Monitoring of Chinese White Dolphins in Southwest Lantau Waters – Sixth Quarterly Report (June-August 2016)

Submitted to the Environmental Project Office for the HZMB, HKLR, HZMB HKBCF and TM-CLKL – Investigation

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1. Introduction

1.1. In March 2015, Hong Kong Cetacean Research Project (HKCRP) was appointed by the Environmental Project Office for the HZMB Hong Kong Projects to undertake a monitoring study of Chinese White Dolphins in Southwest Lantau (SWL) waters.

1.2. The objectives of the monitoring study are to quantify the abundance and density of Chinese White Dolphins in SWL waters, to identify individuals during the monitoring surveys, and to analyze their range use and movement patterns in Hong Kong and the wider Pearl River Estuary waters.

1.3. The monitoring study will supplement the on-going EM&A monitoring results of the HZMB Hong Kong Projects in North and West Lantau waters, and provide a more complete picture of dolphin usage and movements between different survey areas in western Hong Kong waters.

1.4. The present report is the sixth quarterly progress report under this dolphin monitoring study submitted to the Environmental Project Office, summarizing the results of the survey findings during the period of June to August 2016.

2. Monitoring Methodology

2.1. Vessel-based Line-transect Survey

2.1.1. According to the requirement of the technical proposal submitted to the Environmental Project Office, the present dolphin monitoring programme should cover all transect lines

in SWL survey area (see Figure 1) once per month upon instruction. The co-ordinates of all transect lines conducted during the dolphin monitoring survey are shown in Table 1.

Table 1. Co-ordinates of transect lines in SWL survey area (corresponding to transect line layout as shown in Figure 1)

Line #		Northing	Easting		Line #		Northing	Easting
SWL001	1	806180	802510		SWL007	13	807380	808520
	2	804250	802510			14	805600	808520
SWL002	3	806710	803480			15	804400	808520
	4	803450	803480			16	803000	808520
SWL003	5	807270	804500			17	802100	808520
	6	802690	804500			18	800470	808520
SWL004	7	807590	805450		SWL008	19	807380	809550
	8	802295	805450			20	805050	809550
SWL005	9	808490	806500			21	804400	809550
	10	801410	806500			22	800470	809550
SWL006	11	808500	807430		SWL009	23	807380	810550
	12	801250	807430			24	800470	810550
					SWL010	25	809410	811510
						26	801470	811510

2.1.2. The HKCRP survey team used standard line-transect methods (Buckland et al. 2001) to conduct the systematic vessel surveys, and followed the same technique of data collection that has been adopted over the last 19 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2015, 2016). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.

2.1.3. Two experienced observers from HKCRP (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for dolphins and porpoises continuously through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea

ahead of the vessel, between 270° and 90° (in relation to the bow, which is defined as 0°). One to two additional experienced observer was 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.

2.1.4. During on-effort survey periods, the survey team recorded effort data including time, position (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance traveled in each series (a continuous period of search effort) with the assistance of a handheld GPS (*Garmin eTrex Legend*).

2.1.5. Data including time, position and vessel speed were also automatically and continuously logged by handheld GPS throughout the entire survey for subsequent review.

2.1.6. When dolphins were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then the research vessel 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 group to the transect line was later calculated from the initial sighting distance and angle.

2.1.7. Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines (as indicated in Figure 1) was labeled as “primary” survey effort, while the survey effort conducted along the connecting lines between parallel lines as well as the section around the Soko Islands was labeled as “secondary” survey effort. Both primary and secondary survey effort were presented as on-effort survey effort in this report.

2.2. Photo-identification Work

2.2.1. When a group of Chinese White Dolphins were sighted during the line-transect survey, the survey team would end effort and approach the group slowly from the side and behind to take photographs of them. Every attempt was made to photograph every dolphin in the group, and even photograph both sides of the dolphins, since the colouration and markings on both sides may not be symmetrical.

2.2.2. A professional digital camera (*Canon* EOS 7D model), equipped with long telephoto lenses (100-400 mm zoom), were available on board for researchers to take sharp, close-up photographs of dolphins as they surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a

computer.

2.2.3. All digital images taken in the field were first examined, and those containing potentially identifiable individuals were sorted out. These photographs would then be examined in greater detail, and were carefully compared to the existing Chinese White Dolphin photo-identification catalogue maintained by HKCRP since 1995. For individual dolphins that are not readily identifiable from the catalogue but have distinct features on their bodies, they will be placed in a pool of "potential new individuals", with decision being made at the end of each year on whether any of them should be incorporated into the photo-ID catalogue.

2.2.4. 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).

2.2.5. All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database.

2.3. Data analysis

2.3.1. Distribution Analysis – The line-transect survey data was integrated with the Geographic Information System (GIS) in order to visualize and interpret different spatial and temporal patterns of dolphin distribution using sighting positions. Location data of dolphin groups were plotted on map layers of Hong Kong using a desktop GIS (ArcView© 3.1) to examine their distribution patterns in details. The dataset was also stratified into different subsets to examine distribution patterns of dolphin groups with different categories of group sizes, young calves and activities.

2.3.2. Encounter rate analysis – Encounter rates of Chinese white dolphins (number of on-effort sightings per 100 km of survey effort (ER(STG)), and total number of dolphins sighted on-effort per 100 km of survey effort (ER(ANI))) were calculated in SWL survey area in relation to the amount of survey effort conducted during each month of monitoring survey. Only data collected under Beaufort 3 or below would be used for encounter rate analysis. Dolphin encounter rates were calculated in two ways: 1) using primary survey effort alone; and 2) using both primary and secondary survey effort collected.

2.3.3. Quantitative grid analysis on habitat use – To conduct quantitative grid analysis of habitat use, positions of on-effort sightings of Chinese White Dolphins collected during the

quarterly impact phase monitoring period were plotted onto 1-km^2 grids in SWL survey area on GIS. Sighting densities (number of on-effort sightings per km^2) and dolphin densities (total number of dolphins from on-effort sightings per km^2) were then calculated for each 1 km by 1 km grid with the aid of GIS. Sighting density grids and dolphin 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 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 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 from on-effort sightings
E = total number of units of survey effort
SA% = percentage of sea area

2.3.4. Behavioural analysis – When dolphins were sighted during vessel surveys, their behaviour was observed. Different activities were categorized (i.e. feeding, milling/resting, traveling, socializing) and recorded on sighting datasheets. This data was then input into a separate database with sighting information, which can be used to determine the distribution of behavioural data with a desktop GIS. Distribution of sightings of dolphins engaged in different activities and behaviours would then be plotted on GIS and carefully examined to identify important areas for different activities of the dolphins.

2.3.5. Ranging pattern analysis – Location data of individual dolphins that occurred during the

three-month impact phase monitoring period 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, was loaded as an extension with ArcView© 3.1 along with another extension Spatial Analyst 2.0. Using the fixed kernel method, the program calculated kernel density estimates based on all sighting positions, and provided an active interface to display kernel density plots. The kernel estimator then calculated and displayed the overall ranging area at 95% UD (utilization distribution) level. If the sample size (number of re-sightings of each individual within the study period) were adequate (i.e. a minimum of 15 re-sightings, Hung 2008), the core areas of individuals at two different levels (50% and 25% UD) were also examined to investigate their range use in greater details. To examine the movement pattern within individual ranges, the locations of re-sightings made in the present quarterly period were visually examined and compared to those made in recent years, in order to determine whether any apparent shift in range use occurs in the present quarterly period.

3. Monitoring Results

3.1. Summary of survey effort and dolphin sightings

3.1.1. During the period of June to August 2016, three sets of systematic line-transect vessel surveys were conducted on June 7th, July 8th and August 22nd to cover all transect lines in SWL survey area once per month. In addition, nine line-transect surveys were also conducted under the AFCD long-term marine mammal monitoring programme in SWL survey area on June 3rd, June 14th, June 20th, July 6th, July 13th, July 19th, August 9th, August 16th and August 25th (see Appendix I and Table 2). With the permission of AFCD, such monitoring survey data were also incorporated into the present study to increase the sample size for various analyses.

3.1.2. For the present study alone, a total of 210.93 km of survey effort was collected in SWL survey during this quarter (Table 2), with 96.6% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility) (Appendix I). The total survey effort conducted on primary and secondary lines were 161.43 km and 49.50 km respectively during the three sets of surveys. For the combined monitoring dataset from both the present study and AFCD monitoring study, a total of 424.48 km of survey effort was collected in SWL waters during the three-month period.

3.1.3. During the present quarter, 41 groups of 107 Chinese White Dolphins were sighted form

the present study's surveys and AFCD monitoring surveys conducted in SWL survey area (Table 2, Appendix II). Twenty-eight of the 41 dolphin sightings were made during on-effort search. Sixteen of the 28 on-effort sightings were made on primary lines, while the other 12 sightings were made on secondary lines.

Table 2. Summary table of survey effort and dolphin sightings collected during the present quarter (i.e. June-August 2016)

Month	Date	Total Distance (km)	No. of CWD Sighting	No. of Individual
HYD				
June 2016	June 7th	70.16	4	8
July 2016	July 8th	71.47	9	23
August 2016	August 22nd	69.30	1	1
	Total	***210.93***	***14***	***32***
AFCD				
June 2016	June 3rd, 14th, 20th	83.11	14	49
July 2016	July 6th, 13th, 19th	67.40	8	19
August 2016	August 9th, 16th, 25th	63.04	5	7
	Total	***213.55***	***27***	***75***

3.1.4. In addition, the Indo-Pacific finless porpoises were also sighted during the present quarter in SWL survey area, with a total of four groups of six animals sighted (Appendix III).

3.2. Distribution

3.2.1. Distribution of dolphin sightings made during the monitoring surveys from June to August 2016 is shown in Figure 1. Chinese White Dolphins occurred frequently in Southwest Lantau waters during this quarter, and the majority of their sightings were concentrated along the stretch of coastline from Fan Lau to Kau Ling Chung, at the waters between Siu A Chau and Shui Hau Peninsula, and between the Soko Islands (Figure 1). On the contrary, they have mostly avoided the southern and eastern portions of the survey area (Figure 1).

3.2.2. On the contrary, the four groups of finless porpoises were sighted to the south and east of Tai A Chau, with no overlap with the dolphin sightings (Figure 1).

3.2.3. Sighting distribution of dolphins in the present quarter (i.e. summer 2016) was largely similar to the previous summer period of 2015 but at a lower level of occurrence (Figure 2). Moreover, dolphin occurrence was much less frequent (especially around the Soko

Islands) in the summer periods of 2013 and 2014 when compared to the ones in 2015 and 2016 (Figure 2).

3.3. Encounter rate

3.3.1. During the present three-month monitoring period (June-August 2016), encounter rates of Chinese White Dolphins deduced from the survey effort and on-effort sighting data from the primary transect lines under favourable conditions (Beaufort 3 or below) from the SWL survey area are shown in Table 3. The quarterly encounter rates were calculated by pooling the monthly survey effort and on-effort dolphin sightings from the three months during the present quarter, in order to compare them to the historical data. To facilitate the comparison with the AFCD long-term monitoring results, the encounter rates were also calculated for the present quarter using both primary and secondary survey effort (Table 3).

3.3.2. Both types of quarterly encounter rates (ER(STG) and ER(ANI)) deduced from the present quarter were also compared with the same quarters deduced from 2013, 2014 and 2015, while the quarterly encounter rates deduced using the primary and secondary survey effort combined was compared with the ones deduced from all summer months in the past decade (2005-14) (Table 3).

Table 3. Overall dolphin encounter rates (no. of sightings per 100 km of survey effort) from the present monitoring survey and combined database with AFCD monitoring survey conducted in June-August 2016 (i.e. summer 2016) (primary lines only, as well as both primary lines and secondary lines were used) in Southwest Lantau survey area in comparison to the ones deduced during summer months of 2013, 2014 and 2015, as well as the ones in the past decade (June-August 2005-14)

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)		**Encounter rate (ANI)** (no. of dolphins from all on-effort sightings per 100 km of survey effort)	
	Primary Lines Only	Both Primary and Secondary Lines	Primary Lines Only	Both Primary and Secondary Lines
Summer 2016	5.46	6.85	18.09	20.07
Summer 2015	8.51	10.20	31.70	37.14
Summer 2014	9.77	10.53	56.20	43.51
Summer 2013	6.45	6.02	8.60	9.31
Summer of 2005-14		4.02		11.78

3.3.3. Dolphin encounter rates in the present quarter were higher than the ones from the overall period of 2005-14 and the summer period of 2013, but were much lower than the ones recorded in the summer periods of 2014 and 2015. The apparent decline in dolphin usage of SWL survey area in the summer of 2016 should be continuously monitored to

determine whether such recent decline is persistent.

3.4. Group size

3.4.1. Group size of Chinese White Dolphins ranged from one to twelve individuals per group in SWL survey area between June and August 2016. The average dolphin group size for the three-month period was 2.6, which was slightly lower than the one recorded during the summer period of 2005-14 (2.9).

3.4.2. Among the 41 dolphin groups sighted during this quarter, 32 of them were small groups composed of only 1-3 dolphins per group. On the other hand, there were seven larger dolphin groups. Six of these larger groups were moderate in size with 5-8 dolphins per group, while there was one large group of 12 dolphins sighted in association with an operating purse-seiner.

3.4.3. Distribution of dolphins with moderate and large group sizes is shown in Figure 3. These groups were mostly located along the coastal waters between Fan Lau and Shui Hau Peninsula, with the large group of 12 dolphins sighted to the south of Shek Pik (Figure 3).

3.5. Habitat use

3.5.1. From June to August 2016, numerous grids have recorded dolphin presence in SWL survey area, and the high density grids were concentrated near Fan Lau, Kau Ling Chung, along the southeastern coastline of Shui Hau Peninsula, as well as between the Soko Islands (Figures 4a and 4b). However, the results should be treated with cautions as the amount of survey effort collected in each grid during the three-month period was fairly low (5-10 units of survey effort for most grids). A more complete picture of dolphin habitat use pattern can be presented when more survey effort for each grid will be collected throughout the impact phase monitoring programme.

3.5.2. When compared with the habitat use pattern recorded during the summer months of 2012-15, the one in 2016 was similar to previous years, with the high density areas of dolphin occurrence consistently located between the Soko Islands, along the stretch of coastline from Fan Lau to Kau Ling Chung as well as Shui Hau Peninsula (Figures 5a and 5b).

3.6. Mother-calf pairs

3.6.1. During the three-month monitoring period, only two unspotted calves (UJ) were sighted in SWL waters. The rare occurrences of these two mother-calf pairs were located at Fan Lau and near Shui Hau Peninsula respectively (Figure 6).

3.7. Activities and associations with fishing boats

3.7.1. During the three-month monitoring period, six dolphin sightings were associated with feeding activities, and they were mostly located near Fan Lau, Kau Ling Chung and to the south of Shek Pik (Figure 7).

3.7.2. Moreover, three dolphin sightings were associated with socializing activities, and these sightings were made along the southwestern coastline of Shui Hau Peninsula (Figure 7).

3.7.3. Notably, two of the 41 dolphin groups were associated with operating purse-seiners during the present quarter.

3.8. Summary of photo-identification works

3.8.1. Between June and August 2016, nearly 3,000 digital photographs of Chinese White Dolphins were taken during the SWL monitoring surveys for the photo-identification work.

