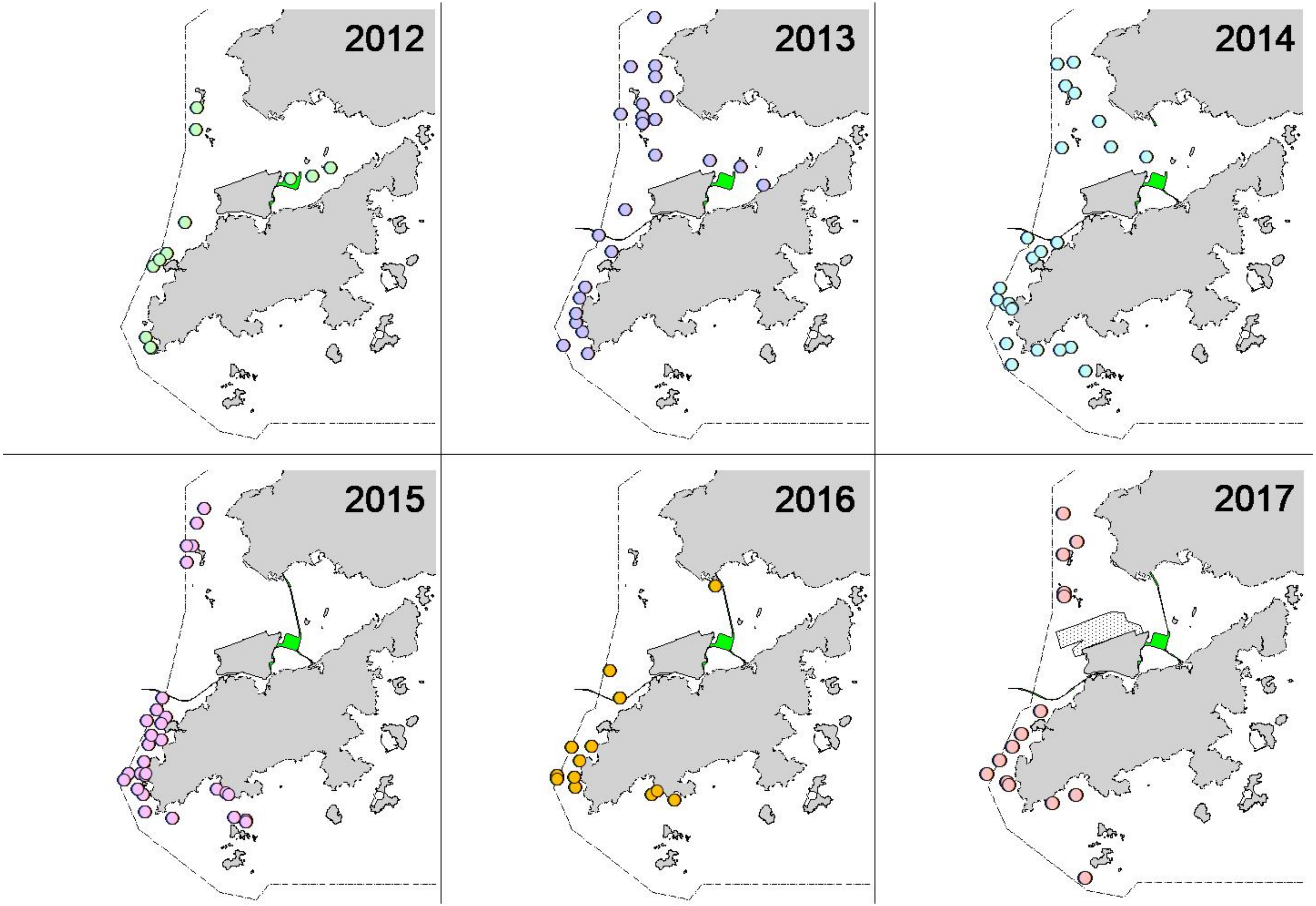


Figure 30. Temporal changes in distribution of dolphin groups engaged in socializing activities in 2012-17

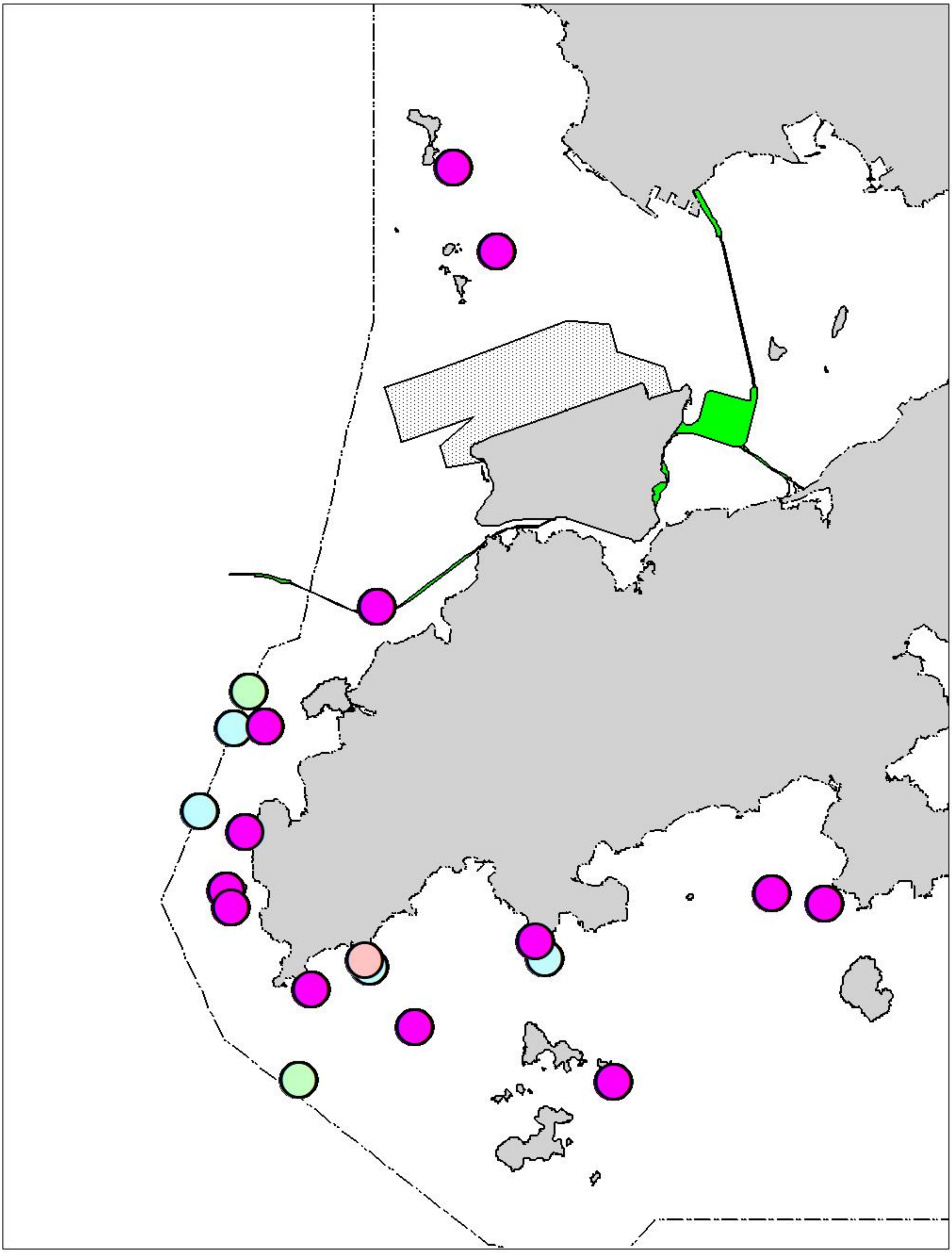


Figure 31. Distribution of dolphin sightings associated with fishing boats in 2017
(purple dots: with purse-seiners, blue dot: with gill-netter; pink dot: hand-liner; green dot: trawlers)

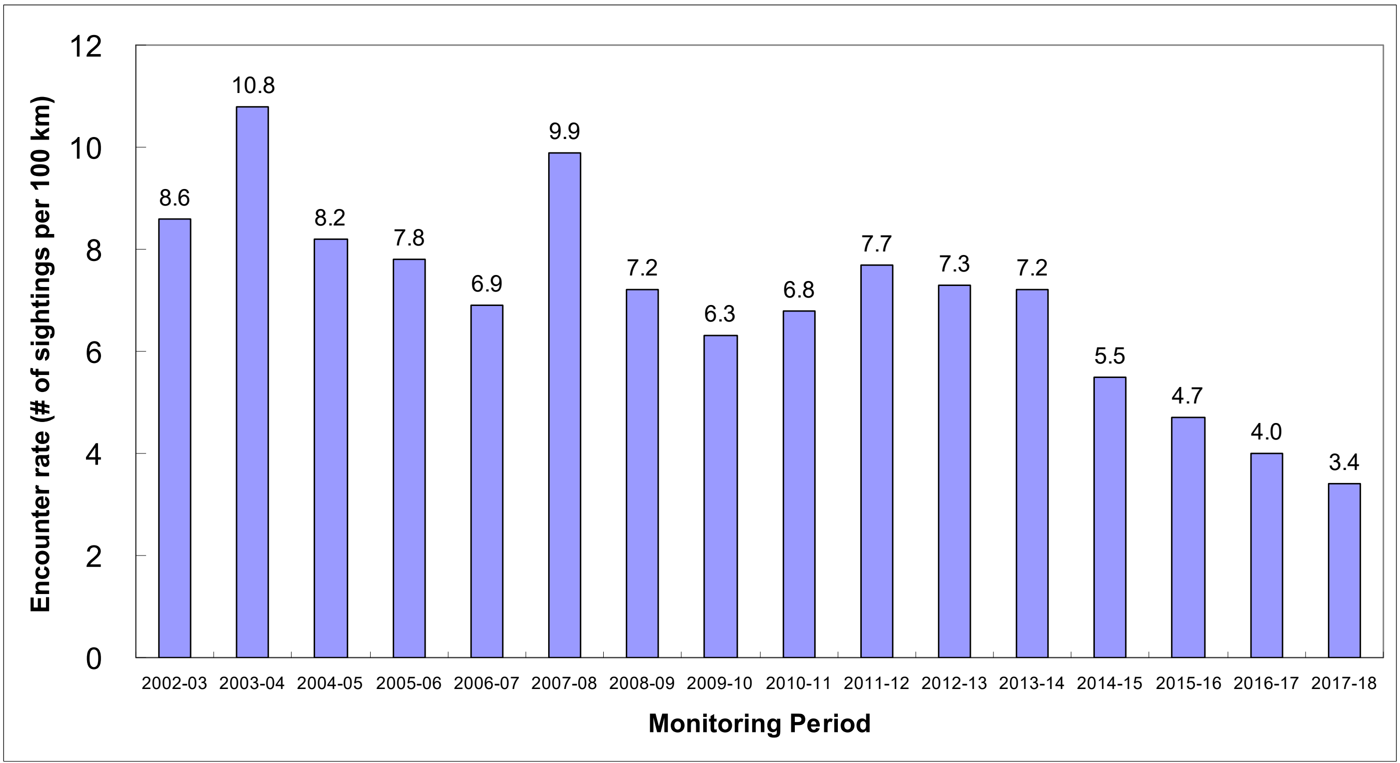


Figure 32. Temporal trend in encounter rates of Chinese white dolphins (combined from WL, NWL, NEL and SWL survey areas) in the past sixteen monitoring periods from 2002-18

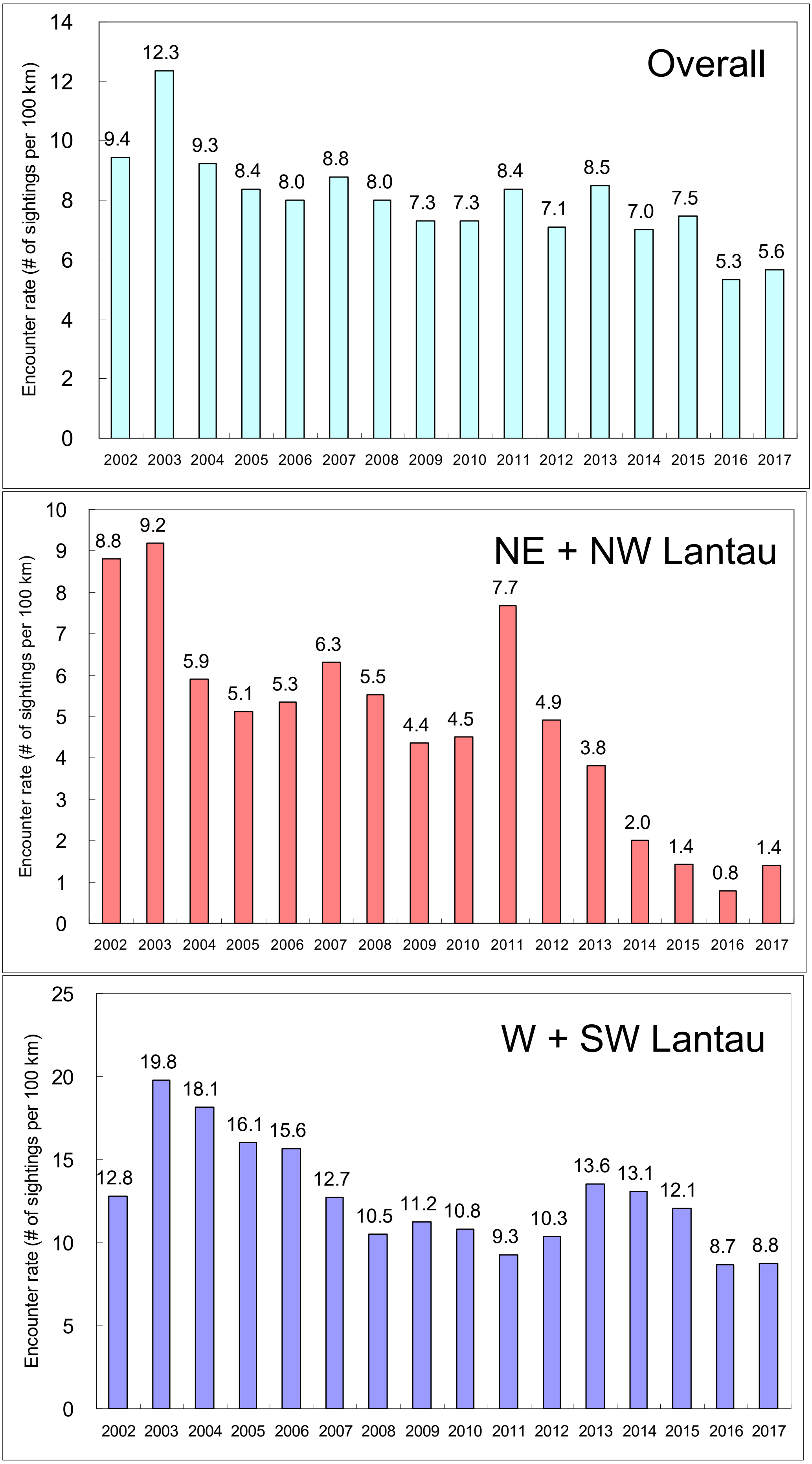


Figure 33. Long-term trends in annual dolphin encounter rates in different survey areas

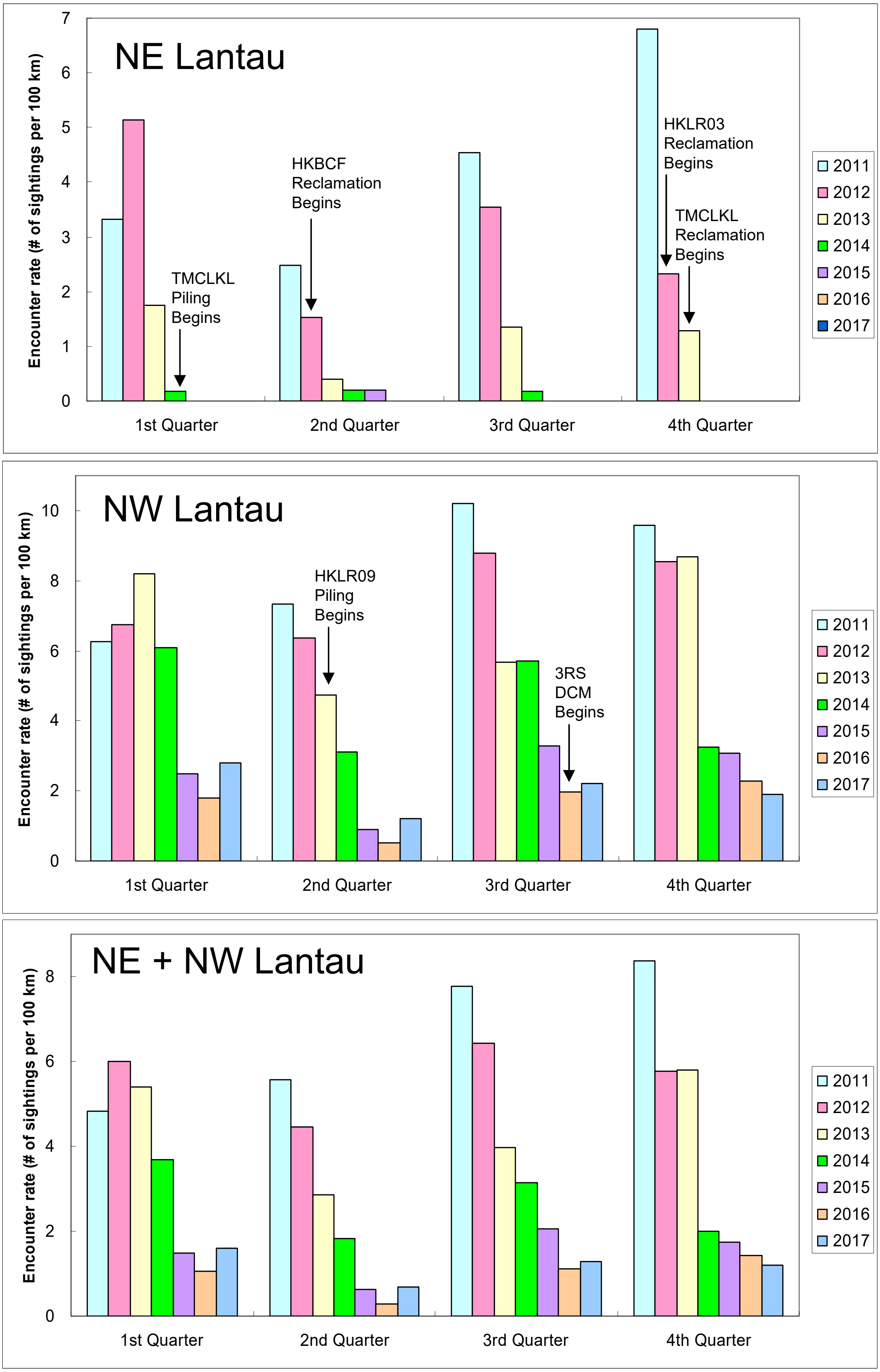


Figure 34. Temporal trends in quarterly dolphin encounter rates in North Lantau region from 2011-17 in association with schedules of HZMB works and 3RS works

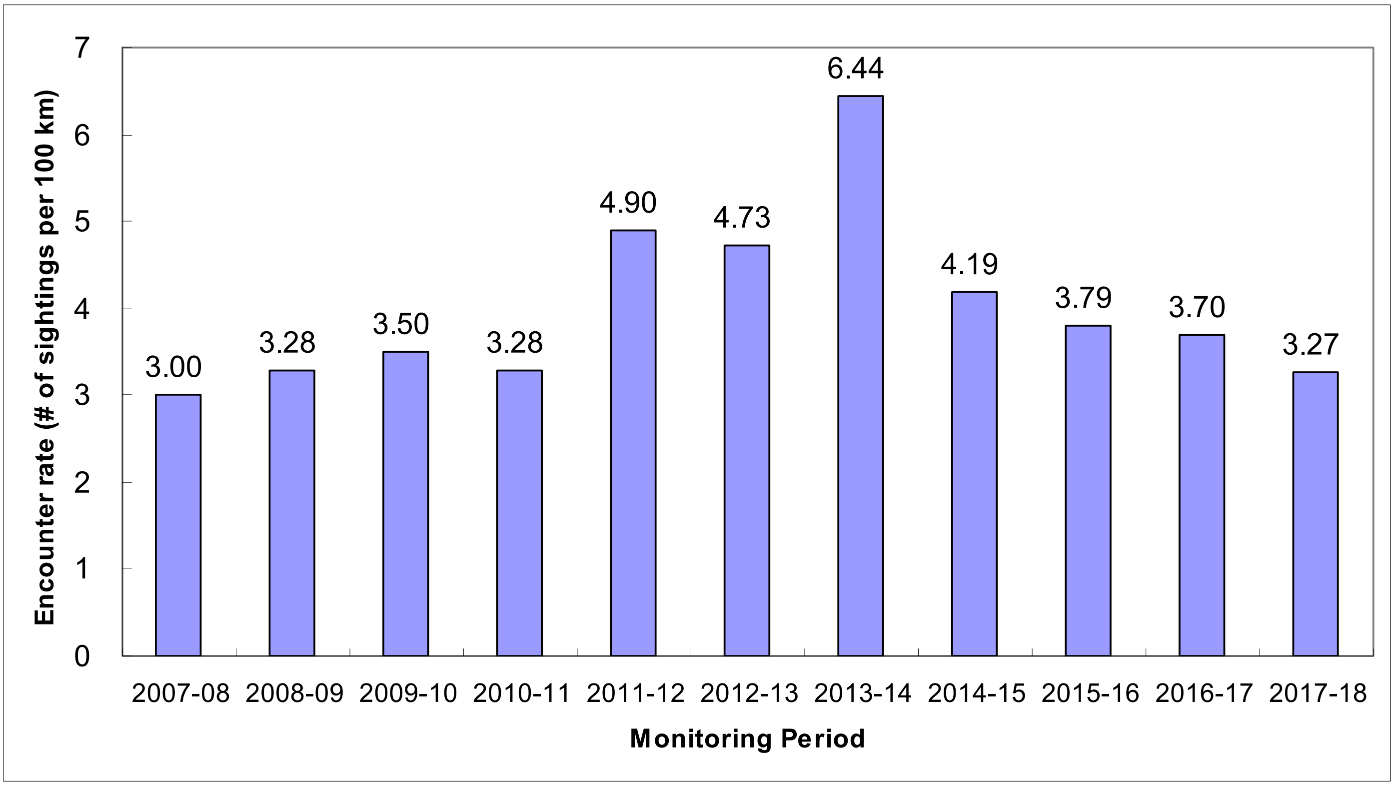


Figure 35. Temporal trend in encounter rates of finless porpoises (combined from SWL, SEL, LM and PT survey areas) in the past eleven monitoring periods from 2007-18

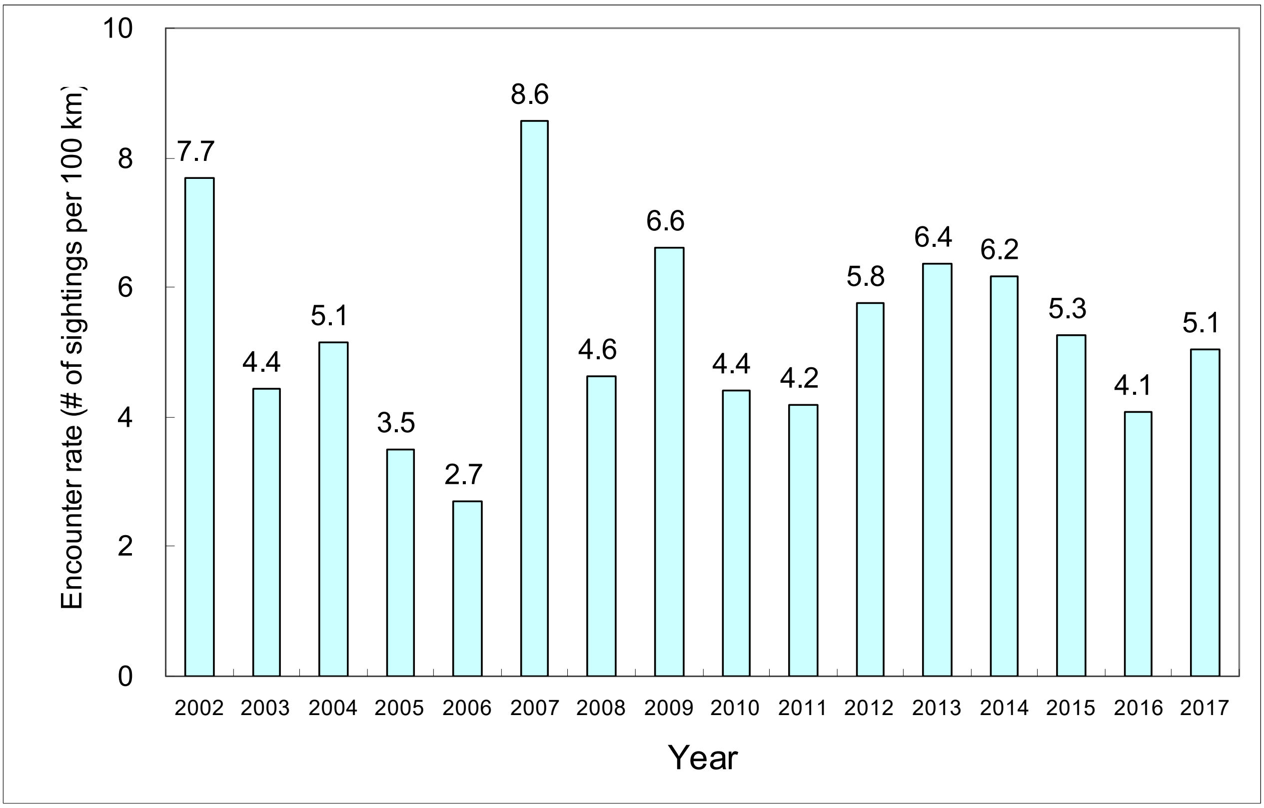


Figure 36a. Temporal trend of annual encounter rates of finless porpoises (combined from SWL, SEL, LM and PT survey areas) from 2002-17

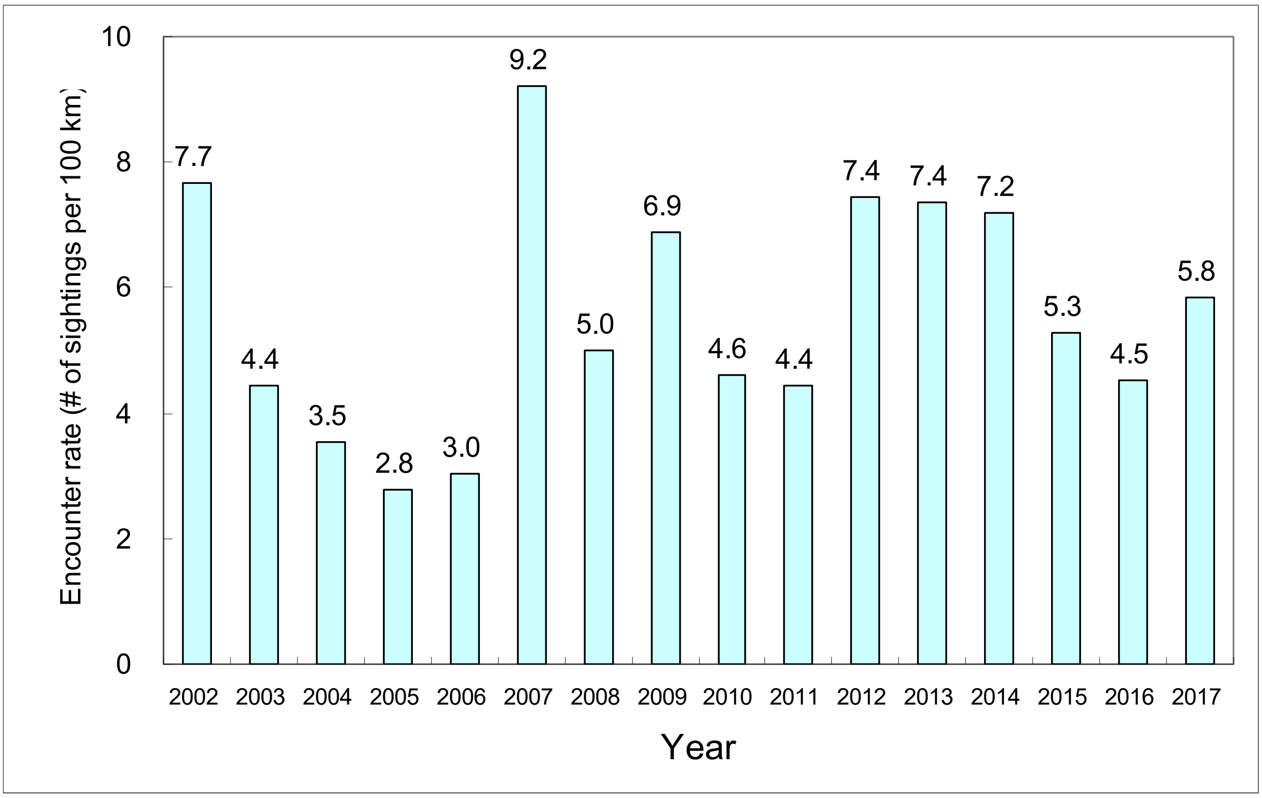


Figure 36b. Temporal trend of porpoise encounter rates in South Lantau and Lamma waters combined from winter/spring months of 2002-17

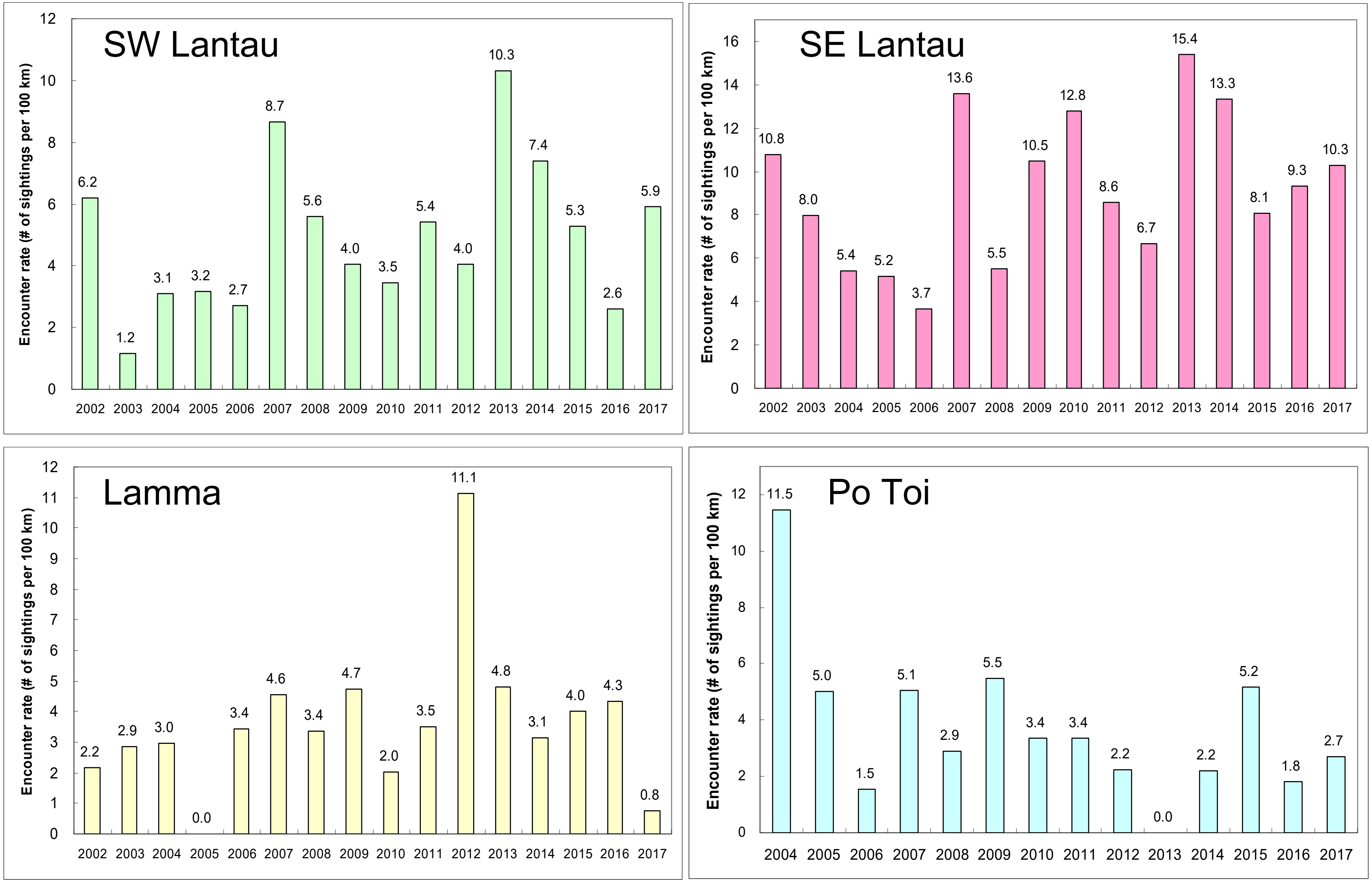


Figure 37. Temporal trends in annual encounter rates of finless porpoises among different survey areas

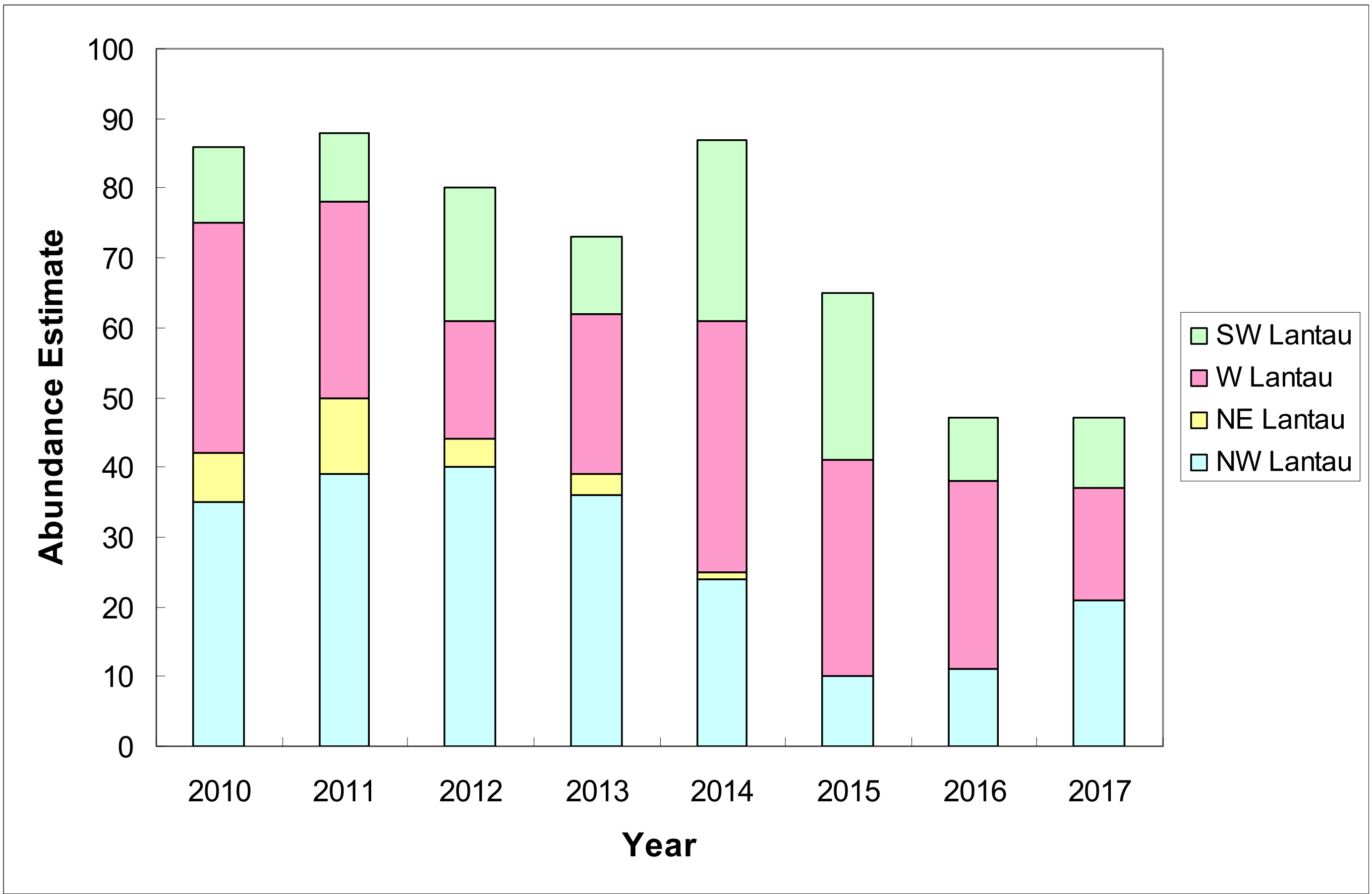


Figure 38. Temporal trends in combined abundance estimates of Chinese White Dolphins in Southwest, West, Northwest & Northeast Lantau from 2010-17

