MONITORING OF MARINE MAMMALS IN HONG KONG WATERS – DATA COLLECTION (2009-10)

FINAL REPORT
(1 April 2009 to 31 March 2010)

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EXECUTIVE SUMMARY

This one-year marine mammal monitoring project funded by the Agriculture, Fisheries and Conservation Department, represents a continuation and extension of a long-term research programme on local dolphins and porpoises conducted by Hong Kong Cetacean Research Project since 1995. The main goal of this study was to collect systematic data for the assessment of distribution and abundance of Chinese white dolphins and finless porpoises in Hong Kong, and to take photographic records of individual dolphins to update the photo-identification catalogue.

From April 2009 to March 2010, 179 line-transect surveys with 5,602.7 km of survey effort were conducted among nine survey areas in Hong Kong. From these surveys, 271 groups of 1,062 Chinese white dolphins and 72 groups of 148 finless porpoises were sighted. Dolphins were mostly sighted in West and Northwest Lantau, while porpoises were often found in South Lantau and Po Toi waters. When compared to previous distribution records, much fewer dolphins were sighted in Northeast Lantau, while more porpoises were sighted in the offshore waters of South Lantau in 2009-10. Combined dolphin encounter rate of survey areas around Lantau was 6.3 sightings per 100 km of survey effort, which was the lowest among recent years of monitoring. During 2002-09, annual dolphin encounter rates were fairly stable in Northwest and West Lantau, but appeared to decline in Northeast Lantau in recent years. On the contrary, no apparent trend was observed in annual encounter rate of porpoises from 2002-09, but temporal trend of porpoise encounter rate in southern waters during their peak months of occurrence showed a steady increase in recent years after a noticeable decline in earlier years.

Habitats utilized the most by dolphins and porpoises in 2009-10 were located along the west coast of Lantau and offshore waters of South Lantau respectively. With a much larger dataset from 2002-09, important dolphin habitats were located around Tai O Peninsula, Lung Kwu Chau, near Fan Lau and Kau Ling Chung, while moderate dolphin usage was also recorded near the Brothers Islands, Sham Shui Kok, Black Point and west of Sha Chau. On the other hand, important porpoises habitats during winter and spring months in 2004-09 were identified at the waters south of Tai A Chau, the offshore waters of Southeast Lantau, around Shek Kwu Chau and the southeast corner of Cheung Chau, while the waters around Po Toi Islands recorded intense porpoise usage during summer and autumn months of the six-year period.

Dolphin group sizes ranged from singles to 18 animals, with an overall mean of

3.9 animals per group. Large aggregations of dolphins were found near the Brothers Islands, along the west coast of Lantau and north of Lung Kwu Chau. Porpoise group sizes tended to be small, with an overall mean of 2.1 animals per group. In 2009-10, five unspotted calves and 67 unspotted juveniles were sighted, and they mostly occurred along the west coast of Lantau, north of Lung Kwu Chau and near the Brothers Islands. After a noticeable decline in calf encounter rate in West Lantau from earlier years, such trend appeared to be reversed in recent years. Monthly occurrence of young calves showed that more calves were likely born in late spring, but it is difficult to define the peak calving period as their occurrence was relatively stable from April through November. Moreover, a total of 44 and 26 dolphin sightings were associated with feeding and socializing activities respectively. Temporal trend in percentages of these activities among all dolphin groups showed a steady increase in recent years.

Over 29,000 photographs of Chinese white dolphins were taken during vessel surveys throughout the study period. A total of 153 individuals with 434 re-sightings were identified, 32 of which were newly-identified individuals. A majority of re-sightings were made in West and Northwest Lantau, and frequent individual movements between these two areas were observed. Many new individuals identified from previous monitoring periods were frequently re-sighted around Lantau in 2009-10, showing their increased reliance on Hong Kong waters.

Several life history parameters of Chinese white dolphins were examined for the first time using long-term photo-identification data. Examination on colour pattern development revealed that juvenile and subadult females likely go through the mottled stage quicker, and reach the speckled stage as young adults or older subadults. At the speckled stage, most of the females are probably sexually mature, and many of them start to give birth. Female spotted adults are found to be all adults with some older ones, and some of the spotted adults will finally reach the unspotted stage that should comprise of mostly old females. On the contrary, the juvenile and subadult males will go through the mottled stage much slower, with some retain heavy spotting even when they become sexually mature. Some of the sexually mature males and older males will reach the speckled stage, but these adult males rarely become spotted or unspotted adults, probably except the very old ones. This colour pattern development theory was further verified by stranding cases of Chinese white dolphins.

Life span of individual dolphins was estimated based on their colour pattern and sighting history. A great proportion of examined individuals are sexually mature adults, many of which have survived well into their twenties and thirties. Their relatively long life span is vital to the sustainability of a healthy dolphin population. It also appeared the females survived longer than males, probably due to the higher pollutant loads in males that may affect their immune system and overall health. Moreover, female-calf association and calving interval of 60 females were examined. Many calves were seen only once with their mothers, likely a result of low calf survival rate, which was also confirmed by the stranding data. The higher mortality rate of young calves may be linked to the negative impacts of water pollution, increased acoustic disturbances from vessels and dolphin-watching activities. Recommendation was made to protect important dolphin nursery habitats to alleviate these impacts on calf survival. In addition, the minimum period of female-calf associations averaged 20.4 months, with most calves being associated with their mothers for less than 24 months. The maximum calving interval averaged 62.6 months. In summary, although the local dolphins likely enjoy longer life span, the females appear to have long calving interval, while their calf survival rate and fecundity are fairly low. All these life history parameters should be closely monitored in the future, to verify these findings with a larger sample size.

Ranging pattern analysis revealed that most individual dolphins utilized the waters of Northwest, Northeast and West Lantau, and their core areas were often centered on the Sha Chau and Lung Kwu Chau marine park, the Brothers Islands, and the west coast of Lantau. A large percentage of year-round residents were found to center their core areas on the Brothers Islands, which should be considered important dolphin habitat. Temporal change in their range use there should be carefully monitored in light of future habitat loss due to reclamation works in nearby waters.

Finally, 18 educational seminars were held at local schools during the study period. The topic presented to the students included up-to-date information on local dolphins and porpoises gained from the long-term monitoring study, the threats they faced, as well as measures implemented by AFCD for marine mammal conservation. Through this integrated approach of research and education programme, the public can gain first-hand knowledge about cetaceans from marine mammal researchers.

行政摘要(中文翻譯)

自 1995 年，香港政府漁農自然護理署便開始資助一項有關本地中華白海豚

及江豚的研究，現在這個爲期一年的研究正是這項長期監察項目的延伸。研究主要目的是要系統化地搜集數據，以分析香港中華白海豚及江豚的分佈和數量；及爲個別中華白海豚拍下照片，以更新海豚相片名錄。

在 2009 年 4 月至 2010 年 3 月期間，研究員共進行了 179 次樣條線船上調查，在全港九個調查區共航行了 5,602.7 公里，並且觀察到共 271 群中華白海豚(總數達 1,062 隻)及 72 群江豚(總數達 148 隻)。大部分中華白海豚都在大嶼山西面及西北面水域出沒，而江豚則經常在大嶼山南面及蒲台群島一帶水域出沒。與以往分佈紀錄比較，本年度很少海豚在大嶼山東北水域被發現，而江豚則較多出沒於大嶼山南面離岸水域。本年度大嶼山周邊水域的總平均遇見海豚比率是 6.3 次/100 公里，而此遇見比率爲近年最低。2002-09 年間每年遇見海豚比率顯示，在大嶼山西北面及西面調查區的趨勢較爲平穩，但在大嶼山東北面則呈下降趨勢。此外，在 2002-09 年間每年遇見江豚比率卻沒有明顯趨勢，但近數年在江豚的出沒高峰期間，遇見江豚比率則在香港南面水域呈上升趨勢。

量化生境使用分析顯示，大嶼山西面水域及南面離岸水域分別是中華白海豚及江豚在 2009-10 年度使用量最高的生境。若利用 2002-09 年度較多樣本的數據，就會發現大澳半島、龍鼓洲、分流及狗嶺涌一帶水域是香港最重要的海豚生境，而且在大小磨刀洲、深水角、爛角咀及沙洲西面附近水域亦錄得較高海豚使用量。另外，在 2004-09 年度的冬春兩季期間，香港最重要的江豚生境分別位於大鴉洲南面水域、大嶼山南面離岸水域、石鼓洲附近水域、及長洲東南面的水域，而蒲台群島附近水域則是江豚在夏秋兩季期間的重要生境。

中華白海豚的組群成員數目由 1 至 18 隻不等，平均數目爲每群 3.9 隻。較大的海豚組群分佈於大小磨刀洲、大嶼山西面及龍鼓洲北面一帶水域。而江豚組群成員數目一般較少，平均數目爲每群 2.1 隻。研究員在本年度共觀察到 5 隻無斑點幼豚及 67 隻無斑點少年豚，這些幼豚大多在大嶼山西面、龍鼓洲北面及大小磨刀洲一帶水域出沒。大嶼山西面的幼豚遇見比率於較早年份持續下降後，在近年已略見回升。幼豚每月出現的比率顯示，牠們較多於春末月份出生，但由於在四月至十一月期間的出現比率相若，現階段較難斷定幼豚出生的高峰期。此外，研究員亦分別發現共 44 群正在覓食的海豚，及 26 群正在進行社交的海豚；這些正在覓食及社交的海豚佔整體海豚的比率在近年有上升的趨勢。

在 2009-10 年度，研究員共拍攝到超過二萬九千多張中華白海豚相片，並辨認出 153 隻個別海豚，共 434 次，其中 32 隻海豚爲相片名錄的新成員。大部分個別海豚均在大嶼山西面及西北面調查區發現，而且有很多個體於此兩個調查區來回穿梭。有很多在過去兩年度才首次發現的海豚個體，均在本年度不斷出現，顯示牠們更多使用香港水域。

利用長期相片辨認的數據，研究員亦詳盡分析了數項有關中華白海豚生命史的參數。有關海豚身體顏色與成長的研究，發現雌性的少年及亞成年個體均較快經過多斑點的階段；而達到中度斑點階段的年輕成年或年齡較大的亞成年，應大多是性成熟的個體，並開始誕下幼豚。少斑點的雌性海豚，應全是成年的個體，當中有些甚至是較年老的；而無斑點的海豚應絕大多數是年老的雌性。雄性方面，少年及亞成年個體均會停留在多斑點的階段較久，當中一些成年個體仍是滿身斑點。部分已達性成熟的雄性及較年長的雄性會進入中度斑點的階段，但只有少數年老的雄性會達到少斑點及無斑點的階段。一些擱淺海豚的資料亦進一步證實上述海豚身體顏色與成長關係的推測。

根據海豚身體斑點的多寡及目擊紀錄的歷史，研究員亦估算出個別海豚的壽命，發現大部分被辨認的海豚都是已達至性成熟的成年個體，當中很多應已超過二十歲，甚至是三十歲以上。中華白海豚較長的壽命對此種群的長期健康發展甚爲重要。另外，研究亦發現雌性一般較雄性長壽，這可能與雄性海豚身體積存較高濃度的環境污染物而導致免疫力較差有關。此外，有關六十隻雌性海豚的產幼間隔及牠們與幼豚聯繫的研究發現，有很多幼豚只有一次與母親聯繫的目擊紀錄，這可能與偏低的幼豚存活率有關，擱淺海豚紀錄的數據亦支持這個推斷。偏低的幼豚存活率可能是由海水污染、及由船隻及觀豚活動所發出的水底噪音造成。要減輕此問題，最有效方法就是儘快保護重要的海豚育幼生境。此外，海豚母子的最短聯繫時間平均值爲 20.4 個月，而大部分聯繫應不會超過 24 個月。雌性海豚產幼間隔最長時間的平均值爲 62.6 個月。總括來說，香港的中華白海豚一般較爲長壽，但雌性海豚的產幼間隔較長，而牠們的幼豚存活率及產幼能力亦較低。這些海豚生命史的重要參數，應在將來數據樣本較大時再作詳細分析。

活動範圍的分析顯示，眾多個別海豚均使用大嶼山西北面、東北面及西面水域作其活動範圍的一部分，而牠們的活動核心區大多圍繞沙洲及龍鼓洲海岸公園、大小磨刀洲、及大嶼山西面一帶水域。大部分全年及長期居於香港水域的海豚均使用大小磨刀洲作其活動核心區，足證此水域是其中一個重要的海豚生境；由於將有大型填海工程在大小磨刀洲附近水域進行，減少了海豚可用的棲息地，因此應密切監察個別海豚在這一帶水域的使用量。

在 2009-10 年度，研究員協助漁農自然護理署，共爲本地中小學主持了十八場講座，內容主要圍繞香港中華白海豚及江豚的最新情況、面對的威脅、與牠們有關的保育措施。透過糅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 finless porpoises (*Neophocaena phocaenoides*) in Hong Kong and the Pearl River Delta region, which is primarily funded by the Agriculture, Fisheries and Conservation Department (AFCD) as well as various government departments, environmental consultants and NGOs. The multi-disciplinary research programme aims at providing critical scientific information to the Hong Kong SAR Government to formulate sound management and conservation strategies for the local populations of dolphins and porpoises. HKCRP has also been extensively involved in numerous environmental consultancy studies to assess potential impacts of marine construction projects on cetaceans in Hong Kong and the Pearl River Estuary, and to provide suggestions on mitigation measures to lessen the development pressures 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 and habitat use over time, and to keep track of levels and changes in mortality rates of local cetaceans (e.g. Hung 2005, 2007, 2008, 2009; Hung and Jefferson 2004; Jefferson 2000, 2007; Jefferson and Hung 2004, 2007, 2008; Jefferson et al. 2002, 2006, 2009; Parsons 1997).

The present monitoring project represents a continuation and extension of this research programme, with funding support from the Agriculture, Fisheries and Conservation Department of HKSAR Government. This is a one-year project covering the period of 1 April 2009 to 31 March 2010. And this final report is submitted to AFCD to summarize the status of the monitoring project covering the entire 12-month study period.

2. OBJECTIVES OF PRESENT STUDY

The main goal of this one-year monitoring study was to collect systematic data for the assessment of distribution and abundance of Chinese white dolphins and finless porpoises in Hong Kong, and to take photographic records of individual dolphins to update the current Pearl River Estuary (PRE) Chinese white dolphin photo-identification catalogue. To achieve this main goal, several specific objectives were set for this study. The first one was to assess the spatial and temporal patterns of distribution, abundance and habitat use of Chinese white dolphins and finless porpoises in Hong Kong in details. This objective was achieved by collecting research data on dolphins and porpoises from 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 photographs of dolphins during vessel and helicopter surveys for photo-ID analysis, and the resulting photo-ID data were used to study the ranging patterns, core area use and life history of individual dolphins in details. Photographs of newly identified or re-sighted individuals were compiled and added to the current photo-ID catalogue, with associated descriptions for each newly identified individual. The third objective was to take photographic records of finless porpoises during vessel and helicopter surveys. Finally, the last objective was to educate the members of the public on local dolphins and porpoises by using study results from the long-term monitoring research programme. This objective was achieved by providing school seminars arranged by 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 data for assessment on spatial and temporal patterns of distribution, abundance and habitat use of Chinese white dolphins and finless porpoises through systematic line-transect vessel surveys;
- to conduct quantitative analysis on spatial patterns of habitat use of local dolphins and porpoises;
- to conduct onboard observations on dolphin activities and behaviour;
- to take photographic records of dolphins for photo-identification analysis and update photo-identification catalogue;
- to take photographic records of finless porpoises during vessel and helicopter surveys; and
- to assist AFCD in arousing public awareness on local dolphins and porpoises through school seminars and production of educational material.

4. METHODOLOGY

4.1 Vessel Surveys

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 last 14 years of dolphin monitoring surveys in Hong Kong developed by HKCRP, especially for the Airport Authority and AFCD (Hung 2007, 2009; Jefferson 2000; Jefferson et al. 2002). The territorial water of Hong Kong Special Administrative Region is divided into twelve survey areas, and line-transect surveys were only conducted among nine survey areas (i.e. Northwest, Northeast, West, Southwest & Southeast Lantau, Deep Bay, Lamma, Po Toi and Ninepins) (Figure 1). Starting in 2010, with the consent of AFCD, revised sets of transect lines in several survey areas were adopted (Figure 2). For example, the configuration of transect lines in Deep Bay and West Lantau survey areas was modified from several parallel transect lines to the coastline, to a series of shorter transect lines running perpendicular to the coastline following the suggestions of Dawson et al. 2008. This improved survey design was to avoid any potential bias and to minimize the variance in encounter rate in line-transect analysis, with consideration of the possibility of a density gradient from high density nearshore to low density offshore (Dawson et al. 2008). Moreover, to improve the coverage throughout the entire survey area for quantitative grid analysis, additional transect lines were placed in the survey areas of Lamma, Po Toi, Ninepins and Northwest Lantau, to allow the survey team to choose alternate sets of transect lines on each survey day for better coverage.

For each vessel survey, a 15-m inboard vessel (*Standard* 31516) 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 35 *Brunton* 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 three additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers were experienced in small cetacean survey techniques and identifying local cetacean species. Beforehand they had participated in at least one at-sea training program provided by the author or Dr. T. A. Jefferson.

During on-effort survey periods, survey team recorded effort data including time, position (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance traveled in each series (a continuous period of search effort) with the assistance of a handheld GPS (*Garmin Geko* 201). When dolphins or porpoises were sighted, the survey team would end the survey effort, and immediately recorded 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 5.0, ArcView© GIS programme) for examination of population status including trends in abundance, distribution and habitat use of Chinese white dolphins and finless porpoises.

4.2 Helicopter Surveys

Several helicopter surveys arranged by the Government Flying Service (GFS) were conducted during the study period to survey mainly the remote survey areas that were relatively inaccessible by boat (e.g. Po Toi, Ninepins, Sai Kung, Mirs Bay) (Figure 3). The survey coverage of each helicopter survey was 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 GFS pilot. The helicopter survey usually lasted 1.5 hours, flying at an altitude of about 150 m and a speed of 150-200 km/hr. Three to four 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 study 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 was sighted during line-transect surveys, the survey team would then end effort and approach the group slowly from the side and behind to take photographs of them. Every attempt was made to photograph every dolphin in the group, and even photograph both sides of the dolphins, since the colouration and markings on both sides may not be symmetrical. Two to three professional digital cameras (*Canon* EOS 7-D, 40-D and 20-D models), 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 to computers.

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 the 650+ identified dolphins in the PRE Chinese white dolphin photo-identification catalogue. Chinese white dolphins can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns were also used as secondary identifying features (Jefferson 2000). 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-ID catalogue incorporated all new photographs of individual dolphins taken during the present study.

4.4 Data Analyses

4.4.1. Distribution pattern analysis

The line-transect survey data were integrated with Geographic Information System (GIS) in order to visualize and interpret different spatial and temporal patterns of dolphin and porpoise distribution using sighting positions. Location data of dolphin/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 in recent years to the one in the present study period.

4.4.2. Encounter rate analysis

Since 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 area of importance to dolphins and porpoises within the study area.

4.4.3. Ranging pattern analysis

For the ongoing ranging pattern study, location data of individual dolphins with 10 or more re-sightings were obtained from the dolphin sighting database and photo-identification catalogue. To deduce home ranges for individual dolphins using the fixed kernel methods, the program Animal Movement Analyst Extension, 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 level. The core areas of individuals with 15+ re-sightings at two different levels (50% and 25% UD) were also examined to investigate their range use in details.

4.4.4. 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 during 1995-2009, 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 were 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" can be defined as the individual dolphins that were regularly sighted in Hong Kong throughout the year, while "seasonal visitors" can be defined as the ones that were sighted sporadically in Hong Kong and only during certain months of the year during the study period.

4.4.5. Quantitative grid analysis on habitat use

To conduct quantitative grid analysis of habitat use, positions of on-effort sightings of Chinese white dolphins and finless porpoises were retrieved from the 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 then further normalized with the amount of survey effort conducted within each grid. The total amount of survey effort spent on each grid was calculated by examining the survey coverage on each line-transect survey to determine how many times the grid was surveyed during the study period. For example, when the survey boat traversed through a specific grid 50 times, 50 units of survey effort were counted for that grid. With the amount of survey effort calculated for each grid, the sighting density and dolphin/porpoise density of each grid were then normalized (i.e. divided by the unit of survey effort). The newly-derived unit for sighting density was termed SPSE, representing the number of on-effort **s**ightings **p**er 100 units of **s**urvey **e**ffort. In addition, the derived unit for actual dolphin/porpoise density was termed DPSE, representing the number of **d**olphins **p**er 100 units of **s**urvey **e**ffort. Among the 1-km^2 grids that were partially covered by land, the percentage of sea area was calculated using GIS tools, and their SPSE and DPSE values were adjusted accordingly. The following formulae were used to estimate SPSE and DPSE in each 1-km^2 grid within the study area:

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

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

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

Both SPSE and DPSE values were useful in examining dolphin/porpoise usage within a one square kilometre area. For the present study, both SPSE and DPSE values were calculated in each 1-km^2 grid among all survey areas for the entire one-year monitoring period (2009-10), and in recent years of monitoring (2002-09 for Chinese white dolphins and 2004-09 for finless porpoises). The grid analysis also offers opportunities to examine sighting and dolphin/porpoise densities in different spatial and temporal scales using pooling and stratification strategies.

4.4.6. 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. These data were then input into a separate database with sighting information, which can be used to determine the distribution of behavioural data with 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. The behavioural data were also used in the quantitative analysis on habitat use to identify important dolphin habitats for various activities.

5. RESULTS AND DISCUSSIONS

5.1. Summary of Survey Effort, Dolphin and Porpoise Sightings

5.1.1. Number of surveys

From April 2009 to March 2010, a total of 179 line-transect vessel surveys were conducted among nine survey areas in Hong Kong waters. These included 41 surveys in West Lantau (WL), 39 surveys in Northwest Lantau (NWL), 27 surveys in Northeast Lantau (NEL), 22 surveys in Southwest Lantau (SWL), 21 surveys in Southeast Lantau (SEL), 13 surveys in Deep Bay (DB), eight surveys in Lamma (LM), five surveys in Po Toi (PT) and three surveys in Ninepins. The survey effort data are shown in Appendix I. Although it is not required to conduct surveys in Ninepins survey area, surveys were conducted at the southernmost transect line of that area in conjunction with PT surveys, in order to increase the overall survey efficiency.

Moreover, three helicopter surveys were conducted during the study period, mainly covering the survey areas in the eastern and southern waters of Hong Kong with the support of the Government Flying Service. The off-effort data on Chinese white dolphins and finless porpoises collected from these surveys were also included in analysis of distribution and group size.

5.1.2. Survey effort

During the 12-month study period, a total of 595.5 hours were spent to collect 5,602.7 km of survey effort among the nine survey areas in Hong Kong. A majority of survey effort (81.3% of total) was conducted around Lantau and in Deep Bay, which included 36.1% of total effort spent in NEL/NWL, 14.0% in WL, 29.2% in SEL/SWL and 3.9% in DB (Figure 4a). In addition, survey effort was also allocated to areas in southern waters of Hong Kong (45.5% of total effort spent in SWL, SEL, LM and PT) where occurrence of finless porpoises were more frequent. Despite the frequent encounters of poorer weather conditions throughout the study period, HKCRP research team still managed to conduct most survey effort (88.2%) under favourable sea conditions (Beaufort 3 or below with good visibility). This percentage was similar to previous monitoring periods (e.g. Hung 2007, 2009). It should be noted that the high percentage of survey effort conducted under favourable sea conditions is vital to the success of the marine mammal data collection programme in Hong Kong, as only these data can be used in encounter rate analysis and habitat use analysis, as well as in line-transect analysis to estimate density and abundance.

In general, survey effort was evenly spread throughout the study period, with at least 280 km of survey effort conducted in every month of the year (Figure 4b). However, more surveys were conducted in December and February to make up for the fewer surveys conducted in April, September and January when weather conditions were generally poor.

Since 1996, the long-term marine mammal monitoring programme has collected a total of 111,567.8 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 on Chinese white dolphins and finless porpoises coordinated by HKCRP, with the majority of survey effort (53.0%) commissioned and funded by AFCD. The survey effort in 2009 alone comprised 7.5% of the total survey effort collected since 1996.

5.1.3. Chinese white dolphin sightings

From April 2009 to March 2010, 271 groups of Chinese white dolphins, numbering 1,062 individuals, were sighted from both vessel and helicopter surveys (Appendix II). Among them, 236 groups were sighted during on-effort line-transect vessel surveys, while others were off-effort sightings. A majority of the dolphin sightings were made in WL (161 sightings) and NWL (67 sightings). Dolphin groups were less frequently sighted in other areas, including 24 groups sighted in SWL, 15 groups in NEL and two groups in SEL and two groups in DB. No dolphin sighting was made in Lamma, Po Toi or Ninepins survey areas.

5.1.4. Finless porpoise sightings

During the 12-month study period, 72 groups of finless porpoises totaling 148 individuals were sighted during vessel surveys (see Appendix III). Among these sightings, 68 of them were recorded during on-effort surveys, which could be used in line-transect analysis to estimate density and abundance as well as analyses on encounter rates and habitat use patterns. The porpoise sightings were mostly sighted in SEL (41 groups), while they were only occasionally sighted in SWL (10 groups) and Po Toi (14 groups). Only five groups of 18 porpoises were sighted in LM. No porpoise sighting was made in the eastern offshore waters during the helicopter surveys.

5.2. Distribution Pattern

5.2.1 Distribution of Chinese white dolphins

In 2009-10, dolphin distribution was quite similar to past distribution records in recent years, with most dolphin groups being regularly sighted in NWL, NEL, WL and SWL waters, and a few being sighted in DB and SEL (Figure 5). When compared to the past five years of monitoring periods (2004-09), fewer dolphins were sighted in NEL and the eastern section of NWL in 2009-10, and the same difference was also observed in 2008-09 (Figure 6). On the other hand, dolphins were regularly sighted in SWL in the past three monitoring periods (2007-10), but not in the earlier years (2004-07). The only two areas that were consistently used by dolphins in the past six monitoring periods were the entire stretch of coastline of WL (from Shum Wat to Fan Lau), and around Lung Kwu Chau in NWL (Figure 6).

During the study period, dolphins were frequently sighted along the west coast of Lantau, and sightings were especially concentrated between Shum Wat and Tai O, around Tai O Peninsula, near Peaked Hill and Fan Lau (Figure 7). It appeared that slightly higher number of dolphin sightings were made along the nearshore transect line than the offshore one (Figure 7). On the contrary, dolphins were less frequently sighted in North Lantau waters during the study period, with the only concentrations to the north and southeast of Lung Kwu Chau and near Black Point (Figure 8). Moreover, dolphins were sparsely distributed around the Brothers Islands and Yam O, to the west and north of the airport, around Sha Chau and near Pillar Point (Figure 8).

In 2009-10, seasonal difference in dolphin distribution was evident in North and South Lantau waters. In North Lantau, dolphins were evenly distributed throughout the entire region only in summer months, but were rarely sighted around the Brothers Islands in the other three seasons, and around Lung Kwu Chau in winter and spring (Figure 9). In South Lantau, dolphins were absent from this area during spring and autumn months, while occurred there occasionally in winter months and more often in summer months (Figure 9). The seasonal distribution pattern observed in 2009-10 was somewhat different from previous years, when more dolphins were sighted throughout North and Southwest Lantau waters in summer and autumn months, especially around the Brothers Islands.

5.2.2. Distribution of finless porpoises

In 2009-10, finless porpoises were mostly sighted in South Lantau and Po Toi waters, but rarely around Lamma Island (Figure 10). Concentrations of these sightings were found just south of Soko Islands, between Shek Kwu Chau and Tai A Chau, around Shek Kwu Chau, and around Po Toi Islands (Figure 10). In South Lantau waters, porpoises were mostly found in the offshore waters with a few exceptions near Pui O Peninsula, and most of these offshore sightings were south of the high-speed ferry route. The apparent avoidance of porpoises in nearshore waters should be further examined in the future to determine whether it is related to the increased amount of vessel traffic in South Lantau waters. Notably, only one porpoise sighting was made near Lamma Island (near Tung O Wan) during the 12-month study period.

Besides the Soko Islands, there was almost no overlap between distributions of finless porpoises and Chinese white dolphins, similar to findings from previous years (Figure 11). Dolphins were generally sighted in the inshore section of SWL with concentration along the southwest coast of Lantau, while porpoises were mostly found in the offshore waters of SWL and SEL, with concentrations just south of Soko Islands and around Shek Kwu Chau (Figure 11).

Porpoise distribution in 2009-10 was also compared to the ones from the past few monitoring periods, and some subtle differences were noticeable (Figure 12). In 2009-10, porpoises were sighted more in offshore waters and less in inshore waters in South Lantau than in previous years. Porpoises were frequently sighted in LM survey area during 2006-07 and 2007-08 monitoring periods, but they were rarely sighted there in other monitoring periods, especially during the 2009-10 monitoring period. Among the six monitoring periods, finless porpoises were consistently found in a few locations, including the south of Soko Islands, around Shek Kwu Chau, and around Po Toi Islands (Figure 12).

5.3. Encounter Rate

5.3.1. Encounter rates of Chinese white dolphins

To calculate encounter rates of Chinese white dolphins, only data collected in

Beaufort 0-3 conditions was included in the analysis, since the dolphin encounter rate was lower in Beaufort 4-5 conditions (encounter rate of 3.75) than in Beaufort 0-3 conditions (encounter rate of 6.39). During the present monitoring period, the combined dolphin encounter rate of NWL, NEL, WL and SWL was 6.3, which was the lowest among recent years of monitoring (i.e. 2002-10) (Figure 13). Besides the high encounter rates recorded during 2003-04 and 2007-08 monitoring periods, there appeared to be a downward trend in dolphin encounter rates in recent years (Figure 13).

Among the four survey areas around Lantau, dolphin encounter rate was the highest in WL (18.0 sightings per 100 km), which was 3.7 times higher than in NWL (4.9), and 8-11 times higher than in SWL (2.2) and NEL (1.7) (Figure 14a). Dolphin encounter rates in WL were also the highest among all four seasons, and the differentiation was the greatest in spring and autumn months when only a few dolphin sightings were made in SWL (Figure 14b). The prominent usage of WL by the dolphins was documented consistently in the past eight monitoring periods (i.e. 2002-10), providing strong evidence that this stretch of coastal waters presented the most important habitat for Chinese white dolphins in Hong Kong.

Temporal trends in annual dolphin encounter rates were also examined in NWL, NEL and WL for the period of 2002-09. Overall, the annual encounter rates from the three areas combined were quite stable throughout the eight-year period, with the exception of high encounter rate recorded in 2003 (Figure 15). In NEL, there was a considerable drop in annual encounter rates from 2002-03 to 2004-08, and another noticeable decline in 2009 (Figure 15). The downward trend in NEL should deserve some attention, as this area was consistently used by many long-time year-round residents as their core areas, and a reclamation project for the Hong Kong Boundary Crossing Facilities will be conducted there in the near future. In NWL, the annual encounter rates also dropped considerably from 2002-03 to 2004-06, while remained relatively stable in recent years with the exception of 2007 (Figure 15). On the other hand, with the exception of 2002, annual encounter rates in WL were consistently high from 2003-09, and the temporal trend appeared to be very stable over the past seven years (Figure 15). The temporal trend in annual dolphin encounter rates should be closely monitored in light of several important infrastructure projects to be constructed within dolphin habitats around Lantau in the next decade. Any significant trend in dolphin encounter rate can provide indication on whether these projects will affect their continuous usage in different parts of Hong Kong waters.

5.3.2. Encounter rates of finless porpoises

The encounter rates of finless porpoises were calculated using only data collected in Beaufort 0-2 conditions, since the porpoise encounter rate dropped considerably from 3.80 sightings per 100 km of survey effort in Beaufort 0-2 conditions to 0.93 in Beaufort 3-5 conditions. Notably, even in relatively calm condition, finless porpoises were even more difficult to find at sea than Chinese white dolphin, and the porpoise encounter rate dropped noticeably from 3.37 in Beaufort 2 condition to 0.97 in Beaufort 3 condition. Therefore, only the data collected in Beaufort 2 or below conditions should be used in calculating porpoise encounter rate and grid analysis to examine habitat use.

In 2009-10, the combined encounter rate of SWL, SEL, LM and PT was 3.5 porpoises per 100 km of survey effort, which was slightly higher than the one recorded during the 2008-09 monitoring period (3.3). Among the four survey areas, porpoise encounter rate was the highest in SEL (6.1) and PT (5.5), and was much lower in SWL (1.9) and LM (1.0). Moreover, temporal trend in annual encounter rates of finless porpoises from the four survey areas combined were examined from 2002 to 2009. Annual encounter rates were relatively higher in 2002, 2007 and 2009, but were lower in 2005 and 2006 (Figure 16). It appeared that porpoise usage fluctuated across recent years with no apparent trend. Porpoise data collected during winter and spring months from SWL, SEL and LM were also pooled to examine the temporal trend of porpoise encounter rate in southern waters during their peak months of occurrence. There appeared to be a noticeable decline of porpoise usage from the highest in 2002 to the lowest in 2005, followed by a steady increase to a higher level during 2007-09 (Figure 17).

5.4. Habitat Use

For the present study period, both SPSE values (number of on-effort sightings per 100 units of survey effort) and DPSE values (number of dolphins/porpoises from on-effort sightings per 100 units of survey effort) were calculated among all grids in the six survey areas where dolphins regularly occur (i.e. DB, NWL, NEL, WL, SWL and SEL) and the four survey areas where porpoises regularly occur (i.e. SWL, SEL, LM and PT). Both SPSE and DPSE values were used to quantitatively assess habitat use patterns of local dolphins and porpoises during the study period and in recent years. The derived quantitative information on habitat use could show the area of importance to dolphins and porpoises more accurately than merely observing their distribution patterns without acknowledging the uneven survey effort coverage between and within survey areas.

Since the encounter rates of dolphins and porpoises dropped noticeably in Beaufort 4+ and Beaufort 3+ conditions respectively, only the survey data collected in favourable survey conditions were used in the present habitat use analysis. To satisfy these conditions, only the survey data from the days that had at least 50% of total survey effort collected in Beaufort 0-3 conditions for dolphins and Beaufort 0-2 conditions for porpoises were included in the grid analysis. This stratification strategy could exclude most survey data that were collected in rougher sea conditions when dolphins and porpoises were more difficult to be sighted, in order to ensure the better quality data being used in the habitat use analysis.

5.4.1. Habitat use patterns of Chinese white dolphins

In 2009-10, the heavily utilized habitats by Chinese white dolphins were located along the west coast of Lantau from Sham Wat to Fan Lau, and around Lung Kwu Chau (Figures 18-19). In West Lantau, 30 of the 34 grids recorded on-effort dolphin sightings. Among them, 12 grids had 20+ SPSE values, and 11 grids had 80+ DPSE values, indicating the intensive dolphin usage in these waters. These high density grids in West Lantau were located near Sham Wat (Grids G22 & H22), around Tai O Peninsula (Grids D23-24 & E22-23), near Kai Kung Shan (Grids C26-27), and at the tip of Fan Lau (Grids C30 & D30) (Figures 18-19). In North Lantau region, only a few grids to the north of Lung Kwu Chau recorded high SPSE/DPSE values (Grids G9-10, H8-9 & H11). A few grids around the Brothers Islands (Grids P16, P18, R16, T16, U15 & V15) also recorded very high DPSE values due to a few large groups sighted there during the study period. In South Lantau region, two grids to the west of Soko Islands and one grid near Shui Hau Peninsula also recorded high DPSE values, again due to a few large groups sighted in those three grids. Evidently, the habitat use patterns illustrated from this single year should be treated with caution, since relatively small amount of survey effort was conducted among the 350 grids around Lantau during the short study period. A more reliable picture on dolphin habitat use can only be drawn from a longer study period with adequate amount of survey effort per grid.

To examine dolphin habitat use in recent years, all survey effort and on-effort dolphin sightings from 2002-09 were pooled to calculate the overall SPSE and DPSE values. The longer study period with much larger sample size can help to depict more accurately where the important habitats for Chinese white dolphins were located in Hong Kong in recent years. During the eight-year period, almost all grids in NWL, NEL, WL and SWL were utilized by dolphins with various degrees (Figures

20-21). Only a few areas were avoided by the dolphins, including the Castle Peak Bay, along Lung Kwu Tan, both sides of the airport platform (mainly due to lack of survey effort within the restricted zone), Yi O Bay, and near Shek Pik. Moreover, SEL and the inner DB area were utilized by dolphins at low levels as marginal habitats, and only a few grids in SEL recorded on-effort dolphin sightings during the eight-year period.

Among the 350 grids around Lantau, WL presented the most important habitats to the dolphins during 2002-09, with all grids recorded dolphin usage, and some grids recorded very high SPSE and DPSE values. In particular, the grids recorded intense dolphin usage were around Tai O Peninsula (Grids D23-24, E22-23), near Kai Kung Shan (Grids B25-26, C25-26), Peaked Hill (Grids B27-28, C27) and at Fan Lau (Grids C30-31, D30) (Figures 20-21). Another important dolphin habitat could be found around Lung Kwu Chau, where a number of grids recorded very high SPSE and DPSE values (Grids G9-10, H8-11). A grid near Kau Ling Chung (Grid F29) also recorded very high dolphin usage. Moreover, several grids near the Brothers Islands and Sham Shui Kok (Grids Q16 & S16), near Black Point (Grids H7 & I7), and west of Sha Chau (G12-13) in North Lantau recorded moderate dolphin densities during 2002-09 (Figures 20-21). All these grids with moderate to high dolphin usage should deserve special attention during the planning of development projects around Lantau waters. In the future, temporal trend in dolphin usage within these important habitats identified by grid analysis will be conducted, to determine whether these areas are consistently used by dolphins in recent years.

5.4.2. Habitat use patterns of finless porpoises

During the 2009-10 monitoring period, several locations recorded intense porpoise usage with higher SPSE and DPSE values. These included the waters south of Tai A Chau, the offshore waters of SEL, all around Shek Kwu Chau except the northeast side, near Pui O Peninsula, near Tung O Wan (east side of Lamma) and around Po Toi Islands (especially near Waglan Island) (Figures 22-23). However, it should be cautioned that only 1-2 porpoise sightings were made among these girds that recorded high porpoise densities, especially the grids in Lamma and Po Toi with only a few units of survey effort per grid. The density estimates of these grids could be seriously biased with the low amount of survey effort, and a longer study period with larger sample size of porpoise sightings and survey effort per grid would be needed to outline important porpoise habitats in Hong Kong.

Consequently, the survey effort and on-effort porpoise sightings from 2004-09 were pooled to calculate SPSE and DPSE values of porpoise densities with a larger sample size and longer study period. Since finless porpoises in Hong Kong exhibited distinct seasonal variations in distributions with rare occurrence in each survey area during certain months of the year (Hung 2005, 2008; Jefferson et al. 2002), the data were stratified into winter/spring (December through May) and summer/autumn (June through November) to deduce habitat use patterns for the two different periods respectively, as recommended in the last monitoring study report (Hung 2009). This stratification strategy can depict a better picture of porpoise usage during the peak months of their occurrence in that particular area.

During winter and spring months in 2004-09, important porpoise habitats with high SPSE and DPSE values were mostly located in South Lantau waters, including the waters south of Tai A Chau, the offshore waters of SEL, the west and southwest sides of Shek Kwu Chau, and the southeast corner of Cheung Chau (Figures 24-25). Grids with low to moderate porpoise densities could also be found along the inshore waters of South Lantau, all around Soko Islands, and the southern portion of Lamma. The Po Toi Islands were not surveyed consistently during the winter and spring months in 2004-09. Therefore, the survey effort per grid there was very low, with a few grids yielded very high DPSE values (Figures 24-25). In the future, Po Toi Islands can be surveyed during the winter and spring months when resources are available, but the weather conditions to conduct surveys on those months will make this work quite challenging.

On the contrary, porpoises were mostly absent from South Lantau waters during summer and autumn months in 2004-09 despite consistent survey effort being conducted there year-round. Only a few grids between the waters west of Shek Kwu Chau and south of Tai A Chau recorded porpoise usage (Figures 24-25). No porpoise was seen in Lamma waters during those months, but this was somewhat related to the lack of survey effort there in summer and autumn months. On the other hand, porpoise usage was relatively high around Po Toi Islands during summer and autumn months, with moderate to high porpoise usage near Beaufort Island, Po Toi Island and Waglan Island (Figure 24-25).

5.5. Group size

5.5.1. Group sizes of Chinese white dolphins

During the study period, dolphin group sizes ranged from singles to 18 animals, with an overall mean of 3.9 ± 3.48. Among the four survey areas where dolphins regularly occurred, the mean group size was higher in NEL (5.8), and the ones in the other three areas were relatively similar (3.5-3.9). Most dolphin groups sighted in 2009-10 tended to be small, with 46.9% of the groups composed of 1-2 animals, and 68.6% of the groups with less than five animals (Figure 26). The smaller dolphin groups were scattered throughout Lantau waters, with more of these occurred in SEL, the northern coast of SWL and the northeastern end of NEL (Figure 27). These peripheral areas with small dolphin groups were likely marginal habitats for the dolphins, and therefore they needed to spread out in smaller subgroups in search of food. On the other hand, among the 245 dolphin groups recorded in 2009-10, 19 groups had more than ten animals, and only two groups had more than 15 animals. These large dolphin aggregations were mostly sighted around the Brothers Islands, to the north of Lung Kwu Chau, and along the west coast of Lantau from Sham Wat to Fan Lau (Figure 28). Notably, among the 15 groups sighted in NEL, four of them were composed of more than 10 animals per group, and many of these were year-round residents that have used the Brothers Islands as their core areas.

The temporal trend in mean dolphin group sizes from 2002-10 showed that the overall mean in 2009-10 rose back to the level similar to earlier years of monitoring (i.e. 2003-07), after a noticeable drop in 2007-08 and 2008-09 monitoring periods (Figure 29a). Among the four areas, the mean group sizes in NWL have been very stable throughout the eight monitoring periods, and the one recorded in 2009-10 in NEL was exceptionally higher than in previous monitoring periods (Figure 29b). The mean group sizes in WL followed the trend of the overall mean group size, in which the mean in 2009-10 bounced back to the level similar to earlier years of monitoring after a noticeable drop in the previous two monitoring periods (Figure 29b). The mean group sizes in SWL were mostly inconsistent across different years, and no apparent trend was observed. The temporal trend in mean group size should be closely monitored in the near future, since the size of dolphin groups can provide important implication on the abundance and patchiness of their prey resources, and shed light on any changes in the social organization of local dolphins.

5.5.2. Group sizes of finless porpoises

During the study period, group sizes of finless porpoises ranged from singles to ten animals, with an overall mean of 2.1 ± 1.66. The mean group size in 2009-10 was much lower than the overall mean in 1996-2006 (3.1), and was considerably lower than the previous two monitoring periods in 2007-08 (2.6) and 2008-09 (3.1). As in the past, porpoises tended to occur in small groups during the study period, with 70.8% of the groups composed of 1-2 animals, and only four of the 57 porpoise groups had more than five animals per group (Figure 30). Among the four survey areas where porpoises regularly occurred during the study period, the mean group size was the highest in LM (3.6), while the ones in SWL (1.9) and PT (1.6) were slightly lower than the overall mean. Moreover, the mean group sizes were slightly higher in spring (2.5) but much lower in autumn (1.3) when compared to the overall mean.

5.6. Association with fishing boats

In 2009-10, the percentage of fishing boat-associated sightings remained to be low, with only 21 groups of Chinese white dolphins associated with operating fishing boats, or 7.7% of all dolphin groups. This percentage was slightly higher than the previous two monitoring periods (5.3% and 5.2% in 2007-08 and 2008-09 respectively). After dropping to the lowest in percentage of fishing boat-associated sightings in 2008, the percentages for association with all fishing boat types (6.8%) and with pair trawlers (2.9%) bounced back to a higher level in 2009 (Figure 31). Among the 21 groups associated with fishing boats, eight groups were associated with pair trawlers and hang trawlers respectively, while the others were associated with shrimp trawlers (four groups) and a gill-netter (one group). Most of these associations occurred in spring months (38%) and in WL survey area (67%). These dolphin groups associated with fishing boats were mostly found along the west coast of Lantau, and a few of them were also sighted to the west of Soko Islands, near Shui Hau Peninsula and to the north of Lung Kwu Chau (Figure 32).

5.7. Group composition and calves

Chinese white dolphins in Hong Kong are classified into six age classes in relation to their colour pattern development (Jefferson and Leatherwood 1997), but the exact sequence of this development has yet to be confirmed, especially for the stages of spotted juvenile/mottled and spotted subadult/speckled (Jefferson 2000). Ongoing work on life-history parameters using data from long-term photo-identification work, biopsy sampling as well as stranded dolphins will help clarify this important issue (Jefferson 2007; Jefferson and Hung 2008). Nevertheless, the age class of unspotted calf (UC) and unspotted juvenile (UJ) should be reliable; these are small, non-weaned young animals that are still dependent on their mother. In the past monitoring periods, special attention has been given to the status of dolphin calves, since there were concerns that the future survival of the local dolphin population might be hampered by high mortality rate of young calves (Jefferson et al. 2006; Parsons and Jefferson 2000).

In 2009-10, a total of 5 UCs and 67 UJs were sighted in Hong Kong, and these young calves comprised 6.8% of all animals sighted during the monitoring period.

They were mostly sighted along the west coast of Lantau (from Shum Wat to Fan Lau), to the north of Lung Kwu Chau, and near the Brothers Islands (Figure 33). Despite the lowest percentage of UCs recorded in 2009-10 among the eight monitoring periods from 2002-10, the overall percentage of young calves (UCs and UJs combined) steadily increased from the lowest in 2007-08 to a relatively high level in 2009-10 (Figure 34a). The encounter rate of young calves was the highest in WL (4.8 per 100 km) during the study period, which was 4-6 times higher than the ones recorded in NEL (1.3), NWL (0.8) and SW Lantau (0.9). Temporal trend in encounter rate of young calves in the past six monitoring periods also showed that calf occurrence was always much higher in WL than the other three survey areas (Figure 34b). After a noticeable decline in calf encounter rate from 2005-08 in WL, such trend appeared to be reversed in 2008-09 and 2009-10 monitoring periods (Figure 34b). This is an encouraging sign, as West Lantau has been identified as the most important nursery areas for dolphin calves in Hong Kong, and perhaps in the Pearl River Estuary (Hung 2008, 2009). On the contrary, there appeared to be a downward trend in calf occurrence in NWL waters, which should be closely monitored in the near future.

The monthly occurrence of 458 UCs and 1,482 UJs in Hong Kong waters was also examined for the period of 1996-2009. Newborn calves (UCs) occurred in every month of the year, and their occurrence reached the highest in April through June (2.4-2.6%) and the lowest in February and March (1.1%) (Figure 35). On the contrary, occurrence of older calves (UJs) were relatively stable throughout the year, with the lowest occurred in January (5.3%) and the highest in June (7.1%) (Figure 35). The marked increase in newborn calves from March to April implied that more calves were likely born in late spring, further confirming previous findings by Jefferson (2000) with a smaller dataset. However, it is difficult to define the “peak calving period” for Chinese white dolphins based on the monthly occurrence pattern, as the occurrence of newborn calves was relatively stable from April through November (range of 1.8-2.6% of calves among all dolphin groups per month). Nevertheless, development projects with more disturbing activities (e.g. piling works) should at least avoid the sensitive period of April to July when occurrences of both newborn calves and all young calves (UCs and UJs combined) are higher, to minimize the impact of acoustic disturbance to the nursing calves and their mothers.

5.8. Activities

When dolphins were sighted during vessel surveys, their behaviours and engaged activities were observed and recorded. Their activities were categorized into four different types, including feeding, socializing, traveling and milling/resting. In 2009-10, a total of 44 and 26 dolphin sightings were associated with feeding and socializing activities respectively, comprising of 16.2% and 9.6% of the total dolphin sightings. Only three dolphin groups were engaged in traveling activity, while no milling/resting behaviour was observed during the study period. Most of the dolphin sightings associated with feeding socializing activities were concentrated along the west coast of Lantau from Fan Lau to Sham Wat, and to a lesser extent to the north of Lung Kwu Chau and near Black Point (Figure 36). A few sightings made near the Brothers Islands and Soko Islands also recorded feeding or socializing activities.

Temporal trend in percentages of activities among all dolphin groups showed that frequencies of both feeding and socializing activities have increased steadily in recent monitoring periods, and the percentage of socializing activities among all dolphin groups reached the second highest in 2009-10 (Figure 37). This trend should be continuously monitored, as the frequencies of activities spent by dolphins could provide important implications to their usage of Hong Kong waters for these important activities.

5.9. Photo-identification work

From April 2009 to March 2010, over 29,000 digital photographs of Chinese white dolphins were taken during vessel surveys for the photo-identification work. All dolphin photographs taken in the field were used to compare and update the photo-identification catalogue that contained 650+ individual Chinese white dolphins identified in Hong Kong and the Pearl River Estuary since 1995. Any new photographs identified as existing or new individuals during the study period as well as updated information on gender and age class were also incorporated into the photo-ID catalogue.

5.9.1. Photo-ID work summary

Currently, a total of 679 individuals have been identified in Hong Kong and the rest of the Pearl River Estuary, including the addition of 32 new individuals identified during the present study period. These included 307 dolphins first identified in Guangdong waters of the Pearl River Estuary, and 372 dolphins first identified within Hong Kong SAR territorial waters. In the PRE Chinese white dolphin photo-identification catalogue, nine individuals were seen 50 times or more; 25 individuals were seen 30 times of more; 76 individuals were seen 15 times or more; and 120 individuals were seen 10 times or more. The individual recorded the highest number of re-sightings was NL24 with a total of 129 re-sightings since 1996.

On the other hand, 59% of all identified individuals were only seen once or twice since the photo-ID catalogue was established in 1995, and the majority of these were only sighted in Guangdong waters.

Combined with all other photo-ID data collected in consultancy projects, ecological studies and dolphin-watching trips, the temporal trend in total number of identified individuals, total number of re-sightings made as well as the number of individuals within several categories of number of re-sightings all indicated that the photo-ID work has progressed very well in recent years (Figures 38a-c). This is an encouraging sign, as the continuous progress in photo-ID work can offer a much larger sample size for analyses to investigate individual ranging patterns, core area use, residency patterns, social dynamics and life history parameters.