3.8.2. In total, 46 individuals sighted 71 times altogether were identified (see the summary table in Appendix IV and photographs of identified individuals in Appendix V). The majority of identified individuals were sighted only once or twice during the three-month period. On the other hand, there were five individuals (WL15, WL91, WL152, WL210 and WL221) being re-sighted thrice, while two individuals (WL131 and WL232) were re-sighted four times during the three month period..

3.9. Individual range use in SWL waters

3.9.1. Ranging patterns of the 46 individuals identified during the three-month study period in SWL waters were determined by the fixed kernel method. Their 95% kernel home ranges including their re-sightings during 2012, 2013, 2014 and 2015-16 are shown separately for each individual in Appendix VI to facilitate the examination of any temporal changes in their range use in recent years.

3.9.2. Notably, two of the 46 individuals (WL166 and WL264) were sighted in SWL survey area for the first time during the present quarterly period (Appendix IV). On the contrary, the other 44 individuals were re-sighted well within their home ranges including SWL waters during this three-month period (Appendix VI).

3.9.3. Notably, four individuals (NL120, WL46, WL61 and WL216) sighted in SWL waters during the present quarter were also sighted in WL waters during HKLR09 monitoring surveys in the same quarter. Another individual, NL150, sighted in SWL waters during

the present quarter was also sighted in NWL waters during a HKLR03 monitoring survey in the same quarter. These cases showed their frequent movements between different survey areas around Lantau Island in this relatively brief period.

3.9.4. Several individuals (e.g. NL33, NL120, NL226) that used to range primarily in North Lantau waters in the past have spent significantly more time in Southwest Lantau in 2015-16 (Appendix VI), showing apparent range shift away from their former prime habitat as described in Hung (2016)

3.9.5. With their primary ranges centered in West Lantau waters in the past, several individuals (e.g. CH38, SL05, WL15, WL61, WL62) showed apparent range extensions to Southwest Lantau waters in 2015-16 (Appendix VI). It remains to be seen whether some of these individuals would continue to spend more times in SWL waters as part of their ranges in the near future.

4. References

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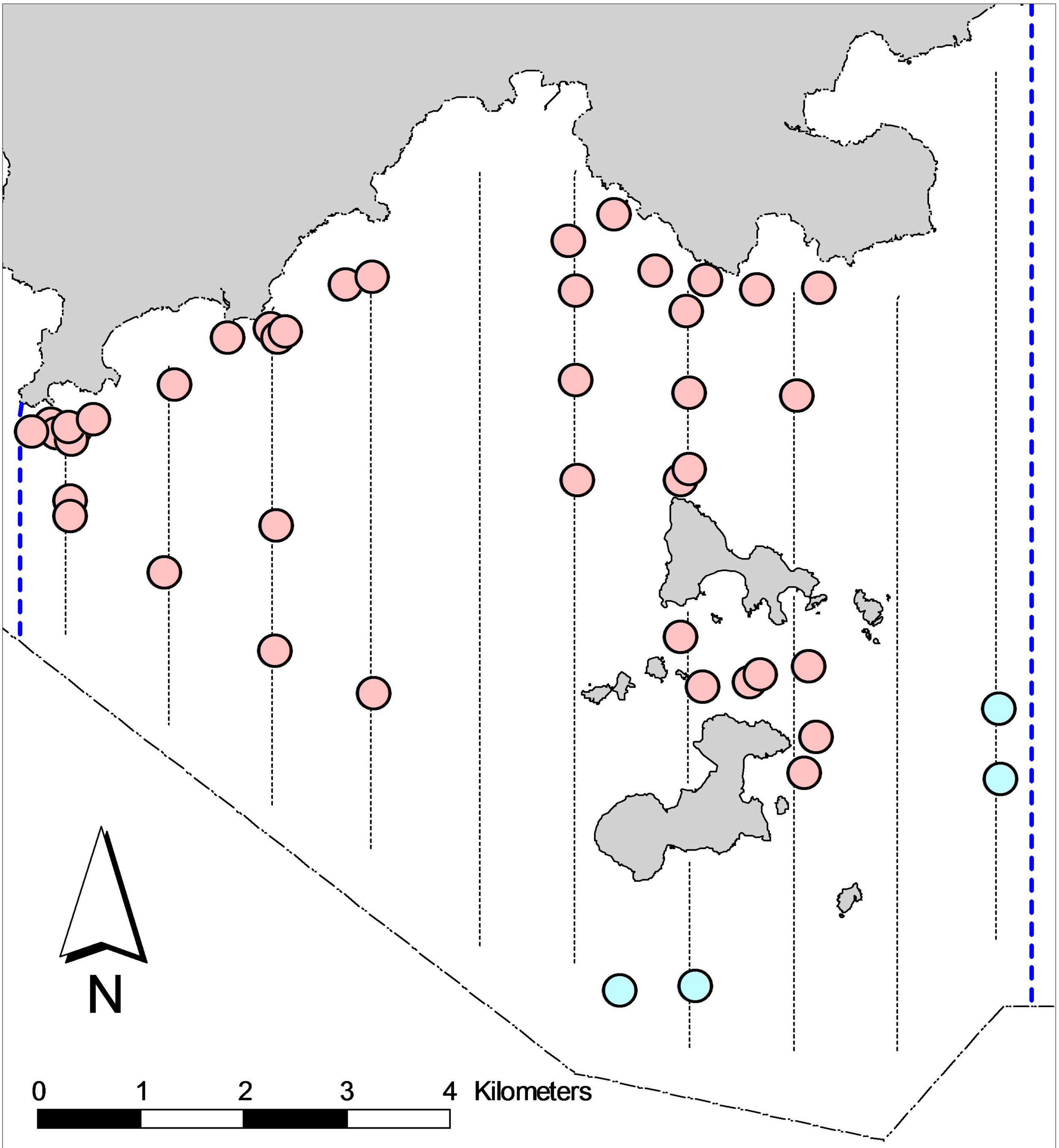


Figure 1. Distribution of marine mammal sightings (pink dots: Chinese White Dolphins; blue dots: Finless Porpoises) during monitoring surveys in Southwest Lantau survey area conducted in June-August 2016

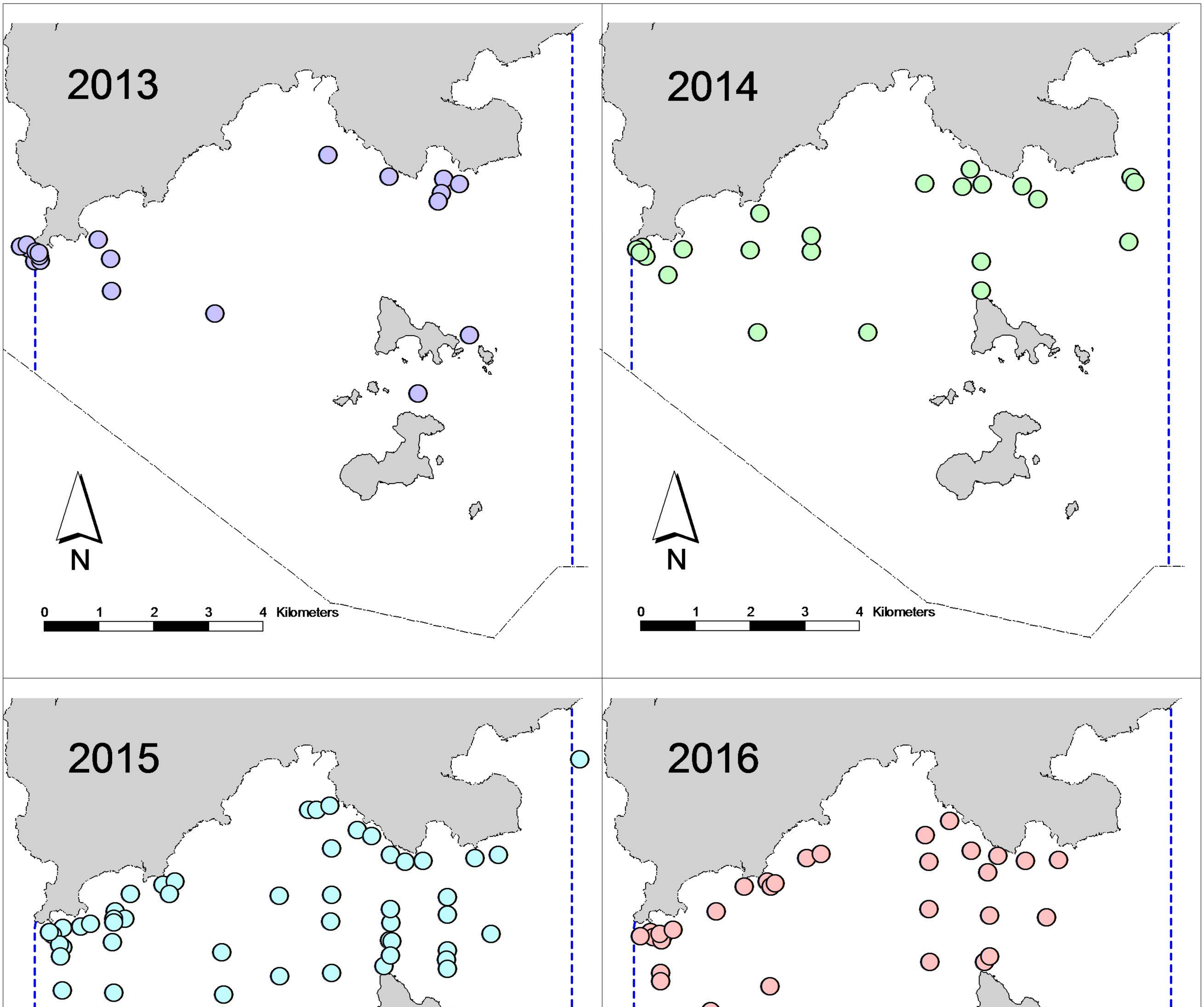


Figure 2. Comparisons on distribution of Chinese White Dolphin sightings in Southwest Lantau survey area during the summer months of 2013-2016

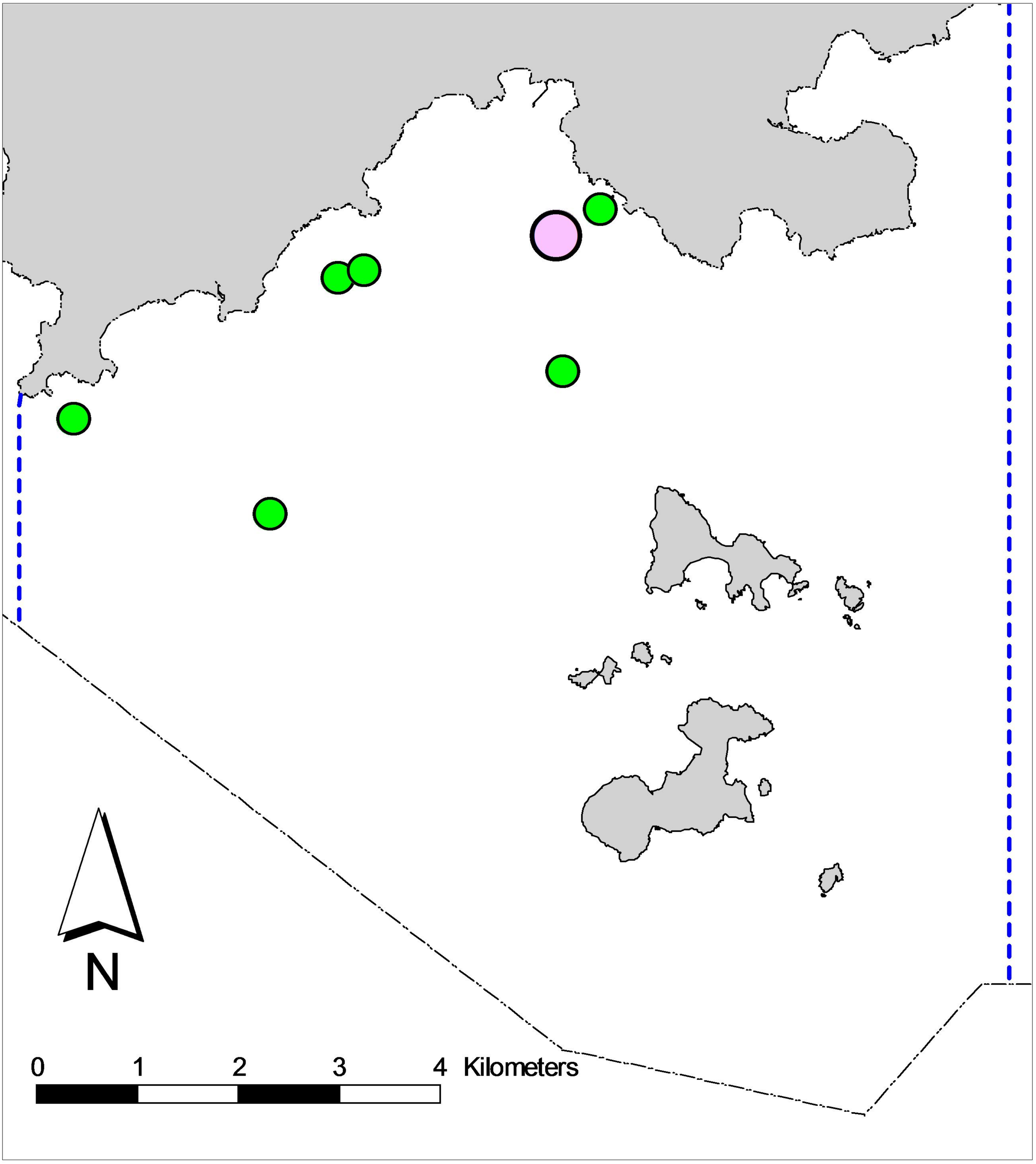


Figure 3. Distribution of Chinese White Dolphins with large group sizes of 5-9 dolphins (green dots) and 10+ dolphins (purple dot) during SWL monitoring surveys conducted in June-August 2016