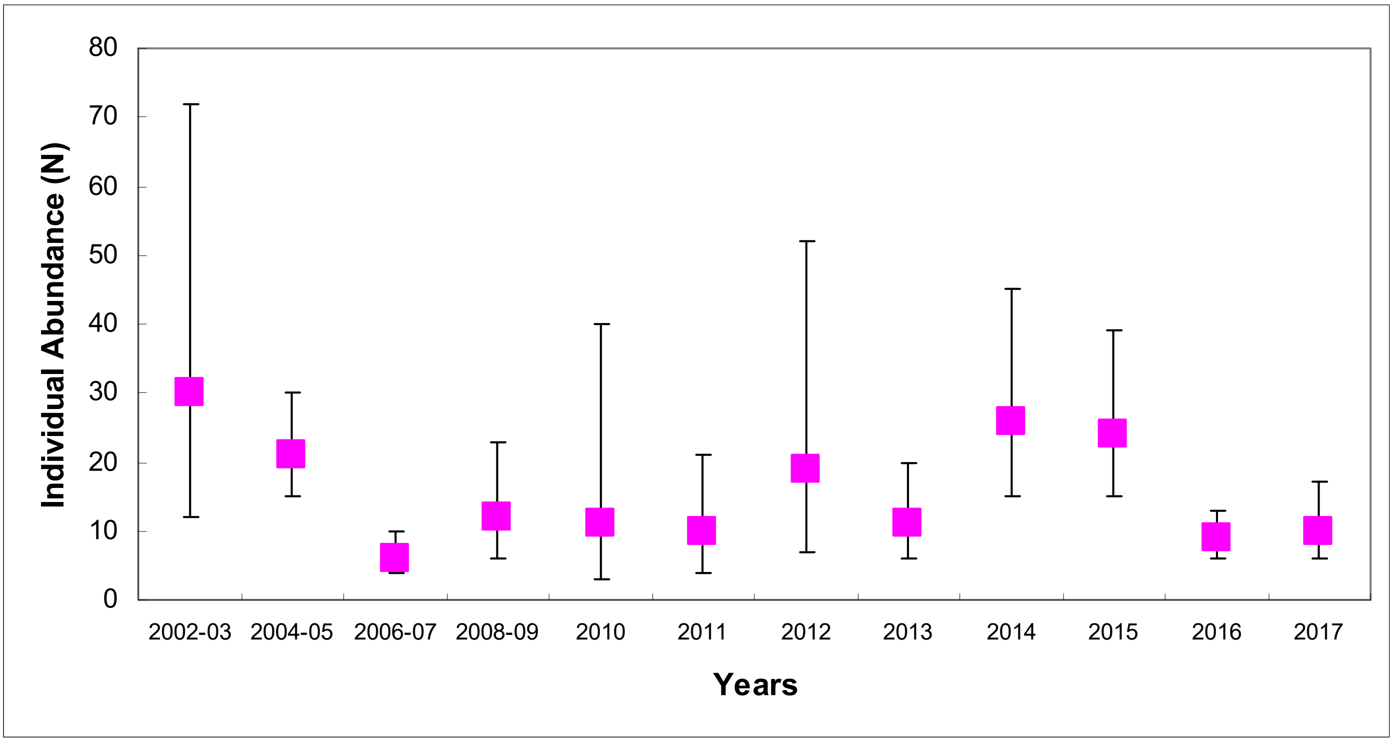


Figure 39. Temporal trend in abundance estimates of Chinese white dolphins in Southwest Lantau from 2002-17 (error bars: 95% confidence interval of abundance estimates)

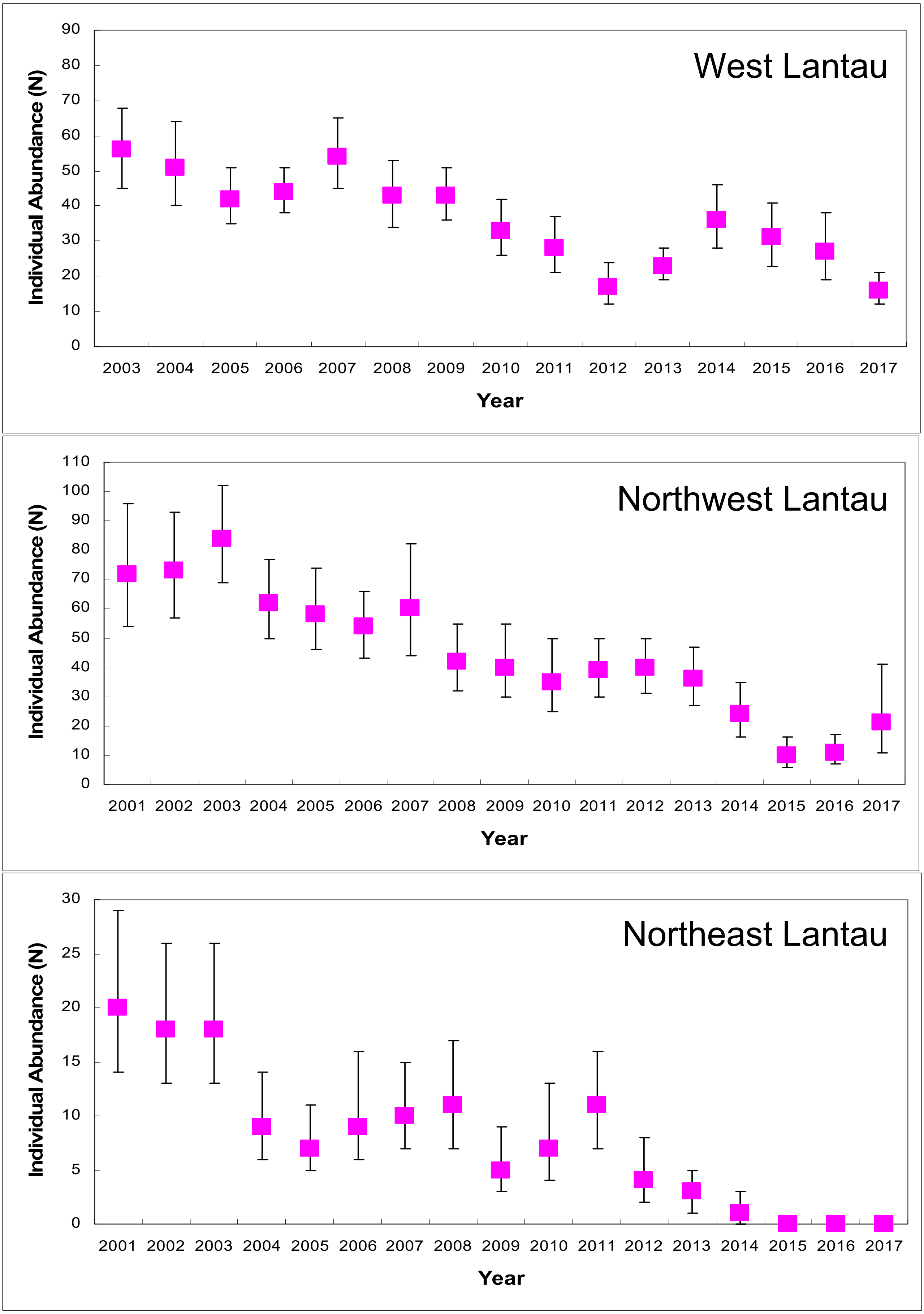


Figure 40. Temporal trends in annual abundance estimates of Chinese white dolphins in WL, NWL & NEL from 2001-17 (error bars: 95% confidence interval of abundance estimates)

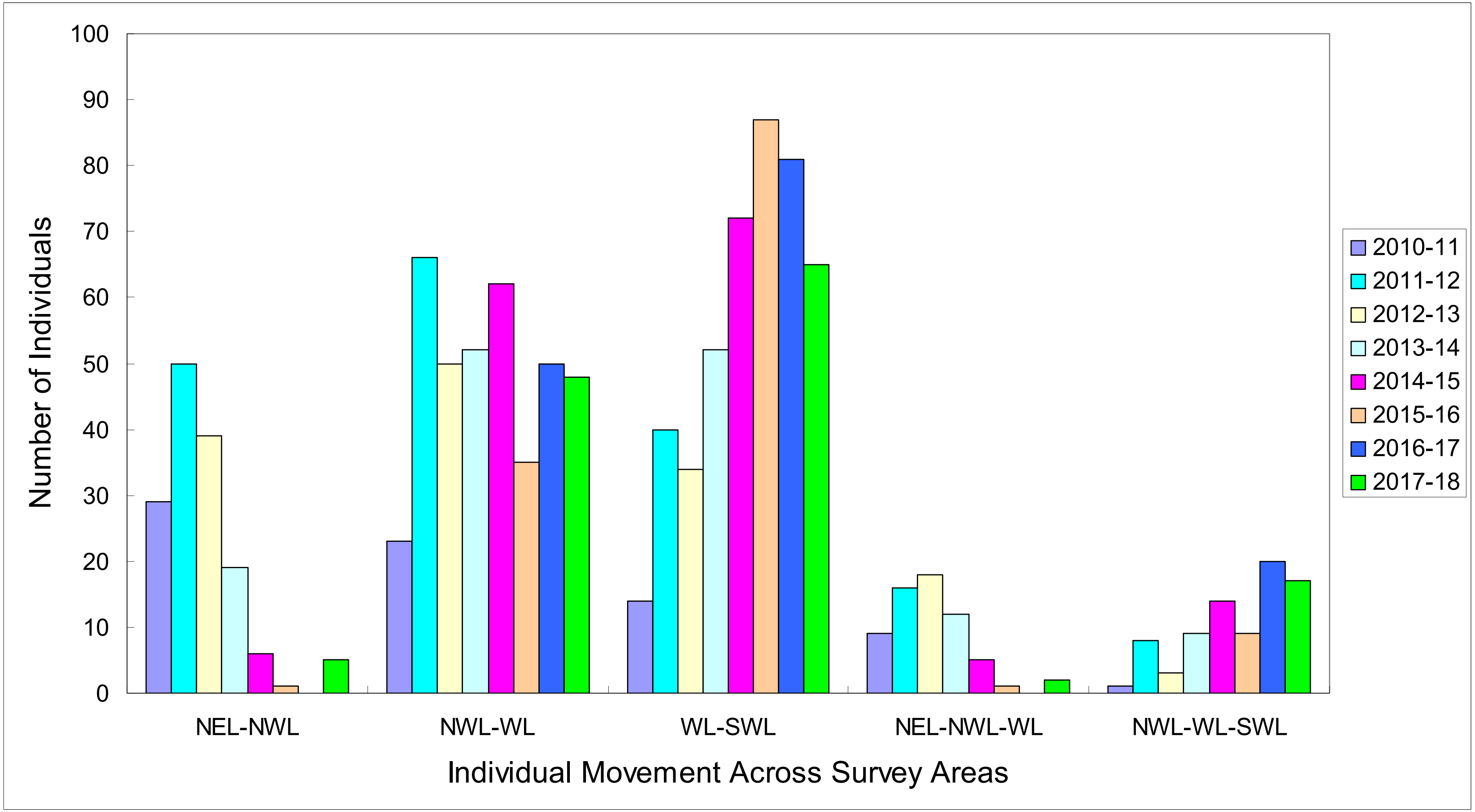


Figure 41. Temporal trends in number of individual dolphins involved in movements across different survey areas around Lantau in the past seven monitoring periods

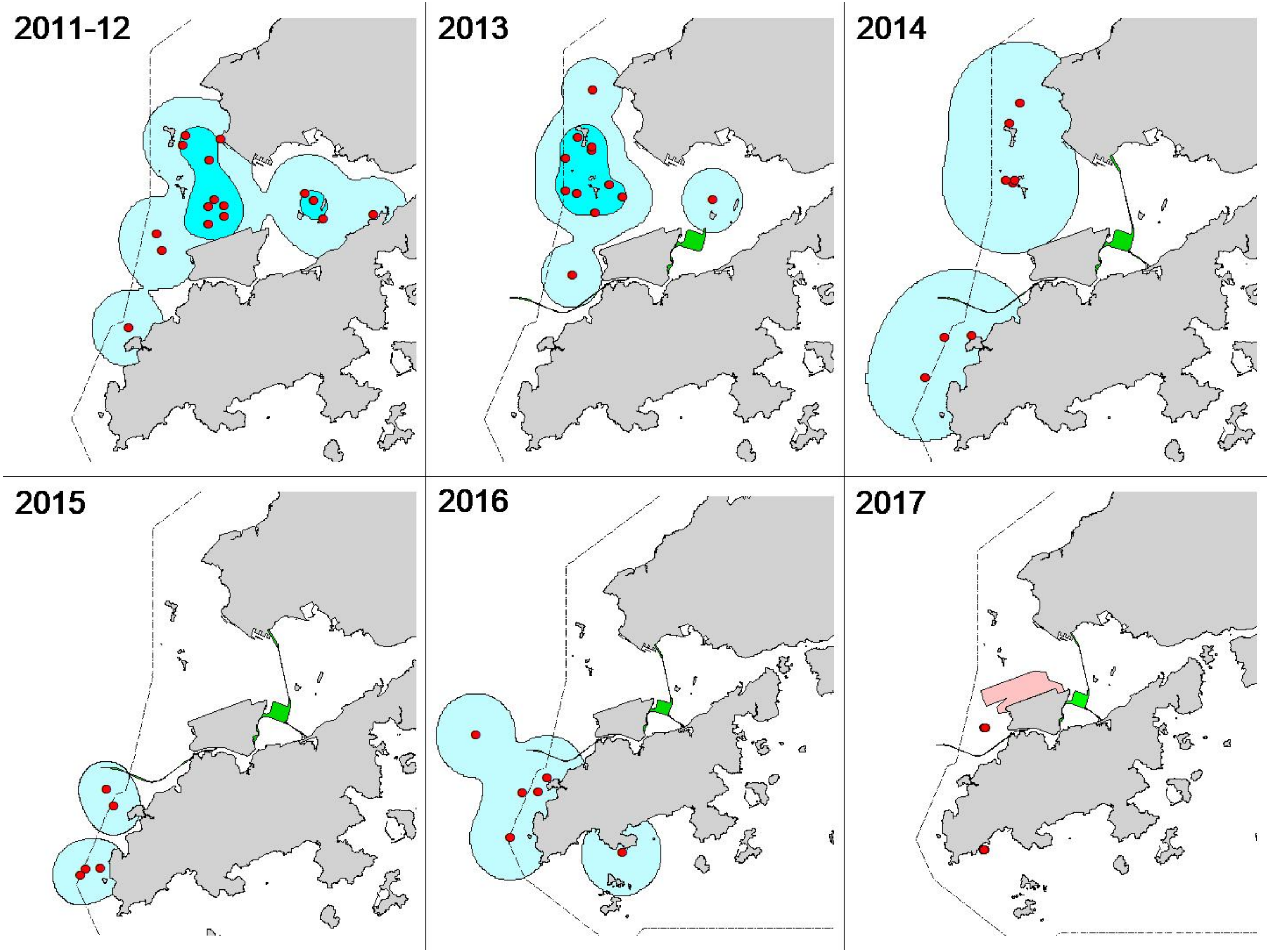


Figure 42. Temporal changes in range use of NL295 as an example of individuals which have shifted their ranges from North Lantau waters to WL and SWL waters during 2011-17

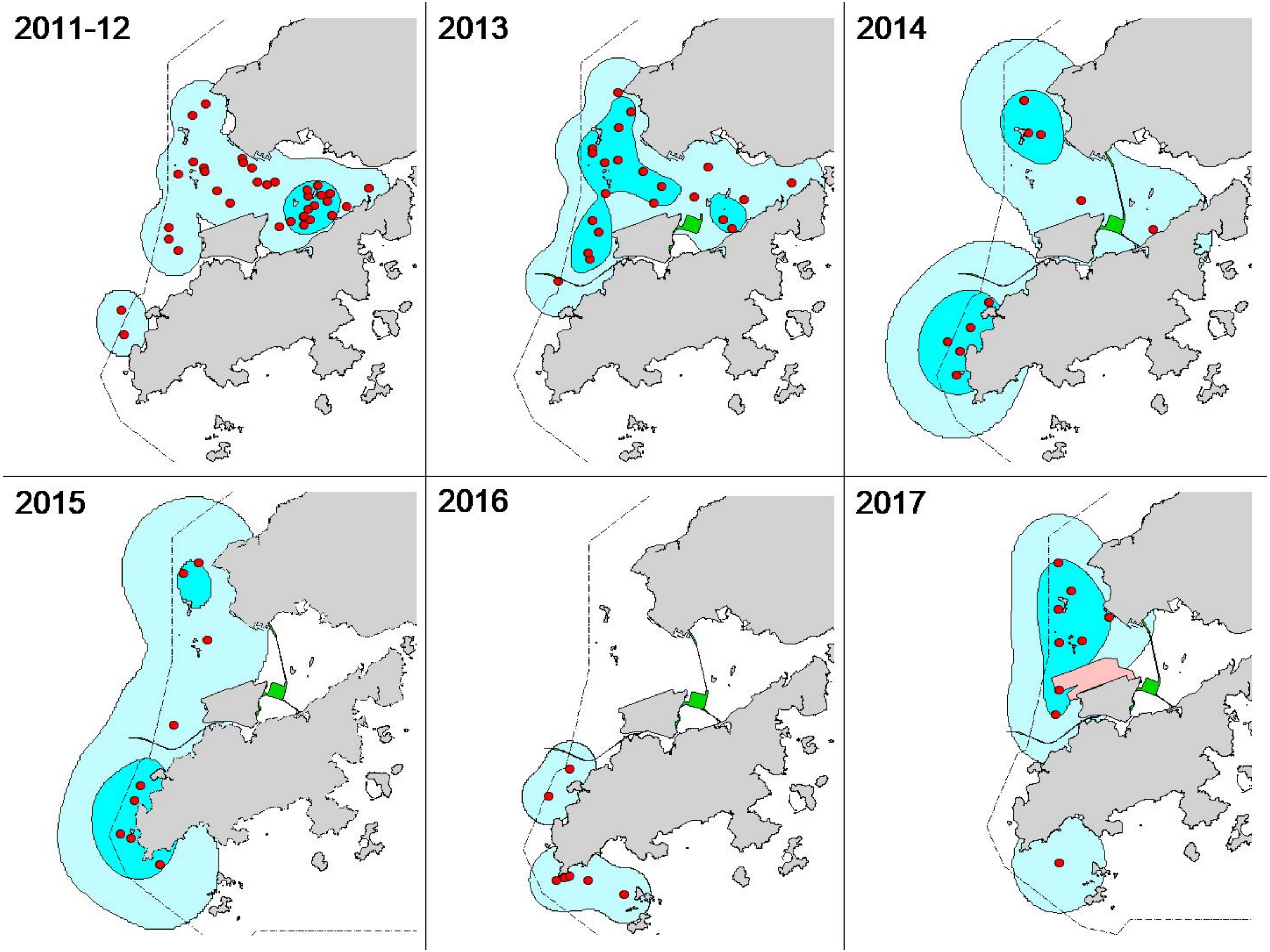


Figure 43. Temporal changes in range use of NL33 as an example of individuals which shifted their ranges from North Lantau waters to WL and SWL waters during 2011-16, but have reversed such shifts in 2017

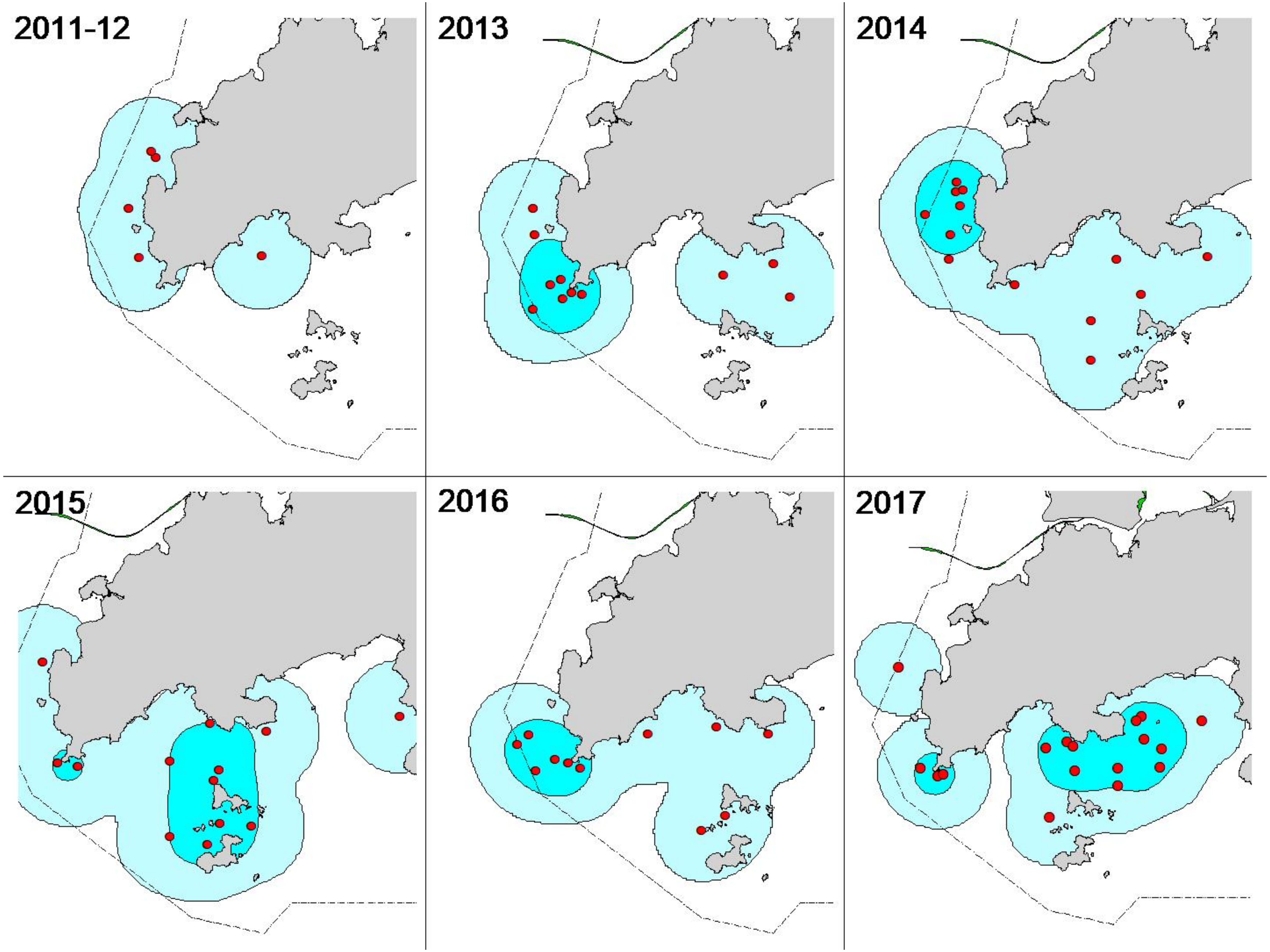


Figure 44. Temporal changes in range use of WL91 as an example of individuals from the southern social cluster which have shifted their range use from WL to SWL waters during 2011-16

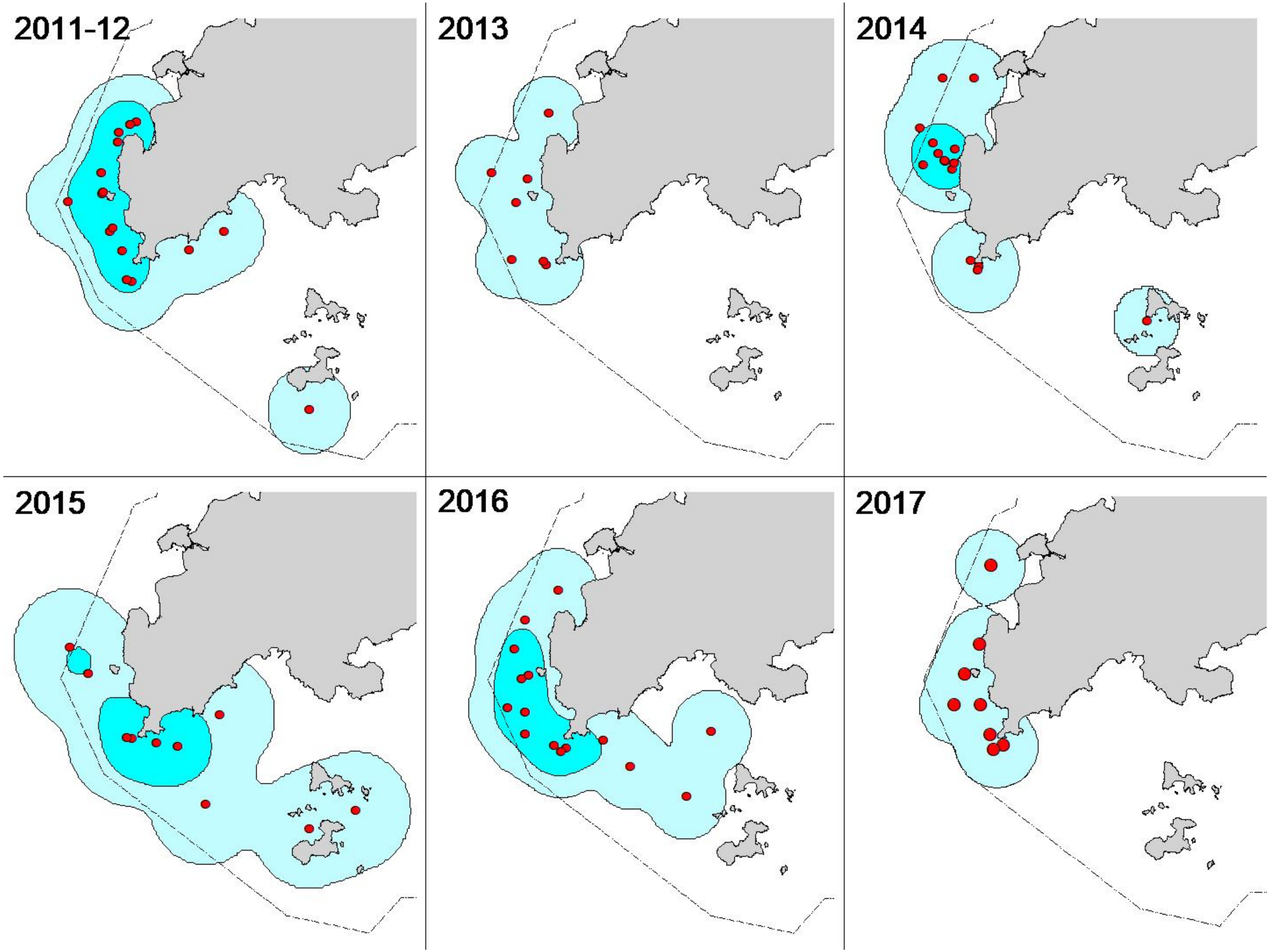


Figure 45. Temporal changes in range use of CH38 as an example of individuals which have expanded their range use from WL to SWL waters during 2011-16, but have reversed such expansions in 2017

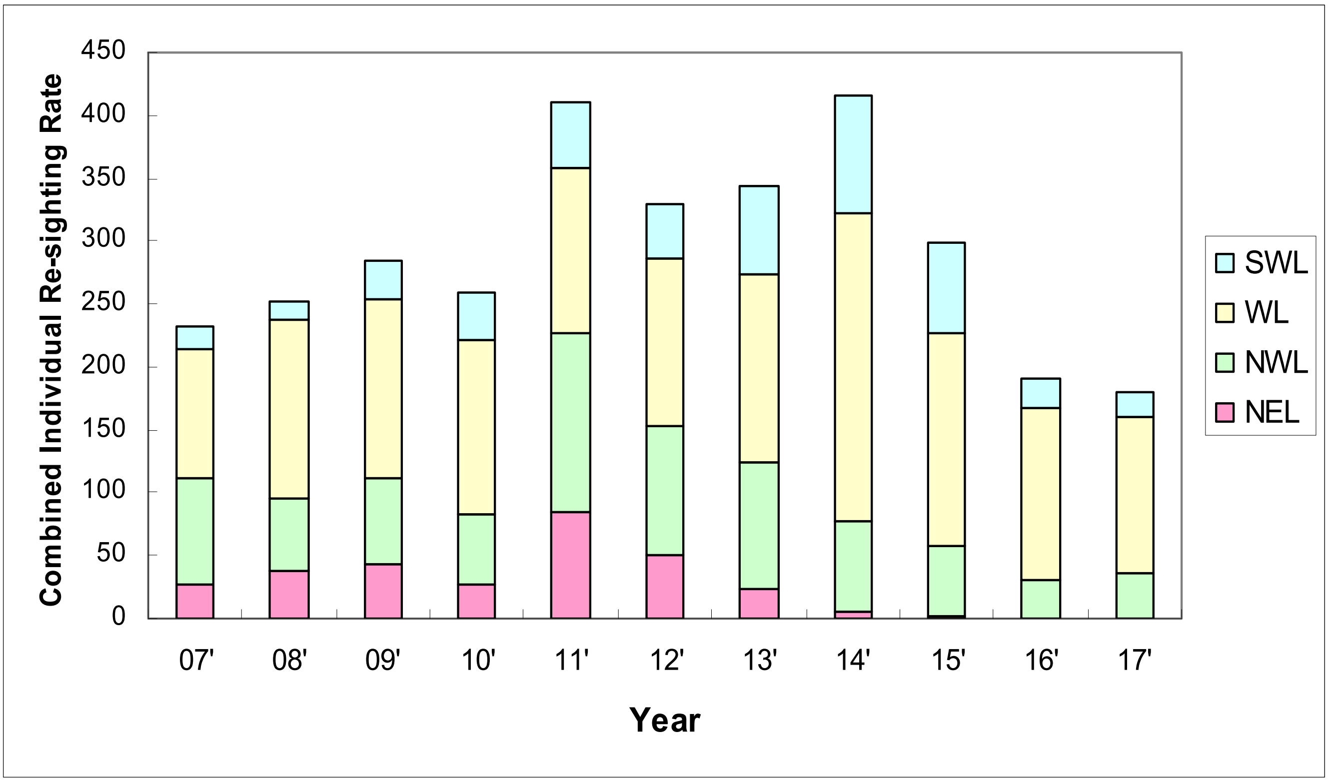


Figure 46a. Combined Individual Re-sighting Rate (total no. of individual re-sightings per 1,000 km of survey effort) of 100 individual dolphins (with 30+ re-sightings) among four survey areas during 2007-2017

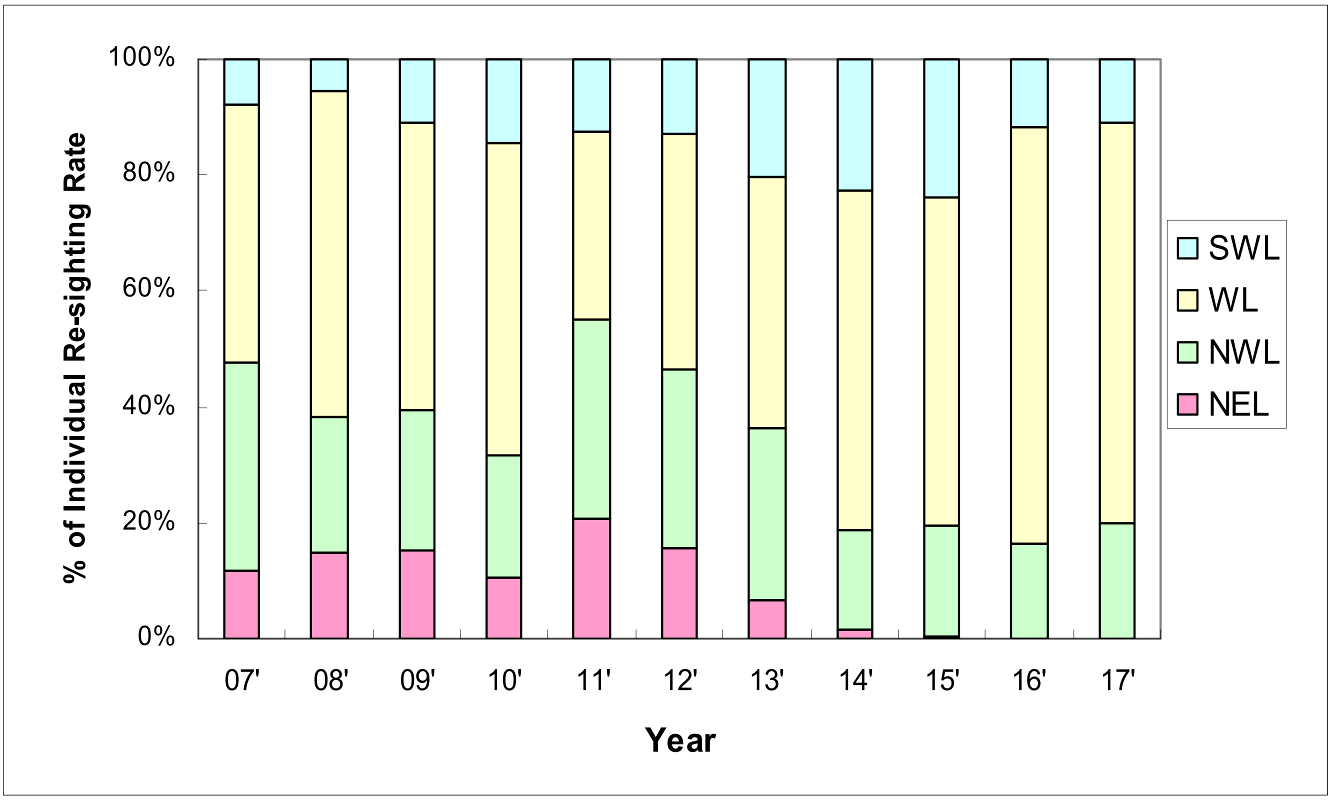


Figure 46b. Proportion of Combined Individual Re-sighting Rate of the total among four survey areas during 2007-2017 based on 100 individual dolphins with 30+ re-sightings

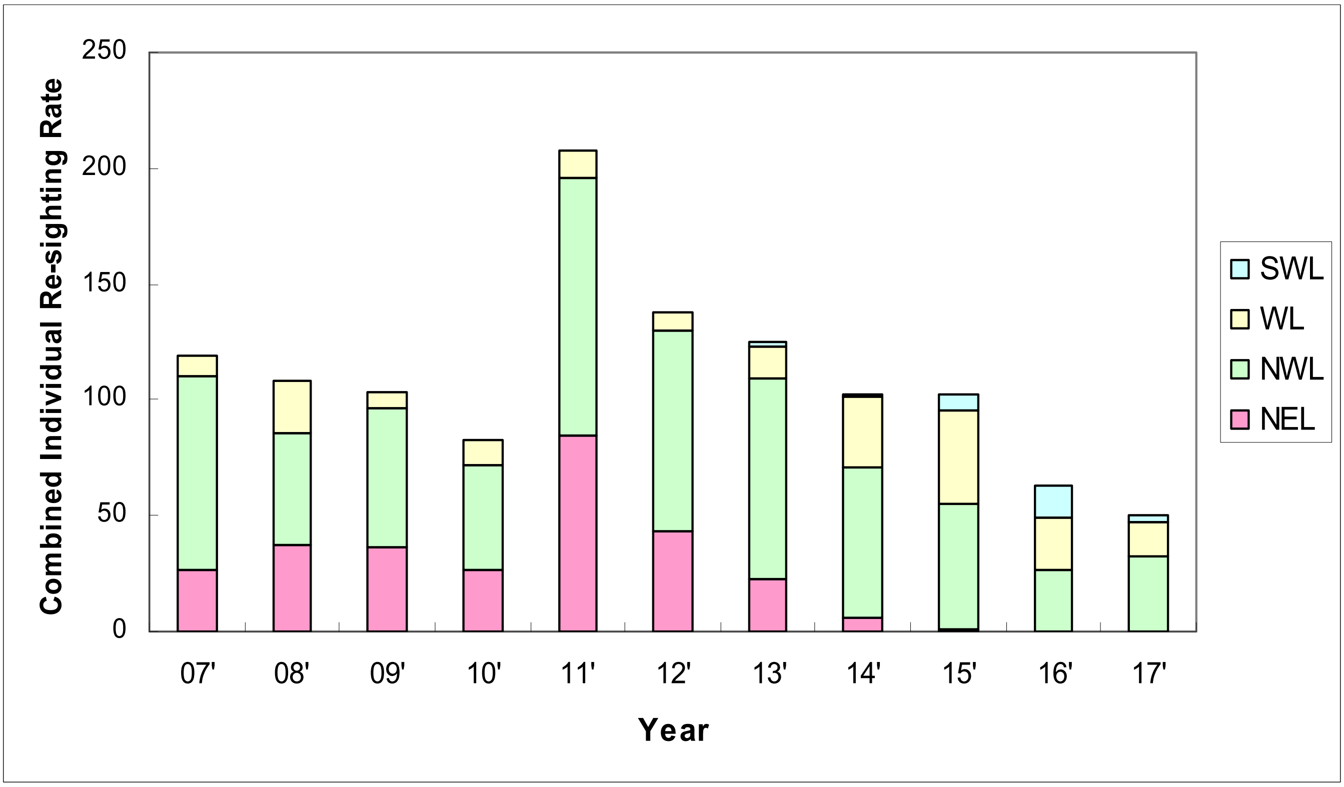


Figure 47a. Combined Individual Re-sighting Rate (total no. of individual re-sightings per 1,000 km of survey effort) of 44 individual dolphins (from northern social cluster) among four survey areas during 2007-2017