During the 2009-10 monitoring period, photo-identification work was quite successful, and many existing individuals in the catalogue were re-sighted. In total, 153 individuals, sighted 434 times altogether, were identified during AFCD monitoring surveys (Appendices IV-V). Among them, 32 individuals were newly-identified for the first time, while the other individuals were existing individuals in the photo-ID catalogue. The majority of re-sightings were made in WL and NWL, comprising 52% and 24% of the total respectively. In addition, 54 re-sightings were made in NEL, while another 41 re-sightings were recorded in SWL. Only ten and one re-sightings were made in DB and SEL respectively. During the study period, most identified individuals were sighted only once or twice, but a number of them were repeatedly sighted. These frequently sighted individuals included WL25 (11 re-sightings), SL05 (9 re-sightings), NL206 and NL233 (8 re-sightings each). In addition, 11 other individuals were re-sighted 6-7 times in the past 12 months. Their common occurrences during the study period suggested that they strongly relied on Hong Kong waters as part of their home ranges recently, and their range use in Hong Kong should be continuously tracked.

Similar to the previous monitoring period in 2008-09, there was a noticeable increase on number of individuals expanding their range use from NWL to WL (or vice versa) during the present study period. For example, 15 individuals were sighted both in NWL and WL survey areas, and another 11 individuals (EL01, NL24, NL33, NL98, NL150, NL233, NL242, NL259, NL260, NL264 and WL44) extended their range use from NEL to WL during the study period. CH144 even extended its range use from NWL to SWL. Moreover, six other NL individuals were seen in WL in 2009-10, while another two WL individuals were seen in NWL during the same period. The extensive movements of individual dolphins between North and West Lantau waters within the study period provided important conservation implication in light of the future construction of the Hong Kong-Zhuhai-Macau Bridge in western waters of Hong Kong, in which the landing point will be near the boundary of NWL and WL survey areas. It will be important to find out whether individual movements between their important habitats in North and West Lantau waters will be affected by the construction works in the near future.

Among the 32 newly-identified individuals, 20 of them were first identified in WL, while the others were first identified in NL (10 dolphins) and SWL (2 dolphins). The rate of discovery of new individuals has not reached a plateau yet, and it is likely that there will be continuous influxes of new individuals from Guangdong waters to begin utilizing Hong Kong waters as part of their ranges. Notably, among the 60 new individuals identified in Hong Kong in the previous two monitoring periods (i.e. 2007-08 and 2008-09), 40 of them were re-sighted again in 2009-10 monitoring period, with 14 individuals being re-sighted 3-4 times and 3 individuals being re-sighted 5-8 times. This provides strong indication that these newly-identified individual dolphins have recently increased their usage of Lantau waters, especially along the stretch of coastal waters in WL. Their increased usage of Hong Kong territorial waters is encouraging, and should be continuously monitored as their temporal changes in range use can provide important conservation implications.

5.9.2 Life history parameters

5.9.2.1. Colour pattern development

Several life history parameters of Chinese white dolphins occurred in Hong Kong were examined for the first time using the long-term photo-identification data. Based on the time period between the first and last sightings of each individual dolphin, the sighting history of 103 individuals with at least 10 re-sightings were estimated to range from 1.0-14.6 years, with 45 and 19 individuals sighted for more than 8 and 12 years respectively. In addition, another 14 individuals with less than 10 re-sightings were also sighted for more than eight years. Among the 59 individuals that were sighted for more than eight years, four were mottled animals (SJ, or spotted juveniles), 10 were speckled animals (SS, or spotted subadults), and 45 were either spotted adults (SA) or unspotted adults (UA). Assuming these animals were at least several years of age when they were first sighted, and Chinese white dolphins in the Pearl River Estuary reached sexual maturity at the age of 9-10 for females and age of 12-13 for males (Jefferson 2000), these 59 animals with at least eight years of sighting history should be considered sexually mature adults.

The calving histories of all identified individuals in the photo-ID catalogues were examined to determine whether other identified individuals could also be identified as adults with shorter sighting histories. In total, 60 individuals were seen with at least a calf before. Among them, one individual was identified as a SJ (NL206), and 22 other individuals were identified as SS, while the rest were either SA or UA. These females should all be considered adults as they are sexually mature with calving history. With the addition of these female adults, a total of 93 individuals were identified as adults, with 5 mottled animals (SJs), 28 speckled animals (SSs), 40 spotted adults and 20 unspotted adults.

Unquestionably, all spotted and unspotted adults are indeed adults. Among the 55 SAs and 28 UAs with more than 10 re-sightings, 29 SAs and 12 UAs were identified as females through calving record or biopsy sampling (6 SAs and 3 UAs), while only one SA (NL128) and one UA (EL01) were identified as males. Therefore, it is very likely that most SAs and UAs are female adults, and the males with little or no spotting are either very old animals or just exceptional cases (possibly anomalous as suggested by Jefferson 2007).

For the 31 speckled animals with more than 10 re-sightings, 19 of them were identified as adults with either calving record and/or long sighting history, while the others are likely sexually immature or not sighted long enough to be classified as an adult. Sixteen of these 31 speckled animals were identified as females from calving record or biopsy sampling, while only three animals were identified as males through biopsy sampling (those with long sighting history but not accompanied by calves before were probably male adults also). Therefore, it is speculated that a good portion (and possibly the majority) of speckled animals are sexually mature female adults, and only a small proportion of male adults will reach the speckled stage at older age.

Among the 22 mottled animals (SJs) with more than 10 re-sightings, five of them were identified as adults from calving record or long sighting history. Three of them (EL07, NL37, NL112) were sighted for more than 10 years since 1995, and EL07 and NL112 identified as male through biopsy sampling. Evidently, these three mottled animals are adults, and it is likely that some males in the dolphin population may retain their heavy spotting well into their adulthood. NL206 was the only mottled animal that was seen with a calf before, and this female was probably just an exceptional case that retained her heavy spotting longer than usual. Through biopsy sampling, three mottled individuals were identified as females and males each, with no clear indication on gender ratio of the mottled animals. However, with only some adult males that can reach the speckled stage, it is suspected that a good proportion of mottled animals are males (with some of them being adult males), while a smaller portion of mottled animals are young females that go through the mottled stage more quickly than the males.

The above synopsis on colour patterns of female and male Chinese white dolphins based on long-term photo-ID data can be summarized as follow. For females, after the unspotted juvenile stage, their juveniles and subadults likely go through the mottled stage quicker, and reach the speckled stage as young adults or occasionally some older subadults. At the speckled stage, most of the females are probably sexually mature, and many of them start to give birth. When they reach the spotted adult stage, they are all adult females with some older ones, and some of the spotted adults will finally reach the unspotted stage that should comprised mostly old females. On the contrary, the juvenile and subadult males will go through the mottled stage much slower, with some retain heavy spotting even when they become sexually mature. Some of the sexually mature males and older males will reach the speckled stage, but these adult males rarely become spotted or unspotted adults, probably except the very old ones. The present study concurs with another life history study by Jefferson (2007) based on age, gender and length information from stranded animals and biopsied animals, suggesting that spots will be lost throughout their life, with females losing their spotting more quickly than males.

The colour pattern development theory established by the present study was further verified by ten stranding cases of Chinese white dolphins (consisted of five females and five males) from 1995-2006. Each of these stranded animals had information on its spotting pattern, body length, gender and age. Among the five females, one was classified as speckled animal, a fully grown animal (NL61 - 235 cm) which was aged 9.5 years old, likely an older subadult. Two adult females classified as spotted adults (DB01 and CH76) were 26 and 27 years old respectively, while another two adult females classified as unspotted adults (unknown ID and NL23) were 28 and 31 years old respectively. On the other hand, among the five males, one was classified as mottled animal, an immature subadult (230 cm in length) that was aged nine years old. Three other adults classified as speckled animals (SL30, NL92 and unknown ID) were 15, 32.5 and 20 years old respectively, and they were fully-grown adults with body length of 245-265 cm. Finally, another male (NL90), classified as either speckled or spotted adult (probably an intermediate of the two age classes), was 246 cm in length and 26 years old. In summary, all these ten stranding cases corresponded well with the established colour pattern development theory presented in this study. Nevertheless, it should be acknowledged that the picture of colour pattern development is not fully worked out yet. The continuous tracking of some frequently-sighted mottled and speckled animals to monitor changes of their spotting pattern will help to verify the above theory (especially the ones with known gender through biopsy sampling and calving history), and the details of this life history parameter will eventually become apparent with a larger sample size. However, the expectation of using colour patterns to determine age class and gender of unknown individuals in the field may not be practical in many cases, since there are still some variations among individuals that may not fit well into the overall theory of colour pattern development.

5.9.2.2. Life span

In the past, age determination of individual Chinese white dolphins was solely depended on the method of teeth aging analysis by sectioning teeth of stranded dolphins and reading the Growth Layer Groups (GLG) (Jefferson 2000, 2007). For the present study, age was estimated for each identified dolphin with known age class and relatively long sighting history, by making some assumptions of its age when it was first seen. The assumed minimum age of each age class is as follow: mottled or SJ (at least 3 years old), speckled or SS (at least 8 years old), SA (at least 10 years old), and UA (at least 15 years old). These assumed minimum ages were based on available information on growth curve (age/length relationship) (see Jefferson 2000, 2007) and theory of colour pattern development established above. The estimated age of identified individuals were then calculated by adding 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.

A total of 148 individuals from the photo-ID catalogue was included in this analysis, and they either have long sighting histories (more than five years), or were frequently sighted since 1995. Among them, 34 individuals were estimated to be over 20 years old, while five of them were over 27 years old (Figure 39). Most individuals were estimated to be 9-20 years old (100 individuals). Moreover, 78 of the 148 identified individuals have gender information through biopsy sampling or calving histories. The mean estimated age of females (16.8, n=71) was slightly higher than males (14.4, n=8). This result was also similar to the one from 1995-2006 stranding records of Chinese white dolphins with body length of over 180 cm (i.e. at least reaching the mottled stage), with the mean estimated age of females (21.2, n=13) higher than the males (14.3, n=21).

Since many young animals in the photo-ID catalogue (all unspotted calves, unspotted juveniles, and most mottled animals) are not included in the analysis, the results presented here do not reflect the age structure of the entire population. However, there is still some important information that can be considered noteworthy. First, a great proportion of identified individuals are sexually mature (i.e. more than 12 years old), and many of them have survived well into their twenties or even thirties. This is somewhat contradictory to the results from stranding records, in which only 31 of 70 stranded Chinese white dolphins with age information were aged over 9, and only a few individuals were estimated to be over 30 years old, including three females, one male and an individual with unknown sex. So far, the oldest animal in Hong Kong was aged 38 years old (Jefferson 2000). The survival of sexually mature adults can be vital to the sustainability of a healthy population, and there have been speculations that many individuals in the PRE population may not survive long enough while battling various threats (e.g. water pollution and coastal development) in their living habitats. The present study showed that many individuals have relatively long life span, and with a longer study period of photo-identification, more individuals are likely to be confirmed to survive longer than 30 years.

Moreover, it appeared that females survived longer than males on average. This is probably due to the fact that males generally have higher pollutant loads than females (Jefferson et al. 2006), and the high concentrations of pollutants may affect their immune system and overall health more than females. However, the sample size for this comparison was still relatively small, and such comparison should be conducted again in the future when more samples are available. Finally, a majority of long-lived individuals (>20 years old) are considered year-round and seasonal residents (25 out of 42 individuals) that have consistently used Hong Kong waters over the 15-year study period. More importantly, 18 of them have calving records before, indicating that they have used HK waters as their nursery habitat consistently over time. Therefore, tracking their continuous usage including fine-scale spatio-temporal changes in core area use will be a top priority, as it will provide important implications for potential impacts from coastal development and human activities on these resident dolphins.

5.9.2.3. Female-calf association and calf survival

In the photo-ID catalogue, a total of 60 females have records of calves since 1996, and the period of female-calf association and calving interval were examined in detail. Among these 60 females, 50 of them were only seen with one calf before. Ten other females had records of two calves, and most of them are residents of Hong

Kong with relatively long sighting history. Notably, many calves (40 out of the 70 calves) were seen only once with their mothers before. It is possible that their mothers are not residents of Hong Kong and do not occur there frequently enough to be re-sighted again during the period of female-calf association, or special attention were not paid on occurrence of young calves (especially the older ones not sticking close to their mothers) until in recent years. Another plausible explanation is that the calves did not survive long enough to be seen at the next re-sighting of their mothers. In fact, epimeletic behaviours were observed in a number of occasions in the past, with healthy individuals supporting dead newborn calves by carrying them in their mouth or on their back. For example, NL176 (in July 2008) and WL11 (in November 2009) were recently observed to accompany their dead newborn calves for extended period of time. The potentially low survival rate of calves was further supported by the stranding data. Among the 137 stranding records of Chinese white dolphins from 1995-2006, 44 and 12 of them had body length of less than 120 cm (presumably newborn calves) and 120-180 cm (presumably older calves) respectively, providing preliminary evidence that many calves did not survive shortly after birth.

If a high proportion of calves die shortly after birth, this can become a serious issue for the continuous survival of the dolphin population with low calf survival rate. 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 (Parsons and Jefferson 2000; Jefferson et al. 2006). The increasing amount of acoustic disturbances from vessel traffic and dolphin-watching activities at Tai O may further compound the problem (Hung 2007, 2009). Special effort 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, 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.

For the 30 calves that were seen more than once, the minimum periods of 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 juveniles (i.e. older calves) when first seen, and they might still associate with their mothers after the last re-sightings. Nevertheless, the minimum period of female-calf associations ranged from 3-107 months, with an average of 20.4 ± 20.17 months (median = 14 months). Most calves were associated with their mothers for less than 24 months, but there were a few exceptions. Both NL202 and SL40 have been seen with their calves for more than three years, and WL 25 was seen with her calves for more than four years. NL18 presented the most exceptional case, as she was accompanied by her calf (NL259) from March 2000 to January 2009, a time span of almost nine years. It is possible that this calf was the last of NL18, and therefore this long-term maternal relationship would be longer than usual. Since NL259 is distinctive enough to be re-sighted, its ranging pattern and associations with other individuals (especially with NL18) should be continuously monitored in detail to examine the influence of its mother on these aspects after their separation.

A total of ten females had records of two calves since 1996, and the maximum calving intervals were estimated. Again, it should be cautioned that the estimated calving intervals are likely overestimates, as the first calves may still associate 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. Nevertheless, the maximum calving intervals between the two births of these 10 mothers ranged from 18-165 months, with an average of 62.6 ± 47.76 months (median = 54.5 months). Four females had their second birth within about two years of time (NL176, NL46, NL19 and NL139), while another three females gave the second birth within 4-6 years (WL25, NL104 and WL28). Notably, NL176 gave birth to a newborn calf in July 2008, which was shortly found dead by HKCRP research team. She had another newborn calf again in December 2009, and therefore recorded the shortest calving interval among all known cases. On the contrary, the calving intervals for CH25, SL05 and NL12 were 73, 120 and 165 months respectively. However, these animals disappeared from Hong Kong for an extended period of time (40-82 months), and they may have had another calf during their long absence from Hong Kong waters.

In summary, the calving interval for this dolphin population is estimated to be about 2-3 years, and could be up to 4-6 years. Although these dolphins likely enjoy longer life span as discussed above, the females appear to have long calving interval, while their calf survival rate and fecundity are fairly low. This is further supported by the evidence that most female year-round residents being sighted consistently in the past 15 years have only produced 1-2 offspring. The low fecundity suggested by the preliminary data may be contributed by a number of factors, such as the adverse impacts of environmental pollutants, lack of abundant prey resources and increased amount of stress from anthropogenic disturbance. The calving history and calving interval should be closely monitored in future years of photo-ID work, to verify these findings with a larger sample size.

5.9.2.4. Conclusion on life history parameters

In the past, information on life history parameters were mostly obtained from stranded specimens, and the present study supplemented this information with long-term photo-ID data. Stranding events are opportunistic, and may have biases toward certain sex and age classes, or even ailing individuals. Even worse, most stranded dolphins were badly decomposed when discovered, and it is often a challenge to determine their gender, spotting pattern and reproductive status (Hung 2006). The present study showed that long-term photo-identification data can serve as another promising source of data for life history studies. However, due to relatively small sample size and the long-lived nature of these K-selected marine mammals, examinations on these life history parameters are still work in progress, even with more than 15 years of long-term photo-ID data. Thus a longer time period will be necessary to confirm some of the above findings, further validating the importance of longitudinal study of this dolphin species. In the near future, it is highly recommended that life history parameters based on photo-identification data should be examined in a periodic basis to revisit some of the above analysis with a larger sample size and longer study period.

5.9.3 Individual range use and residency patterns

The matrix of occurrence of 80 individual dolphins with 10+ re-sightings that were frequently sighted within 2004-09 is shown in Table 1, and the kernel home ranges (at 95% UD level) of 88 individuals that occurred during 2008 and/or 2009 is shown in Appendix VI. Among the 57 individuals that were sighted 15+ times and occurred in recent years, a majority of them were mostly sighted in NWL (52 dolphins), NEL (34) and WL (41), but only a few individuals used DB (7 dolphins), EL (5), SWL (12) or SEL (3) survey areas as part of their ranges (Table 2). Moreover, 28 individuals occupied ranges that spanned from Hong Kong across the border to Guangdong waters, showing frequent cross-border movements of many individuals. However, their intensity of occurrence across the border varied greatly among individuals (Table 2).

None of the 57 individuals had their ranges confined to just one survey area. In fact, many individuals ranged extensively across several survey areas. For example, 24 individuals utilized NWL, NEL and WL survey areas; 5 individuals ranged across EL, NWL and NEL survey areas; two individuals (NL20 and WL15) utilized NEL, NWL, WL and SWL survey areas; and three individuals (NL128, SL07 and SL35) ranged from WL, SWL, SEL to Guangdong waters (Table 2). Notably, individuals that were sighted in DB were always found in NWL survey areas as well, and the ones that utilized SWL were always found in WL also. Using the kernel estimator, individual ranges at 50% and 25% UD levels were examined for the core area use. For the 57 individuals with 15+ re-sightings, their 25% UD core areas were mainly concentrated at four areas: around the marine park (30 dolphins), around the Brothers Islands (20), along the stretch of coastal waters from Tai O to Fan Lau (13), and around the northeast corner of airport (5) (Table 2). Examples of identified individuals that utilized each of the three core areas are illustrated in Figures 40-42.

Annual and monthly occurrences of the 57 individuals were also examined to understand their residency patterns in Hong Kong. Forty-nine of them were considered residents in Hong Kong (i.e. sighted in at least eight years, or five years in a row), while the other eight dolphins were considered visitors (sighted sporadically from 1996-2009) (Table 2). The high proportion of residents may be biased, as the visitors were likely sighted less frequently in Hong Kong waters, and their numbers of re-sightings will usually take much longer to accumulate in order to reach the minimum requirement of 15 re-sightings for this analysis.

Moreover, by examining their monthly occurrence, it was found that 16 individuals used Hong Kong year-round, while 41 individuals showed distinct seasonal occurrence, which were always absent from Hong Kong during certain months of the year (Table 2). Among these 41 individuals, the months with higher percentages of absent individuals included the period of March through June, while most individuals occurred in Hong Kong waters from October through December. The large percentages of individual dolphins absent during spring months coincided well with seasonal patterns of distribution and abundance, with fewer dolphins occurred in spring months (i.e. March through May) and more occurred in autumn months (i.e. September through November) (Hung 2008).

Overall, 16 and 33 individuals dolphins were identified as year-round and seasonal residents respectively, while only eight were identified as seasonal visitors (Table 2). Notably, the percentage of year-round residents utilizing the Brothers Islands as their 25% UD core areas (56%) was twice as high as the one of seasonal residents (24%) In contrast, the percentage of seasonal residents utilizing the marine park as their 25% UD core areas (70%) was much higher than the one of year-round residents (25%). Even though dolphin densities around the marine park were higher than the ones around the Brother Islands, the latter should still be considered as important dolphin habitat, as this area serve an important function for the year-round residents that heavily relied on Hong Kong waters. As part of the conditions of approval for the reclamation work of the Hong Kong Boundary Crossing Facilities (HKBCF), the Brothers Islands will be established as a marine park in the near future, and its preliminary boundary will consider the usage of these year-round residents as well as other dolphin usage information. Hopefully, the establishment of this marine protected area will provide a refuge for dolphins to recover from the impacts of habitat loss in nearby waters, and also attract the resident dolphins to continue to use this important habitat after the construction of the HKBCF and the Tuen Mun-Chek Lap Kok Link.

5.10. School Seminars and Public Talks

During the study period, HKCRP researchers continued to provide assistance to AFCD to increase public awareness on conservation of local cetaceans. In total, HKCRP researchers delivered 18 education seminars at local primary and secondary schools about conservation of Chinese white dolphins and finless porpoises in Hong Kong. A PowerPoint presentation was produced for these school talks, with up-to-date information on both dolphins and porpoises gained from the 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. Moreover, the author helped the Marine Park Division of AFCD to speak at their Lecture Series on past occurrences of cetacean species in Hong Kong, including the recent incident of humpback whale. Through this integrated approach of long-term monitoring research and publicity programme, the Hong Kong public can gain the first-hand information from our dolphin researchers. Their support will be vital to the long-term success in conservation of local cetaceans.

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Table 1. Matrix of occurrence of the 80 frequently sighted individual dolphins that were also sighted in 2009

ID	# of Stg.	2004												2005												2006												2007												2008												2009											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CH12	15																										C			W	SW		C					W		W				W				W						W								W			W			W					
CH25	11																																									W									W		W			W							NW						W				
CH34	32																			NE	NE						NW	NW				NE	NE	NE	NW		NW	C			NW	NW	NW			NE	NE	NE	NW						NE		NE		NW									NE	NW		DB
CH37	13																						SW											W							W					W										SW								W		W			W		
CH38	13																										C								W			SW		W					SW													W						W				SW		W		
CH98	29		NW																					NW		NW	NW							NW		NW	NW				NW					NW	NW	NW			NW	NW							DB		NW	NW	NW	NW						NW			DB
CH108	14			C																											W							W	W		W									W			W			W					W		W		W		W	SW					
EL01	56		NE			NW	W			NW	NE			NE					NE	NE		NW		NE			NW			NW					NW	NE		NW						NW				NE												NE	NE			NW		W	W						NE
EL03	11																W							C	SW																	W						SW						NW				SW		SW			W										SW
NL06	12																																							NW															NW	NE	NE			NW	NW		NW	NW									
NL11	58		NW								NW								NW	NW		NW	NW	NW		DB	NW						NW		NW		NW			NW							NW	NW	NW		NW	NW									NW	NW											DB
NL12	17								NW																							NW														NW					NW																		NW				
NL18	67									NE		NE	NW								NE	NE	NW				NE	NW	NE	NW		NE	NE		NW	NW		NE		NW		NE									NE				NW		NW	W			NE	NW					NE	NE				NW	NE
NL24	128		NW						NW	NE		NW	NW	NW			NW			NW	NE	NW	NW				NW		W					NW	W	NW	NW	NW	NW			NE	NW					W				NW	NW			NE			NW	NW	NW	NE	NW				NW	NE			NE		NE
NL33	35									NW																										NW		NE				NW			NE		NE		NW	W	NE					NE				NE	NW	NE	NW	NE				NW					
NL37	41																NW			SW	W			NE			NW																NW	NE							NW											NW					NE						
NL46	32					NW			NW	NW	NW	NW													W		W					C	NW	C	NW		NW	NW		NW			NW						NW						NW				W		NW			NW								NW	
NL48	29									NW													NW				NW									NW	NW	NW		NW					NE		NE		NW							NE	NE			NW	NW	NW				NW			NW			
NL49	16											W																							NW														NW													NW											
NL60	25			C						NW												NW									C					C									NW												NW					DB								NW		DB
NL75	14																																	NW		NW	NE														NE						NE											NW				NW		NE
NL93	19																						NE										NE			NW								NE				NW							NW				W				NW			NW	NW						NW
NL98	65										NW						W				NW	NW	NW	NE		W	NW	NW							W	NW					NW	NW									NW								NW	NW		NE	NW				NW	NE			NE		NE
NL103	30																NW							NW		NW	NW									NW	NW	NW									NW		NW			NW					W	W			NW		NW										
NL104	42									NW		NW								NE	NW			NW			NW				W		W				NW			NW			NW					W			NW		NW		NW	NE	W	W									NE					NW	
NL105	16		C																																												NW		NW								W	W											W					
NL112	16		NW											NW																							NW						NE				NW	NW	NW								NW						NW										
NL118	31					W																			NW	NW				NW	W	NE				NW	NW			NW						W	NW		NW					NW	W						NW		NW									NW	
NL120	49	NE			NW								W										NE	NW							NE				NW	NW	NW	NW	NW		NW	NW	NW	NE	NE	NE	NW								NW	NE	NE	NE			NW	NE		NE				NE			NE		NE
NL123	66					NW			NE	NW		NW	NE	W						NW	NW	NW	NW	W			NW	NW	NW						W	NE	NW	W			NW	NE			NE			NW		W						NE		W			NW	NE					NE				NW		NE
NL128	27																				W		W				SW				W			W			W	W			W					W	SW			SW									W			NW						W					
NL136	18																						NW	NW			NW										NW	NW									NW	NW				NE									NW		NW	NW	NW				NW					
NL139	61									NW		NE								NE		NW	W	NE			NW	NW				NE		NW	NW		NE	W		NW			NW		NE			NW	NE		NE							NE			NE						NW			NE			NE
NL145	18											W						W		NE													W																						NW																NW		
NL150	13																						NW				DB											NW										NW										NW				NW						W					
NL153	15																						NW				NW			NW				NW			NW			NW					NW	NW																							NW				
NL165	25		NW						NE		NW	NE						NW																	NW			NW		NW					NE						NE	NW	NW		NW	NE					NW		W	NE				NW					
NL169	19	NW					NW							NW						DB				NW		NW	NW	DB							NW						DB						NW	NW			NW						NW						NW										
NL176	33	NE							NE	NW			NW				NW						NW	NE				NW	NE						W	NW		NE		NW				NE	NE		NW			W		NW			NW	NE					NW	NW						NW					NW
NL179	19									NE								NW																NW				NW							NE	NE			NE	NE		NE	NW		NW	NE					NW			NE									
NL188	23								NW	NW											W		NW				NW	NW								NW		W		NW				NE			W	NW			NE		W						W	NW	NW											NW	
NL191	27								NE	NE	NE	NE	W											NW		W				W			NW			C		NW		NW								NW	NW						NE			NW		NW		NE								NW		NE
NL202	21																	NW	W							NW	NW								NW		NW	NW								W	NW	NW	NW						NE	W	NW	NW												NW		
NL206	16																										NW												W				W					W													W				W	W	W	SW	W			W	SW
NL210	13																							NW		NW	NW	NW														NW				W									NW	NE							NE								NW		
NL215	12																										NE							NW			NE											NE	NW				NW		NW			NE		W	NE												NE
NL220	12																																	NW	NW		NW	NW		NW						NE		NW			NW							NE	W										NW			
NL233	15																																				NW	NW		NW								NW	NW						NE					NW	NW		NW		NW		W				NW	
NL242	11																										NW										NW										NE	NW											NW				NW				NW					NW	
NL244	18																																					NW		NW		NE	W						NW	NE		NW				NE		W	NW		NW						NW		NW		NW	
NL260	17																																																					NW	NE		NE	W		NW	NE	NW	NE			NW				NE		
NL261	10																																																						NE		NE	NW	NE	NW			NE							NW		DB
SL05	19																																W																		W			W				W					W	W			SW			W	SW	SW
SL27	13		SW						W													W						W	W		SW	W												SW		W	SW											W				W										
SL35	38																		SW					SW	W	SW	SW			SW	W				C		W		W			SW		SW	W	W			W					SW	SW		W	W	W	W	SW	W	W	W							W	
SL40	11																																					SW												W								SW	W			W		W	W			SW			W		SW
WL04	11										NW	W																							NW		NW	NW													NW				NW														W			
WL05	13																			NW															NW									NE	W		NW	NW							NE						NW								NW			
WL09	14																W												W		W							W		W																					NW			W		W	W		W			
WL11	34		NW			NW			NW		NW	NW								SW							NW	NW				NE	NW		W			NW					NW	NE							NE		NW			NE						NW	NW			NW	NW	W				NW	
WL15	33		W						W	NW										SW																W					W						W				SW	W					SW			W	W		W	W	W		W				W	W	
WL17	12																				W													W				W												SW																						SE
WL21	19																W			W											SW	W	W		C	C		W					W							W			W		SW	W								W			W					
WL25	57												W				W	W			W			W	W	W	C		W	W	SW		W		NW	W		W		W	W			W		W	W	W		W		W			W			W	W			W	W		W				SW	W		W	W
WL37	12		C				W																						C	W													W								W																W						
WL42	26										W		W	W													W	W			C							W		W								W				W	W	W	W	W	W		W		NW		W					SW	SW				W
WL50	17																							W		W	C			W							NW									W	W			W			W		W							W		W	W		W	SW			W	
WL55	21																													W		W						SW		W	W				SW		W	SW			SW			W			SW						W		W	W	W	W			W	W	SW
WL61	16																															W		W				W									W	W		W	W				W				W	W	W			W	W								
WL62	20																															W		W						W	W							SW		W		W					SW		W				W	W	W						W	W	
WL69	16																																		W	W			W	W												W						W	W		W	W	W				W	W		W	W	
WL72	14																																					W									W	W				W				SW	SW				W	W	W					W				W	
WL83	13																																						W	W	W										W	W				W			W				W		W	W		W					
WL88	14																																							W	W								SW										W		W	W				W			W		W	W	W
WL95	11																																									W												W	W		NW								W		W					
WL108	17																																															W		SW				W			W		W		W		W		W	W					W	SW	
WL109	13																W																			C						W						W				W	W				SW				W	W				W						W	
WL111	11																																										W									NE				NE			NW		NW		NW					NW		NW		NW	
WL116	12																																																			W							W		W		NW		W	W			SW			W	
WL123	10																																																						W		W						W		W		SW		W			W	

Table 2. Range use (50%/25% UD core areas and sighting coverage) and residency pattern of 57 individuals with 15+ sightings from the PRE humpback dolphin photo-ID catalogue during 1995-2009.

(abbreviations: MP= Sha Chau & Lung Kwu Chau Marine Park; CLK= northeast corner of airport; BR= Brothers Islands; 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)

		Age			50% UD Core Area				25% UD Core Area				Occurrence in Survey Areas							
ID#	**# STG**	**Class**	**Gender**	**Residency**	**MP**	**CLK**	**BR**	**WL**	**MP**	**CLK**	**BR**	**WL**	**DB**	**EL**	**NEL**	**NWL**	**WL**	**SWL**	**SEL**	**CH**
CH34	32	UA	F	Year-round Resident	√		√				√		√		√	√				√
EL01	56	UA	M*	Year-round Resident	√		√				√			√	√	√	√			
EL07	62	SJ	M*	Year-round Resident			√				√			√	√	√	√			
NL11	58	SA	F	Year-round Resident	√				√				√			√				√
NL18	67	SA	F	Year-round Resident			√				√				√	√	√			√
NL24	128	SA	?	Year-round Resident	√		√		√						√	√	√			√
NL98	65	SS	F*	Year-round Resident	√	√	√		√		√				√	√	√			√
NL120	49	SS	F*	Year-round Resident			√				√				√	√	√			
NL123	66	SS	F	Year-round Resident	√	√	√			√	√				√	√	√			
NL139	61	UA	F	Year-round Resident			√				√				√	√	√			√
NL165	25	SS	?	Year-round Resident	√		√				√				√	√	√			
SL35	38	SS	?	Year-round Resident				√				√				√	√	√	√	√
WL11	34	SS	F*	Year-round Resident	√				√						√	√	√			
WL25	57	SA	F	Year-round Resident				√				√				√	√	√		√
WL42	22	SS	?	Year-round Resident				√				√				√	√	√		√
WL50	17	SJ	F	Year-round Resident				√				√				√	√			√
CH06	33	SA	?	Seasonal Resident				√				√					√	√		√
CH98	29	UA	?	Seasonal Resident	√				√				√			√	√			
NL12	17	SA	F	Seasonal Resident	√				√							√		√		√
NL19	31	SA	F	Seasonal Resident		√	√				√				√	√				√
NL20	38	UA	F	Seasonal Resident	√				√						√	√	√	√		√
NL32	21	SS	?	Seasonal Resident	√	√	√			√	√			√	√	√				
NL33	35	SS	F*	Seasonal Resident	√		√		√		√				√	√	√			
NL37	41	SJ	?	Seasonal Resident	√	√	√		√	√	√			√	√	√	√			
NL46	32	SA	F*	Seasonal Resident	√				√							√	√			√
NL48	29	SA	?	Seasonal Resident	√				√						√	√				
NL49	16	SA	F*	Seasonal Resident	√				√						√	√	√			
NL60	21	UA	?	Seasonal Resident	√				√				√			√				√
NL93	19	SS	F	Seasonal Resident	√		√		√						√	√	√			
NL103	30	SA	?	Seasonal Resident	√				√							√	√			
NL104	42	SA	F	Seasonal Resident	√	√	√		√						√	√	√			√
NL105	16	SA	?	Seasonal Resident	√				√							√	√			√
NL111	41	SJ	?	Seasonal Resident			√				√				√	√				
NL112	16	SJ	M*	Seasonal Resident	√				√				√		√	√	√			
NL118	31	SS	F*	Seasonal Resident	√		√		√						√	√	√			
NL128	27	SA	M*	Seasonal Resident				√				√				√	√	√	√	√
NL136	18	UA	F*	Seasonal Resident	√				√						√	√				
NL145	18	SS	F	Seasonal Resident	√				√						√	√	√			
NL149	20	SS	?	Seasonal Resident				√				√				√	√			√
NL169	19	SJ	?	Seasonal Resident	√				√				√			√				
NL176	33	SS	F*	Seasonal Resident	√		√		√		√				√	√	√			
NL179	19	SJ	?	Seasonal Resident		√	√				√				√	√				
NL188	23	SJ	?	Seasonal Resident	√				√						√	√	√			
NL191	27	SJ	?	Seasonal Resident	√	√	√		√		√				√	√	√			√
NL202	21	SA	F	Seasonal Resident	√				√						√	√	√			
SL07	24	UA	?	Seasonal Resident				√				√					√	√	√	√
WL15	33	SS	M*	Seasonal Resident				√				√			√	√	√	√		
WL21	19	SS	F	Seasonal Resident				√				√					√	√		√
WL40	17	SA	F*	Seasonal Resident	√			√	√							√	√			√
CH03	17	SJ	?	Seasonal Visitor	√	√	√		√	√	√				√	√				√
CH12	15	SA	?	Seasonal Visitor				√				√					√	√		√
NL16	23	SJ	?	Seasonal Visitor	√		√				√			√	√	√				
NL59	18	SA	?	Seasonal Visitor	√			√				√				√	√			√
NL81	15	SJ	?	Seasonal Visitor		√	√			√	√				√	√				
NL153	15	SS	F	Seasonal Visitor	√				√							√				
NL181	19	SS	M*	Seasonal Visitor	√				√				√			√				√
SL05	19	UA	F	Seasonal Visitor				√				√					√	√		

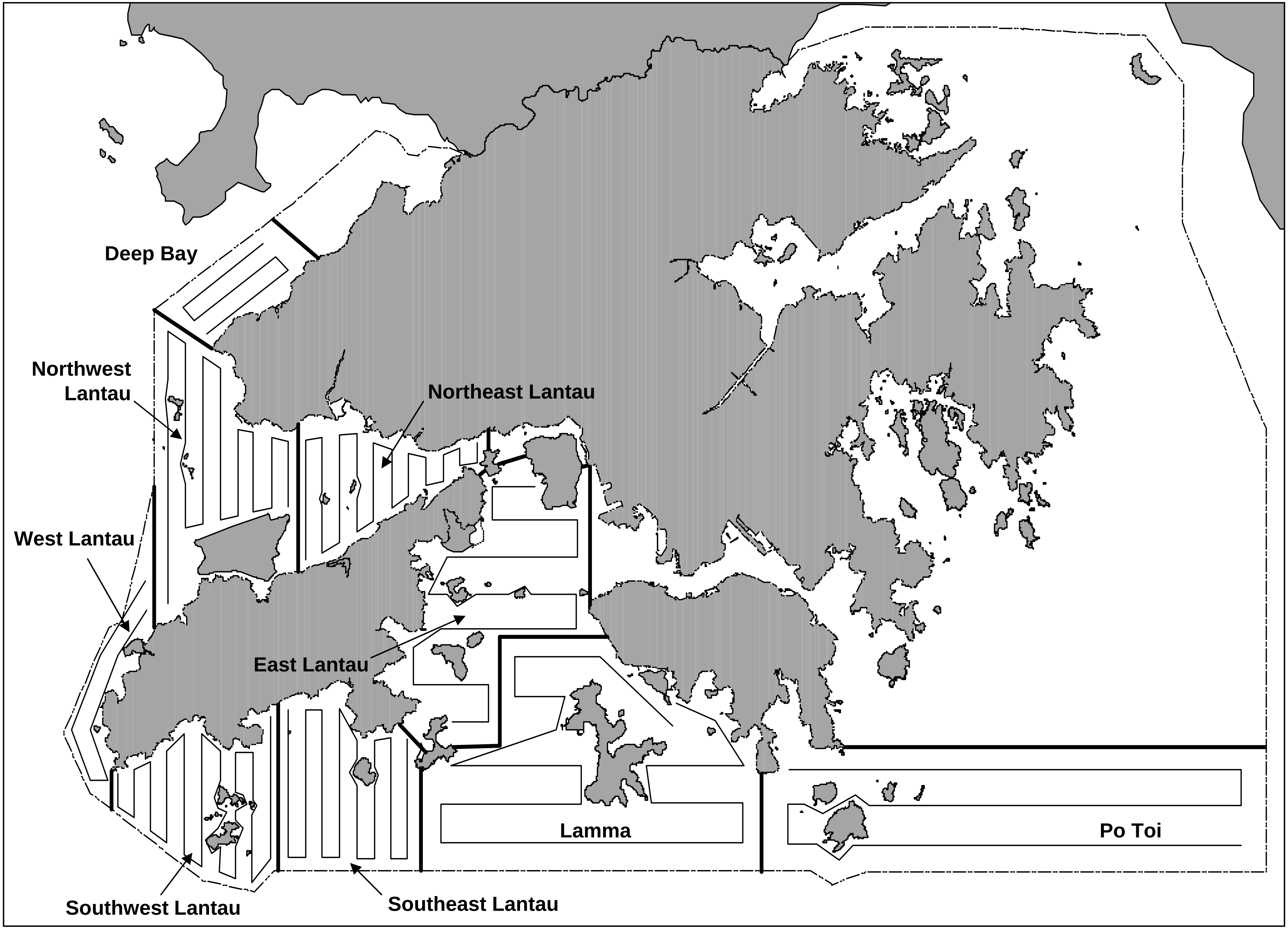


Figure 1. Nine Line-Transect Survey Areas within the Study Area

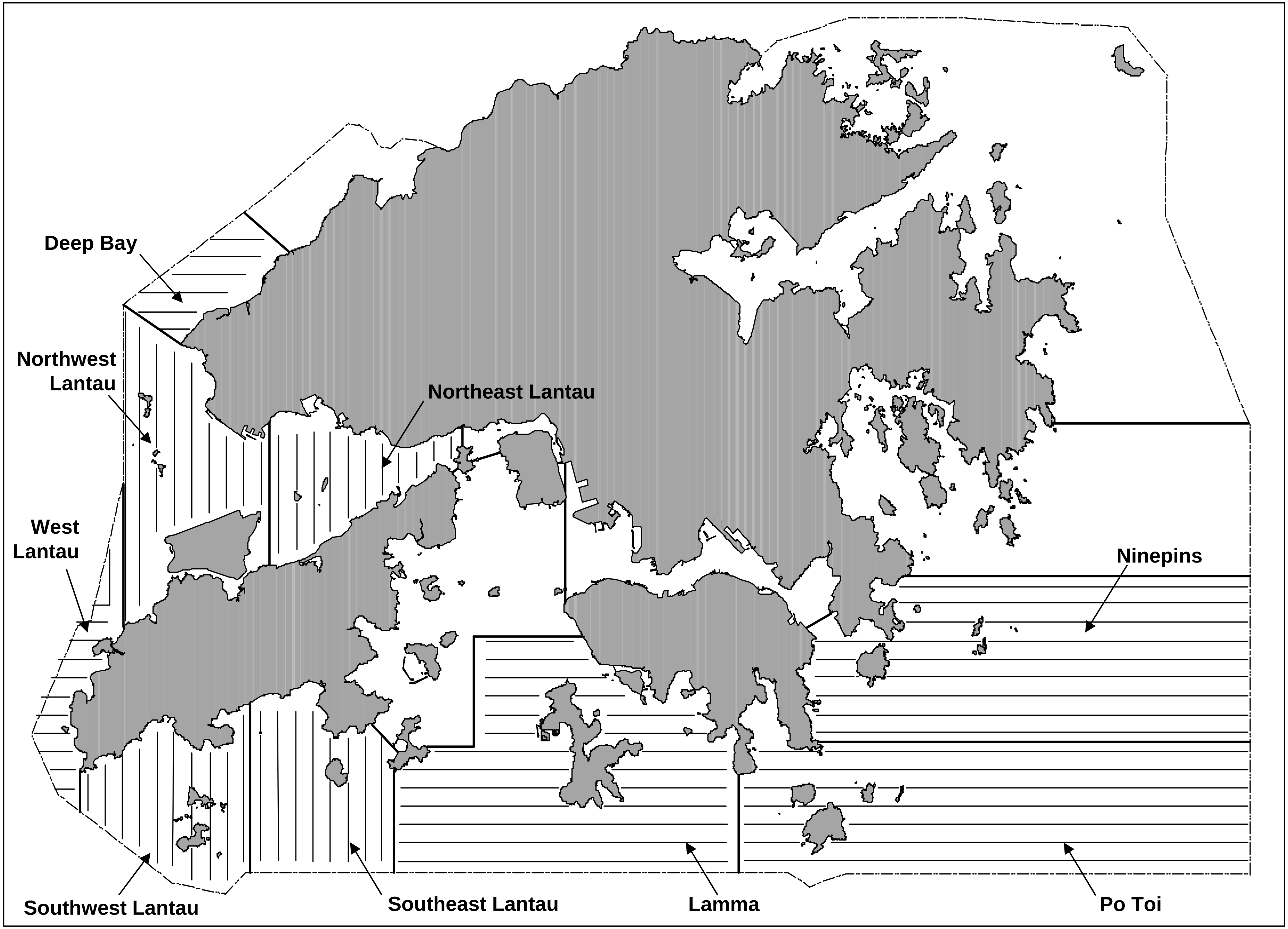


Figure 2. Revised Configuration of Transect Lines among Different Survey Areas in the Study Area

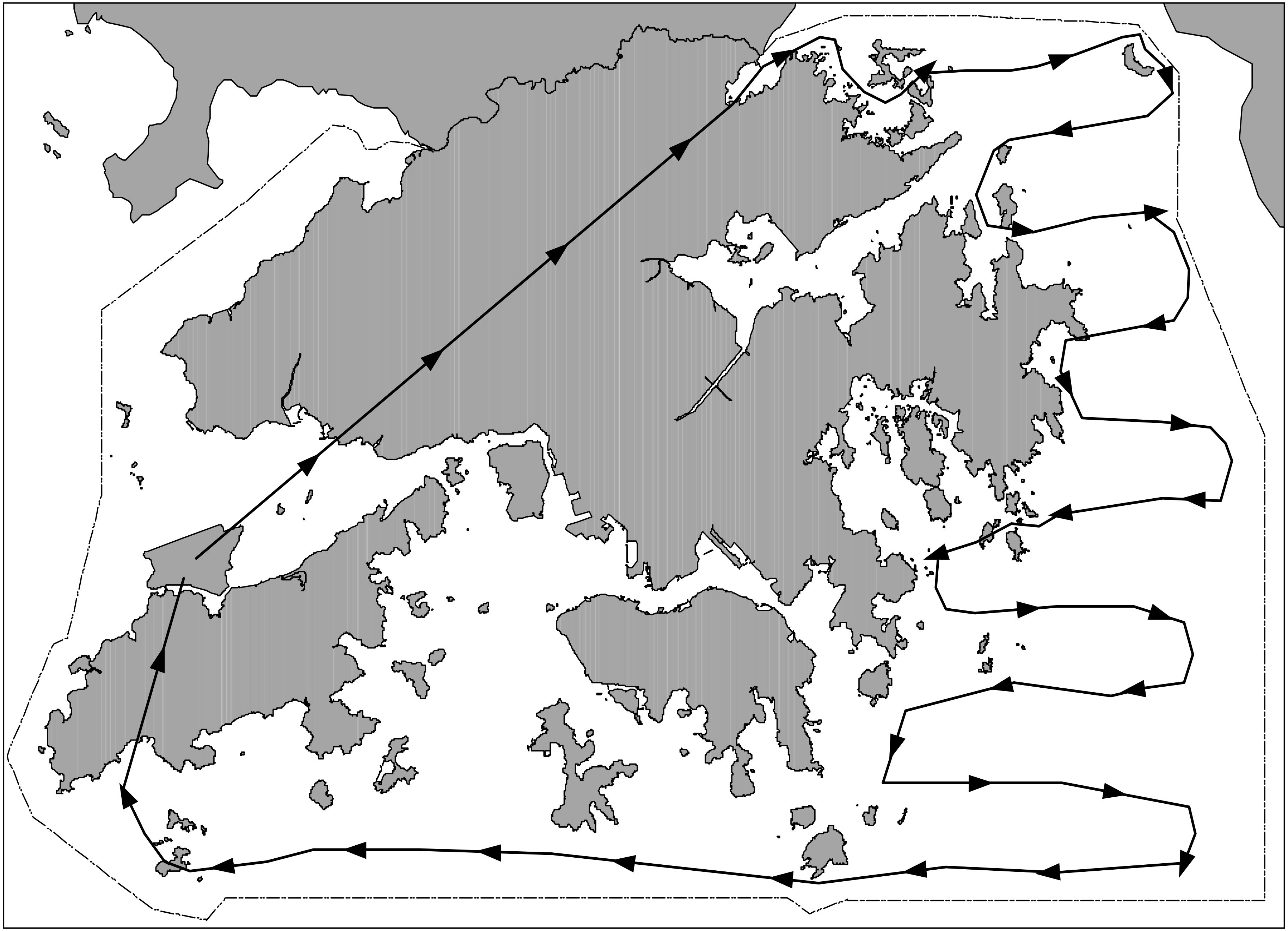


Figure 3. Survey Route for Helicopter Surveys in Eastern and Southern Waters of Hong Kong

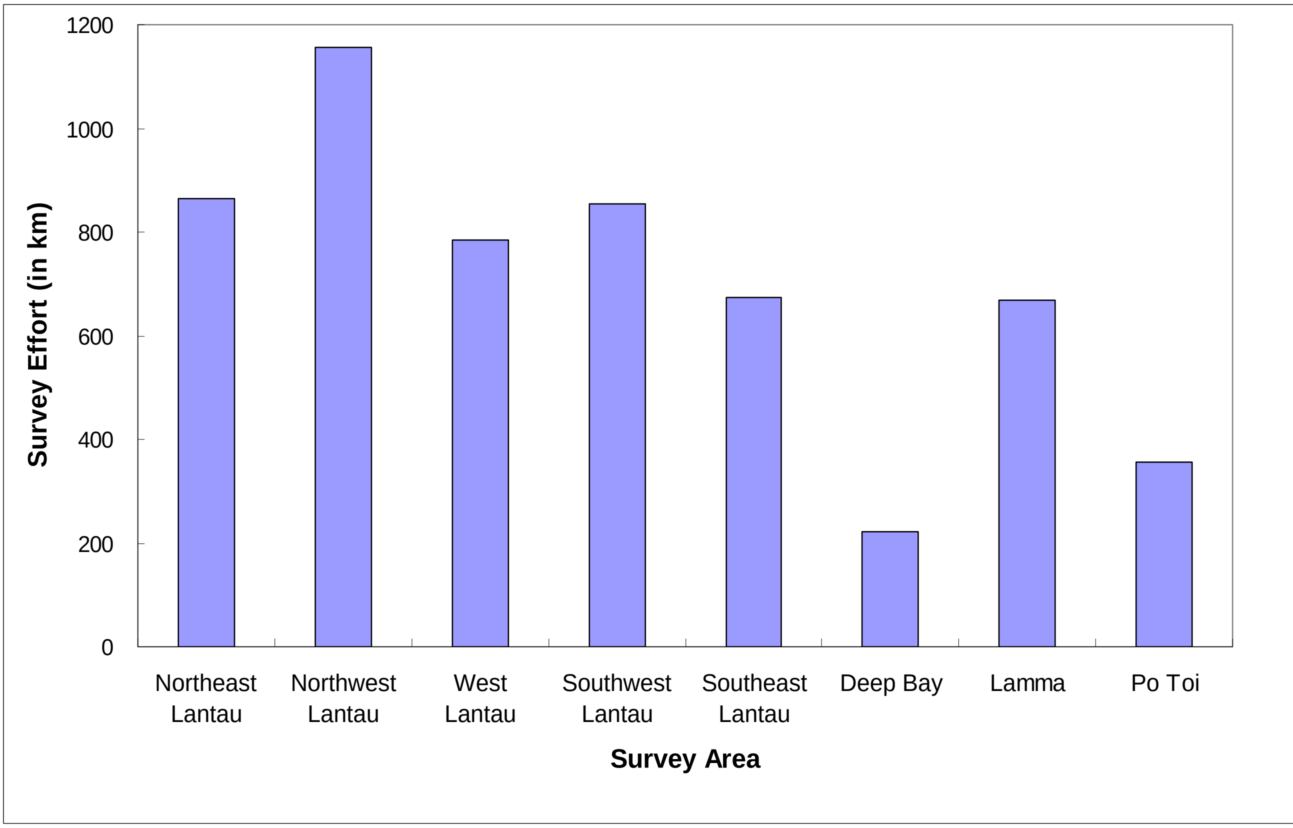


Figure 4a. Distribution of survey effort among nine survey areas from April 2009 – March 2010