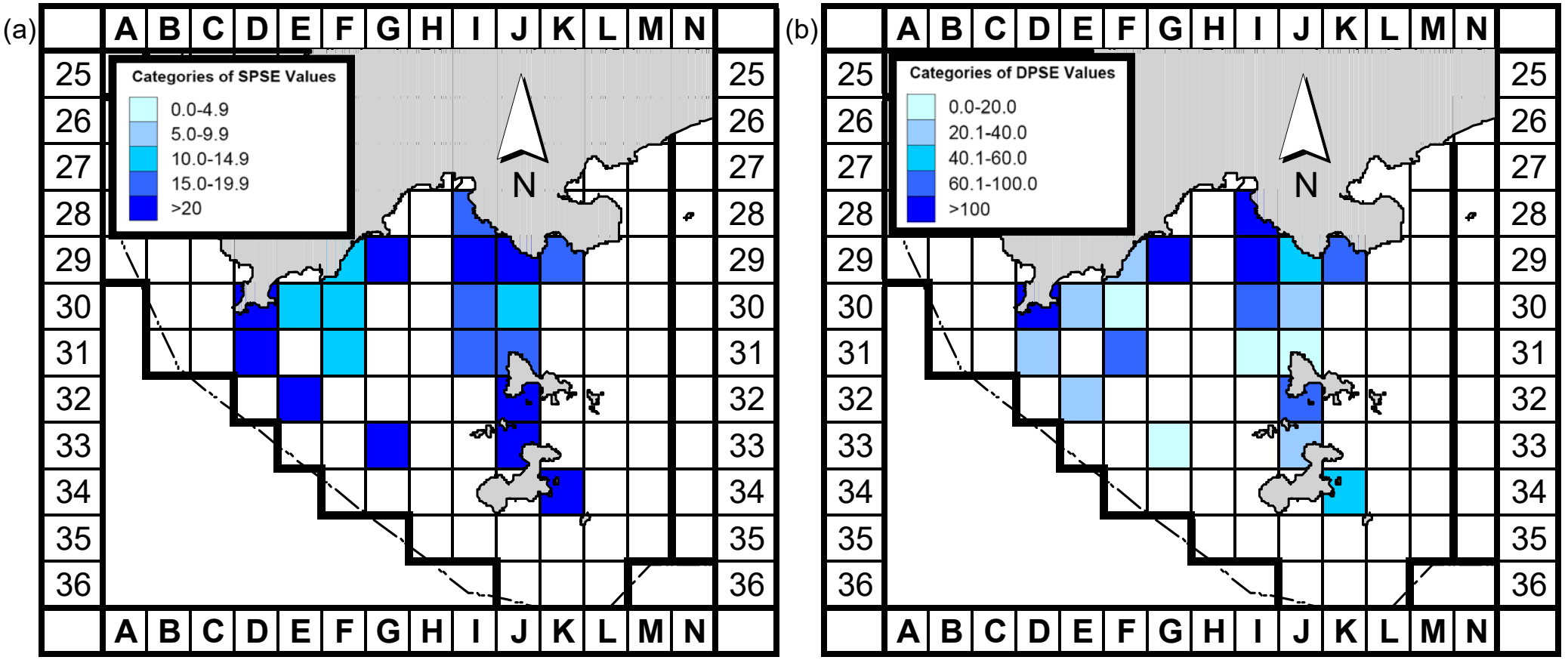


Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km^2 in Southwest Lantau survey area during summer months (June-August) of 2016 (SPSE = no. of on-effort sightings per 100 units of survey effort)

Figure 4b. Density of Chinese white dolphins with corrected survey effort per km^2 in Southwest Lantau survey area during summer months (June-August) of 2016 (DPSE = no. of dolphins per 100 units of survey effort)

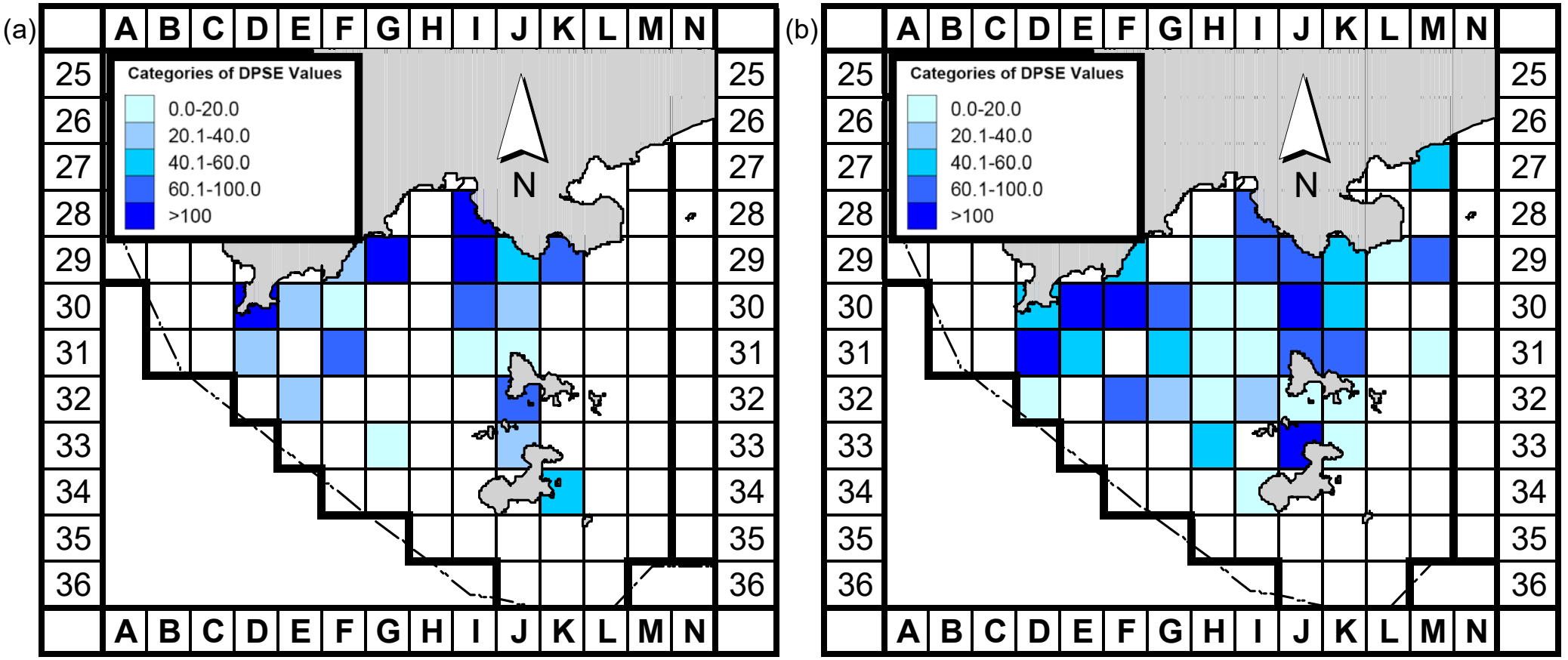


Figure 5a. Density of Chinese white dolphins with corrected survey effort per km^2 in Southwest Lantau survey area during summer months (June-August) of 2016 (DPSE = no. of dolphins per 100 units of survey effort)

Figure 5b. Density of Chinese white dolphins with corrected survey effort per km^2 in Southwest Lantau survey area during summer months (June-August) of 2012-2015 (DPSE = no. of dolphins per 100 units of survey effort)

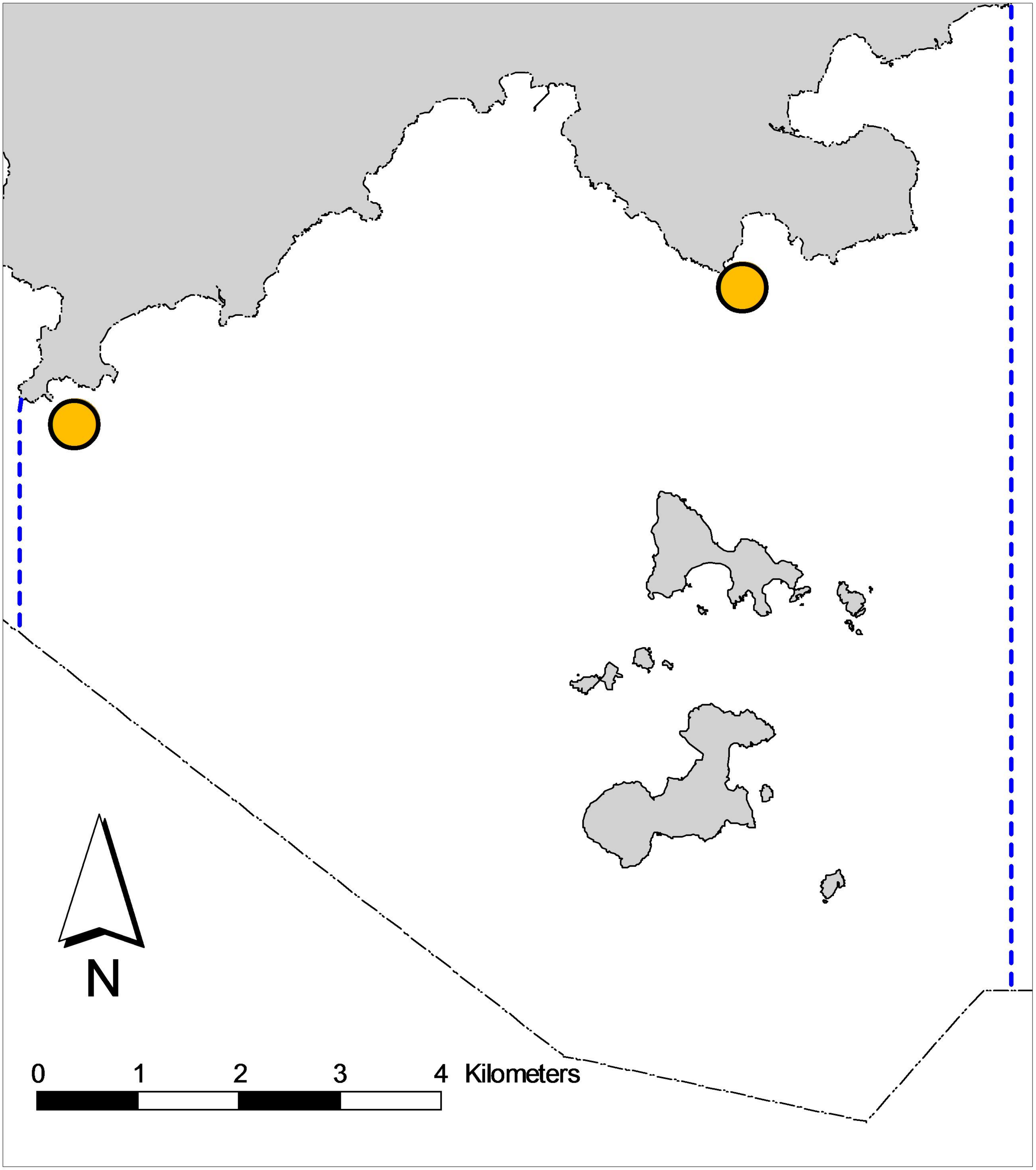


Figure 6. Distribution of young calf of Chinese White Dolphin during SWL monitoring surveys conducted in June-August 2016

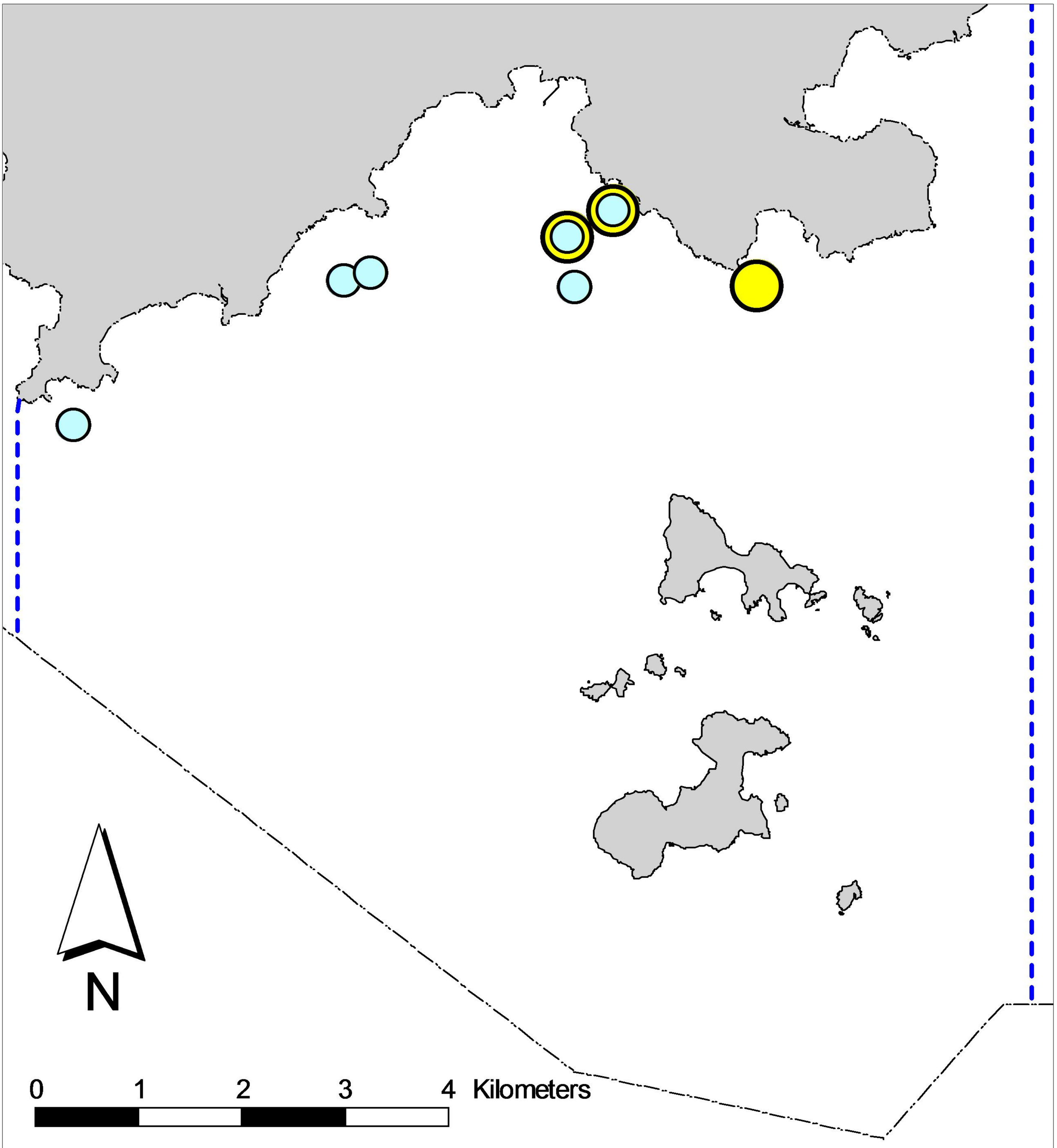


Figure 7. Distribution of Chinese White Dolphins engaged in feeding (blue dots) and socializing activities (yellow dots) during SWL monitoring surveys conducted in June-August 2016