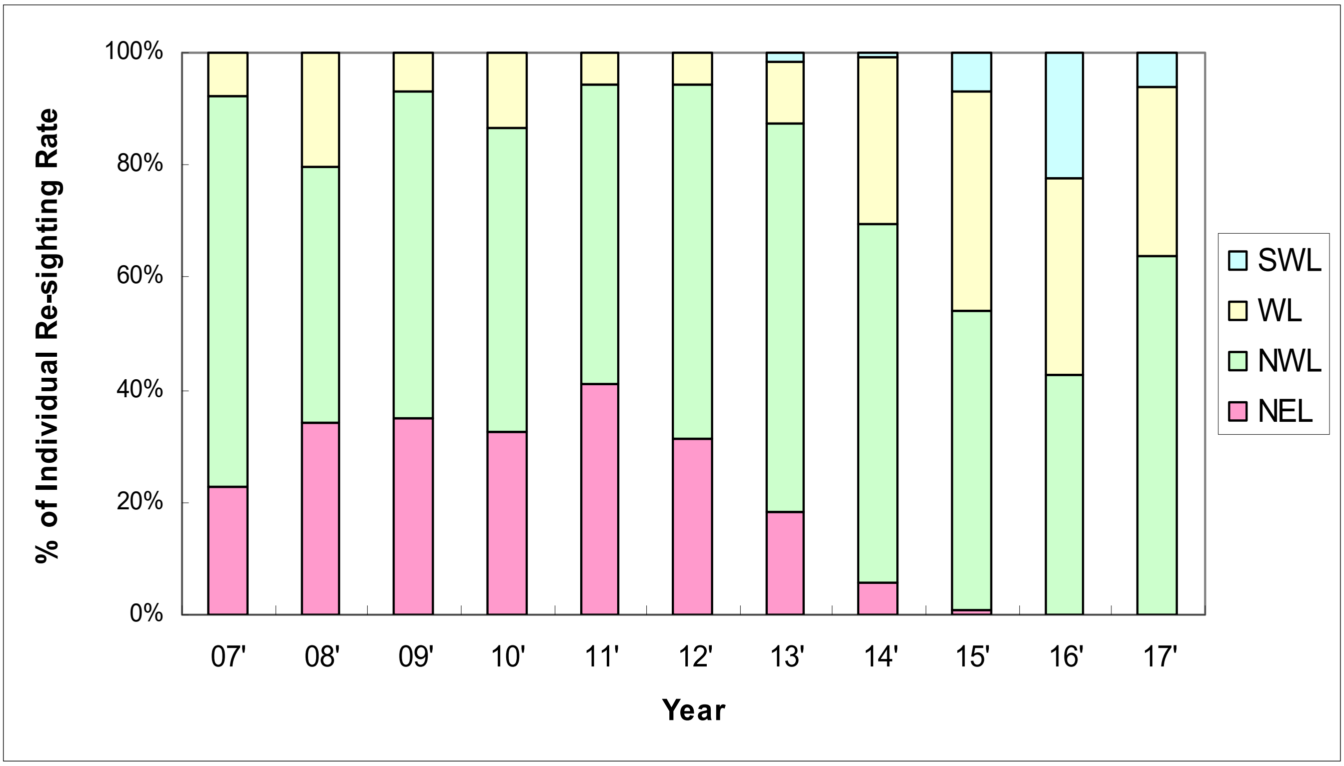


Figure 47b. Proportion of Combined Individual Re-sighting Rate of the total among four survey areas during 2007-2017 based on 44 individual dolphins from northern social cluster

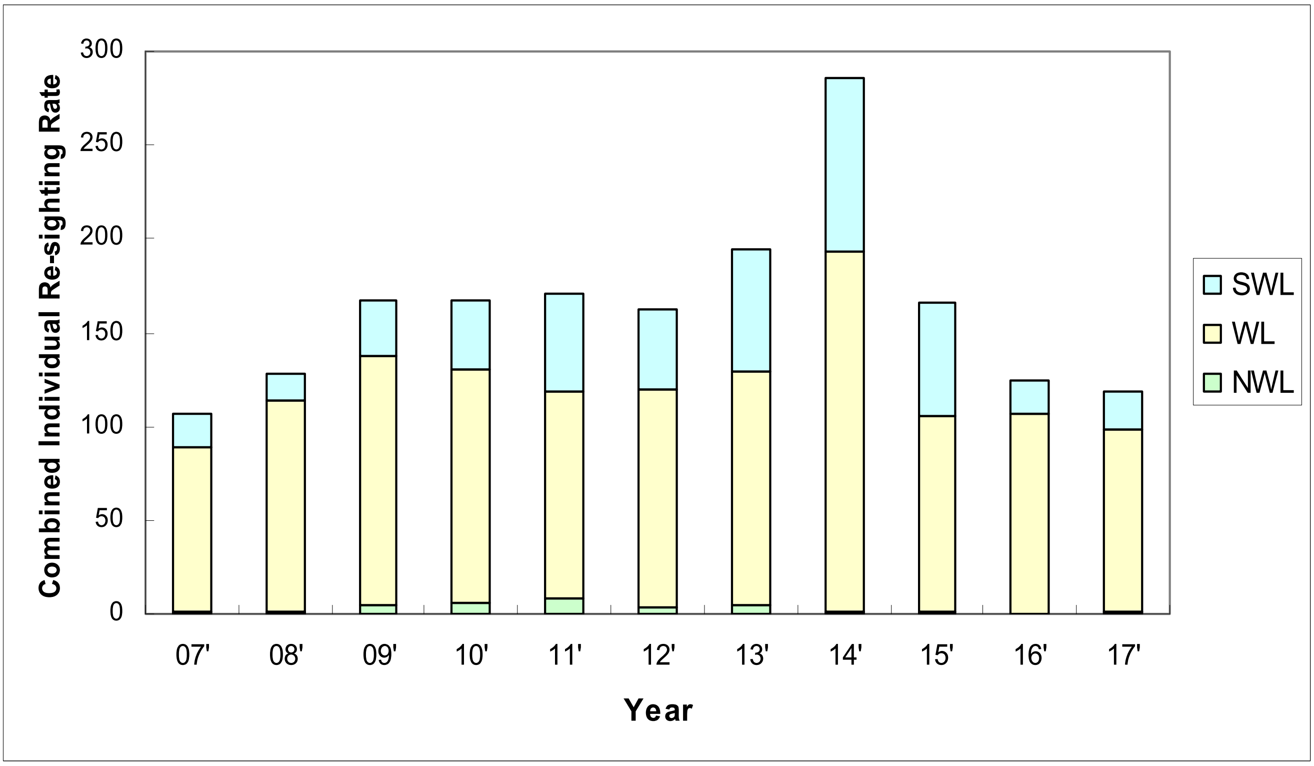


Figure 48a. Combined Individual Re-sighting Rate (total no. of individual re-sightings per 1,000 km of survey effort) of 46 individual dolphins (from southern social cluster) among four survey areas during 2007-2017

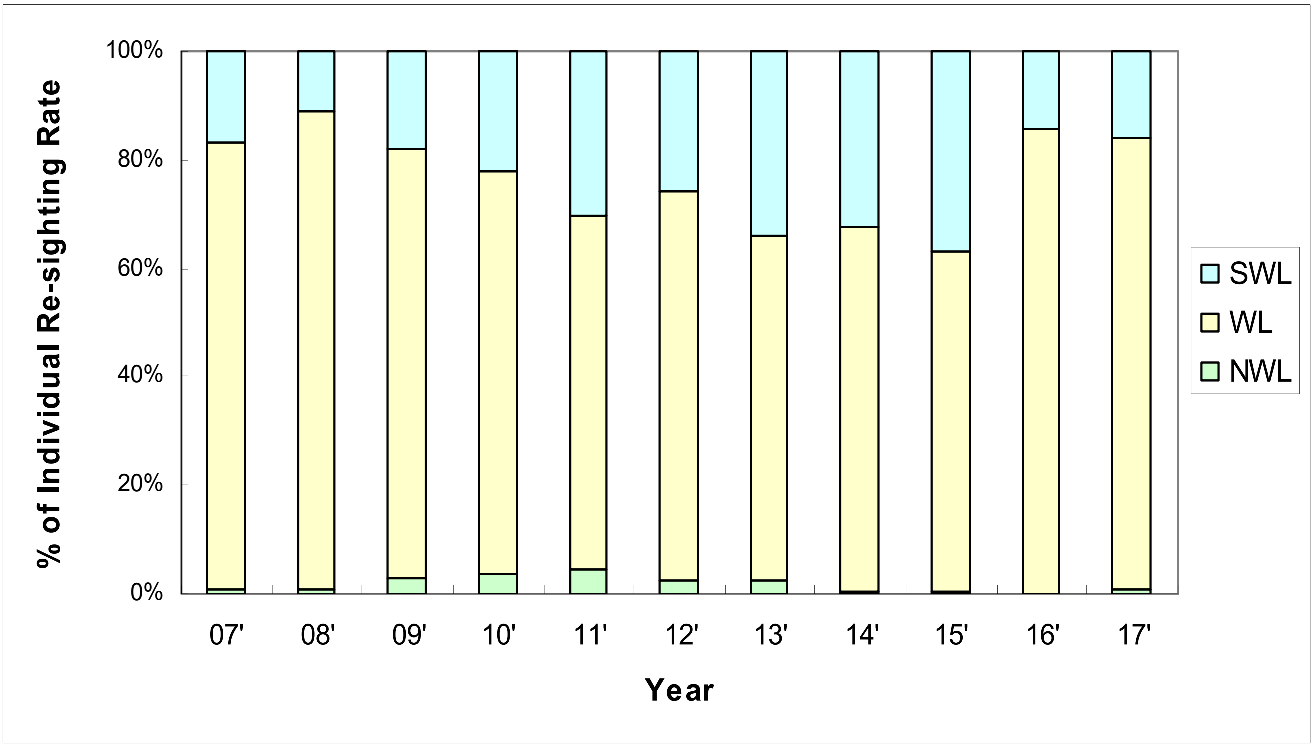


Figure 48b. Proportion of Combined Individual Re-sighting Rate of the total among four survey areas during 2007-2017 based on 46 individual dolphins from southern social cluster