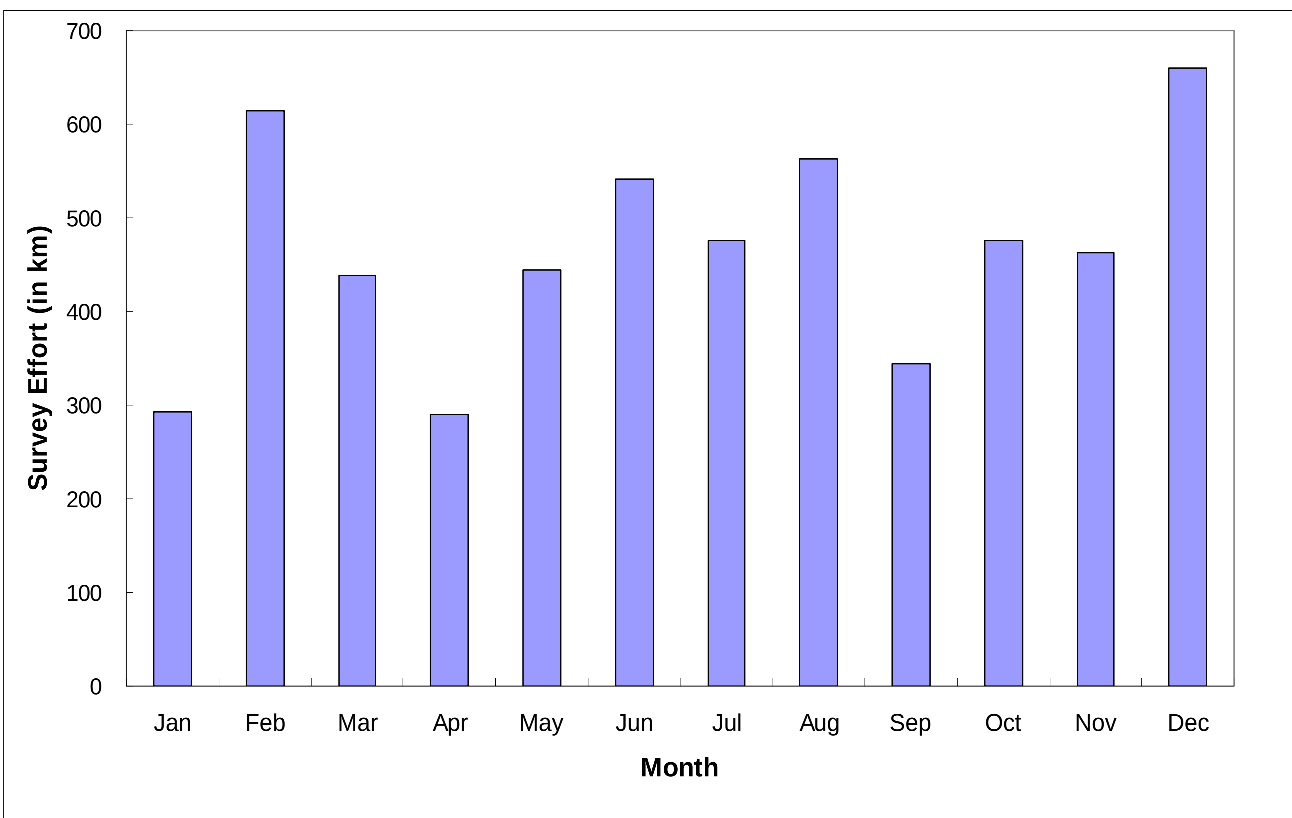


Figure 4b. Distribution of survey effort among different months from April 2009 – March 2010

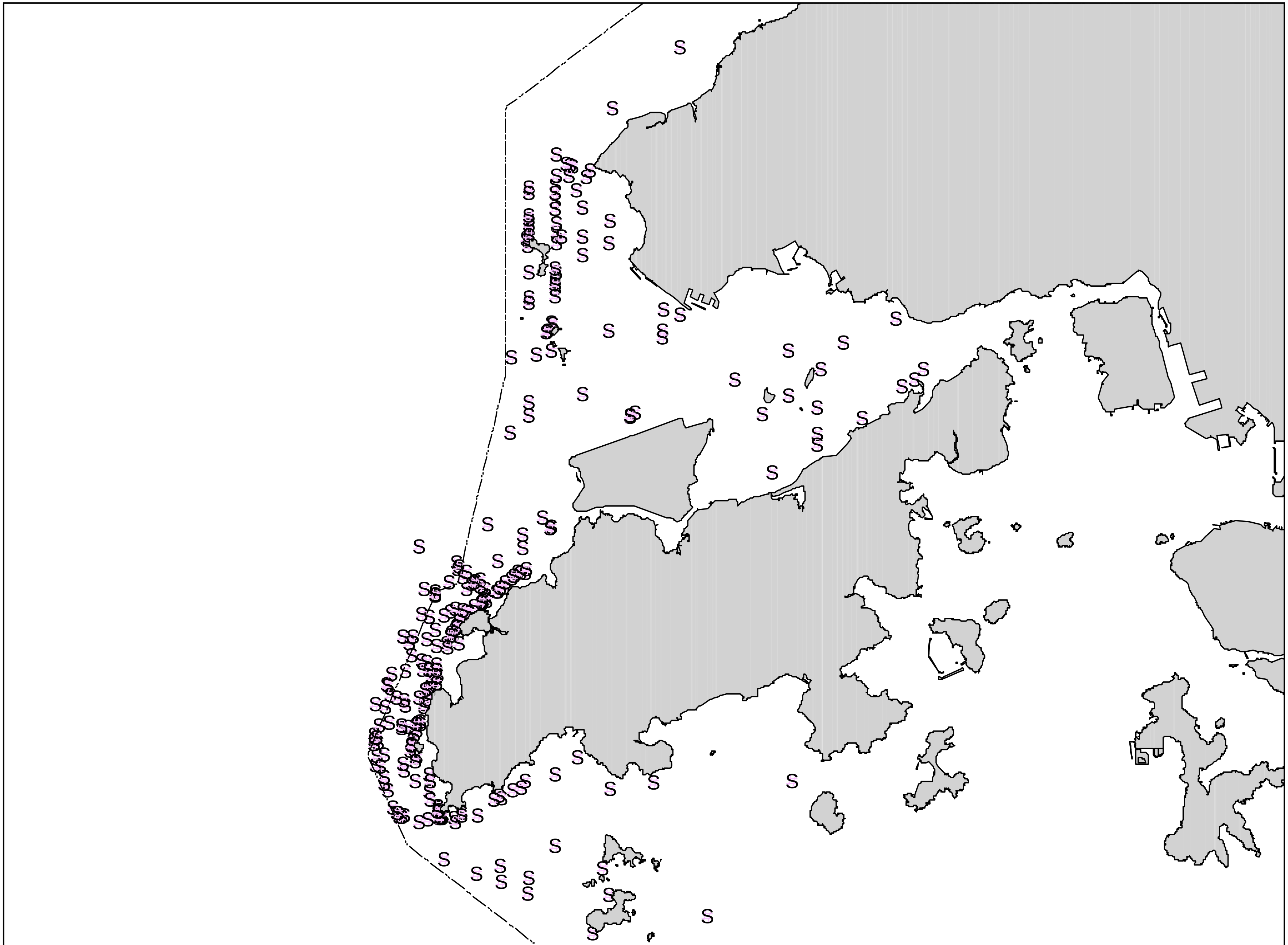


Figure 5. Distribution of Chinese white dolphin sightings in Hong Kong waters (April 2009 – March 2010)

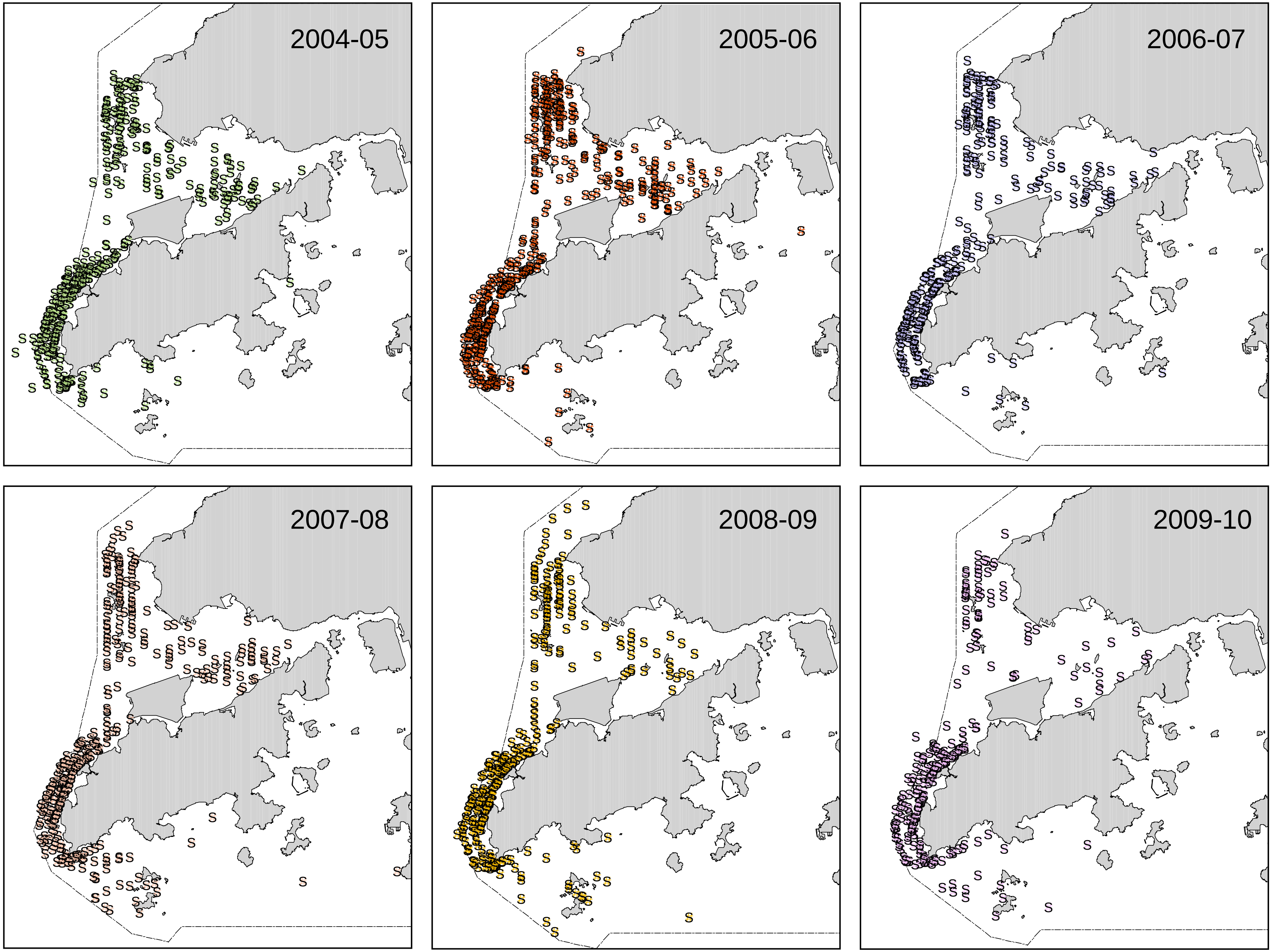


Figure 6. Comparison of dolphin distribution patterns from the past six years of monitoring period (2004-10)

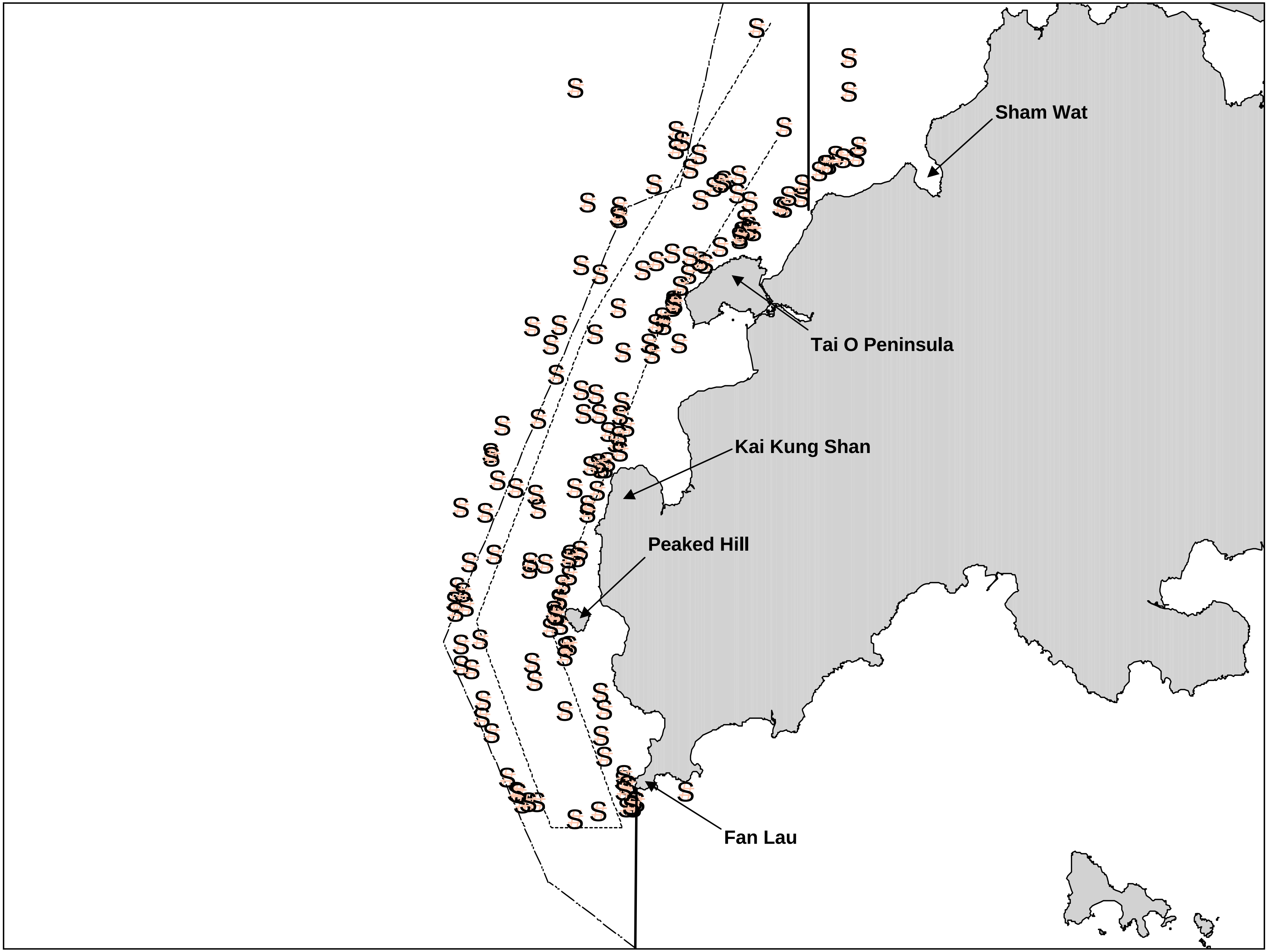


Figure 7. Distribution of Chinese white dolphin sightings in West Lantau waters (April 2009 – March 2010)

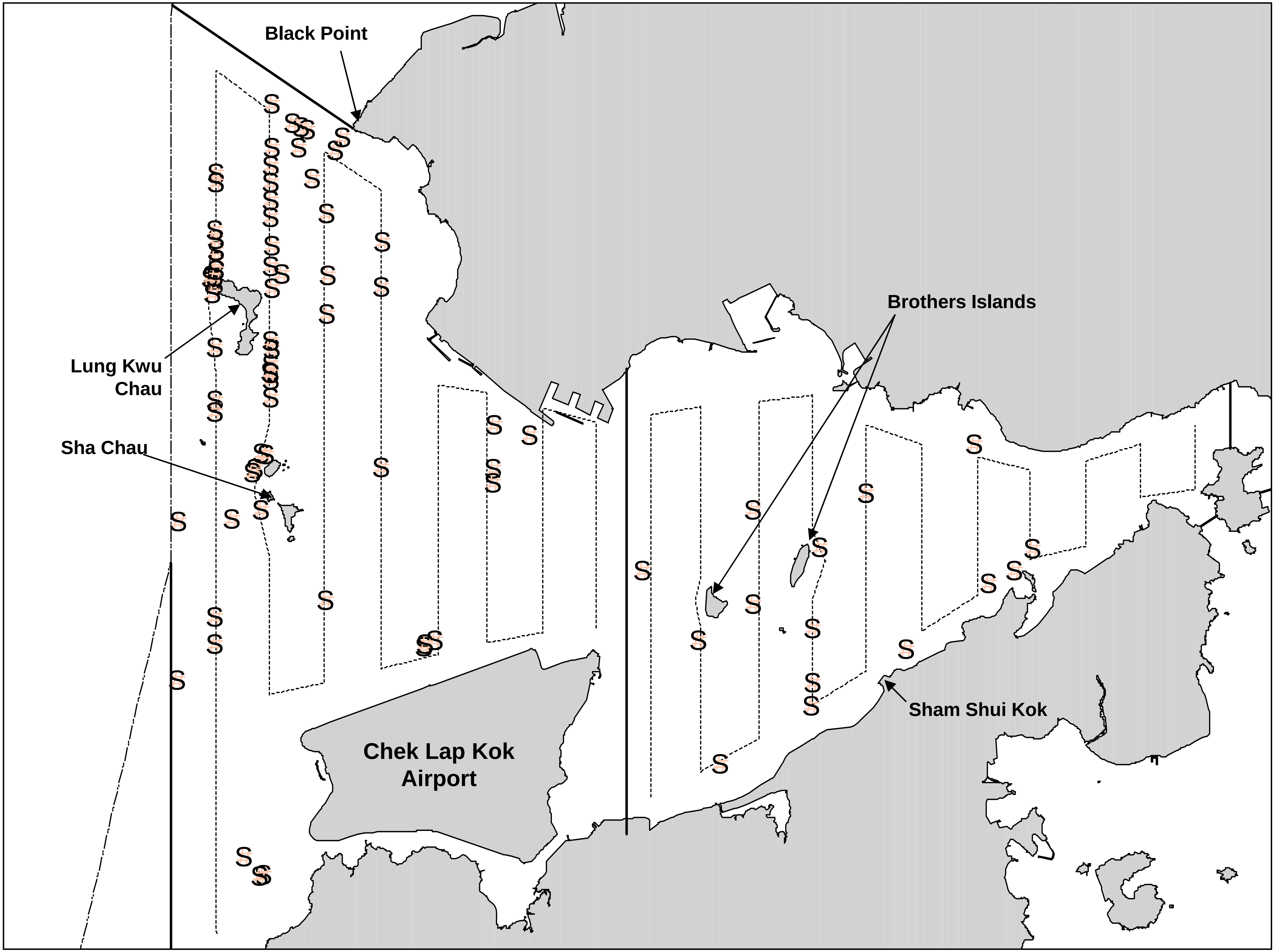


Figure 8. Distribution of Chinese white dolphin sightings in North Lantau waters (April 2009 – March 2010)

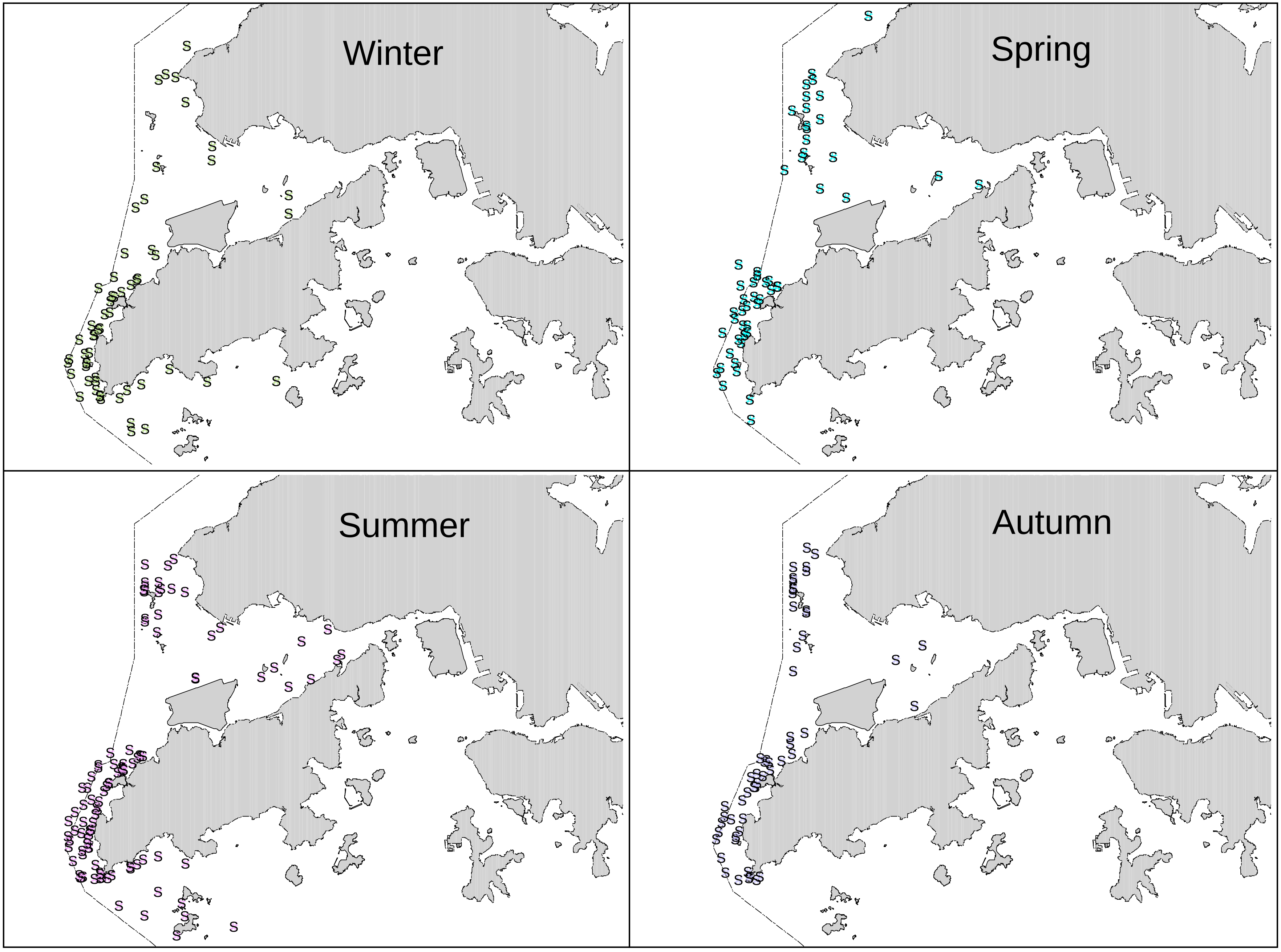


Figure 9. Seasonal distribution of Chinese white dolphins in Hong Kong waters (April 2009 – March 2010)

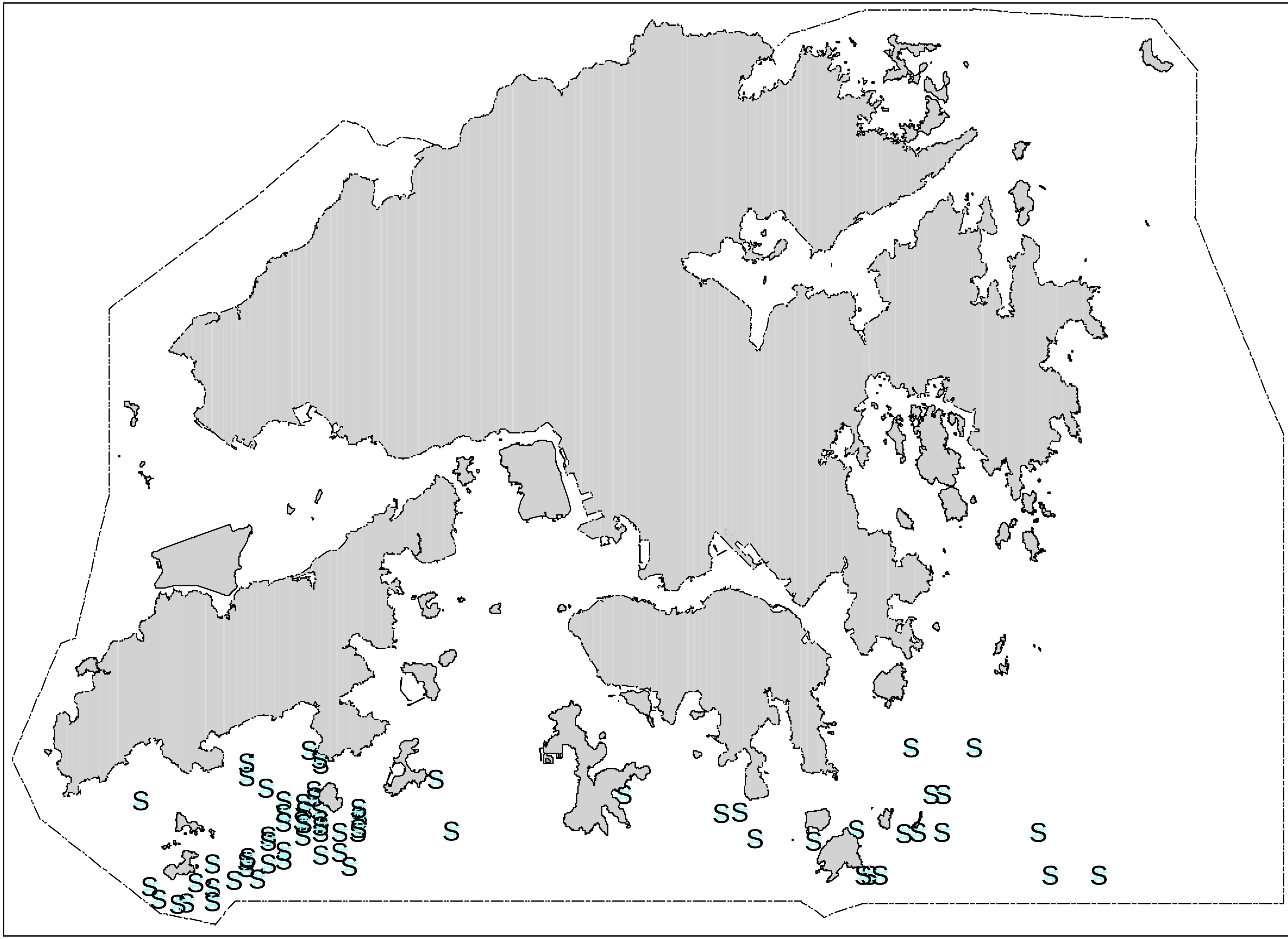


Figure 10. Distribution of finless porpoise sightings (April 2009 – March 2010)

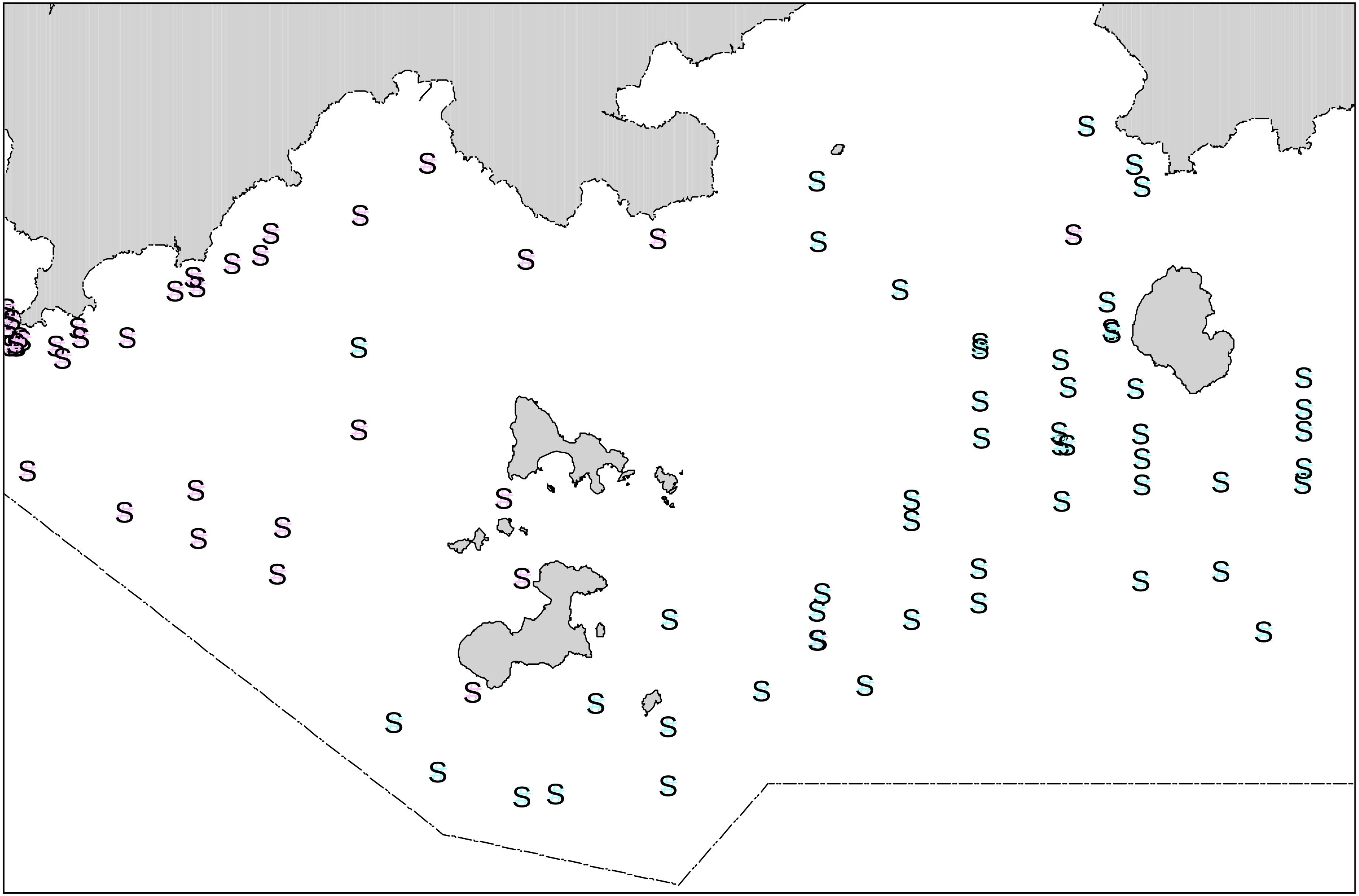


Figure 11. Overlapping distributions of sightings of Chinese white dolphins (pink dots) and finless porpoise (blue dots) from April 2009 to March 2010

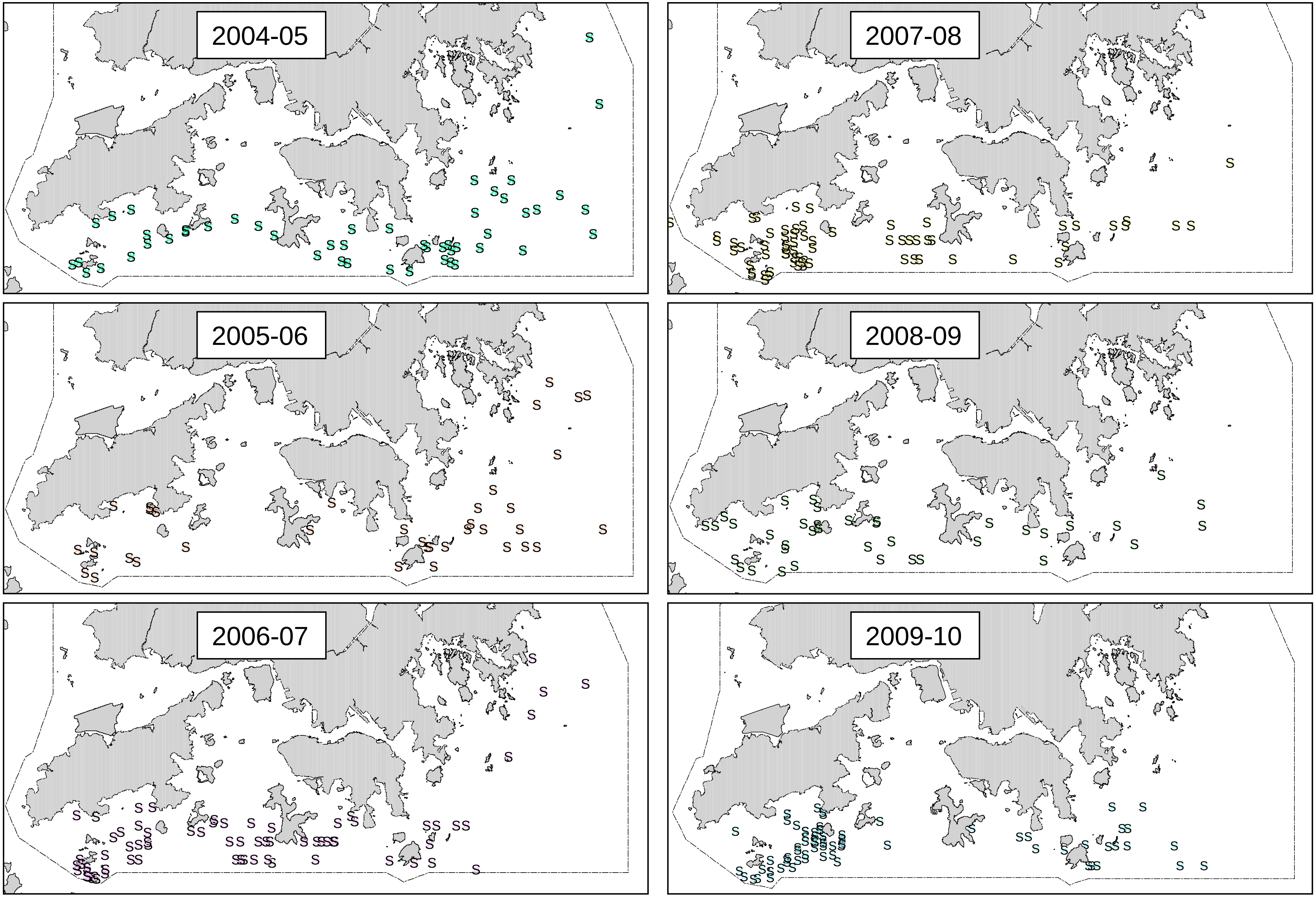


Figure 12. Comparison of porpoise distribution patterns from the past six years of monitoring period (2004-10)

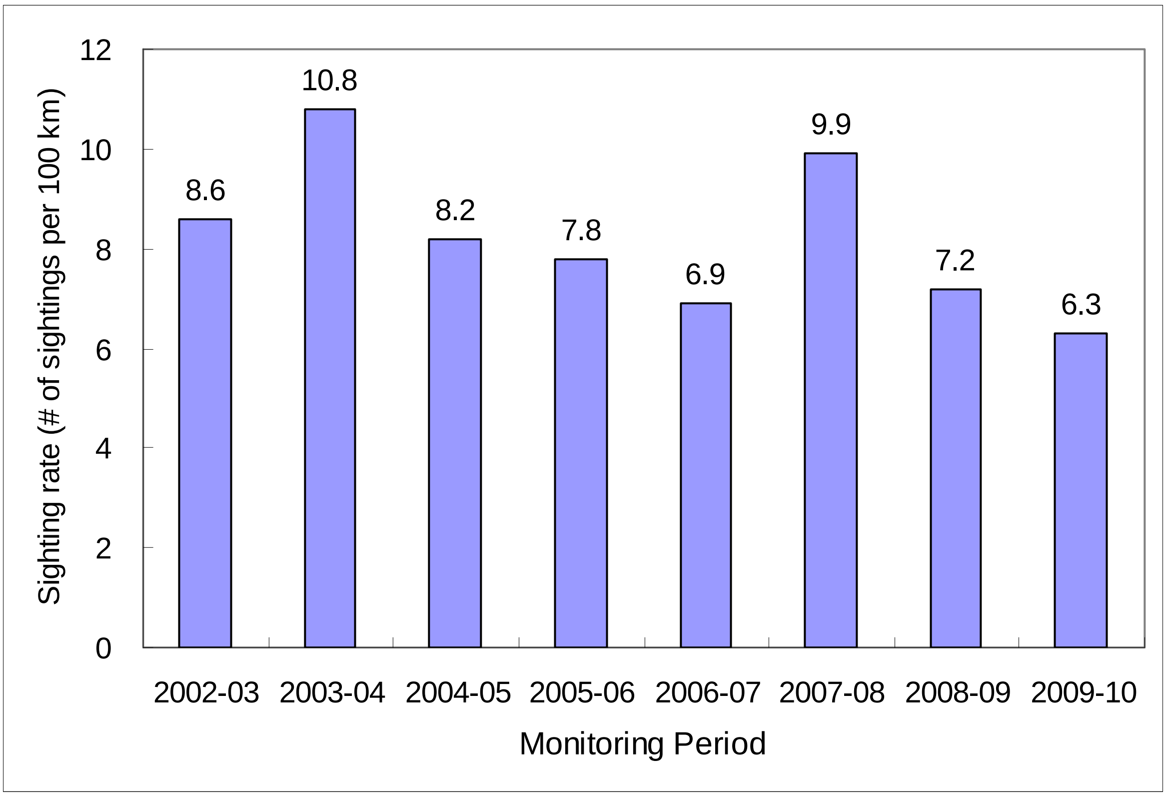


Figure 13. Temporal trend of dolphin encounter rates in the past seven monitoring periods from 2002-10

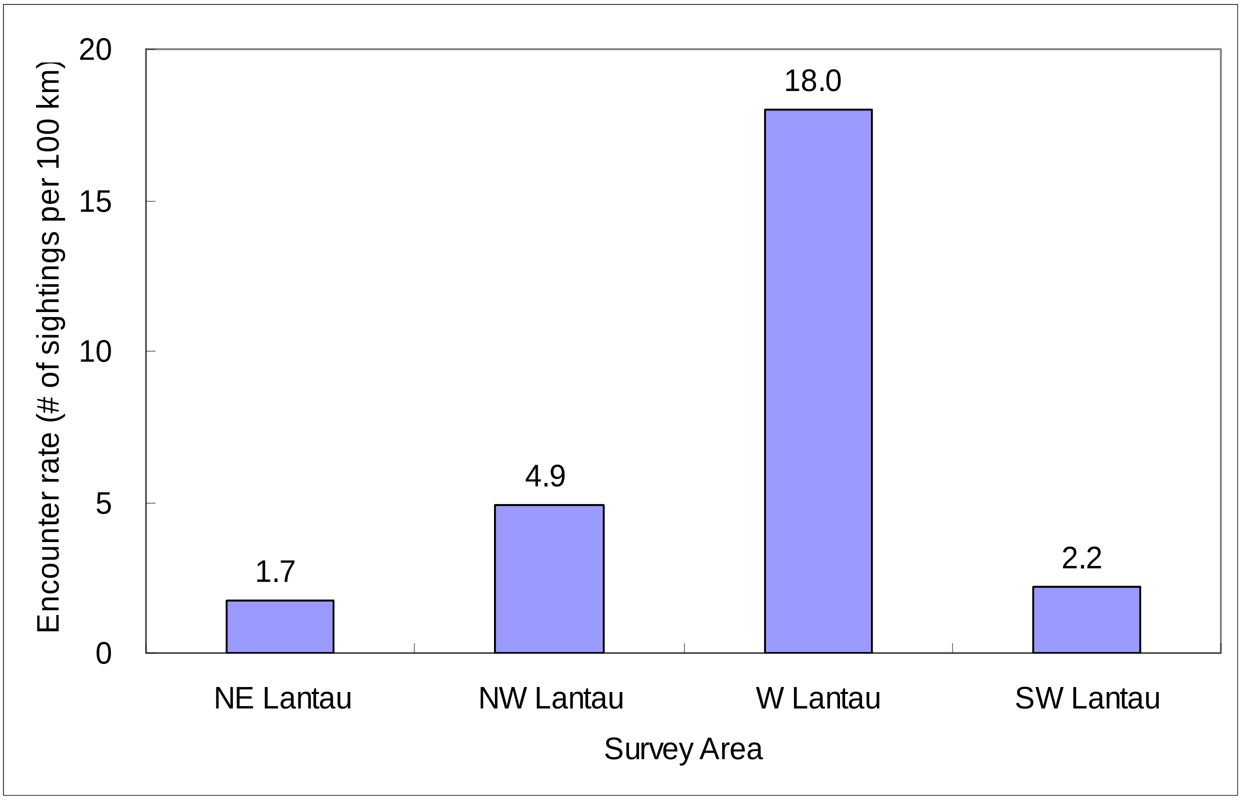


Figure 14a. Encounter rates of Chinese white dolphins among different survey areas (April 2009 – March 2010)

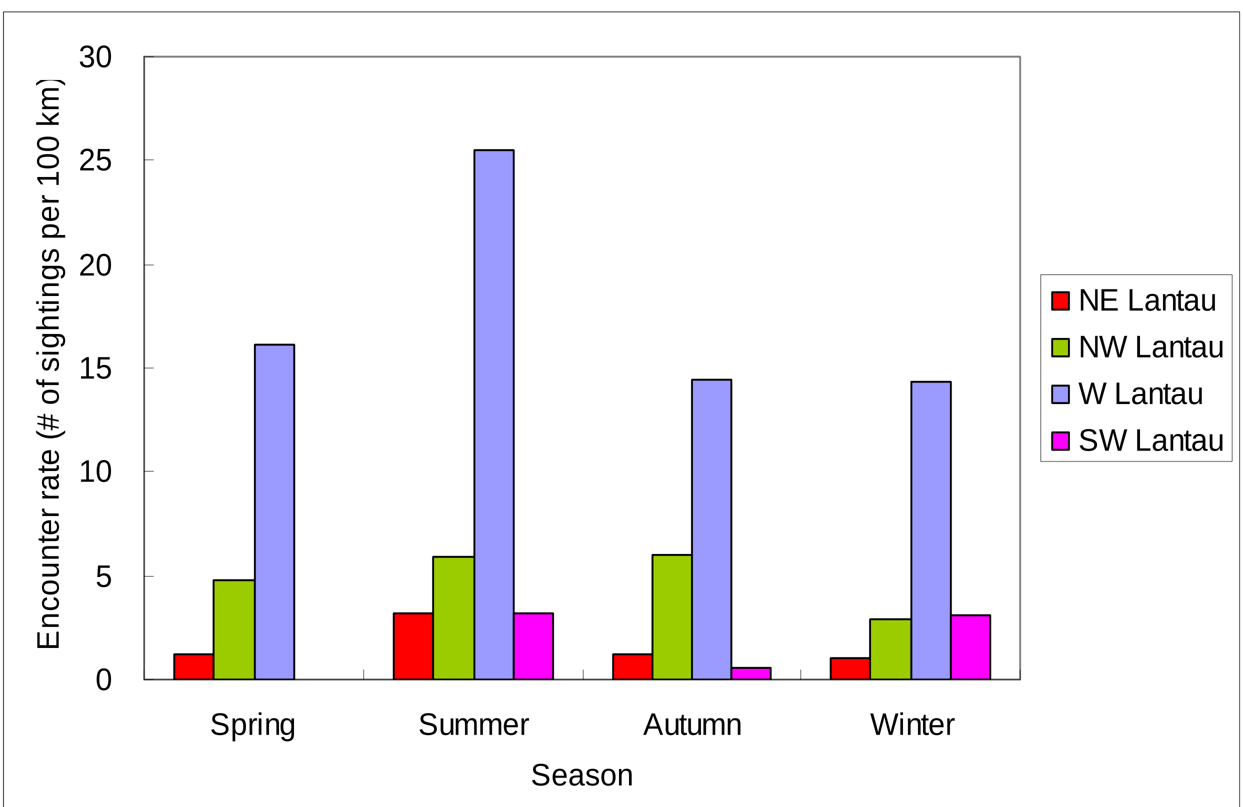


Figure 14b. Seasonal encounter rates of Chinese white dolphins among different survey areas (April 2009 – March 2010)

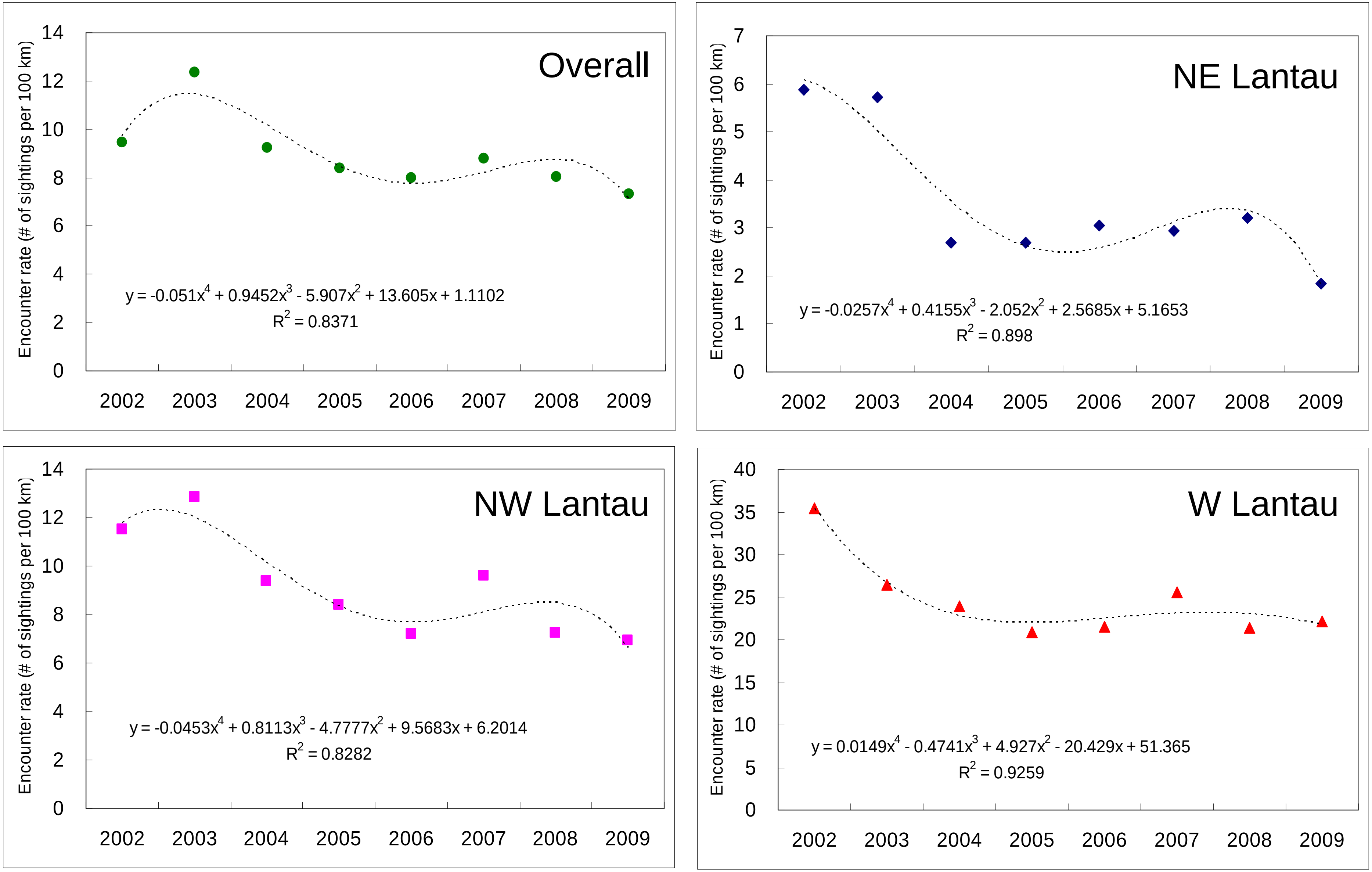


Figure 15. Temporal trends in annual encounter rates of Chinese white dolphins among different survey areas

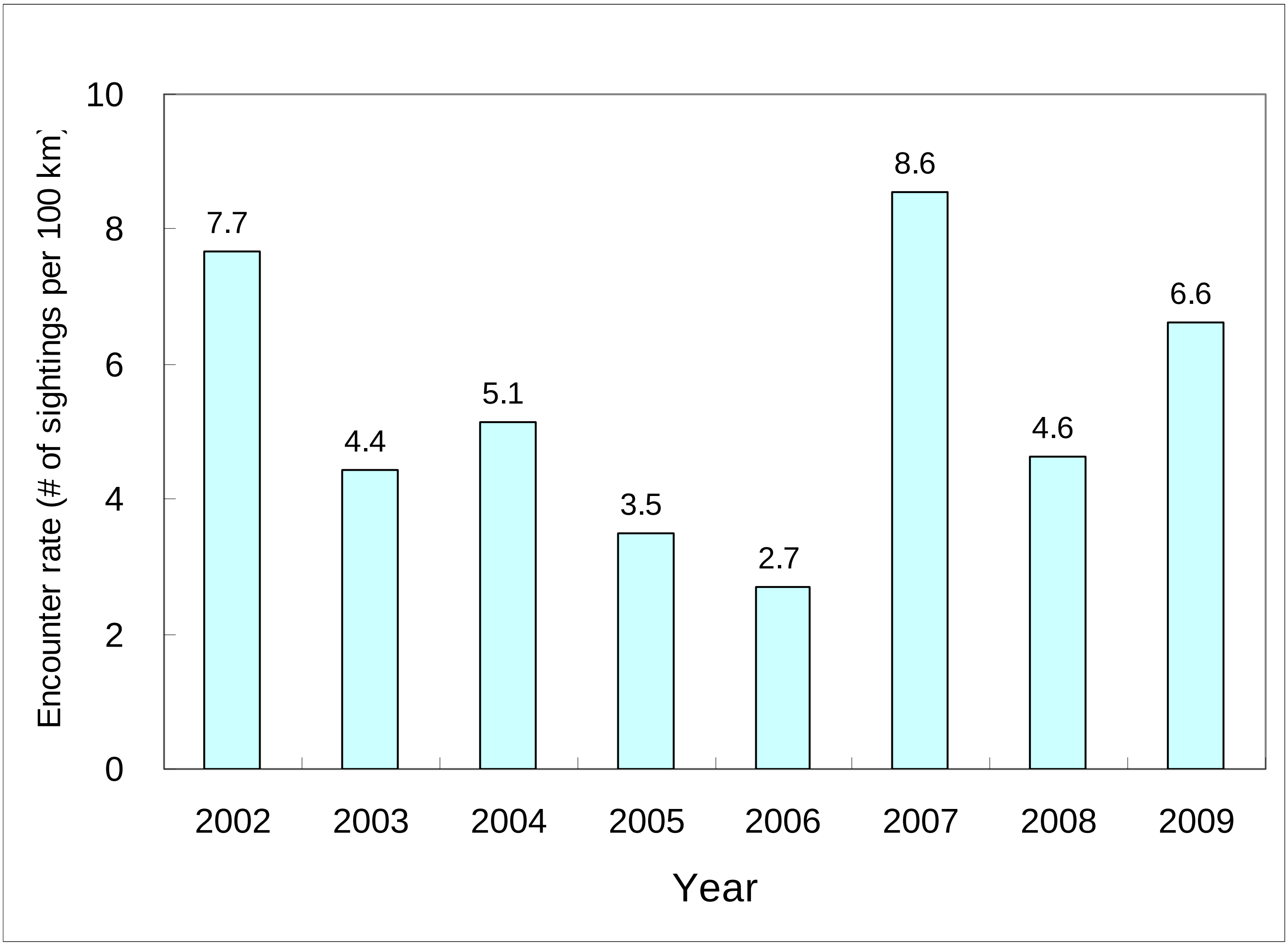


Figure 16. Temporal trend of annual encounter rates of finless porpoises from 2002-09