Appendix I. Survey Effort Database in SWL Survey Area (June-August 2016)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
3-Jun-16	SW LANTAU	2	10.81	SUMMER	STANDARD31516	HKCRP	P
3-Jun-16	SW LANTAU	3	11.09	SUMMER	STANDARD31516	HKCRP	P
3-Jun-16	SW LANTAU	2	2.60	SUMMER	STANDARD31516	HKCRP	S
3-Jun-16	SW LANTAU	3	11.32	SUMMER	STANDARD31516	HKCRP	S
7-Jun-16	SW LANTAU	2	42.07	SUMMER	STANDARD31516	HYD-HZMB	P
7-Jun-16	SW LANTAU	3	11.39	SUMMER	STANDARD31516	HYD-HZMB	P
7-Jun-16	SW LANTAU	2	11.93	SUMMER	STANDARD31516	HYD-HZMB	S
7-Jun-16	SW LANTAU	3	3.57	SUMMER	STANDARD31516	HYD-HZMB	S
7-Jun-16	SW LANTAU	4	1.20	SUMMER	STANDARD31516	HYD-HZMB	S
14-Jun-16	SW LANTAU	2	6.20	SUMMER	STANDARD31516	HKCRP	P
14-Jun-16	SW LANTAU	3	12.92	SUMMER	STANDARD31516	HKCRP	P
14-Jun-16	SW LANTAU	4	1.30	SUMMER	STANDARD31516	HKCRP	P
14-Jun-16	SW LANTAU	2	2.72	SUMMER	STANDARD31516	HKCRP	S
14-Jun-16	SW LANTAU	3	4.48	SUMMER	STANDARD31516	HKCRP	S
14-Jun-16	SW LANTAU	4	0.53	SUMMER	STANDARD31516	HKCRP	S
20-Jun-16	SW LANTAU	2	12.93	SUMMER	STANDARD31516	HKCRP	P
20-Jun-16	SW LANTAU	3	1.84	SUMMER	STANDARD31516	HKCRP	P
20-Jun-16	SW LANTAU	2	4.37	SUMMER	STANDARD31516	HKCRP	S
6-Jul-16	SW LANTAU	1	1.70	SUMMER	STANDARD31516	HKCRP	P
6-Jul-16	SW LANTAU	2	3.46	SUMMER	STANDARD31516	HKCRP	P
6-Jul-16	SW LANTAU	3	1.45	SUMMER	STANDARD31516	HKCRP	P
6-Jul-16	SW LANTAU	2	3.14	SUMMER	STANDARD31516	HKCRP	S
8-Jul-16	SW LANTAU	2	48.38	SUMMER	STANDARD31516	HyD-HZMB	P
8-Jul-16	SW LANTAU	3	8.19	SUMMER	STANDARD31516	HyD-HZMB	P
8-Jul-16	SW LANTAU	2	14.90	SUMMER	STANDARD31516	HyD-HZMB	S
13-Jul-16	SW LANTAU	1	2.32	SUMMER	STANDARD31516	HKCRP	P
13-Jul-16	SW LANTAU	2	17.94	SUMMER	STANDARD31516	HKCRP	P
13-Jul-16	SW LANTAU	1	2.42	SUMMER	STANDARD31516	HKCRP	S
13-Jul-16	SW LANTAU	2	6.02	SUMMER	STANDARD31516	HKCRP	S
19-Jul-16	SW LANTAU	2	4.95	SUMMER	STANDARD31516	HKCRP	P
19-Jul-16	SW LANTAU	3	11.97	SUMMER	STANDARD31516	HKCRP	P
19-Jul-16	SW LANTAU	2	3.23	SUMMER	STANDARD31516	HKCRP	S
19-Jul-16	SW LANTAU	3	7.70	SUMMER	STANDARD31516	HKCRP	S
19-Jul-16	SW LANTAU	4	1.10	SUMMER	STANDARD31516	HKCRP	S
9-Aug-16	SW LANTAU	2	6.22	SUMMER	STANDARD31516	HKCRP	P
9-Aug-16	SW LANTAU	3	3.50	SUMMER	STANDARD31516	HKCRP	P
9-Aug-16	SW LANTAU	4	2.20	SUMMER	STANDARD31516	HKCRP	P
9-Aug-16	SW LANTAU	5	1.80	SUMMER	STANDARD31516	HKCRP	P
9-Aug-16	SW LANTAU	2	4.70	SUMMER	STANDARD31516	HKCRP	S
9-Aug-16	SW LANTAU	3	2.50	SUMMER	STANDARD31516	HKCRP	S
9-Aug-16	SW LANTAU	4	1.99	SUMMER	STANDARD31516	HKCRP	S
16-Aug-16	SW LANTAU	1	4.81	SUMMER	STANDARD36826	HKCRP	P
16-Aug-16	SW LANTAU	2	1.65	SUMMER	STANDARD36826	HKCRP	P
16-Aug-16	SW LANTAU	1	2.17	SUMMER	STANDARD36826	HKCRP	S
22-Aug-16	SW LANTAU	2	1.73	SUMMER	STANDARD36826	HyD-HZMB	P
22-Aug-16	SW LANTAU	3	45.49	SUMMER	STANDARD36826	HyD-HZMB	P
22-Aug-16	SW LANTAU	4	4.18	SUMMER	STANDARD36826	HyD-HZMB	P
22-Aug-16	SW LANTAU	2	2.59	SUMMER	STANDARD36826	HyD-HZMB	S
22-Aug-16	SW LANTAU	3	13.60	SUMMER	STANDARD36826	HyD-HZMB	S
22-Aug-16	SW LANTAU	4	1.71	SUMMER	STANDARD36826	HyD-HZMB	S
25-Aug-16	SW LANTAU	2	19.93	SUMMER	STANDARD36826	HKCRP	P
25-Aug-16	SW LANTAU	2	10.27	SUMMER	STANDARD36826	HKCRP	S
25-Aug-16	SW LANTAU	3	1.30	SUMMER	STANDARD36826	HKCRP	S

Appendix II. Chinese White Dolphin Sighting Database in SWL Survey Area (June-August 2016)

(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance; BOAT ASSOC. = Fishing Boat Association; P/S: Sighting Made on Primary/Secondary Lines)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
3-Jun-16	2	1123	3	SW LANTAU	2	ND	OFF	HKCRP	806195	802332	SUMMER	NONE	
3-Jun-16	3	1403	1	SW LANTAU	3	54	ON	HKCRP	805684	808436	SUMMER	NONE	S
7-Jun-16	1	1154	5	SW LANTAU	2	765	ON	HYD-HZMB	805260	804506	SUMMER	NONE	P
7-Jun-16	2	1336	1	SW LANTAU	2	27	ON	HYD-HZMB	805675	807426	SUMMER	NONE	P
7-Jun-16	3	1506	1	SW LANTAU	2	106	ON	HYD-HZMB	803002	809638	SUMMER	NONE	P
7-Jun-16	4	1531	1	SW LANTAU	2	ND	OFF	HYD-HZMB	807442	809780	SUMMER	NONE	
14-Jun-16	1	1310	4	SW LANTAU	3	ND	OFF	HKCRP	806457	809562	SUMMER	NONE	
14-Jun-16	2	1338	4	SW LANTAU	3	218	ON	HKCRP	807421	809172	SUMMER	NONE	S
14-Jun-16	3	1400	2	SW LANTAU	3	88	ON	HKCRP	807511	808667	SUMMER	NONE	S
14-Jun-16	4	1428	5	SW LANTAU	3	665	ON	HKCRP	806594	807417	SUMMER	NONE	P
14-Jun-16	5	1537	1	SW LANTAU	2	ND	OFF	HKCRP	803834	809103	SUMMER	NONE	
20-Jun-16	1	1349	1	SW LANTAU	3	635	ON	HKCRP	805497	802506	SUMMER	NONE	P
20-Jun-16	2	1353	8	SW LANTAU	2	14	ON	HKCRP	806150	802569	SUMMER	NONE	P
20-Jun-16	3	1414	2	SW LANTAU	2	889	ON	HKCRP	807065	804458	SUMMER	NONE	S
20-Jun-16	4	1503	12	SW LANTAU	2	462	ON	HKCRP	807868	807337	SUMMER	PURSE-SEINE	P
20-Jun-16	5	1542	2	SW LANTAU	2	155	ON	HKCRP	806481	808520	SUMMER	NONE	P
20-Jun-16	6	1600	3	SW LANTAU	2	158	ON	HKCRP	804245	808423	SUMMER	NONE	S
20-Jun-16	7	1613	1	SW LANTAU	2	ND	OFF	HKCRP	803977	809671	SUMMER	NONE	
6-Jul-16	1	1421	3	SW LANTAU	2	ND	OFF	HKCRP	806106	802384	SUMMER	NONE	
6-Jul-16	2	1504	2	SW LANTAU	2	ND	OFF	HKCRP	806976	804520	SUMMER	NONE	
6-Jul-16	3	1523	5	SW LANTAU	2	52	ON	HKCRP	807462	805191	SUMMER	NONE	S
6-Jul-16	4	1556	3	SW LANTAU	2	ND	OFF	HKCRP	807223	808491	SUMMER	NONE	
8-Jul-16	1	1100	2	SW LANTAU	2	206	ON	HYD-HZMB	806050	802528	SUMMER	NONE	P
8-Jul-16	2	1105	1	SW LANTAU	3	281	ON	HYD-HZMB	805353	802506	SUMMER	NONE	P
8-Jul-16	3	1139	1	SW LANTAU	2	126	ON	HYD-HZMB	806977	804035	SUMMER	NONE	S
8-Jul-16	4	1156	1	SW LANTAU	2	ND	OFF	HYD-HZMB	804119	804504	SUMMER	NONE	
8-Jul-16	5	1215	1	SW LANTAU	2	235	ON	HYD-HZMB	803730	805452	SUMMER	NONE	P
8-Jul-16	6	1245	7	SW LANTAU	2	143	ON	HYD-HZMB	807539	805449	SUMMER	NONE	P
8-Jul-16	7	1411	7	SW LANTAU	2	263	ON	HYD-HZMB	808110	807791	SUMMER	NONE	S
8-Jul-16	8	1444	1	SW LANTAU	2	210	ON	HYD-HZMB	803790	808639	SUMMER	NONE	S
8-Jul-16	9	1523	2	SW LANTAU	2	400	ON	HYD-HZMB	803334	809742	SUMMER	NONE	P

Appendix II. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
13-Jul-16	1	1341	1	SW LANTAU	2	ND	OFF	HKCRP	806118	802146	SUMMER	NONE	
19-Jul-16	1	1345	1	SW LANTAU	2	ND	OFF	HKCRP	805773	808519	SUMMER	NONE	
19-Jul-16	2	1413	1	SW LANTAU	2	8	ON	HKCRP	807589	808182	SUMMER	NONE	S
19-Jul-16	3	1537	3	SW LANTAU	1	ND	OFF	HKCRP	803911	809196	SUMMER	NONE	
9-Aug-16	1	1316	1	SW LANTAU	2	25	ON	HKCRP	806161	802497	SUMMER	NONE	S
9-Aug-16	2	1328	1	SW LANTAU	2	ND	OFF	HKCRP	807031	804603	SUMMER	NONE	
16-Aug-16	3	1327	2	SW LANTAU	1	69	ON	HKCRP	806546	803519	SUMMER	NONE	P
16-Aug-16	4	1337	2	SW LANTAU	2	93	ON	HKCRP	804841	803433	SUMMER	NONE	P
22-Aug-16	1	1345	1	SW LANTAU	3	30	ON	HYD-HZMB	807402	807419	SUMMER	PURSE-SEINE	P
25-Aug-16	4	1106	1	SW LANTAU	3	131	ON	HKCRP	806238	802735	SUMMER	NONE	S

Appendix III. Finless Porpoise Sighting Database in SWL Survey Area (June-August 2016)

(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance; BOAT ASSOC. = Fishing Boat Association; P/S: Sighting Made on Primary/Secondary Lines)

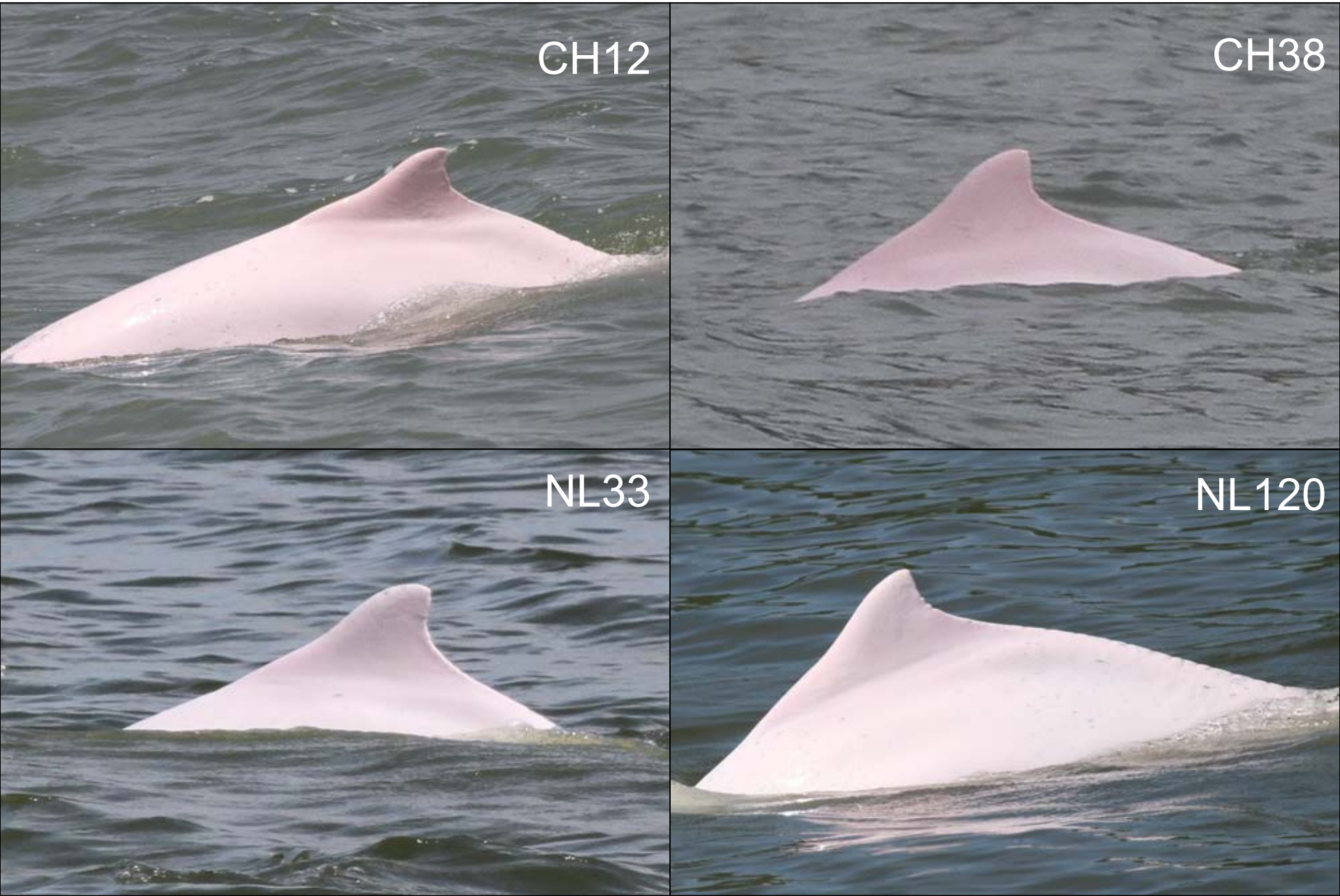
DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	P/S
7-Jun-16	5	1624	2	SW LANTAU	3	175	ON	HYD-HZMB	802944	811526	SUMMER	P
25-Aug-16	5	1203	1	SW LANTAU	2	129	ON	HKCRP	801023	807840	SUMMER	S
25-Aug-16	6	1210	2	SW LANTAU	2	277	ON	HKCRP	801055	808572	SUMMER	S
25-Aug-16	7	1318	1	SW LANTAU	2	4	ON	HKCRP	803586	811517	SUMMER	P