Appendix I. HKCRP-AFCD Survey Effort Database (April 2017 - March 2018)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
5-Apr-17	SW LANTAU	2	7.51	SPRING	STANDARD33706	P
5-Apr-17	SW LANTAU	3	9.46	SPRING	STANDARD33706	P
5-Apr-17	SW LANTAU	2	3.70	SPRING	STANDARD33706	S
5-Apr-17	SW LANTAU	3	8.53	SPRING	STANDARD33706	S
6-Apr-17	LAMMA	2	31.90	SPRING	STANDARD33706	P
6-Apr-17	LAMMA	3	16.50	SPRING	STANDARD33706	P
6-Apr-17	LAMMA	4	0.10	SPRING	STANDARD33706	P
6-Apr-17	LAMMA	2	4.03	SPRING	STANDARD33706	S
6-Apr-17	LAMMA	3	5.85	SPRING	STANDARD33706	S
6-Apr-17	SE LANTAU	1	3.03	SPRING	STANDARD33706	P
6-Apr-17	SE LANTAU	2	10.30	SPRING	STANDARD33706	P
6-Apr-17	SE LANTAU	1	0.99	SPRING	STANDARD33706	S
6-Apr-17	SE LANTAU	2	5.29	SPRING	STANDARD33706	S
7-Apr-17	W LANTAU	1	3.34	SPRING	STANDARD36826	S
7-Apr-17	W LANTAU	2	3.47	SPRING	STANDARD36826	S
7-Apr-17	W LANTAU	3	3.49	SPRING	STANDARD36826	S
11-Apr-17	SE LANTAU	1	29.30	SPRING	STANDARD33706	P
11-Apr-17	SE LANTAU	1	3.21	SPRING	STANDARD33706	S
11-Apr-17	SE LANTAU	2	3.77	SPRING	STANDARD33706	S
11-Apr-17	SW LANTAU	1	2.99	SPRING	STANDARD33706	P
11-Apr-17	SW LANTAU	2	10.67	SPRING	STANDARD33706	P
11-Apr-17	SW LANTAU	2	3.45	SPRING	STANDARD33706	S
13-Apr-17	SW LANTAU	1	12.27	SPRING	STANDARD36826	P
13-Apr-17	SW LANTAU	2	6.00	SPRING	STANDARD36826	P
13-Apr-17	SW LANTAU	1	1.90	SPRING	STANDARD36826	S
13-Apr-17	SW LANTAU	2	4.87	SPRING	STANDARD36826	S
18-Apr-17	W LANTAU	2	8.37	SPRING	STANDARD33706	P
18-Apr-17	W LANTAU	2	8.76	SPRING	STANDARD33706	S
18-Apr-17	SW LANTAU	2	9.63	SPRING	STANDARD33706	S
18-Apr-17	SE LANTAU	1	1.98	SPRING	STANDARD33706	P
18-Apr-17	SE LANTAU	2	13.30	SPRING	STANDARD33706	P
18-Apr-17	SE LANTAU	2	3.22	SPRING	STANDARD33706	S
21-Apr-17	LAMMA	2	10.74	SPRING	STANDARD36826	P
21-Apr-17	LAMMA	3	48.36	SPRING	STANDARD36826	P
21-Apr-17	LAMMA	4	12.57	SPRING	STANDARD36826	P
21-Apr-17	LAMMA	2	4.47	SPRING	STANDARD36826	S
21-Apr-17	LAMMA	3	13.86	SPRING	STANDARD36826	S
21-Apr-17	LAMMA	4	2.00	SPRING	STANDARD36826	S
28-Apr-17	NW LANTAU	2	30.26	SPRING	STANDARD36826	P
28-Apr-17	NW LANTAU	3	1.81	SPRING	STANDARD36826	P
28-Apr-17	NW LANTAU	1	1.10	SPRING	STANDARD36826	S
28-Apr-17	NW LANTAU	2	9.49	SPRING	STANDARD36826	S
28-Apr-17	DEEP BAY	1	1.50	SPRING	STANDARD36826	P
28-Apr-17	DEEP BAY	2	9.76	SPRING	STANDARD36826	P
28-Apr-17	DEEP BAY	3	1.60	SPRING	STANDARD36826	P
28-Apr-17	DEEP BAY	1	1.20	SPRING	STANDARD36826	S
28-Apr-17	DEEP BAY	2	5.90	SPRING	STANDARD36826	S
5-May-17	LAMMA	1	42.18	SPRING	STANDARD36826	P
5-May-17	LAMMA	2	39.40	SPRING	STANDARD36826	P
5-May-17	LAMMA	1	6.82	SPRING	STANDARD36826	S
5-May-17	LAMMA	2	10.10	SPRING	STANDARD36826	S
8-May-17	SW LANTAU	3	7.32	SPRING	STANDARD36826	P
8-May-17	SW LANTAU	4	2.96	SPRING	STANDARD36826	P
8-May-17	SW LANTAU	2	1.10	SPRING	STANDARD36826	S
8-May-17	SW LANTAU	3	8.61	SPRING	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
8-May-17	SW LANTAU	4	2.19	SPRING	STANDARD36826	S
10-May-17	W LANTAU	2	9.63	SPRING	STANDARD36826	S
12-May-17	W LANTAU	1	9.02	SPRING	STANDARD36826	S
12-May-17	W LANTAU	2	1.08	SPRING	STANDARD36826	S
12-May-17	SW LANTAU	2	26.28	SPRING	STANDARD36826	P
12-May-17	SW LANTAU	1	3.68	SPRING	STANDARD36826	S
12-May-17	SW LANTAU	2	6.24	SPRING	STANDARD36826	S
12-May-17	SW LANTAU	3	1.80	SPRING	STANDARD36826	S
12-May-17	SE LANTAU	2	14.77	SPRING	STANDARD36826	P
12-May-17	SE LANTAU	3	8.66	SPRING	STANDARD36826	P
12-May-17	SE LANTAU	2	6.99	SPRING	STANDARD36826	S
19-May-17	W LANTAU	2	6.23	SPRING	STANDARD36826	S
19-May-17	W LANTAU	3	4.37	SPRING	STANDARD36826	S
19-May-17	NE LANTAU	2	10.02	SPRING	STANDARD36826	P
19-May-17	NE LANTAU	1	1.50	SPRING	STANDARD36826	S
19-May-17	NE LANTAU	2	5.28	SPRING	STANDARD36826	S
23-May-17	SE LANTAU	2	21.12	SPRING	STANDARD36826	P
23-May-17	SE LANTAU	3	7.57	SPRING	STANDARD36826	P
23-May-17	SE LANTAU	2	8.81	SPRING	STANDARD36826	S
23-May-17	SW LANTAU	2	5.25	SPRING	STANDARD36826	P
23-May-17	SW LANTAU	3	10.50	SPRING	STANDARD36826	P
23-May-17	SW LANTAU	4	1.91	SPRING	STANDARD36826	P
23-May-17	SW LANTAU	2	7.43	SPRING	STANDARD36826	S
23-May-17	SW LANTAU	3	1.59	SPRING	STANDARD36826	S
23-May-17	SW LANTAU	4	0.75	SPRING	STANDARD36826	S
25-May-17	NW LANTAU	2	18.24	SPRING	STANDARD36826	P
25-May-17	NW LANTAU	3	9.57	SPRING	STANDARD36826	P
25-May-17	NW LANTAU	2	4.69	SPRING	STANDARD36826	S
25-May-17	DEEP BAY	1	1.30	SPRING	STANDARD36826	P
25-May-17	DEEP BAY	2	2.79	SPRING	STANDARD36826	P
25-May-17	DEEP BAY	3	8.60	SPRING	STANDARD36826	P
25-May-17	DEEP BAY	1	1.60	SPRING	STANDARD36826	S
25-May-17	DEEP BAY	2	5.41	SPRING	STANDARD36826	S
25-May-17	NE LANTAU	1	3.60	SPRING	STANDARD36826	P
25-May-17	NE LANTAU	2	24.63	SPRING	STANDARD36826	P
25-May-17	NE LANTAU	1	4.80	SPRING	STANDARD36826	S
25-May-17	NE LANTAU	2	6.77	SPRING	STANDARD36826	S
31-May-17	LAMMA	1	27.06	SPRING	STANDARD36826	P
31-May-17	LAMMA	2	10.00	SPRING	STANDARD36826	P
31-May-17	LAMMA	1	5.94	SPRING	STANDARD36826	S
31-May-17	SE LANTAU	1	0.93	SPRING	STANDARD36826	P
31-May-17	SE LANTAU	2	34.30	SPRING	STANDARD36826	P
31-May-17	SE LANTAU	3	1.10	SPRING	STANDARD36826	P
31-May-17	SE LANTAU	2	7.51	SPRING	STANDARD36826	S
31-May-17	SE LANTAU	3	1.34	SPRING	STANDARD36826	S
1-Jun-17	NW LANTAU	3	18.37	SUMMER	STANDARD36826	P
1-Jun-17	NW LANTAU	4	14.79	SUMMER	STANDARD36826	P
1-Jun-17	NW LANTAU	5	2.23	SUMMER	STANDARD36826	P
1-Jun-17	NW LANTAU	3	2.80	SUMMER	STANDARD36826	S
1-Jun-17	NW LANTAU	4	6.21	SUMMER	STANDARD36826	S
1-Jun-17	NW LANTAU	5	1.67	SUMMER	STANDARD36826	S
1-Jun-17	DEEP BAY	3	6.30	SUMMER	STANDARD36826	P
1-Jun-17	DEEP BAY	4	5.49	SUMMER	STANDARD36826	P
1-Jun-17	DEEP BAY	3	4.69	SUMMER	STANDARD36826	S
1-Jun-17	DEEP BAY	4	1.82	SUMMER	STANDARD36826	S
1-Jun-17	DEEP BAY	5	0.20	SUMMER	STANDARD36826	S
1-Jun-17	NE LANTAU	2	8.76	SUMMER	STANDARD36826	P
1-Jun-17	NE LANTAU	3	7.20	SUMMER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
1-Jun-17	NE LANTAU	2	6.65	SUMMER	STANDARD36826	S
1-Jun-17	NE LANTAU	3	3.89	SUMMER	STANDARD36826	S
6-Jun-17	SE LANTAU	3	14.28	SUMMER	STANDARD36826	P
6-Jun-17	SE LANTAU	4	2.20	SUMMER	STANDARD36826	P
6-Jun-17	SE LANTAU	3	2.62	SUMMER	STANDARD36826	S
6-Jun-17	SW LANTAU	2	3.50	SUMMER	STANDARD36826	P
6-Jun-17	SW LANTAU	3	18.78	SUMMER	STANDARD36826	P
6-Jun-17	SW LANTAU	2	4.80	SUMMER	STANDARD36826	S
6-Jun-17	SW LANTAU	3	8.59	SUMMER	STANDARD36826	S
8-Jun-17	PO TOI	2	3.21	SUMMER	STANDARD36826	P
8-Jun-17	PO TOI	3	50.31	SUMMER	STANDARD36826	P
8-Jun-17	PO TOI	2	0.49	SUMMER	STANDARD36826	S
8-Jun-17	PO TOI	3	3.79	SUMMER	STANDARD36826	S
8-Jun-17	NINEPINS	2	6.20	SUMMER	STANDARD36826	P
8-Jun-17	NINEPINS	3	21.41	SUMMER	STANDARD36826	P
8-Jun-17	NINEPINS	4	1.79	SUMMER	STANDARD36826	P
8-Jun-17	NINEPINS	3	2.10	SUMMER	STANDARD36826	S
9-Jun-17	SW LANTAU	2	5.21	SUMMER	STANDARD36826	P
9-Jun-17	SW LANTAU	3	7.12	SUMMER	STANDARD36826	P
9-Jun-17	SW LANTAU	2	4.72	SUMMER	STANDARD36826	S
9-Jun-17	SW LANTAU	3	1.81	SUMMER	STANDARD36826	S
9-Jun-17	SW LANTAU	4	0.64	SUMMER	STANDARD36826	S
15-Jun-17	DEEP BAY	2	3.40	SUMMER	STANDARD36826	P
15-Jun-17	DEEP BAY	3	6.15	SUMMER	STANDARD36826	P
15-Jun-17	DEEP BAY	4	3.17	SUMMER	STANDARD36826	P
15-Jun-17	DEEP BAY	2	2.64	SUMMER	STANDARD36826	S
15-Jun-17	DEEP BAY	3	2.95	SUMMER	STANDARD36826	S
15-Jun-17	DEEP BAY	4	2.09	SUMMER	STANDARD36826	S
15-Jun-17	NE LANTAU	2	12.17	SUMMER	STANDARD36826	P
15-Jun-17	NE LANTAU	3	2.43	SUMMER	STANDARD36826	P
15-Jun-17	NE LANTAU	2	6.44	SUMMER	STANDARD36826	S
15-Jun-17	NE LANTAU	3	1.36	SUMMER	STANDARD36826	S
21-Jun-17	SW LANTAU	2	8.18	SUMMER	STANDARD36826	S
21-Jun-17	SW LANTAU	3	0.53	SUMMER	STANDARD36826	S
21-Jun-17	SE LANTAU	2	0.90	SUMMER	STANDARD36826	P
21-Jun-17	SE LANTAU	3	11.11	SUMMER	STANDARD36826	P
21-Jun-17	SE LANTAU	2	0.68	SUMMER	STANDARD36826	S
21-Jun-17	SE LANTAU	3	7.11	SUMMER	STANDARD36826	S
23-Jun-17	NW LANTAU	2	7.98	SUMMER	STANDARD36826	P
23-Jun-17	NW LANTAU	3	15.42	SUMMER	STANDARD36826	P
23-Jun-17	NW LANTAU	3	4.60	SUMMER	STANDARD36826	S
23-Jun-17	W LANTAU	3	11.09	SUMMER	STANDARD36826	P
23-Jun-17	W LANTAU	4	1.31	SUMMER	STANDARD36826	P
23-Jun-17	W LANTAU	3	7.49	SUMMER	STANDARD36826	S
23-Jun-17	W LANTAU	4	2.41	SUMMER	STANDARD36826	S
26-Jun-17	DEEP BAY	3	7.97	SUMMER	STANDARD36826	P
26-Jun-17	DEEP BAY	4	6.06	SUMMER	STANDARD36826	P
26-Jun-17	DEEP BAY	3	4.97	SUMMER	STANDARD36826	S
26-Jun-17	DEEP BAY	4	0.90	SUMMER	STANDARD36826	S
26-Jun-17	NE LANTAU	2	13.93	SUMMER	STANDARD36826	P
26-Jun-17	NE LANTAU	3	2.64	SUMMER	STANDARD36826	P
26-Jun-17	NE LANTAU	2	7.54	SUMMER	STANDARD36826	S
26-Jun-17	NE LANTAU	3	1.69	SUMMER	STANDARD36826	S
28-Jun-17	W LANTAU	2	1.46	SUMMER	STANDARD36826	P
28-Jun-17	W LANTAU	3	6.75	SUMMER	STANDARD36826	P
28-Jun-17	W LANTAU	4	1.71	SUMMER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
28-Jun-17	W LANTAU	2	1.12	SUMMER	STANDARD36826	S
28-Jun-17	W LANTAU	3	8.00	SUMMER	STANDARD36826	S
28-Jun-17	SW LANTAU	2	6.89	SUMMER	STANDARD36826	P
28-Jun-17	SW LANTAU	3	10.09	SUMMER	STANDARD36826	P
28-Jun-17	SW LANTAU	2	5.16	SUMMER	STANDARD36826	S
28-Jun-17	SW LANTAU	3	7.61	SUMMER	STANDARD36826	S
29-Jun-17	PO TOI	1	24.33	SUMMER	STANDARD36826	P
29-Jun-17	PO TOI	2	44.39	SUMMER	STANDARD36826	P
29-Jun-17	PO TOI	2	14.20	SUMMER	STANDARD36826	S
30-Jun-17	NINEPINS	1	20.59	SUMMER	STANDARD36826	P
30-Jun-17	NINEPINS	2	49.85	SUMMER	STANDARD36826	P
30-Jun-17	NINEPINS	2	8.62	SUMMER	STANDARD36826	S
30-Jun-17	NINEPINS	3	0.64	SUMMER	STANDARD36826	S
4-Jul-17	SE LANTAU	2	15.44	SUMMER	STANDARD36826	P
4-Jul-17	SE LANTAU	2	7.44	SUMMER	STANDARD36826	S
4-Jul-17	SE LANTAU	3	1.30	SUMMER	STANDARD36826	S
5-Jul-17	NW LANTAU	2	2.07	SUMMER	STANDARD36826	P
5-Jul-17	NW LANTAU	3	16.16	SUMMER	STANDARD36826	P
5-Jul-17	NW LANTAU	4	3.88	SUMMER	STANDARD36826	P
5-Jul-17	NW LANTAU	2	2.02	SUMMER	STANDARD36826	S
5-Jul-17	NW LANTAU	3	7.29	SUMMER	STANDARD36826	S
5-Jul-17	W LANTAU	2	3.05	SUMMER	STANDARD36826	P
5-Jul-17	W LANTAU	3	6.51	SUMMER	STANDARD36826	P
5-Jul-17	W LANTAU	4	3.72	SUMMER	STANDARD36826	P
5-Jul-17	W LANTAU	2	1.34	SUMMER	STANDARD36826	S
5-Jul-17	W LANTAU	3	8.28	SUMMER	STANDARD36826	S
5-Jul-17	W LANTAU	4	1.30	SUMMER	STANDARD36826	S
11-Jul-17	PO TOI	2	42.35	SUMMER	STANDARD36826	P
11-Jul-17	PO TOI	3	8.12	SUMMER	STANDARD36826	P
11-Jul-17	PO TOI	2	5.45	SUMMER	STANDARD36826	S
11-Jul-17	NINEPINS	2	25.60	SUMMER	STANDARD36826	P
11-Jul-17	NINEPINS	2	5.00	SUMMER	STANDARD36826	S
13-Jul-17	SW LANTAU	2	2.30	SUMMER	STANDARD36826	P
13-Jul-17	SW LANTAU	3	15.46	SUMMER	STANDARD36826	P
13-Jul-17	SW LANTAU	4	2.50	SUMMER	STANDARD36826	P
13-Jul-17	SW LANTAU	3	5.44	SUMMER	STANDARD36826	S
13-Jul-17	SW LANTAU	4	2.20	SUMMER	STANDARD36826	S
14-Jul-17	SE LANTAU	2	6.08	SUMMER	STANDARD36826	P
14-Jul-17	SE LANTAU	3	15.37	SUMMER	STANDARD36826	P
14-Jul-17	SE LANTAU	2	4.86	SUMMER	STANDARD36826	S
14-Jul-17	SE LANTAU	3	5.19	SUMMER	STANDARD36826	S
14-Jul-17	SW LANTAU	3	12.46	SUMMER	STANDARD36826	P
14-Jul-17	SW LANTAU	4	9.28	SUMMER	STANDARD36826	P
14-Jul-17	SW LANTAU	2	0.80	SUMMER	STANDARD36826	S
14-Jul-17	SW LANTAU	3	6.13	SUMMER	STANDARD36826	S
14-Jul-17	SW LANTAU	4	4.66	SUMMER	STANDARD36826	S
24-Jul-17	DEEP BAY	2	12.04	SUMMER	STANDARD36826	P
24-Jul-17	DEEP BAY	3	1.00	SUMMER	STANDARD36826	P
24-Jul-17	DEEP BAY	2	7.06	SUMMER	STANDARD36826	S
24-Jul-17	NE LANTAU	2	7.29	SUMMER	STANDARD36826	P
24-Jul-17	NE LANTAU	3	7.97	SUMMER	STANDARD36826	P
24-Jul-17	NE LANTAU	2	4.27	SUMMER	STANDARD36826	S
24-Jul-17	NE LANTAU	3	5.87	SUMMER	STANDARD36826	S
26-Jul-17	PO TOI	2	47.73	SUMMER	STANDARD36826	P
26-Jul-17	PO TOI	3	1.40	SUMMER	STANDARD36826	P
26-Jul-17	PO TOI	2	6.37	SUMMER	STANDARD36826	S
26-Jul-17	NINEPINS	2	20.68	SUMMER	STANDARD36826	P
26-Jul-17	NINEPINS	3	3.32	SUMMER	STANDARD36826	P
26-Jul-17	NINEPINS	2	2.30	SUMMER	STANDARD36826	S
26-Jul-17	NINEPINS	3	1.00	SUMMER	STANDARD36826	S
28-Jul-17	W LANTAU	2	6.90	SUMMER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
28-Jul-17	W LANTAU	3	3.51	SUMMER	STANDARD36826	P
28-Jul-17	W LANTAU	2	5.65	SUMMER	STANDARD36826	S
28-Jul-17	W LANTAU	3	5.88	SUMMER	STANDARD36826	S
28-Jul-17	SW LANTAU	1	1.87	SUMMER	STANDARD36826	S
28-Jul-17	SW LANTAU	2	7.37	SUMMER	STANDARD36826	S
2-Aug-17	SE LANTAU	2	13.96	SUMMER	STANDARD36826	P
2-Aug-17	SE LANTAU	3	7.86	SUMMER	STANDARD36826	P
2-Aug-17	SE LANTAU	2	5.83	SUMMER	STANDARD36826	S
2-Aug-17	SE LANTAU	3	0.95	SUMMER	STANDARD36826	S
2-Aug-17	SW LANTAU	1	4.09	SUMMER	STANDARD36826	P
2-Aug-17	SW LANTAU	2	9.70	SUMMER	STANDARD36826	P
2-Aug-17	SW LANTAU	1	3.29	SUMMER	STANDARD36826	S
2-Aug-17	SW LANTAU	2	8.41	SUMMER	STANDARD36826	S
4-Aug-17	W LANTAU	2	8.18	SUMMER	STANDARD36826	S
4-Aug-17	W LANTAU	3	1.24	SUMMER	STANDARD36826	S
4-Aug-17	SW LANTAU	2	18.51	SUMMER	STANDARD36826	P
4-Aug-17	SW LANTAU	3	10.38	SUMMER	STANDARD36826	P
4-Aug-17	SW LANTAU	2	7.20	SUMMER	STANDARD36826	S
4-Aug-17	SW LANTAU	3	2.25	SUMMER	STANDARD36826	S
4-Aug-17	SE LANTAU	2	14.53	SUMMER	STANDARD36826	P
4-Aug-17	SE LANTAU	2	2.83	SUMMER	STANDARD36826	S
8-Aug-17	SW LANTAU	3	7.53	SUMMER	STANDARD36826	P
8-Aug-17	SW LANTAU	2	0.57	SUMMER	STANDARD36826	S
8-Aug-17	SW LANTAU	3	2.93	SUMMER	STANDARD36826	S
14-Aug-17	SW LANTAU	2	5.76	SUMMER	STANDARD36826	P
14-Aug-17	SW LANTAU	3	11.65	SUMMER	STANDARD36826	P
14-Aug-17	SW LANTAU	3	3.46	SUMMER	STANDARD36826	S
15-Aug-17	DEEP BAY	3	12.61	SUMMER	STANDARD36826	P
15-Aug-17	DEEP BAY	3	7.59	SUMMER	STANDARD36826	S
15-Aug-17	NE LANTAU	2	13.91	SUMMER	STANDARD36826	P
15-Aug-17	NE LANTAU	3	8.94	SUMMER	STANDARD36826	P
15-Aug-17	NE LANTAU	2	13.08	SUMMER	STANDARD36826	S
15-Aug-17	NE LANTAU	3	1.07	SUMMER	STANDARD36826	S
17-Aug-17	W LANTAU	2	1.56	SUMMER	STANDARD36826	P
17-Aug-17	W LANTAU	3	6.14	SUMMER	STANDARD36826	P
17-Aug-17	W LANTAU	2	3.76	SUMMER	STANDARD36826	S
17-Aug-17	W LANTAU	3	4.44	SUMMER	STANDARD36826	S
18-Aug-17	SAI KUNG	1	11.25	SUMMER	STANDARD36826	P
18-Aug-17	SAI KUNG	2	56.42	SUMMER	STANDARD36826	P
18-Aug-17	SAI KUNG	3	1.70	SUMMER	STANDARD36826	P
18-Aug-17	SAI KUNG	1	1.90	SUMMER	STANDARD36826	S
18-Aug-17	SAI KUNG	2	9.03	SUMMER	STANDARD36826	S
22-Aug-17	PO TOI	1	20.10	SUMMER	STANDARD36826	P
22-Aug-17	PO TOI	2	41.98	SUMMER	STANDARD36826	P
22-Aug-17	PO TOI	1	2.10	SUMMER	STANDARD36826	S
22-Aug-17	PO TOI	2	6.58	SUMMER	STANDARD36826	S
22-Aug-17	NINEPINS	2	3.80	SUMMER	STANDARD36826	P
29-Aug-17	NW LANTAU	2	19.18	SUMMER	STANDARD36826	P
29-Aug-17	NW LANTAU	2	7.52	SUMMER	STANDARD36826	S
30-Aug-17	PO TOI	1	0.67	SUMMER	STANDARD36826	P
30-Aug-17	PO TOI	2	45.16	SUMMER	STANDARD36826	P
30-Aug-17	PO TOI	2	6.99	SUMMER	STANDARD36826	S
30-Aug-17	NINEPINS	2	30.00	SUMMER	STANDARD36826	P
30-Aug-17	NINEPINS	2	2.10	SUMMER	STANDARD36826	S
1-Sep-17	W LANTAU	2	18.73	AUTUMN	STANDARD36826	P
1-Sep-17	W LANTAU	2	10.37	AUTUMN	STANDARD36826	S
1-Sep-17	SW LANTAU	2	16.13	AUTUMN	STANDARD36826	P
1-Sep-17	SW LANTAU	2	7.29	AUTUMN	STANDARD36826	S
6-Sep-17	PO TOI	0	6.90	AUTUMN	STANDARD36826	P
6-Sep-17	PO TOI	1	12.10	AUTUMN	STANDARD36826	P
6-Sep-17	PO TOI	2	56.53	AUTUMN	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
6-Sep-17	PO TOI	1	1.60	AUTUMN	STANDARD36826	S
6-Sep-17	PO TOI	2	12.87	AUTUMN	STANDARD36826	S
7-Sep-17	SW LANTAU	2	7.01	AUTUMN	STANDARD36826	P
7-Sep-17	SW LANTAU	2	4.43	AUTUMN	STANDARD36826	S
8-Sep-17	SE LANTAU	1	3.25	AUTUMN	STANDARD36826	P
8-Sep-17	SE LANTAU	2	26.04	AUTUMN	STANDARD36826	P
8-Sep-17	SE LANTAU	3	0.60	AUTUMN	STANDARD36826	P
8-Sep-17	SE LANTAU	2	7.71	AUTUMN	STANDARD36826	S
8-Sep-17	SW LANTAU	1	5.56	AUTUMN	STANDARD36826	P
8-Sep-17	SW LANTAU	2	11.15	AUTUMN	STANDARD36826	P
8-Sep-17	SW LANTAU	3	3.96	AUTUMN	STANDARD36826	P
8-Sep-17	SW LANTAU	1	1.10	AUTUMN	STANDARD36826	S
8-Sep-17	SW LANTAU	2	3.29	AUTUMN	STANDARD36826	S
8-Sep-17	SW LANTAU	3	1.30	AUTUMN	STANDARD36826	S
12-Sep-17	SAI KUNG	1	3.74	AUTUMN	STANDARD36826	P
12-Sep-17	SAI KUNG	2	24.46	AUTUMN	STANDARD36826	P
12-Sep-17	SAI KUNG	3	7.60	AUTUMN	STANDARD36826	P
12-Sep-17	SAI KUNG	1	2.40	AUTUMN	STANDARD36826	S
12-Sep-17	SAI KUNG	2	6.50	AUTUMN	STANDARD36826	S
12-Sep-17	NINEPINS	1	11.50	AUTUMN	STANDARD36826	P
12-Sep-17	NINEPINS	2	20.20	AUTUMN	STANDARD36826	P
12-Sep-17	NINEPINS	1	1.20	AUTUMN	STANDARD36826	S
12-Sep-17	NINEPINS	2	3.40	AUTUMN	STANDARD36826	S
13-Sep-17	SW LANTAU	2	9.64	AUTUMN	STANDARD36826	P
13-Sep-17	SW LANTAU	2	4.45	AUTUMN	STANDARD36826	S
13-Sep-17	SW LANTAU	3	0.78	AUTUMN	STANDARD36826	S
13-Sep-17	SW LANTAU	4	1.07	AUTUMN	STANDARD36826	S
14-Sep-17	DEEP BAY	2	9.25	AUTUMN	STANDARD36826	P
14-Sep-17	DEEP BAY	3	2.30	AUTUMN	STANDARD36826	P
14-Sep-17	DEEP BAY	4	1.68	AUTUMN	STANDARD36826	P
14-Sep-17	DEEP BAY	2	4.58	AUTUMN	STANDARD36826	S
14-Sep-17	DEEP BAY	3	2.49	AUTUMN	STANDARD36826	S
14-Sep-17	NE LANTAU	2	8.71	AUTUMN	STANDARD36826	P
14-Sep-17	NE LANTAU	3	6.89	AUTUMN	STANDARD36826	P
14-Sep-17	NE LANTAU	2	7.65	AUTUMN	STANDARD36826	S
14-Sep-17	NE LANTAU	3	3.15	AUTUMN	STANDARD36826	S
18-Sep-17	NW LANTAU	2	5.09	AUTUMN	STANDARD36826	P
18-Sep-17	NW LANTAU	3	13.50	AUTUMN	STANDARD36826	P
18-Sep-17	NW LANTAU	4	3.99	AUTUMN	STANDARD36826	P
18-Sep-17	NW LANTAU	2	3.01	AUTUMN	STANDARD36826	S
18-Sep-17	NW LANTAU	3	8.61	AUTUMN	STANDARD36826	S
20-Sep-17	W LANTAU	2	8.46	AUTUMN	STANDARD36826	P
20-Sep-17	W LANTAU	3	0.38	AUTUMN	STANDARD36826	P
20-Sep-17	W LANTAU	4	0.46	AUTUMN	STANDARD36826	P
20-Sep-17	W LANTAU	2	10.72	AUTUMN	STANDARD36826	S
20-Sep-17	SE LANTAU	1	0.26	AUTUMN	STANDARD36826	P
20-Sep-17	SE LANTAU	2	10.14	AUTUMN	STANDARD36826	P
20-Sep-17	SE LANTAU	3	17.18	AUTUMN	STANDARD36826	P
20-Sep-17	SE LANTAU	1	2.29	AUTUMN	STANDARD36826	S
20-Sep-17	SE LANTAU	2	3.61	AUTUMN	STANDARD36826	S
20-Sep-17	SE LANTAU	3	3.85	AUTUMN	STANDARD36826	S
25-Sep-17	W LANTAU	2	7.50	AUTUMN	STANDARD36826	S
25-Sep-17	W LANTAU	3	2.86	AUTUMN	STANDARD36826	S
25-Sep-17	SW LANTAU	3	9.09	AUTUMN	STANDARD36826	S
28-Sep-17	PO TOI	1	9.26	AUTUMN	STANDARD36826	P
28-Sep-17	PO TOI	2	43.37	AUTUMN	STANDARD36826	P
28-Sep-17	PO TOI	3	16.41	AUTUMN	STANDARD36826	P
28-Sep-17	PO TOI	1	0.60	AUTUMN	STANDARD36826	S
28-Sep-17	PO TOI	2	9.46	AUTUMN	STANDARD36826	S
29-Sep-17	DEEP BAY	1	0.57	AUTUMN	STANDARD36826	P
29-Sep-17	DEEP BAY	2	8.90	AUTUMN	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
29-Sep-17	DEEP BAY	3	3.30	AUTUMN	STANDARD36826	P
29-Sep-17	DEEP BAY	1	1.14	AUTUMN	STANDARD36826	S
29-Sep-17	DEEP BAY	2	6.19	AUTUMN	STANDARD36826	S
29-Sep-17	DEEP BAY	3	0.50	AUTUMN	STANDARD36826	S
29-Sep-17	NE LANTAU	2	2.14	AUTUMN	STANDARD36826	P
29-Sep-17	NE LANTAU	3	6.43	AUTUMN	STANDARD36826	P
29-Sep-17	NE LANTAU	4	1.53	AUTUMN	STANDARD36826	P
29-Sep-17	NE LANTAU	2	3.90	AUTUMN	STANDARD36826	S
29-Sep-17	NE LANTAU	3	6.30	AUTUMN	STANDARD36826	S
10-Oct-17	SW LANTAU	3	7.19	AUTUMN	STANDARD36826	P
10-Oct-17	SW LANTAU	4	8.12	AUTUMN	STANDARD36826	P
10-Oct-17	SW LANTAU	2	0.60	AUTUMN	STANDARD36826	S
10-Oct-17	SW LANTAU	3	6.10	AUTUMN	STANDARD36826	S
10-Oct-17	SW LANTAU	4	3.73	AUTUMN	STANDARD36826	S
10-Oct-17	SW LANTAU	5	2.06	AUTUMN	STANDARD36826	S
11-Oct-17	SE LANTAU	3	24.88	AUTUMN	STANDARD36826	P
11-Oct-17	SE LANTAU	4	6.35	AUTUMN	STANDARD36826	P
11-Oct-17	SE LANTAU	2	1.57	AUTUMN	STANDARD36826	S
11-Oct-17	SE LANTAU	3	6.73	AUTUMN	STANDARD36826	S
11-Oct-17	SE LANTAU	4	5.10	AUTUMN	STANDARD36826	S
11-Oct-17	SE LANTAU	5	0.16	AUTUMN	STANDARD36826	S
11-Oct-17	SW LANTAU	3	14.21	AUTUMN	STANDARD36826	P
11-Oct-17	SW LANTAU	4	8.46	AUTUMN	STANDARD36826	P
11-Oct-17	SW LANTAU	3	4.70	AUTUMN	STANDARD36826	S
11-Oct-17	SW LANTAU	4	2.93	AUTUMN	STANDARD36826	S
12-Oct-17	W LANTAU	3	5.50	AUTUMN	STANDARD36826	P
12-Oct-17	W LANTAU	4	5.02	AUTUMN	STANDARD36826	P
12-Oct-17	W LANTAU	3	7.09	AUTUMN	STANDARD36826	S
12-Oct-17	W LANTAU	4	4.56	AUTUMN	STANDARD36826	S
19-Oct-17	NW LANTAU	2	5.93	AUTUMN	STANDARD36826	P
19-Oct-17	NW LANTAU	3	2.32	AUTUMN	STANDARD36826	P
19-Oct-17	NW LANTAU	4	7.15	AUTUMN	STANDARD36826	P
19-Oct-17	NW LANTAU	2	3.25	AUTUMN	STANDARD36826	S
19-Oct-17	NW LANTAU	3	7.67	AUTUMN	STANDARD36826	S
19-Oct-17	NW LANTAU	4	1.68	AUTUMN	STANDARD36826	S
20-Oct-17	DEEP BAY	1	0.30	AUTUMN	STANDARD36826	P
20-Oct-17	DEEP BAY	2	11.24	AUTUMN	STANDARD36826	P
20-Oct-17	DEEP BAY	3	1.72	AUTUMN	STANDARD36826	P
20-Oct-17	DEEP BAY	1	0.90	AUTUMN	STANDARD36826	S
20-Oct-17	DEEP BAY	2	5.84	AUTUMN	STANDARD36826	S
20-Oct-17	DEEP BAY	3	0.20	AUTUMN	STANDARD36826	S
20-Oct-17	NE LANTAU	2	15.76	AUTUMN	STANDARD36826	P
20-Oct-17	NE LANTAU	2	9.74	AUTUMN	STANDARD36826	S
20-Oct-17	NW LANTAU	2	17.92	AUTUMN	STANDARD36826	P
20-Oct-17	NW LANTAU	3	18.35	AUTUMN	STANDARD36826	P
20-Oct-17	NW LANTAU	2	10.23	AUTUMN	STANDARD36826	S
24-Oct-17	SW LANTAU	2	12.17	AUTUMN	STANDARD36826	P
24-Oct-17	SW LANTAU	3	4.64	AUTUMN	STANDARD36826	P
24-Oct-17	SW LANTAU	2	3.30	AUTUMN	STANDARD36826	S
24-Oct-17	SW LANTAU	3	4.49	AUTUMN	STANDARD36826	S
26-Oct-17	W LANTAU	2	9.42	AUTUMN	STANDARD36826	P
26-Oct-17	W LANTAU	3	0.53	AUTUMN	STANDARD36826	P
26-Oct-17	W LANTAU	2	11.20	AUTUMN	STANDARD36826	S
31-Oct-17	NW LANTAU	2	17.59	AUTUMN	STANDARD36826	P
31-Oct-17	NW LANTAU	3	4.91	AUTUMN	STANDARD36826	P
31-Oct-17	NW LANTAU	2	12.80	AUTUMN	STANDARD36826	S
31-Oct-17	NW LANTAU	3	1.00	AUTUMN	STANDARD36826	S
31-Oct-17	W LANTAU	2	5.41	AUTUMN	STANDARD36826	P
31-Oct-17	W LANTAU	3	9.10	AUTUMN	STANDARD36826	P
31-Oct-17	W LANTAU	2	6.81	AUTUMN	STANDARD36826	S
31-Oct-17	W LANTAU	3	7.68	AUTUMN	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
2-Nov-17	PO TOI	2	12.20	AUTUMN	STANDARD36826	P
2-Nov-17	PO TOI	3	39.64	AUTUMN	STANDARD36826	P
2-Nov-17	PO TOI	4	1.96	AUTUMN	STANDARD36826	P
2-Nov-17	PO TOI	2	3.31	AUTUMN	STANDARD36826	S
2-Nov-17	PO TOI	3	14.19	AUTUMN	STANDARD36826	S
2-Nov-17	NINEPINS	3	7.22	AUTUMN	STANDARD36826	P
7-Nov-17	SE LANTAU	2	19.57	AUTUMN	STANDARD36826	P
7-Nov-17	SE LANTAU	3	9.54	AUTUMN	STANDARD36826	P
7-Nov-17	SE LANTAU	2	4.83	AUTUMN	STANDARD36826	S
7-Nov-17	SE LANTAU	3	3.56	AUTUMN	STANDARD36826	S
7-Nov-17	SW LANTAU	2	9.17	AUTUMN	STANDARD36826	P
7-Nov-17	SW LANTAU	3	13.14	AUTUMN	STANDARD36826	P
7-Nov-17	SW LANTAU	2	1.70	AUTUMN	STANDARD36826	S
7-Nov-17	SW LANTAU	3	6.71	AUTUMN	STANDARD36826	S
8-Nov-17	W LANTAU	2	0.99	AUTUMN	STANDARD36826	P
8-Nov-17	W LANTAU	3	1.80	AUTUMN	STANDARD36826	P
8-Nov-17	W LANTAU	4	3.81	AUTUMN	STANDARD36826	P
8-Nov-17	W LANTAU	2	1.16	AUTUMN	STANDARD36826	S
8-Nov-17	W LANTAU	3	5.27	AUTUMN	STANDARD36826	S
8-Nov-17	W LANTAU	4	3.64	AUTUMN	STANDARD36826	S
9-Nov-17	SW LANTAU	2	8.50	AUTUMN	STANDARD36826	P
9-Nov-17	SW LANTAU	3	6.09	AUTUMN	STANDARD36826	P
9-Nov-17	SW LANTAU	2	6.31	AUTUMN	STANDARD36826	S
9-Nov-17	SW LANTAU	3	2.40	AUTUMN	STANDARD36826	S
9-Nov-17	SW LANTAU	4	1.90	AUTUMN	STANDARD36826	S
13-Nov-17	W LANTAU	2	16.12	AUTUMN	STANDARD36826	P
13-Nov-17	W LANTAU	2	13.57	AUTUMN	STANDARD36826	S
13-Nov-17	NW LANTAU	1	1.10	AUTUMN	STANDARD36826	P
13-Nov-17	NW LANTAU	2	21.22	AUTUMN	STANDARD36826	P
13-Nov-17	NW LANTAU	1	2.10	AUTUMN	STANDARD36826	S
13-Nov-17	NW LANTAU	2	8.88	AUTUMN	STANDARD36826	S
14-Nov-17	DEEP BAY	2	6.72	AUTUMN	STANDARD36826	P
14-Nov-17	DEEP BAY	3	5.25	AUTUMN	STANDARD36826	P
14-Nov-17	DEEP BAY	2	6.34	AUTUMN	STANDARD36826	S
14-Nov-17	DEEP BAY	3	0.89	AUTUMN	STANDARD36826	S
14-Nov-17	NE LANTAU	2	7.76	AUTUMN	STANDARD36826	P
14-Nov-17	NE LANTAU	3	7.88	AUTUMN	STANDARD36826	P
14-Nov-17	NE LANTAU	2	9.16	AUTUMN	STANDARD36826	S
14-Nov-17	NE LANTAU	3	0.60	AUTUMN	STANDARD36826	S
17-Nov-17	W LANTAU	2	5.04	AUTUMN	STANDARD36826	S
17-Nov-17	W LANTAU	3	2.11	AUTUMN	STANDARD36826	S
17-Nov-17	W LANTAU	4	3.05	AUTUMN	STANDARD36826	S
17-Nov-17	SW LANTAU	2	3.43	AUTUMN	STANDARD36826	P
17-Nov-17	SW LANTAU	3	5.06	AUTUMN	STANDARD36826	P
17-Nov-17	SW LANTAU	3	7.15	AUTUMN	STANDARD36826	S
20-Nov-17	W LANTAU	3	9.51	AUTUMN	STANDARD36826	S
20-Nov-17	SW LANTAU	2	6.10	AUTUMN	STANDARD36826	P
20-Nov-17	SW LANTAU	3	9.66	AUTUMN	STANDARD36826	P
20-Nov-17	SW LANTAU	4	1.70	AUTUMN	STANDARD36826	P
20-Nov-17	SW LANTAU	2	4.16	AUTUMN	STANDARD36826	S
20-Nov-17	SW LANTAU	3	8.18	AUTUMN	STANDARD36826	S
20-Nov-17	SW LANTAU	4	2.30	AUTUMN	STANDARD36826	S
20-Nov-17	SE LANTAU	2	13.61	AUTUMN	STANDARD36826	P
20-Nov-17	SE LANTAU	3	15.47	AUTUMN	STANDARD36826	P
20-Nov-17	SE LANTAU	2	4.94	AUTUMN	STANDARD36826	S
20-Nov-17	SE LANTAU	3	3.88	AUTUMN	STANDARD36826	S
22-Nov-17	SE LANTAU	2	4.50	AUTUMN	STANDARD36826	P
22-Nov-17	SE LANTAU	3	10.19	AUTUMN	STANDARD36826	P
22-Nov-17	SE LANTAU	4	2.42	AUTUMN	STANDARD36826	P
22-Nov-17	SE LANTAU	2	2.50	AUTUMN	STANDARD36826	S
22-Nov-17	SE LANTAU	3	3.99	AUTUMN	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
27-Nov-17	NW LANTAU	2	11.94	AUTUMN	STANDARD36826	P
27-Nov-17	NW LANTAU	3	13.65	AUTUMN	STANDARD36826	P
27-Nov-17	NW LANTAU	2	4.92	AUTUMN	STANDARD36826	S
27-Nov-17	NW LANTAU	3	2.62	AUTUMN	STANDARD36826	S
27-Nov-17	DEEP BAY	2	12.30	AUTUMN	STANDARD36826	P
27-Nov-17	DEEP BAY	3	0.60	AUTUMN	STANDARD36826	P
27-Nov-17	DEEP BAY	2	7.40	AUTUMN	STANDARD36826	S
27-Nov-17	NE LANTAU	1	0.60	AUTUMN	STANDARD36826	P
27-Nov-17	NE LANTAU	2	18.48	AUTUMN	STANDARD36826	P
27-Nov-17	NE LANTAU	1	2.50	AUTUMN	STANDARD36826	S
27-Nov-17	NE LANTAU	2	8.02	AUTUMN	STANDARD36826	S
28-Nov-17	W LANTAU	2	4.30	AUTUMN	STANDARD36826	P
28-Nov-17	W LANTAU	3	4.17	AUTUMN	STANDARD36826	P
28-Nov-17	W LANTAU	2	11.30	AUTUMN	STANDARD36826	S
28-Nov-17	W LANTAU	3	0.66	AUTUMN	STANDARD36826	S
29-Nov-17	SE LANTAU	2	4.49	AUTUMN	STANDARD36826	P
29-Nov-17	SE LANTAU	3	10.13	AUTUMN	STANDARD36826	P
29-Nov-17	SE LANTAU	4	5.30	AUTUMN	STANDARD36826	P
29-Nov-17	SE LANTAU	2	6.69	AUTUMN	STANDARD36826	S
29-Nov-17	SE LANTAU	3	8.66	AUTUMN	STANDARD36826	S
29-Nov-17	SE LANTAU	4	0.50	AUTUMN	STANDARD36826	S
29-Nov-17	SW LANTAU	2	19.11	AUTUMN	STANDARD36826	P
29-Nov-17	SW LANTAU	3	4.02	AUTUMN	STANDARD36826	P
29-Nov-17	SW LANTAU	2	9.00	AUTUMN	STANDARD36826	S
29-Nov-17	SW LANTAU	3	1.97	AUTUMN	STANDARD36826	S
4-Dec-17	SW LANTAU	2	7.00	WINTER	STANDARD36826	P
4-Dec-17	SW LANTAU	3	15.34	WINTER	STANDARD36826	P
4-Dec-17	SW LANTAU	2	0.22	WINTER	STANDARD36826	S
4-Dec-17	SW LANTAU	3	11.85	WINTER	STANDARD36826	S
6-Dec-17	NW LANTAU	2	19.51	WINTER	STANDARD36826	P
6-Dec-17	NW LANTAU	3	5.11	WINTER	STANDARD36826	P
6-Dec-17	NW LANTAU	2	5.53	WINTER	STANDARD36826	S
6-Dec-17	NW LANTAU	3	5.32	WINTER	STANDARD36826	S
6-Dec-17	W LANTAU	2	9.26	WINTER	STANDARD36826	P
6-Dec-17	W LANTAU	1	0.72	WINTER	STANDARD36826	S
6-Dec-17	W LANTAU	2	11.17	WINTER	STANDARD36826	S
7-Dec-17	W LANTAU	2	8.48	WINTER	STANDARD36826	S
7-Dec-17	W LANTAU	3	1.62	WINTER	STANDARD36826	S
7-Dec-17	SE LANTAU	2	15.56	WINTER	STANDARD36826	P
7-Dec-17	SE LANTAU	2	5.74	WINTER	STANDARD36826	S
12-Dec-17	W LANTAU	2	5.05	WINTER	STANDARD36826	P
12-Dec-17	W LANTAU	3	5.29	WINTER	STANDARD36826	P
12-Dec-17	W LANTAU	2	6.64	WINTER	STANDARD36826	S
12-Dec-17	W LANTAU	3	3.66	WINTER	STANDARD36826	S
14-Dec-17	DEEP BAY	2	12.78	WINTER	STANDARD36826	P
14-Dec-17	DEEP BAY	1	1.55	WINTER	STANDARD36826	S
14-Dec-17	DEEP BAY	2	5.57	WINTER	STANDARD36826	S
14-Dec-17	NE LANTAU	1	6.94	WINTER	STANDARD36826	P
14-Dec-17	NE LANTAU	2	12.28	WINTER	STANDARD36826	P
14-Dec-17	NE LANTAU	2	10.18	WINTER	STANDARD36826	S
18-Dec-17	SW LANTAU	3	0.90	WINTER	STANDARD36826	P
18-Dec-17	SW LANTAU	4	12.85	WINTER	STANDARD36826	P
18-Dec-17	SW LANTAU	5	2.00	WINTER	STANDARD36826	P
18-Dec-17	SW LANTAU	3	0.70	WINTER	STANDARD36826	S
18-Dec-17	SW LANTAU	4	4.01	WINTER	STANDARD36826	S
18-Dec-17	SW LANTAU	5	1.04	WINTER	STANDARD36826	S
18-Dec-17	SE LANTAU	2	11.24	WINTER	STANDARD36826	P
18-Dec-17	SE LANTAU	3	19.94	WINTER	STANDARD36826	P
18-Dec-17	SE LANTAU	4	4.80	WINTER	STANDARD36826	P
18-Dec-17	SE LANTAU	2	3.20	WINTER	STANDARD36826	S
18-Dec-17	SE LANTAU	3	3.78	WINTER	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
18-Dec-17	SE LANTAU	4	1.70	WINTER	STANDARD36826	S
20-Dec-17	NW LANTAU	4	12.77	WINTER	STANDARD36826	P
20-Dec-17	NW LANTAU	5	0.56	WINTER	STANDARD36826	P
20-Dec-17	NW LANTAU	2	1.62	WINTER	STANDARD36826	S
20-Dec-17	NW LANTAU	3	6.99	WINTER	STANDARD36826	S
20-Dec-17	NW LANTAU	5	2.87	WINTER	STANDARD36826	S
20-Dec-17	DEEP BAY	2	4.07	WINTER	STANDARD36826	P
20-Dec-17	DEEP BAY	3	8.28	WINTER	STANDARD36826	P
20-Dec-17	DEEP BAY	2	2.89	WINTER	STANDARD36826	S
20-Dec-17	DEEP BAY	3	4.76	WINTER	STANDARD36826	S
21-Dec-17	SE LANTAU	3	7.55	WINTER	STANDARD36826	P
21-Dec-17	SE LANTAU	4	1.53	WINTER	STANDARD36826	P
21-Dec-17	SE LANTAU	5	0.71	WINTER	STANDARD36826	P
21-Dec-17	SE LANTAU	2	1.70	WINTER	STANDARD36826	S
21-Dec-17	SE LANTAU	3	3.10	WINTER	STANDARD36826	S
21-Dec-17	SE LANTAU	4	5.33	WINTER	STANDARD36826	S
21-Dec-17	SE LANTAU	5	2.08	WINTER	STANDARD36826	S
28-Dec-17	SE LANTAU	1	1.20	WINTER	STANDARD36826	P
28-Dec-17	SE LANTAU	2	25.65	WINTER	STANDARD36826	P
28-Dec-17	SE LANTAU	3	3.80	WINTER	STANDARD36826	P
28-Dec-17	SE LANTAU	2	3.85	WINTER	STANDARD36826	S
28-Dec-17	SE LANTAU	3	1.90	WINTER	STANDARD36826	S
28-Dec-17	LAMMA	2	13.88	WINTER	STANDARD36826	P
28-Dec-17	LAMMA	3	25.67	WINTER	STANDARD36826	P
28-Dec-17	LAMMA	2	5.65	WINTER	STANDARD36826	S
28-Dec-17	LAMMA	3	3.80	WINTER	STANDARD36826	S
29-Dec-17	W LANTAU	1	1.22	WINTER	STANDARD36826	P
29-Dec-17	W LANTAU	2	18.21	WINTER	STANDARD36826	P
29-Dec-17	W LANTAU	3	1.70	WINTER	STANDARD36826	P
29-Dec-17	W LANTAU	2	10.18	WINTER	STANDARD36826	S
29-Dec-17	W LANTAU	3	0.65	WINTER	STANDARD36826	S
29-Dec-17	SW LANTAU	3	7.07	WINTER	STANDARD36826	P
29-Dec-17	SW LANTAU	4	5.30	WINTER	STANDARD36826	P
29-Dec-17	SW LANTAU	2	1.72	WINTER	STANDARD36826	S
29-Dec-17	SW LANTAU	3	2.18	WINTER	STANDARD36826	S
29-Dec-17	SW LANTAU	4	5.03	WINTER	STANDARD36826	S
2-Jan-18	W LANTAU	2	4.08	WINTER	STANDARD36826	P
2-Jan-18	W LANTAU	1	0.77	WINTER	STANDARD36826	S
2-Jan-18	W LANTAU	2	7.35	WINTER	STANDARD36826	S
2-Jan-18	W LANTAU	3	1.30	WINTER	STANDARD36826	S
3-Jan-18	SW LANTAU	3	13.68	WINTER	STANDARD36826	P
3-Jan-18	SW LANTAU	4	3.25	WINTER	STANDARD36826	P
3-Jan-18	SW LANTAU	2	3.40	WINTER	STANDARD36826	S
3-Jan-18	SW LANTAU	3	1.50	WINTER	STANDARD36826	S
3-Jan-18	SW LANTAU	4	3.57	WINTER	STANDARD36826	S
4-Jan-18	SE LANTAU	2	10.38	WINTER	STANDARD36826	P
4-Jan-18	SE LANTAU	3	14.52	WINTER	STANDARD36826	P
4-Jan-18	SE LANTAU	4	1.46	WINTER	STANDARD36826	P
4-Jan-18	SE LANTAU	2	6.13	WINTER	STANDARD36826	S
4-Jan-18	SE LANTAU	3	3.06	WINTER	STANDARD36826	S
4-Jan-18	SE LANTAU	4	1.95	WINTER	STANDARD36826	S
4-Jan-18	SW LANTAU	3	18.50	WINTER	STANDARD36826	P
4-Jan-18	SW LANTAU	4	4.60	WINTER	STANDARD36826	P
4-Jan-18	SW LANTAU	3	6.44	WINTER	STANDARD36826	S
4-Jan-18	SW LANTAU	4	3.46	WINTER	STANDARD36826	S
5-Jan-18	W LANTAU	0	0.87	WINTER	STANDARD36826	P
5-Jan-18	W LANTAU	1	9.07	WINTER	STANDARD36826	P
5-Jan-18	W LANTAU	2	2.41	WINTER	STANDARD36826	P
5-Jan-18	W LANTAU	1	8.72	WINTER	STANDARD36826	S
5-Jan-18	W LANTAU	2	2.41	WINTER	STANDARD36826	S
5-Jan-18	NW LANTAU	1	1.59	WINTER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
5-Jan-18	NW LANTAU	2	6.96	WINTER	STANDARD36826	P
5-Jan-18	NW LANTAU	3	17.15	WINTER	STANDARD36826	P
5-Jan-18	NW LANTAU	2	6.60	WINTER	STANDARD36826	S
5-Jan-18	NW LANTAU	3	4.20	WINTER	STANDARD36826	S
11-Jan-18	DEEP BAY	2	1.39	WINTER	STANDARD36826	P
11-Jan-18	DEEP BAY	3	8.29	WINTER	STANDARD36826	P
11-Jan-18	DEEP BAY	3	4.15	WINTER	STANDARD36826	S
15-Jan-18	LAMMA	2	12.05	WINTER	STANDARD36826	P
15-Jan-18	LAMMA	3	8.14	WINTER	STANDARD36826	P
15-Jan-18	LAMMA	2	6.61	WINTER	STANDARD36826	S
15-Jan-18	LAMMA	3	1.30	WINTER	STANDARD36826	S
15-Jan-18	SE LANTAU	2	4.40	WINTER	STANDARD36826	P
15-Jan-18	SE LANTAU	3	20.97	WINTER	STANDARD36826	P
15-Jan-18	SE LANTAU	4	2.70	WINTER	STANDARD36826	P
15-Jan-18	SE LANTAU	1	1.15	WINTER	STANDARD36826	S
15-Jan-18	SE LANTAU	2	2.95	WINTER	STANDARD36826	S
15-Jan-18	SE LANTAU	3	0.90	WINTER	STANDARD36826	S
15-Jan-18	SE LANTAU	4	1.10	WINTER	STANDARD36826	S
15-Jan-18	SW LANTAU	3	9.96	WINTER	STANDARD36826	P
15-Jan-18	SW LANTAU	3	4.84	WINTER	STANDARD36826	S
16-Jan-18	W LANTAU	2	9.54	WINTER	STANDARD36826	S
16-Jan-18	SW LANTAU	1	3.09	WINTER	STANDARD36826	P
16-Jan-18	SW LANTAU	2	5.59	WINTER	STANDARD36826	P
16-Jan-18	SW LANTAU	1	1.61	WINTER	STANDARD36826	S
16-Jan-18	SW LANTAU	2	3.48	WINTER	STANDARD36826	S
17-Jan-18	LAMMA	1	18.24	WINTER	STANDARD36826	P
17-Jan-18	LAMMA	2	44.93	WINTER	STANDARD36826	P
17-Jan-18	LAMMA	3	12.86	WINTER	STANDARD36826	P
17-Jan-18	LAMMA	1	5.46	WINTER	STANDARD36826	S
17-Jan-18	LAMMA	2	8.11	WINTER	STANDARD36826	S
17-Jan-18	LAMMA	3	1.00	WINTER	STANDARD36826	S
19-Jan-18	W LANTAU	1	4.26	WINTER	STANDARD36826	P
19-Jan-18	W LANTAU	2	2.72	WINTER	STANDARD36826	P
19-Jan-18	W LANTAU	1	10.44	WINTER	STANDARD36826	S
22-Jan-18	LAMMA	1	10.90	WINTER	STANDARD36826	P
22-Jan-18	LAMMA	2	26.87	WINTER	STANDARD36826	P
22-Jan-18	LAMMA	1	2.00	WINTER	STANDARD36826	S
22-Jan-18	LAMMA	2	5.31	WINTER	STANDARD36826	S
22-Jan-18	SE LANTAU	1	16.08	WINTER	STANDARD36826	P
22-Jan-18	SE LANTAU	2	4.41	WINTER	STANDARD36826	P
22-Jan-18	SE LANTAU	1	0.19	WINTER	STANDARD36826	S
22-Jan-18	SE LANTAU	2	6.59	WINTER	STANDARD36826	S
23-Jan-18	W LANTAU	1	1.10	WINTER	STANDARD36826	S
23-Jan-18	W LANTAU	2	7.30	WINTER	STANDARD36826	S
23-Jan-18	W LANTAU	3	1.30	WINTER	STANDARD36826	S
23-Jan-18	NE LANTAU	2	12.79	WINTER	STANDARD36826	P
23-Jan-18	NE LANTAU	1	3.80	WINTER	STANDARD36826	S
23-Jan-18	NE LANTAU	2	6.41	WINTER	STANDARD36826	S
30-Jan-18	W LANTAU	2	1.72	WINTER	STANDARD36826	P
30-Jan-18	W LANTAU	3	6.85	WINTER	STANDARD36826	P
30-Jan-18	W LANTAU	4	1.30	WINTER	STANDARD36826	P
30-Jan-18	W LANTAU	2	5.20	WINTER	STANDARD36826	S
30-Jan-18	W LANTAU	3	6.93	WINTER	STANDARD36826	S
30-Jan-18	SW LANTAU	2	19.37	WINTER	STANDARD36826	P
30-Jan-18	SW LANTAU	3	3.68	WINTER	STANDARD36826	P
30-Jan-18	SW LANTAU	2	11.04	WINTER	STANDARD36826	S
30-Jan-18	SW LANTAU	3	3.88	WINTER	STANDARD36826	S
30-Jan-18	SE LANTAU	2	5.40	WINTER	STANDARD36826	P
30-Jan-18	SE LANTAU	3	5.74	WINTER	STANDARD36826	P
30-Jan-18	SE LANTAU	2	2.63	WINTER	STANDARD36826	S
31-Jan-18	NE LANTAU	2	9.04	WINTER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
31-Jan-18	NE LANTAU	3	8.30	WINTER	STANDARD36826	P
31-Jan-18	NE LANTAU	1	1.10	WINTER	STANDARD36826	S
31-Jan-18	NE LANTAU	2	4.76	WINTER	STANDARD36826	S
31-Jan-18	NE LANTAU	3	3.80	WINTER	STANDARD36826	S
31-Jan-18	NW LANTAU	2	2.16	WINTER	STANDARD36826	P
31-Jan-18	NW LANTAU	3	16.35	WINTER	STANDARD36826	P
31-Jan-18	NW LANTAU	4	16.24	WINTER	STANDARD36826	P
31-Jan-18	NW LANTAU	2	1.66	WINTER	STANDARD36826	S
31-Jan-18	NW LANTAU	3	7.29	WINTER	STANDARD36826	S
31-Jan-18	NW LANTAU	4	4.40	WINTER	STANDARD36826	S
2-Feb-18	W LANTAU	3	2.33	WINTER	STANDARD36826	S
2-Feb-18	W LANTAU	4	7.02	WINTER	STANDARD36826	S
2-Feb-18	SW LANTAU	3	3.90	WINTER	STANDARD36826	P
2-Feb-18	SW LANTAU	4	8.56	WINTER	STANDARD36826	P
2-Feb-18	SW LANTAU	5	1.00	WINTER	STANDARD36826	P
2-Feb-18	SW LANTAU	4	2.34	WINTER	STANDARD36826	S
2-Feb-18	SW LANTAU	5	2.00	WINTER	STANDARD36826	S
7-Feb-18	LAMMA	2	30.34	WINTER	STANDARD36826	P
7-Feb-18	LAMMA	3	21.64	WINTER	STANDARD36826	P
7-Feb-18	LAMMA	2	7.58	WINTER	STANDARD36826	S
7-Feb-18	LAMMA	3	0.99	WINTER	STANDARD36826	S
7-Feb-18	SE LANTAU	2	21.12	WINTER	STANDARD36826	P
7-Feb-18	SE LANTAU	2	5.88	WINTER	STANDARD36826	S
8-Feb-18	SW LANTAU	2	9.04	WINTER	STANDARD36826	P
8-Feb-18	SW LANTAU	3	10.68	WINTER	STANDARD36826	P
8-Feb-18	SW LANTAU	4	4.10	WINTER	STANDARD36826	P
8-Feb-18	SW LANTAU	2	6.34	WINTER	STANDARD36826	S
8-Feb-18	SW LANTAU	3	7.34	WINTER	STANDARD36826	S
12-Feb-18	NW LANTAU	2	5.79	WINTER	STANDARD36826	P
12-Feb-18	NW LANTAU	3	14.79	WINTER	STANDARD36826	P
12-Feb-18	NW LANTAU	4	5.12	WINTER	STANDARD36826	P
12-Feb-18	NW LANTAU	3	7.63	WINTER	STANDARD36826	S
12-Feb-18	DEEP BAY	2	10.74	WINTER	STANDARD36826	P
12-Feb-18	DEEP BAY	3	0.60	WINTER	STANDARD36826	P
12-Feb-18	DEEP BAY	4	1.10	WINTER	STANDARD36826	P
12-Feb-18	DEEP BAY	2	6.36	WINTER	STANDARD36826	S
12-Feb-18	DEEP BAY	3	0.80	WINTER	STANDARD36826	S
12-Feb-18	NE LANTAU	2	13.48	WINTER	STANDARD36826	P
12-Feb-18	NE LANTAU	3	5.25	WINTER	STANDARD36826	P
12-Feb-18	NE LANTAU	2	10.67	WINTER	STANDARD36826	S
13-Feb-18	W LANTAU	2	5.47	WINTER	STANDARD36826	S
13-Feb-18	W LANTAU	4	3.04	WINTER	STANDARD36826	S
23-Feb-18	SW LANTAU	2	8.31	WINTER	STANDARD36826	P
23-Feb-18	SW LANTAU	3	11.57	WINTER	STANDARD36826	P
23-Feb-18	SW LANTAU	4	1.40	WINTER	STANDARD36826	P
23-Feb-18	SW LANTAU	2	4.37	WINTER	STANDARD36826	S
23-Feb-18	SW LANTAU	3	7.45	WINTER	STANDARD36826	S
2-Mar-18	LAMMA	1	3.00	SPRING	STANDARD36826	P
2-Mar-18	LAMMA	2	19.21	SPRING	STANDARD36826	P
2-Mar-18	LAMMA	3	62.92	SPRING	STANDARD36826	P
2-Mar-18	LAMMA	1	1.10	SPRING	STANDARD36826	S
2-Mar-18	LAMMA	2	6.89	SPRING	STANDARD36826	S
2-Mar-18	LAMMA	3	13.08	SPRING	STANDARD36826	S
7-Mar-18	W LANTAU	2	7.07	SPRING	STANDARD36826	S
7-Mar-18	W LANTAU	3	2.29	SPRING	STANDARD36826	S
7-Mar-18	NW LANTAU	3	7.62	SPRING	STANDARD36826	P
7-Mar-18	NW LANTAU	2	1.49	SPRING	STANDARD36826	S
7-Mar-18	NW LANTAU	3	3.67	SPRING	STANDARD36826	S
9-Mar-18	W LANTAU	3	6.45	SPRING	STANDARD36826	S
9-Mar-18	W LANTAU	4	2.81	SPRING	STANDARD36826	S
9-Mar-18	SW LANTAU	2	10.14	SPRING	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
9-Mar-18	SW LANTAU	3	5.42	SPRING	STANDARD36826	P
9-Mar-18	SW LANTAU	4	0.85	SPRING	STANDARD36826	P
9-Mar-18	SW LANTAU	2	8.64	SPRING	STANDARD36826	S
9-Mar-18	SW LANTAU	3	2.35	SPRING	STANDARD36826	S
12-Mar-18	W LANTAU	2	5.95	SPRING	STANDARD36826	P
12-Mar-18	W LANTAU	3	1.60	SPRING	STANDARD36826	P
12-Mar-18	W LANTAU	2	4.95	SPRING	STANDARD36826	S
12-Mar-18	W LANTAU	3	4.80	SPRING	STANDARD36826	S
15-Mar-18	SW LANTAU	1	18.23	SPRING	STANDARD36826	P
15-Mar-18	SW LANTAU	2	1.15	SPRING	STANDARD36826	P
15-Mar-18	SW LANTAU	1	3.15	SPRING	STANDARD36826	S
15-Mar-18	SW LANTAU	2	6.89	SPRING	STANDARD36826	S
15-Mar-18	SE LANTAU	0	0.95	SPRING	STANDARD36826	P
15-Mar-18	SE LANTAU	1	7.27	SPRING	STANDARD36826	P
15-Mar-18	SE LANTAU	0	1.17	SPRING	STANDARD36826	S
15-Mar-18	SE LANTAU	1	0.81	SPRING	STANDARD36826	S
16-Mar-18	LAMMA	1	13.95	SPRING	STANDARD36826	P
16-Mar-18	LAMMA	2	35.29	SPRING	STANDARD36826	P
16-Mar-18	LAMMA	3	8.70	SPRING	STANDARD36826	P
16-Mar-18	LAMMA	1	5.75	SPRING	STANDARD36826	S
16-Mar-18	LAMMA	2	4.00	SPRING	STANDARD36826	S
16-Mar-18	SE LANTAU	1	11.75	SPRING	STANDARD36826	P
16-Mar-18	SE LANTAU	2	10.31	SPRING	STANDARD36826	P
16-Mar-18	SE LANTAU	1	4.02	SPRING	STANDARD36826	S
23-Mar-18	DEEP BAY	1	2.69	SPRING	STANDARD36826	P
23-Mar-18	DEEP BAY	2	10.11	SPRING	STANDARD36826	P
23-Mar-18	DEEP BAY	2	6.91	SPRING	STANDARD36826	S
23-Mar-18	NE LANTAU	3	5.48	SPRING	STANDARD36826	P
23-Mar-18	NE LANTAU	4	1.40	SPRING	STANDARD36826	P
23-Mar-18	NE LANTAU	3	3.10	SPRING	STANDARD36826	S
26-Mar-18	W LANTAU	2	7.45	SPRING	STANDARD36826	P
26-Mar-18	W LANTAU	3	1.67	SPRING	STANDARD36826	P
26-Mar-18	W LANTAU	2	9.29	SPRING	STANDARD36826	S
26-Mar-18	W LANTAU	3	4.15	SPRING	STANDARD36826	S
29-Mar-18	SE LANTAU	1	1.22	SPRING	STANDARD36826	P
29-Mar-18	SE LANTAU	2	15.40	SPRING	STANDARD36826	P
29-Mar-18	SE LANTAU	3	11.74	SPRING	STANDARD36826	P
29-Mar-18	SE LANTAU	2	2.93	SPRING	STANDARD36826	S
29-Mar-18	SE LANTAU	3	6.25	SPRING	STANDARD36826	S
29-Mar-18	SW LANTAU	2	3.60	SPRING	STANDARD36826	P
29-Mar-18	SW LANTAU	3	20.49	SPRING	STANDARD36826	P
29-Mar-18	SW LANTAU	4	0.90	SPRING	STANDARD36826	P
29-Mar-18	SW LANTAU	2	2.50	SPRING	STANDARD36826	S
29-Mar-18	SW LANTAU	3	5.29	SPRING	STANDARD36826	S
29-Mar-18	SW LANTAU	4	2.02	SPRING	STANDARD36826	S