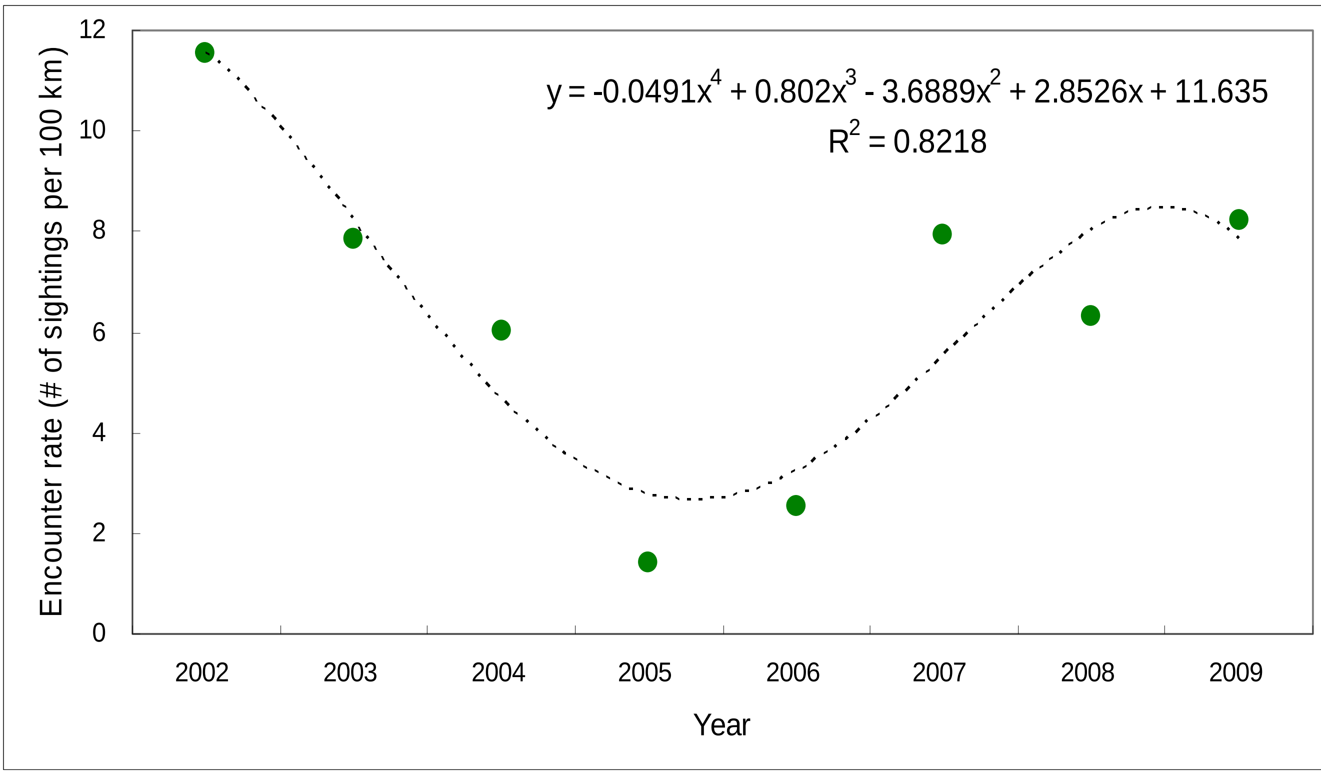


Figure 17. Temporal trend of porpoise encounter rates in South Lantau and Lamma waters combined from winter/spring months of 2002-09

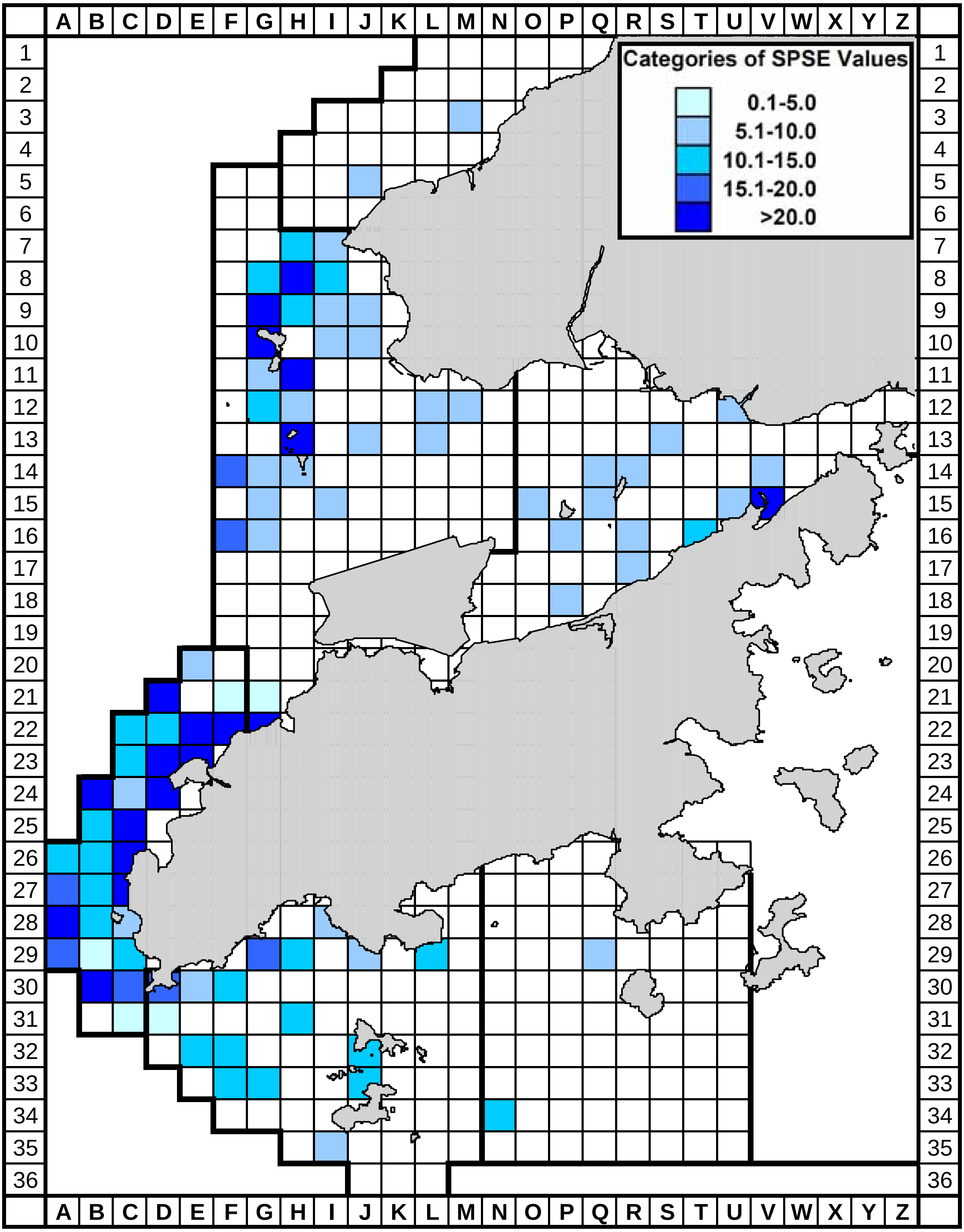


Figure 18. Sighting density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island, using data collected during 2009-10 (SPSE = no. of on-effort dolphin sightings per 100 units of survey effort)

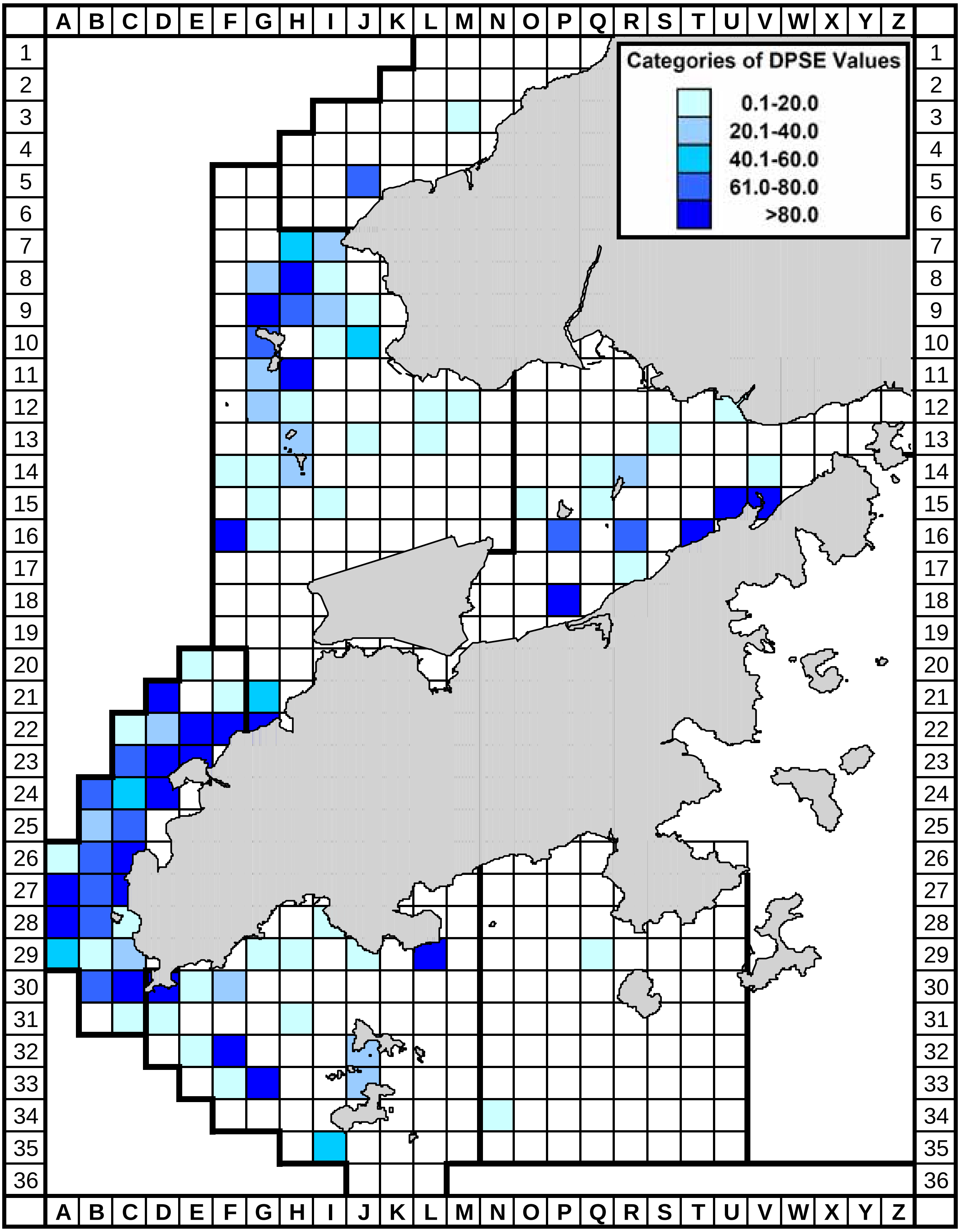


Figure 19. Density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island, using data collected during 2009-10 (DPSE = no. of dolphins per 100 units of survey effort)

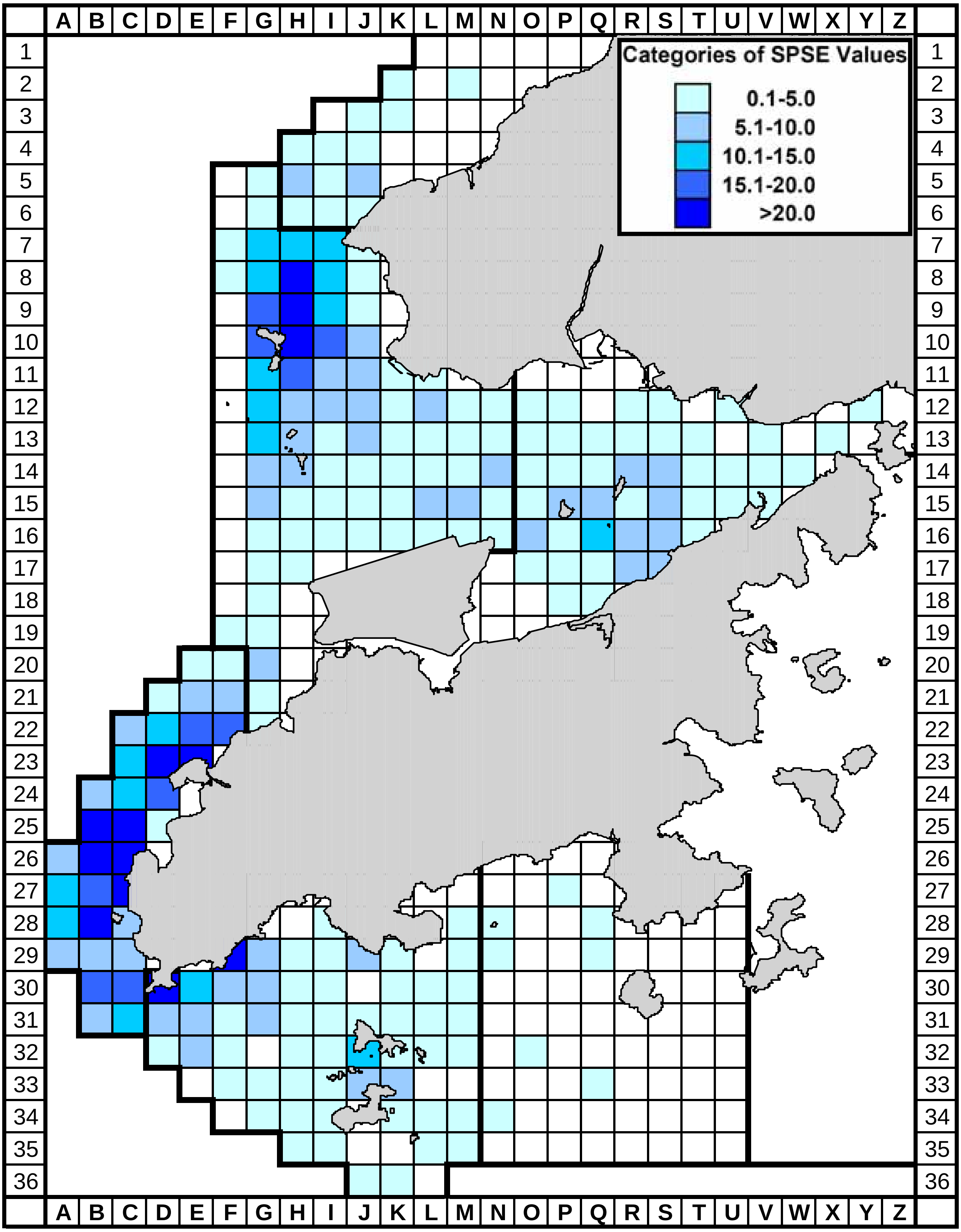


Figure 20. Sighting density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island, using data collected during 2002-09 (SPSE = no. of on-effort dolphin sightings per 100 units of survey effort)

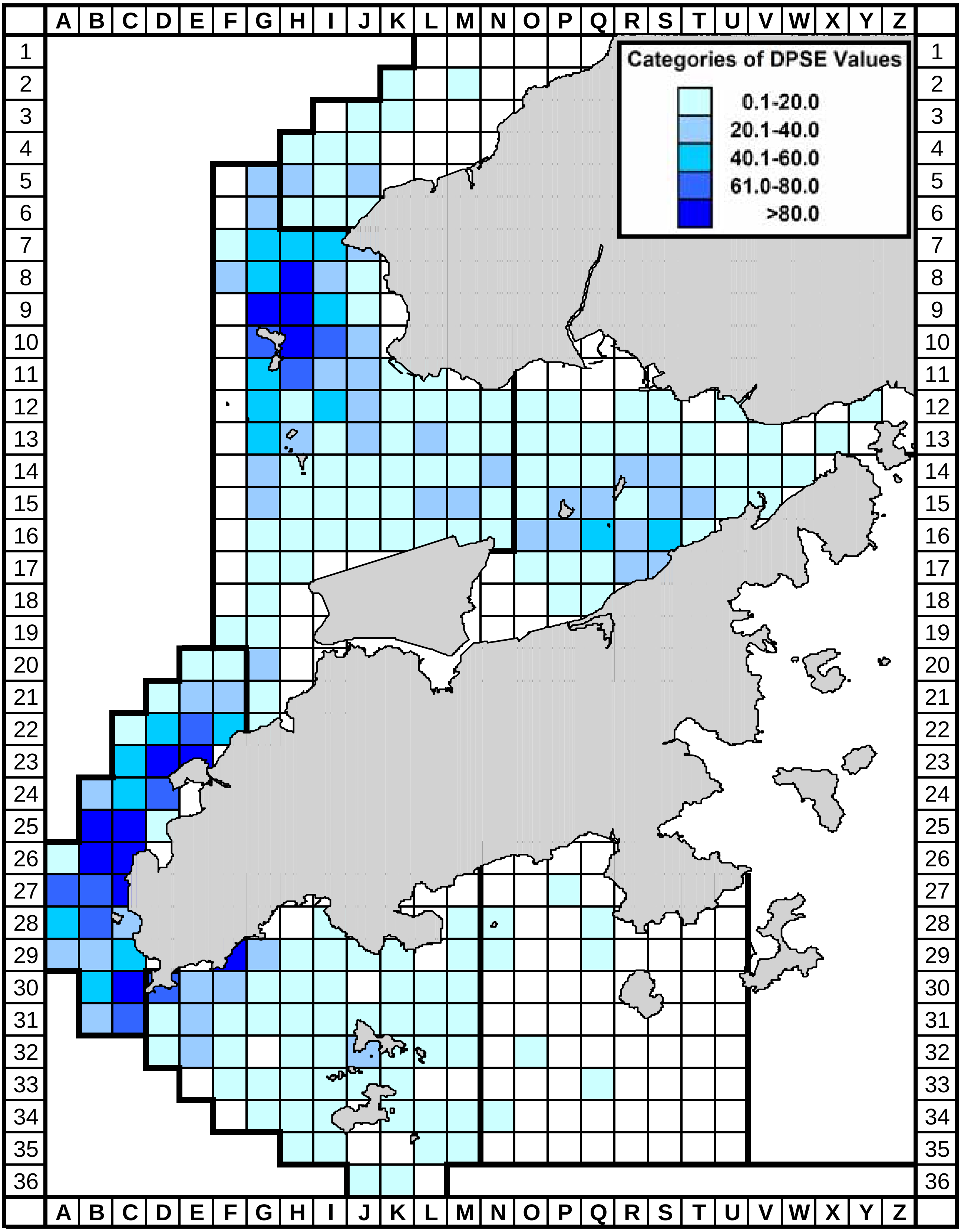


Figure 21. Density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island, using data collected during 2002-09 (DPSE = no. of dolphins per 100 units of survey effort)

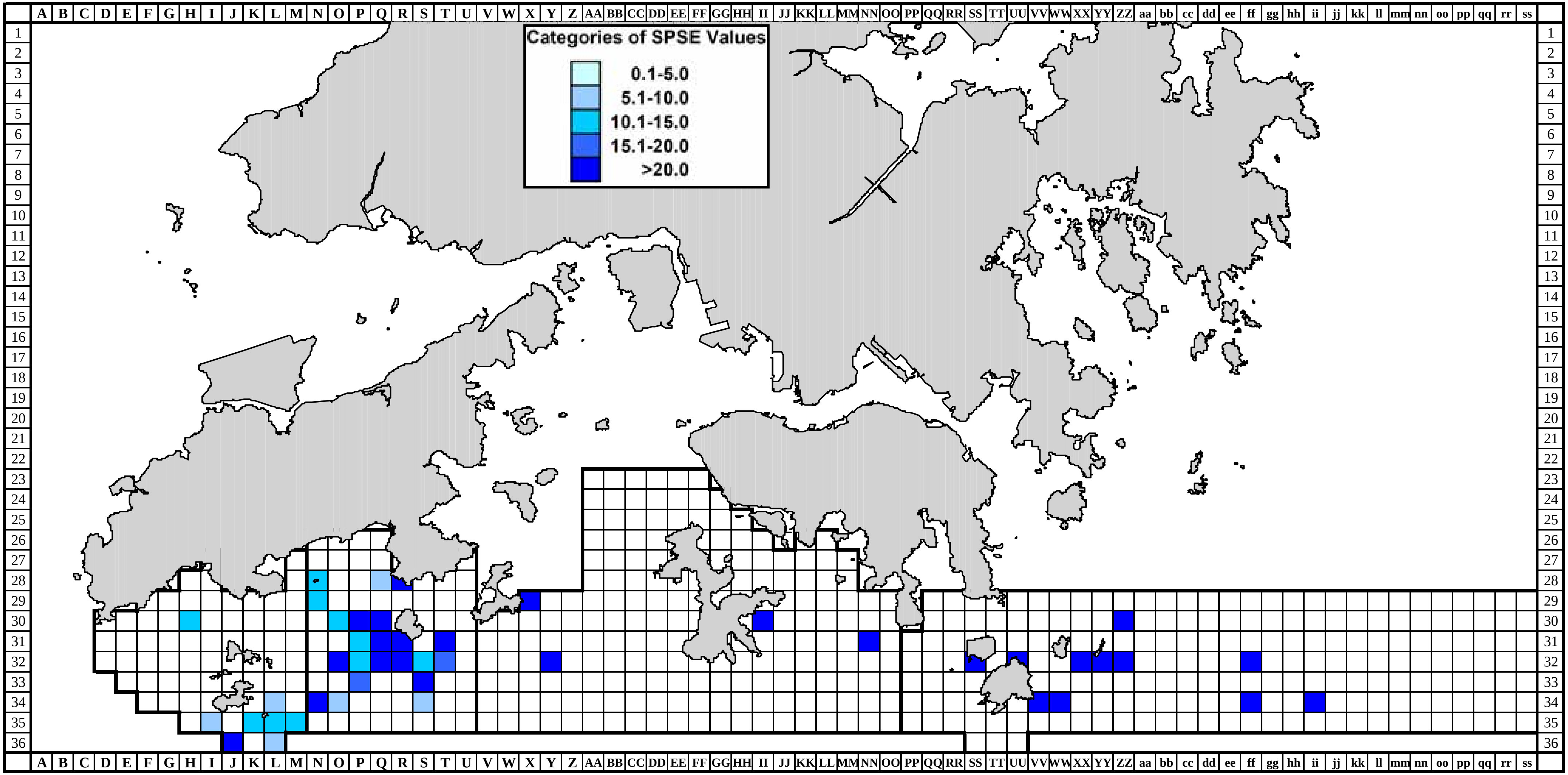


Figure 22. Sighting density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong, using data collected during 2009-10 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort)

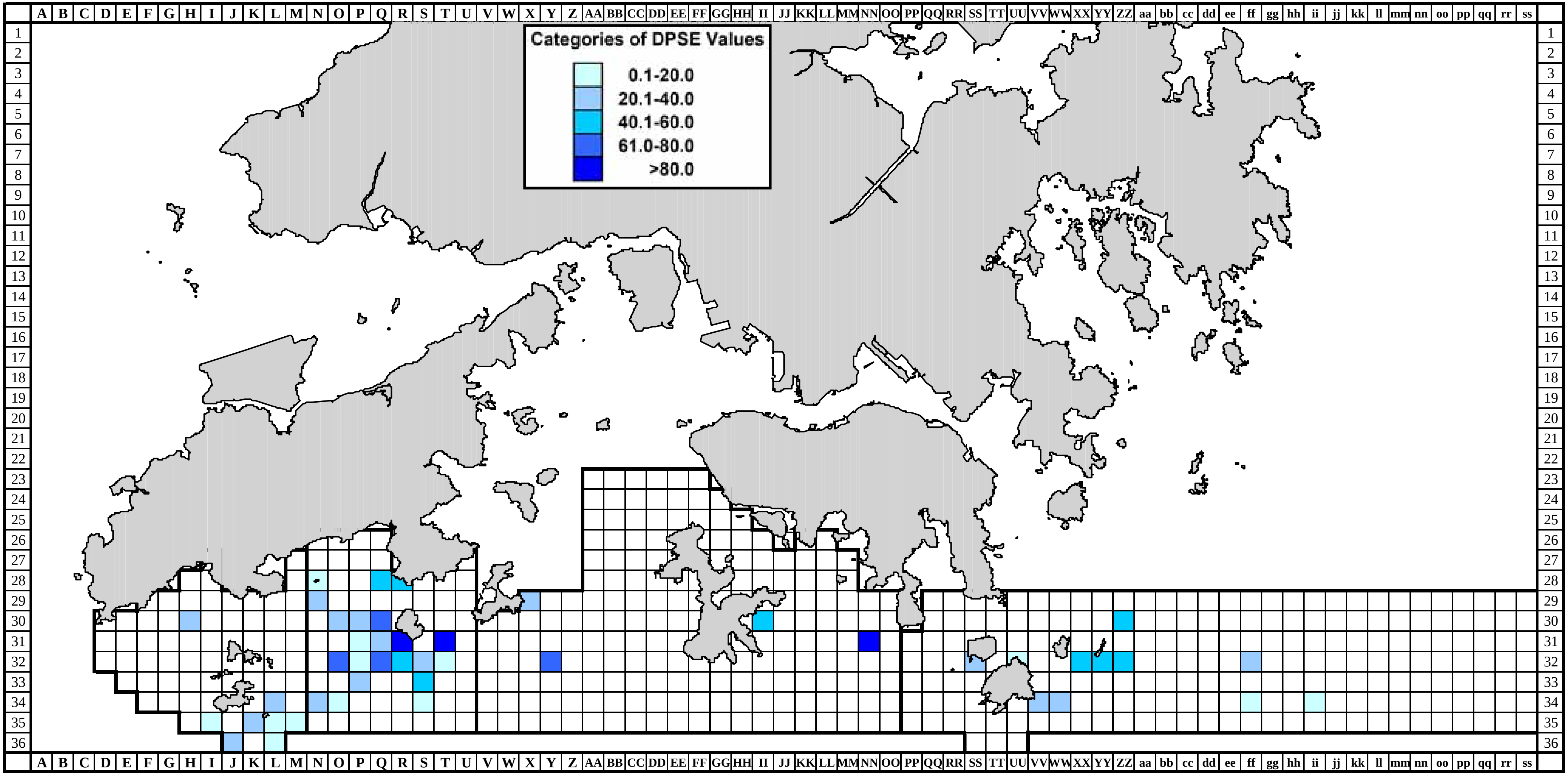


Figure 23. Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong, using data collected during 2009-10 (DPSE = no. of porpoises per 100 units of survey effort)

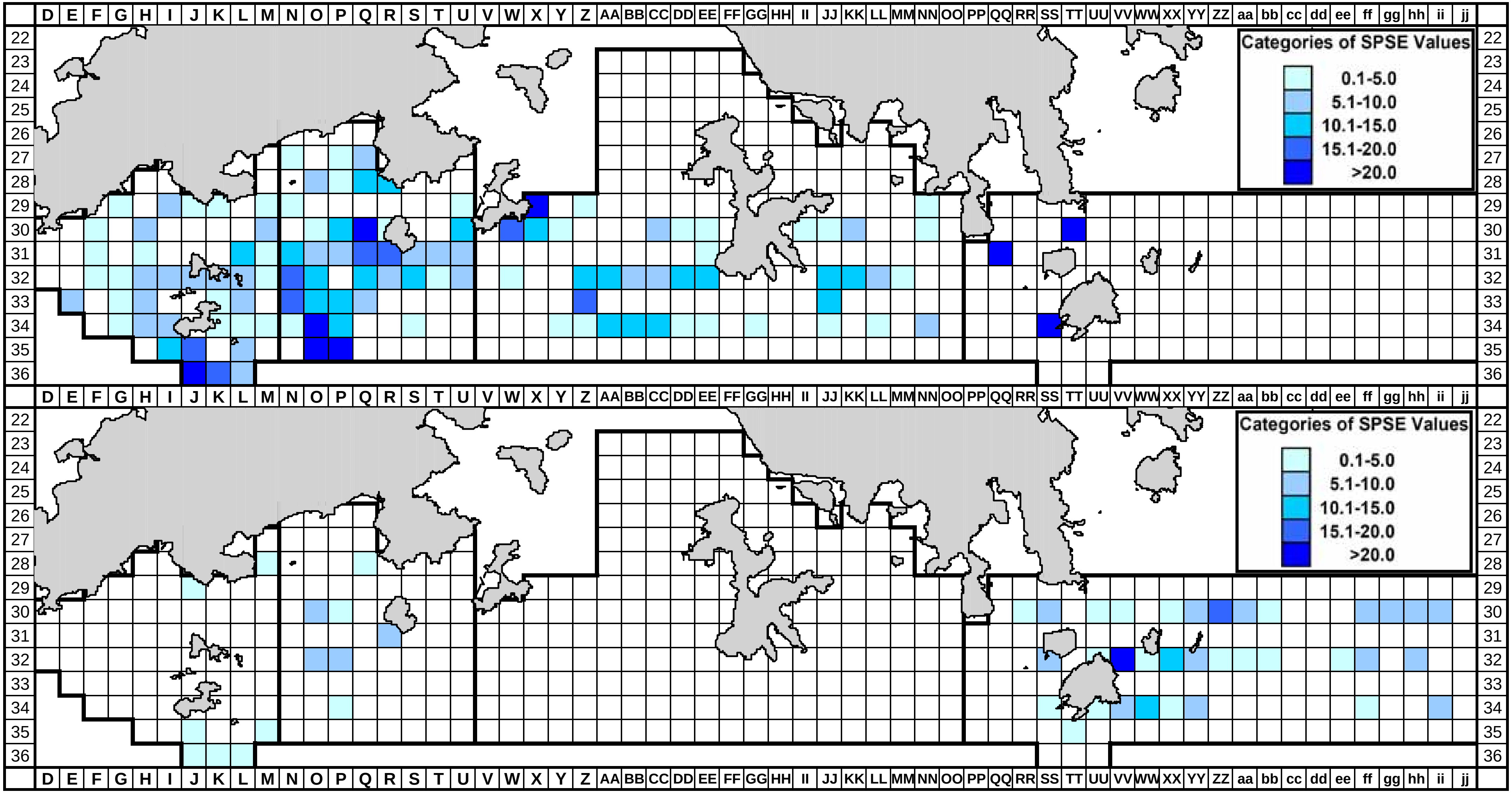


Figure 24. Sighting density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (top) and wet season (bottom) using data collected during 2004-09 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort)

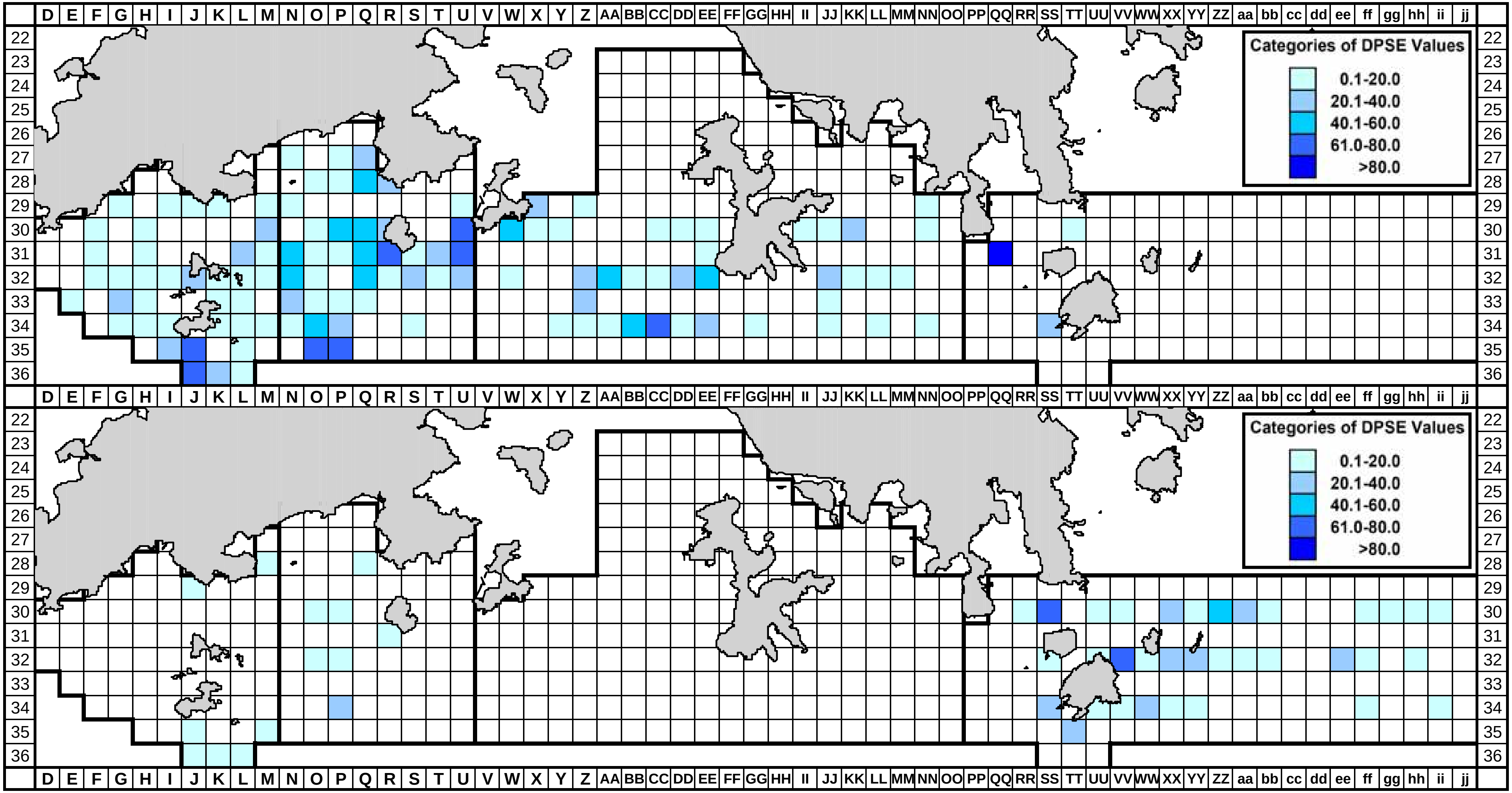


Figure 25. Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (top) and wet season (bottom), using data collected during 2004-09 (DPSE = no. of porpoises per 100 units of survey effort)

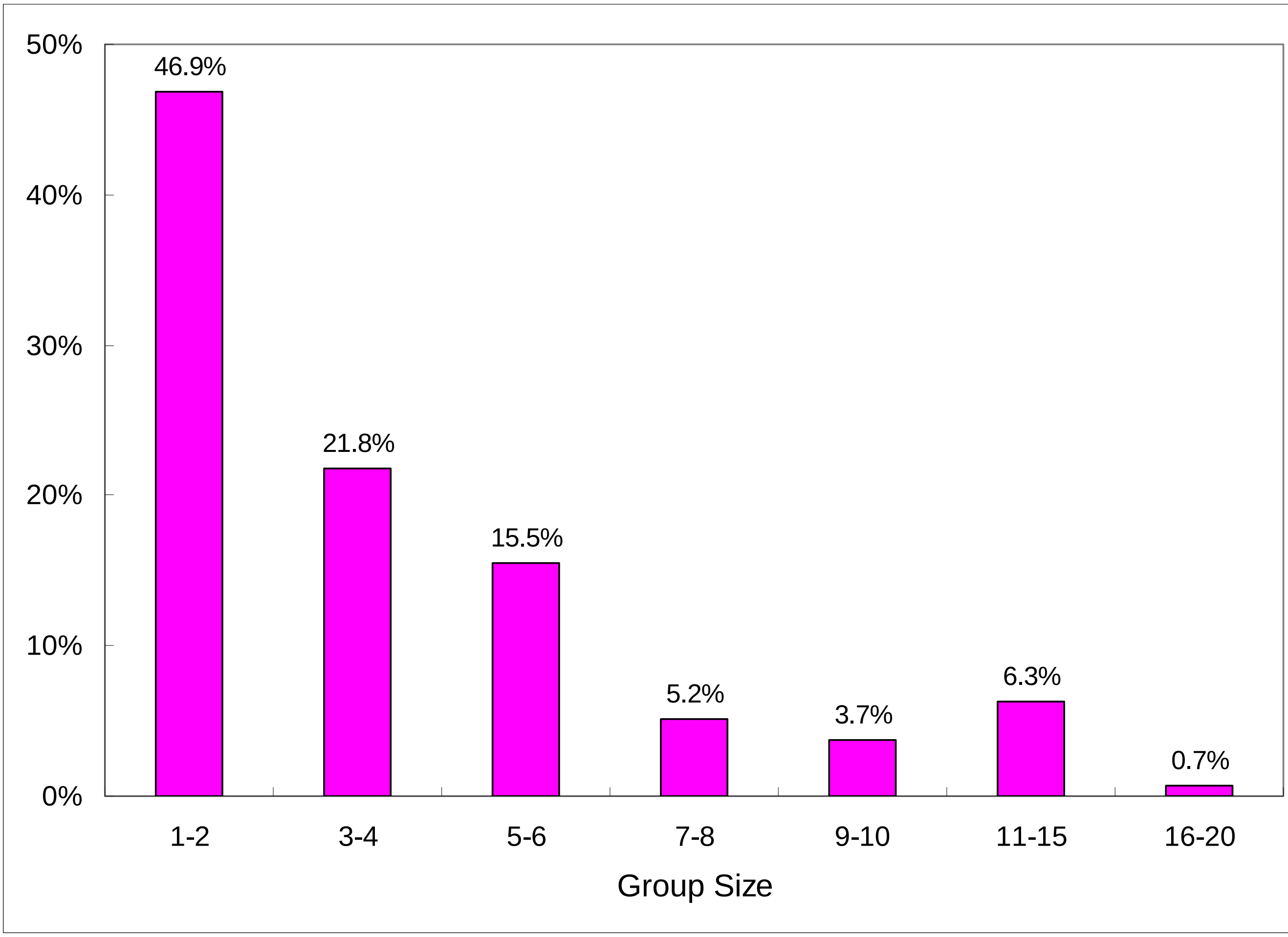


Figure 26. Percentages of different group sizes of Chinese white dolphins in Hong Kong during 2009-10

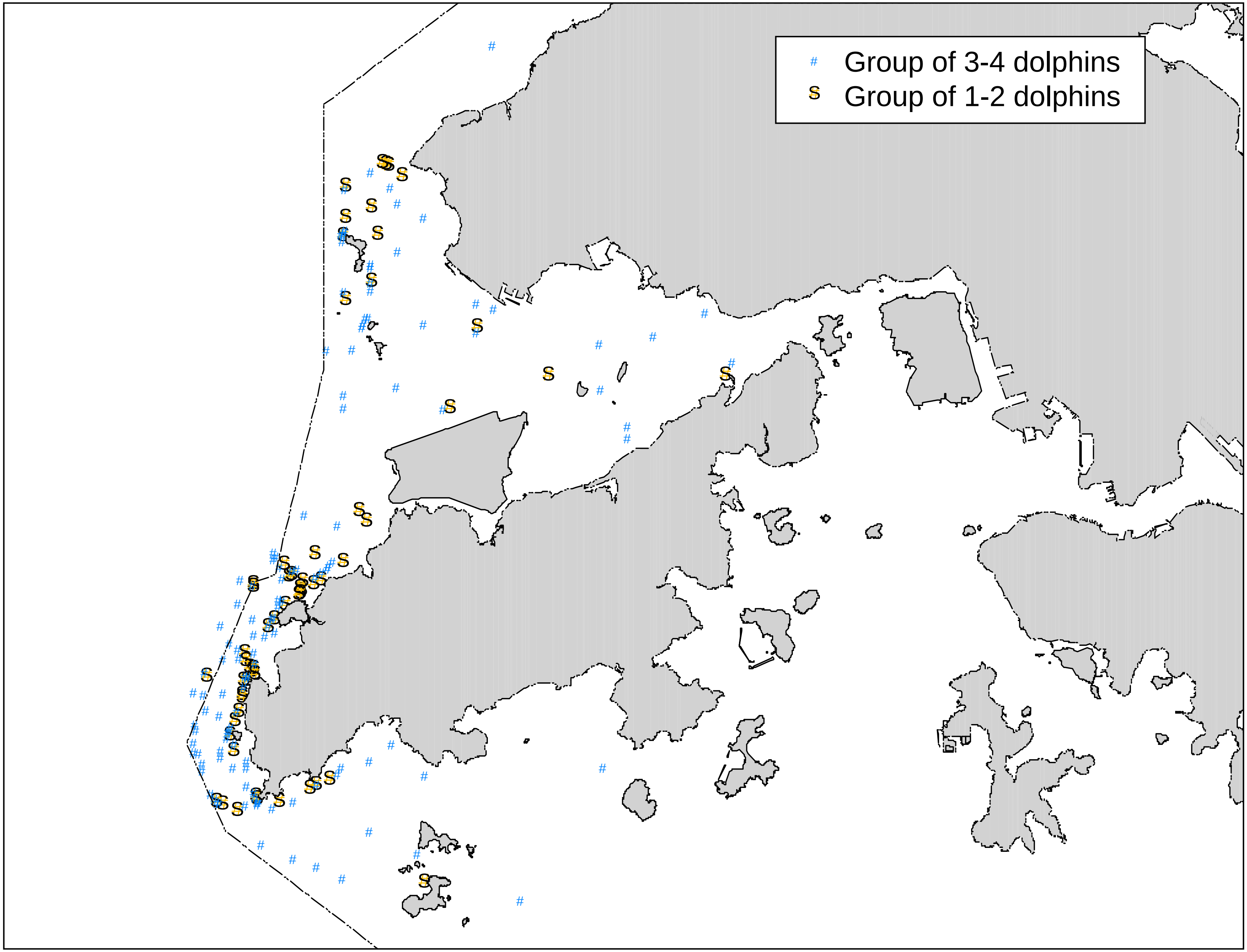


Figure 27. Distribution of Chinese white dolphins with small group sizes (April 2009 – March 2010)

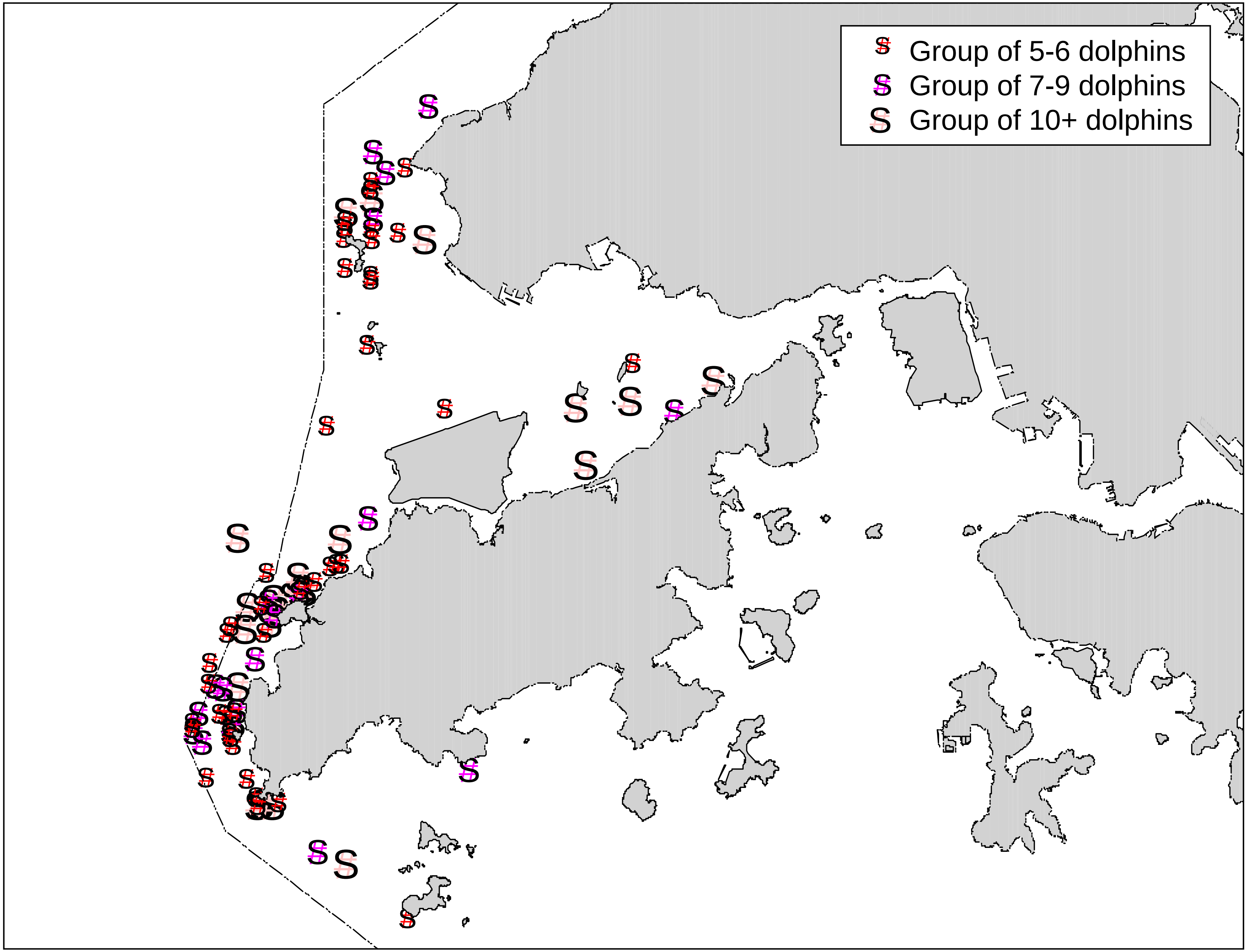
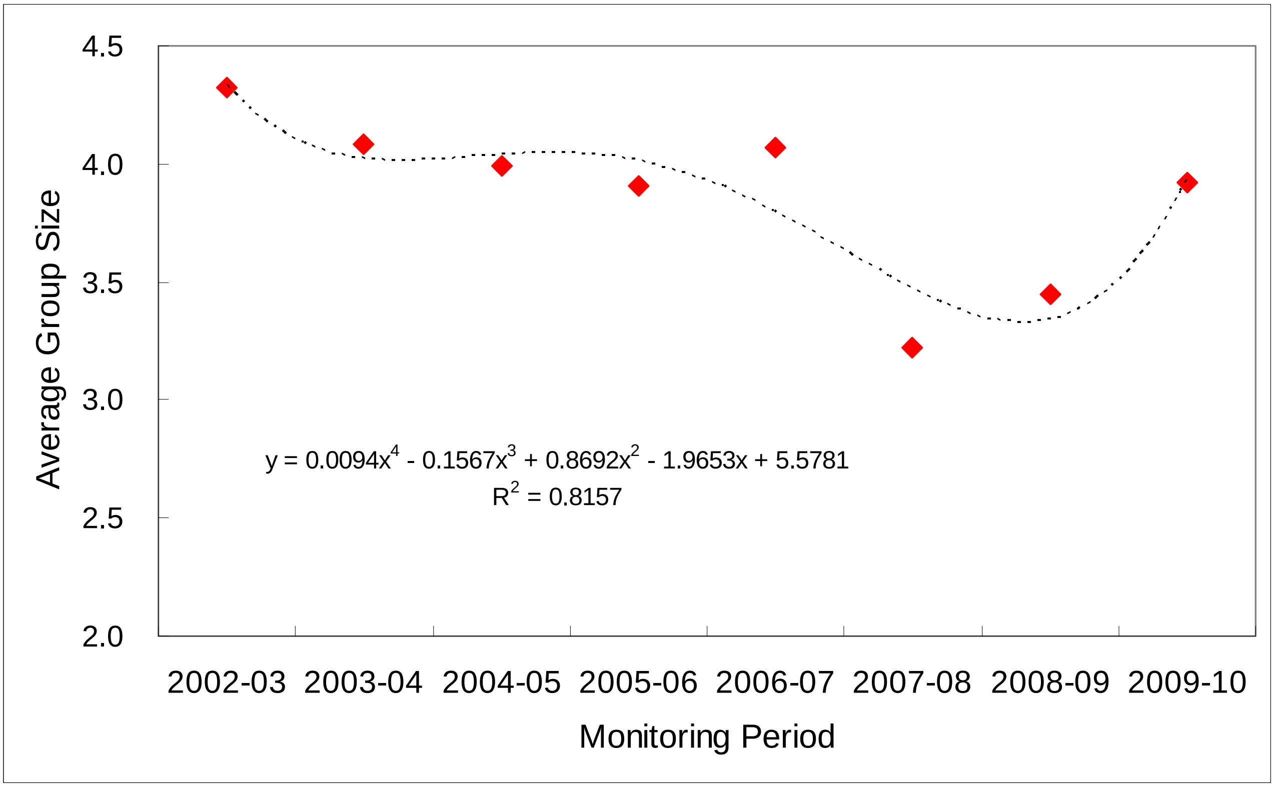


Figure 28. Distribution of Chinese white dolphins with medium and large group sizes (April 2009 – March 2010)

(a)



(b)