Appendix IV. Individual dolphins identified during SWL monitoring surveys in June-August 2016

ID#	DATE	STG#	AREA
CH12	03/06/16	2	HKCRP
CH38	14/06/16	4	HKCRP
NL33	20/06/16	2	HKCRP
NL120	20/06/16	4	HKCRP
NL150	20/06/16	2	HKCRP
NL206	20/06/16	2	HKCRP
	08/07/16	7	HYD-HZMB
NL226	20/06/16	4	HKCRP
SL05	08/07/16	5	HYD-HZMB
SL47	20/06/16	4	HKCRP
SL54	20/06/16	4	HKCRP
SL55	14/06/16	2	HKCRP
SL60	07/06/16	2	HYD-HZMB
	07/06/16	3	HYD-HZMB
WL15	14/06/16	4	HKCRP
	08/07/16	2	HYD-HZMB
	08/07/16	3	HYD-HZMB
WL46	14/06/16	3	HKCRP
WL47	14/06/16	2	HKCRP
	20/06/16	4	HKCRP
WL61	07/06/16	4	HYD-HZMB
	06/07/16	3	HKCRP
WL62	06/07/16	2	HKCRP
	19/07/16	3	HKCRP
WL69	08/07/16	6	HYD-HZMB
WL74	20/06/16	2	HKCRP
WL91	20/06/16	6	HKCRP
	06/07/16	1	HKCRP
	06/07/16	3	HKCRP
WL92	06/07/16	4	HKCRP
WL114	08/07/16	6	HYD-HZMB
WL116	14/06/16	4	HKCRP
WL128	14/06/16	4	HKCRP
WL130	08/07/16	6	HYD-HZMB
WL131	14/06/16	4	HKCRP
	20/06/16	2	HKCRP
	06/07/16	1	HKCRP
	06/07/16	3	HKCRP

ID#	DATE	STG#	AREA
WL137	08/07/16	7	HYD-HZMB
WL152	03/06/16	2	HKCRP
	06/07/16	1	HKCRP
	06/07/16	3	HKCRP
WL166	20/06/16	4	HKCRP
WL168	14/06/16	1	HKCRP
	16/08/16	3	HKCRP
WL173	20/06/16	4	HKCRP
WL178	19/07/16	2	HKCRP
WL208	20/06/16	4	HKCRP
WL210	20/06/16	4	HKCRP
	08/07/16	6	HYD-HZMB
	19/07/16	3	HKCRP
WL215	08/07/16	7	HYD-HZMB
WL216	14/06/16	3	HKCRP
WL221	08/07/16	6	HYD-HZMB
	08/07/16	7	HYD-HZMB
	19/07/16	1	HKCRP
WL232	20/06/16	4	HKCRP
	06/07/16	3	HKCRP
	08/07/16	7	HYD-HZMB
	25/08/16	4	HKCRP
WL234	22/08/16	1	HYD-HZMB
WL235	08/07/16	6	HYD-HZMB
	08/07/16	7	HYD-HZMB
WL238	08/07/16	6	HYD-HZMB
	08/07/16	7	HYD-HZMB
WL241	20/06/16	4	HKCRP
WL243	20/06/16	5	HKCRP
	06/07/16	4	HKCRP
WL250	14/06/16	2	HKCRP
WL264	20/06/16	4	HKCRP
WL265	20/06/16	4	HKCRP

Appendix V. Forty-six individual dolphins that were identified in Southwest Lantau survey area during June-August 2016



Appendix V. (cont'd)

Appendix V. (cont'd)

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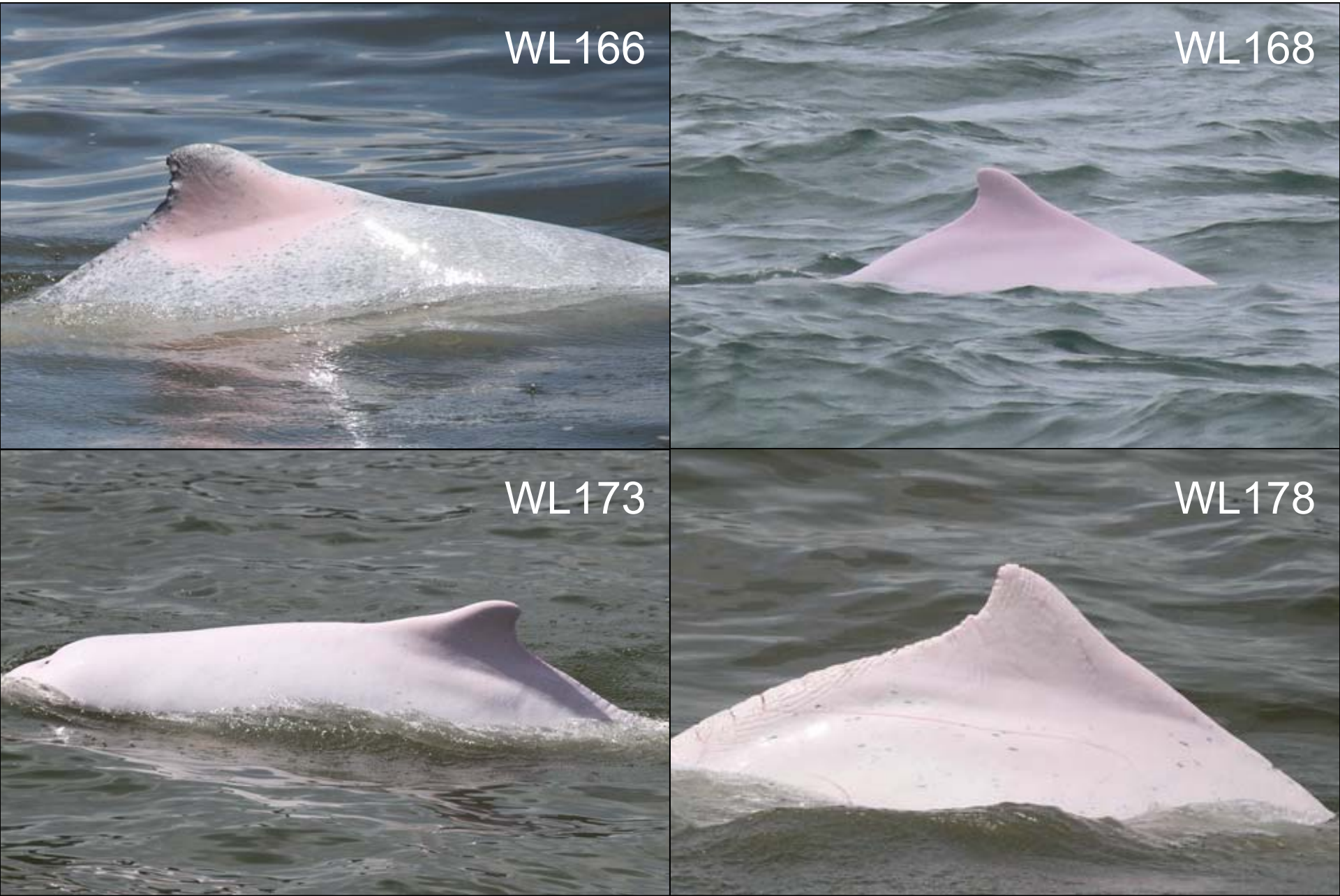
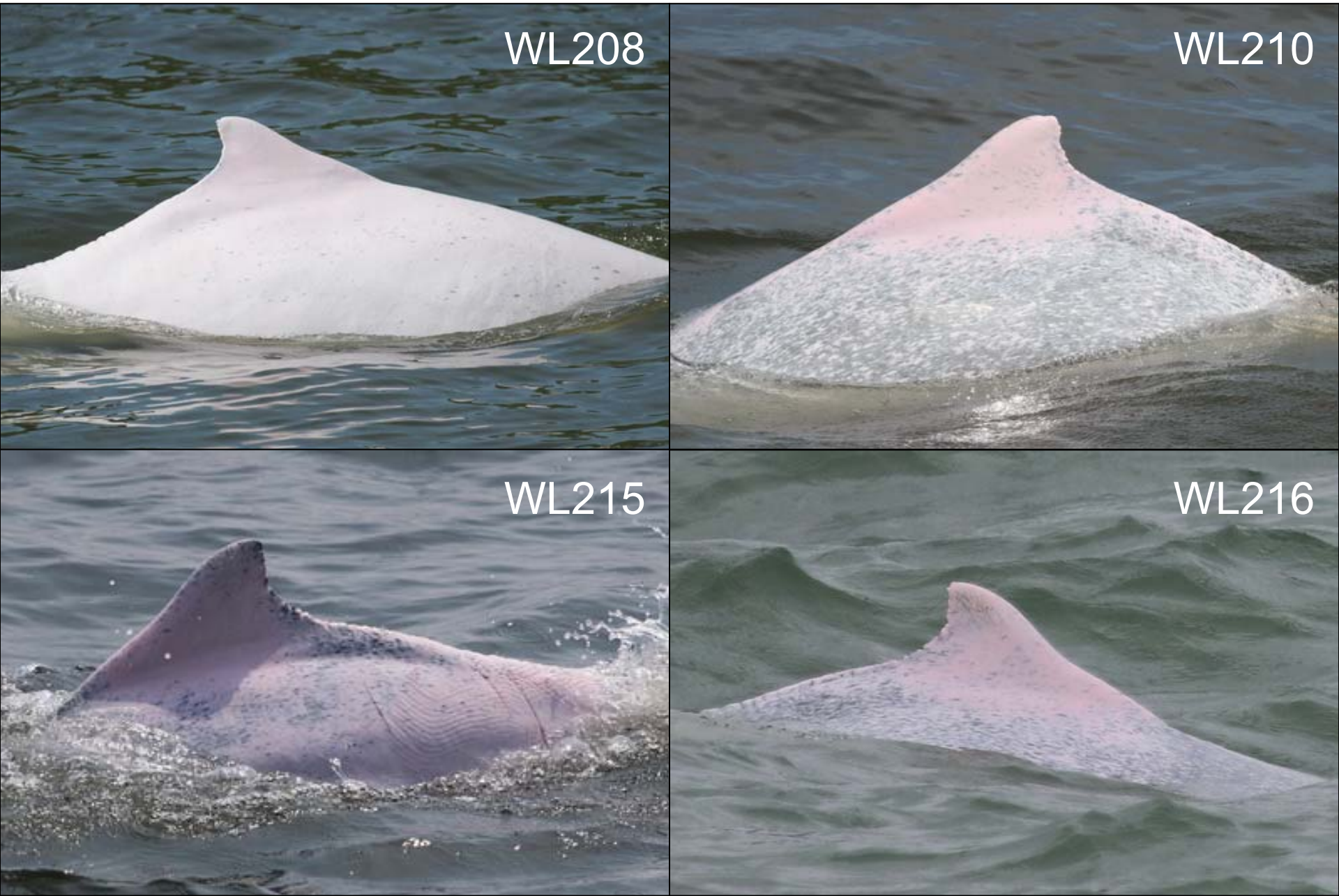
Appendix V. (cont'd)

Appendix V. (cont'd)



Appendix V. (cont'd)



Appendix V. (cont'd)