Appendix II. HKCRP-AFCD Chinese White Dolphin Sighting Database (April 2017 - March 2018)

(Note: P = sightings made on primary lines; S = sightings made on secondary line

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
7-Apr-17	1	1038	4	W LANTAU	3	639	ON	HKCRP	809022	800751	SPRING	NONE	S
13-Apr-17	1	1354	1	SW LANTAU	1	82	ON	HKCRP	805849	803487	SPRING	NONE	P
18-Apr-17	1	1032	1	W LANTAU	2	ND	OFF	HKCRP	814280	801690	SPRING	NONE	
18-Apr-17	2	1050	5	W LANTAU	2	534	ON	HKCRP	812463	802140	SPRING	NONE	P
18-Apr-17	3	1201	8	W LANTAU	2	353	ON	HKCRP	806474	801106	SPRING	NONE	P
18-Apr-17	4	1305	1	SW LANTAU	2	159	ON	HKCRP	808492	811452	SPRING	NONE	S
18-Apr-17	8	1458	1	SE LANTAU	2	376	ON	HKCRP	809394	814970	SPRING	NONE	S
28-Apr-17	1	1247	4	DEEP BAY	2	69	ON	HKCRP	831423	806455	SPRING	NONE	P
28-Apr-17	2	1333	3	NW LANTAU	2	135	ON	HKCRP	828788	806491	SPRING	NONE	P
28-Apr-17	3	1524	2	NW LANTAU	2	142	ON	HKCRP	822166	812525	SPRING	NONE	P
8-May-17	1	1437	1	SW LANTAU	4	298	ON	HKCRP	803834	803080	SPRING	NONE	S
10-May-17	1	1030	3	W LANTAU	2	94	ON	HKCRP	810926	801147	SPRING	NONE	S
10-May-17	2	1036	4	W LANTAU	2	285	ON	HKCRP	810041	800743	SPRING	NONE	S
10-May-17	3	1044	6	W LANTAU	2	78	ON	HKCRP	808679	800750	SPRING	NONE	S
10-May-17	4	1101	4	W LANTAU	2	33	ON	HKCRP	806251	801930	SPRING	NONE	S
12-May-17	1	1024	2	W LANTAU	1	187	ON	HKCRP	812894	802265	SPRING	NONE	S
12-May-17	2	1028	1	W LANTAU	1	148	ON	HKCRP	812131	801830	SPRING	NONE	S
12-May-17	3	1031	1	W LANTAU	1	289	ON	HKCRP	811446	801457	SPRING	NONE	S
12-May-17	4	1033	6	W LANTAU	1	29	ON	HKCRP	809775	800711	SPRING	NONE	S
12-May-17	5	1043	2	W LANTAU	1	147	ON	HKCRP	809022	800730	SPRING	NONE	S
17-May-17	1	1629	3	W LANTAU	3	ND	OFF	HELI	809443	800721	SPRING	NONE	
19-May-17	1	1018	1	W LANTAU	3	186	ON	HKCRP	812795	802223	SPRING	NONE	S
25-May-17	1	1108	4	NW LANTAU	2	69	ON	HKCRP	830761	805548	SPRING	NONE	P
31-May-17	1	1420	3	SE LANTAU	3	282	ON	HKCRP	807261	812636	SPRING	NONE	P
1-Jun-17	1	1258	3	NW LANTAU	3	13	ON	HKCRP	827714	806468	SUMMER	NONE	P
6-Jun-17	1	1415	5	SW LANTAU	3	85	ON	HKCRP	807020	804541	SUMMER	NONE	P
6-Jun-17	2	1503	7	SW LANTAU	3	47	ON	HKCRP	805052	803423	SUMMER	NONE	P
6-Jun-17	3	1540	10	SW LANTAU	3	ND	OFF	HKCRP	807389	808532	SUMMER	PURSE-SEINE	
9-Jun-17	1	1349	1	SW LANTAU	3	ND	OFF	HKCRP	805663	802383	SUMMER	NONE	
9-Jun-17	2	1358	1	SW LANTAU	2	89	ON	HKCRP	806281	803560	SUMMER	NONE	S
9-Jun-17	3	1406	4	SW LANTAU	2	180	ON	HKCRP	806634	803870	SUMMER	NONE	S
9-Jun-17	4	1427	1	SW LANTAU	2	64	ON	HKCRP	807109	804758	SUMMER	NONE	S
9-Jun-17	5	1550	1	SW LANTAU	2	66	ON	HKCRP	807355	809099	SUMMER	NONE	S

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DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
21-Jun-17	1	1406	9	SW LANTAU	2	402	ON	HKCRP	806337	803044	SUMMER	NONE	S
23-Jun-17	1	1327	1	W LANTAU	3	383	ON	HKCRP	811057	801992	SUMMER	NONE	S
23-Jun-17	2	1405	2	W LANTAU	3	212	ON	HKCRP	807193	801695	SUMMER	NONE	S
23-Jun-17	3	1420	2	W LANTAU	3	169	ON	HKCRP	806284	801848	SUMMER	NONE	S
23-Jun-17	4	1447	12	SW LANTAU	2	ND	OFF	HKCRP	806115	803209	SUMMER	NONE	
23-Jun-17	5	1540	2	SW LANTAU	2	ND	OFF	HKCRP	807379	807893	SUMMER	NONE	
23-Jun-17	6	1551	3	SW LANTAU	2	ND	OFF	HKCRP	807474	810615	SUMMER	NONE	
28-Jun-17	1	1022	4	W LANTAU	2	645	ON	HKCRP	814456	802258	SUMMER	NONE	P
28-Jun-17	2	1125	5	W LANTAU	3	84	ON	HKCRP	811112	801910	SUMMER	NONE	S
28-Jun-17	3	1151	2	W LANTAU	3	108	ON	HKCRP	809246	799699	SUMMER	NONE	S
28-Jun-17	4	1216	6	W LANTAU	3	395	ON	HKCRP	808468	800760	SUMMER	NONE	P
28-Jun-17	5	1254	1	W LANTAU	3	ND	OFF	HKCRP	806175	801280	SUMMER	NONE	
28-Jun-17	6	1307	3	SW LANTAU	2	65	ON	HKCRP	806150	802466	SUMMER	NONE	P
28-Jun-17	7	1352	1	SW LANTAU	2	136	ON	HKCRP	807507	805088	SUMMER	NONE	S
28-Jun-17	8	1402	1	SW LANTAU	2	123	ON	HKCRP	808279	806369	SUMMER	NONE	S
28-Jun-17	9	1524	5	SW LANTAU	2	99	ON	HKCRP	805474	808292	SUMMER	NONE	S
28-Jun-17	10	1553	4	SW LANTAU	2	172	ON	HKCRP	807420	809883	SUMMER	NONE	S
4-Jul-17	1	1337	2	SW LANTAU	3	ND	OFF	HKCRP	806293	803013	SUMMER	NONE	
5-Jul-17	1	1127	2	NW LANTAU	2	34	ON	HKCRP	829628	806966	SUMMER	NONE	S
5-Jul-17	2	1329	4	W LANTAU	3	682	ON	HKCRP	811370	800529	SUMMER	NONE	P
5-Jul-17	3	1438	4	W LANTAU	3	ND	OFF	HKCRP	805698	801774	SUMMER	NONE	
5-Jul-17	4	1620	1	SE LANTAU	2	ND	OFF	HKCRP	808297	815783	SUMMER	PURSE-SEINE	
12-Jul-17	1	957	4	W LANTAU	2	ND	OFF	HELI	812773	802264	SUMMER	NONE	
12-Jul-17	2	1001	1	W LANTAU	2	ND	OFF	HELI	809231	801267	SUMMER	NONE	
12-Jul-17	3	1002	1	W LANTAU	2	ND	OFF	HELI	808168	801553	SUMMER	NONE	
12-Jul-17	4	1002	1	W LANTAU	2	ND	OFF	HELI	805750	803280	SUMMER	NONE	
14-Jul-17	1	1339	2	SW LANTAU	3	ND	OFF	HKCRP	803569	808494	SUMMER	NONE	
14-Jul-17	2	1353	1	SW LANTAU	3	19	ON	HKCRP	804078	808526	SUMMER	NONE	S
14-Jul-17	3	1605	2	SE LANTAU	2	ND	OFF	HKCRP	808076	815318	SUMMER	NONE	
28-Jul-17	1	1313	2	W LANTAU	2	107	ON	HKCRP	813936	801762	SUMMER	NONE	S
28-Jul-17	2	1425	1	W LANTAU	3	ND	OFF	HKCRP	806499	800002	SUMMER	NONE	
28-Jul-17	3	1507	3	SW LANTAU	2	133	ON	HKCRP	807012	808758	SUMMER	GILLNET	S
28-Jul-17	4	1530	1	SW LANTAU	2	24	ON	HKCRP	807506	811636	SUMMER	NONE	S
2-Aug-17	1	1312	6	SW LANTAU	2	137	ON	HKCRP	804898	808208	SUMMER	NONE	S

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DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
2-Aug-17	2	1419	5	SW LANTAU	2	183	ON	HKCRP	807670	806481	SUMMER	NONE	P
2-Aug-17	3	1452	3	SW LANTAU	1	186	ON	HKCRP	804658	806496	SUMMER	NONE	P
4-Aug-17	1	1014	3	W LANTAU	2	8	ON	HKCRP	814032	803494	SUMMER	NONE	S
4-Aug-17	2	1044	2	W LANTAU	2	60	ON	HKCRP	808745	800884	SUMMER	NONE	S
4-Aug-17	3	1100	4	W LANTAU	3	55	ON	HKCRP	806561	801776	SUMMER	NONE	S
4-Aug-17	4	1128	5	SW LANTAU	2	123	ON	HKCRP	806081	803477	SUMMER	NONE	P
8-Aug-17	1	1434	1	SW LANTAU	2	252	ON	HKCRP	806149	802992	SUMMER	NONE	S
8-Aug-17	2	1508	2	SW LANTAU	3	54	ON	HKCRP	802213	805181	SUMMER	NONE	S
8-Aug-17	3	1536	7	SW LANTAU	3	ND	OFF	HKCRP	805519	808024	SUMMER	NONE	
9-Aug-17	1	1557	1	SW LANTAU	3	ND	OFF	HELI	807070	807428	SUMMER	NONE	
9-Aug-17	2	1559	2	W LANTAU	3	ND	OFF	HELI	806872	801385	SUMMER	NONE	
14-Aug-17	1	1335	2	SW LANTAU	2	ND	OFF	HKCRP	806250	802528	SUMMER	NONE	
14-Aug-17	2	1427	1	SW LANTAU	3	109	ON	HKCRP	805811	805518	SUMMER	NONE	P
14-Aug-17	3	1523	1	SW LANTAU	3	86	ON	HKCRP	804280	807433	SUMMER	NONE	P
17-Aug-17	1	1342	1	W LANTAU	2	144	ON	HKCRP	814522	802577	SUMMER	NONE	P
17-Aug-17	2	1446	8	W LANTAU	2	246	ON	HKCRP	809962	801279	SUMMER	PURSE-SEINE	S
1-Sep-17	1	1036	1	W LANTAU	2	341	ON	HKCRP	814777	802166	AUTUMN	NONE	S
1-Sep-17	2	1105	3	W LANTAU	2	314	ON	HKCRP	813295	801338	AUTUMN	NONE	S
1-Sep-17	3	1140	1	W LANTAU	2	261	ON	HKCRP	811183	800168	AUTUMN	NONE	S
1-Sep-17	4	1225	2	W LANTAU	2	0	ON	HKCRP	808469	800595	AUTUMN	NONE	P
1-Sep-17	5	1247	6	W LANTAU	2	103	ON	HKCRP	807416	800829	AUTUMN	NONE	P
1-Sep-17	6	1312	5	W LANTAU	2	212	ON	HKCRP	806864	800117	AUTUMN	NONE	S
1-Sep-17	7	1421	1	SW LANTAU	2	100	ON	HKCRP	803176	805451	AUTUMN	NONE	P
7-Sep-17	1	1445	1	SW LANTAU	2	81	ON	HKCRP	805680	804610	AUTUMN	NONE	P
7-Sep-17	2	1509	10	SW LANTAU	2	82	ON	HKCRP	807637	806553	AUTUMN	NONE	P
7-Sep-17	3	1608	2	SW LANTAU	2	ND	OFF	HKCRP	807484	811172	AUTUMN	NONE	
8-Sep-17	1	1452	5	SW LANTAU	3	474	ON	HKCRP	805000	807383	AUTUMN	NONE	P
13-Sep-17	1	1336	2	W LANTAU	2	ND	OFF	HKCRP	805278	801093	AUTUMN	NONE	
13-Sep-17	2	1426	11	SW LANTAU	2	369	ON	HKCRP	805391	805497	AUTUMN	PURSE-SEINE	P
18-Sep-17	1	1459	4	NW LANTAU	3	119	ON	HKCRP	828764	807480	AUTUMN	NONE	P
20-Sep-17	1	1029	2	W LANTAU	2	328	ON	HKCRP	814433	802361	AUTUMN	NONE	P
20-Sep-17	2	1051	2	W LANTAU	2	2	ON	HKCRP	813866	803380	AUTUMN	NONE	S
20-Sep-17	3	1059	2	W LANTAU	2	177	ON	HKCRP	813325	802853	AUTUMN	NONE	S
20-Sep-17	4	1104	1	W LANTAU	2	148	ON	HKCRP	812583	802903	AUTUMN	NONE	S

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DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
20-Sep-17	5	1131	6	W LANTAU	2	188	ON	HKCRP	810417	800785	AUTUMN	NONE	P
20-Sep-17	6	1152	1	W LANTAU	2	33	ON	HKCRP	809674	801257	AUTUMN	NONE	S
20-Sep-17	7	1206	1	W LANTAU	2	159	ON	HKCRP	808357	801151	AUTUMN	NONE	P
20-Sep-17	8	1308	1	SW LANTAU	3	ND	OFF	HKCRP	807983	811101	AUTUMN	NONE	
25-Sep-17	1	1406	1	W LANTAU	3	ND	OFF	HKCRP	808557	800894	AUTUMN	NONE	
25-Sep-17	2	1425	5	W LANTAU	3	85	ON	HKCRP	806661	801787	AUTUMN	NONE	S
12-Oct-17	1	1458	2	W LANTAU	4	413	ON	HKCRP	807407	800087	AUTUMN	NONE	P
19-Oct-17	1	1418	10	NW LANTAU	4	32	ON	HKCRP	823186	805512	AUTUMN	NONE	P
19-Oct-17	2	1529	3	NW LANTAU	2	137	ON	HKCRP	823404	807418	AUTUMN	NONE	P
24-Oct-17	1	1437	1	SW LANTAU	2	316	ON	HKCRP	807849	805491	AUTUMN	NONE	P
26-Oct-17	1	1340	3	W LANTAU	2	91	ON	HKCRP	814444	802433	AUTUMN	NONE	P
26-Oct-17	2	1352	3	W LANTAU	2	751	ON	HKCRP	814088	803432	AUTUMN	NONE	S
26-Oct-17	3	1512	2	SW LANTAU	2	ND	OFF	HKCRP	806513	803632	AUTUMN	NONE	
31-Oct-17	1	1051	2	W LANTAU	3	1703	ON	HKCRP	811455	802251	AUTUMN	NONE	S
31-Oct-17	2	1059	2	W LANTAU	3	195	ON	HKCRP	810659	801600	AUTUMN	NONE	S
31-Oct-17	3	1116	5	W LANTAU	3	90	ON	HKCRP	810417	800671	AUTUMN	NONE	P
31-Oct-17	4	1138	1	W LANTAU	3	112	ON	HKCRP	808981	799420	AUTUMN	NONE	S
31-Oct-17	5	1207	1	W LANTAU	2	69	ON	HKCRP	807463	799829	AUTUMN	NONE	P
31-Oct-17	6	1246	3	W LANTAU	3	28	ON	HKCRP	811489	801921	AUTUMN	NONE	P
8-Nov-17	1	1446	4	W LANTAU	3	0	ON	HKCRP	808556	800987	AUTUMN	NONE	S
8-Nov-17	2	1502	1	W LANTAU	2	6	ON	HKCRP	806306	801930	AUTUMN	NONE	S
13-Nov-17	1	1028	5	W LANTAU	2	341	ON	HKCRP	813473	801204	AUTUMN	NONE	S
13-Nov-17	2	1135	1	W LANTAU	2	35	ON	HKCRP	808391	800842	AUTUMN	NONE	P
13-Nov-17	3	1211	1	W LANTAU	2	44	ON	HKCRP	811434	801725	AUTUMN	NONE	P
13-Nov-17	4	1225	5	W LANTAU	2	78	ON	HKCRP	812883	802594	AUTUMN	NONE	S
13-Nov-17	5	1253	5	W LANTAU	2	303	ON	HKCRP	814611	801990	AUTUMN	NONE	S
17-Nov-17	1	1347	4	W LANTAU	2	426	ON	HKCRP	812252	802346	AUTUMN	NONE	S
17-Nov-17	2	1456	4	SW LANTAU	3	471	ON	HKCRP	804241	804597	AUTUMN	NONE	P
20-Nov-17	1	1052	3	W LANTAU	3	49	ON	HKCRP	807226	801510	AUTUMN	NONE	S
22-Nov-17	1	1405	2	SW LANTAU	3	ND	OFF	HKCRP	807762	810925	AUTUMN	NONE	
27-Nov-17	1	1254	1	NW LANTAU	2	17	ON	HKCRP	828520	807510	AUTUMN	NONE	P
28-Nov-17	1	1414	1	W LANTAU	2	230	ON	HKCRP	811592	800416	AUTUMN	NONE	S
28-Nov-17	2	1437	1	W LANTAU	2	563	ON	HKCRP	810471	801383	AUTUMN	NONE	P
28-Nov-17	3	1503	1	W LANTAU	2	346	ON	HKCRP	808184	799058	AUTUMN	NONE	S

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DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
28-Nov-17	4	1527	2	SW LANTAU	2	ND	OFF	HKCRP	806095	802177	AUTUMN	NONE	
28-Nov-17	5	1546	1	SW LANTAU	2	ND	OFF	HKCRP	806198	806169	AUTUMN	NONE	
29-Nov-17	1	1452	3	SW LANTAU	2	132	ON	HKCRP	806810	804468	AUTUMN	NONE	P
4-Dec-17	1	1304	3	SW LANTAU	3	181	ON	HKCRP	806194	802549	WINTER	NONE	P
4-Dec-17	2	1324	1	SW LANTAU	3	53	ON	HKCRP	806955	804252	WINTER	HANDLINER	S
6-Dec-17	1	1057	2	NW LANTAU	2	170	ON	HKCRP	825796	807443	WINTER	NONE	P
6-Dec-17	2	1116	3	NW LANTAU	2	82	ON	HKCRP	827446	807405	WINTER	NONE	P
6-Dec-17	3	1317	1	W LANTAU	2	54	ON	HKCRP	813704	801576	WINTER	NONE	S
6-Dec-17	4	1352	3	W LANTAU	2	819	ON	HKCRP	811481	800499	WINTER	NONE	P
6-Dec-17	5	1429	1	W LANTAU	2	123	ON	HKCRP	807373	800221	WINTER	NONE	P
6-Dec-17	6	1517	2	SW LANTAU	3	ND	OFF	HKCRP	807744	808172	WINTER	NONE	
6-Dec-17	7	1550	1	SE LANTAU	3	ND	OFF	HKCRP	808064	816288	WINTER	NONE	
7-Dec-17	1	1332	2	W LANTAU	3	226	ON	HKCRP	808767	800791	WINTER	NONE	S
7-Dec-17	2	1350	2	SW LANTAU	2	ND	OFF	HKCRP	806313	803745	WINTER	NONE	
7-Dec-17	3	1400	1	SW LANTAU	2	ND	OFF	HKCRP	806777	804396	WINTER	GILLNET	
7-Dec-17	5	1544	1	SE LANTAU	2	163	ON	HKCRP	808509	814453	WINTER	PURSE-SEINE	P
11-Dec-17	7	1559	1	SW LANTAU	2	ND	OFF	HELI	805907	802146	WINTER	NONE	
11-Dec-17	8	1603	1	W LANTAU	2	ND	OFF	HELI	815788	806187	WINTER	NONE	
12-Dec-17	1	1417	7	W LANTAU	3	1090	ON	HKCRP	808457	800935	WINTER	NONE	P
12-Dec-17	2	1513	1	SW LANTAU	2	ND	OFF	HKCRP	805730	802084	WINTER	NONE	
12-Dec-17	3	1545	1	SW LANTAU	2	ND	OFF	HKCRP	807389	808831	WINTER	NONE	
29-Dec-17	1	1040	4	W LANTAU	2	341	ON	HKCRP	814578	801980	WINTER	NONE	S
29-Dec-17	2	1144	1	W LANTAU	2	ND	OFF	HKCRP	811480	801004	WINTER	NONE	
29-Dec-17	3	1208	3	W LANTAU	2	221	ON	HKCRP	809454	800803	WINTER	NONE	P
29-Dec-17	4	1308	4	W LANTAU	2	386	ON	HKCRP	806406	801766	WINTER	NONE	P
29-Dec-17	5	1341	4	SW LANTAU	2	ND	OFF	HKCRP	806184	802198	WINTER	NONE	
29-Dec-17	6	1515	1	SW LANTAU	3	168	ON	HKCRP	803373	806679	WINTER	NONE	S
2-Jan-18	1	1503	3	SW LANTAU	2	ND	OFF	HKCRP	806239	802178	WINTER	NONE	
5-Jan-18	1	1021	1	W LANTAU	1	ND	OFF	HKCRP	813845	803143	WINTER	NONE	
5-Jan-18	2	1029	2	W LANTAU	2	ND	OFF	HKCRP	812485	802192	WINTER	NONE	
5-Jan-18	3	1035	2	W LANTAU	2	ND	OFF	HKCRP	811202	801642	WINTER	NONE	
5-Jan-18	4	1040	2	W LANTAU	1	ND	OFF	HKCRP	810040	801114	WINTER	NONE	
5-Jan-18	5	1049	1	W LANTAU	2	ND	OFF	HKCRP	807882	800676	WINTER	NONE	
5-Jan-18	6	1057	1	W LANTAU	2	ND	OFF	HKCRP	806143	800517	WINTER	NONE	

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DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
5-Jan-18	7	1107	3	W LANTAU	2	27	ON	HKCRP	806185	801693	WINTER	NONE	S
5-Jan-18	8	1147	2	W LANTAU	1	184	ON	HKCRP	809422	799968	WINTER	NONE	P
5-Jan-18	9	1225	1	W LANTAU	1	117	ON	HKCRP	812875	801162	WINTER	NONE	S
11-Jan-18	1	1303	4	DEEP BAY	3	338	ON	HKCRP	831347	805703	WINTER	NONE	P
16-Jan-18	1	1406	1	W LANTAU	2	55	ON	HKCRP	806384	801838	WINTER	NONE	S
16-Jan-18	2	1417	4	SW LANTAU	2	124	ON	HKCRP	806072	802559	WINTER	NONE	P
16-Jan-18	3	1529	1	SW LANTAU	1	4	ON	HKCRP	806208	806540	WINTER	NONE	P
17-Jan-18	1	1452	1	LAMMA	2	1182	ON	HKCRP	804526	821285	WINTER	NONE	P
19-Jan-18	1	1433	12	W LANTAU	1	59	ON	HKCRP	809520	801092	WINTER	NONE	S
19-Jan-18	2	1458	8	W LANTAU	1	105	ON	HKCRP	806317	801879	WINTER	NONE	S
23-Jan-18	1	1005	1	NW LANTAU	2	ND	OFF	HKCRP	816927	806839	WINTER	NONE	
23-Jan-18	2	1027	2	W LANTAU	1	224	ON	HKCRP	814962	803774	WINTER	NONE	S
23-Jan-18	3	1045	2	W LANTAU	2	220	ON	HKCRP	812817	802264	WINTER	NONE	S
23-Jan-18	4	1101	2	W LANTAU	2	25	ON	HKCRP	810317	801207	WINTER	NONE	S
23-Jan-18	5	1105	4	W LANTAU	2	265	ON	HKCRP	810007	801134	WINTER	NONE	S
23-Jan-18	6	1113	3	W LANTAU	2	ND	OFF	HKCRP	809465	800896	WINTER	NONE	
30-Jan-18	1	1225	2	SW LANTAU	2	105	ON	HKCRP	804341	804504	WINTER	NONE	P
12-Feb-18	1	1018	2	NW LANTAU	3	338	ON	HKCRP	817018	805407	WINTER	NONE	P
12-Feb-18	2	1112	7	NW LANTAU	3	91	ON	HKCRP	823020	805450	WINTER	NONE	P
12-Feb-18	3	1140	4	NW LANTAU	2	80	ON	HKCRP	826664	805241	WINTER	NONE	P
13-Feb-18	1	1416	1	W LANTAU	2	165	ON	HKCRP	813734	803091	WINTER	NONE	S
13-Feb-18	2	1441	2	W LANTAU	2	364	ON	HKCRP	811865	802221	WINTER	NONE	P
23-Feb-18	1	1440	1	SW LANTAU	2	180	ON	HKCRP	804896	809765	WINTER	NONE	S
7-Mar-18	1	1409	2	W LANTAU	2	55	ON	HKCRP	810150	801258	SPRING	NONE	S
7-Mar-18	2	1521	1	NW LANTAU	3	51	ON	HKCRP	823330	805419	SPRING	NONE	P
15-Mar-18	1	1008	1	NW LANTAU	0	ND	OFF	HKCRP	817773	804625	SPRING	NONE	
23-Mar-18	1	1234	3	DEEP BAY	2	1124	ON	HKCRP	832687	805830	SPRING	NONE	S
26-Mar-18	1	1415	6	W LANTAU	3	875	ON	HKCRP	810342	799795	SPRING	NONE	S
26-Mar-18	2	1451	2	W LANTAU	2	76	ON	HKCRP	809366	800494	SPRING	NONE	P
26-Mar-18	3	1518	3	W LANTAU	2	296	ON	HKCRP	807483	800675	SPRING	PURSE-SEINE	P
26-Mar-18	4	1539	2	W LANTAU	2	519	ON	HKCRP	808957	800225	SPRING	NONE	S
26-Mar-18	5	1603	4	W LANTAU	2	0	ON	HKCRP	813148	802667	SPRING	NONE	S

Appendix III. HKCRP-AFCD Finless Porpoise Sighting Database (April 2017 - March 2018)
(Note: P = sightings made on primary lines; S = sightings made on secondary lines)

DATE	STG #	TIME	HRD SZ	NORTHING	EASTING	AREA	BEAU	PSD	EFFORT	SEASON	P/S
5-Apr-17	1	1555	3	807745	814689	SE LANTAU	2	ND	OFF	SPRING	
6-Apr-17	1	1322	4	801443	826636	LAMMA	2	60	ON	SPRING	P
6-Apr-17	2	1452	1	805893	816316	SE LANTAU	2	115	ON	SPRING	S
6-Apr-17	3	1516	3	804512	814478	SE LANTAU	1	292	ON	SPRING	P
6-Apr-17	4	1520	4	805043	814489	SE LANTAU	2	78	ON	SPRING	P
6-Apr-17	5	1530	4	806660	814502	SE LANTAU	2	97	ON	SPRING	P
11-Apr-17	1	1028	3	805436	819461	SE LANTAU	1	153	ON	SPRING	P
11-Apr-17	2	1118	2	806113	817564	SE LANTAU	1	173	ON	SPRING	P
11-Apr-17	3	1205	2	804865	815469	SE LANTAU	1	57	ON	SPRING	P
11-Apr-17	4	1234	1	802044	813495	SE LANTAU	1	145	ON	SPRING	P
11-Apr-17	5	1237	1	802354	813516	SE LANTAU	1	46	ON	SPRING	P
11-Apr-17	6	1247	2	803971	813456	SE LANTAU	1	55	ON	SPRING	P
11-Apr-17	7	1252	2	804458	813426	SE LANTAU	1	83	ON	SPRING	P
11-Apr-17	8	1300	6	805709	813438	SE LANTAU	1	71	ON	SPRING	P
11-Apr-17	9	1356	4	804173	811497	SW LANTAU	2	39	ON	SPRING	P
11-Apr-17	10	1403	1	803575	811506	SW LANTAU	1	323	ON	SPRING	P
11-Apr-17	11	1442	2	804242	809867	SW LANTAU	2	123	ON	SPRING	S
11-Apr-17	12	1507	2	807462	811626	SW LANTAU	2	ND	OFF	SPRING	
13-Apr-17	2	1524	7	801264	809615	SW LANTAU	1	54	ON	SPRING	S
13-Apr-17	3	1532	2	802481	809937	SW LANTAU	2	22	ON	SPRING	P
13-Apr-17	4	1558	1	805976	813016	SE LANTAU	1	ND	OFF	SPRING	
13-Apr-17	5	1604	4	806560	814605	SE LANTAU	1	ND	OFF	SRPING	
18-Apr-17	5	1338	2	804980	812437	SE LANTAU	2	10	ON	SPRING	P
18-Apr-17	6	1348	1	803518	812445	SE LANTAU	2	109	ON	SPRING	P
18-Apr-17	7	1413	5	802784	814517	SE LANTAU	2	116	ON	SPRING	P
5-May-17	1	1027	2	805426	834084	LAMMA	1	400	ON	SPRING	P
12-May-17	6	1252	4	800311	809572	SW LANTAU	2	73	ON	SPRING	P
12-May-17	7	1311	3	802811	811567	SW LANTAU	2	192	ON	SPRING	P
12-May-17	8	1322	2	803242	811702	SW LANTAU	2	81	ON	SPRING	P
12-May-17	9	1553	2	806255	819565	SE LANTAU	2	46	ON	SPRING	P
12-May-17	10	1600	3	806875	819555	SE LANTAU	2	44	ON	SPRING	P
23-May-17	1	1427	2	800978	808490	SW LANTAU	3	77	ON	SPRING	P
31-May-17	2	1449	1	804546	813488	SE LANTAU	2	55	ON	SPRING	P
29-Jun-17	1	1018	1	801508	844760	PO TOI	2	301	ON	SUMMER	P
29-Jun-17	2	1031	5	801642	847009	PO TOI	1	81	ON	SUMMER	P
29-Jun-17	3	1118	2	801564	857139	PO TOI	1	75	ON	SUMMER	P
29-Jun-17	4	1131	2	801456	859409	PO TOI	1	91	ON	SUMMER	P
4-Jul-17	2	1459	1	804581	812498	SE LANTAU	2	4	ON	SUMMER	P
11-Jul-17	1	1217	2	807410	863782	PO TOI	2	97	ON	SUMMER	P
11-Jul-17	2	1252	2	807422	857173	PO TOI	3	80	ON	SUMMER	P
12-Jul-17	5	1016	2	802851	848865	PO TOI	3	ND	OFF	SUMMER	
18-Aug-17	1	1124	1	819631	867542	SAI KUNG	1	96	ON	SUMMER	P
18-Aug-17	2	1308	1	821847	868342	SAI KUNG	2	247	ON	SUMMER	S
22-Aug-17	1	1034	4	802584	847586	PO TOI	1	79	ON	SUMMER	P
22-Aug-17	2	1101	6	802500	853362	PO TOI	1	52	ON	SUMMER	P
22-Aug-17	3	1113	7	802525	855168	PO TOI	1	164	ON	SUMMER	P
22-Aug-17	4	1124	3	802560	856601	PO TOI	1	280	ON	SUMMER	P
22-Aug-17	5	1138	1	802574	859376	PO TOI	1	287	ON	SUMMER	P
6-Sep-17	1	1213	4	805498	865869	PO TOI	2	36	ON	AUTUMN	P
20-Sep-17	9	1357	2	801402	813060	SE LANTAU	3	82	ON	AUTUMN	S
28-Sep-17	1	1140	1	802330	858613	PO TOI	2	143	ON	AUTUMN	P
11-Oct-17	1	1105	4	805263	815521	SE LANTAU	4	174	ON	AUTUMN	P
11-Oct-17	2	1533	1	806029	814532	SE LANTAU	3	117	ON	AUTUMN	P
2-Nov-17	1	1159	1	803836	848843	PO TOI	3	183	ON	AUTUMN	S
2-Nov-17	2	1348	1	806494	849305	PO TOI	2	84	ON	AUTUMN	P
2-Nov-17	3	1527	2	808631	848860	NINEPINS	3	207	ON	AUTUMN	P
7-Nov-17	1	1102	4	803600	817530	SE LANTAU	3	103	ON	AUTUMN	P
7-Nov-17	2	1332	2	802822	811546	SW LANTAU	2	89	ON	AUTUMN	P

Appendix III. (cont'd)