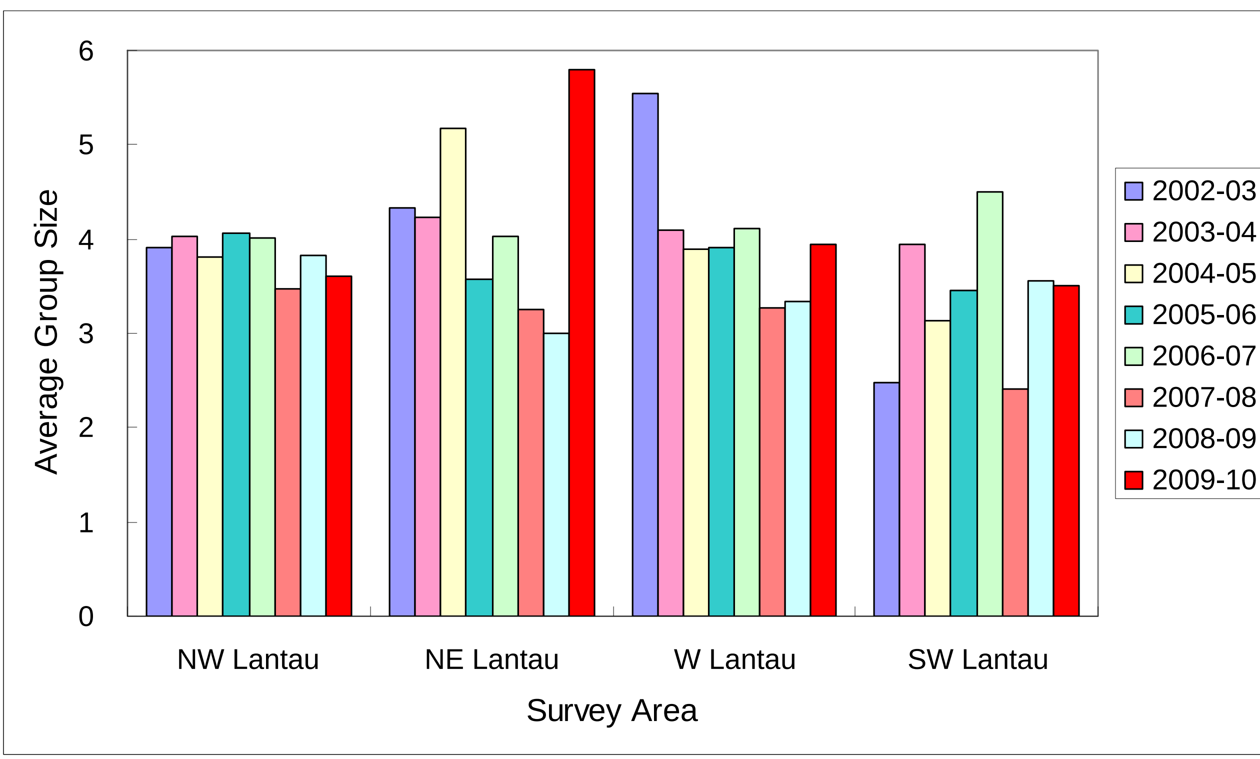


Figure 29(a) Temporal trend of mean group size in 2002-10; (b) Temporal trend of mean group sizes among different areas in 2002-10

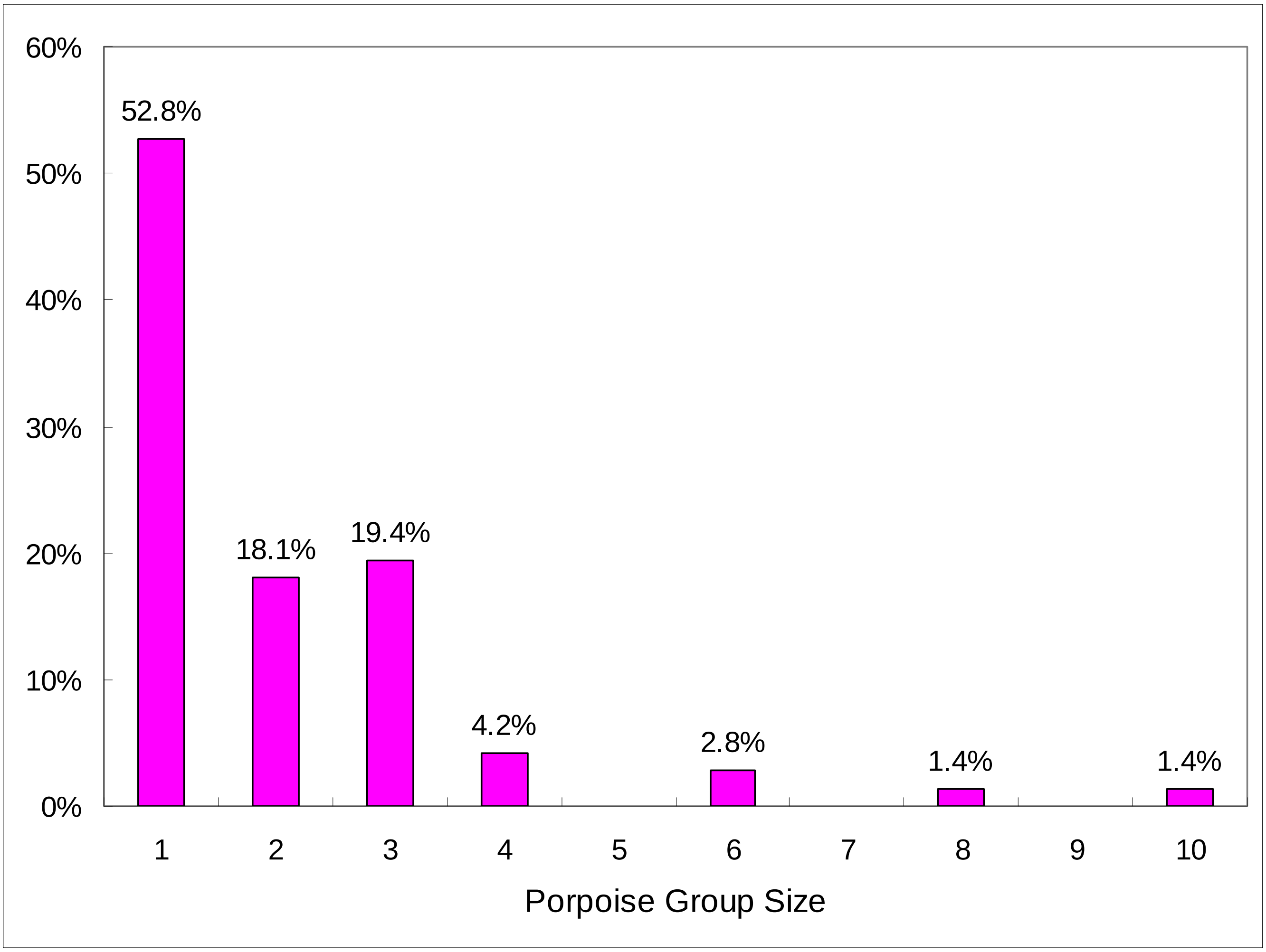


Figure 30. Percentages of different group sizes of finless porpoises in Hong Kong during 2009-10

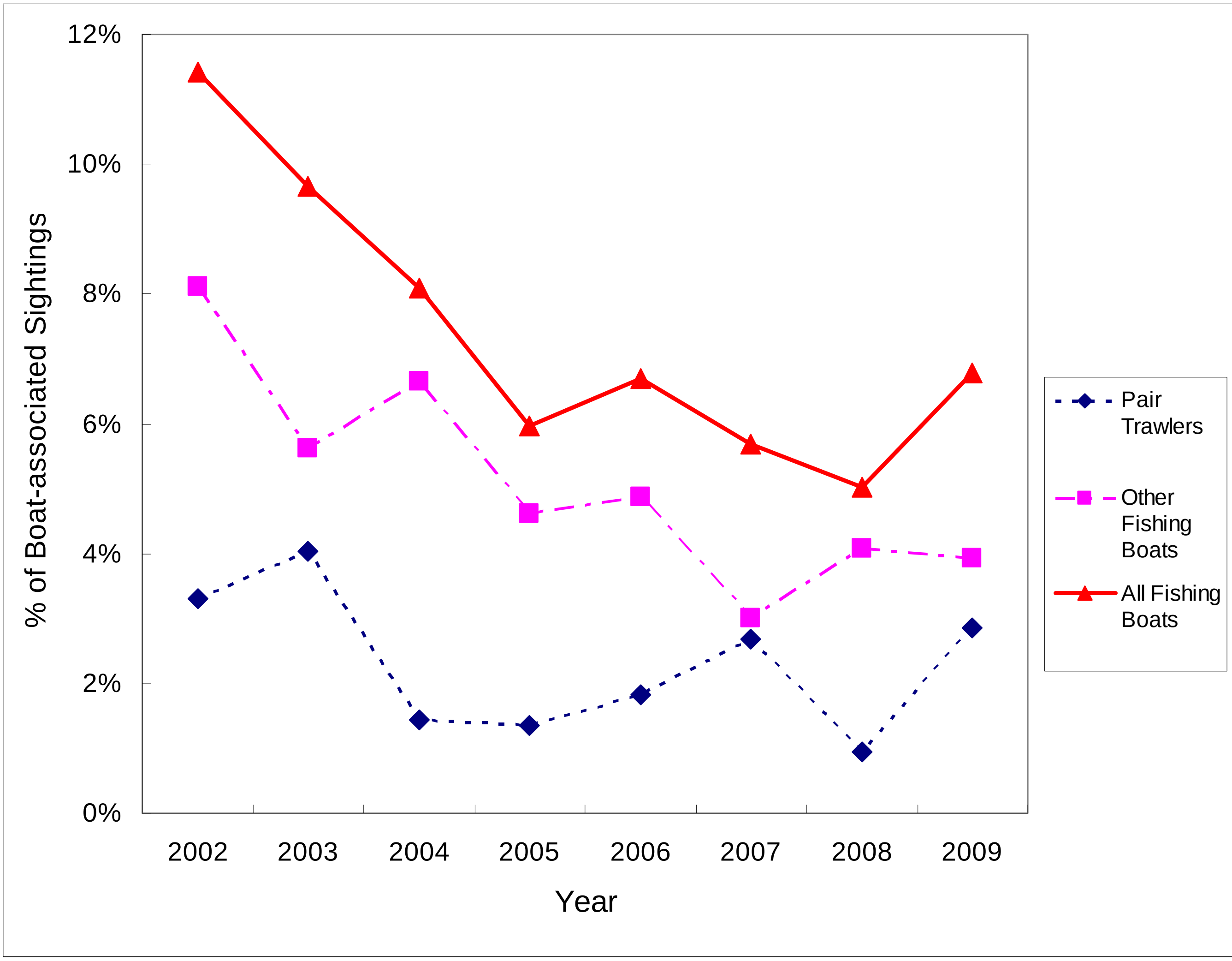


Figure 31. Temporal trend of percentages of dolphin groups in association with fishing boats in Hong Kong from 2002-09

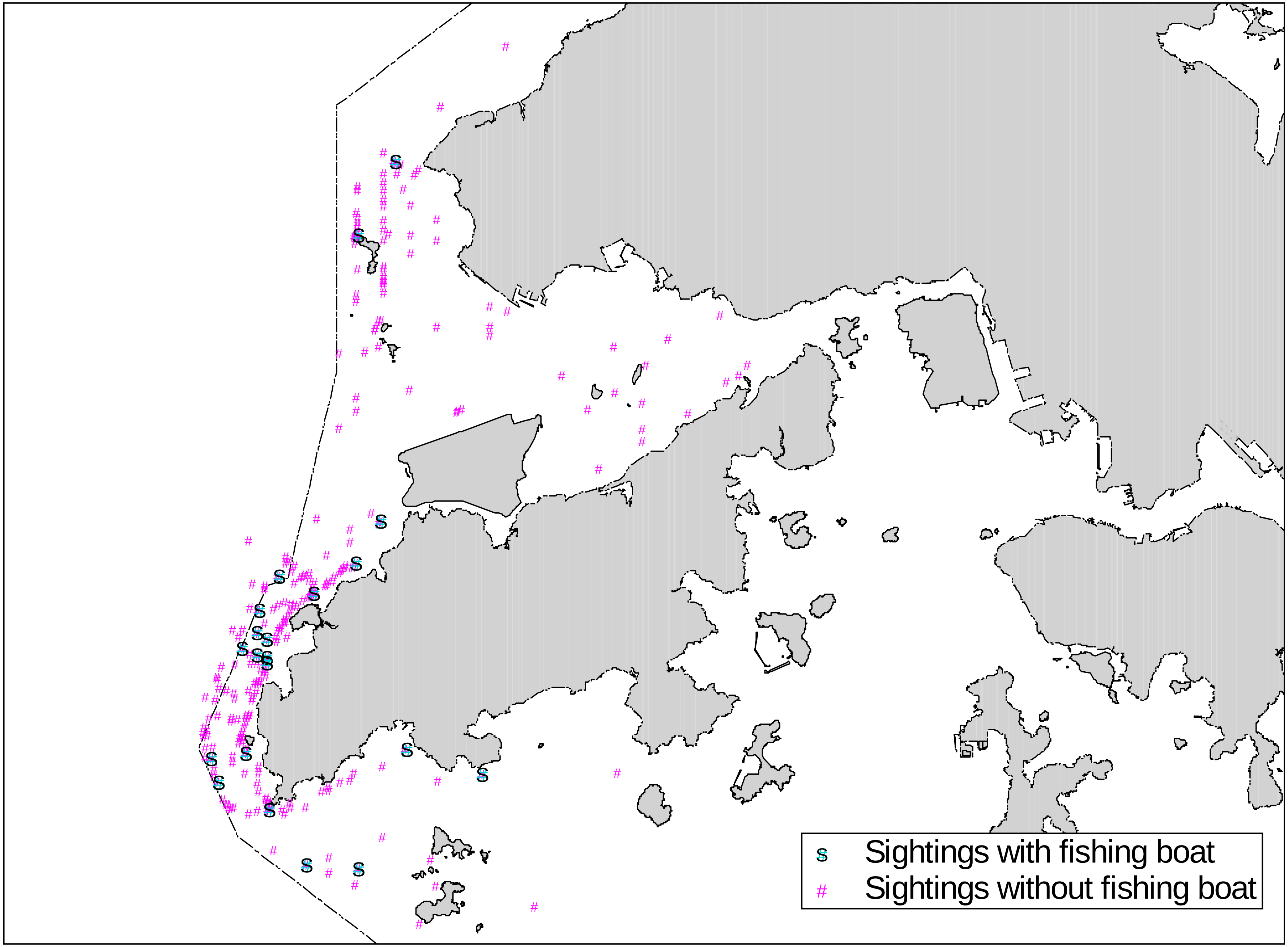


Figure 32. Distribution of dolphin sightings associated with and without fishing boats (April 2009 – March 2010)

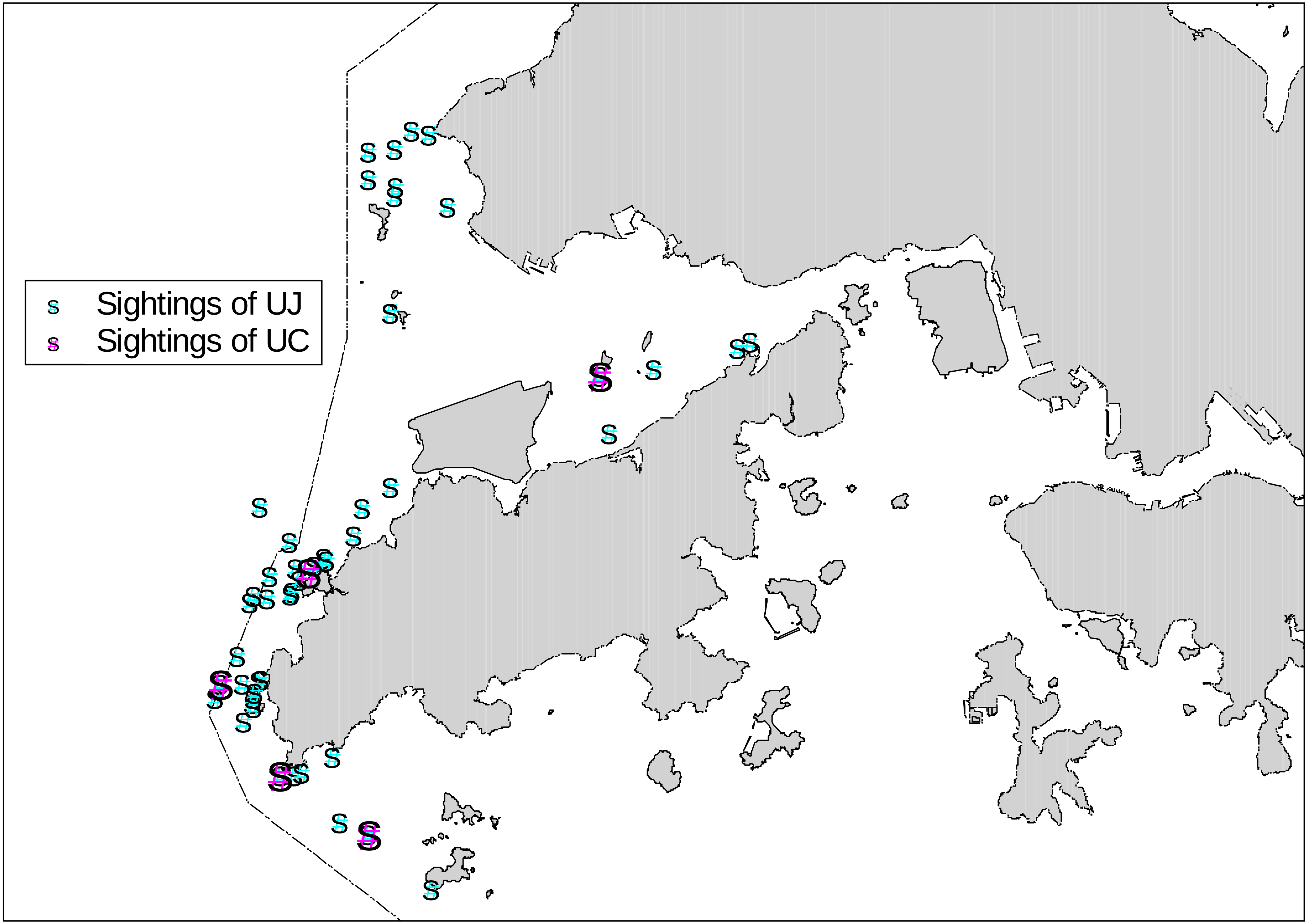


Figure 33. Distribution of sightings of Unspotted Calves (UC) & Unspotted Juveniles (UJ) (April 2009 – March 2010)

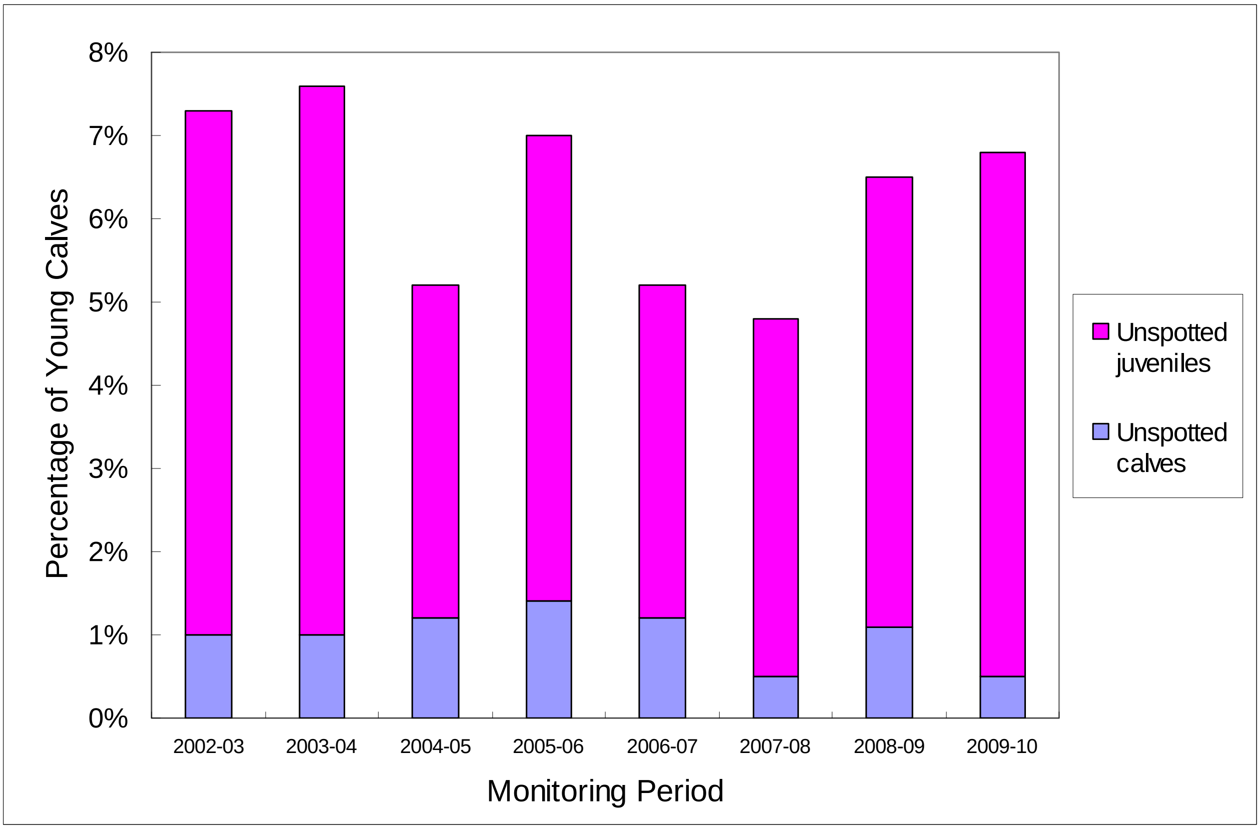


Figure 34a. Percentages of young calves (including unspotted calves and unspotted juveniles) among dolphin groups in Hong Kong during 2002-10

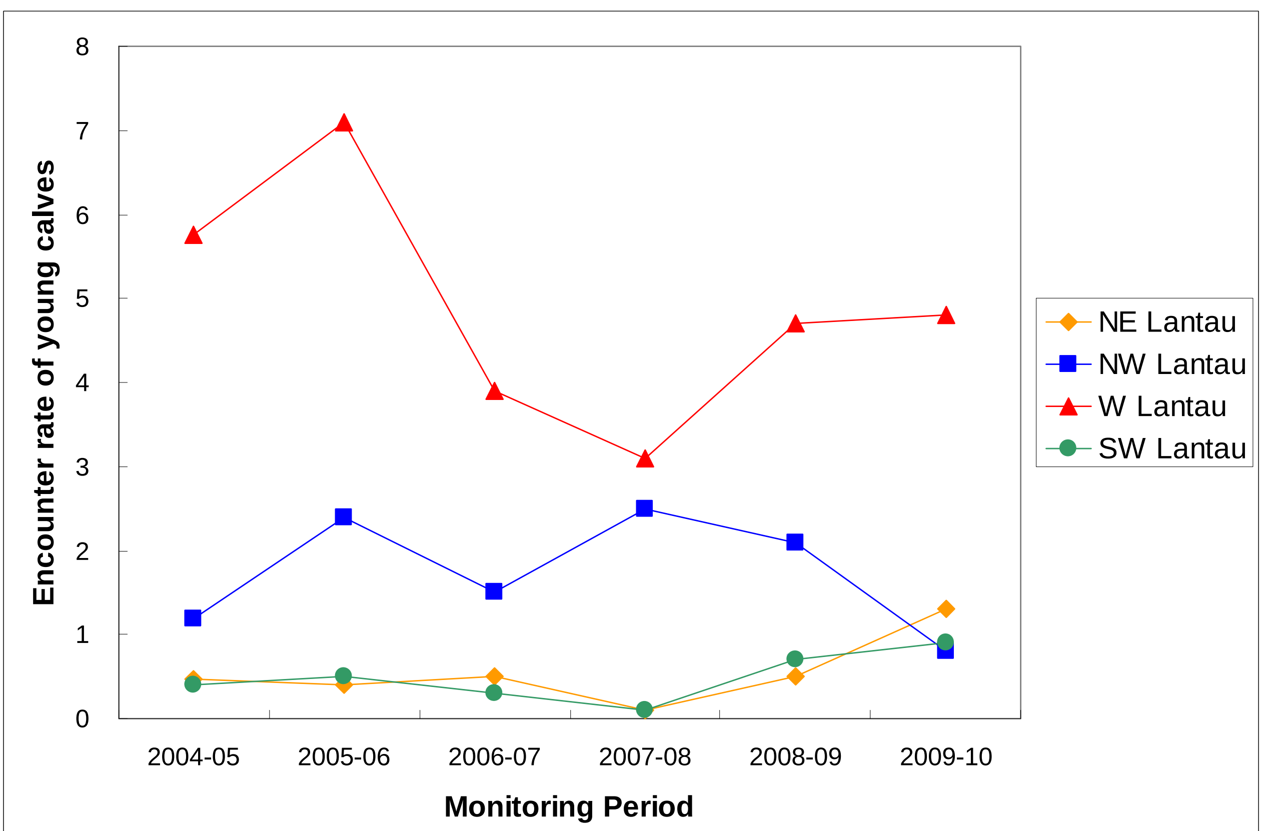


Figure 34b. Temporal trends of encounter rates of young calves (including unspotted calves and unspotted juveniles) in 2004-10

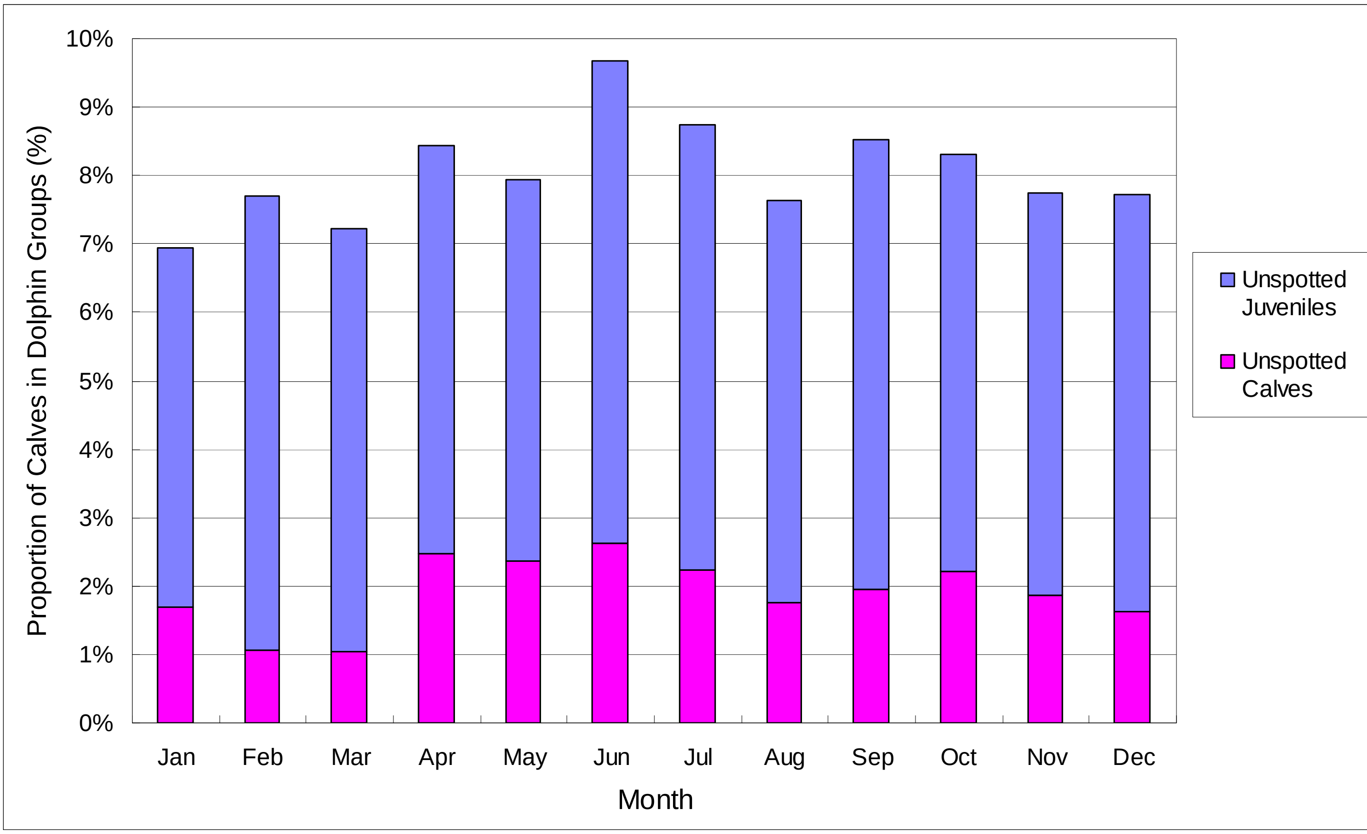


Figure 35. Monthly percentages of young calves (unspotted calves and juveniles) among all dolphin groups sighted in Hong Kong during 1996-2009.

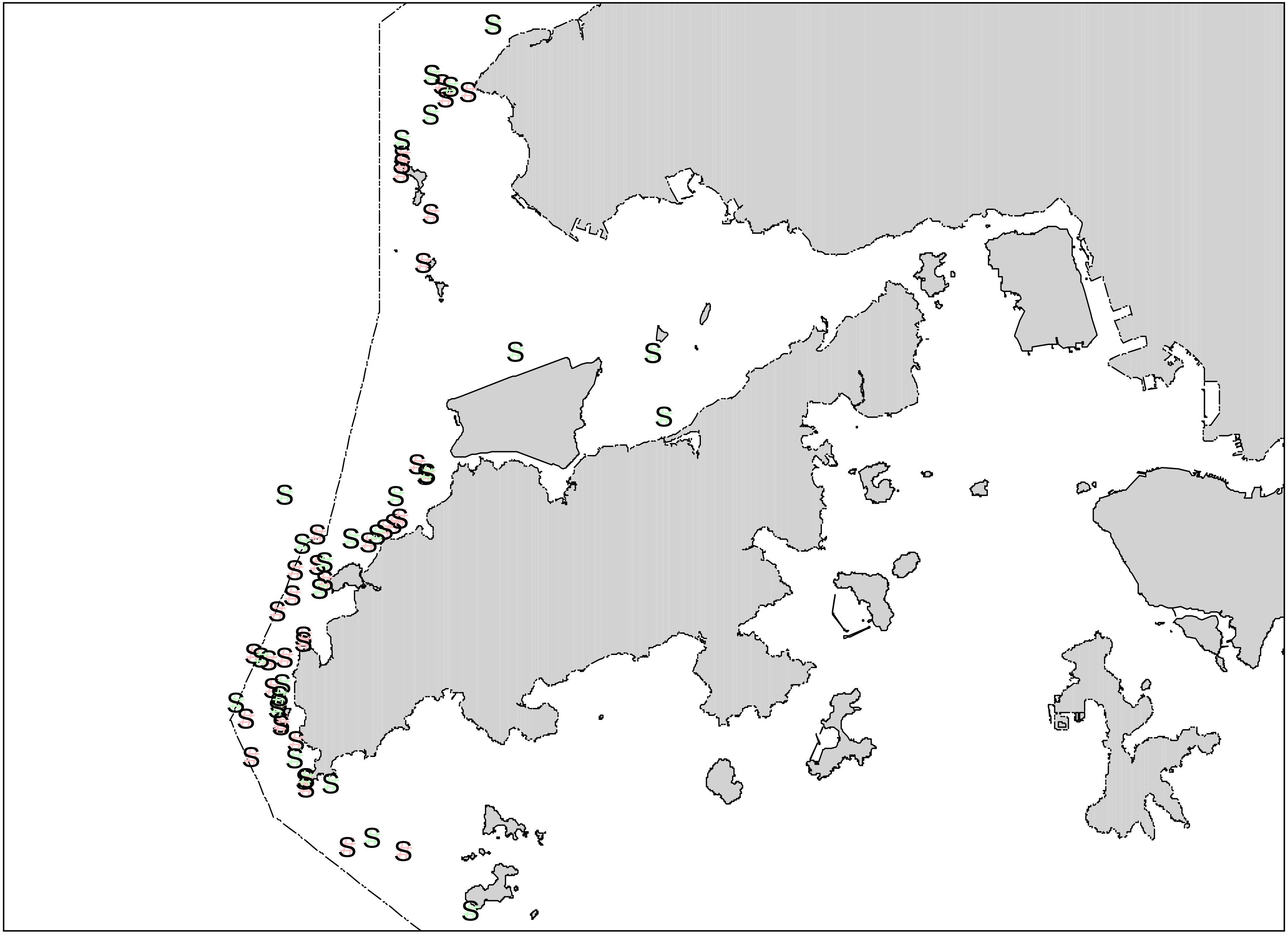


Figure 36. Distribution of Chinese white dolphins engaged in feeding (pink dots) and socializing (green dots) activities (April 2009 – March 2010)

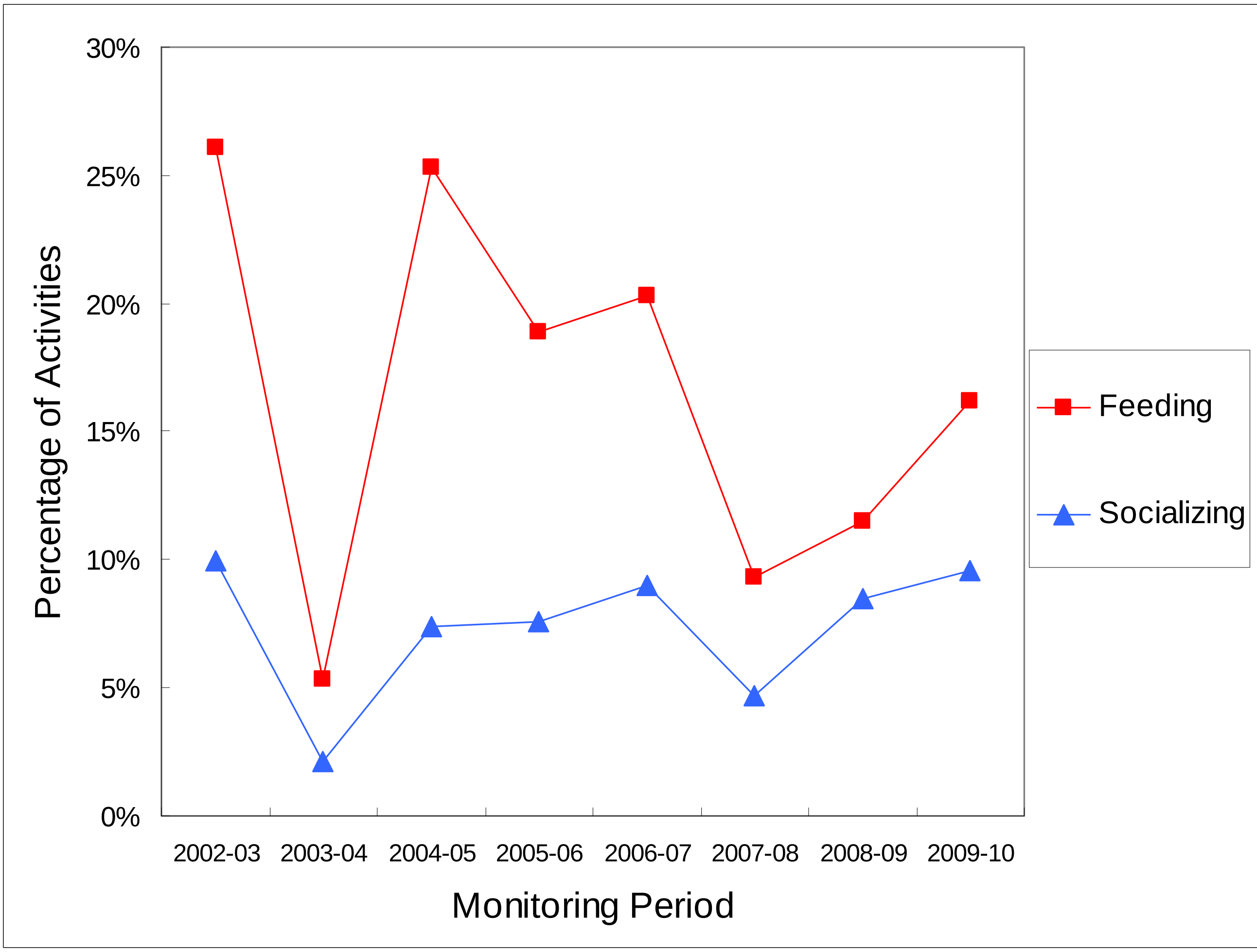


Figure 37. Percentages of feeding and socializing activities among all dolphin groups sighted in Hong Kong during 2002-10

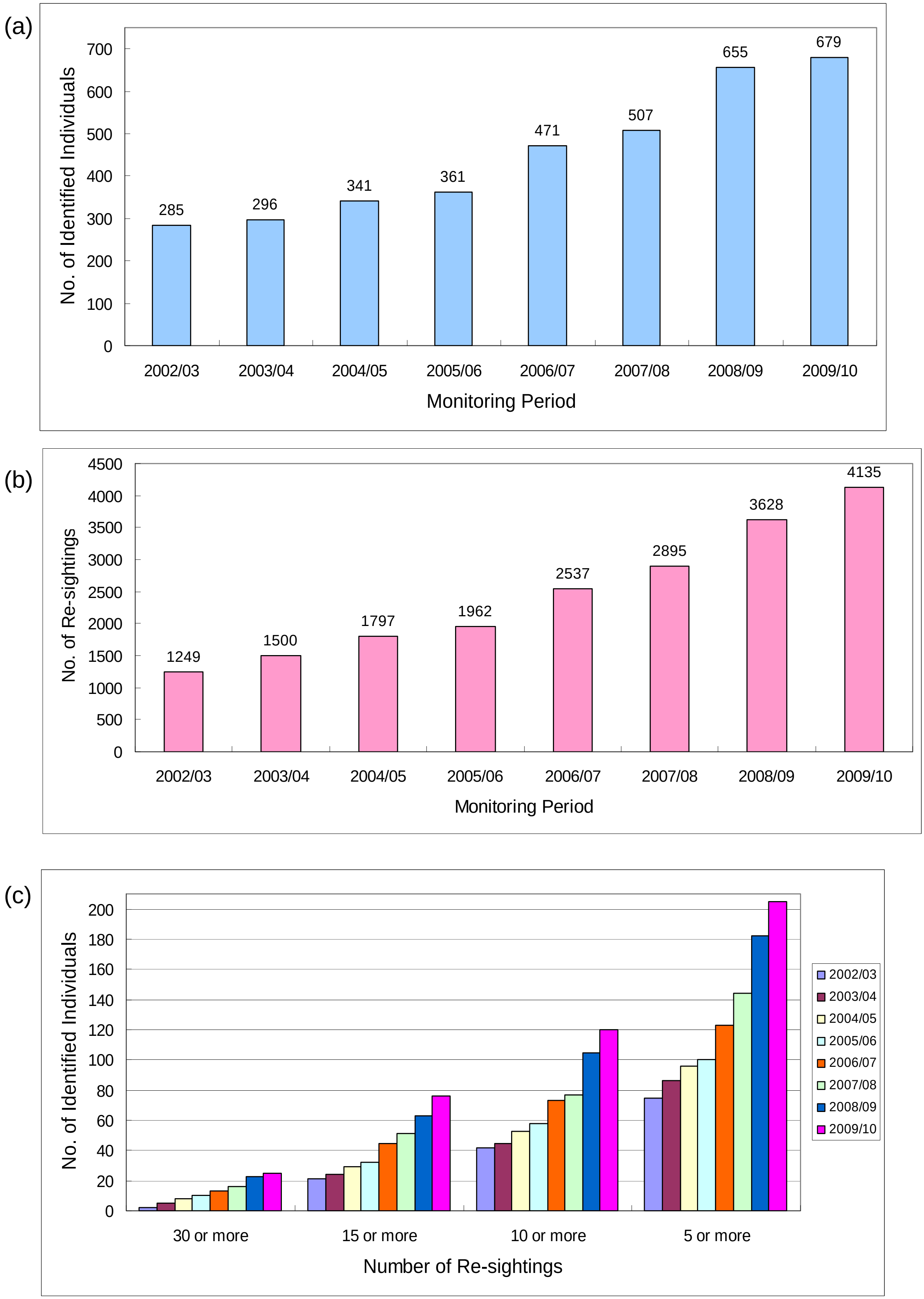


Figure 38. Temporal trends of (a) total number of identified individuals; (b) total number of re-sightings made; and (c) number of identified individuals within several categories of number of re-sightings in the past eight monitoring periods.

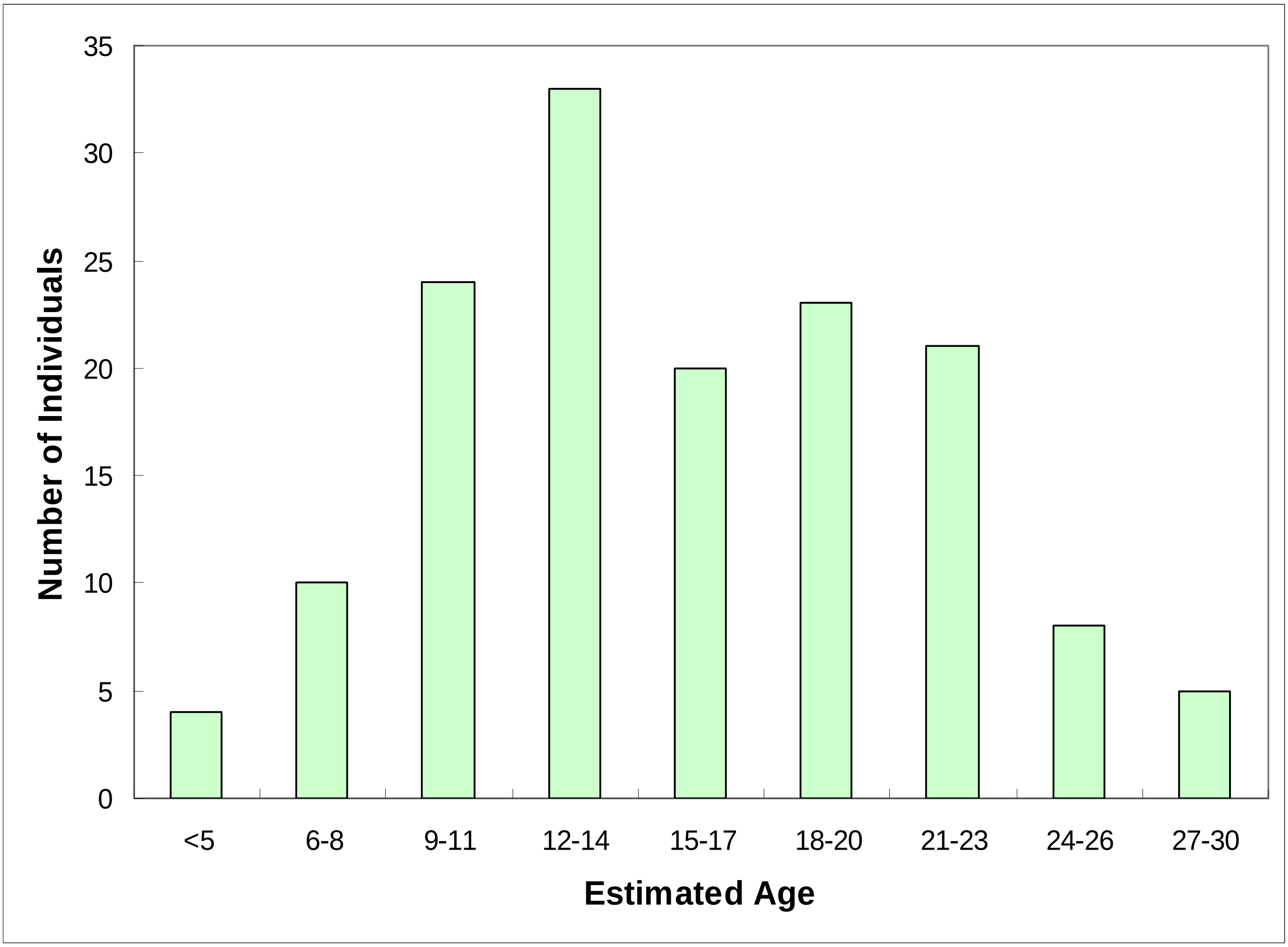


Figure 39. Estimated minimum age of 148 individual dolphins identified in the photo-ID catalogue, based on their age classes and by making some assumptions of their age when they were first seen.