WL238

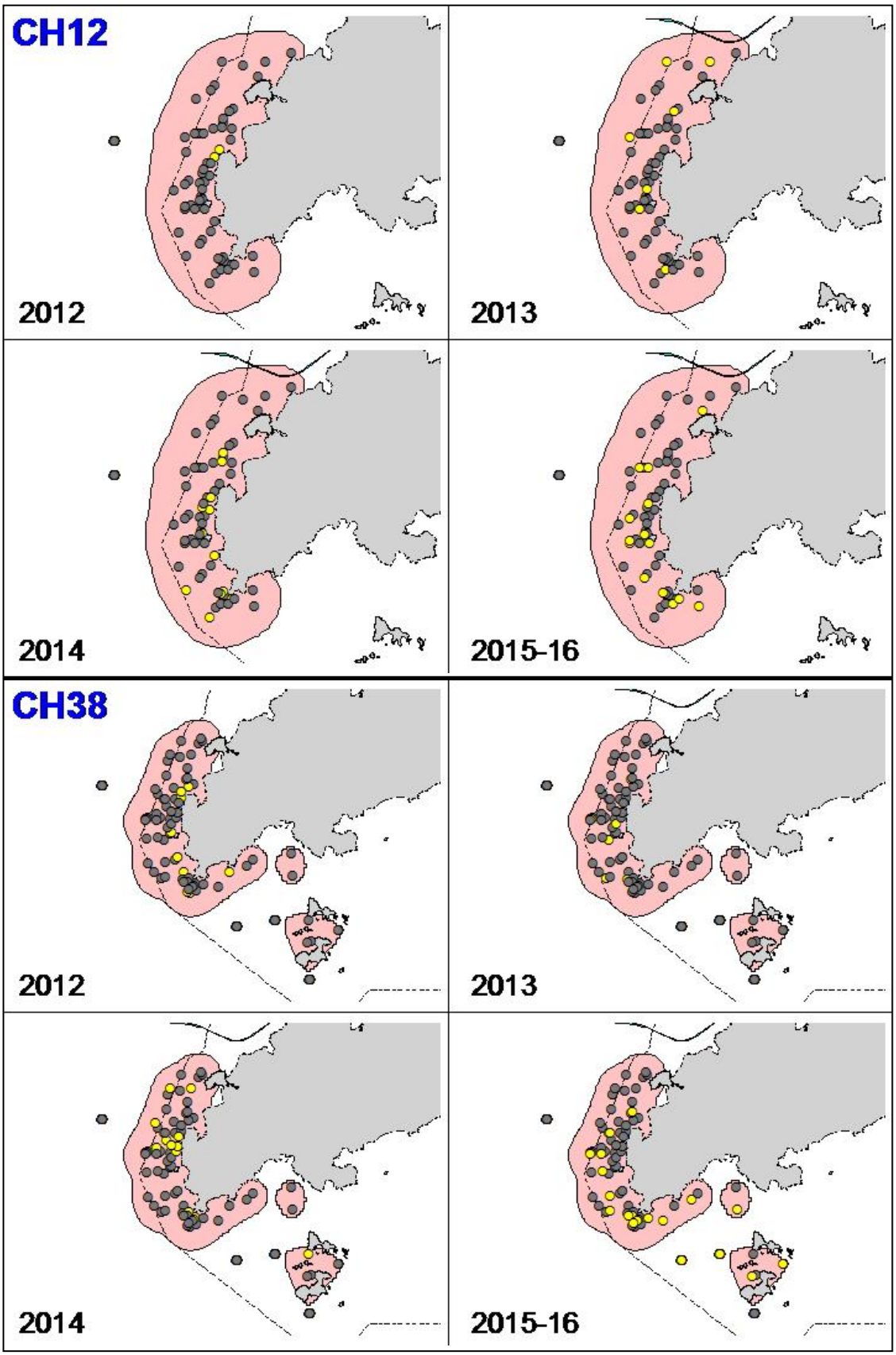

WL241


WL243

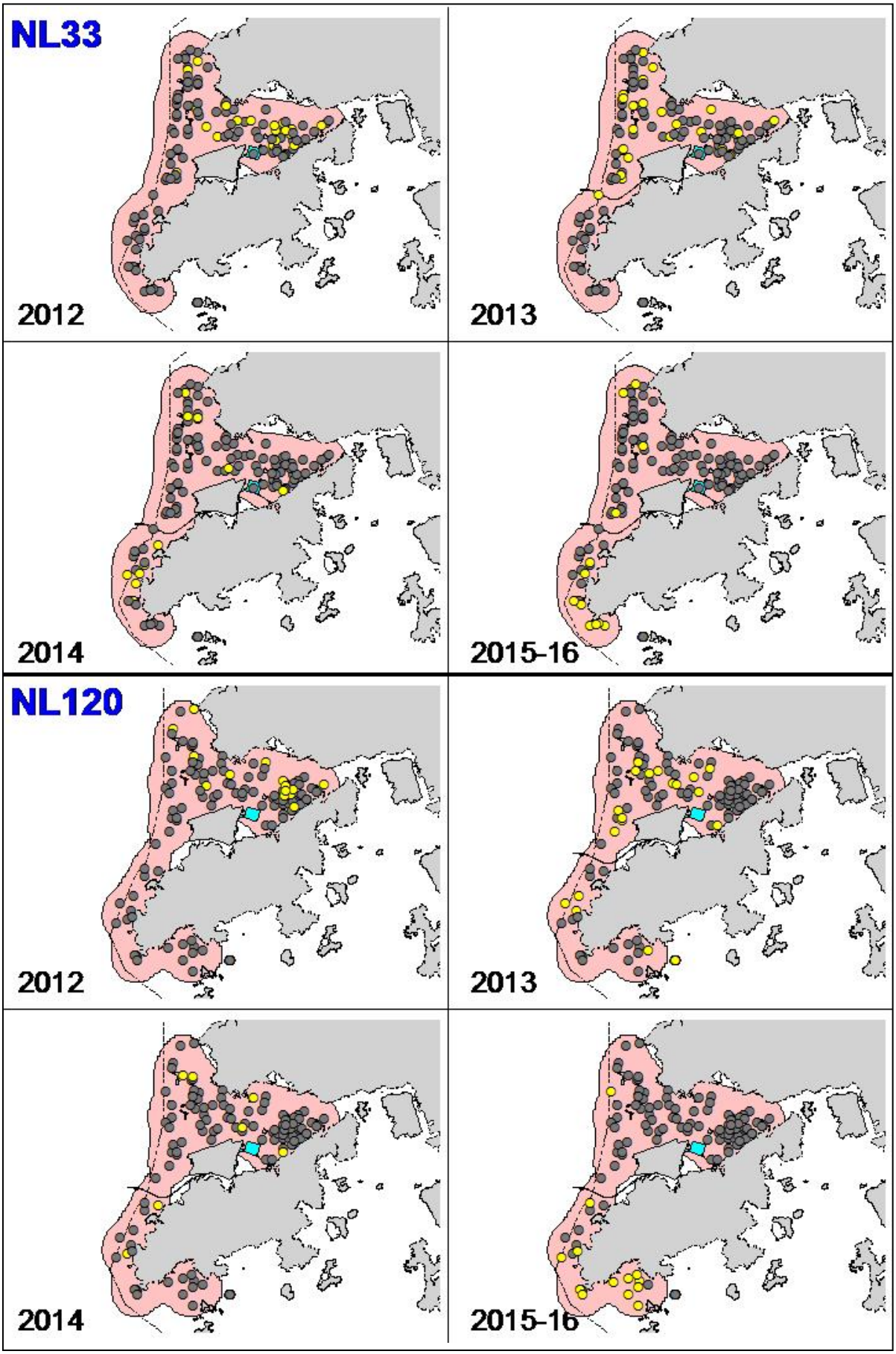

WL250

Appendix V. (cont'd)

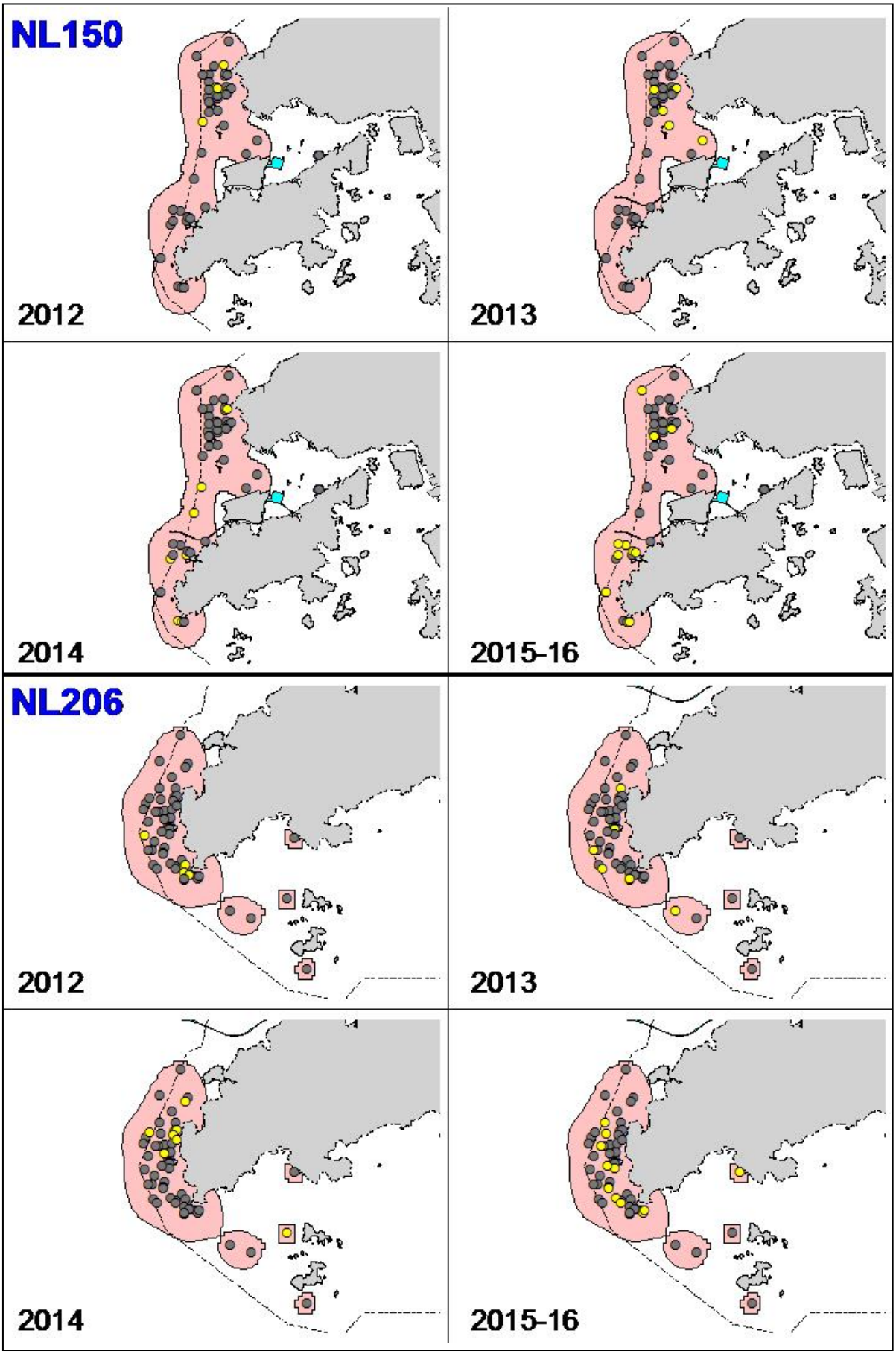
Appendix VI. Ranging patterns (95% kernel ranges) of 46 individual dolphins that were sighted in Southwest Lantau survey area during June-August 2016 (note: yellow dots indicates sightings made in the respective years of 2012-16)



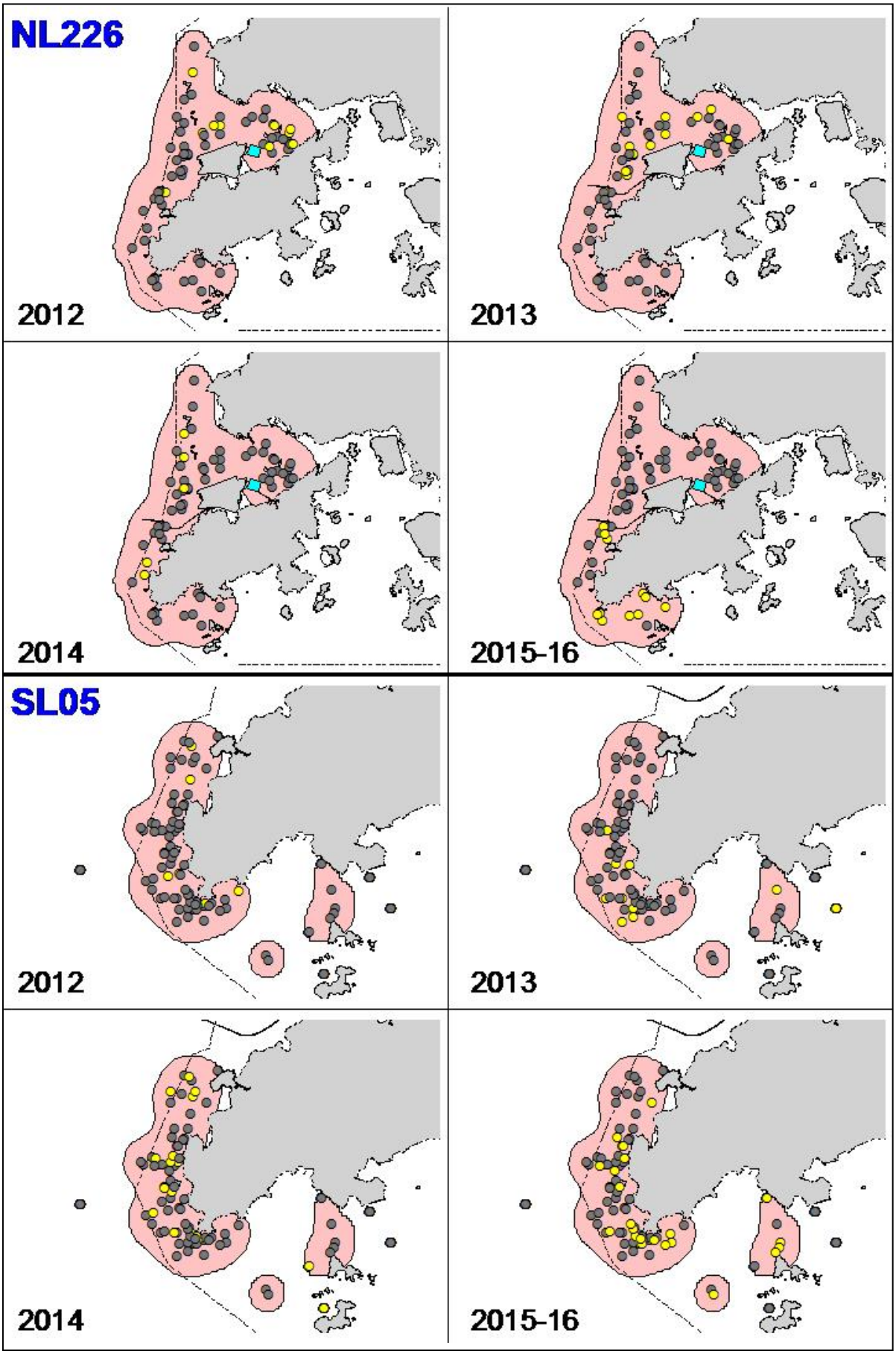
Appendix VI. (cont'd)

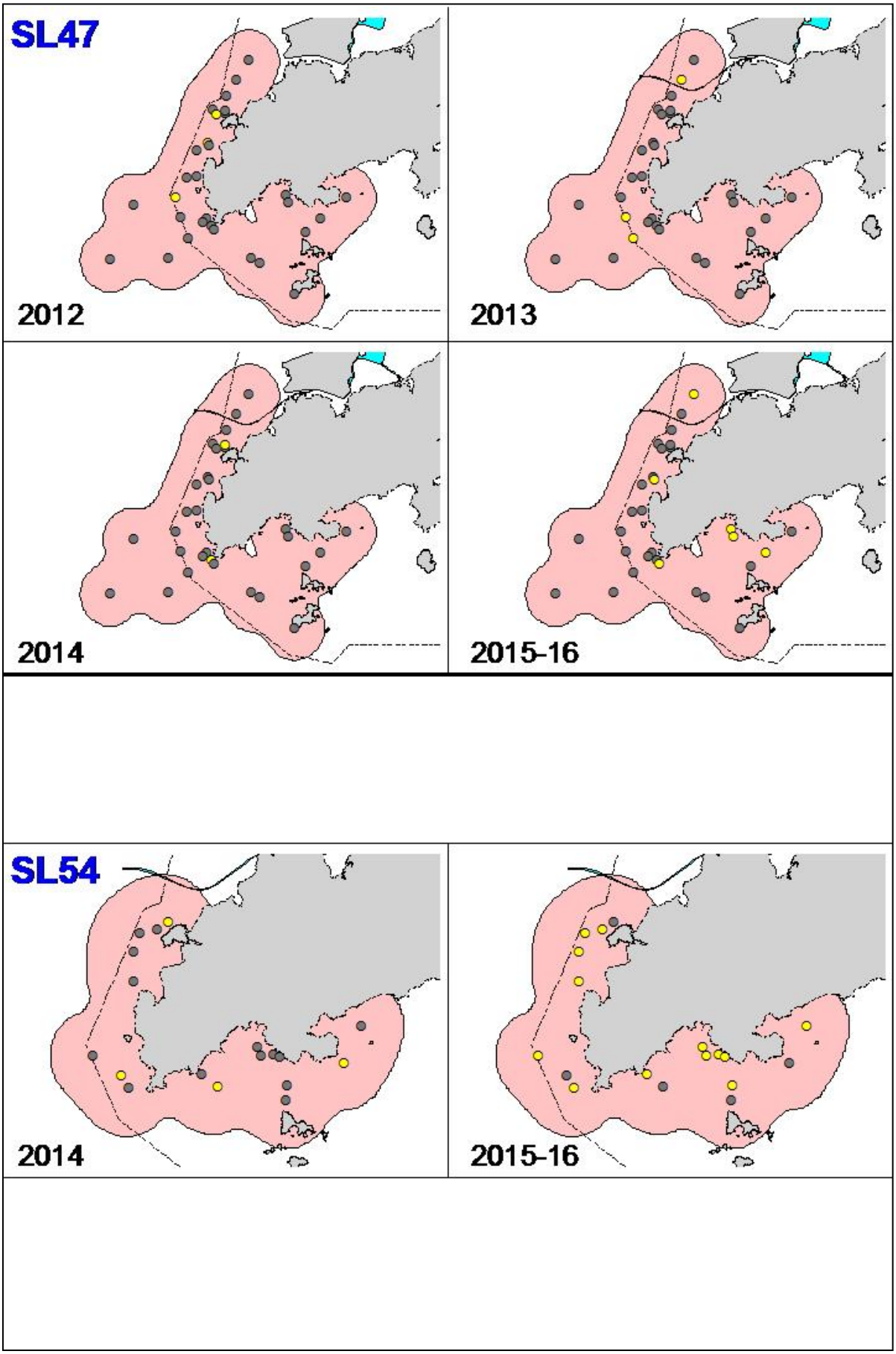


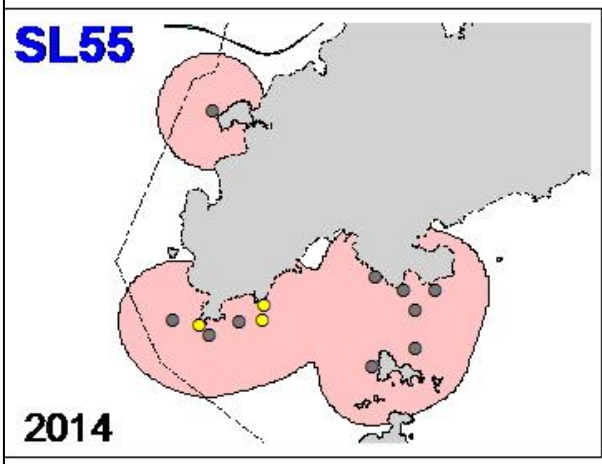
Appendix VI. (cont'd)