DATE	STG #	TIME	HRD SZ	NORTHING	EASTING	AREA	BEAU	PSD	EFFORT	SEASON	P/S
29-Nov-17	2	1608	1	806082	816151	SW LANTAU	2	35	ON	AUTUMN	S
7-Dec-17	4	1502	3	801824	812391	SE LANTAU	2	188	ON	WINTER	P
11-Dec-17	1	1513	2	835580	862868	MIRS BAY	2	ND	OFF	WINTER	
11-Dec-17	2	1520	1	823758	865556	SAI KUNG	3	ND	OFF	WINTER	
11-Dec-17	3	1521	1	820586	863275	SAI KUNG	3	ND	OFF	WINTER	
11-Dec-17	4	1528	2	817151	861807	SAI KUNG	3	ND	OFF	WINTER	
11-Dec-17	5	1532	1	809932	862613	NINEPINS	3	ND	OFF	WINTER	
11-Dec-17	6	1535	1	807826	852326	PO TOI	3	ND	OFF	WINTER	
18-Dec-17	1	1355	2	802797	813465	SE LANTAU	3	216	ON	WINTER	P
18-Dec-17	2	1405	1	801633	813865	SE LANTAU	3	18	ON	WINTER	S
28-Dec-17	1	1452	1	805401	820595	LAMMA	3	15	ON	WINTER	S
4-Jan-18	1	1054	3	808529	815979	SE LANTAU	2	56	ON	WINTER	S
15-Jan-18	1	1249	2	806614	815533	SE LANTAU	3	81	ON	WINTER	P
15-Jan-18	2	1339	2	804956	813385	SE LANTAU	3	184	ON	WINTER	P
17-Jan-18	2	1454	2	804835	821523	LAMMA	2	ND	OFF	WINTER	
22-Jan-18	1	1238	3	805566	822152	LAMMA	2	110	ON	WINTER	P
22-Jan-18	2	1344	1	803742	818458	SE LANTAU	1	146	ON	WINTER	P
22-Jan-18	3	1511	2	804268	814519	SE LANTAU	1	5	ON	WINTER	P
22-Jan-18	4	1518	2	803570	814497	SE LANTAU	1	56	ON	WINTER	P
22-Jan-18	5	1528	3	802076	814444	SE LANTAU	1	124	ON	WINTER	P
22-Jan-18	6	1537	3	801279	814216	SE LANTAU	1	149	ON	WINTER	S
30-Jan-18	2	1547	1	808930	814567	SE LANTAU	2	44	ON	WINTER	P
7-Feb-18	1	1300	2	804509	828515	LAMMA	2	23	ON	WINTER	P
7-Feb-18	2	1311	2	804520	829361	LAMMA	2	95	ON	WINTER	P
7-Feb-18	3	1338	2	803447	826132	LAMMA	3	ND	OFF	WINTER	
7-Feb-18	4	1626	2	808437	818856	SE LANTAU	2	ND	OFF	WINTER	
8-Feb-18	1	1437	1	802220	807656	SW LANTAU	3	19	ON	WINTER	S
2-Mar-18	1	1415	2	805523	820688	LAMMA	3	319	ON	SPRING	P
15-Mar-18	2	1426	1	801474	809522	SW LANTAU	1	46	ON	SPRING	P
15-Mar-18	3	1430	5	801087	809470	SW LANTAU	1	ND	OFF	SPRING	
15-Mar-18	4	1444	1	801571	811472	SW LANTAU	1	ND	OFF	SPRING	
15-Mar-18	5	1448	2	802168	811556	SW LANTAU	1	15	ON	SPRING	P
15-Mar-18	6	1452	3	802833	811598	SW LANTAU	1	182	ON	SPRING	P
15-Mar-18	7	1455	8	803431	811599	SW LANTAU	1	521	ON	SPRING	P
15-Mar-18	8	1505	1	804727	811436	SW LANTAU	1	170	ON	SPRING	P
15-Mar-18	9	1519	2	807860	811451	SW LANTAU	1	145	ON	SPRING	P
15-Mar-18	10	1521	5	807882	811926	SE LANTAU	1	ND	OFF	SPRING	
15-Mar-18	11	1523	5	807881	812328	SE LANTAU	1	ND	OFF	SPRING	
15-Mar-18	12	1532	2	806894	813564	SE LANTAU	1	83	ON	SPRING	P
15-Mar-18	13	1537	1	805565	813644	SE LANTAU	0	425	ON	SPRING	P
15-Mar-18	14	1538	2	805089	813644	SE LANTAU	1	272	ON	SPRING	P
15-Mar-18	15	1552	6	801767	813515	SE LANTAU	1	66	ON	SPRING	P
15-Mar-18	16	1628	1	805335	820316	SE LANTAU	1	ND	OFF	SPRING	
15-Mar-18	17	1637	2	806031	821658	LAMMA	0	ND	OFF	SPRING	
15-Mar-18	18	1641	2	806761	822669	LAMMA	0	ND	OFF	SPRING	
15-Mar-18	19	1643	1	807126	823185	LAMMA	0	ND	OFF	SPRING	
16-Mar-18	1	1342	1	801430	829060	LAMMA	2	144	ON	SPRING	P
16-Mar-18	2	1354	1	801465	826966	LAMMA	2	161	ON	SPRING	P
16-Mar-18	3	1447	3	805945	819461	SE LANTAU	2	27	ON	SPRING	P
16-Mar-18	4	1522	3	804895	817490	SE LANTAU	1	225	ON	SPRING	P
29-Mar-18	1	1013	3	806997	819452	SE LANTAU	1	161	ON	SPRING	P
29-Mar-18	2	1021	3	805568	819471	SE LANTAU	2	48	ON	SPRING	P

Appendix IV. Individual dolphins identified during AFCD surveys (April 2017 to March 2018)

(*in bold & italics: new individuals*)

DOLPHIN ID	DATE	STG#	AREA
CH12	04/08/17	3	WL
	13/09/17	2	SWL
	05/01/18	7	WL
	19/01/18	1	WL
	30/01/18	1	SWL
CH34	25/05/17	1	NWL
	12/02/18	3	NWL
CH108	02/08/17	1	SWL
	07/09/17	2	SWL
	31/10/17	6	WL
	29/12/17	5	SWL
CH113	21/06/17	1	SWL
	23/06/17	3	WL
CH153	28/06/17	4	WL
CH181	25/09/17	2	WL
CH206	04/08/17	3	WL
EL01	21/06/17	1	SWL
NL12	28/04/17	1	DB
	18/09/17	1	NWL
NL33	13/09/17	2	SWL
	19/10/17	1	NWL
	19/10/17	2	NWL
NL37	13/11/17	4	WL
	13/11/17	5	WL
NL46	19/10/17	1	NWL
	06/12/17	1	NWL
NL80	05/07/17	2	WL
NL98	07/09/17	2	SWL
NL104	18/09/17	1	NWL
NL123	13/11/17	4	WL
NL136	25/05/17	1	NWL
	18/09/17	1	NWL
	12/02/18	3	NWL
NL145	06/12/17	1	NWL
NL156	02/08/17	3	SWL
	08/08/17	3	SWL
	19/01/18	1	WL
	12/02/18	1	NWL
	26/03/18	5	WL
NL165	12/05/17	1	WL
	23/06/17	4	SWL
NL182	25/05/17	1	NWL
	18/09/17	1	NWL
	12/02/18	3	NWL
NL202	19/10/17	1	NWL
	27/11/17	1	NWL
	06/12/17	2	NWL
NL212	02/08/17	1	SWL
	07/09/17	2	SWL
	29/12/17	4	WL
NL224	18/04/17	3	WL
	28/04/17	1	DB
	10/05/17	2	WL
NL226	06/06/17	3	SWL
	05/07/17	3	WL
	28/07/17	3	SWL

DOLPHIN ID	DATE	STG#	AREA
NL233	28/04/17	1	DB
	01/09/17	2	WL
	11/01/18	1	DB
NL249	20/09/17	5	WL
NL256	19/10/17	1	NWL
NL259	13/11/17	4	WL
	06/12/17	3	WL
	29/12/17	3	WL
NL261	28/04/17	3	NWL
NL264	13/11/17	1	WL
NL269	06/06/17	3	SWL
	01/09/17	4	WL
NL272	28/04/17	3	NWL
	20/09/17	1	WL
	12/02/18	3	NWL
NL279	17/08/17	2	WL
NL280	28/04/17	1	DB
	05/07/17	2	WL
	20/09/17	5	WL
	11/01/18	1	DB
NL286	19/10/17	1	NWL
	06/12/17	2	NWL
NL288	13/11/17	1	WL
NL295	28/06/17	7	SWL
NL297	13/02/18	2	WL
NL299	28/06/17	4	WL
NL303	25/05/17	1	NWL
	01/09/17	4	WL
NL306	18/04/17	8	SEL
	31/05/17	1	SEL
	05/07/17	4	SEL
NL311	18/04/17	2	WL
	01/09/17	6	WL
	07/09/17	2	SWL
NL317	20/09/17	5	WL
NL320	19/10/17	2	NWL
NL321	18/09/17	1	NWL
NL322	13/09/17	2	SWL
	19/10/17	1	NWL
	19/10/17	2	NWL
NL329	***28/04/17***	***1***	***DB***
	11/01/18	***1***	***DB***
NL330	***05/07/17***	***2***	***WL***
SL40	20/11/17	1	WL
	02/01/18	1	SWL
	19/01/18	1	WL
SL43	04/08/17	3	WL
SL44	02/08/17	1	SWL
SL47	28/06/17	9	SWL
SL54	23/06/17	5	SWL
	28/06/17	10	SWL
	07/09/17	2	SWL
SL58	06/06/17	2	SWL
	28/06/17	9	SWL
	07/09/17	2	SWL
	05/01/18	2	WL

DOLPHIN ID	DATE	STG#	AREA
SL59	06/06/17	2	SWL
	02/08/17	1	SWL
SL60	28/06/17	6	SWL
	08/09/17	1	SWL
	08/11/17	2	WL
	06/12/17	6	SWL
	07/12/17	2	SWL
	26/03/18	2	WL
SL61	07/09/17	2	SWL
	24/10/17	1	SWL
	26/10/17	1	WL
WL15	13/04/17	1	SWL
	10/05/17	3	WL
	06/06/17	1	SWL
	21/06/17	1	SWL
	13/09/17	2	SWL
	29/11/17	1	SWL
	19/01/18	2	WL
WL17	06/06/17	3	SWL
	13/11/17	4	WL
	07/03/18	2	NWL
WL21	21/06/17	1	SWL
	23/06/17	4	SWL
	28/06/17	2	WL
	05/07/17	3	WL
	04/08/17	3	WL
WL29	08/08/17	3	SWL
	17/11/17	2	SWL
WL42	18/04/17	3	WL
	10/05/17	4	WL
	21/06/17	1	SWL
	28/11/17	4	SWL
	29/12/17	5	SWL
	19/01/18	1	WL
	23/01/18	4	WL
WL44	29/12/17	3	WL
WL46	28/06/17	3	WL
	17/08/17	2	WL
WL61	06/06/17	2	SWL
	09/06/17	4	SWL
	04/08/17	4	SWL
	08/11/17	1	WL
	19/01/18	1	WL
WL62	31/05/17	1	SEL
	22/11/17	1	SWL
	06/12/17	7	SEL
	07/12/17	2	SWL
WL68	12/05/17	4	WL
	13/09/17	2	SWL
	08/11/17	1	WL
	19/01/18	1	WL
	23/01/18	5	WL
WL69	06/06/17	3	SWL
	09/06/17	5	SWL
	22/11/17	1	SWL
	26/03/18	1	WL
	26/03/18	3	WL

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

DOLPHIN ID	DATE	STG#	AREA
WL72	28/06/17	6	SWL
	28/06/17	9	SWL
	08/08/17	3	SWL
	19/01/18	1	WL
	26/03/18	5	WL
WL74	12/05/17	4	WL
	06/06/17	2	SWL
	04/08/17	4	SWL
WL76	18/04/17	3	WL
WL79	04/08/17	1	WL
	17/08/17	2	WL
	25/09/17	2	WL
	23/01/18	2	WL
WL91	18/04/17	4	SWL
	31/05/17	1	SEL
	06/06/17	3	SWL
	14/08/17	3	SWL
	07/12/17	5	SEL
	23/02/18	1	SWL
WL92	08/08/17	3	SWL
	04/12/17	1	SWL
WL94	31/10/17	5	WL
WL98	23/06/17	4	SWL
	07/09/17	2	SWL
WL109	18/04/17	3	WL
	28/06/17	9	SWL
	07/09/17	2	SWL
	19/01/18	2	WL
	23/01/18	6	WL
WL114	21/06/17	1	SWL
	04/08/17	4	SWL
	16/01/18	2	SWL
	19/01/18	2	WL
	23/01/18	5	WL
WL118	06/06/17	1	SWL
	09/06/17	3	SWL
	20/09/17	5	WL
	31/10/17	2	WL
	12/12/17	1	WL
WL120	17/08/17	2	WL
	25/09/17	2	WL
WL123	02/08/17	3	SWL
	07/09/17	2	SWL
	13/09/17	2	SWL
	19/01/18	1	WL
	23/01/18	6	WL
	30/01/18	1	SWL
	26/03/18	5	WL
WL124	04/08/17	2	WL
WL129	21/06/17	1	SWL
	02/01/18	1	SWL
WL130	06/06/17	3	SWL
	04/12/17	1	SWL
	29/12/17	6	SWL
	19/01/18	2	WL

DOLPHIN ID	DATE	STG#	AREA
WL131	28/06/17	9	SWL
	13/09/17	2	SWL
	29/12/17	4	WL
	16/01/18	1	WL
	16/01/18	2	SWL
WL137	06/06/17	3	SWL
	28/06/17	9	SWL
	01/09/17	6	WL
	28/11/17	4	SWL
	29/11/17	1	SWL
	29/12/17	4	WL
	05/01/18	8	WL
	19/01/18	1	WL
	23/01/18	4	WL
	26/03/18	1	WL
WL142	04/08/17	4	SWL
WL145	18/04/17	2	WL
	29/12/17	1	WL
	12/02/18	2	NWL
WL152	18/04/17	3	WL
	21/06/17	1	SWL
	28/06/17	9	SWL
	08/08/17	3	SWL
	08/11/17	1	WL
	20/11/17	1	WL
	29/12/17	5	SWL
	05/01/18	7	WL
	16/01/18	2	SWL
	19/01/18	2	WL
	26/03/18	4	WL
WL156	12/02/18	2	NWL
WL166	06/06/17	2	SWL
WL168	06/06/17	3	SWL
	01/09/17	5	WL
	19/01/18	2	WL
WL169	02/08/17	2	SWL
WL171	01/09/17	5	WL
	01/09/17	6	WL
	17/11/17	2	SWL
	05/01/18	7	WL
WL173	10/05/17	4	WL
	01/09/17	6	WL
	07/09/17	2	SWL
	13/09/17	2	SWL
	17/11/17	2	SWL
	12/12/17	3	SWL
WL179	12/02/18	2	NWL
WL180	09/06/17	3	SWL
	02/08/17	3	SWL
	29/12/17	5	SWL
	19/01/18	1	WL
	23/01/18	5	WL
WL188	05/07/17	2	WL
WL190	06/06/17	3	SWL
	01/09/17	6	WL
WL191	12/02/18	2	NWL
	13/02/18	1	WL

DOLPHIN ID	DATE	STG#	AREA
WL199	23/06/17	4	SWL
	02/08/17	1	SWL
	01/09/17	5	WL
	07/09/17	2	SWL
	13/09/17	2	SWL
	12/02/18	1	NWL
WL203	29/12/17	4	WL
WL207	28/06/17	4	WL
WL208	18/04/17	3	WL
	26/03/18	1	WL
	26/03/18	3	WL
WL209	28/11/17	1	WL
WL210	04/08/17	4	SWL
	26/03/18	1	WL
WL211	10/05/17	3	WL
WL213	18/04/17	2	WL
WL214	28/06/17	1	WL
WL215	06/06/17	3	SWL
	31/10/17	3	WL
	29/11/17	1	SWL
	19/01/18	1	WL
	23/01/18	6	WL
	13/02/18	2	WL
	26/03/18	2	WL
WL216	18/04/17	2	WL
	05/07/17	3	WL
	14/08/17	1	SWL
	17/08/17	2	WL
WL218	20/09/17	7	WL
	25/09/17	1	WL
WL220	08/11/17	1	WL
	20/11/17	1	WL
	29/12/17	5	SWL
	16/01/18	2	SWL
WL221	23/06/17	5	SWL
	14/07/17	1	SWL
	13/09/17	2	SWL
	26/10/17	3	SWL
	04/12/17	1	SWL
	23/01/18	6	WL
	07/03/18	1	WL
WL226	17/08/17	2	WL
WL229	23/01/18	5	WL
WL230	07/09/17	2	SWL
	13/09/17	2	SWL
	20/09/17	1	WL
	20/09/17	2	WL
	13/11/17	1	WL
WL232	23/01/18	1	NWL
	15/03/18	1	NWL
WL233	06/06/17	2	SWL
WL234	28/07/17	3	SWL
	25/09/17	2	WL
	26/10/17	3	SWL
	04/12/17	2	SWL
	06/12/17	6	SWL
	07/12/17	3	SWL

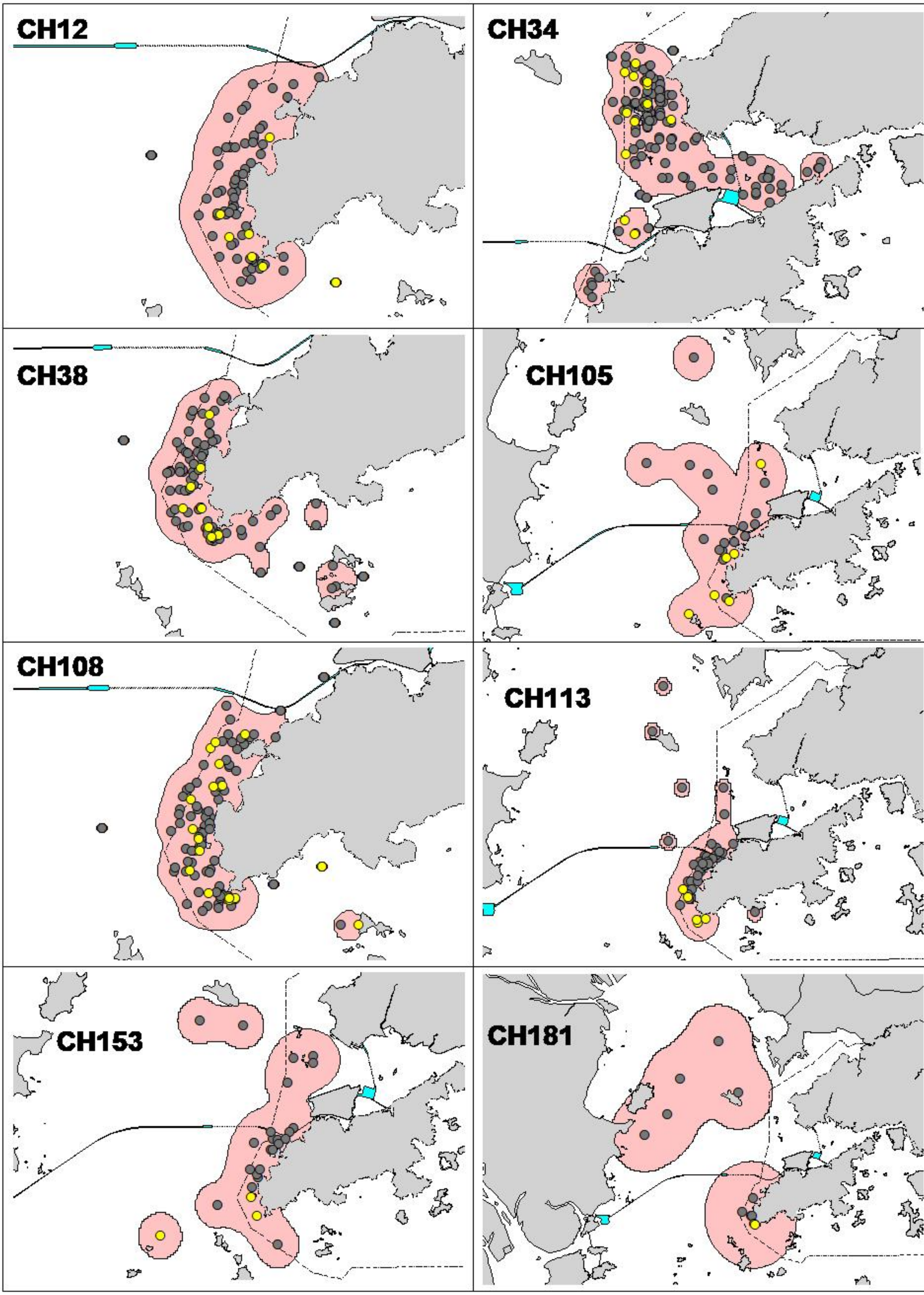
Appendix IV. (cont'd)
(***in bold & italics: new individuals***)

DOLPHIN ID	DATE	STG#	AREA
WL241	26/10/17	1	WL
WL243	14/07/17	1	SWL
	07/09/17	2	SWL
	26/10/17	1	WL
WL246	04/08/17	1	WL
WL250	06/06/17	3	SWL
	02/08/17	2	SWL
	13/09/17	2	SWL
WL251	28/06/17	4	WL
WL254	06/06/17	1	SWL
	31/10/17	3	WL
	12/12/17	1	WL
WL256	21/06/17	1	SWL
	23/06/17	4	SWL
	04/08/17	3	WL
WL257	13/09/17	2	SWL
WL260	12/12/17	1	WL
WL267	02/08/17	2	SWL
WL268	18/04/17	2	WL
WL269	06/06/17	1	SWL
	31/10/17	3	WL
	12/12/17	1	WL
WL273	28/11/17	3	WL
	19/01/18	2	WL
WL275	28/07/17	3	SWL
WL277	28/06/17	1	WL
	28/06/17	4	WL
	04/08/17	1	WL
WL279	04/08/17	1	WL
WL280	***02/08/17***	***2***	***SWL***
WL284	***09/06/17***	***3***	***SWL***
	12/12/17	***1***	***WL***
WL285	***07/09/17***	***2***	***SWL***
WL286	***06/06/17***	***1***	***SWL***
	09/06/17	***3***	***SWL***
	12/12/17	***1***	***WL***
WL287	***23/06/17***	***2***	***WL***
	23/06/17	***4***	***SWL***
WL289	***29/12/17***	***4***	***WL***
WL290	***13/02/18***	***2***	***WL***
WL291	***02/08/17***	***2***	***SWL***
WL292	***10/05/17***	***3***	***WL***
WL293	***23/06/17***	***2***	***WL***
	19/10/17	***1***	***NWL***
WL294	***31/10/17***	***6***	***WL***
	16/01/18	***3***	***SWL***

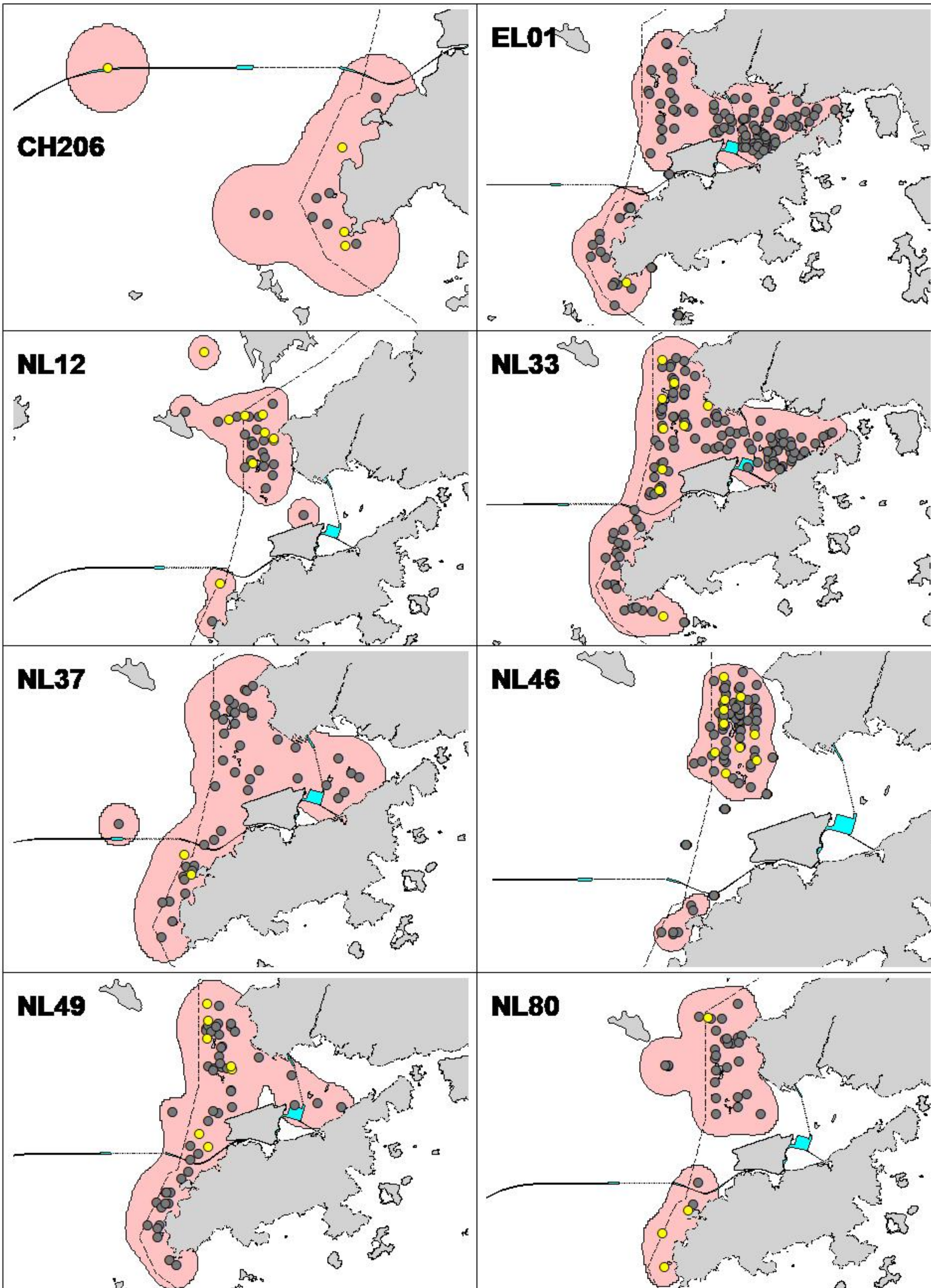
Appendix V. Finless Porpoise Land-based Theodolite Tracking Database (April 2014 - December 2017)

Date	Station	Start Time	End Time	Duration	Beaufort	Visibility	Number of Porpoise Groups	Total No. of Fixes	No. of fix (porpoise)	No. of fix (fishing boat)	No. of fix (other vessels)
22/04/14	Shek Kwu Chau	10:13	15:15	5:02	2	3-3.5	3	166	27	13	46
16/05/14	Shek Kwu Chau	10:19	11:53	1:34	2-3	2	0	26	0	12	13
16/01/15	Shek Kwu Chau	10:08	15:51	5:43	2	2	4	87	21	29	34
18/03/15	Shek Kwu Chau	10:13	15:46	5:33	2	1.5-3	6	246	117	8	119
28/04/15	Shek Kwu Chau	10:07	15:47	5:40	1-2	2.5	3	47	10	4	31
24/12/15	Shek Kwu Chau	10:12	15:46	5:34	2	2-2.5	1	69	4	36	28
26/02/16	Shek Kwu Chau	10:04	15:19	5:15	2	2-3	9	86	72	6	7
18/03/16	Shek Kwu Chau	10:17	15:22	5:05	2	3-4	6	111	81	9	18
28/04/16	Shek Kwu Chau	10:15	15:27	5:12	2	2	2	34	11	9	13
24/05/16	Shek Kwu Chau	10:21	15:39	5:18	2	2.5	4	47	23	0	23
16/11/16	Shek Kwu Chau	10:09	15:40	5:31	3-4	3	1	55	2	14	38
09/12/16	Shek Kwu Chau	10:04	14:26	4:22	2-3	2	0	93	0	66	26
20/12/16	Shek Kwu Chau	10:23	15:38	5:15	2-4	2.5	1	87	4	43	38
26/01/17	Shek Kwu Chau	10:16	15:48	5:32	2-4	2	1	33	9	11	12
17/02/17	Shek Kwu Chau	10:25	15:41	5:16	2	1.5-2	7	149	86	40	21
10/03/17	Shek Kwu Chau	10:08	15:33	5:25	2	3	2	162	22	107	31
20/03/17	Shek Kwu Chau	10:03	15:41	5:38	1-3	1.5	7	234	132	63	38
30/03/17	Shek Kwu Chau	10:09	15:34	5:25	2-3	2.5	5	87	44	35	7
11/05/17	Shek Kwu Chau	10:23	15:24	5:01	2-3	2	1	57	15	25	14
06/07/17	Shek Kwu Chau	10:18	15:35	5:17	3	1	0	50	0	12	36
21/11/17	Shek Kwu Chau	10:14	15:39	5:25	2	1-1.5	4	176	109	51	15

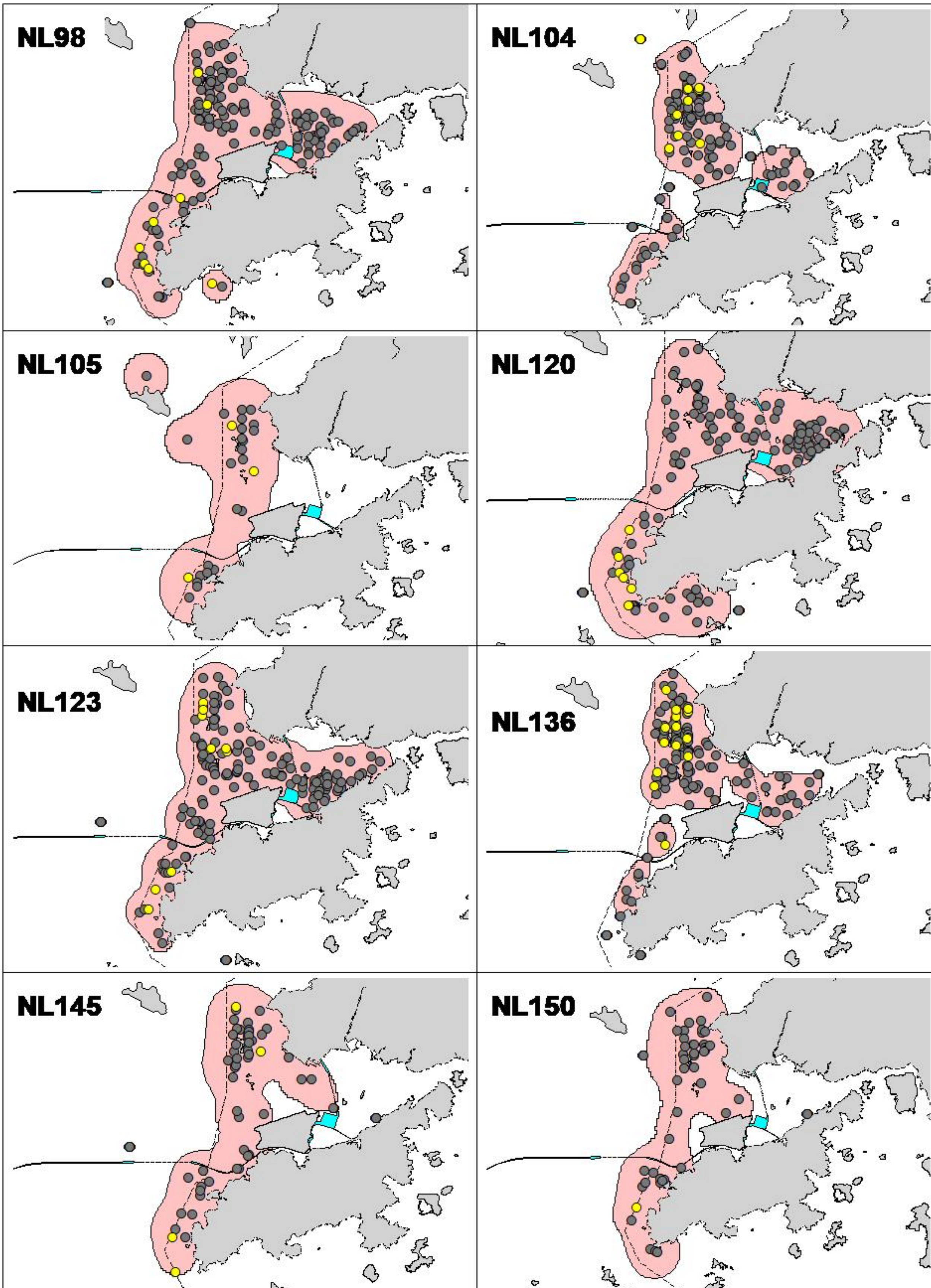
Appendix VI. Ranging patterns (95% kernel ranges) of 159 individual dolphins with 10+ re-sightings that were sighted during 2017 (note: yellow dots indicates sightings made in 2017)



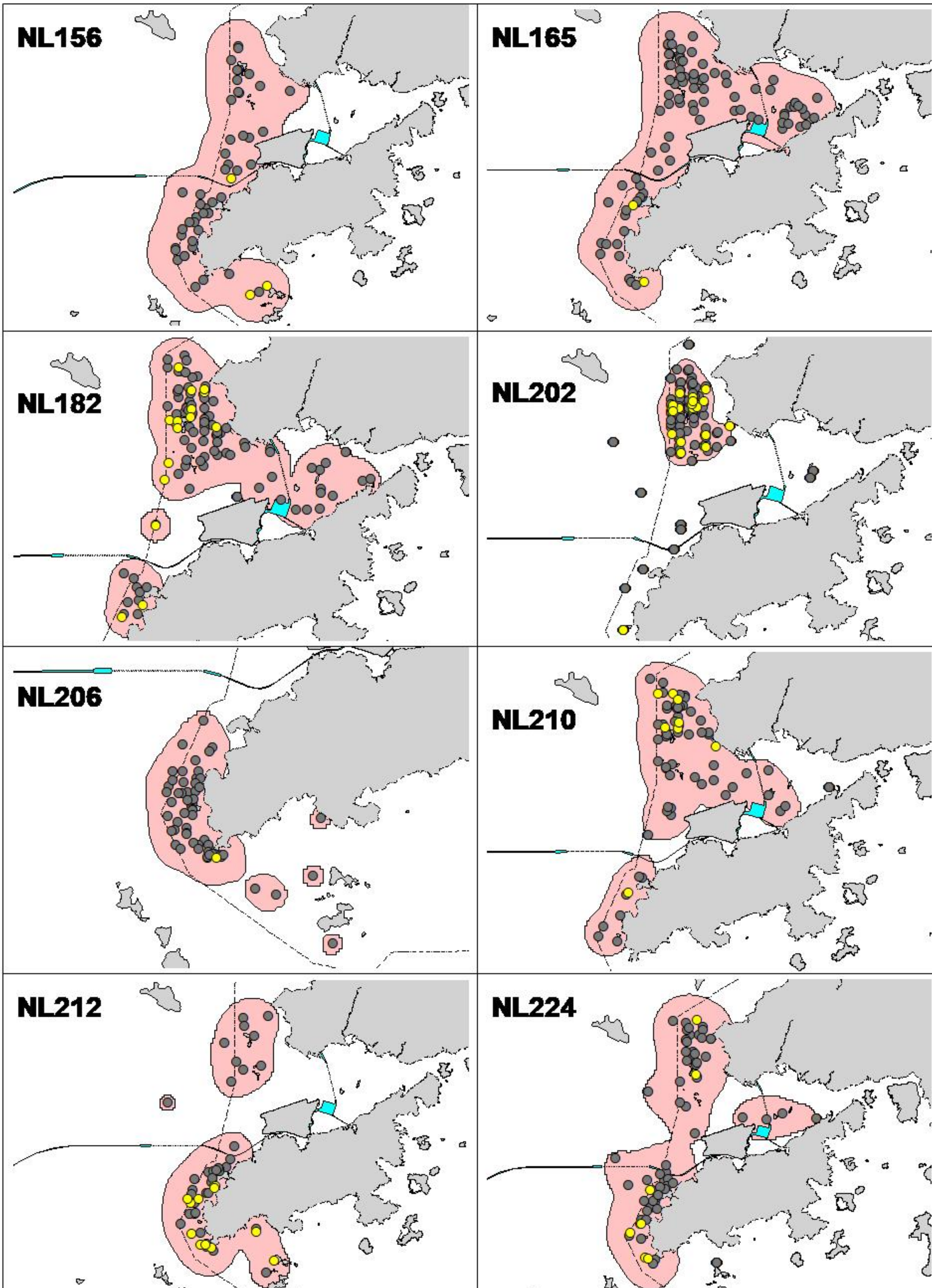
Appendix VI. (cont'd).



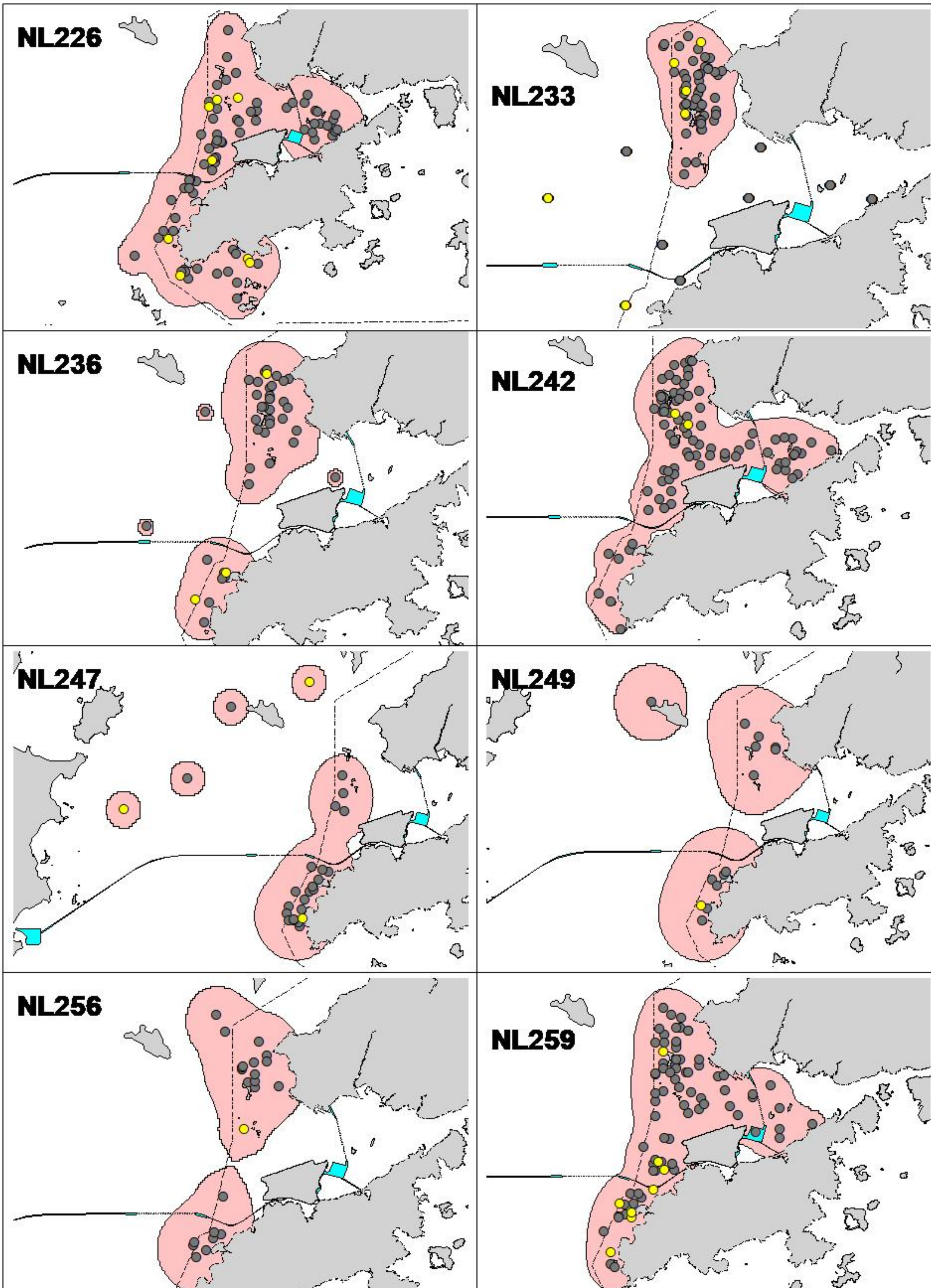
Appendix VI. (cont'd).