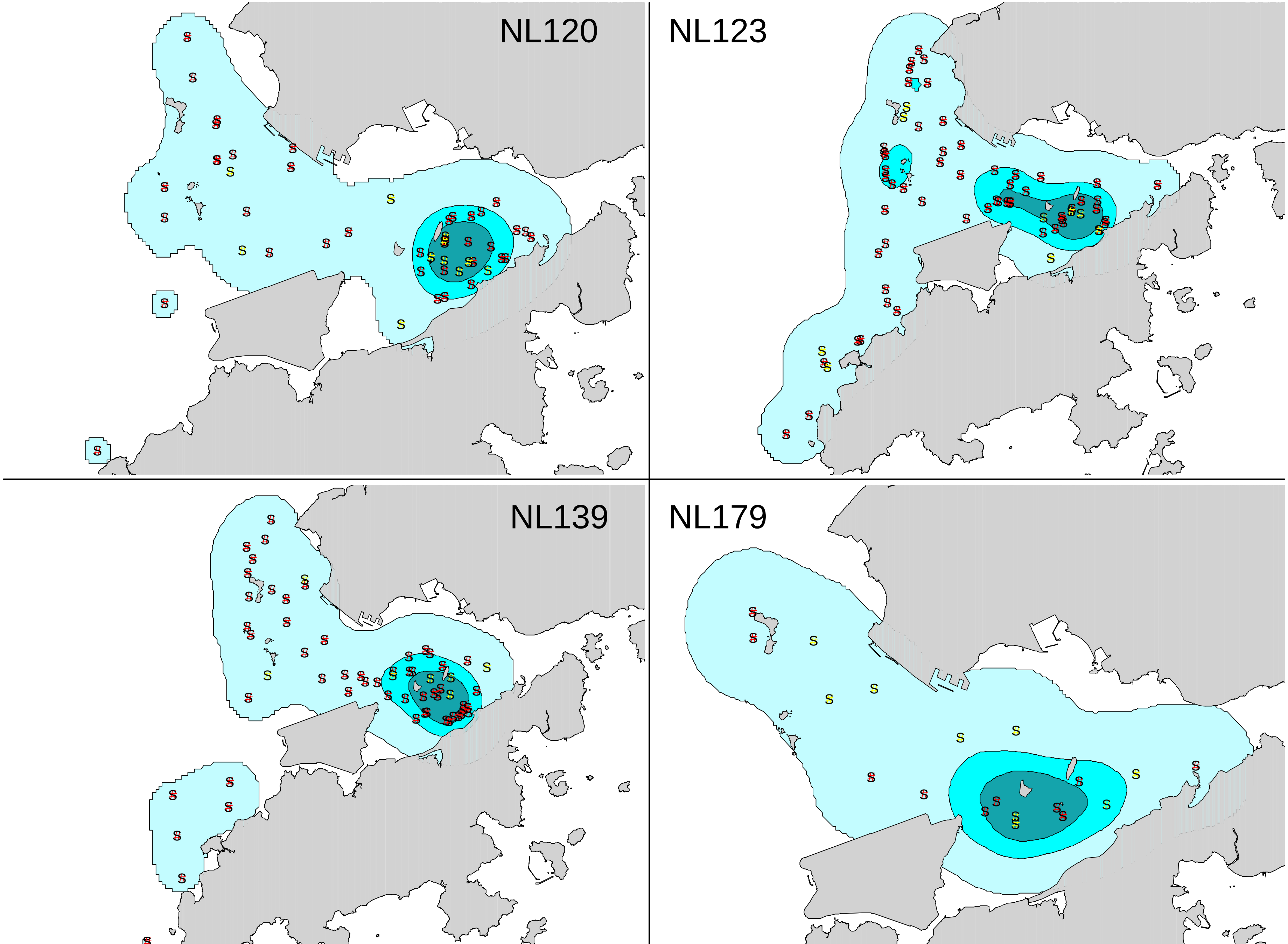


Figure 40. Ranging patterns of four individuals with their core areas centered around the Brothers Islands

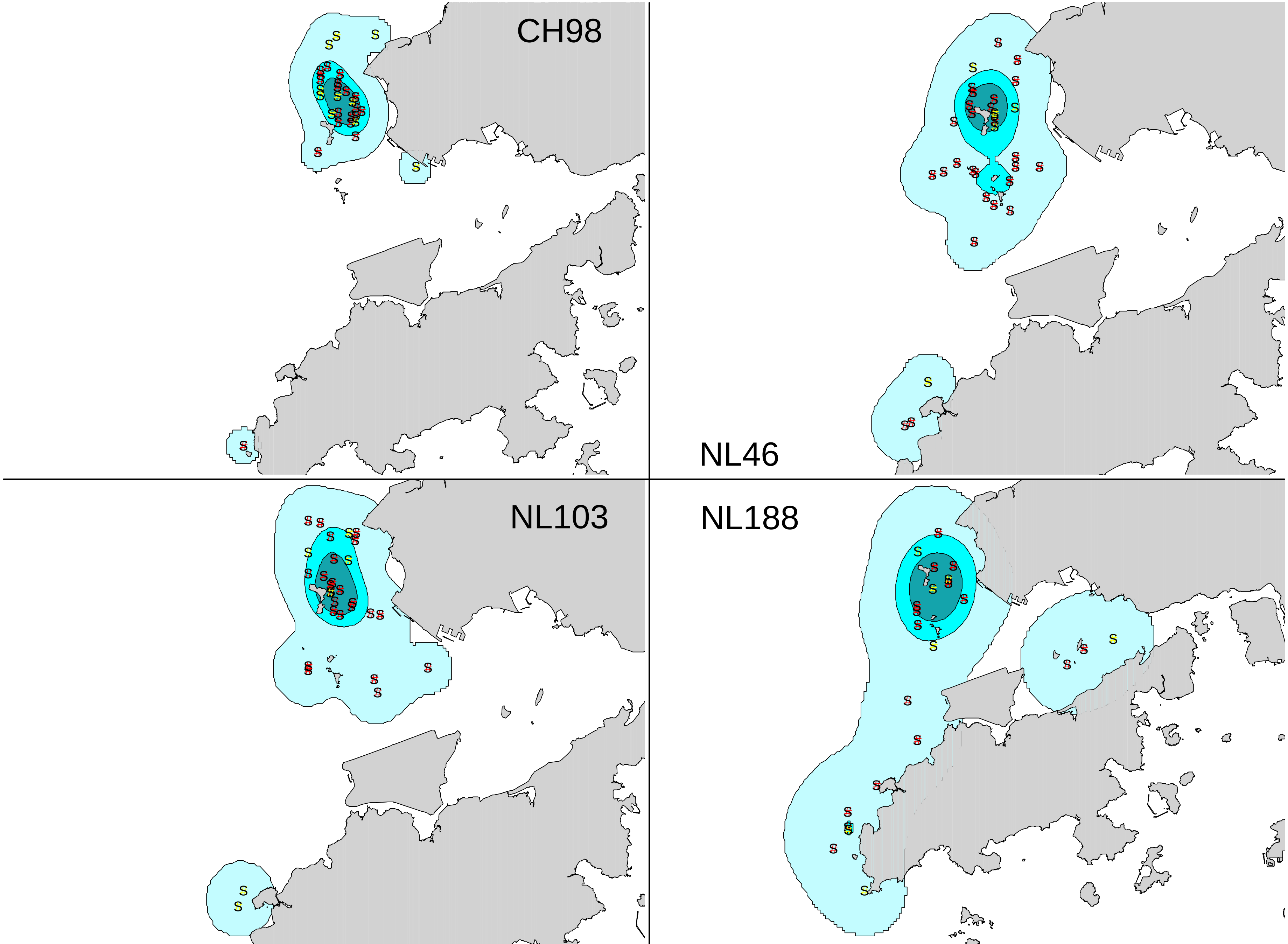


Figure 41. Ranging patterns of four individuals with their core areas centered around SC & LKC Marine Park

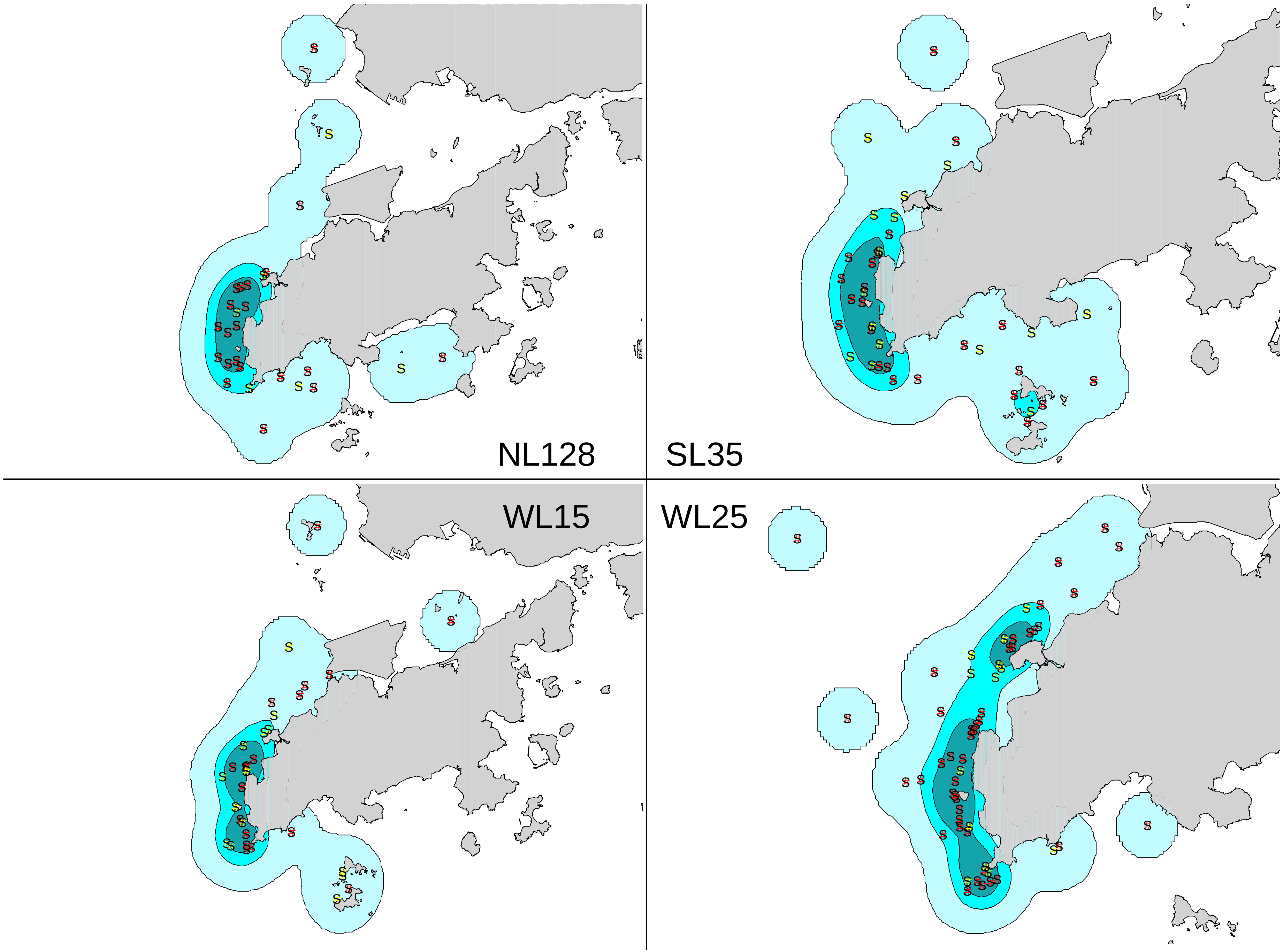


Figure 42. Ranging patterns of four individuals with their core areas centered along west coast of Lantau

Appendix I. Survey effort database (April 2009 - March 2010)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
8-Apr-09	W LANTAU	2	20.7	SPRING	STANDARD31516	OPERATIONAL
8-Apr-09	NW LANTAU	2	20.9	SPRING	STANDARD31516	OPERATIONAL
8-Apr-09	NW LANTAU	3	0.8	SPRING	STANDARD31516	OPERATIONAL
8-Apr-09	DEEP BAY	3	14.7	SPRING	STANDARD31516	OPERATIONAL
15-Apr-09	W LANTAU	2	12.0	SPRING	STANDARD31516	OPERATIONAL
15-Apr-09	W LANTAU	3	6.1	SPRING	STANDARD31516	OPERATIONAL
15-Apr-09	W LANTAU	4	3.7	SPRING	STANDARD31516	OPERATIONAL
15-Apr-09	NW LANTAU	2	5.5	SPRING	STANDARD31516	OPERATIONAL
15-Apr-09	NW LANTAU	3	16.7	SPRING	STANDARD31516	OPERATIONAL
15-Apr-09	NW LANTAU	4	2.7	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	W LANTAU	2	6.8	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	W LANTAU	3	2.3	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	SW LANTAU	2	3.8	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	SW LANTAU	3	23.0	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	SW LANTAU	4	10.0	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	SE LANTAU	2	9.7	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	SE LANTAU	3	18.4	SPRING	STANDARD31516	OPERATIONAL
16-Apr-09	SE LANTAU	4	2.8	SPRING	STANDARD31516	OPERATIONAL
21-Apr-09	LAMMA	1	12.2	SPRING	STANDARD31516	OPERATIONAL
21-Apr-09	LAMMA	2	23.0	SPRING	STANDARD31516	OPERATIONAL
21-Apr-09	LAMMA	3	15.3	SPRING	STANDARD31516	OPERATIONAL
21-Apr-09	LAMMA	4	13.8	SPRING	STANDARD31516	OPERATIONAL
22-Apr-09	LAMMA	5	15.3	SPRING	STANDARD31516	OPERATIONAL
30-Apr-09	NE LANTAU	2	14.8	SPRING	STANDARD31516	OPERATIONAL
30-Apr-09	NE LANTAU	3	14.5	SPRING	STANDARD31516	OPERATIONAL
5-May-09	NE LANTAU	2	6.1	SPRING	STANDARD31516	OPERATIONAL
5-May-09	NE LANTAU	3	25.5	SPRING	STANDARD31516	OPERATIONAL
5-May-09	NE LANTAU	4	1.3	SPRING	STANDARD31516	OPERATIONAL
6-May-09	NW LANTAU	2	1.2	SPRING	STANDARD31516	OPERATIONAL
6-May-09	NW LANTAU	3	14.3	SPRING	STANDARD31516	OPERATIONAL
6-May-09	NW LANTAU	4	6.9	SPRING	STANDARD31516	OPERATIONAL
6-May-09	DEEP BAY	1	4.3	SPRING	STANDARD31516	OPERATIONAL
6-May-09	DEEP BAY	2	10.4	SPRING	STANDARD31516	OPERATIONAL
6-May-09	DEEP BAY	3	0.5	SPRING	STANDARD31516	OPERATIONAL
6-May-09	W LANTAU	2	8.4	SPRING	STANDARD31516	OPERATIONAL
6-May-09	W LANTAU	3	3.8	SPRING	STANDARD31516	OPERATIONAL
6-May-09	W LANTAU	4	4.1	SPRING	STANDARD31516	OPERATIONAL
6-May-09	W LANTAU	5	1.2	SPRING	STANDARD31516	OPERATIONAL
7-May-09	W LANTAU	2	2.3	SPRING	STANDARD31516	OPERATIONAL
7-May-09	W LANTAU	3	8.9	SPRING	STANDARD31516	OPERATIONAL
7-May-09	W LANTAU	4	10.2	SPRING	STANDARD31516	OPERATIONAL
7-May-09	W LANTAU	5	0.9	SPRING	STANDARD31516	OPERATIONAL
7-May-09	NW LANTAU	3	11.2	SPRING	STANDARD31516	OPERATIONAL
7-May-09	NW LANTAU	4	6.9	SPRING	STANDARD31516	OPERATIONAL
7-May-09	NE LANTAU	3	16.5	SPRING	STANDARD31516	OPERATIONAL
7-May-09	NE LANTAU	4	3.4	SPRING	STANDARD31516	OPERATIONAL
8-May-09	SE LANTAU	2	1.8	SPRING	STANDARD31516	OPERATIONAL
8-May-09	SE LANTAU	3	23.6	SPRING	STANDARD31516	OPERATIONAL
8-May-09	SW LANTAU	3	6.3	SPRING	STANDARD31516	OPERATIONAL
8-May-09	SW LANTAU	4	17.3	SPRING	STANDARD31516	OPERATIONAL
8-May-09	SW LANTAU	5	14.5	SPRING	STANDARD31516	OPERATIONAL
8-May-09	W LANTAU	2	2.3	SPRING	STANDARD31516	OPERATIONAL
8-May-09	W LANTAU	3	6.5	SPRING	STANDARD31516	OPERATIONAL
8-May-09	W LANTAU	4	2.7	SPRING	STANDARD31516	OPERATIONAL
13-May-09	SE LANTAU	1	2.0	SPRING	STANDARD31516	OPERATIONAL
13-May-09	SE LANTAU	2	31.0	SPRING	STANDARD31516	OPERATIONAL
13-May-09	SW LANTAU	2	29.5	SPRING	STANDARD31516	OPERATIONAL
13-May-09	SW LANTAU	3	6.2	SPRING	STANDARD31516	OPERATIONAL
13-May-09	W LANTAU	3	5.4	SPRING	STANDARD31516	OPERATIONAL
13-May-09	W LANTAU	4	4.0	SPRING	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
14-May-09	NW LANTAU	2	0.6	SPRING	STANDARD31516	OPERATIONAL
14-May-09	NW LANTAU	3	17.3	SPRING	STANDARD31516	OPERATIONAL
14-May-09	NW LANTAU	4	17.9	SPRING	STANDARD31516	OPERATIONAL
14-May-09	NE LANTAU	3	14.7	SPRING	STANDARD31516	OPERATIONAL
14-May-09	NE LANTAU	4	14.5	SPRING	STANDARD31516	OPERATIONAL
14-May-09	NE LANTAU	5	1.2	SPRING	STANDARD31516	OPERATIONAL
22-May-09	LAMMA	2	18.8	SPRING	STANDARD31516	OPERATIONAL
22-May-09	LAMMA	3	51.2	SPRING	STANDARD31516	OPERATIONAL
22-May-09	LAMMA	4	5.5	SPRING	STANDARD31516	OPERATIONAL
22-May-09	LAMMA	5	1.5	SPRING	STANDARD31516	OPERATIONAL
1-Jun-09	W LANTAU	2	8.6	SUMMER	STANDARD31516	OPERATIONAL
1-Jun-09	W LANTAU	3	12.5	SUMMER	STANDARD31516	OPERATIONAL
1-Jun-09	NW LANTAU	2	7.3	SUMMER	STANDARD31516	OPERATIONAL
1-Jun-09	NW LANTAU	3	16.6	SUMMER	STANDARD31516	OPERATIONAL
2-Jun-09	W LANTAU	2	2.4	SUMMER	STANDARD31516	OPERATIONAL
2-Jun-09	W LANTAU	3	9.6	SUMMER	STANDARD31516	OPERATIONAL
2-Jun-09	W LANTAU	4	11.3	SUMMER	STANDARD31516	OPERATIONAL
2-Jun-09	SW LANTAU	2	18.6	SUMMER	STANDARD31516	OPERATIONAL
2-Jun-09	SW LANTAU	3	58.8	SUMMER	STANDARD31516	OPERATIONAL
2-Jun-09	SW LANTAU	4	2.1	SUMMER	STANDARD31516	OPERATIONAL
3-Jun-09	NE LANTAU	2	5.3	SUMMER	STANDARD31516	OPERATIONAL
3-Jun-09	NE LANTAU	3	16.1	SUMMER	STANDARD31516	OPERATIONAL
3-Jun-09	NE LANTAU	4	2.0	SUMMER	STANDARD31516	OPERATIONAL
8-Jun-09	NE LANTAU	2	7.0	SUMMER	STANDARD31516	OPERATIONAL
8-Jun-09	NE LANTAU	3	23.4	SUMMER	STANDARD31516	OPERATIONAL
8-Jun-09	NE LANTAU	4	2.3	SUMMER	STANDARD31516	OPERATIONAL
9-Jun-09	NW LANTAU	2	3.0	SUMMER	STANDARD31516	OPERATIONAL
9-Jun-09	NW LANTAU	3	13.1	SUMMER	STANDARD31516	OPERATIONAL
9-Jun-09	DEEP BAY	2	5.1	SUMMER	STANDARD31516	OPERATIONAL
9-Jun-09	DEEP BAY	3	10.1	SUMMER	STANDARD31516	OPERATIONAL
9-Jun-09	NE LANTAU	2	7.1	SUMMER	STANDARD31516	OPERATIONAL
9-Jun-09	NE LANTAU	3	9.6	SUMMER	STANDARD31516	OPERATIONAL
10-Jun-09	W LANTAU	2	12.6	SUMMER	STANDARD31516	OPERATIONAL
10-Jun-09	W LANTAU	3	9.3	SUMMER	STANDARD31516	OPERATIONAL
10-Jun-09	NW LANTAU	2	16.1	SUMMER	STANDARD31516	OPERATIONAL
10-Jun-09	NW LANTAU	3	18.9	SUMMER	STANDARD31516	OPERATIONAL
18-Jun-09	PO TOI	1	16.3	SUMMER	STANDARD31516	OPERATIONAL
18-Jun-09	PO TOI	2	55.9	SUMMER	STANDARD31516	OPERATIONAL
18-Jun-09	NINEPINS	2	7.5	SUMMER	STANDARD31516	OPERATIONAL
23-Jun-09	NW LANTAU	2	8.0	SUMMER	STANDARD31516	OPERATIONAL
23-Jun-09	NW LANTAU	3	16.1	SUMMER	STANDARD31516	OPERATIONAL
23-Jun-09	NE LANTAU	1	3.0	SUMMER	STANDARD31516	OPERATIONAL
23-Jun-09	NE LANTAU	2	23.1	SUMMER	STANDARD31516	OPERATIONAL
23-Jun-09	NE LANTAU	3	3.1	SUMMER	STANDARD31516	OPERATIONAL
24-Jun-09	W LANTAU	2	5.7	SUMMER	STANDARD31516	OPERATIONAL
24-Jun-09	W LANTAU	3	19.1	SUMMER	STANDARD31516	OPERATIONAL
24-Jun-09	SW LANTAU	1	11.4	SUMMER	STANDARD31516	OPERATIONAL
24-Jun-09	SW LANTAU	2	30.7	SUMMER	STANDARD31516	OPERATIONAL
24-Jun-09	SW LANTAU	3	3.6	SUMMER	STANDARD31516	OPERATIONAL
25-Jun-09	NE LANTAU	1	3.5	SUMMER	STANDARD31516	OPERATIONAL
25-Jun-09	NE LANTAU	2	18.5	SUMMER	STANDARD31516	OPERATIONAL
25-Jun-09	NE LANTAU	3	7.5	SUMMER	STANDARD31516	OPERATIONAL
2-Jul-09	SE LANTAU	3	20.90	SUMMER	STANDARD31516	OPERATIONAL
2-Jul-09	SE LANTAU	4	8.80	SUMMER	STANDARD31516	OPERATIONAL
2-Jul-09	SW LANTAU	2	5.10	SUMMER	STANDARD31516	OPERATIONAL
2-Jul-09	SW LANTAU	3	29.90	SUMMER	STANDARD31516	OPERATIONAL
2-Jul-09	SW LANTAU	4	4.30	SUMMER	STANDARD31516	OPERATIONAL
2-Jul-09	W LANTAU	2	0.70	SUMMER	STANDARD31516	OPERATIONAL
2-Jul-09	W LANTAU	3	8.10	SUMMER	STANDARD31516	OPERATIONAL
3-Jul-09	NW LANTAU	2	0.20	SUMMER	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
3-Jul-09	NW LANTAU	3	11.20	SUMMER	STANDARD31516	OPERATIONAL
3-Jul-09	NW LANTAU	4	12.60	SUMMER	STANDARD31516	OPERATIONAL
3-Jul-09	NW LANTAU	5	7.60	SUMMER	STANDARD31516	OPERATIONAL
3-Jul-09	NE LANTAU	2	8.40	SUMMER	STANDARD31516	OPERATIONAL
3-Jul-09	NE LANTAU	3	16.30	SUMMER	STANDARD31516	OPERATIONAL
3-Jul-09	NE LANTAU	4	4.10	SUMMER	STANDARD31516	OPERATIONAL
7-Jul-09	NE LANTAU	2	24.10	SUMMER	STANDARD31516	OPERATIONAL
7-Jul-09	NE LANTAU	3	2.10	SUMMER	STANDARD31516	OPERATIONAL
8-Jul-09	W LANTAU	2	0.30	SUMMER	STANDARD31516	OPERATIONAL
8-Jul-09	W LANTAU	3	14.40	SUMMER	STANDARD31516	OPERATIONAL
8-Jul-09	NW LANTAU	3	11.20	SUMMER	STANDARD31516	OPERATIONAL
8-Jul-09	NW LANTAU	4	16.00	SUMMER	STANDARD31516	OPERATIONAL
8-Jul-09	NW LANTAU	5	0.60	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	W LANTAU	2	4.20	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	W LANTAU	3	11.30	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	W LANTAU	4	8.80	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	NW LANTAU	2	3.10	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	NW LANTAU	3	10.80	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	NW LANTAU	4	7.40	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	DEEP BAY	2	3.50	SUMMER	STANDARD31516	OPERATIONAL
16-Jul-09	DEEP BAY	3	11.50	SUMMER	STANDARD31516	OPERATIONAL
17-Jul-09	W LANTAU	1	1.80	SUMMER	STANDARD31516	OPERATIONAL
17-Jul-09	W LANTAU	2	9.10	SUMMER	STANDARD31516	OPERATIONAL
17-Jul-09	SW LANTAU	1	0.80	SUMMER	STANDARD31516	OPERATIONAL
17-Jul-09	SW LANTAU	2	33.40	SUMMER	STANDARD31516	OPERATIONAL
17-Jul-09	SW LANTAU	3	11.00	SUMMER	STANDARD31516	OPERATIONAL
17-Jul-09	SE LANTAU	1	1.50	SUMMER	STANDARD31516	OPERATIONAL
17-Jul-09	SE LANTAU	2	26.40	SUMMER	STANDARD31516	OPERATIONAL
29-Jul-09	NW LANTAU	2	4.60	SUMMER	STANDARD31516	OPERATIONAL
29-Jul-09	NW LANTAU	3	26.50	SUMMER	STANDARD31516	OPERATIONAL
29-Jul-09	NE LANTAU	2	7.80	SUMMER	STANDARD31516	OPERATIONAL
29-Jul-09	NE LANTAU	3	31.40	SUMMER	STANDARD31516	OPERATIONAL
30-Jul-09	W LANTAU	2	8.80	SUMMER	STANDARD31516	OPERATIONAL
30-Jul-09	W LANTAU	3	9.80	SUMMER	STANDARD31516	OPERATIONAL
30-Jul-09	W LANTAU	4	3.10	SUMMER	STANDARD31516	OPERATIONAL
30-Jul-09	NW LANTAU	2	5.00	SUMMER	STANDARD31516	OPERATIONAL
30-Jul-09	NW LANTAU	3	25.50	SUMMER	STANDARD31516	OPERATIONAL
30-Jul-09	NW LANTAU	4	1.60	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	SE LANTAU	2	9.00	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	SE LANTAU	3	21.80	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	SE LANTAU	4	0.50	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	SE LANTAU	5	1.10	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	SW LANTAU	3	6.20	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	SW LANTAU	4	12.00	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	SW LANTAU	5	3.00	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	W LANTAU	1	0.70	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	W LANTAU	2	6.50	SUMMER	STANDARD31516	OPERATIONAL
3-Aug-09	W LANTAU	3	2.60	SUMMER	STANDARD31516	OPERATIONAL
7-Aug-09	PO TOI	2	1.80	SUMMER	STANDARD31516	OPERATIONAL
7-Aug-09	PO TOI	3	61.10	SUMMER	STANDARD31516	OPERATIONAL
7-Aug-09	PO TOI	4	9.00	SUMMER	STANDARD31516	OPERATIONAL
13-Aug-09	NE LANTAU	1	11.00	SUMMER	STANDARD31516	OPERATIONAL
13-Aug-09	NE LANTAU	2	11.20	SUMMER	STANDARD31516	OPERATIONAL
13-Aug-09	NW LANTAU	1	2.90	SUMMER	STANDARD31516	OPERATIONAL
13-Aug-09	NW LANTAU	2	24.00	SUMMER	STANDARD31516	OPERATIONAL
13-Aug-09	NW LANTAU	3	4.00	SUMMER	STANDARD31516	OPERATIONAL
14-Aug-09	W LANTAU	1	7.90	SUMMER	STANDARD31516	OPERATIONAL
14-Aug-09	W LANTAU	2	3.60	SUMMER	STANDARD31516	OPERATIONAL
14-Aug-09	SW LANTAU	1	23.10	SUMMER	STANDARD31516	OPERATIONAL
14-Aug-09	SW LANTAU	2	21.60	SUMMER	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
14-Aug-09	SW LANTAU	3	1.00	SUMMER	STANDARD31516	OPERATIONAL
14-Aug-09	SE LANTAU	1	12.60	SUMMER	STANDARD31516	OPERATIONAL
14-Aug-09	SE LANTAU	2	7.00	SUMMER	STANDARD31516	OPERATIONAL
19-Aug-09	W LANTAU	1	2.80	SUMMER	STANDARD31516	OPERATIONAL
19-Aug-09	W LANTAU	2	13.50	SUMMER	STANDARD31516	OPERATIONAL
19-Aug-09	W LANTAU	3	4.40	SUMMER	STANDARD31516	OPERATIONAL
19-Aug-09	NW LANTAU	1	0.60	SUMMER	STANDARD31516	OPERATIONAL
19-Aug-09	NW LANTAU	2	24.60	SUMMER	STANDARD31516	OPERATIONAL
19-Aug-09	NW LANTAU	3	5.90	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	W LANTAU	1	2.10	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	W LANTAU	2	3.00	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	W LANTAU	3	4.80	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	SE LANTAU	2	32.10	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	SE LANTAU	3	2.60	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	SW LANTAU	1	13.90	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	SW LANTAU	2	22.30	SUMMER	STANDARD31516	OPERATIONAL
20-Aug-09	SW LANTAU	3	1.60	SUMMER	STANDARD31516	OPERATIONAL
21-Aug-09	PO TOI	1	12.60	SUMMER	STANDARD31516	OPERATIONAL
21-Aug-09	PO TOI	2	49.70	SUMMER	STANDARD31516	OPERATIONAL
21-Aug-09	PO TOI	3	8.30	SUMMER	STANDARD31516	OPERATIONAL
21-Aug-09	NINEPINS	2	5.20	SUMMER	STANDARD31516	OPERATIONAL
21-Aug-09	NINEPINS	3	0.70	SUMMER	STANDARD31516	OPERATIONAL
28-Aug-09	PO TOI	2	10.10	SUMMER	STANDARD31516	OPERATIONAL
28-Aug-09	PO TOI	3	63.00	SUMMER	STANDARD31516	OPERATIONAL
28-Aug-09	PO TOI	4	1.40	SUMMER	STANDARD31516	OPERATIONAL
28-Aug-09	NINEPINS	3	11.30	SUMMER	STANDARD31516	OPERATIONAL
28-Aug-09	NINEPINS	4	0.70	SUMMER	STANDARD31516	OPERATIONAL
1-Sep-09	NE LANTAU	1	1.70	AUTUMN	STANDARD31516	OPERATIONAL
1-Sep-09	NE LANTAU	2	27.50	AUTUMN	STANDARD31516	OPERATIONAL
1-Sep-09	NE LANTAU	3	3.10	AUTUMN	STANDARD31516	OPERATIONAL
1-Sep-09	NW LANTAU	1	7.20	AUTUMN	STANDARD31516	OPERATIONAL
1-Sep-09	NW LANTAU	2	24.70	AUTUMN	STANDARD31516	OPERATIONAL
1-Sep-09	NW LANTAU	3	3.30	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	W LANTAU	2	3.50	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	W LANTAU	3	18.60	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	NW LANTAU	1	4.60	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	NW LANTAU	2	13.10	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	NW LANTAU	3	3.00	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	DEEP BAY	1	9.00	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	DEEP BAY	2	5.80	AUTUMN	STANDARD31516	OPERATIONAL
2-Sep-09	DEEP BAY	3	0.60	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	SE LANTAU	2	2.30	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	SE LANTAU	3	20.80	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	SE LANTAU	4	6.10	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	SW LANTAU	3	17.20	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	SW LANTAU	4	21.80	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	SW LANTAU	5	1.60	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	W LANTAU	2	1.70	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	W LANTAU	3	5.00	AUTUMN	STANDARD31516	OPERATIONAL
7-Sep-09	W LANTAU	4	3.70	AUTUMN	STANDARD31516	OPERATIONAL
8-Sep-09	NW LANTAU	1	8.50	AUTUMN	STANDARD31516	OPERATIONAL
8-Sep-09	NW LANTAU	2	20.20	AUTUMN	STANDARD31516	OPERATIONAL
8-Sep-09	NE LANTAU	1	6.70	AUTUMN	STANDARD31516	OPERATIONAL
8-Sep-09	NE LANTAU	2	15.40	AUTUMN	STANDARD31516	OPERATIONAL
8-Sep-09	NE LANTAU	3	6.50	AUTUMN	STANDARD31516	OPERATIONAL
21-Sep-09	W LANTAU	1	4.80	AUTUMN	STANDARD31516	OPERATIONAL
21-Sep-09	W LANTAU	2	5.50	AUTUMN	STANDARD31516	OPERATIONAL
21-Sep-09	SW LANTAU	1	14.70	AUTUMN	STANDARD31516	OPERATIONAL
21-Sep-09	SW LANTAU	2	20.60	AUTUMN	STANDARD31516	OPERATIONAL
21-Sep-09	SE LANTAU	1	6.20	AUTUMN	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
21-Sep-09	SE LANTAU	2	27.80	AUTUMN	STANDARD31516	OPERATIONAL
21-Sep-09	SE LANTAU	3	1.30	AUTUMN	STANDARD31516	OPERATIONAL
6-Oct-09	SE LANTAU	2	18.10	AUTUMN	STANDARD31516	OPERATIONAL
6-Oct-09	SE LANTAU	3	38.20	AUTUMN	STANDARD31516	OPERATIONAL
6-Oct-09	SE LANTAU	4	5.10	AUTUMN	STANDARD31516	OPERATIONAL
6-Oct-09	W LANTAU	2	1.10	AUTUMN	STANDARD31516	OPERATIONAL
6-Oct-09	W LANTAU	3	9.70	AUTUMN	STANDARD31516	OPERATIONAL
7-Oct-09	W LANTAU	2	8.90	AUTUMN	STANDARD31516	OPERATIONAL
7-Oct-09	W LANTAU	3	12.60	AUTUMN	STANDARD31516	OPERATIONAL
7-Oct-09	W LANTAU	4	2.80	AUTUMN	STANDARD31516	OPERATIONAL
7-Oct-09	NW LANTAU	2	17.20	AUTUMN	STANDARD31516	OPERATIONAL
7-Oct-09	NW LANTAU	3	16.60	AUTUMN	STANDARD31516	OPERATIONAL
7-Oct-09	DEEP BAY	2	12.30	AUTUMN	STANDARD31516	OPERATIONAL
7-Oct-09	DEEP BAY	3	2.90	AUTUMN	STANDARD31516	OPERATIONAL
8-Oct-09	NW LANTAU	2	19.80	AUTUMN	STANDARD31516	OPERATIONAL
8-Oct-09	NW LANTAU	3	10.70	AUTUMN	STANDARD31516	OPERATIONAL
8-Oct-09	NE LANTAU	2	30.40	AUTUMN	STANDARD31516	OPERATIONAL
8-Oct-09	NE LANTAU	3	15.80	AUTUMN	STANDARD31516	OPERATIONAL
15-Oct-09	NE LANTAU	0	1.50	AUTUMN	STANDARD31516	OPERATIONAL
15-Oct-09	NE LANTAU	1	13.20	AUTUMN	STANDARD31516	OPERATIONAL
15-Oct-09	NE LANTAU	2	34.40	AUTUMN	STANDARD31516	OPERATIONAL
15-Oct-09	NE LANTAU	3	2.30	AUTUMN	STANDARD31516	OPERATIONAL
15-Oct-09	NW LANTAU	2	15.70	AUTUMN	STANDARD31516	OPERATIONAL
15-Oct-09	NW LANTAU	3	0.80	AUTUMN	STANDARD31516	OPERATIONAL
16-Oct-09	W LANTAU	2	10.60	AUTUMN	STANDARD31516	OPERATIONAL
16-Oct-09	W LANTAU	3	6.80	AUTUMN	STANDARD31516	OPERATIONAL
16-Oct-09	W LANTAU	4	4.40	AUTUMN	STANDARD31516	OPERATIONAL
16-Oct-09	W LANTAU	5	0.80	AUTUMN	STANDARD31516	OPERATIONAL
16-Oct-09	NW LANTAU	2	23.40	AUTUMN	STANDARD31516	OPERATIONAL
28-Oct-09	NW LANTAU	2	13.80	AUTUMN	STANDARD31516	OPERATIONAL
28-Oct-09	NW LANTAU	3	8.80	AUTUMN	STANDARD31516	OPERATIONAL
28-Oct-09	DEEP BAY	2	12.60	AUTUMN	STANDARD31516	OPERATIONAL
28-Oct-09	DEEP BAY	3	2.30	AUTUMN	STANDARD31516	OPERATIONAL
28-Oct-09	W LANTAU	1	4.70	AUTUMN	STANDARD31516	OPERATIONAL
28-Oct-09	W LANTAU	2	18.40	AUTUMN	STANDARD31516	OPERATIONAL
28-Oct-09	W LANTAU	3	2.10	AUTUMN	STANDARD31516	OPERATIONAL
29-Oct-09	W LANTAU	3	7.30	AUTUMN	STANDARD31516	OPERATIONAL
29-Oct-09	W LANTAU	4	3.60	AUTUMN	STANDARD31516	OPERATIONAL
29-Oct-09	SW LANTAU	3	23.50	AUTUMN	STANDARD31516	OPERATIONAL
29-Oct-09	SW LANTAU	4	20.30	AUTUMN	STANDARD31516	OPERATIONAL
29-Oct-09	SE LANTAU	3	10.30	AUTUMN	STANDARD31516	OPERATIONAL
29-Oct-09	SE LANTAU	4	10.60	AUTUMN	STANDARD31516	OPERATIONAL
29-Oct-09	SE LANTAU	5	2.00	AUTUMN	STANDARD31516	OPERATIONAL
5-Nov-09	SE LANTAU	1	8.50	AUTUMN	STANDARD31516	OPERATIONAL
5-Nov-09	SE LANTAU	2	25.60	AUTUMN	STANDARD31516	OPERATIONAL
5-Nov-09	SW LANTAU	1	14.00	AUTUMN	STANDARD31516	OPERATIONAL
5-Nov-09	SW LANTAU	2	13.00	AUTUMN	STANDARD31516	OPERATIONAL
5-Nov-09	SW LANTAU	3	6.40	AUTUMN	STANDARD31516	OPERATIONAL
5-Nov-09	W LANTAU	2	5.10	AUTUMN	STANDARD31516	OPERATIONAL
5-Nov-09	W LANTAU	3	5.90	AUTUMN	STANDARD31516	OPERATIONAL
6-Nov-09	NW LANTAU	1	9.30	AUTUMN	STANDARD31516	OPERATIONAL
6-Nov-09	NW LANTAU	2	23.00	AUTUMN	STANDARD31516	OPERATIONAL
6-Nov-09	NE LANTAU	2	31.10	AUTUMN	STANDARD31516	OPERATIONAL
6-Nov-09	NE LANTAU	3	11.90	AUTUMN	STANDARD31516	OPERATIONAL
10-Nov-09	PO TOI	1	13.50	AUTUMN	STANDARD31516	OPERATIONAL
10-Nov-09	PO TOI	2	41.60	AUTUMN	STANDARD31516	OPERATIONAL
10-Nov-09	PO TOI	3	11.30	AUTUMN	STANDARD31516	OPERATIONAL
11-Nov-09	LAMMA	2	18.20	AUTUMN	STANDARD31516	OPERATIONAL
11-Nov-09	LAMMA	3	46.60	AUTUMN	STANDARD31516	OPERATIONAL
11-Nov-09	LAMMA	4	10.50	AUTUMN	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
19-Nov-09	W LANTAU	4	2.80	AUTUMN	STANDARD31516	OPERATIONAL
19-Nov-09	W LANTAU	5	7.10	AUTUMN	STANDARD31516	OPERATIONAL
19-Nov-09	W LANTAU	6	0.80	AUTUMN	STANDARD31516	OPERATIONAL
19-Nov-09	NE LANTAU	2	24.00	AUTUMN	STANDARD31516	OPERATIONAL
19-Nov-09	NE LANTAU	3	27.10	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	W LANTAU	4	2.30	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	W LANTAU	5	5.40	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	W LANTAU	6	2.80	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	SW LANTAU	3	0.70	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	SW LANTAU	4	8.20	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	SW LANTAU	5	9.70	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	SE LANTAU	2	1.60	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	SE LANTAU	3	6.10	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	SE LANTAU	4	2.20	AUTUMN	STANDARD31516	OPERATIONAL
20-Nov-09	SE LANTAU	5	4.90	AUTUMN	STANDARD31516	OPERATIONAL
25-Nov-09	W LANTAU	1	14.50	AUTUMN	STANDARD31516	OPERATIONAL
25-Nov-09	W LANTAU	2	10.10	AUTUMN	STANDARD31516	OPERATIONAL
25-Nov-09	NW LANTAU	1	4.60	AUTUMN	STANDARD31516	OPERATIONAL
25-Nov-09	NW LANTAU	2	17.50	AUTUMN	STANDARD31516	OPERATIONAL
25-Nov-09	DEEP BAY	2	14.80	AUTUMN	STANDARD31516	OPERATIONAL
2-Dec-09	NW LANTAU	2	2.50	WINTER	STANDARD31516	OPERATIONAL
2-Dec-09	NW LANTAU	3	24.80	WINTER	STANDARD31516	OPERATIONAL
2-Dec-09	NW LANTAU	4	1.50	WINTER	STANDARD31516	OPERATIONAL
2-Dec-09	DEEP BAY	1	3.10	WINTER	STANDARD31516	OPERATIONAL
2-Dec-09	DEEP BAY	2	10.20	WINTER	STANDARD31516	OPERATIONAL
2-Dec-09	DEEP BAY	3	0.40	WINTER	STANDARD31516	OPERATIONAL
2-Dec-09	NE LANTAU	2	5.70	WINTER	STANDARD31516	OPERATIONAL
2-Dec-09	NE LANTAU	3	14.40	WINTER	STANDARD31516	OPERATIONAL
3-Dec-09	W LANTAU	3	3.40	WINTER	STANDARD31516	OPERATIONAL
3-Dec-09	W LANTAU	4	7.40	WINTER	STANDARD31516	OPERATIONAL
3-Dec-09	W LANTAU	5	14.70	WINTER	STANDARD31516	OPERATIONAL
3-Dec-09	NE LANTAU	2	10.80	WINTER	STANDARD31516	OPERATIONAL
3-Dec-09	NE LANTAU	3	24.70	WINTER	STANDARD31516	OPERATIONAL
4-Dec-09	W LANTAU	2	7.50	WINTER	STANDARD31516	OPERATIONAL
4-Dec-09	W LANTAU	3	1.50	WINTER	STANDARD31516	OPERATIONAL
4-Dec-09	SW LANTAU	1	1.50	WINTER	STANDARD31516	OPERATIONAL
4-Dec-09	SW LANTAU	2	24.90	WINTER	STANDARD31516	OPERATIONAL
4-Dec-09	SW LANTAU	3	14.10	WINTER	STANDARD31516	OPERATIONAL
4-Dec-09	SE LANTAU	2	24.40	WINTER	STANDARD31516	OPERATIONAL
4-Dec-09	SE LANTAU	3	1.90	WINTER	STANDARD31516	OPERATIONAL
10-Dec-09	SE LANTAU	1	1.20	WINTER	STANDARD31516	OPERATIONAL
10-Dec-09	SE LANTAU	2	35.00	WINTER	STANDARD31516	OPERATIONAL
10-Dec-09	SE LANTAU	3	15.40	WINTER	STANDARD31516	OPERATIONAL
10-Dec-09	SW LANTAU	1	1.40	WINTER	STANDARD31516	OPERATIONAL
10-Dec-09	SW LANTAU	2	11.20	WINTER	STANDARD31516	OPERATIONAL
10-Dec-09	SW LANTAU	3	5.50	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	NW LANTAU	1	0.60	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	NW LANTAU	2	4.50	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	NW LANTAU	3	15.20	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	NW LANTAU	4	14.50	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	DEEP BAY	3	12.40	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	DEEP BAY	4	2.40	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	NE LANTAU	2	25.50	WINTER	STANDARD31516	OPERATIONAL
17-Dec-09	NE LANTAU	3	2.90	WINTER	STANDARD31516	OPERATIONAL
18-Dec-09	W LANTAU	3	1.40	WINTER	STANDARD31516	OPERATIONAL
18-Dec-09	W LANTAU	4	10.50	WINTER	STANDARD31516	OPERATIONAL
18-Dec-09	SW LANTAU	2	10.20	WINTER	STANDARD31516	OPERATIONAL
18-Dec-09	SW LANTAU	3	28.80	WINTER	STANDARD31516	OPERATIONAL
18-Dec-09	SW LANTAU	4	3.70	WINTER	STANDARD31516	OPERATIONAL
18-Dec-09	SE LANTAU	2	6.20	WINTER	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
18-Dec-09	SE LANTAU	3	14.40	WINTER	STANDARD31516	OPERATIONAL
18-Dec-09	SE LANTAU	4	8.70	WINTER	STANDARD31516	OPERATIONAL
21-Dec-09	LAMMA	2	29.20	WINTER	STANDARD31516	OPERATIONAL
21-Dec-09	LAMMA	3	50.10	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	W LANTAU	2	2.00	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	W LANTAU	3	3.90	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	W LANTAU	4	4.70	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	W LANTAU	5	9.20	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	W LANTAU	6	6.00	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	NW LANTAU	2	5.20	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	NW LANTAU	3	18.00	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	NW LANTAU	4	9.10	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	DEEP BAY	2	11.90	WINTER	STANDARD31516	OPERATIONAL
29-Dec-09	DEEP BAY	3	3.20	WINTER	STANDARD31516	OPERATIONAL
30-Dec-09	W LANTAU	1	0.90	WINTER	STANDARD31516	OPERATIONAL
30-Dec-09	W LANTAU	2	11.10	WINTER	STANDARD31516	OPERATIONAL
30-Dec-09	W LANTAU	3	12.30	WINTER	STANDARD31516	OPERATIONAL
30-Dec-09	W LANTAU	4	1.40	WINTER	STANDARD31516	OPERATIONAL
30-Dec-09	NE LANTAU	0	7.50	WINTER	STANDARD31516	OPERATIONAL
30-Dec-09	NE LANTAU	1	20.30	WINTER	STANDARD31516	OPERATIONAL
30-Dec-09	NE LANTAU	2	22.40	WINTER	STANDARD31516	OPERATIONAL
14-Jan-10	NE LANTAU	2	4.5	WINTER	STANDARD31516	OPERATIONAL
14-Jan-10	NE LANTAU	3	16.6	WINTER	STANDARD31516	OPERATIONAL
14-Jan-10	NE LANTAU	4	5.9	WINTER	STANDARD31516	OPERATIONAL
14-Jan-10	NW LANTAU	3	37.3	WINTER	STANDARD31516	OPERATIONAL
14-Jan-10	NW LANTAU	4	13.8	WINTER	STANDARD31516	OPERATIONAL
15-Jan-10	W LANTAU	1	2.7	WINTER	STANDARD31516	OPERATIONAL
15-Jan-10	W LANTAU	2	19.0	WINTER	STANDARD31516	OPERATIONAL
15-Jan-10	W LANTAU	3	11.1	WINTER	STANDARD31516	OPERATIONAL
15-Jan-10	W LANTAU	4	8.0	WINTER	STANDARD31516	OPERATIONAL
15-Jan-10	W LANTAU	5	0.6	WINTER	STANDARD31516	OPERATIONAL
15-Jan-10	NW LANTAU	2	9.5	WINTER	STANDARD31516	OPERATIONAL
15-Jan-10	NW LANTAU	3	8.3	WINTER	STANDARD31516	OPERATIONAL
20-Jan-10	LAMMA	1	18.9	WINTER	STANDARD31516	OPERATIONAL
20-Jan-10	LAMMA	2	33.2	WINTER	STANDARD31516	OPERATIONAL
20-Jan-10	LAMMA	3	27.3	WINTER	STANDARD31516	OPERATIONAL
28-Jan-10	SE LANTAU	0	11.0	WINTER	STANDARD31516	OPERATIONAL
28-Jan-10	SE LANTAU	1	12.8	WINTER	STANDARD31516	OPERATIONAL
28-Jan-10	SE LANTAU	2	10.2	WINTER	STANDARD31516	OPERATIONAL
28-Jan-10	SW LANTAU	0	12.9	WINTER	STANDARD31516	OPERATIONAL
28-Jan-10	SW LANTAU	1	16.5	WINTER	STANDARD31516	OPERATIONAL
28-Jan-10	SW LANTAU	2	13.4	WINTER	STANDARD31516	OPERATIONAL
1-Feb-10	SE LANTAU	0	14.9	WINTER	STANDARD31516	OPERATIONAL
1-Feb-10	SE LANTAU	1	18.4	WINTER	STANDARD31516	OPERATIONAL
1-Feb-10	SW LANTAU	0	5.8	WINTER	STANDARD31516	OPERATIONAL
1-Feb-10	SW LANTAU	1	15.2	WINTER	STANDARD31516	OPERATIONAL
1-Feb-10	SW LANTAU	2	11.2	WINTER	STANDARD31516	OPERATIONAL
1-Feb-10	SW LANTAU	3	1.9	WINTER	STANDARD31516	OPERATIONAL
2-Feb-10	W LANTAU	2	0.9	WINTER	STANDARD31516	OPERATIONAL
2-Feb-10	W LANTAU	3	24.0	WINTER	STANDARD31516	OPERATIONAL
2-Feb-10	W LANTAU	4	17.1	WINTER	STANDARD31516	OPERATIONAL
2-Feb-10	NW LANTAU	1	0.6	WINTER	STANDARD31516	OPERATIONAL
2-Feb-10	NW LANTAU	2	2.0	WINTER	STANDARD31516	OPERATIONAL
2-Feb-10	NW LANTAU	3	20.2	WINTER	STANDARD31516	OPERATIONAL
2-Feb-10	NW LANTAU	4	5.8	WINTER	STANDARD31516	OPERATIONAL
10-Feb-10	NW LANTAU	2	5.0	WINTER	STANDARD31516	OPERATIONAL
10-Feb-10	NW LANTAU	3	34.2	WINTER	STANDARD31516	OPERATIONAL
10-Feb-10	NW LANTAU	4	2.8	WINTER	STANDARD31516	OPERATIONAL
10-Feb-10	DEEP BAY	2	1.0	WINTER	STANDARD31516	OPERATIONAL
10-Feb-10	DEEP BAY	3	26.5	WINTER	STANDARD31516	OPERATIONAL
10-Feb-10	DEEP BAY	4	1.6	WINTER	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
11-Feb-10	SW LANTAU	0	0.6	WINTER	STANDARD31516	OPERATIONAL
11-Feb-10	SW LANTAU	1	27.8	WINTER	STANDARD31516	OPERATIONAL
11-Feb-10	SW LANTAU	2	17.1	WINTER	STANDARD31516	OPERATIONAL
11-Feb-10	SE LANTAU	0	2.7	WINTER	STANDARD31516	OPERATIONAL
11-Feb-10	SE LANTAU	1	7.4	WINTER	STANDARD31516	OPERATIONAL
11-Feb-10	SE LANTAU	2	23.6	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	0	2.00	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	1	8.70	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	2	27.50	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	3	21.80	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	4	11.20	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	1	1.10	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	2	12.30	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	3	7.00	WINTER	STANDARD31516	OPERATIONAL
22-Feb-10	LAMMA	4	3.60	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SE LANTAU	0	11.40	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SE LANTAU	1	12.70	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SE LANTAU	0	1.40	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SE LANTAU	1	7.50	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SW LANTAU	1	12.90	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SW LANTAU	2	7.00	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SW LANTAU	1	8.10	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SW LANTAU	2	4.90	WINTER	STANDARD31516	OPERATIONAL
23-Feb-10	SW LANTAU	3	0.90	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NW LANTAU	2	1.10	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NW LANTAU	3	16.00	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NW LANTAU	4	9.40	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NW LANTAU	5	2.90	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NW LANTAU	3	3.60	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NW LANTAU	4	3.30	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NE LANTAU	1	0.50	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NE LANTAU	2	3.20	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NE LANTAU	3	7.80	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NE LANTAU	4	10.60	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NE LANTAU	1	2.00	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NE LANTAU	2	2.90	WINTER	STANDARD31516	OPERATIONAL
24-Feb-10	NE LANTAU	3	5.90	WINTER	STANDARD31516	OPERATIONAL
26-Feb-10	LAMMA	0	49.5	WINTER	STANDARD31516	OPERATIONAL
26-Feb-10	LAMMA	1	16.0	WINTER	STANDARD31516	OPERATIONAL
26-Feb-10	LAMMA	2	2.7	WINTER	STANDARD31516	OPERATIONAL
26-Feb-10	LAMMA	0	17.3	WINTER	STANDARD31516	OPERATIONAL
26-Feb-10	LAMMA	1	7.1	WINTER	STANDARD31516	OPERATIONAL
26-Feb-10	LAMMA	2	2.1	WINTER	STANDARD31516	OPERATIONAL
2-Mar-10	W LANTAU	2	5.7	SPRING	STANDARD31516	OPERATIONAL
2-Mar-10	W LANTAU	3	14.5	SPRING	STANDARD31516	OPERATIONAL
2-Mar-10	W LANTAU	2	5.4	SPRING	STANDARD31516	OPERATIONAL
2-Mar-10	W LANTAU	3	15.4	SPRING	STANDARD31516	OPERATIONAL
2-Mar-10	NW LANTAU	2	6.4	SPRING	STANDARD31516	OPERATIONAL
2-Mar-10	NW LANTAU	3	16.8	SPRING	STANDARD31516	OPERATIONAL
2-Mar-10	NW LANTAU	2	1.5	SPRING	STANDARD31516	OPERATIONAL
2-Mar-10	NW LANTAU	3	2.4	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	NW LANTAU	2	7.2	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	NW LANTAU	3	19.6	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	NW LANTAU	4	5.8	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	NW LANTAU	2	3.1	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	NW LANTAU	3	8.0	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	DEEP BAY	1	1.9	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	DEEP BAY	2	13.4	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	DEEP BAY	3	2.1	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	DEEP BAY	1	0.6	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	DEEP BAY	2	9.4	SPRING	STANDARD31516	OPERATIONAL
4-Mar-10	DEEP BAY	3	0.3	SPRING	STANDARD31516	OPERATIONAL
11-Mar-10	NE LANTAU	1	7.7	SPRING	STANDARD31516	OPERATIONAL
11-Mar-10	NE LANTAU	2	9.3	SPRING	STANDARD31516	OPERATIONAL
11-Mar-10	NE LANTAU	1	3.2	SPRING	STANDARD31516	OPERATIONAL
11-Mar-10	NE LANTAU	2	4.7	SPRING	STANDARD31516	OPERATIONAL
11-Mar-10	NW LANTAU	1	14.3	SPRING	STANDARD31516	OPERATIONAL
11-Mar-10	NW LANTAU	2	23.5	SPRING	STANDARD31516	OPERATIONAL

Appendix I. (cont'd)