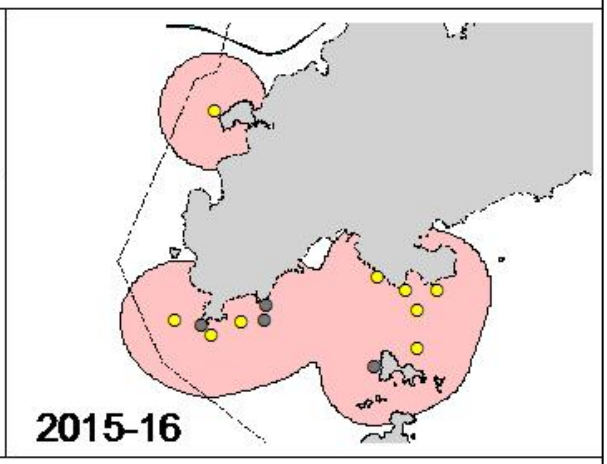


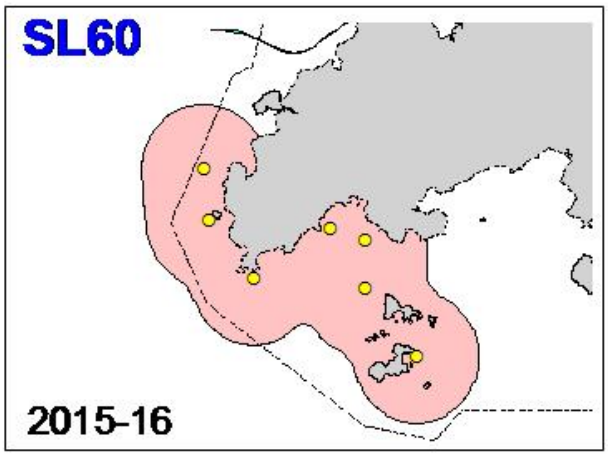
Appendix VI. (cont'd)



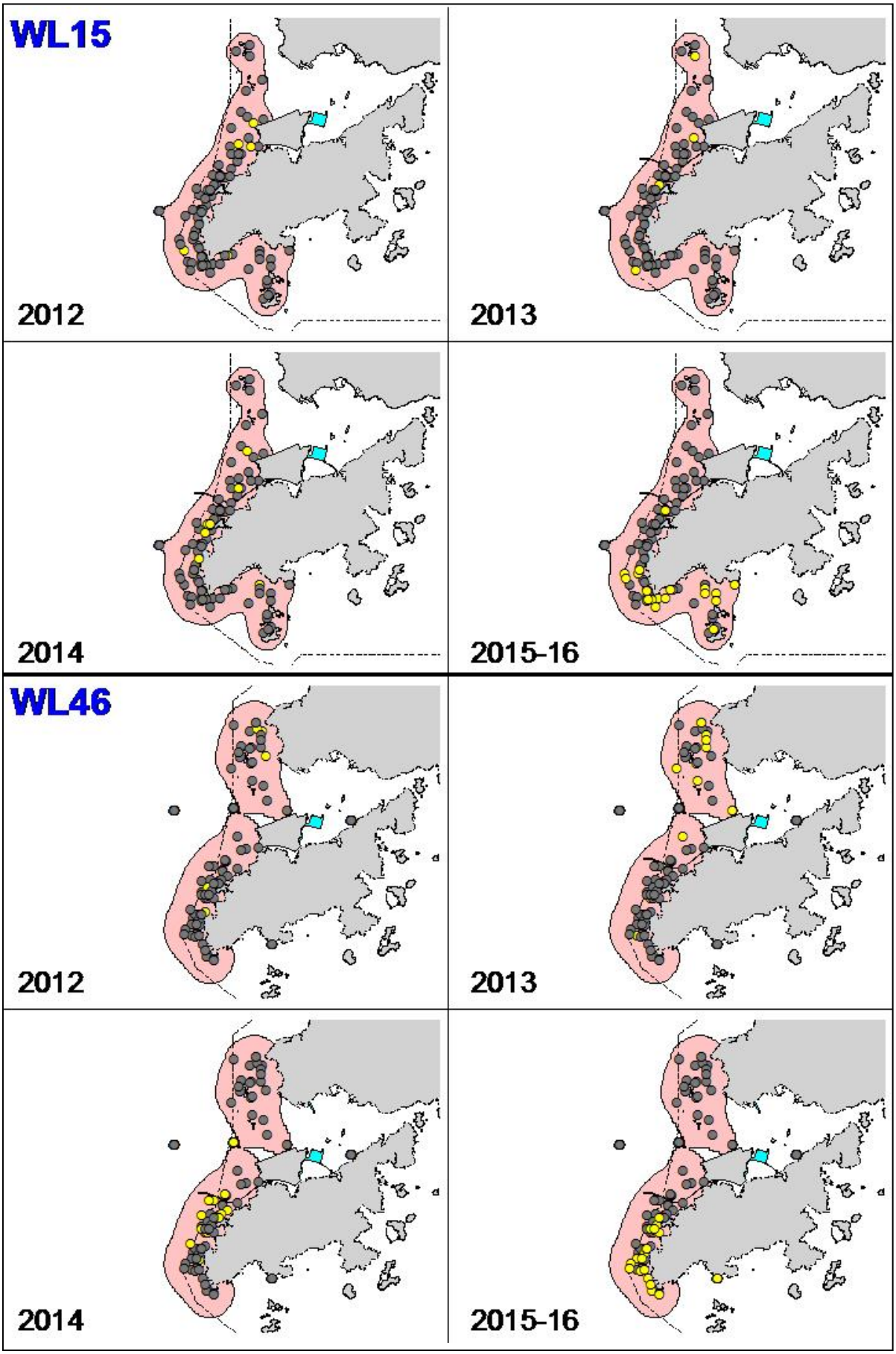

SL47
2012
2013
2014
2015-16
SL54
2014
2015-16


SL55
2014

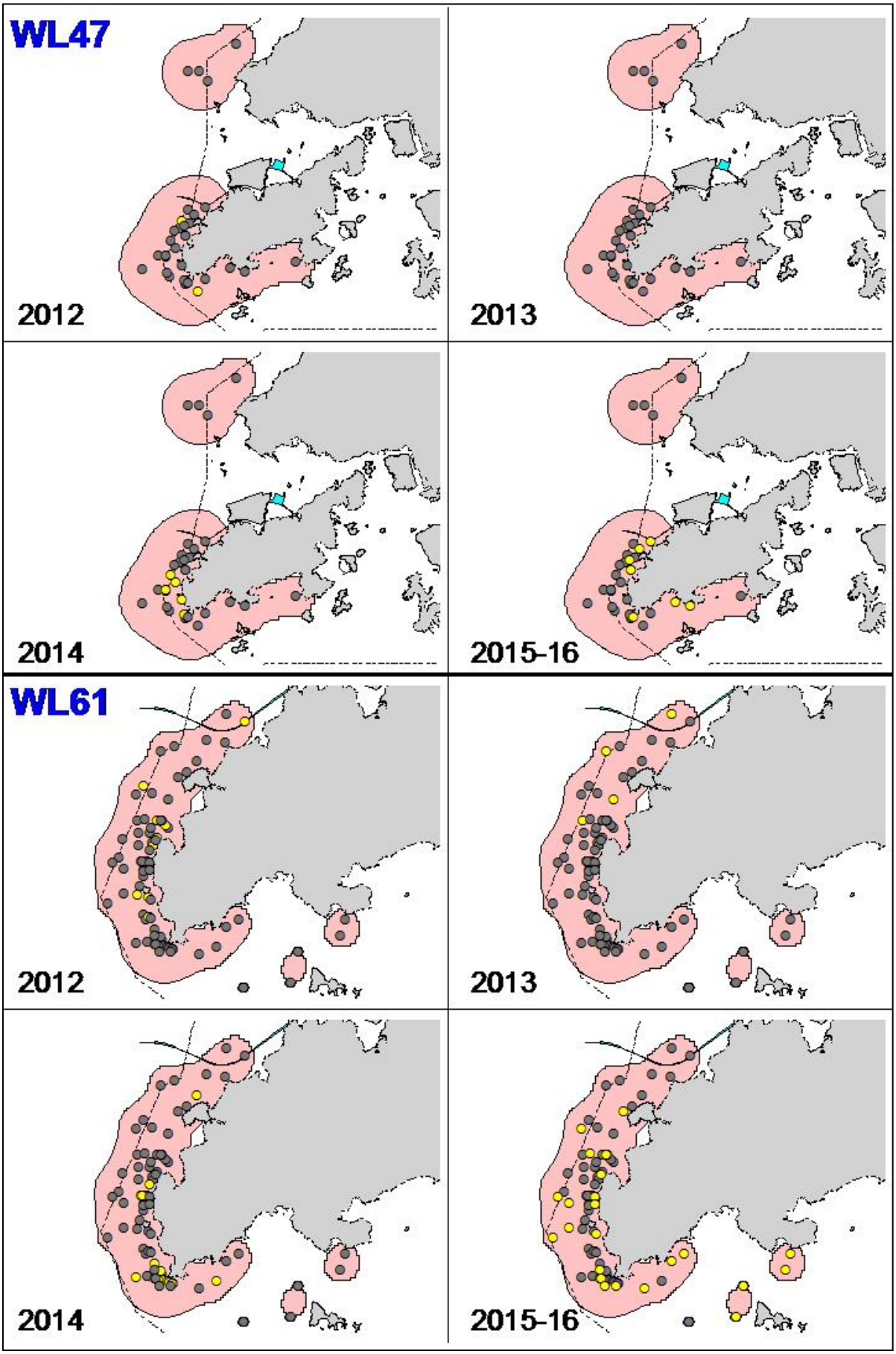

2015-16


SL60
2015-16

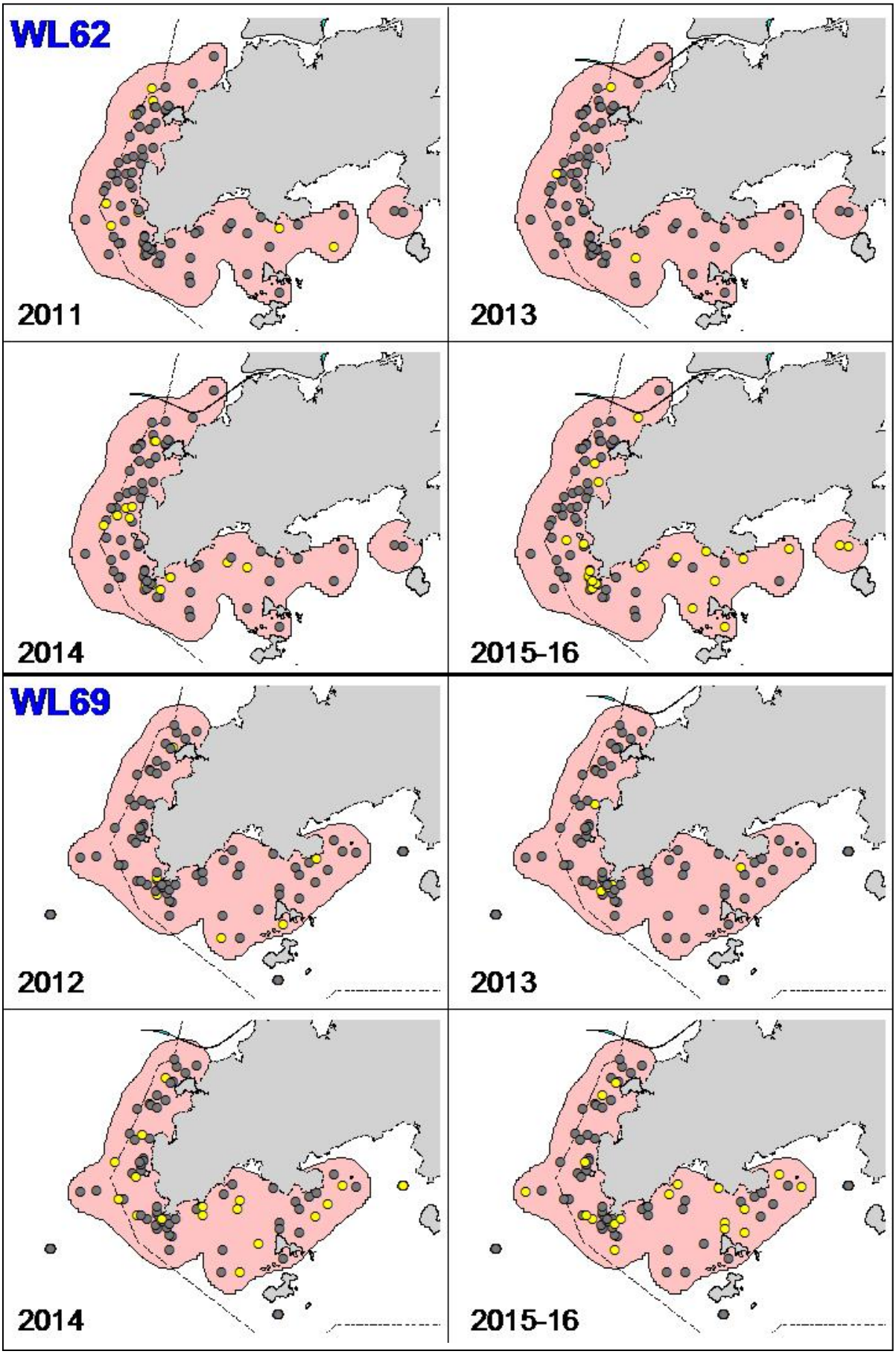
Appendix VI. (cont'd)