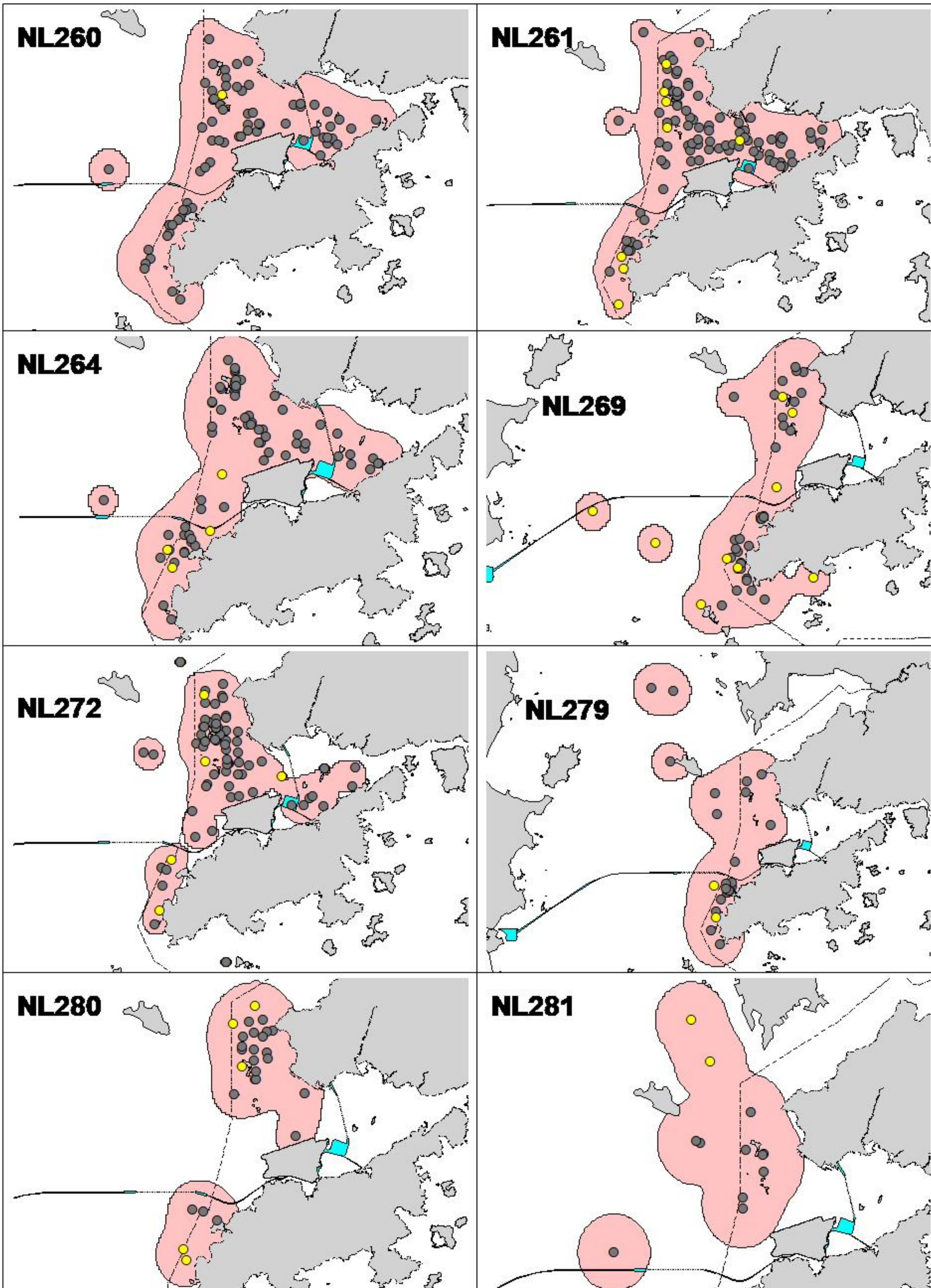
Appendix VI. (cont'd).



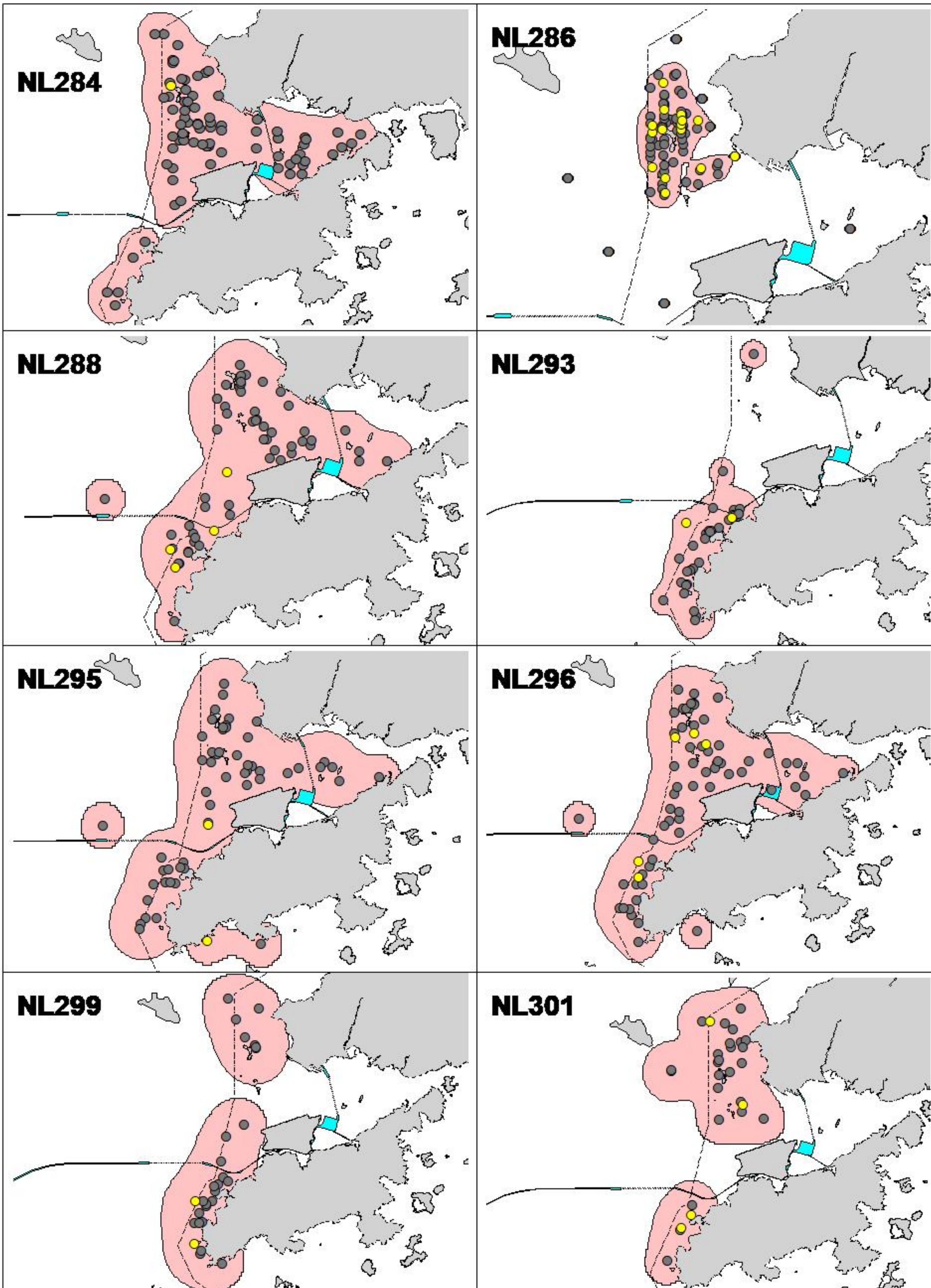
Appendix VI. (cont'd).



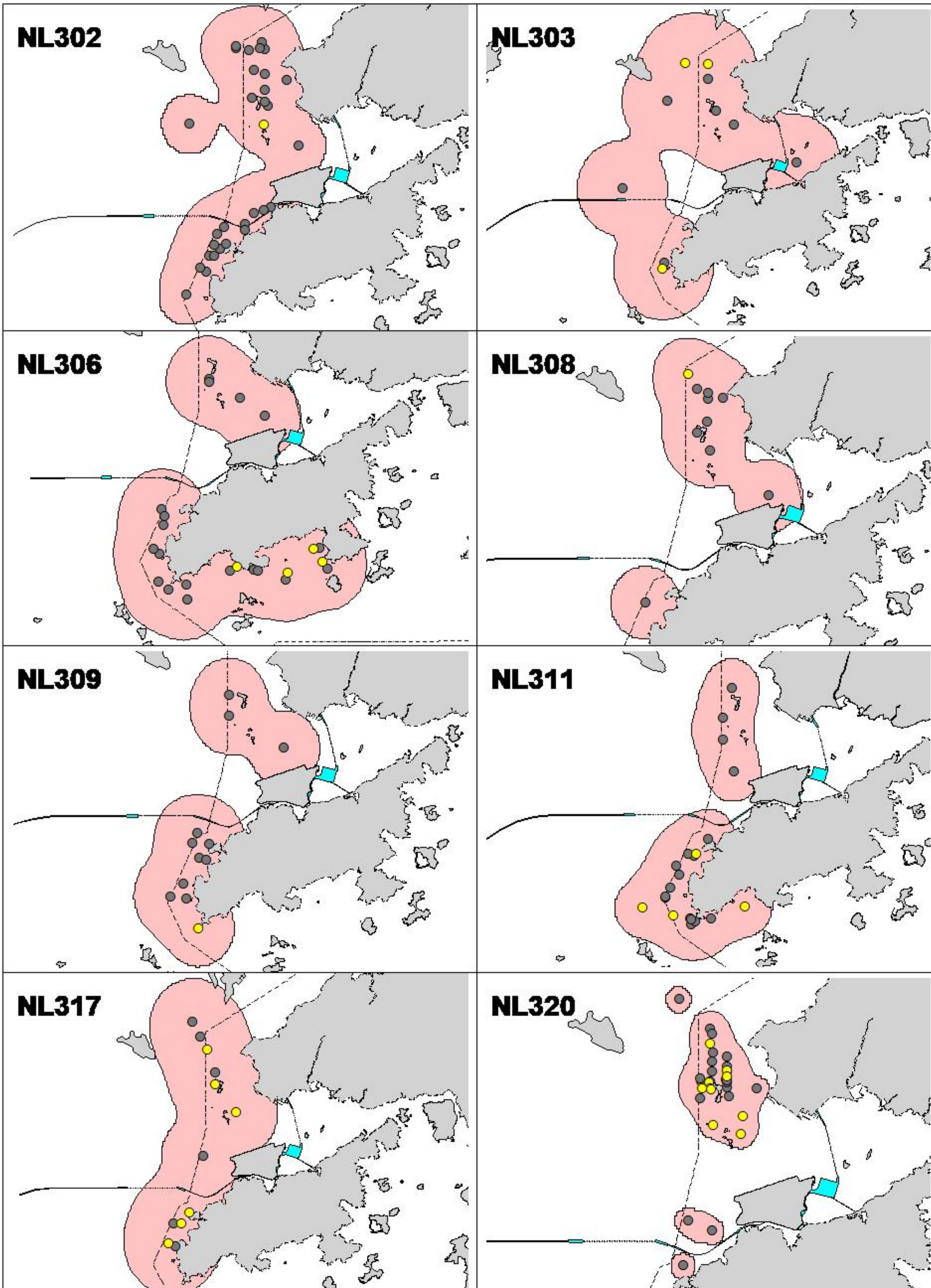
Appendix VI. (cont'd).



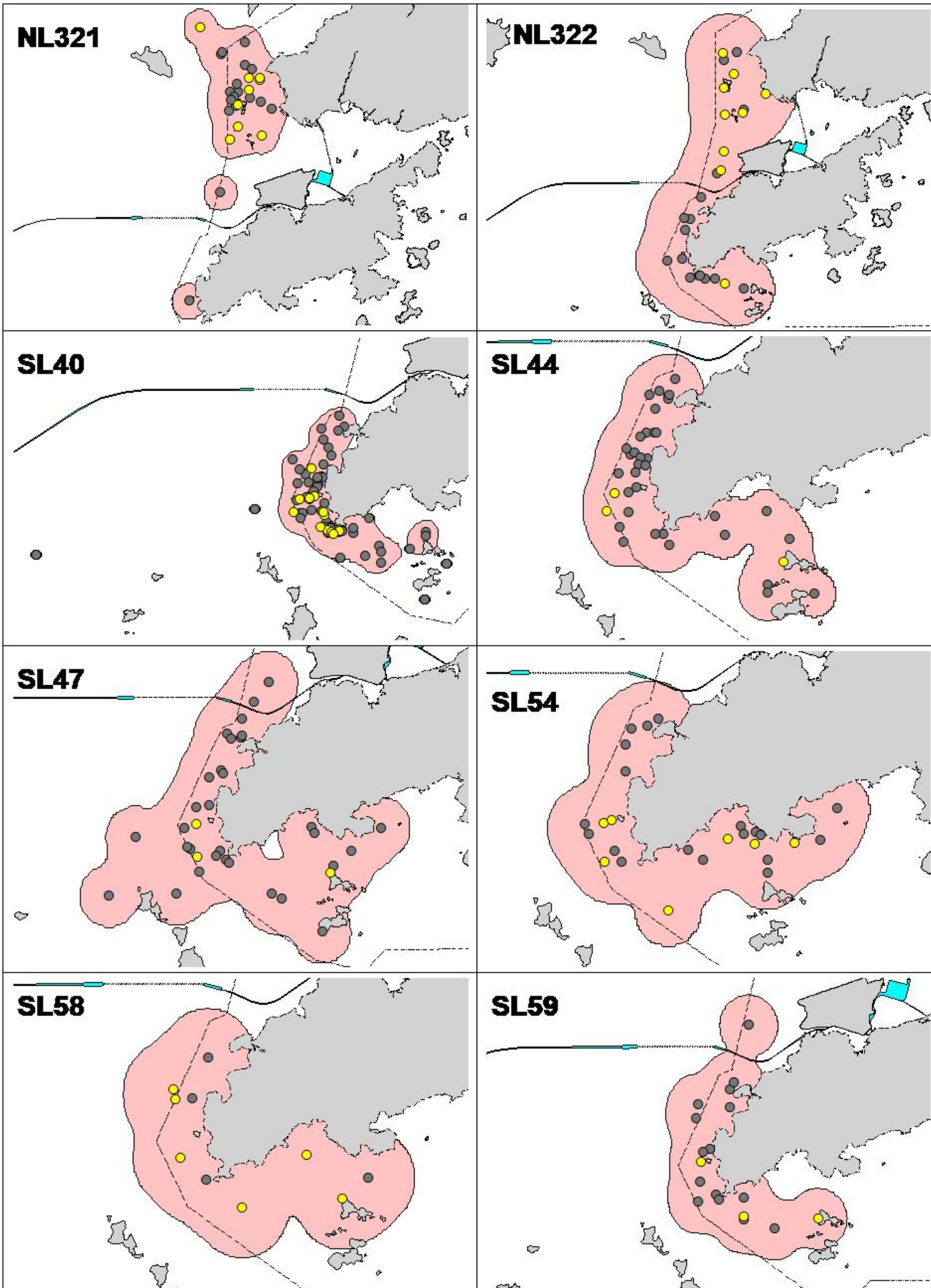
Appendix VI. (cont'd).



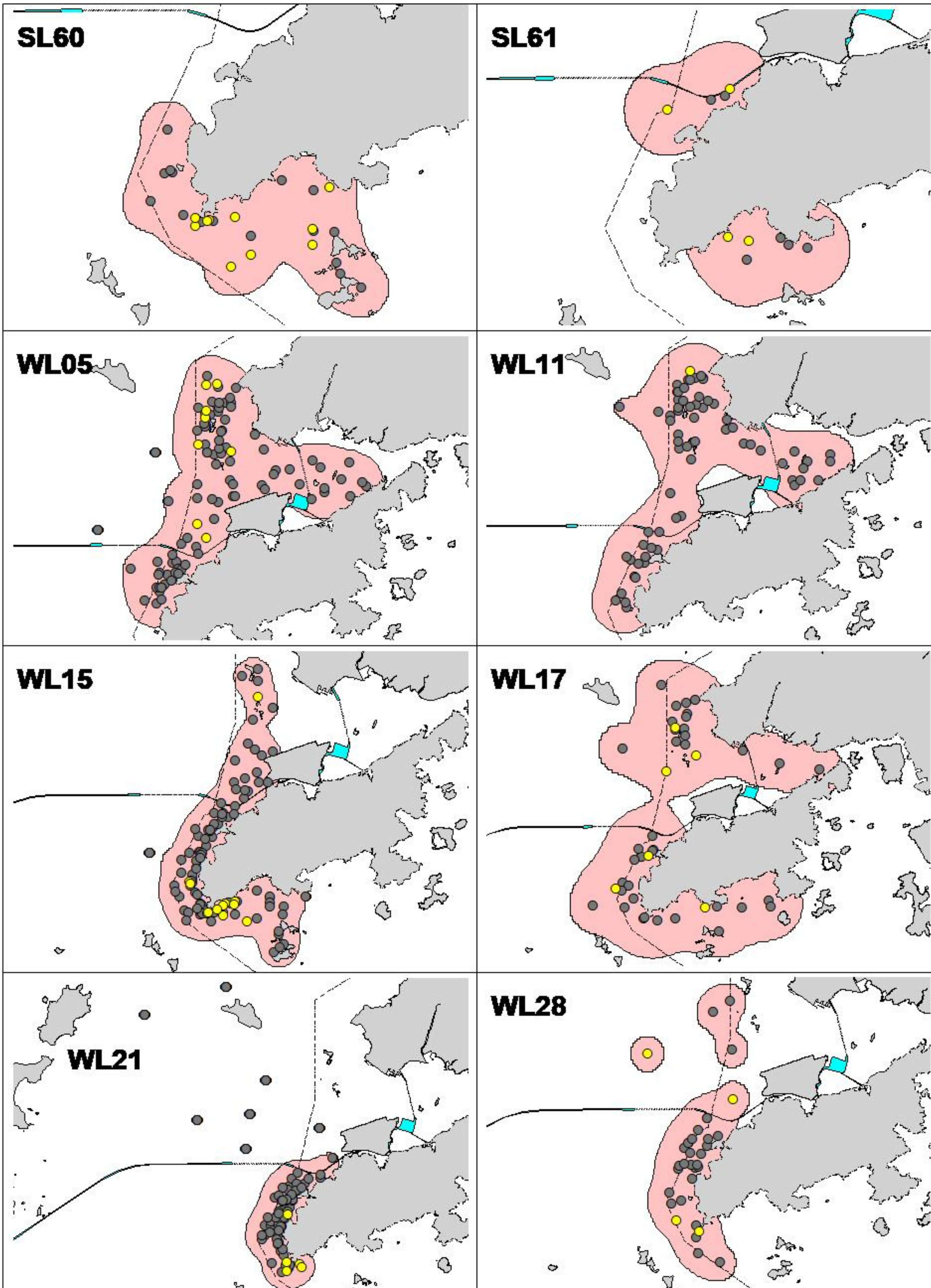
Appendix VI. (cont'd).



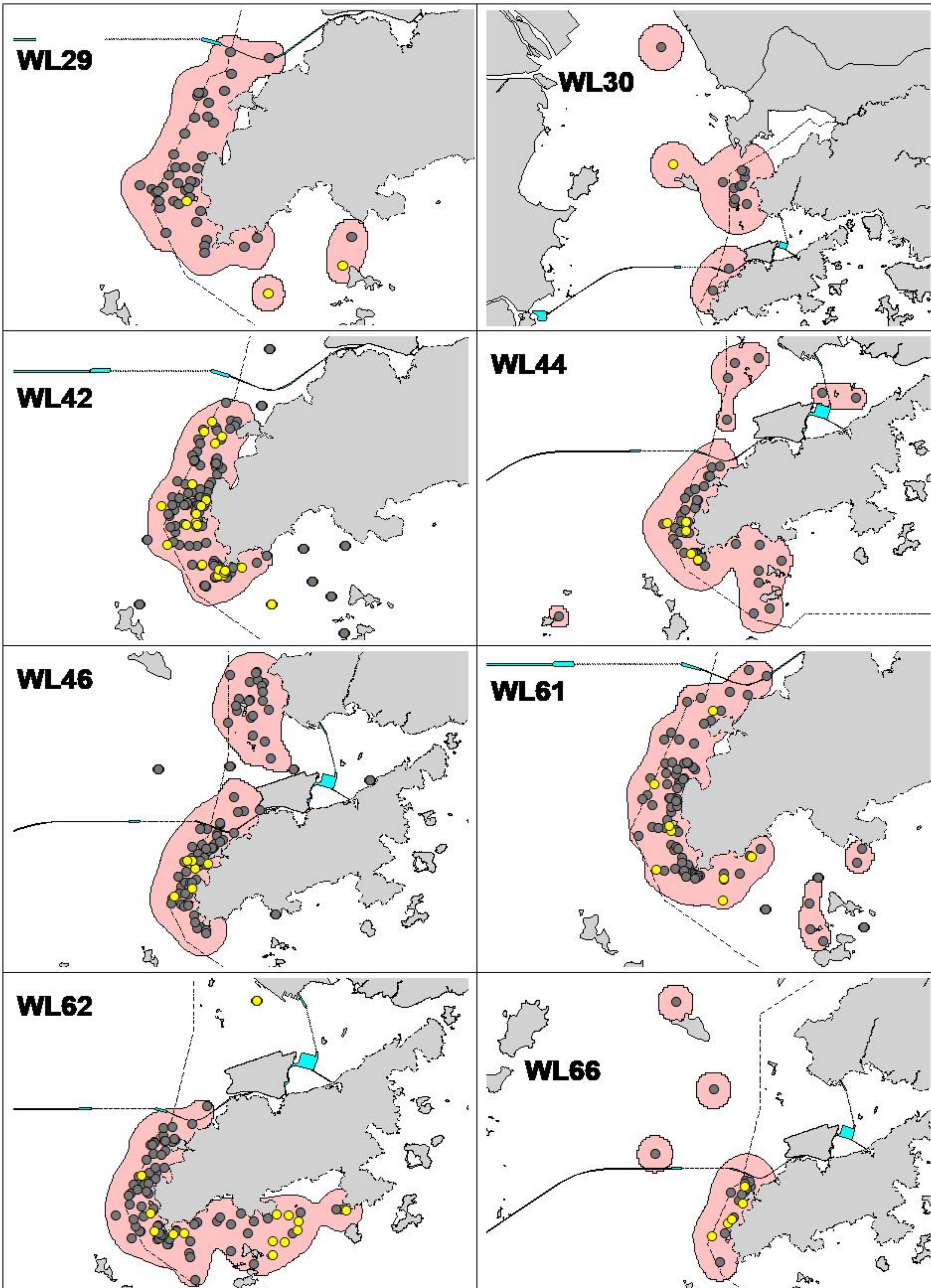
Appendix VI. (cont'd).



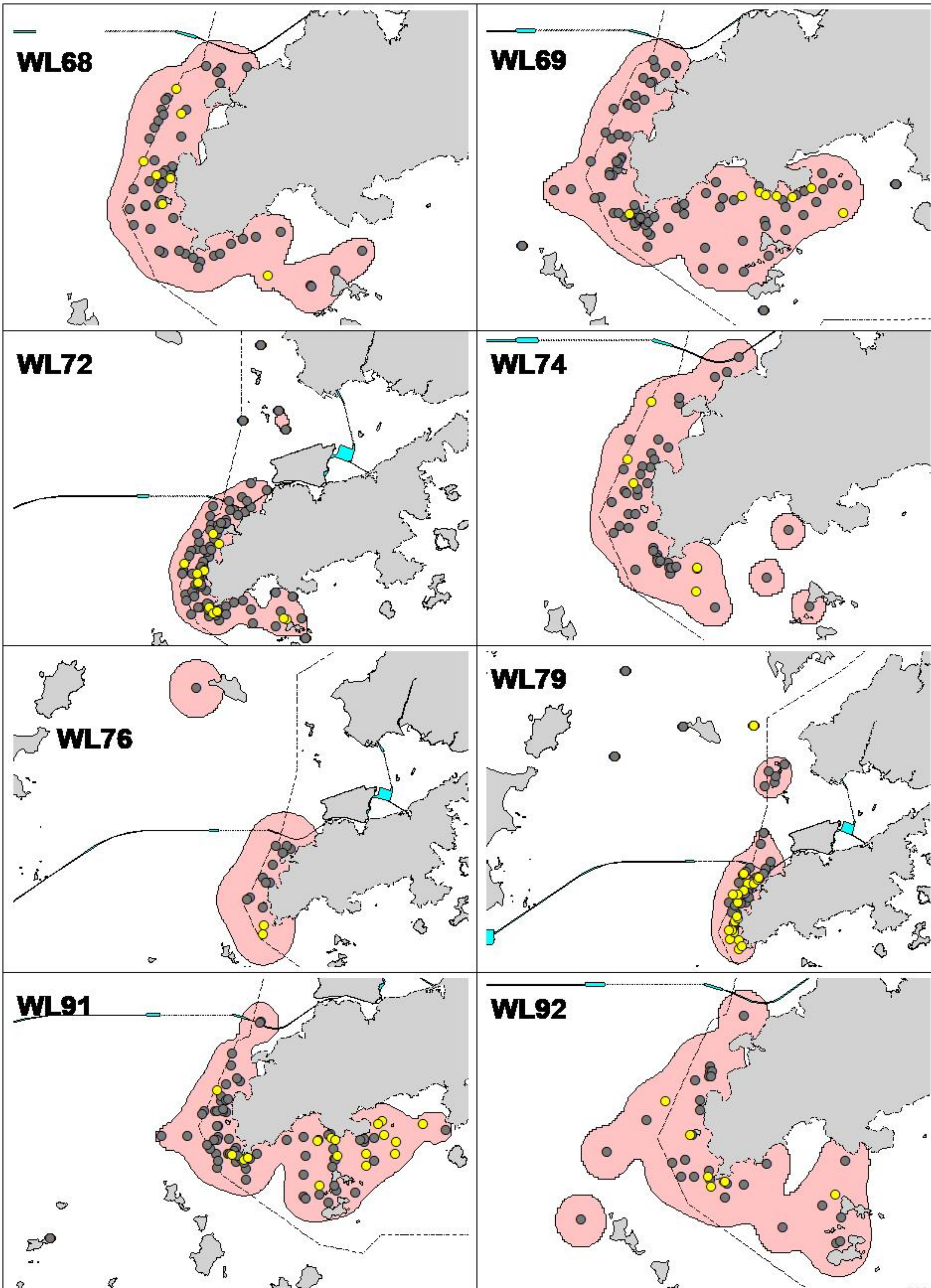
Appendix VI. (cont'd).



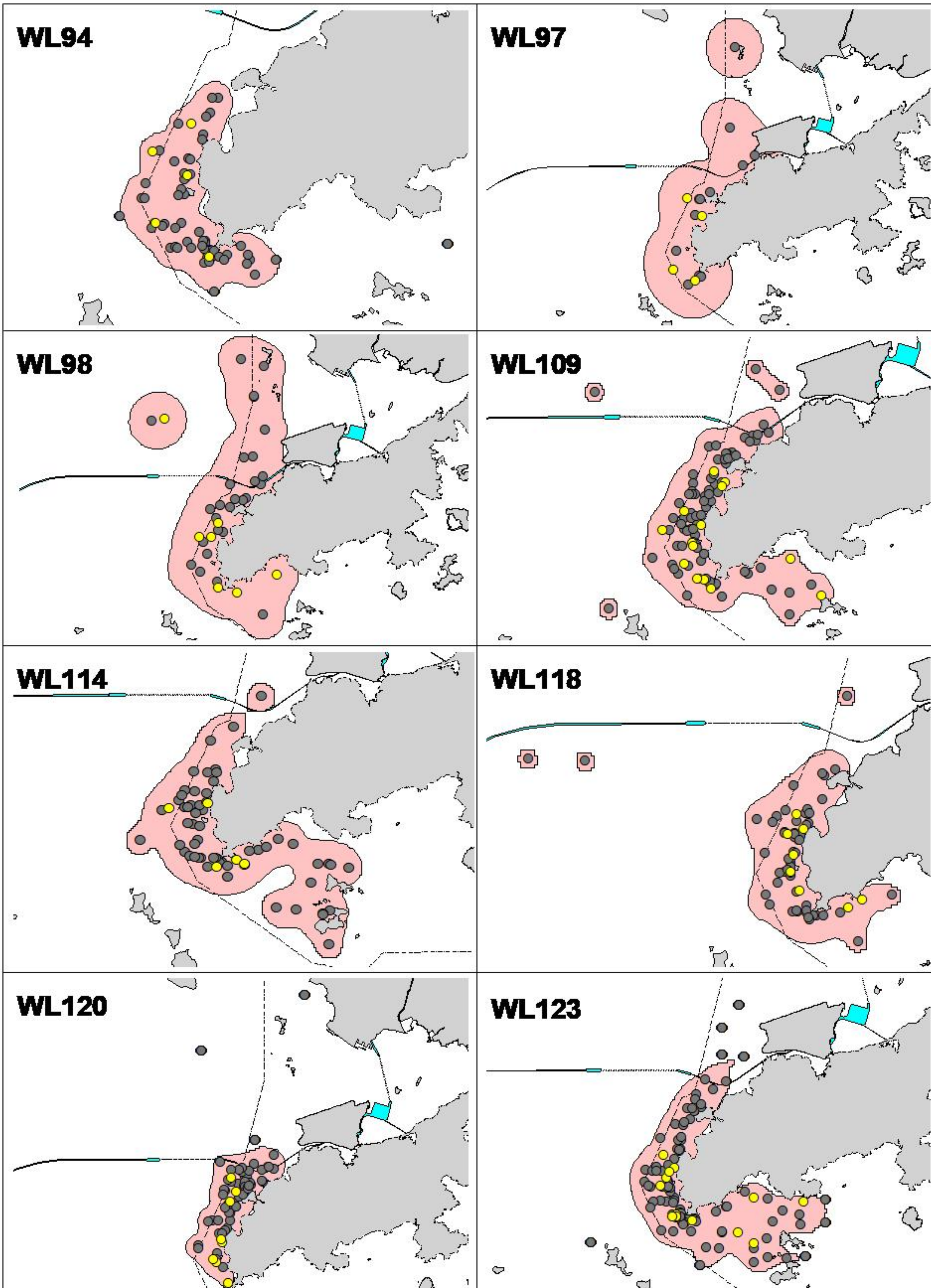
Appendix VI. (cont'd).



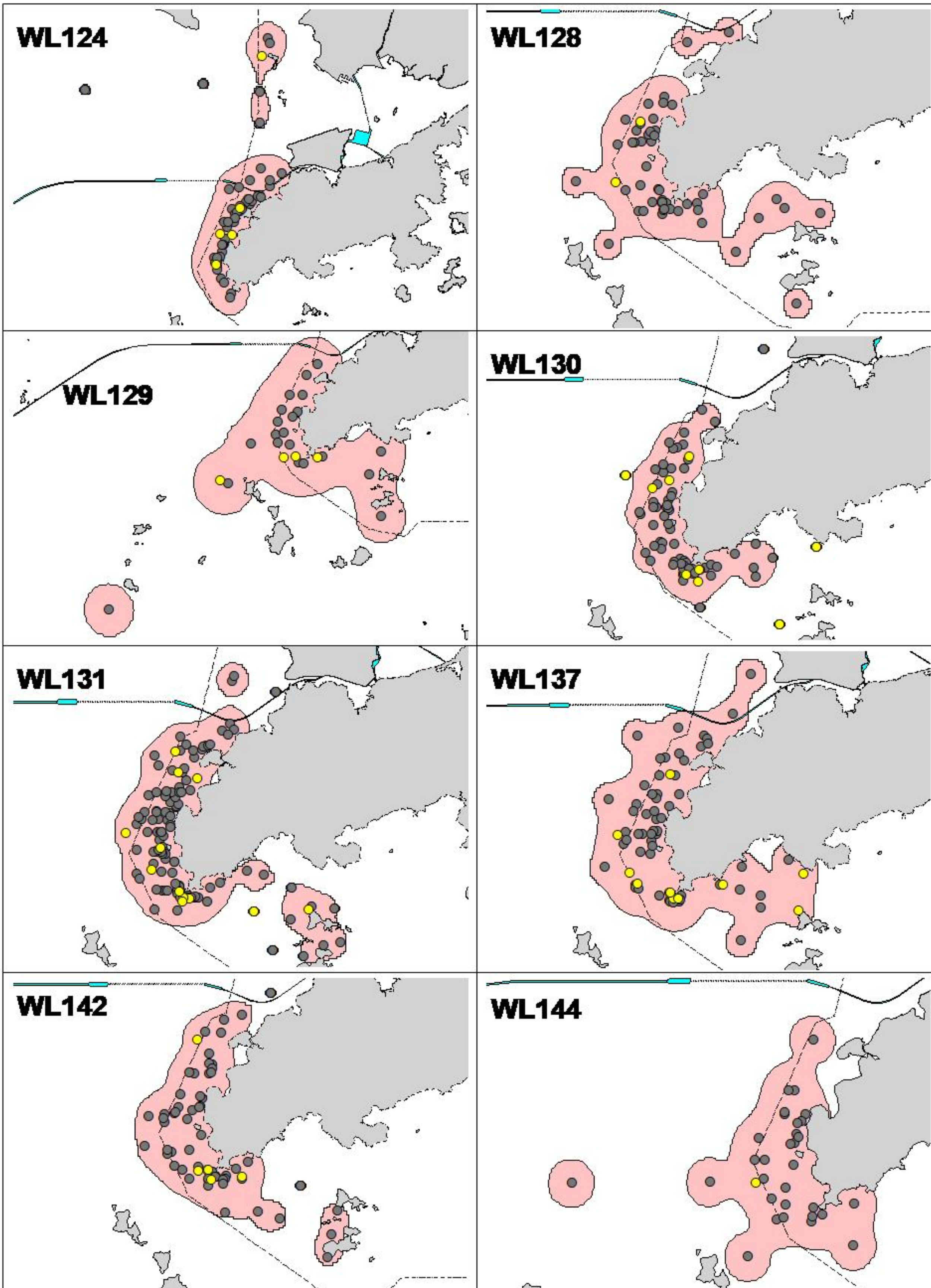
Appendix VI. (cont'd).



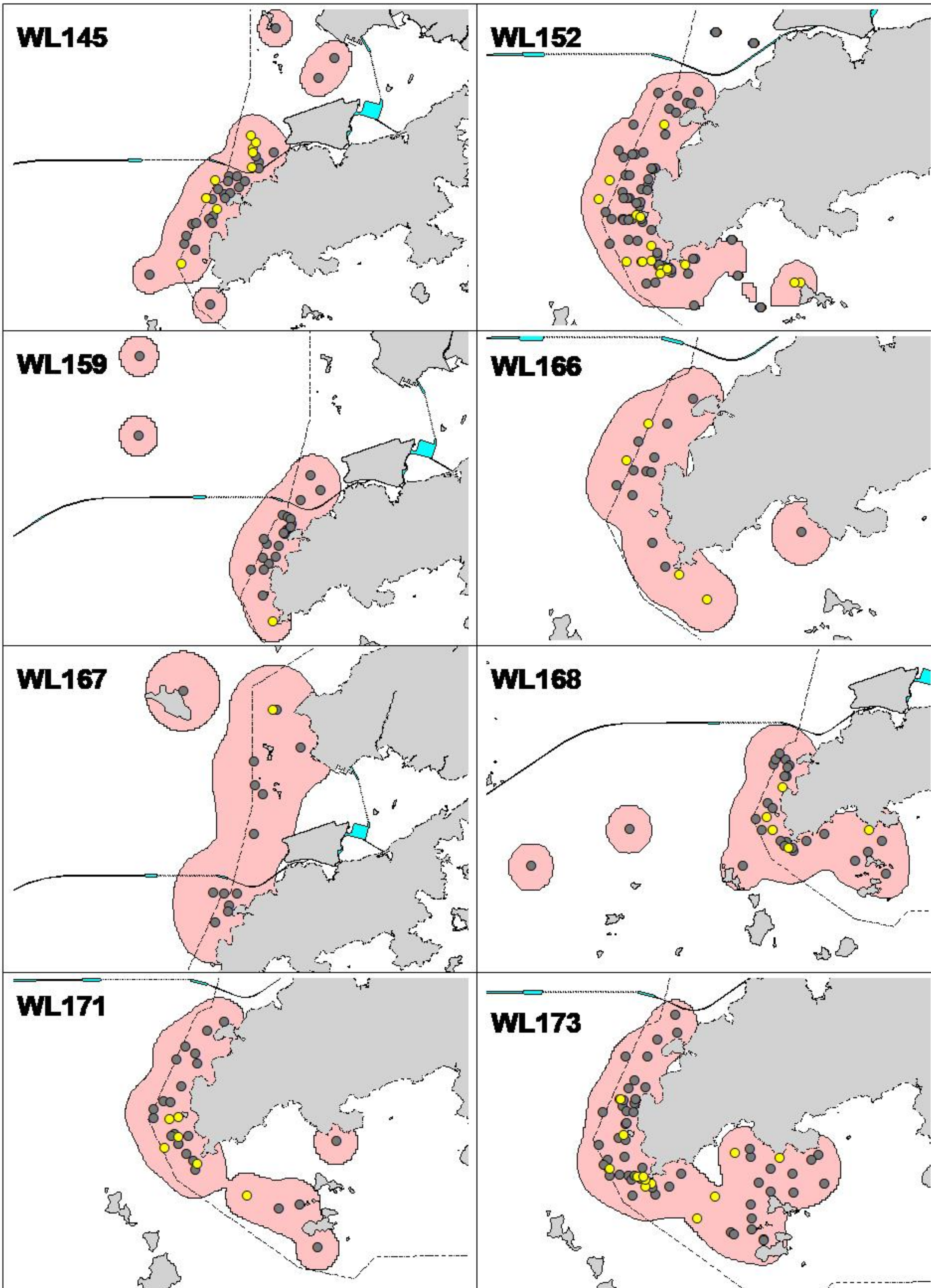
Appendix VI. (cont'd).