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL	PHASE
11-Mar-10	NW LANTAU	1	5.5	SPRING	STANDARD31516	OPERATIONAL
11-Mar-10	NW LANTAU	2	6.5	SPRING	STANDARD31516	OPERATIONAL
19-Mar-10	LAMMA	1	4.8	SPRING	STANDARD31516	OPERATIONAL
19-Mar-10	LAMMA	2	47.9	SPRING	STANDARD31516	OPERATIONAL
19-Mar-10	LAMMA	3	13.0	SPRING	STANDARD31516	OPERATIONAL
19-Mar-10	LAMMA	1	2.7	SPRING	STANDARD31516	OPERATIONAL
19-Mar-10	LAMMA	2	14.8	SPRING	STANDARD31516	OPERATIONAL
19-Mar-10	LAMMA	3	4.0	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	2	1.5	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	3	11.2	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	4	2.7	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	5	3.4	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	2	0.9	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	3	9.9	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	4	2.2	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	W LANTAU	5	1.3	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	NW LANTAU	2	3.5	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	NW LANTAU	3	9.7	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	NW LANTAU	4	7.0	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	NW LANTAU	2	0.8	SPRING	STANDARD31516	OPERATIONAL
30-Mar-10	NW LANTAU	3	0.8	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NW LANTAU	3	18.3	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NW LANTAU	4	18.7	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NW LANTAU	2	0.3	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NW LANTAU	3	6.8	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NW LANTAU	4	5.6	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NE LANTAU	2	7.4	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NE LANTAU	3	18.9	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NE LANTAU	2	5.3	SPRING	STANDARD31516	OPERATIONAL
31-Mar-10	NE LANTAU	3	1.0	SPRING	STANDARD31516	OPERATIONAL

Appendix II. Chinese white dolphin sighting database (April 2009 - March 2010)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	SEASON	BOAT ASSOC.	UC	UJ	SJ	SS	SA	UA
8-Apr-09	1	1011	3	W LANTAU	2	ON	814032	803669	SPRING	NONE			2		1	
8-Apr-09	2	1034	3	W LANTAU	2	ON	810228	801331	SPRING	NONE			2		1	
8-Apr-09	3	1050	6	W LANTAU	2	ON	808745	800884	SPRING	NONE		1	3			1
8-Apr-09	4	1110	1	W LANTAU	2	ON	806107	802002	SPRING	NONE						
8-Apr-09	5	1134	1	W LANTAU	2	ON	808039	799511	SPRING	NONE						
8-Apr-09	6	1200	5	W LANTAU	2	ON	812422	800800	SPRING	NONE		1		2		
8-Apr-09	7	1231	5	W LANTAU	2	ON	814611	802299	SPRING	HANG		1	1	1		
8-Apr-09	8	1538	1	NW LANTAU	2	ON	826405	807424	SPRING	NONE						
15-Apr-09	1	1021	11	W LANTAU	2	ON	815920	801169	SPRING	NONE		1	4	1	1	
15-Apr-09	2	1050	1	W LANTAU	2	OFF	814358	801330	SPRING	NONE			1			
15-Apr-09	3	1059	14	W LANTAU	2	ON	813372	801523	SPRING	PAIR		2	2	2	2	2
15-Apr-09	4	1134	1	W LANTAU	2	ON	810951	799930	SPRING	NONE						
15-Apr-09	5	1235	1	W LANTAU	2	ON	810737	801590	SPRING	NONE			1			
15-Apr-09	6	1453	2	NW LANTAU	3	ON	823971	806204	SPRING	NONE						
16-Apr-09	1	1024	18	W LANTAU	2	ON	812553	801449	SPRING	PAIR		2	4	4	4	2
6-May-09	1	1016	4	NW LANTAU	2	OFF	820720	809412	SPRING	NONE						
6-May-09	2	1036	1	NW LANTAU	2	ON	821400	807404	SPRING	NONE						
6-May-09	3	1249	4	NW LANTAU	4	OFF	827062	805293	SPRING	NONE			2		2	
6-May-09	4	1401	2	W LANTAU	2	ON	815330	802610	SPRING	NONE						
6-May-09	5	1413	9	W LANTAU	2	ON	813548	802338	SPRING	NONE			4			1
6-May-09	6	1600	7	W LANTAU	2	ON	813027	802584	SPRING	NONE			4			
6-May-09	7	1614	3	W LANTAU	2	ON	814308	804123	SPRING	NONE			2			
7-May-09	1	939	2	W LANTAU	3	ON	813380	802802	SPRING	NONE			2			
7-May-09	2	1011	2	W LANTAU	3	ON	810814	801621	SPRING	NONE			2			
7-May-09	3	1052	6	W LANTAU	4	ON	807130	799952	SPRING	PAIR			3			1
7-May-09	4	1200	2	W LANTAU	4	OFF	815086	802620	SPRING	NONE						
8-May-09	4	1550	1	W LANTAU	3	ON	812918	801790	SPRING	NONE			1			
8-May-09	5	1609	2	W LANTAU	3	ON	814719	803516	SPRING	NONE						
13-May-09	7	1633	6	W LANTAU	3	ON	814286	804185	SPRING	NONE			3	1		2
14-May-09	1	1051	5	NW LANTAU	4	ON	827226	806395	SPRING	NONE		1		1		
14-May-09	2	1111	6	NW LANTAU	3	ON	828976	806389	SPRING	NONE		1	1	1		1
1-Jun-09	1	1032	4	W LANTAU	2	ON	814429	804433	SUMMER	NONE						
1-Jun-09	2	1038	8	W LANTAU	2	ON	813855	803545	SUMMER	NONE			1			
1-Jun-09	3	1104	3	W LANTAU	3	ON	811091	801745	SUMMER	NONE						
1-Jun-09	4	1116	7	W LANTAU	3	ON	809564	801092	SUMMER	NONE		1	4	1	1	
1-Jun-09	5	1201	6	W LANTAU	2	ON	807082	801530	SUMMER	NONE			2	1	1	
1-Jun-09	6	1234	1	W LANTAU	2	ON	808338	799512	SUMMER	NONE						
1-Jun-09	7	1256	5	W LANTAU	3	ON	812676	800924	SUMMER	NONE		1				
1-Jun-09	8	1412	6	NW LANTAU	3	ON	827328	805366	SUMMER	NONE			4		1	
1-Jun-09	9	1539	1	NW LANTAU	2	OFF	820599	809226	SUMMER	NONE			1			
2-Jun-09	1	1014	1	W LANTAU	3	ON	815186	802703	SUMMER	NONE					1	
2-Jun-09	2	1037	3	W LANTAU	4	OFF	810895	799961	SUMMER	NONE			2			
2-Jun-09	3	1152	3	SW LANTAU	2	OFF	807109	804727	SUMMER	NONE			1		1	
2-Jun-09	4	1322	1	SW LANTAU	2	ON	807157	808480	SUMMER	NONE						
2-Jun-09	5	1635	1	SW LANTAU	3	OFF	803376	805307	SUMMER	NONE						
2-Jun-09	6	1725	3	W LANTAU	3	ON	809276	801071	SUMMER	NONE						
2-Jun-09	7	1743	1	W LANTAU	3	ON	812927	802564	SUMMER	NONE						
2-Jun-09	8	1758	2	W LANTAU	3	ON	814993	804928	SUMMER	NONE						
3-Jun-09	1	1113	1	NE LANTAU	3	ON	824128	819399	SUMMER	NONE			1			
3-Jun-09	2	1126	1	NE LANTAU	2	ON	822311	820468	SUMMER	NONE						
9-Jun-09	1	1041	1	NW LANTAU	2	ON	825244	806381	SUMMER	NONE						

Appendix II. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	SEASON	BOAT ASSOC.	UC	UJ	SJ	SS	SA	UA
9-Jun-09	2	1428	14	NE LANTAU	3	ON	820702	814295	SUMMER	NONE	1	2	4		3	2
10-Jun-09	1	1019	6	W LANTAU	2	ON	814871	804815	SUMMER	NONE		1				
10-Jun-09	2	1036	3	W LANTAU	2	ON	814375	803690	SUMMER	NONE				1		
10-Jun-09	3	1050	10	W LANTAU	2	ON	813745	803266	SUMMER	NONE		1	2	1		1
10-Jun-09	4	1105	5	W LANTAU	2	ON	812440	802233	SUMMER	NONE						
10-Jun-09	5	1124	3	W LANTAU	3	ON	811224	801642	SUMMER	NONE			1			
10-Jun-09	6	1150	4	W LANTAU	2	ON	806484	801859	SUMMER	NONE			3			
10-Jun-09	7	1218	2	W LANTAU	2	ON	808848	799575	SUMMER	NONE			1			
10-Jun-09	8	1421	1	NW LANTAU	3	ON	824892	805361	SUMMER	NONE						
10-Jun-09	9	1435	1	NW LANTAU	3	ON	826974	805324	SUMMER	NONE					1	
23-Jun-09	1	1048	1	NW LANTAU	3	ON	823938	806286	SUMMER	NONE					1	
23-Jun-09	2	1137	3	NW LANTAU	3	ON	829251	807584	SUMMER	NONE			2		1	
23-Jun-09	3	1155	10	NW LANTAU	3	ON	826857	808434	SUMMER	NONE		1	3		3	1
23-Jun-09	4	1238	5	NW LANTAU	3	OFF	820654	809247	SUMMER	NONE			2			
24-Jun-09	1	1035	1	W LANTAU	3	ON	812666	800543	SUMMER	NONE					1	
24-Jun-09	2	1114	3	W LANTAU	3	ON	806187	800610	SUMMER	NONE			1	1		
24-Jun-09	3	1204	2	SW LANTAU	2	ON	806822	804293	SUMMER	NONE			1			
24-Jun-09	4	1212	1	SW LANTAU	2	ON	807462	805222	SUMMER	NONE			1			
24-Jun-09	5	1219	1	SW LANTAU	2	ON	807681	806357	SUMMER	NONE						
24-Jun-09	7	1526	3	W LANTAU	2	OFF	806327	802766	SUMMER	NONE			2			
2-Jul-09	1	1545	3	W LANTAU	3	ON	809608	801226	SUMMER	NONE		1	1			
2-Jul-09	2	1614	10	W LANTAU	2	ON	814043	803659	SUMMER	NONE		1	2	1	2	1
3-Jul-09	1	1110	6	NW LANTAU	2	OFF	826850	806405	SUMMER	NONE			2	1	1	1
3-Jul-09	2	1238	4	NW LANTAU	4	ON	823709	810499	SUMMER	NONE				2	1	
3-Jul-09	3	1531	4	NE LANTAU	2	ON	821935	820138	SUMMER	NONE		1	1		2	
7-Jul-09	1	1524	8	NE LANTAU	2	ON	820564	818138	SUMMER	NONE			2	2	2	
7-Jul-09	2	1621	2	NE LANTAU	2	ON	819979	816406	SUMMER	NONE						
8-Jul-09	1	955	6	W LANTAU	2	ON	814959	805042	SUMMER	NONE			2	1	1	
8-Jul-09	2	1017	3	W LANTAU	3	ON	814121	803607	SUMMER	NONE			1			
8-Jul-09	3	1028	12	W LANTAU	3	ON	812783	802419	SUMMER	NONE		2	4	2	1	
8-Jul-09	4	1122	7	W LANTAU	3	ON	808933	800936	SUMMER	NONE		1	2	1	2	
8-Jul-09	5	1140	10	W LANTAU	3	ON	806173	802054	SUMMER	NONE			1		2	
8-Jul-09	6	1203	2	W LANTAU	3	ON	806166	800404	SUMMER	NONE						
8-Jul-09	7	1206	2	W LANTAU	3	ON	806321	800311	SUMMER	NONE						
8-Jul-09	8	1216	2	W LANTAU	3	ON	807341	799819	SUMMER	NONE					1	
8-Jul-09	9	1230	6	W LANTAU	3	ON	809114	799452	SUMMER	NONE			1	1	2	
8-Jul-09	10	1449	3	NW LANTAU	4	ON	827093	806591	SUMMER	NONE						
8-Jul-09	11	1545	1	NW LANTAU	3	ON	824283	811169	SUMMER	NONE						
16-Jul-09	1	1038	1	W LANTAU	4	ON	810199	799506	SUMMER	NONE						
16-Jul-09	2	1107	12	W LANTAU	3	ON	806107	801909	SUMMER	HANG	1		4	1	2	2
16-Jul-09	3	1141	2	W LANTAU	3	ON	808313	801079	SUMMER	NONE			1		1	
16-Jul-09	4	1309	6	NW LANTAU	2	ON	826907	805344	SUMMER	NONE			1		1	
16-Jul-09	5	1320	6	NW LANTAU	3	ON	827505	805366	SUMMER	NONE			3		1	1
17-Jul-09	1	1011	2	W LANTAU	2	ON	814399	802969	SUMMER	NONE						
17-Jul-09	2	1103	13	SW LANTAU	2	ON	806117	802487	SUMMER	NONE		2	3	1	1	1
30-Jul-09	1	1023	6	W LANTAU	2	ON	813977	803659	SUMMER	HANG			3		1	
30-Jul-09	2	1046	3	W LANTAU	3	ON	810726	801528	SUMMER	NONE			1			
30-Jul-09	3	1059	6	W LANTAU	3	OFF	808291	801017	SUMMER	NONE			2	1	1	1
30-Jul-09	4	1224	3	W LANTAU	2	ON	814302	801804	SUMMER	NONE			1		1	1
3-Aug-09	1	1351	5	SW LANTAU	3	ON	801953	807800	SUMMER	NONE		1	2	1		
3-Aug-09	2	1414	3	SW LANTAU	3	ON	803325	808422	SUMMER	NONE			1	1	1	

Appendix II. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	SEASON	BOAT ASSOC.	UC	UJ	SJ	SS	SA	UA
3-Aug-09	3	1433	2	SW LANTAU	4	ON	804289	808197	SUMMER	NONE						
3-Aug-09	4	1512	1	SW LANTAU	4	ON	805101	806352	SUMMER	NONE						
3-Aug-09	5	1535	5	W LANTAU	3	ON	806417	801931	SUMMER	NONE					3	2
3-Aug-09	6	1625	3	W LANTAU	3	ON	812982	802574	SUMMER	NONE			1			
13-Aug-09	1	1203	1	NE LANTAU	1	ON	823267	817400	SUMMER	NONE						
13-Aug-09	2	1239	1	NE LANTAU	1	ON	821342	815316	SUMMER	NONE			1			
13-Aug-09	3	1502	7	NW LANTAU	2	ON	827581	806406	SUMMER	NONE		1	1		2	
14-Aug-09	1	1047	1	W LANTAU	2	ON	807826	800573	SUMMER	NONE					1	
14-Aug-09	2	1057	2	W LANTAU	2	ON	806053	801497	SUMMER	NONE			1			
14-Aug-09	3	1126	1	SW LANTAU	1	ON	804111	803369	SUMMER	HANG						1
14-Aug-09	4	1151	3	SW LANTAU	1	OFF	806933	804242	SUMMER	NONE			1	1	1	
19-Aug-09	1	1008	6	W LANTAU	1	ON	814970	805238	SUMMER	NONE			2		1	
19-Aug-09	2	1019	13	W LANTAU	1	ON	813965	803741	SUMMER	NONE		3	2	2	1	1
19-Aug-09	3	1038	1	W LANTAU	2	ON	811644	801839	SUMMER	SHRIMP						
19-Aug-09	4	1047	3	W LANTAU	2	ON	810128	801341	SUMMER	NONE			1			2
19-Aug-09	5	1057	6	W LANTAU	2	ON	808601	800946	SUMMER	NONE		1		1	1	1
19-Aug-09	6	1122	1	W LANTAU	2	ON	806177	800486	SUMMER	NONE						
19-Aug-09	7	1148	2	W LANTAU	2	ON	809555	799989	SUMMER	NONE						
19-Aug-09	8	1205	2	W LANTAU	2	ON	811403	800632	SUMMER	NONE						
19-Aug-09	9	1218	1	W LANTAU	2	ON	813495	801245	SUMMER	NONE						
19-Aug-09	10	1225	1	W LANTAU	2	ON	814136	801804	SUMMER	NONE						
19-Aug-09	11	1342	4	NW LANTAU	2	ON	824681	805350	SUMMER	NONE			1	1	1	
19-Aug-09	12	1406	2	NW LANTAU	2	ON	827018	805252	SUMMER	NONE						
19-Aug-09	13	1417	3	NW LANTAU	1	ON	828845	805369	SUMMER	NONE		1				
19-Aug-09	14	1429	1	NW LANTAU	2	ON	828753	807160	SUMMER	NONE						
19-Aug-09	15	1437	6	NW LANTAU	2	ON	827080	807435	SUMMER	NONE			1		1	1
20-Aug-09	1	1009	4	W LANTAU	1	ON	815393	804187	SUMMER	NONE			2			
20-Aug-09	2	1030	2	W LANTAU	3	ON	811800	801242	SUMMER	NONE						
20-Aug-09	3	1039	1	W LANTAU	2	ON	810185	800630	SUMMER	NONE						
20-Aug-09	4	1044	1	W LANTAU	3	ON	809366	800504	SUMMER	NONE						
20-Aug-09	5	1050	2	W LANTAU	3	ON	808081	800532	SUMMER	NONE		1				
20-Aug-09	6	1417	1	SE LANTAU	2	ON	802588	812206	SUMMER	NONE						
1-Sep-09	1	1400	2	NW LANTAU	2	ON	826763	805303	AUTUMN	NONE			1		1	
1-Sep-09	2	1422	6	NW LANTAU	1	ON	825811	805363	AUTUMN	NONE			2			2
2-Sep-09	1	1013	13	W LANTAU	2	ON	813669	802565	AUTUMN	NONE		1	5	1	1	1
2-Sep-09	2	1057	1	W LANTAU	3	ON	806206	802023	AUTUMN	NONE				1		
2-Sep-09	3	1116	1	W LANTAU	3	ON	807573	799830	AUTUMN	NONE						
2-Sep-09	4	1325	10	NW LANTAU	2	ON	828367	806387	AUTUMN	NONE			2	2	1	2
7-Sep-09	1	1524	2	SW LANTAU	3	ON	805962	802569	AUTUMN	NONE			1			
8-Sep-09	1	1030	2	NW LANTAU	1	ON	823705	806100	AUTUMN	NONE			1	1		
8-Sep-09	2	1046	3	NW LANTAU	2	ON	825377	806371	AUTUMN	NONE			2			1
8-Sep-09	3	1109	5	NW LANTAU	2	ON	825521	806382	AUTUMN	NONE			1			
8-Sep-09	4	1302	4	NE LANTAU	1	ON	821921	813256	AUTUMN	NONE					1	1
21-Sep-09	1	1007	15	W LANTAU	2	ON	815867	805116	AUTUMN	NONE		3	5	1	2	
21-Sep-09	2	1033	2	W LANTAU	1	ON	814653	803320	AUTUMN	NONE						1
21-Sep-09	3	1045	6	W LANTAU	1	ON	813437	802132	AUTUMN	NONE			2			
21-Sep-09	4	1055	1	W LANTAU	1	ON	812319	801851	AUTUMN	HANG						
21-Sep-09	5	1100	4	W LANTAU	1	ON	811745	801468	AUTUMN	PAIR						
6-Oct-09	3	1617	3	W LANTAU	3	ON	814576	803175	AUTUMN	NONE						
7-Oct-09	1	1019	3	W LANTAU	2	ON	813524	803049	AUTUMN	NONE	1			1		
7-Oct-09	2	1033	1	W LANTAU	3	ON	812971	802595	AUTUMN	NONE						

Appendix II. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	SEASON	BOAT ASSOC.	UC	UJ	SJ	SS	SA	UA
7-Oct-09	3	1037	2	W LANTAU	2	ON	812684	802439	AUTUMN	NONE			1			
7-Oct-09	4	1134	2	W LANTAU	3	ON	810131	799867	AUTUMN	NONE					1	1
8-Oct-09	1	1054	6	NW LANTAU	3	ON	828688	806378	AUTUMN	NONE			4	1		1
8-Oct-09	2	1115	3	NW LANTAU	3	ON	829617	807059	AUTUMN	NONE		2	1			
8-Oct-09	3	1340	16	NE LANTAU	2	ON	818564	814704	AUTUMN	NONE		3	5	1	3	1
8-Oct-09	4	1416	1	NE LANTAU	2	ON	822970	815298	AUTUMN	NONE						
16-Oct-09	1	1029	2	W LANTAU	2	ON	814606	804453	AUTUMN	NONE			2			
16-Oct-09	2	1041	12	W LANTAU	2	OFF	814475	803515	AUTUMN	NONE			7	2	2	1
16-Oct-09	3	1219	9	W LANTAU	3	ON	809445	799628	AUTUMN	NONE	1	3	1	1	2	1
16-Oct-09	4	1240	5	W LANTAU	3	ON	810574	800043	AUTUMN	NONE			2		1	1
16-Oct-09	5	1334	2	W LANTAU	2	ON	814809	802836	AUTUMN	NONE						
16-Oct-09	6	1352	1	W LANTAU	2	OFF	816321	805117	AUTUMN	NONE						
16-Oct-09	7	1427	2	NW LANTAU	2	ON	822820	805676	AUTUMN	NONE			1	1		
16-Oct-09	8	1503	3	NW LANTAU	2	ON	827694	805366	AUTUMN	NONE						
16-Oct-09	9	1507	2	NW LANTAU	2	ON	828690	805368	AUTUMN	NONE						
28-Oct-09	1	1209	7	NW LANTAU	2	OFF	830050	806401	AUTUMN	NONE				2	4	1
28-Oct-09	2	1241	5	NW LANTAU	2	ON	825355	806392	AUTUMN	NONE						
28-Oct-09	3	1428	3	W LANTAU	1	ON	805954	801166	AUTUMN	NONE						1
28-Oct-09	4	1443	1	W LANTAU	2	ON	806550	801869	AUTUMN	NONE			1			
28-Oct-09	5	1500	2	W LANTAU	2	ON	810427	801486	AUTUMN	NONE						
29-Oct-09	1	1038	8	W LANTAU	3	ON	810373	800589	AUTUMN	NONE			3	1	3	
5-Nov-09	1	1531	1	W LANTAU	3	ON	809519	801195	AUTUMN	NONE			1			
6-Nov-09	1	957	7	NW LANTAU	0	OFF	816629	806241	AUTUMN	HANG		1	2	1	1	
6-Nov-09	2	1031	1	NW LANTAU	2	ON	821105	805353	AUTUMN	NONE						
6-Nov-09	3	1054	1	NW LANTAU	2	ON	827040	805355	AUTUMN	GILL					1	
6-Nov-09	4	1101	15	NW LANTAU	1	ON	827849	805356	AUTUMN	NONE		1	5	3	3	1
19-Nov-09	1	1005	3	W LANTAU	4	ON	815114	805269	AUTUMN	SHRIMP			1	1	1	
19-Nov-09	2	1115	2	W LANTAU	4	OFF	808944	800936	AUTUMN	NONE		1				
19-Nov-09	3	1136	4	W LANTAU	4	OFF	812706	802336	AUTUMN	NONE		1	1	1		
19-Nov-09	4	1151	3	W LANTAU	4	OFF	813966	803586	AUTUMN	NONE						
20-Nov-09	1	1108	5	SW LANTAU	6	OFF	806216	802807	AUTUMN	NONE		1	3			1
25-Nov-09	1	1039	14	W LANTAU	2	ON	809143	800988	AUTUMN	NONE		2	3		1	2
25-Nov-09	2	1114	5	W LANTAU	2	ON	806118	801971	AUTUMN	NONE		1			1	1
25-Nov-09	3	1135	1	W LANTAU	2	ON	806510	800178	AUTUMN	NONE						
25-Nov-09	4	1146	6	W LANTAU	2	ON	808925	799420	AUTUMN	NONE		1	3		1	
25-Nov-09	5	1218	5	W LANTAU	2	ON	811316	800117	AUTUMN	NONE			2			
25-Nov-09	6	1338	2	NW LANTAU	2	ON	827162	805365	AUTUMN	NONE						
2-Dec-09	1	1029	6	NW LANTAU	3	ON	822974	806212	WINTER	NONE		1	1	2	1	1
2-Dec-09	2	1113	1	NW LANTAU	3	ON	829286	806399	WINTER	NONE						
2-Dec-09	3	1222	8	DEEP BAY	2	ON	831740	808577	WINTER	NONE			3		2	2
2-Dec-09	4	1349	2	NW LANTAU	3	ON	824462	810510	WINTER	NONE						
2-Dec-09	5	1541	13	NE LANTAU	3	ON	820920	816397	WINTER	NONE		2	2	1	2	3
3-Dec-09	1	1117	2	W LANTAU	5	ON	806794	801581	WINTER	NONE						
3-Dec-09	2	1144	1	W LANTAU	4	ON	811290	801900	WINTER	NONE						
3-Dec-09	3	1455	1	NE LANTAU	3	ON	819569	816395	WINTER	NONE			1			
4-Dec-09	1	1025	2	W LANTAU	2	ON	814783	804701	WINTER	NONE			2			
4-Dec-09	2	1034	1	W LANTAU	2	ON	814440	804247	WINTER	NONE				1		
4-Dec-09	3	1046	2	W LANTAU	2	ON	813557	802967	WINTER	NONE						
4-Dec-09	4	1102	1	W LANTAU	2	ON	810792	801497	WINTER	NONE			1			
4-Dec-09	5	1153	1	SW LANTAU	1	ON	806215	803394	WINTER	NONE				1		
4-Dec-09	6	1225	14	SW LANTAU	2	ON	803940	805370	WINTER	PAIR	1	2	3	2	3	2

Appendix II. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	SEASON	BOAT ASSOC.	UC	UJ	SJ	SS	SA	UA
4-Dec-09	7	1343	1	SW LANTAU	2	ON	808300	807214	WINTER	PAIR						
4-Dec-09	8	1620	2	SE LANTAU	2	ON	807445	815452	WINTER	NONE						1
18-Dec-09	1	1101	2	W LANTAU	4	ON	806151	801971	WINTER	NONE						
18-Dec-09	2	1142	3	SW LANTAU	3	ON	806767	804004	WINTER	NONE		1	1			
29-Dec-09	1	1026	4	W LANTAU	4	ON	810759	801394	WINTER	NONE			1		1	1
29-Dec-09	2	1039	1	W LANTAU	6	ON	808800	800853	WINTER	NONE			1			
29-Dec-09	3	1042	2	W LANTAU	6	ON	808557	800811	WINTER	NONE				1		
29-Dec-09	4	1141	3	W LANTAU	3	ON	814169	801783	WINTER	NONE						
29-Dec-09	5	1522	2	NW LANTAU	3	ON	823443	810498	WINTER	NONE						
30-Dec-09	1	1005	1	W LANTAU	2	ON	814871	804784	WINTER	NONE						
30-Dec-09	2	1037	3	W LANTAU	2	ON	808723	800894	WINTER	NONE			1	1		1
30-Dec-09	3	1117	1	W LANTAU	3	ON	807984	799676	WINTER	PAIR						
15-Jan-10	1	1016	4	NW LANTAU	2	OFF	816940	805891	WINTER	NONE			3			1
15-Jan-10	2	1045	2	W LANTAU	2	ON	816734	803798	WINTER	NONE						
15-Jan-10	3	1058	3	W LANTAU	1	ON	815008	802960	WINTER	NONE			2			
15-Jan-10	4	1135	1	W LANTAU	2	ON	811468	801282	WINTER	NONE						
15-Jan-10	5	1156	5	W LANTAU	2	ON	809432	800731	WINTER	NONE			3		1	
15-Jan-10	6	1245	3	W LANTAU	4	ON	806299	800352	WINTER	NONE			1	1		
15-Jan-10	7	1314	9	W LANTAU	2	ON	808770	799441	WINTER	NONE			2	3		1
15-Jan-10	8	1325	1	W LANTAU	2	ON	809036	799544	WINTER	NONE			1			
15-Jan-10	9	1530	3	NW LANTAU	2	ON	829662	806936	WINTER	NONE			1	1		
15-Jan-10	10	1546	6	NW LANTAU	2	OFF	829472	807718	WINTER	NONE		1			3	
15-Jan-10	11	1608	1	NW LANTAU	2	ON	827643	808456	WINTER	NONE						
28-Jan-10	5	1518	1	SW LANTAU	0	ON	807208	805088	WINTER	NONE						
28-Jan-10	6	1558	3	W LANTAU	3	OFF	806417	801931	WINTER	NONE			1			
28-Jan-10	7	1613	5	W LANTAU	2	OFF	809509	801071	WINTER	NONE			3		1	
28-Jan-10	8	1638	1	W LANTAU	2	OFF	812296	802274	WINTER	NONE			1			
1-Feb-10	8	1532	9	SW LANTAU	0	ON	804386	804278	WINTER	NONE		1			2	3
1-Feb-10	9	1540	1	SW LANTAU	1	ON	803799	804297	WINTER	NONE						
1-Feb-10	10	1636	1	W LANTAU	0	OFF	807669	801542	WINTER	NONE				1		
1-Feb-10	11	1705	3	W LANTAU	0	OFF	811168	801807	WINTER	NONE			2		1	
1-Feb-10	12	1718	11	W LANTAU	1	OFF	813226	802688	WINTER	NONE		1	5		1	
2-Feb-10	1	0957	3	NW LANTAU	3	OFF	816596	806179	WINTER	NONE				1	1	1
2-Feb-10	2	1052	1	W LANTAU	3	ON	813624	802823	WINTER	NONE						
2-Feb-10	3	1201	1	W LANTAU	4	ON	807427	801025	WINTER	NONE						
2-Feb-10	4	1206	1	W LANTAU	4	ON	807448	801582	WINTER	NONE						
2-Feb-10	5	1302	8	W LANTAU	3	ON	810463	800311	WINTER	NONE		1	2		2	1
2-Feb-10	6	1340	2	W LANTAU	3	ON	812439	802666	WINTER	NONE				1	1	
2-Feb-10	7	1448	6	NW LANTAU	4	ON	820021	804661	WINTER	NONE			1		1	1
11-Feb-10	1	1043	1	W LANTAU	2	OFF	808734	800884	WINTER	NONE				1		
11-Feb-10	2	1057	2	W LANTAU	2	OFF	806340	801879	WINTER	NONE				1	1	
23-Feb-10	10	1312	9	SW LANTAU	2	ON	807398	810151	WINTER	PAIR						
23-Feb-10	12	1637	4	W LANTAU	2	OFF	813899	803535	WINTER	NONE						
24-Feb-10	1	1021	1	NW LANTAU	4	ON	820651	805342	WINTER	NONE						
2-Mar-10	1	1107	4	W LANTAU	3	ON	811468	801519	SPRING	NONE				2		
2-Mar-10	2	1115	7	W LANTAU	3	ON	811456	801818	SPRING	HANG			2	2	2	1
2-Mar-10	3	1144	6	W LANTAU	3	ON	809443	800514	SPRING	NONE		1	2		1	
2-Mar-10	4	1350	3	W LANTAU	3	ON	814620	803279	SPRING	NONE				1	1	
4-Mar-10	1	1200	2	DEEP BAY	2	ON	833940	811134	SPRING	NONE			1			1
4-Mar-10	2	1350	2	NW LANTAU	3	ON	825798	806413	SPRING	NONE			1		1	
4-Mar-10	3	1451	2	NW LANTAU	2	ON	823712	808438	SPRING	NONE						

Appendix II. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	SEASON	BOAT ASSOC.	UC	UJ	SJ	SS	SA	UA
10-Mar-10	2	1102	1	SW LANTAU	4	OFF	804612	802133	SPRING	NONE						
10-Mar-10	3	1107	4	W LANTAU	4	OFF	808169	801027	SPRING	HANG						
11-Mar-10	1	1049	15	NE LANTAU	2	ON	821691	819654	SPRING	NONE		2	3	1	5	2
11-Mar-10	2	1147	5	NE LANTAU	1	ON	822337	816533	SPRING	NONE						
11-Mar-10	3	1447	2	NW LANTAU	2	ON	824945	806381	SPRING	NONE						
11-Mar-10	4	1452	1	NW LANTAU	2	ON	825931	806383	SPRING	NONE					1	
11-Mar-10	5	1508	4	NW LANTAU	2	ON	829728	806781	SPRING	SHRIMP					2	1
11-Mar-10	6	1558	1	NW LANTAU	2	ON	822767	804677	SPRING	NONE						
30-Mar-10	1	1052	2	W LANTAU	3	ON	812012	800892	SPRING	SHRIMP						2
30-Mar-10	2	1110	4	W LANTAU	3	ON	810969	801827	SPRING	NONE			2	2		
30-Mar-10	3	1202	7	W LANTAU	3	ON	808404	799801	SPRING	NONE			1	1		3
30-Mar-10	4	1237	11	W LANTAU	3	ON	810461	801156	SPRING	NONE			4	3	2	
30-Mar-10	5	1511	7	NW LANTAU	3	ON	829296	806904	SPRING	NONE			2	1	2	
30-Mar-10	6	1528	1	NW LANTAU	3	ON	828155	807427	SPRING	NONE						
31-Mar-10	1	1122	3	NW LANTAU	4	ON	828090	806387	SPRING	NONE						
31-Mar-10	2	1148	1	NW LANTAU	2	ON	823628	806048	SPRING	NONE						

Appendix III. Finless porpoise sighting database (April 2009 - March 2010)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	TYPE	SEASON
16-Apr-09	2	1518	6	SE LANTAU	2	ON	808751	815608	HKCRP	SPRING
16-Apr-09	3	1533	1	SE LANTAU	2	ON	806315	815924	HKCRP	SPRING
8-May-09	1	1120	1	SE LANTAU	3	ON	805950	815285	HKCRP	SPRING
8-May-09	2	1127	1	SE LANTAU	3	ON	804931	815283	HKCRP	SPRING
8-May-09	3	1351	3	SW LANTAU	5	ON	801601	806789	HKCRP	SPRING
13-May-09	1	1022	4	SE LANTAU	2	ON	805348	818378	HKCRP	SPRING
13-May-09	2	1026	6	SE LANTAU	2	ON	805094	818377	HKCRP	SPRING
13-May-09	3	1032	1	SE LANTAU	2	ON	804462	818366	HKCRP	SPRING
13-May-09	4	1113	3	SE LANTAU	2	ON	806647	815873	HKCRP	SPRING
13-May-09	5	1217	1	SE LANTAU	1	ON	802932	812176	HKCRP	SPRING
13-May-09	6	1337	1	SW LANTAU	2	ON	800745	808850	HKCRP	SPRING
24-Jun-09	6	1418	1	SW LANTAU	2	ON	801969	811473	HKCRP	SUMMER
7-Aug-09	1	1424	2	PO TOI	3	ON	804021	843542	HKCRP	SUMMER
21-Aug-09	1	938	10	LAMMA	2	OFF	805515	839509	HKCRP	SUMMER
21-Aug-09	2	1020	1	PO TOI	2	ON	804598	845934	HKCRP	SUMMER
21-Aug-09	3	1033	3	PO TOI	2	ON	804423	848565	HKCRP	SUMMER
21-Aug-09	4	1040	3	PO TOI	2	ON	804446	849400	HKCRP	SUMMER
21-Aug-09	5	1046	3	PO TOI	2	ON	804447	850710	HKCRP	SUMMER
21-Aug-09	6	1110	1	PO TOI	2	ON	804452	856011	HKCRP	SUMMER
21-Aug-09	7	1307	1	PO TOI	2	ON	802227	856664	HKCRP	SUMMER
21-Aug-09	8	1544	1	NINEPINS	2	ON	808878	852459	HKCRP	SUMMER
21-Aug-09	9	1603	1	NINEPINS	2	ON	808864	848984	HKCRP	SUMMER
28-Aug-09	1	938	1	PO TOI	2	OFF	804142	840314	HKCRP	SUMMER
28-Aug-09	2	1013	1	PO TOI	3	ON	802218	846679	HKCRP	SUMMER
28-Aug-09	3	1017	2	PO TOI	2	ON	802207	847236	HKCRP	SUMMER
28-Aug-09	4	1442	2	PO TOI	2	ON	806473	850780	HKCRP	SUMMER
06-Oct-09	1	1151	1	SE LANTAU	3	ON	805063	816304	HKCRP	AUTUMN
06-Oct-09	2	1333	3	SE LANTAU	3	ON	806795	813234	HKCRP	AUTUMN
29-Oct-09	2	1512	1	SE LANTAU	4	ON	805618	815377	HKCRP	AUTUMN
10-Nov-09	1	1018	1	PO TOI	2	ON	806473	850079	HKCRP	AUTUMN
10-Nov-09	2	1147	1	PO TOI	1	ON	802231	859356	HKCRP	AUTUMN
10-Nov-09	3	1245	1	PO TOI	2	ON	802218	846359	HKCRP	AUTUMN
20-Nov-09	2	1425	1	SE LANTAU	3	OFF	803291	816312	HKCRP	AUTUMN
10-Dec-09	1	1115	3	SE LANTAU	2	ON	808019	816318	HKCRP	WINTER
10-Dec-09	2	1157	1	SE LANTAU	3	ON	803028	814239	HKCRP	WINTER
10-Dec-09	3	1316	3	SW LANTAU	2	ON	802835	810298	HKCRP	WINTER
10-Dec-09	4	1324	1	SW LANTAU	2	ON	801539	810286	HKCRP	WINTER
10-Dec-09	5	1330	2	SW LANTAU	2	ON	800831	810295	HKCRP	WINTER
10-Dec-09	6	1604	1	SE LANTAU	1	ON	808285	816216	HKCRP	WINTER
18-Dec-09	3	1618	1	SE LANTAU	3	ON	802680	817869	HKCRP	WINTER
07-Jan-09	1	1146	4	SE LANTAU	2	ON	804256	815292	HKCRP	WINTER
28-Jan-10	1	1055	2	SE LANTAU	0	ON	803401	817334	HKCRP	WINTER
28-Jan-10	2	1103	2	SE LANTAU	1	ON	804475	817335	HKCRP	WINTER
28-Jan-10	3	1151	1	SE LANTAU	2	ON	805075	815273	HKCRP	WINTER
28-Jan-10	4	1339	3	SW LANTAU	2	ON	801818	809358	HKCRP	WINTER
01-Feb-10	1	1103	1	SE LANTAU	1	ON	804443	816314	HKCRP	WINTER
01-Feb-10	2	1110	8	SE LANTAU	0	ON	805606	816243	HKCRP	WINTER
01-Feb-10	3	1129	3	SE LANTAU	0	ON	806281	815945	HKCRP	WINTER
01-Feb-10	4	1206	1	SE LANTAU	1	ON	806140	814254	HKCRP	WINTER
01-Feb-10	5	1220	2	SE LANTAU	1	ON	803449	814239	HKCRP	WINTER
01-Feb-10	6	1240	1	SE LANTAU	1	ON	802588	812185	HKCRP	WINTER
01-Feb-10	7	1401	1	SW LANTAU	1	ON	800712	808417	HKCRP	WINTER

Appendix III. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	EFFORT	NORTHING	EASTING	TYPE	SEASON
11-Feb-10	3	1220	1	SW LANTAU	2	ON	801002	807355	HKCRP	WINTER
11-Feb-10	4	1453	2	SE LANTAU	2	ON	804259	813384	HKCRP	WINTER
11-Feb-10	5	1500	3	SE LANTAU	2	ON	804015	813384	HKCRP	WINTER
11-Feb-10	6	1507	1	SE LANTAU	2	ON	802830	813393	HKCRP	WINTER
11-Feb-10	7	1534	1	SE LANTAU	2	ON	804920	815366	HKCRP	WINTER
22-Feb-10	1	1040	1	LAMMA	2	ON	807215	822670	HKCRP	WINTER
22-Feb-10	2	1206	2	LAMMA	2	ON	804524	823544	HKCRP	WINTER
23-Feb-10	1	1026	1	SE LANTAU	1	ON	805736	818378	HKCRP	WINTER
23-Feb-10	2	1035	1	SE LANTAU	1	ON	804639	818377	HKCRP	WINTER
23-Feb-10	3	1108	4	SE LANTAU	0	ON	804764	816314	HKCRP	WINTER
23-Feb-10	4	1151	1	SE LANTAU	1	ON	806084	814264	HKCRP	WINTER
23-Feb-10	5	1155	2	SE LANTAU	1	ON	805453	814263	HKCRP	WINTER
23-Feb-10	6	1159	2	SE LANTAU	0	ON	804999	814272	HKCRP	WINTER
23-Feb-10	7	1221	1	SE LANTAU	1	ON	802045	812793	HKCRP	WINTER
23-Feb-10	8	1248	2	SE LANTAU	0	ON	807361	812193	HKCRP	WINTER
23-Feb-10	9	1252	1	SE LANTAU	0	ON	808092	812184	HKCRP	WINTER
23-Feb-10	11	1502	3	SW LANTAU	1	ON	806098	806354	HKCRP	WINTER
26-Feb-10	1	1430	3	LAMMA	0	ON	806445	833105	HKCRP	WINTER
10-Mar-10	1	1055	3	SE LANTAU	3	OFF	803142	812248	HELI	SPRING
19-Mar-10	1	1401	2	LAMMA	2	ON	805459	838529	HKCRP	SPRING

Appendix IV. Individual dolphins identified during April 2009 to March 2010

DOLPHIN ID	DATE	STG#	AREA
CH12	15/04/09	3	WL
	08/07/09	4	WL
CH25	19/08/09	2	WL
CH34	08/09/09	4	NEL
	28/10/09	1	NWL
	02/12/09	3	DB
CH37	07/05/09	3	WL
	08/07/09	3	WL
	16/10/09	2	WL
CH38	08/04/09	6	WL
	15/04/09	3	WL
	16/04/09	1	WL
	03/08/09	2	SWL
	16/10/09	3	WL
	30/03/10	4	WL
CH98	02/09/09	4	NWL
	02/12/09	3	DB
CH108	08/04/09	7	WL
	01/06/09	4	WL
	17/07/09	2	SWL
CH113	08/07/09	3	WL
CH141	04/12/09	6	SWL
CH144	15/04/09	2	WL
	15/04/09	3	WL
	02/09/09	1	WL
	21/09/09	1	WL
	23/02/10	10	SWL
DB03	06/11/09	4	NWL
EL01	10/06/09	3	WL
	02/12/09	5	NEL
	11/03/10	1	NEL
EL03	04/12/09	6	SWL
NL06	02/12/09	1	NWL
NL11	02/12/09	3	DB
	11/03/10	5	NWL
NL12	13/08/09	3	NWL
NL18	09/06/09	2	NEL
	03/07/09	3	NEL
	07/07/09	1	NEL
	06/11/09	1	NWL
	02/12/09	5	NEL
NL24	09/06/09	2	NEL
	23/06/09	3	NWL
	03/07/09	3	NEL
	08/10/09	3	NEL
	02/12/09	5	NEL
	15/01/10	10	NWL
	11/03/10	1	NEL
NL33	03/07/09	2	NWL
	07/07/09	1	NEL
	11/03/10	1	NEL
NL37	09/06/09	2	NEL
NL48	23/06/09	2	NWL
	01/09/09	2	NWL
NL60	08/10/09	1	NWL
	08/10/09	2	NWL
	28/10/09	1	NWL
	02/12/09	3	DB
NL75	23/06/09	3	NWL
	28/10/09	1	NWL
	02/12/09	5	NEL
NL93	14/05/09	1	NWL
	23/06/09	3	NWL
	02/12/09	1	NWL
NL98	09/06/09	2	NEL
	23/06/09	3	NWL
	03/07/09	3	NEL
	08/10/09	3	NEL
	02/12/09	5	NEL
	15/01/10	10	NWL
	11/03/10	1	NEL

DOLPHIN ID	DATE	STG#	AREA
NL104	09/06/09	2	NEL
NL105	02/07/09	2	WL
	03/07/09	1	NWL
NL118	11/03/10	4	NWL
NL120	07/07/09	1	NEL
	08/10/09	3	NEL
	02/12/09	5	NEL
	11/03/10	1	NEL
NL123	09/06/09	2	NEL
	08/10/09	3	NEL
	02/12/09	5	NEL
	11/03/10	1	NEL
NL128	16/07/09	2	WL
	01/02/10	8	SWL
NL136	16/07/09	5	NWL
	02/12/09	1	NWL
NL139	23/06/09	3	NWL
	08/09/09	4	NEL
	02/12/09	5	NEL
	02/02/10	7	NWL
NL150	07/07/09	1	NEL
	08/07/09	1	WL
NL152	06/11/09	4	NWL
NL153	13/08/09	3	NWL
NL156	08/07/09	9	WL
NL165	03/07/09	2	NWL
	07/07/09	1	NEL
NL170	15/04/09	1	WL
NL176	03/07/09	2	NWL
	02/12/09	1	NWL
NL179	11/03/10	1	NEL
NL182	02/12/09	5	NEL
NL188	06/11/09	4	NWL
NL191	16/10/09	7	NWL
	03/12/09	3	NEL
	11/03/10	1	NEL
NL196	06/11/09	4	NWL
NL203	30/03/10	5	NWL
NL205	11/03/10	5	NWL
NL206	08/04/09	3	WL
	15/04/09	3	WL
	01/06/09	4	WL
	08/07/09	4	WL
	17/07/09	2	SWL
	19/08/09	5	WL
	25/11/09	1	WL
	04/12/09	6	SWL
NL210	08/10/09	1	NWL
	08/10/09	2	NWL
	16/10/09	7	NWL
	11/03/10	1	NEL
NL212	19/08/09	2	WL
NL213	30/03/10	5	NWL
NL215	02/12/09	5	NEL
	11/03/10	1	NEL
NL220	01/09/09	1	NWL
NL221	19/08/09	15	NWL
NL222	02/02/10	7	NWL
NL226	16/10/09	3	WL
NL227	09/06/09	2	NEL
NL230	19/08/09	4	WL
NL233	06/05/09	3	NWL
	07/07/09	1	NEL
	08/07/09	1	WL
	06/11/09	4	NWL
	15/01/10	9	NWL
	04/03/10	2	NWL
	11/03/10	5	NWL
	31/03/10	1	NWL
NL236	04/03/10	2	NWL
	31/03/10	1	NWL

DOLPHIN ID	DATE	STG#	AREA
NL237	23/06/09	1	NWL
	28/10/09	1	NWL
	06/11/09	3	NWL
	06/11/09	4	NWL
NL241	02/09/09	4	NWL
	11/03/10	5	NWL
NL242	23/06/09	3	NWL
	06/11/09	4	NWL
	15/01/10	10	NWL
	11/03/10	1	NEL
NL244	03/07/09	1	NWL
	01/09/09	2	NWL
	08/09/09	2	NWL
	06/11/09	4	NWL
NL246	08/10/09	1	NWL
	08/10/09	2	NWL
	11/03/10	1	NEL
NL249	23/06/09	3	NWL
NL253	28/10/09	1	NWL
NL255	01/06/09	8	NWL
	30/03/10	5	NWL
NL258	02/07/09	2	WL
	30/07/09	2	WL
	02/12/09	1	NWL
NL259	16/04/09	1	WL
	07/07/09	1	NEL
	01/09/09	2	NWL
	06/11/09	1	NWL
NL260	01/06/09	9	NWL
	09/06/09	2	NEL
	23/06/09	3	NWL
	08/10/09	3	NEL
	23/02/10	12	WL
	11/03/10	1	NEL
NL261	08/10/09	1	NWL
	02/12/09	3	DB
NL262	08/10/09	2	NWL
NL264(new)	09/06/09	2	NEL
NL265(new)	02/09/09	1	WL
	21/09/09	1	WL
	04/12/09	2	WL
	30/03/10	4	WL
NL267(new)	01/06/09	8	NWL
	08/10/09	3	NEL
	02/12/09	3	DB
	04/03/10	1	DB
NL268(new)	09/06/09	2	NEL
	06/11/09	4	NWL
NL269(new)	23/06/09	2	NWL
	02/12/09	1	NWL
NL270(new)	23/06/09	3	NWL
	02/12/09	3	DB
NL271(new)	16/07/09	5	NWL
	19/08/09	11	NWL
NL272(new)	08/10/09	2	NWL
NL273(new)	08/10/09	3	NEL
	02/12/09	3	DB
	04/03/10	1	DB
SL05	08/04/09	3	WL
	15/04/09	3	WL
	16/04/09	1	WL
	17/07/09	2	SWL
	16/10/09	3	WL
	20/11/09	1	SWL
	25/11/09	2	WL
	04/12/09	6	SWL
	23/02/10	10	SWL
SL27	04/12/09	5	SWL
	01/02/10	11	WL
	11/02/10	1	WL
	23/02/10	10	SWL
SL35	15/04/09	1	WL
	16/04/09	1	WL

Appendix IV. (cont'd)

DOLPHIN ID	DATE	STG#	AREA
SL35	25/11/09	1	WL
	01/02/10	10	WL
	02/02/10	6	WL
	11/02/10	2	WL
SL40	16/04/09	1	WL
	17/07/09	2	SWL
	16/10/09	3	WL
	04/12/09	6	SWL
	01/02/10	8	SWL
SL41	17/07/09	2	SWL
	04/12/09	2	WL
SL44	15/04/09	3	WL
	29/10/09	1	WL
SL45	21/09/09	1	WL
SL47(new)	01/06/09	4	WL
	03/08/09	1	SWL
	04/12/09	6	SWL
WL04	02/09/09	1	WL
WL05	08/09/09	1	NWL
	02/02/10	7	NWL
WL09	15/04/09	1	WL
	10/06/09	7	WL
	16/07/09	2	WL
	08/09/09	1	NWL
	01/02/10	12	WL
WL11	14/05/09	2	NWL
	23/06/09	3	NWL
	08/07/09	3	WL
	06/11/09	4	NWL
	23/02/10	12	WL
WL15	16/04/09	1	WL
	24/06/09	2	WL
	16/10/09	2	WL
	16/10/09	4	WL
	01/02/10	11	WL
	02/02/10	6	WL
	11/02/10	2	WL
WL17	04/12/09	8	SEL
	15/01/10	3	WL
WL21	08/04/09	7	WL
	30/07/09	3	WL
	15/01/10	7	WL
	02/02/10	1	NWL
	02/02/10	5	WL
WL25	16/04/09	1	WL
	03/08/09	5	WL
	14/08/09	4	SWL
	02/09/09	1	WL
	21/09/09	2	WL
	29/12/09	1	WL
	15/01/10	7	WL
	02/02/10	5	WL
	02/03/10	2	WL
	30/03/10	1	WL
	30/03/10	3	WL
WL28	08/07/09	9	WL
	30/07/09	4	WL
WL29	02/09/09	1	WL
	25/11/09	4	WL
WL30	01/09/09	1	NWL
WL37	02/06/09	2	WL
WL42	17/07/09	2	SWL
	14/08/09	4	SWL
	30/12/09	2	WL
	02/02/10	5	WL
	30/03/10	2	WL
	30/03/10	3	WL
WL43	08/07/09	3	WL
WL44	08/07/09	3	WL
	02/12/09	5	NEL
WL46	08/07/09	1	WL
	08/10/09	1	NWL
	08/10/09	2	NWL

DOLPHIN ID	DATE	STG#	AREA
WL48	02/07/09	2	WL
WL50	16/04/09	1	WL
	06/05/09	5	WL
	08/07/09	4	WL
	14/08/09	4	SWL
WL55	16/04/09	1	WL
	07/05/09	3	WL
	10/06/09	6	WL
	08/07/09	3	WL
	16/10/09	2	WL
	16/10/09	4	WL
	04/12/09	6	SWL
WL56	01/06/09	4	WL
	04/12/09	2	WL
WL61	16/04/09	1	WL
WL62	15/04/09	3	WL
	16/04/09	1	WL
	16/10/09	3	WL
	19/11/09	3	WL
	01/02/10	8	SWL
	30/03/10	1	WL
WL66	08/07/09	3	WL
WL68	16/10/09	2	WL
WL69	16/07/09	2	WL
	03/08/09	5	WL
	29/10/09	1	WL
	25/11/09	2	WL
	23/02/10	10	SWL
WL72	08/07/09	3	WL
	19/11/09	1	WL
	02/03/10	2	WL
WL73	15/04/09	3	WL
	30/12/09	2	WL
	30/03/10	2	WL
	30/03/10	4	WL
WL79	10/06/09	2	WL
	19/08/09	11	NWL
WL83	16/04/09	1	WL
	16/07/09	3	WL
WL84	08/04/09	1	WL
	29/10/09	1	WL
WL86	08/04/09	6	WL
	10/06/09	3	WL
WL87	15/04/09	3	WL
	16/04/09	1	WL
	25/11/09	2	WL
	01/02/10	8	SWL
WL88	03/08/09	5	WL
	16/10/09	2	WL
	28/10/09	3	WL
	30/12/09	2	WL
WL91	15/04/09	3	WL
	16/04/09	1	WL
	17/07/09	2	SWL
	16/10/09	3	WL
WL92	07/05/09	3	WL
	16/10/09	2	WL
	04/12/09	6	SWL
WL93	15/04/09	1	WL
	16/04/09	1	WL
	07/05/09	3	WL
WL94	01/06/09	5	WL
	19/08/09	5	WL
WL95	06/05/09	5	WL
	06/05/09	6	WL
WL95	07/05/09	1	WL
	08/07/09	3	WL
	30/07/09	2	WL
WL98	19/08/09	2	WL
WL99	16/07/09	2	WL
WL100	16/07/09	2	WL
WL108	08/04/09	2	WL
	15/04/09	1	WL

DOLPHIN ID	DATE	STG#	AREA
WL108	07/05/09	2	WL
	16/10/09	1	WL
	16/10/09	2	WL
	20/11/09	1	SWL
	04/12/09	6	SWL
WL109	06/05/09	5	WL
	15/01/10	5	WL
WL111	03/07/09	1	NWL
	08/09/09	2	NWL
	06/11/09	4	NWL
WL114	15/04/09	3	WL
	03/08/09	2	SWL
	29/10/09	1	WL
WL116	15/04/09	3	WL
	15/04/09	5	WL
	03/08/09	2	SWL
	25/11/09	1	WL
WL118	08/07/09	4	WL
	16/10/09	3	WL
	30/03/10	2	WL
WL120	15/04/09	1	WL
	07/05/09	1	WL
	02/09/09	1	WL
WL121	25/11/09	1	WL
WL123	08/04/09	2	WL
	16/04/09	1	WL
	02/06/09	3	SWL
	03/08/09	5	WL
	15/01/10	1	NWL
	15/01/10	7	WL
	30/03/10	3	WL
WL124	08/07/09	4	WL
	19/08/09	2	WL
WL128	01/06/09	5	WL
WL129(new)	21/09/09	3	WL
WL130(new)	16/04/09	1	WL
	16/07/09	3	WL
	02/03/10	2	WL
WL131(new)	16/04/09	1	WL
WL132(new)	16/04/09	1	WL
	16/07/09	2	WL
	01/02/10	8	SWL
	30/03/10	3	WL
WL135(new)	16/10/09	1	WL
	16/10/09	2	WL
	16/10/09	4	WL
	20/11/09	1	SWL
	04/12/09	4	WL
WL137(new)	15/04/09	3	WL
	01/06/09	4	WL
	16/10/09	2	WL
	25/11/09	4	WL
	04/12/09	6	SWL
WL138(new)	30/03/10	2	WL
WL139(new)	15/04/09	1	WL
WL140(new)	16/04/09	1	WL
	07/10/09	4	WL
	01/02/10	8	SWL
WL141(new)	06/05/09	5	WL
	07/05/09	3	WL
	13/05/09	7	WL
WL142(new)	03/08/09	1	SWL
	16/10/09	2	WL
	04/12/09	6	SWL
WL143(new)	01/06/09	4	WL
WL144(new)	01/06/09	4	WL
	29/10/09	1	WL
	25/11/09	1	WL
WL145(new)	02/07/09	2	WL
	21/09/09	1	WL
	06/11/09	1	NWL
WL146(new)	08/07/09	3	WL
WL147(new)	16/10/09	2	WL

Appendix V. Association of Identified Dolphins on Each Survey Day During the Study Period

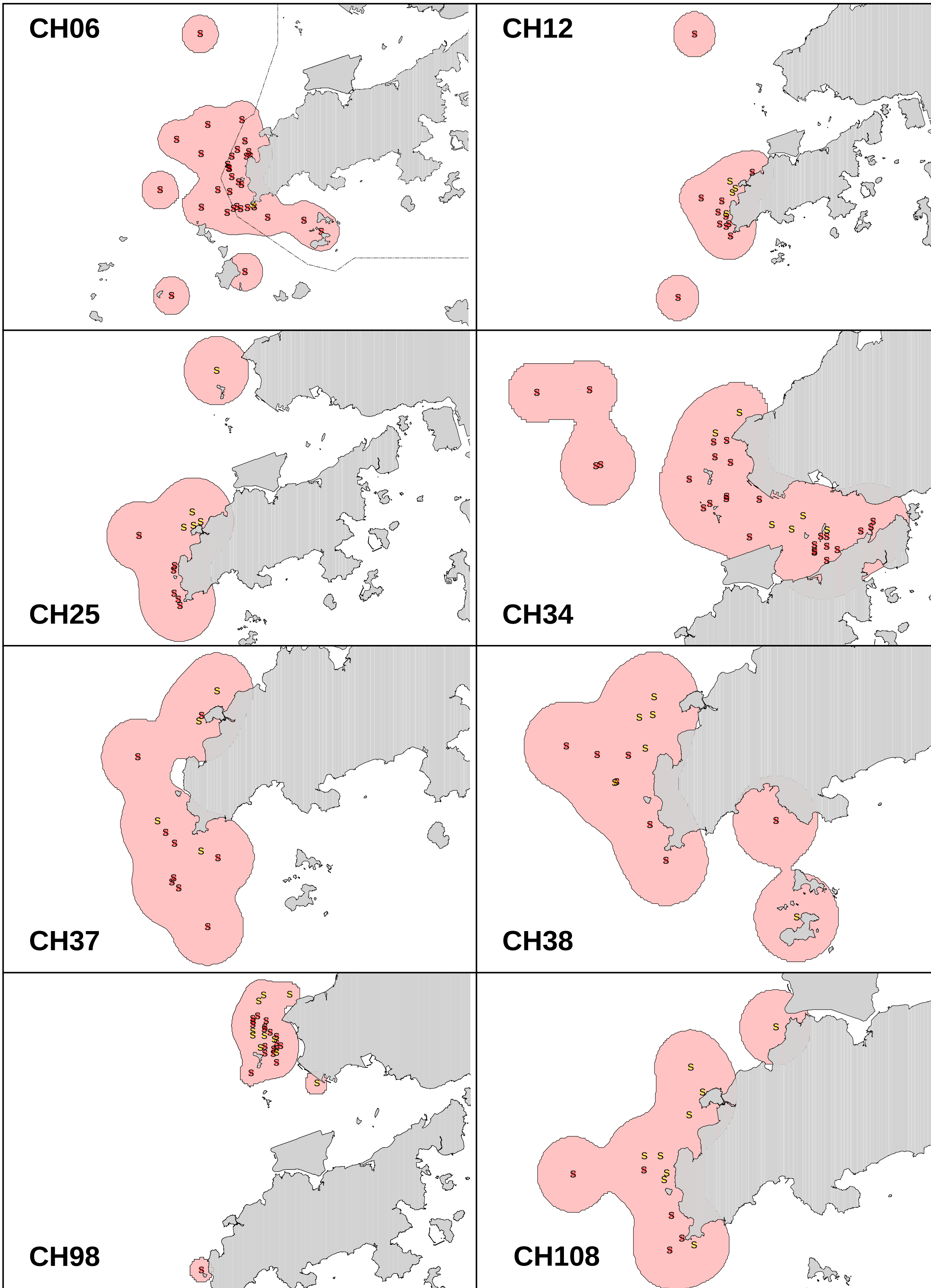
DATE	STG#	AREA	DOLPHIN ID
08/04/09	1	WL	WL84
"	2	WL	WL108, WL123
"	3	WL	NL206, SL05
"	6	WL	CH38, WL86
"	7	WL	CH108, WL21
15/04/09	1	WL	NL170, SL35, WL09, WL93, WL108, WL120, WL139
"	2	WL	CH144
"	3	WL	CH12, CH38, CH144, NL206, SL06, SL44, WL62, WL73, WL87, WL91, WL114, WL116, WL137
"	5	WL	WL116
16/04/09	1	WL	CH38, NL259, SL05, SL35, SL40, WL15, WL25, WL50, WL55, WL61, WL62, WL83, WL87, WL91, WL93, WL123, WL130, WL131, WL132, WL140
06/05/09	3	NWL	NL233
"	5	WL	WL50, WL95, WL109, WL141
"	6	WL	WL95
07/05/09	1	WL	WL95, WL120
"	2	WL	WL108
"	3	WL	CH37, WL55, WL92, WL93, WL141
13/05/09	7	WL	WL141
14/05/09	1	NWL	NL93
"	2	NWL	WL11
01/06/09	4	WL	CH108, NL206, SL47, WL56, WL137, WL143, WL144
"	5	WL	WL94, WL128
"	8	NWL	NL255, NL267
"	9	NWL	NL260
02/06/09	2	WL	WL37
"	3	SWL	WL123
09/06/09	2	NEL	NL18, NL24, NL37, NL98, NL104, NL123, NL227, NL260, NL264, NL268
10/06/09	2	WL	WL79
"	3	WL	EL01, WL86
"	6	WL	WL55
"	7	WL	WL09
23/06/09	1	NWL	NL237
"	2	NWL	NL48, NL269
"	3	NWL	NL24, NL75, NL93, NL98, NL139, NL242, NL249, NL260, NL270, WL11
24/06/09	2	WL	WL15
02/07/09	2	WL	NL105, NL258, WL48, WL145
03/07/09	1	NWL	NL105, NL244, WL111
"	2	NWL	NL33, NL165, NL176
"	3	NEL	NL18, NL24, NL98
07/07/09	1	NEL	NL18, NL33, NL120, NL150 NL165, NL233, NL259
08/07/09	1	WL	NL150, NL233, WL46
"	3	WL	CH37, CH113, WL11, WL43, WL44, WL55, WL66, WL72, WL95, WL146
08/07/09	4	WL	CH12, NL206, WL50, WL118, WL124
"	9	WL	NL156, WL28
16/07/09	2	WL	NL128, WL09, WL69, WL99, WL100 WL132
"	3	WL	WL83, WL130
"	5	NWL	NL136, NL271
17/07/09	2	SWL	CH108, NL206, SL05, SL40, SL41, WL42, WL91
30/07/09	2	WL	NL258, WL95
"	3	WL	WL21
"	4	WL	WL28
03/08/09	1	SWL	SL47, WL142
"	2	SWL	CH38, WL114, WL116
"	5	WL	WL25, WL69, WL88, WL123
13/08/09	3	NWL	NL12, NL153
14/08/09	4	SWL	WL25, WL42, WL50
19/08/09	2	WL	CH25, NL212, WL98, WL124
"	4	WL	NL230
"	5	WL	NL206, WL94
"	11	NWL	NL271, WL79
"	15	NWL	NL221
01/09/09	1	NWL	NL220, WL30
"	2	NWL	NL48, NL244, NL259
02/09/09	1	WL	CH144, NL265, WL04, WL25, WL29, WL120
"	4	NWL	CH98, NL241
08/09/09	1	NWL	WL05, WL09
"	2	NWL	NL244, WL111
"	4	NEL	CH34, NL139
21/09/09	1	WL	CH144, NL265, SL45, WL145
"	2	WL	WL25
"	3	WL	WL129
07/10/09	4	WL	WL140
08/10/09	1	NWL	NL60, NL210, NL246, NL261, WL46
"	2	NWL	NL60, NL210, NL246, NL262, NL271, WL46
"	3	NEL	NL24, NL98, NL120, NL123, NL260, NL267, NL273
16/10/09	1	WL	WL108, WL135
"	2	WL	CH37, WL15, WL55, WL68, WL88, WL92, WL108, WL135, WL137, WL142, WL147
"	3	WL	CH38, NL226, SL05, SL40, WL62, WL91, WL118
"	4	WL	WL15, WL55, WL135
"	7	NWL	NL191, NL210
28/10/09	1	NWL	CH34, NL60, NL75, NL237, NL253
"	3	WL	WL88
29/10/09	1	WL	SL44, WL69, WL84, WL114, WL144

Appendix V. (cont'd)

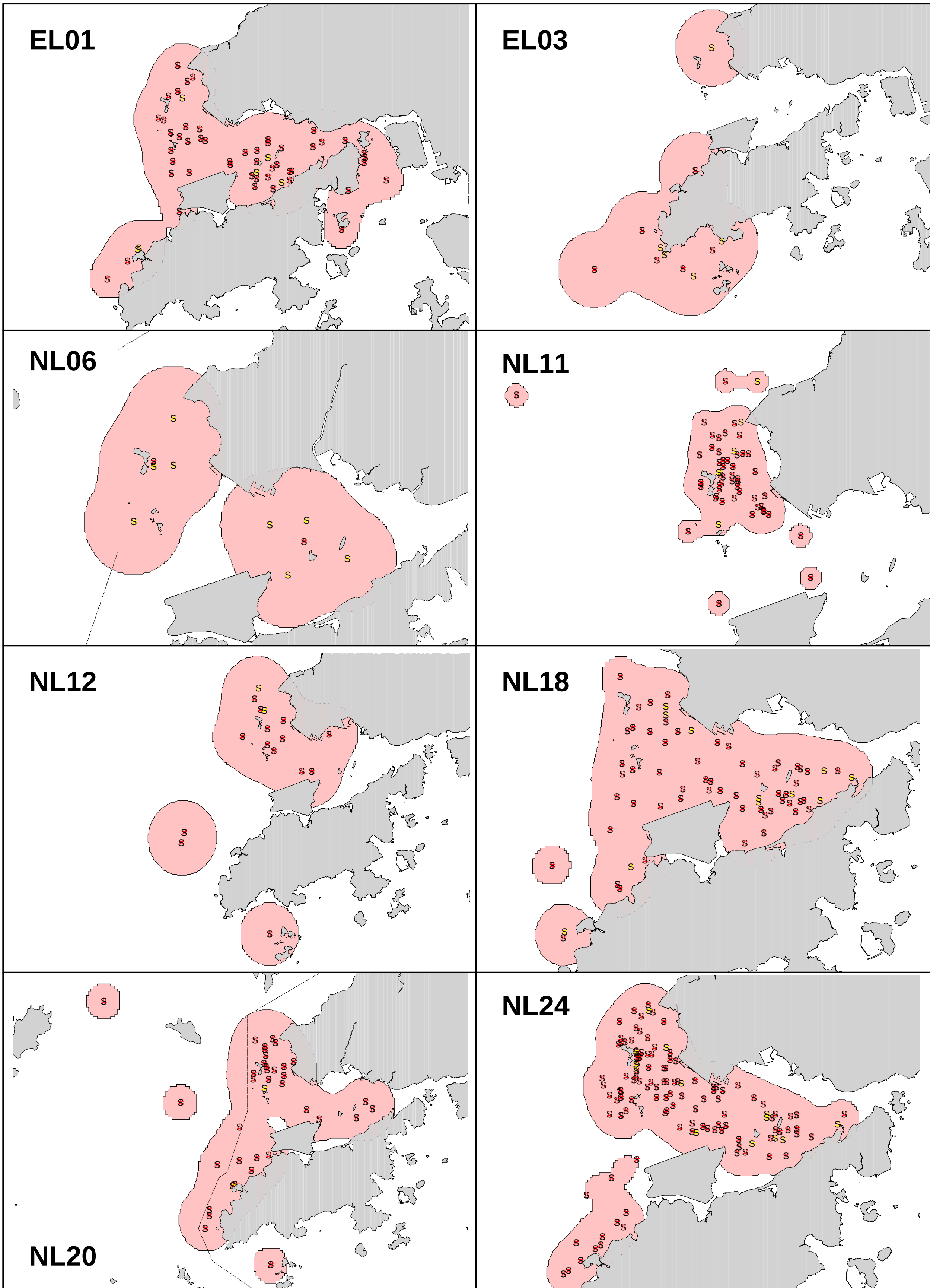
DATE	STG#	AREA	DOLPHIN ID
06/11/09	1	NWL	NL18, NL259, WL145
"	3	NWL	NL237
"	4	NWL	DB03, NL152, NL188, NL196, NL233, NL237, NL242, NL244, NL268, WL11, WL111
19/11/09	1	WL	WL72
"	3	WL	WL62
20/11/09	1	SWL	SL05, WL108, WL135
25/11/09	1	WL	NL206, SL35, WL116, WL121, WL144
"	2	WL	SL05, WL69, WL87
"	4	WL	WL29, WL137
02/12/09	1	NWL	NL06, NL93, NL136, NL176, NL258, NL269
"	3	DB	CH34, CH98, NL11, NL60, NL261, NL267, NL270, NL273
"	5	NEL	EL01, NL18, NL24, NL75, NL98, NL120, NL123, NL139, NL182, NL215, WL44
03/12/09	3	NEL	NL191
04/12/09	2	WL	NL265, SL41, WL56
"	4	WL	WL135
"	5	SWL	SL27
"	6	SWL	CH141, EL03, NL206, SL05, SL40, SL47, WL55, WL92, WL108, WL137, WL142
"	8	SEL	WL17
29/12/09	1	WL	WL25
30/12/09	2	WL	WL42, WL73, WL88
15/01/10	1	NWL	WL123
"	3	WL	WL17
"	5	WL	WL109
"	7	WL	WL21, WL25, WL123
"	9	NWL	NL233
"	10	NWL	NL24, NL98, NL242
01/02/10	8	SWL	NL128, SL40, WL62, WL87, WL132, WL140
"	10	WL	SL35
"	11	WL	SL27, WL15
"	12	WL	WL09
02/02/10	1	NWL	WL21
"	5	WL	WL21, WL25, WL42
"	6	WL	SL35, WL15
"	7	NWL	NL139, NL222
11/02/10	1	WL	SL27
"	2	WL	SL35, WL15
23/02/10	10	SWL	CH144, SL05, SL27, WL69
"	12	WL	NL260, WL11
02/03/10	2	WL	WL25, WL72, WL130
04/03/10	1	DB	NL267, NL273
"	2	NWL	NL233, NL236
11/03/10	1	NEL	EL01, NL24, NL33, NL98, NL120, NL123, NL179, NL191, NL210, NL215, NL242, NL246, NL260
"	4	NWL	NL118
"	5	NWL	NL11, NL205, NL233, NL241
30/03/10	1	WL	WL25, WL62
"	2	WL	WL42, WL73, WL118, WL138
"	3	WL	WL25, WL42, WL123, WL132
"	4	WL	CH38, NL265, WL73
"	5	NWL	NL203, NL213, NL255
31/03/10	1	NWL	NL233, NL236

Appendix VI. Ranging patterns (95% kernel ranges) of 88 individual dolphins with 10+ re-sightings that were sighted in 2008 and 2009

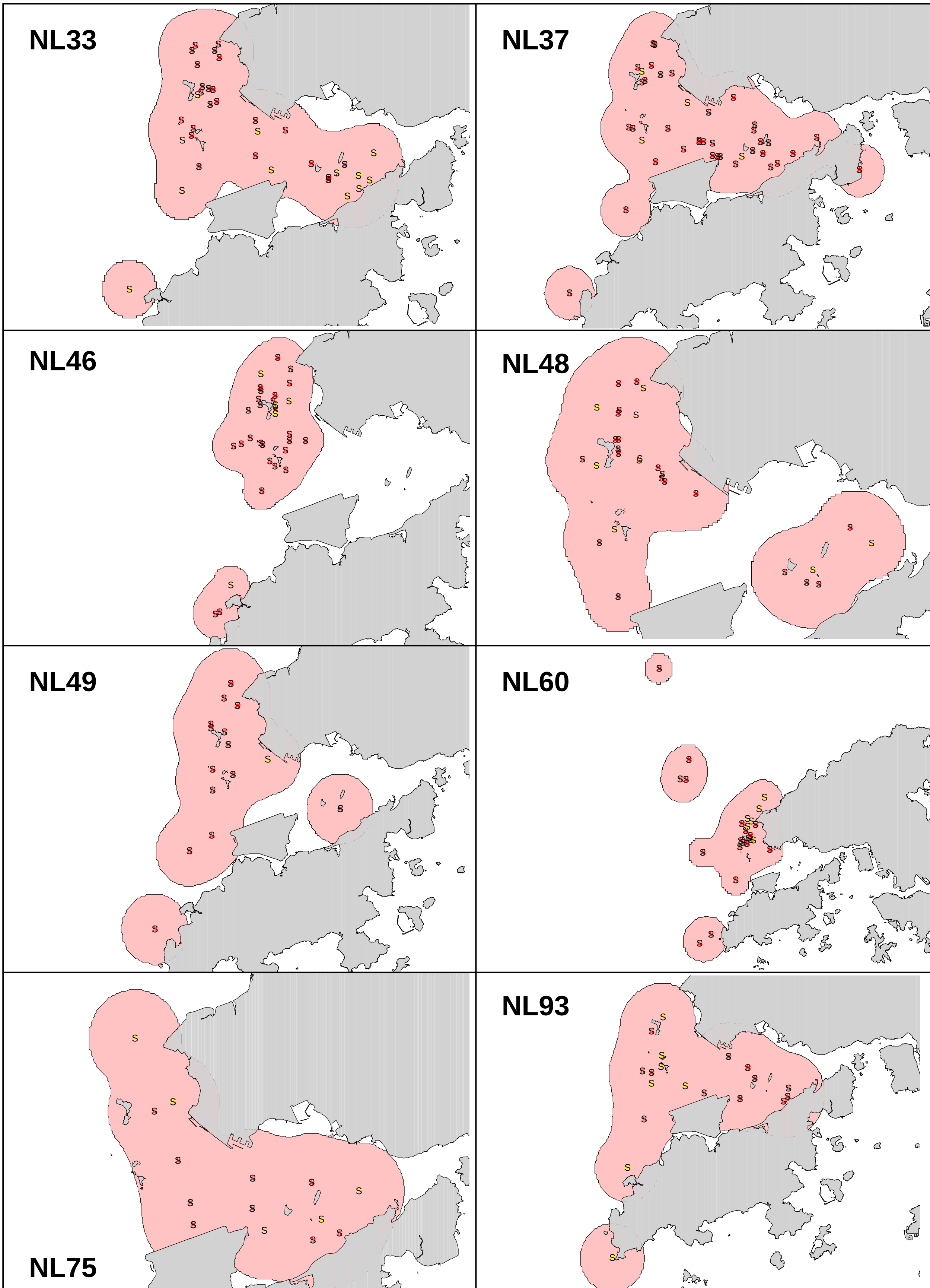
(note: yellow dots indicates sightings made in 2008-09)



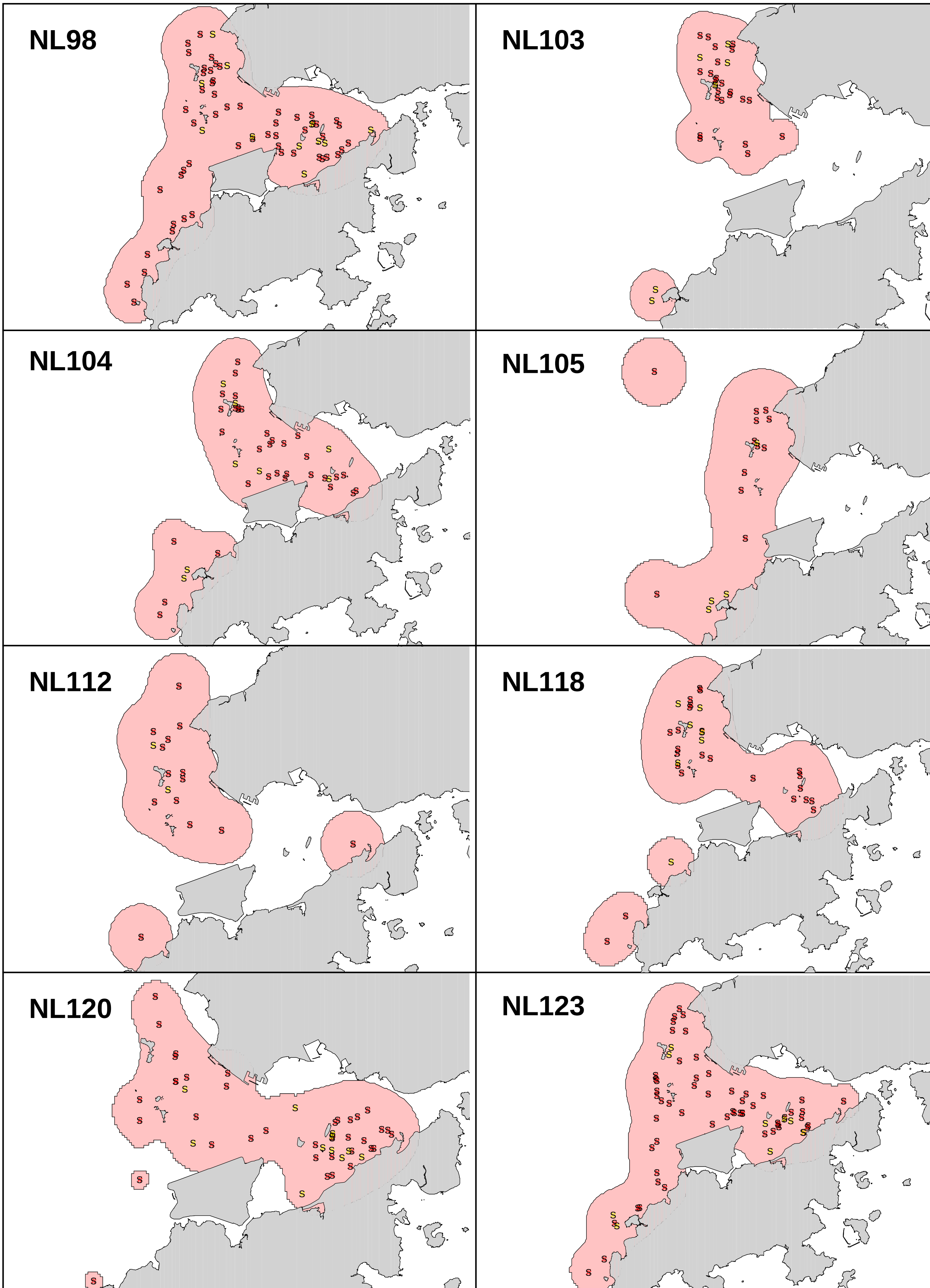
Appendix VI (cont'd).



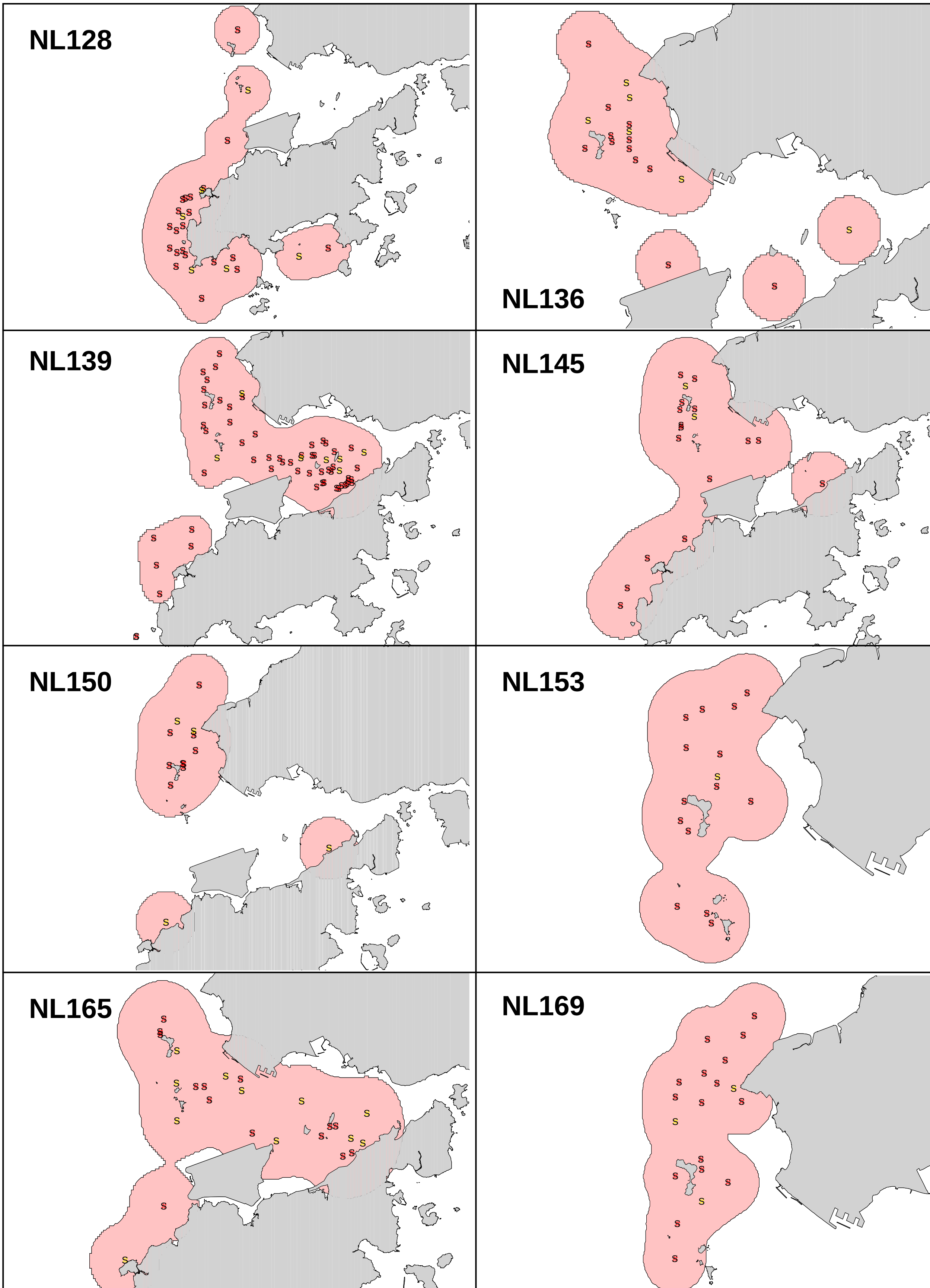
Appendix VI (cont'd).



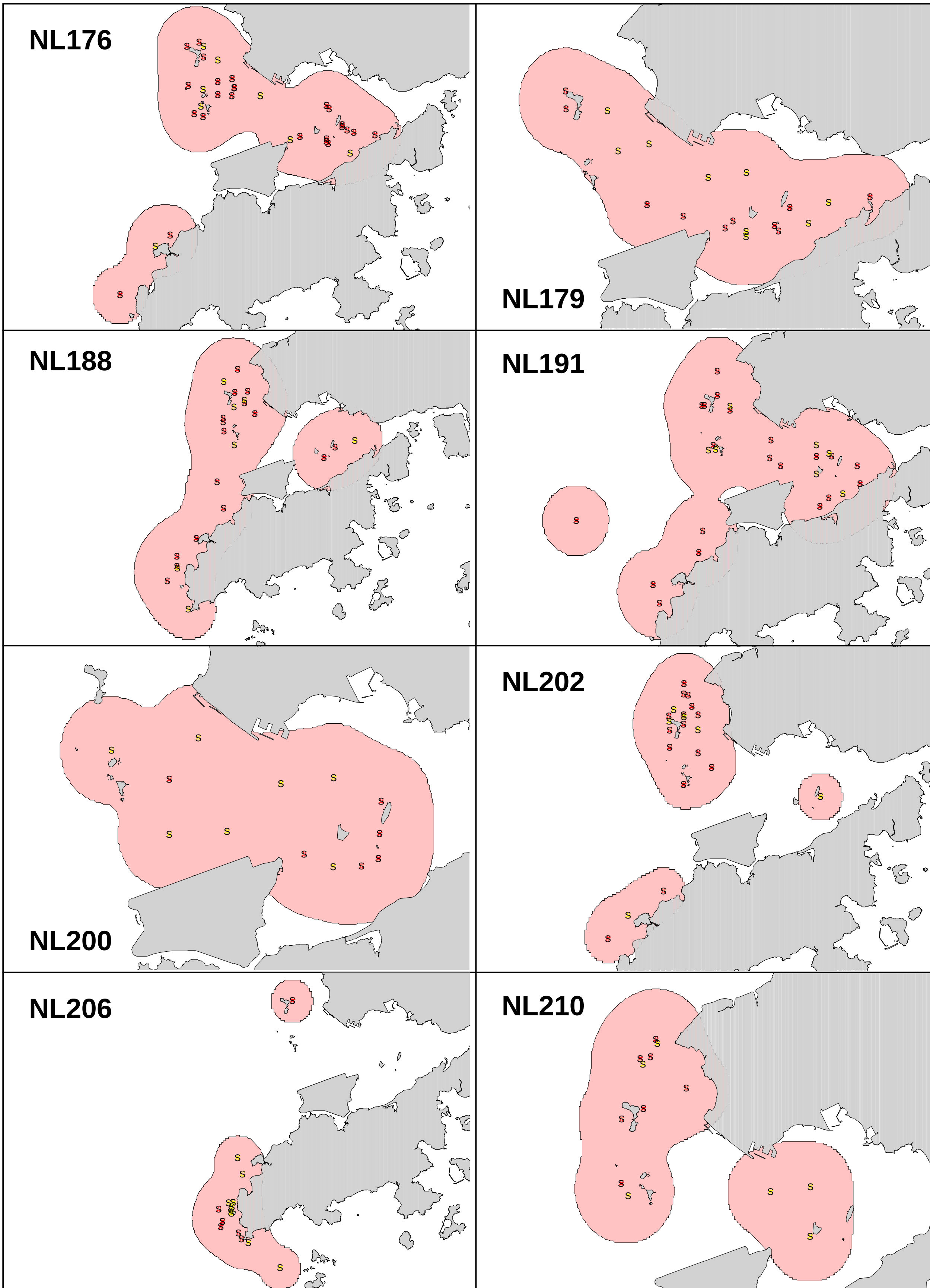
Appendix VI (cont'd).



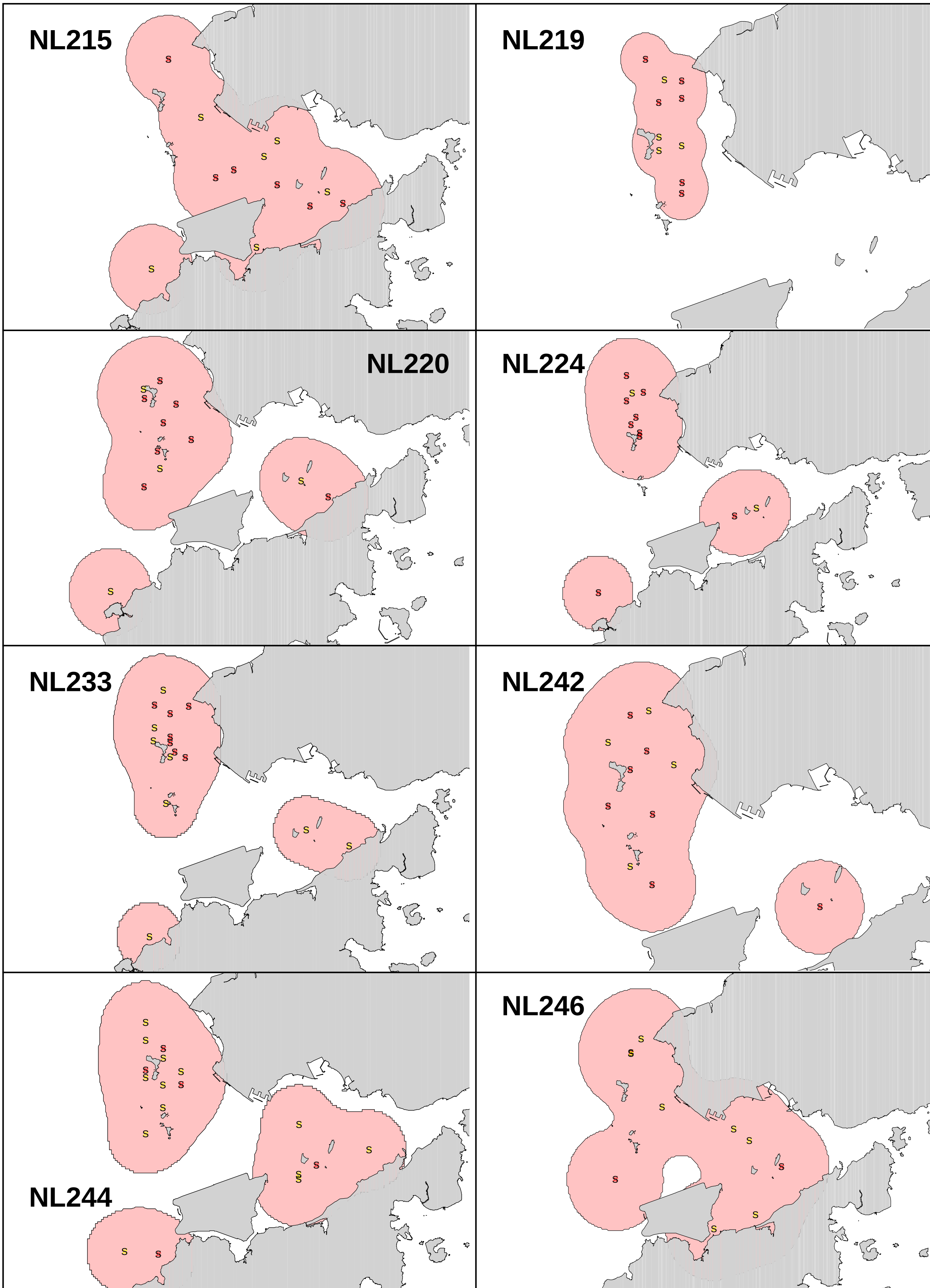
Appendix VI (cont'd).



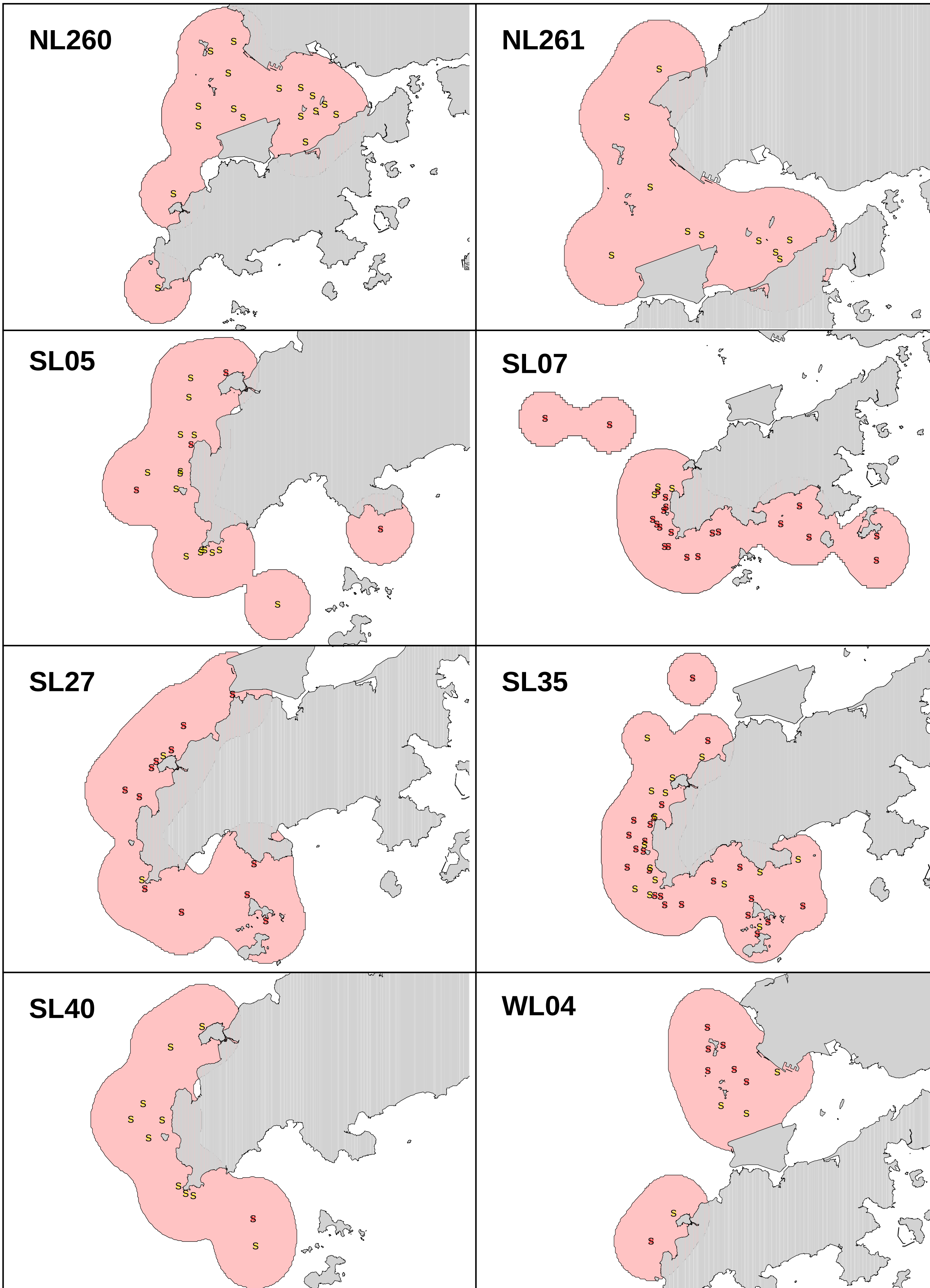
Appendix VI (cont'd).



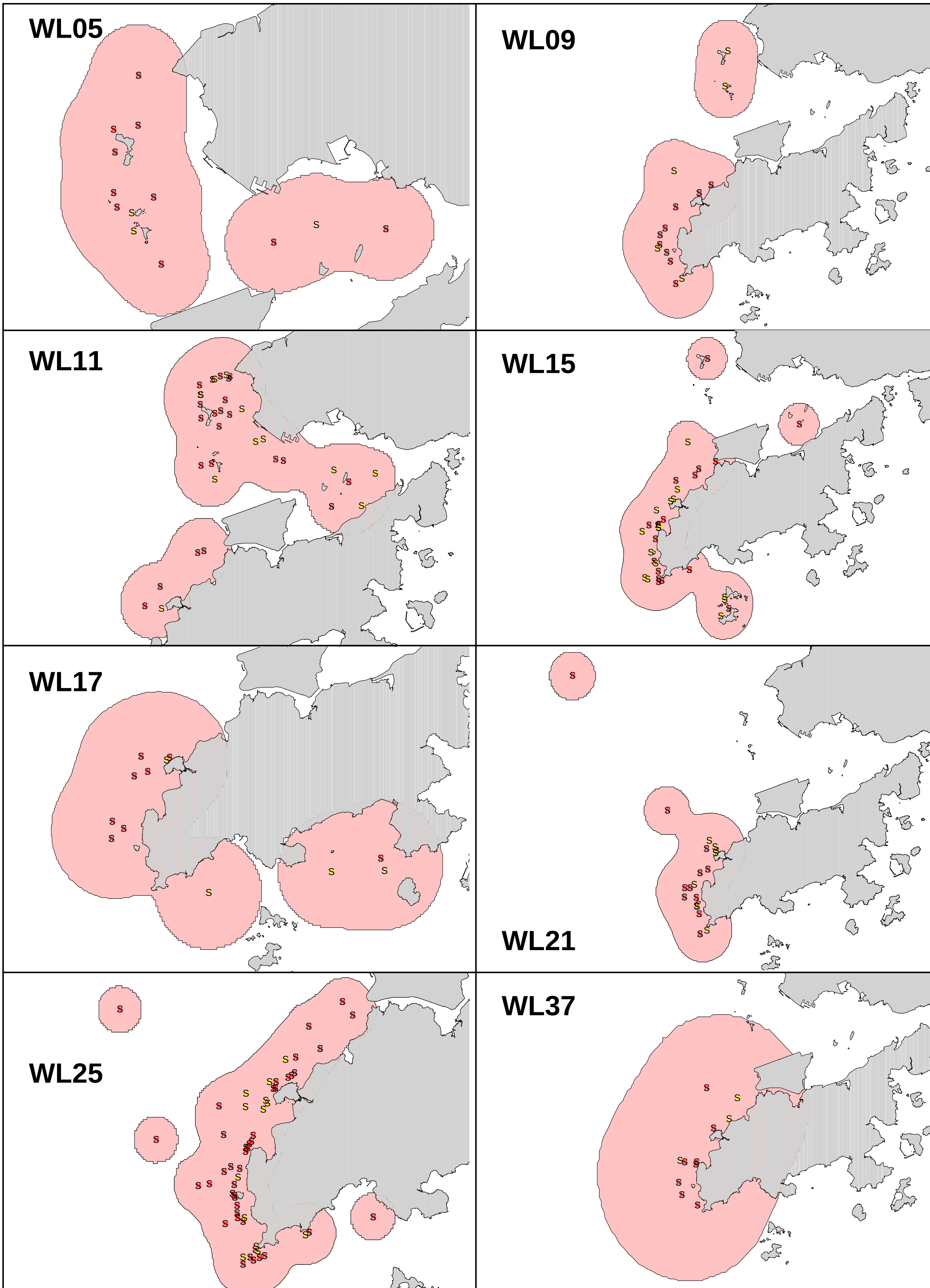
Appendix VI (cont'd).



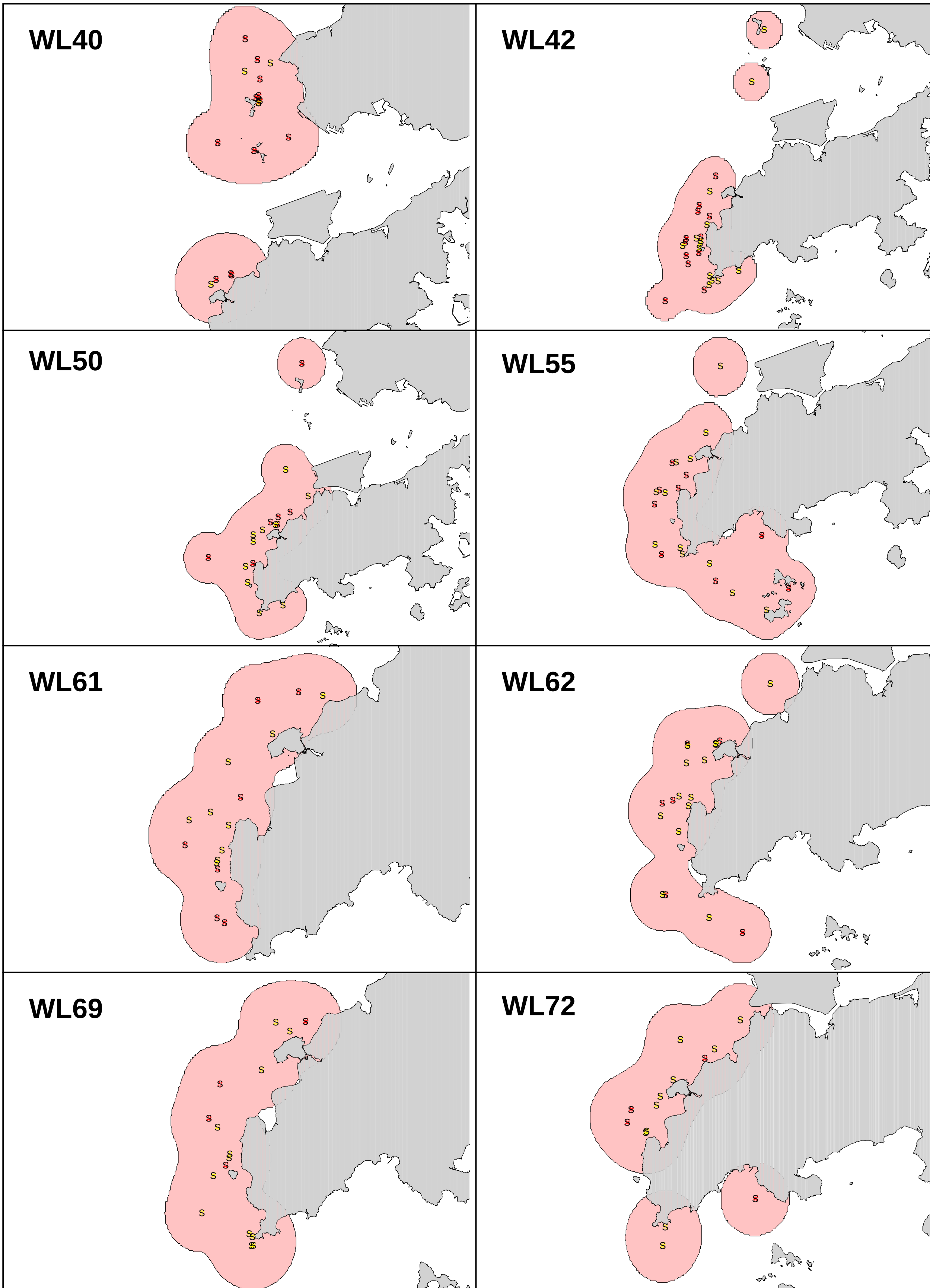
Appendix VI (cont'd).



Appendix VI (cont'd).



Appendix VI (cont'd).



Appendix VI (cont'd).