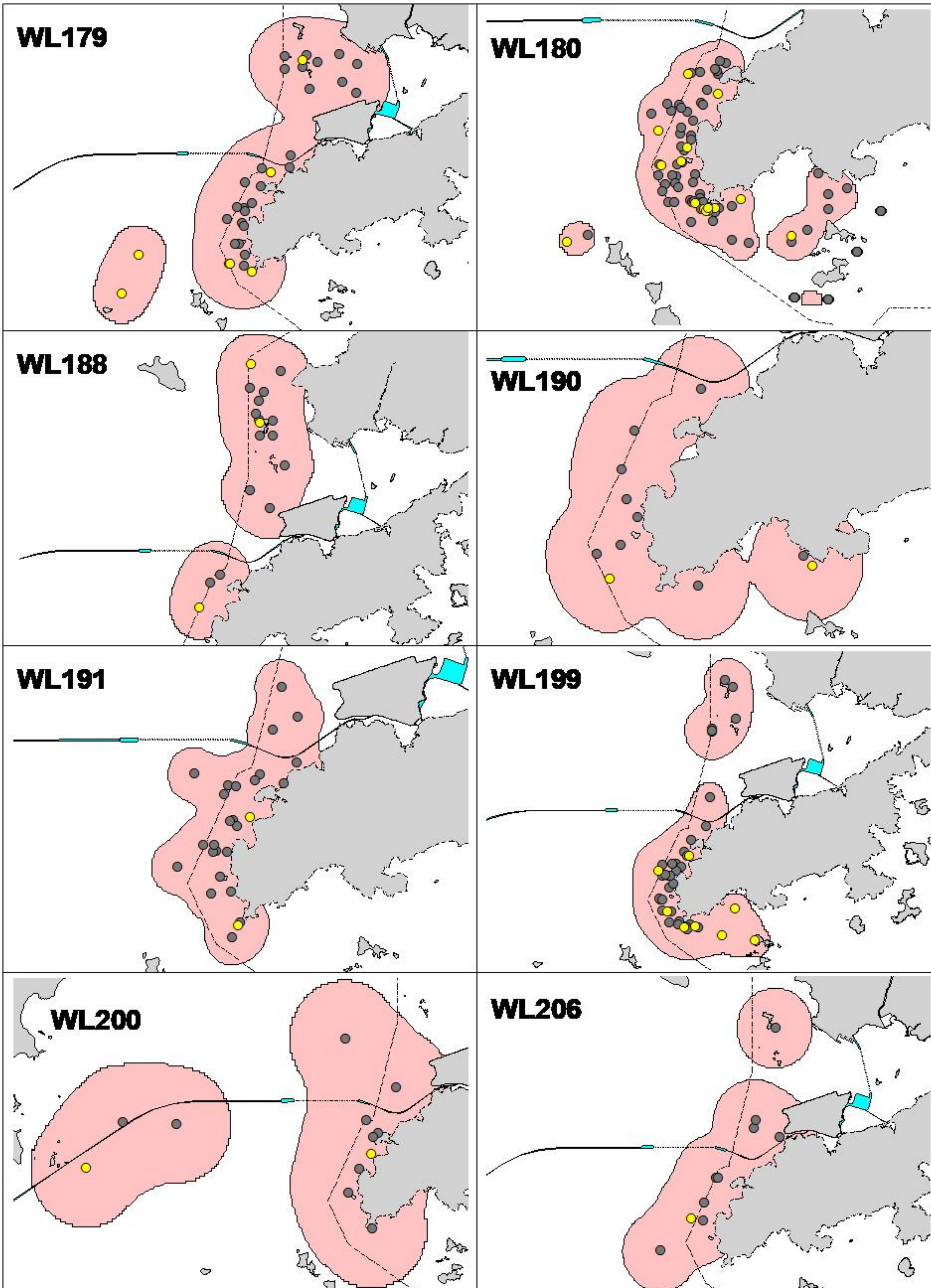
Appendix VI. (cont'd).



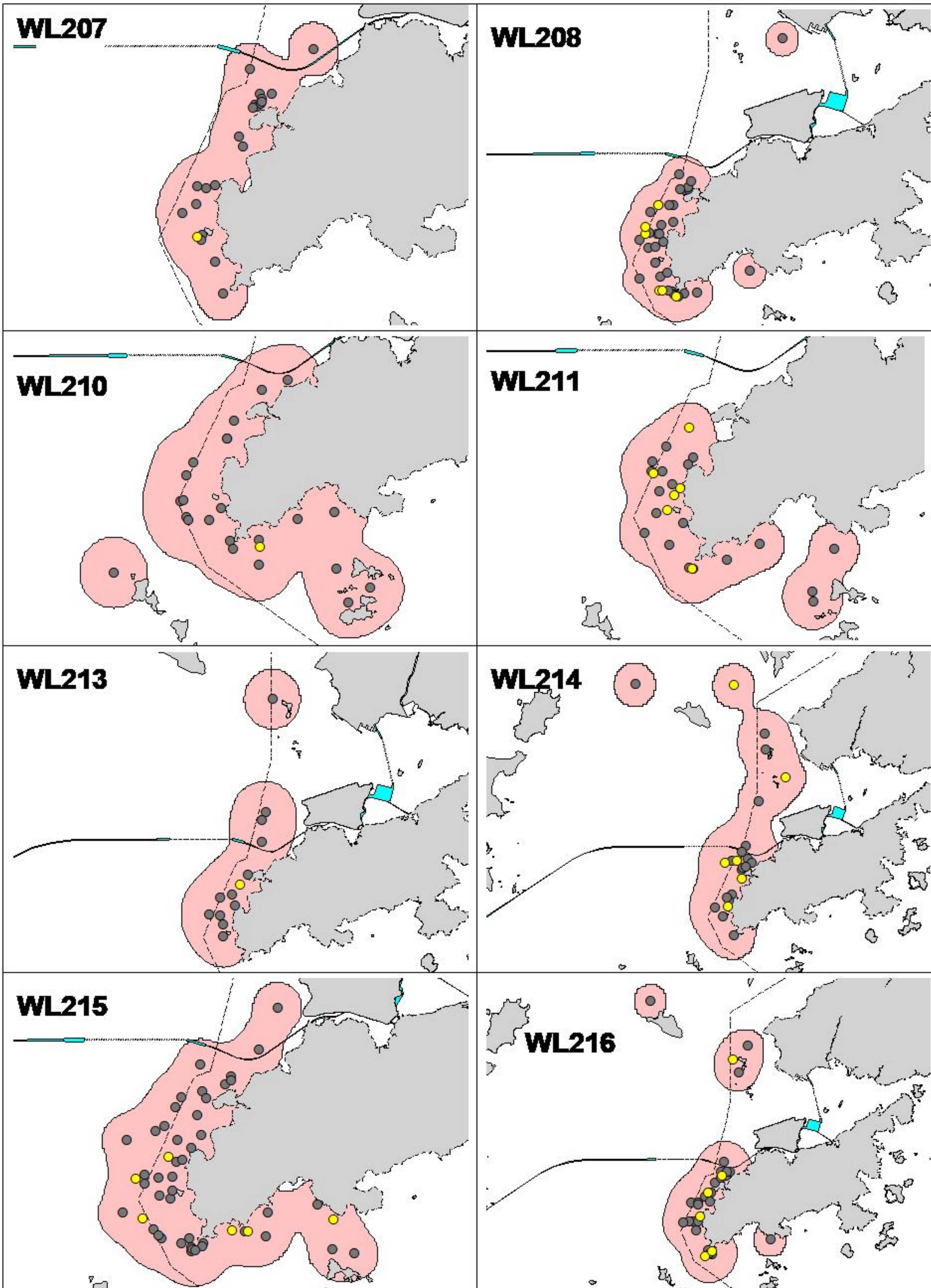
Appendix VI. (cont'd).



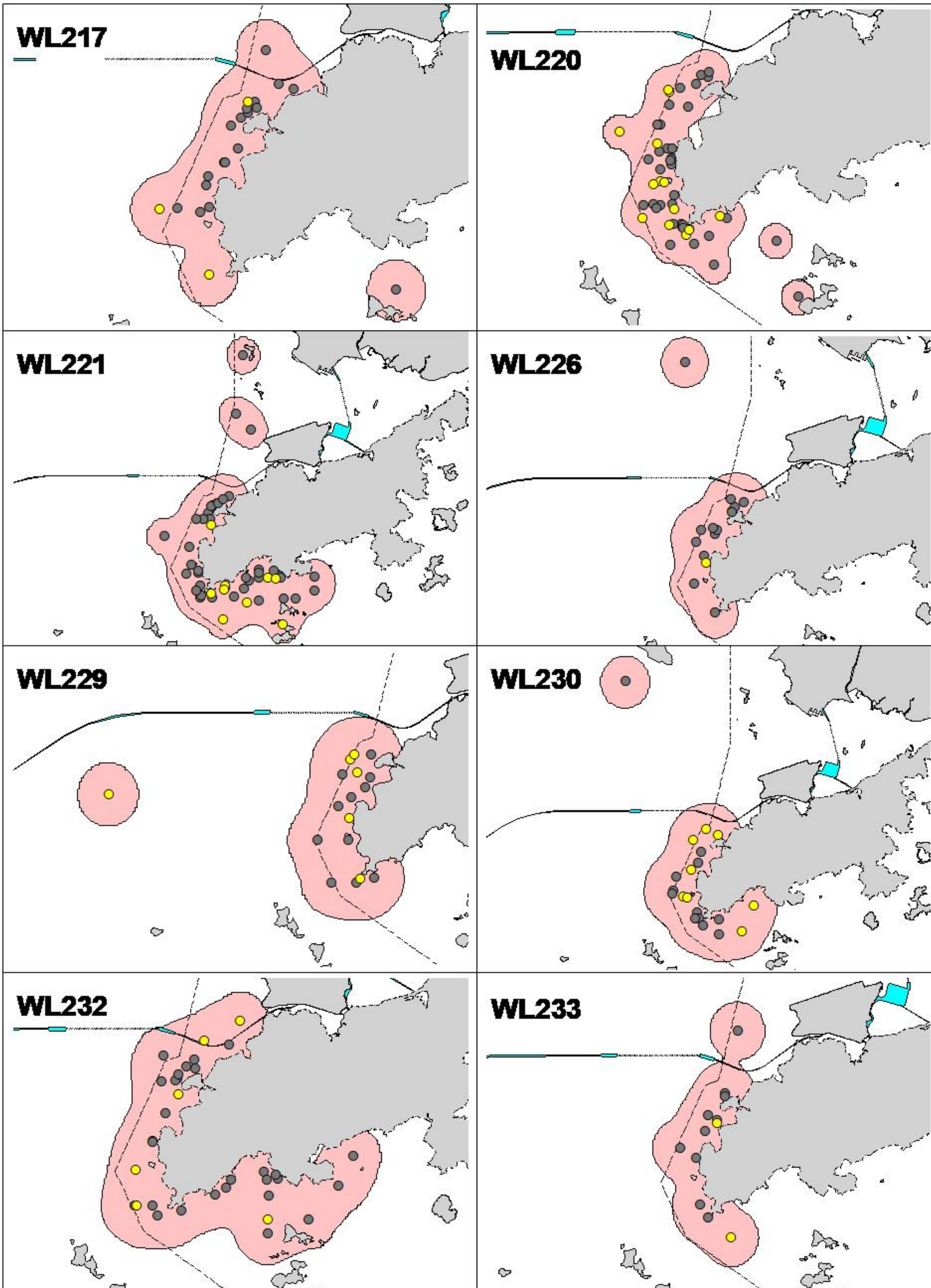
Appendix VI. (cont'd).



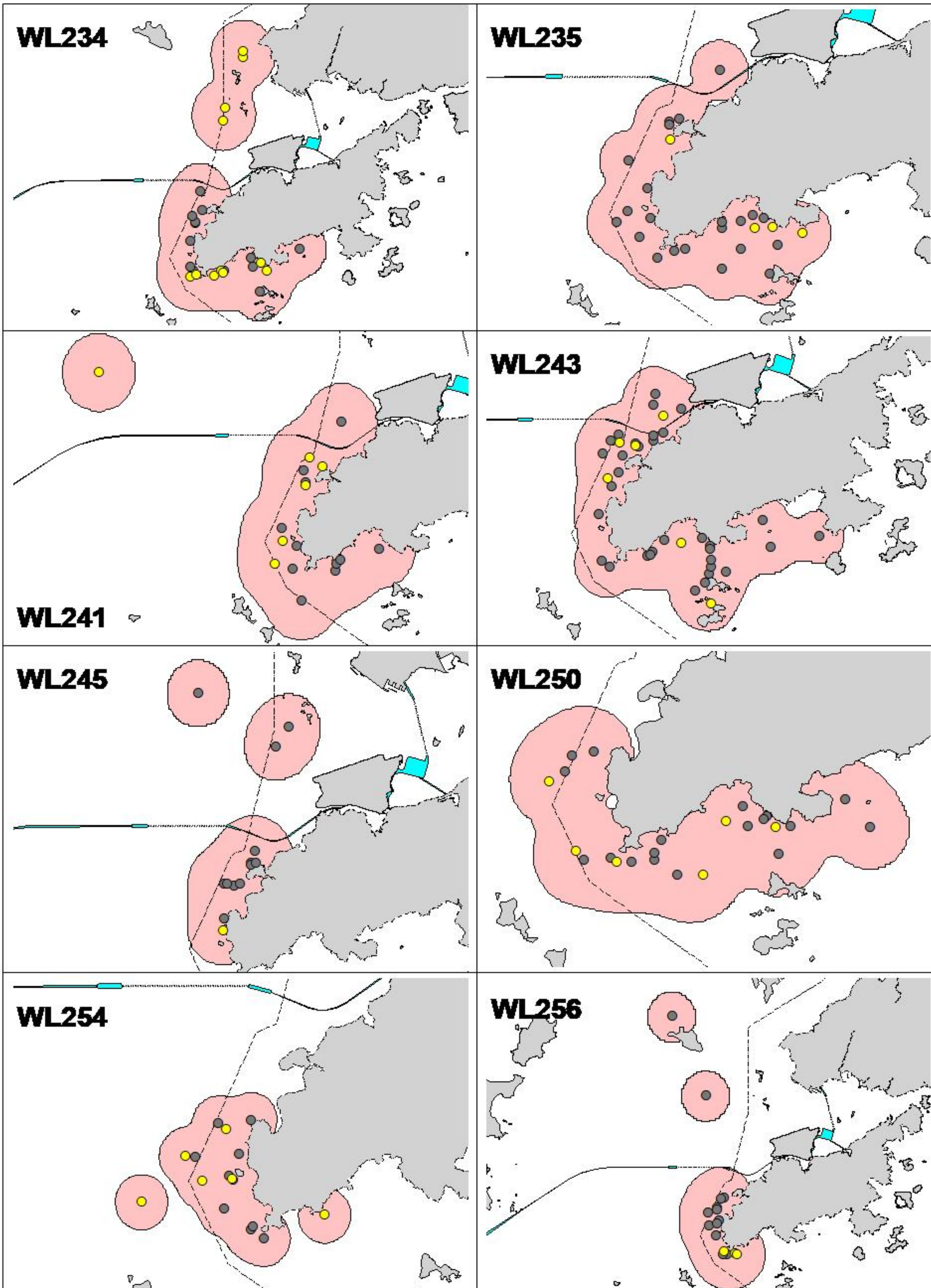
Appendix VI. (cont'd).



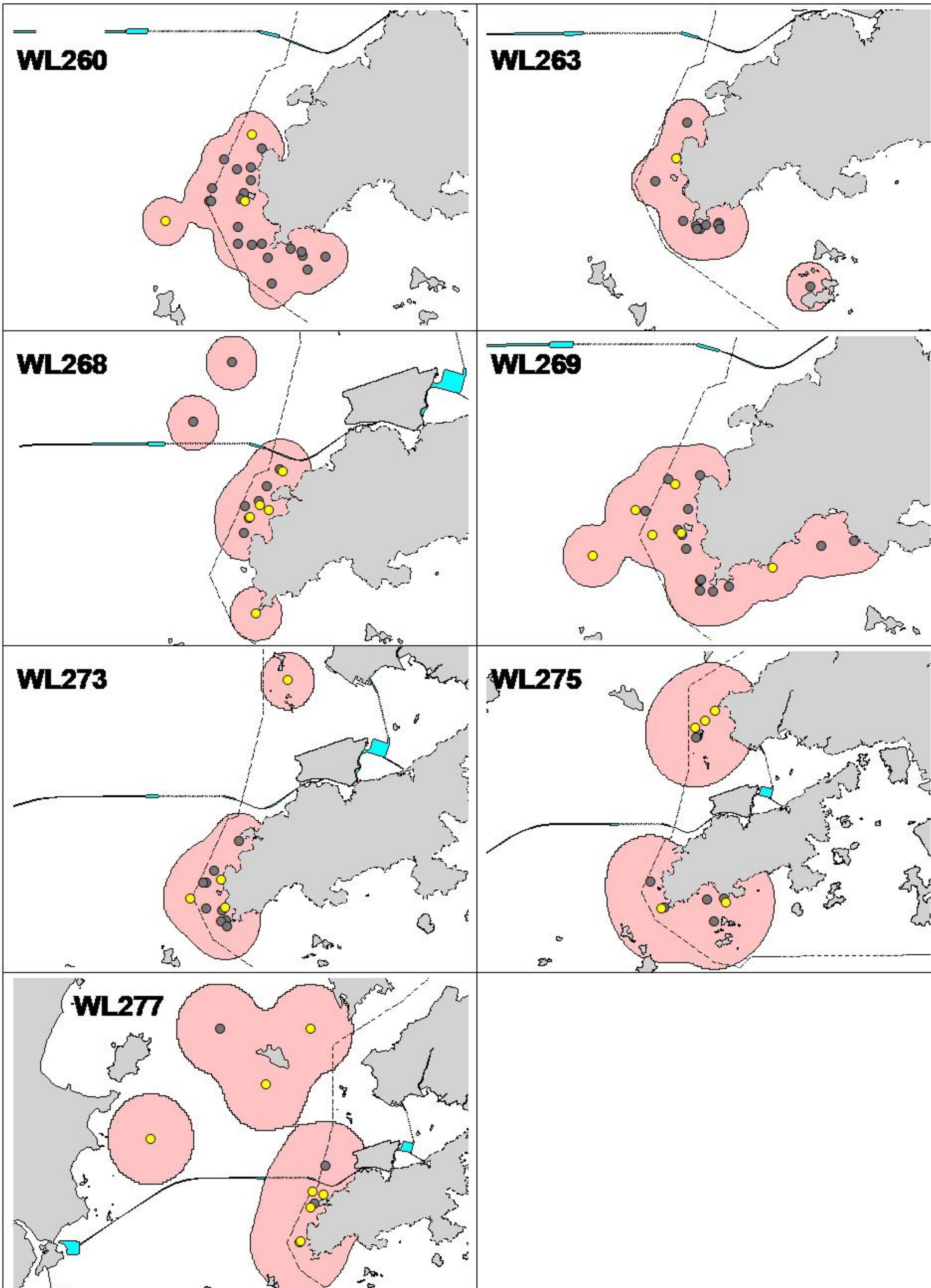
Appendix VI. (cont'd).



Appendix VI. (cont'd).



Appendix VI. (cont'd).



APPENDIX VII Responses to Comments

Monitoring of Marine Mammals in Hong Kong Waters (2017-18)

Final Report

(1 April 2017 to 31 March 2018)

Responses to Comments

Comments Received	Date Received
Civil Engineering and Development Department (CEDD)	7 June 2018
Airport Authority Hong Kong (AAHK)	19 June 2018
Marine Department (MD)	27 June 2018

Monitoring of Marine Mammals in Hong Kong Waters (2017-18)

Final Report

(1 April 2017 to 31 March 2018)

Responses to Comments

Comments	Responses
Comments from CEDD dated 7 June 2018	
1. 2nd and 3rd paragraphs of the Executive Summary	
For the sake of clarity, please consider insert "(covering both survey areas SWL and WL)" after the term "West Lantau" as the term " West Lantau" might tend to refer to the survey area of "WL" only.	The descriptions in both paragraphs specified the consistent habitat usage of dolphins along the "coastal waters of West Lantau", rather than referring to the whole survey area of WL or SWL. It is regarded as appropriate to keep the descriptions unchanged.
2. Figure 38	
For easy reference/comparison, an additional table is suggested to be added to provide the exact figures of CWD abundance estimates for each survey area under different years, which are now presented in bar chart format in Figure 38.	The corresponding abundance estimates were put under Table 5b, which had been referenced together with Figure 38 at the 2nd and 3rd paragraphs on Page 41.

Monitoring of Marine Mammals in Hong Kong Waters (2017-18)

Final Report

(1 April 2017 to 31 March 2018)

Responses to Comments

Comments	Responses
Comments from AAHK dated 19 June 2018	
1. I do not have any comments on the draft Final Report as circulated.	Noted with thanks.

Monitoring of Marine Mammals in Hong Kong Waters (2017-18)

Final Report

(1 April 2017 to 31 March 2018)

<u>Responses to Comments</u>

Comments	Responses
Comments from MD dated 27 June 2018	
1. Executive Summary Page 4 – 4th para.	
Please enlighten us the details and meaning of the combined estimate of dolphin abundance.	The abundance estimates were calculated from dolphin sightings and effort data collected in the standard line-transect survey. Details of survey methods and line-transect analysis were presented under section 4.1 and 4.5.3, respectively. The resultant combined estimate of abundance could be hypothetically taken as the average total number of dolphins that would appear in the four survey areas at any time within the survey period.
2. Executive Summary Page 5 - 2nd para.	
It seems that no further observation of the dolphin calves may be due to many other possible reasons such as moving to Mainland water areas. It is doubtful whether this can suggest a low survival rate of dolphin calves.	Supporting observations on low survival rate of dolphin calves were detailed at 2nd paragraph on Page 54.
3. Main Report Page 8 – 1st para.	
What is the meaning of "longitudinal study"? What does "NGOs" stand for? If "NGOs" means "Non-government offices", please advise the relevant names of NGOs for reference.	"Longitudinal study" means temporally continuous study. "NGOs" represents Non-government organizations. Dolphin Conservation Society is one example of such NGOs.
4. Main Report Page 24 – 4th para.	

Comments	Responses
The correct geographical name for "The Brothers" should be " The Brothers" on navigation chart. Hence " the Brothers Islands" should be named as "The Brothers". " the Brothers Marine Park" should be named as "The Brothers Marine Park". Please use the proper and correct geographical names in the whole report.	Noted. The relevant names have been corrected throughout the report.
5. Main Report Page 25 – 3rd para. Figure 7 Distribution of CWD sightings in West & South Lantau waters(2017)	
The area south of Fan Lau Peninsula is an existing recommended traffic separation scheme. Most of high speed passenger ferries plying between HK and Macau/Mainland mainly take the TSS routes north of Soko Islands daily. It indicates that the assumption of the correlation between high speed vessel volume and reduced dolphin occurrence is not in line with the reality of "higher the marine traffic, the higher the sighting of dolphins.	The paragraph made reference to Figure 7 which showed the distribution of dolphin sightings. Waters between Tai O Peninsula and Peaked Hill is not known to be an area with high traffic volume of high speed ferry, while sightings around Fan Lau Peninsula were concentrated along the narrow stretch of waters close to the shoreline. Overlaying the provided TSS route on Figure 7 apparently support the observation of "…they were less frequently sighted ….. at the southern end of the survey area that overlapped with the high-speed ferry route (Figure 7)." stated at the end of the paragraph. References should also be made to Figure 11 and 12 which presented the sighting/dolphin densities with correction of survey effort for each 1km^2 grid. The density of sightings/dolphins for the grids within the provided TSS route were generally lower when compared with the adjacent grids outside the TSS route. The statement of "the reality of higher the marine traffic, the higher the sighting of dolphins." seems not in line with the monitoring results presented in the report.
6. Main Report Page 26 – 1st para.	
Please advise us the justifications to show that the decline in dolphin usage in NEL waters is due to the increase in high speed ferry traffic. As regards there are some claims of the risk of collisions between high speed vessels with CWDs, we are not aware that there has been any report about collision between a high speed	The correlation of decline dolphin usage and high-speed ferry traffic at NEL was revealed in a historical cumulative impacts study for the north Lantau waters over the period between 1996 and 2013 (AFCD 2014, Marcotte et al. 2015). Taken into account the five categories of human impact, including (1) land reclamation

Comments	Responses
vessel and a dolphin in Hong Kong water.	projects; (2) pile driving works; 3) dredging works; (4) cargo shipping traffic; and (5) high-speed ferry traffic, spatial analyses showed evidence of relationship between the addition of new high-speed ferry routes and decrease in dolphins at the NEL over the study period. Dolphins are highly sensitive to noise disturbance. When the high-speed ferries travel through dolphin habitats, there are two major concerns: (i) dolphins may be physically harmed by collision; (ii) dolphins may be disturbed and, therefore, could not carry out their normal activities including feeding, socialising, mating and raising their young. References.: AFCD. 2014. Monitoring of Marine Mammals in Hong Kong Waters (2013 - 14). Final Report. (http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/con_mar_chi_chi.html) Marcotte D, Hung SK, Caquard S. 2015. Mapping cumulative impacts on Hong Kong's pink dolphin population. Ocean & Coastal Management 109, 51-63.
7. Main Report Page 46 – 1st para.	
It is rightly pointed out that the decline of observation of CWD in Hong Kong waters does not mean an actual reduction of CWD as a whole because some CWD may shift their living environment from one place to another and from time to time. Please enlighten us the justifications to claim that high speed ferry traffic restricts the movements of CWD within Hong Kong waters.	**CWDs occur in Hong Kong** The Chinese white dolphins (CWDs) that occur in Hong Kong belong to a large CWD population inhabiting the Pearl River Estuary (PRE), the size of which is some 2,500. In the monitoring of 2015-16, expansion or shift of habitat use by some dolphins to Mainland waters have been evidenced by surveys conducted by Mainland researchers in Lingding Bay. However, using the photo-identification technique, a significant portion of the dolphins observed in Hong Kong were found to be residents in local waters, as reflected by their high site fidelity. The observation reflects that Hong Kong, in particular the waters around Lantau, has provided suitable habitats that support a substantial number of CWD. While our monitoring results indicated a drop in

Comments	Responses
	CWD abundance in Hong Kong, the detected decline in Hong Kong did not necessarily imply a similar drop of the PRE CWD population, given our data are restricted to only a small portion of the whole population range. Nevertheless, recent studies on the PRE CWD population have suggested that the population is declining at a rate of about 2.5% per annum. The findings open up the possibility that the detected decline of CWD in Hong Kong may well be a reflection of the downward trend of the whole PRE CWD population. **Effect of high speed ferry on dolphin movements** The effects of vessel traffic on marine mammals around the world have been well documented in the past. At behavioural level, general impact on dolphins include spatial avoidance, increase in swimming speed, changes in diving behaviour and acoustic behaviour. A case study on the impact of high speed ferry on local dolphins and porpoises over the period between 1999 and 2010 were studied and reported in the 2011-12 monitoring report (AFCD 2012). Examination of temporal changes in dolphin usage at several sites at or near the two major vessel fairways in North and South Lantau indicated that the notable decline in dolphin densities at Fan Lau, around Soko Islands and the northeast corner of the airport over the decade correlated closely with the increase in traffic volume of high speed ferries during the same period. Moreover, it was known that dolphins would move across the South Lantau vessel fairway from Fan Lau and Kau Ling Chung to the Soko Islands. There was an observed decline in dolphin densities and average dolphin groups size at the water around Soko Island over the study period of increasing high speed ferry volume at the South Lantau vessel fairway (AFCD 2012). The observation reflected that the transit of dolphins to the Soko Islands might be deterred by the growing amount of high speed ferry traffic.

Comments	Responses
	Reference: AFCD. 2012. Monitoring of Marine Mammals in Hong Kong Waters (2011 - 12). Final Report. (http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/con_mar_chi_chi.html)

Monitoring of Marine Mammals in Hong Kong Waters (2017-18)

Final Report

(1 April 2017 to 31 March 2018)

Responses to Further Comments

Comments Received	Date Received
Further Comments from Marine Department (MD)	5 July 2018

Monitoring of Marine Mammals in Hong Kong Waters (2017-18)

Final Report

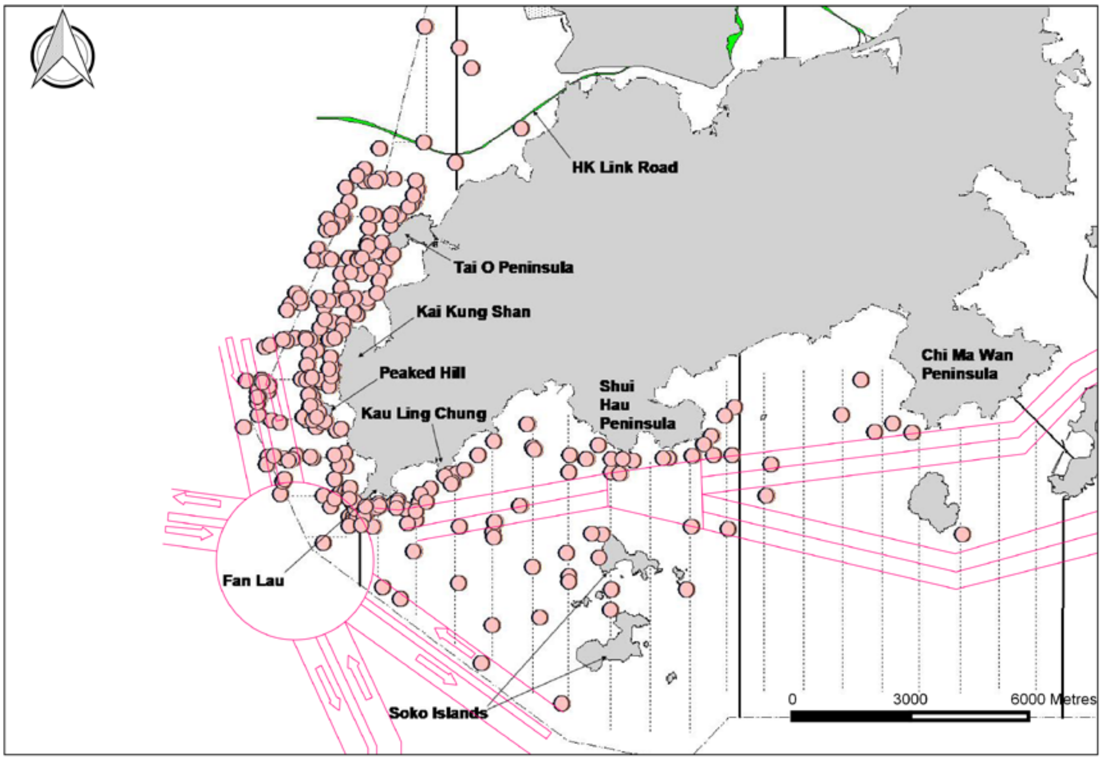
(1 April 2017 to 31 March 2018)

Responses to Further Comments

Further Comments	Responses
Further Comments from MD dated 5 July 2018	
1. Executive Summary Page 4 – 4th para.	
Comments: Please enlighten us the details and meaning of the combined estimate of dolphin abundance. **Responses (AFCD):** Please refer to RtoC (1) from MD dated 27 June 2018. **Further comments:** MD Comments: Noted with thanks. It is understood that the combined estimate of dolphin abundance was obtained hypothetically.	Further comments are noted.
2. Executive Summary Page 5 - 2nd para.	
Comments: It seems that no further observation of the dolphin calves may be due to many other possible reasons such as moving to Mainland water areas. It is doubtful whether this can suggest a low survival rate of dolphin calves. **Responses (AFCD):** Please refer to RtoC (2) from MD dated 27 June 2018. **Further comments:** MD Comments: It is noted that the assumption is based on observations and prediction.	Further comments are noted.

Further Comments	Responses
3. Main Report Page 8 – 1st para.	
Comments: What is the meaning of "longitudinal study"? What does "NGOs" stand for? If "NGOs" means "Non-government offices", please advise the relevant names of NGOs for reference.	Noted. The relevant NGOs will be provided in the future reports.
Responses (AFCD): Please refer to RtoC (3) from MD dated 27 June 2018.	
Further comments: MD Comments: Please indicate other concerned NGOs if possible in the report for reference.	
4. Main Report Page 24 – 4th para.	
Comments: The correct geographical name for "The Brothers" should be " The Brothers" on navigation chart. Hence " the Brothers Islands" should be named as "The Brothers". " the Brothers Marine Park" should be named as "The Brothers Marine Park". Please use the proper and correct geographical names in the whole report.	Noted.
Responses (AFCD): Please refer to RtoC (4) from MD dated 27 June 2018.	
Further comments: MD Comments: Noted with thanks.	

Further Comments	Responses
5. Main Report Page 25 – 3rd para. Figure 7 Distribution of CWD sightings in West & South Lantau waters(2017)	
Comments: The area south of Fan Lau Peninsula is an existing recommended traffic separation scheme. Most of high speed passenger ferries plying between HK and Macau/Mainland mainly take the TSS routes north of Soko Islands daily. It indicates that the assumption of the correlation between high speed vessel volume and reduced dolphin occurrence is not in line with the reality of "higher the marine traffic, the higher the sighting of dolphins.	A figure showing the TSS route and CWD sightings is provided below for reference.
Responses (AFCD): Please refer to RtoC (5) from MD dated 27 June 2018.	
Further comments: <u>MD Comments</u>: Please provide the figure which can show the TSS route and the CWD density for reference.	



Further Comments	Responses
6. Main Report Page 26 – 1st para.	
Comments: Please advise us the justifications to show that the decline in dolphin usage in NEL waters is due to the increase in high speed ferry traffic. As regards there are some claims of the risk of collisions between high speed vessels with CWDs, we are not aware that there has been any report about collision between a high speed vessel and a dolphin in Hong Kong water.	Further comments are noted.
Responses (AFCD): Please refer to RtoC (6) from MD dated 27 June 2018.	
Further comments: <u>MD Comments:</u> Please also take into account that there is a fact that we have not received any report about collision between a high speed vessel and a dolphin in Hong Kong waters.	
7. Main Report Page 46 – 1st para.	
Comments: It is rightly pointed out that the decline of observation of CWD in Hong Kong waters does not mean an actual reduction of CWD as a whole because some CWD may shift their living environment from one place to another and from time to time. Please enlighten us the justifications to claim that high speed ferry traffic restricts the movements of CWD within Hong Kong waters.	Further comments are noted. Please be advised that “The proposed speed restrictions and route diversions of the high speed ferry routes” are not recommendations made under this monitoring report, but were proposed mitigation measures by WWF-HK based upon an underwater hydrophone study at Southern Lantau, presented by WWF-HK in the 54th Marine Mammal Conservation Working Group dated 7 June 2018.
Responses (AFCD): Please refer to RtoC (7) from MD dated 27 June 2018.	

Further Comments	Responses
Further comments: MD Comments: Thanks for your detailed response to our comments. From marine traffic safety point of view, we hope you would understand that the marine industry have reservation on the assumption of the correlation between high speed vessel volume and reduced dolphin occurrence, and hence the proposed mitigation measures based on this assumption. We have concerns on the detrimental impacts of the proposed mitigation measures for protection of CWD on marine traffic and the efficient operation of the marine trade and the port. The proposed speed restrictions and route diversions of the high speed ferry routes for protection of CWD would inevitably pose a negative effect to the shipping industry, the port efficiency and the economy of Hong Kong. Therefore we view that serious consideration, strong evidences and justifications, scientific and quantitative assessments shall be required to support the assumption of the correlation between high speed vessel volume and reduced dolphin occurrence and the proposed mitigation measures.	

- End -