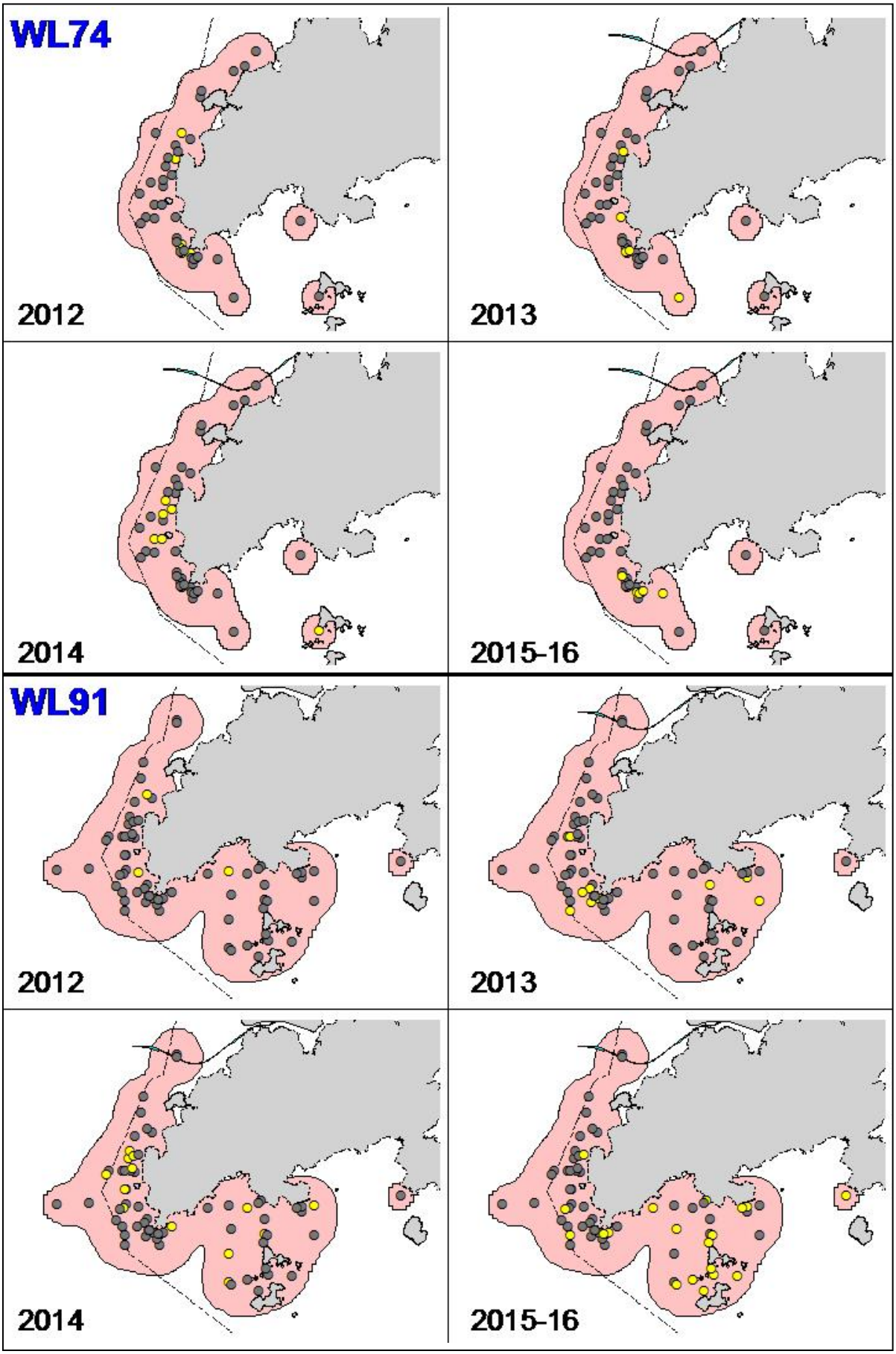
Appendix VI. (cont'd)



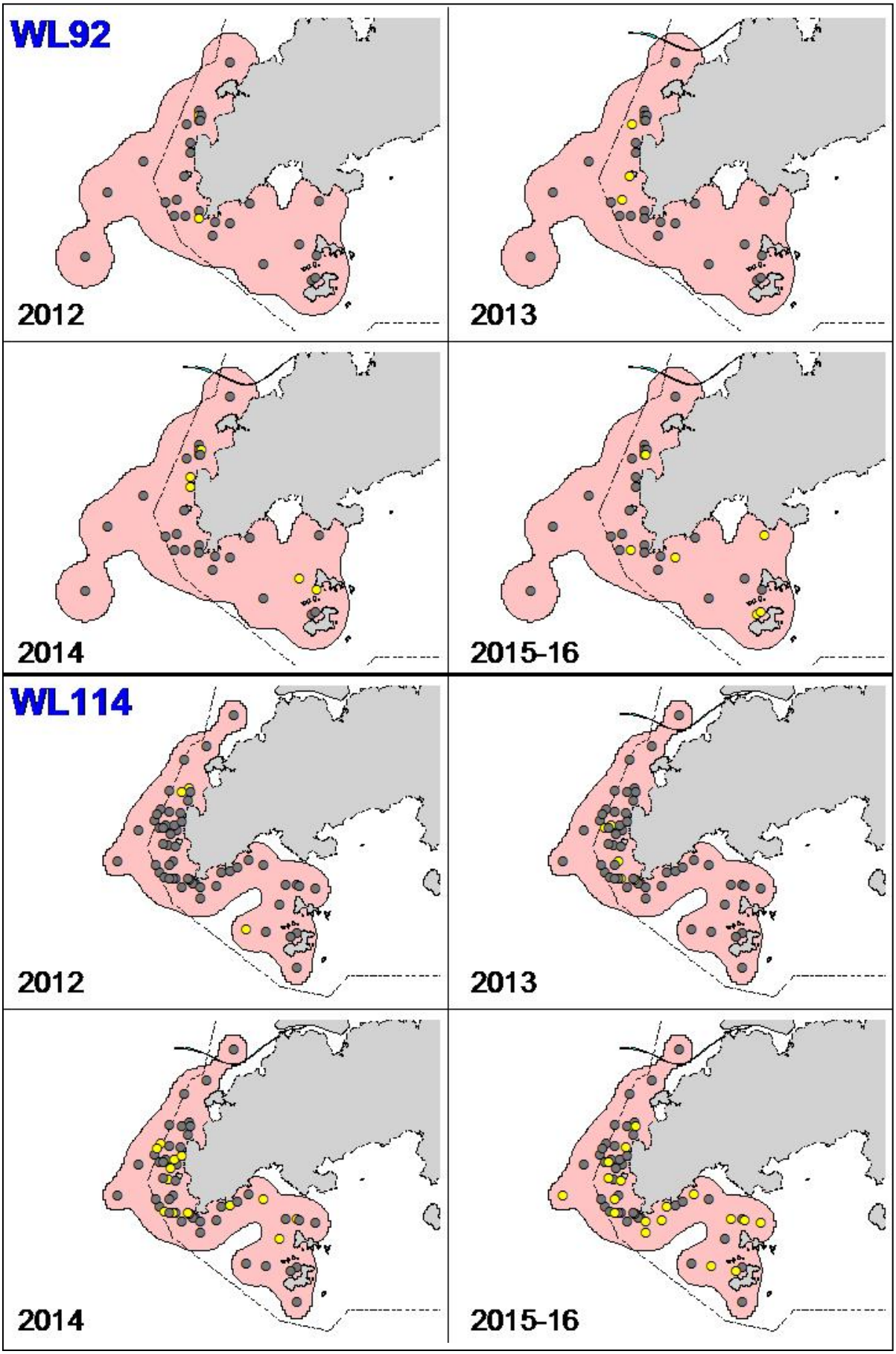
Appendix VI. (cont'd)



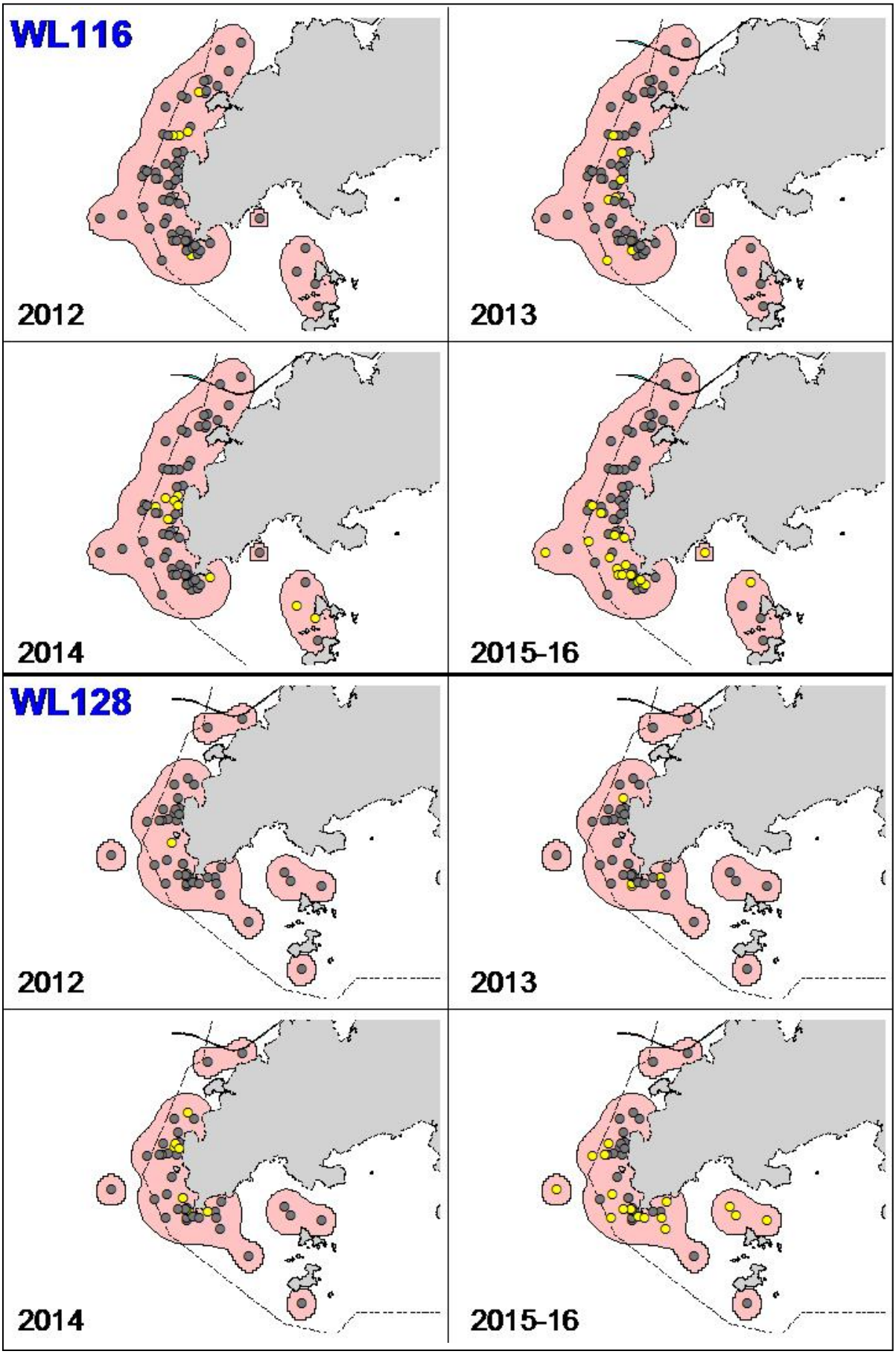
Appendix VI. (cont'd)



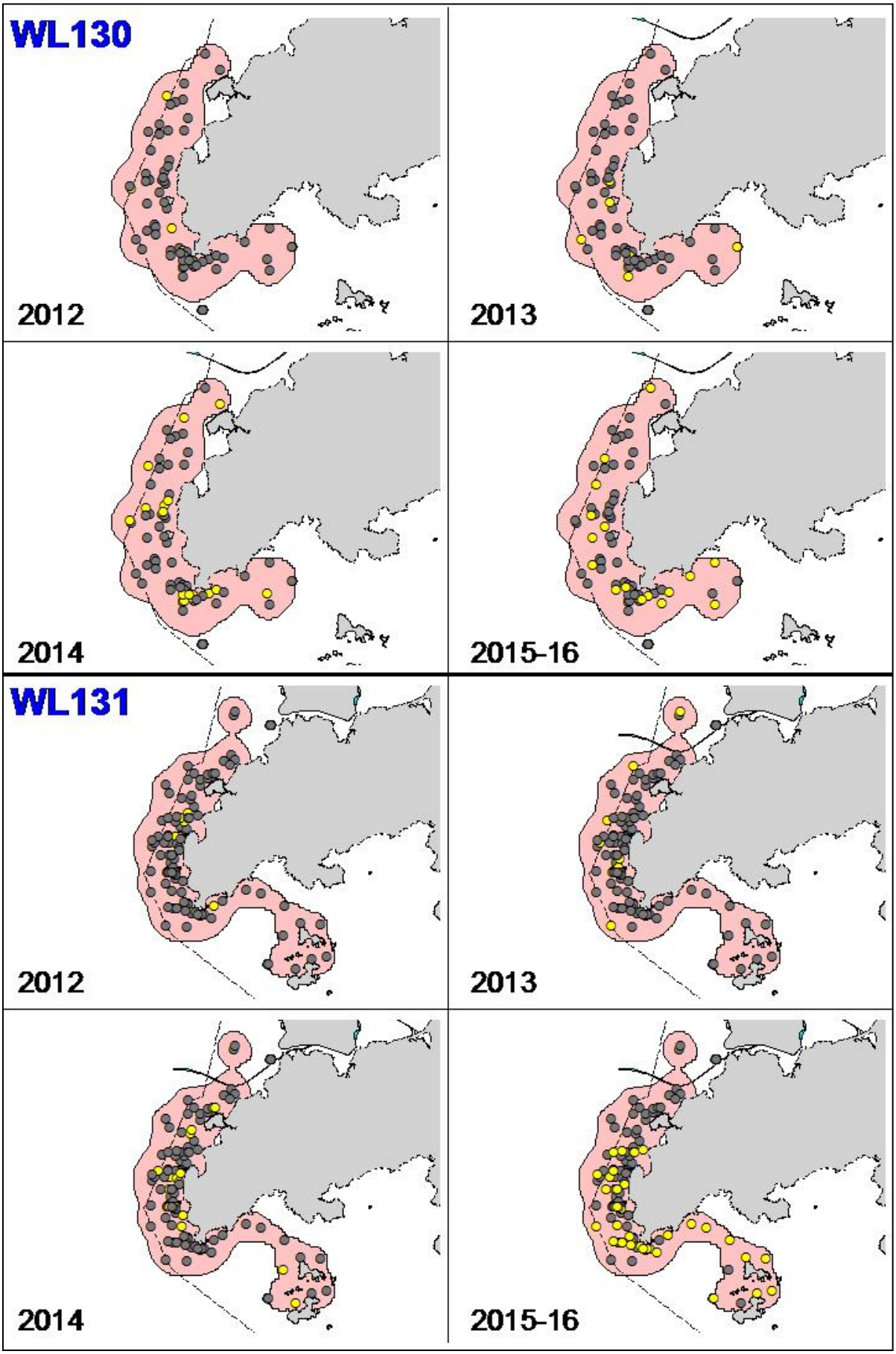
Appendix VI. (cont'd)



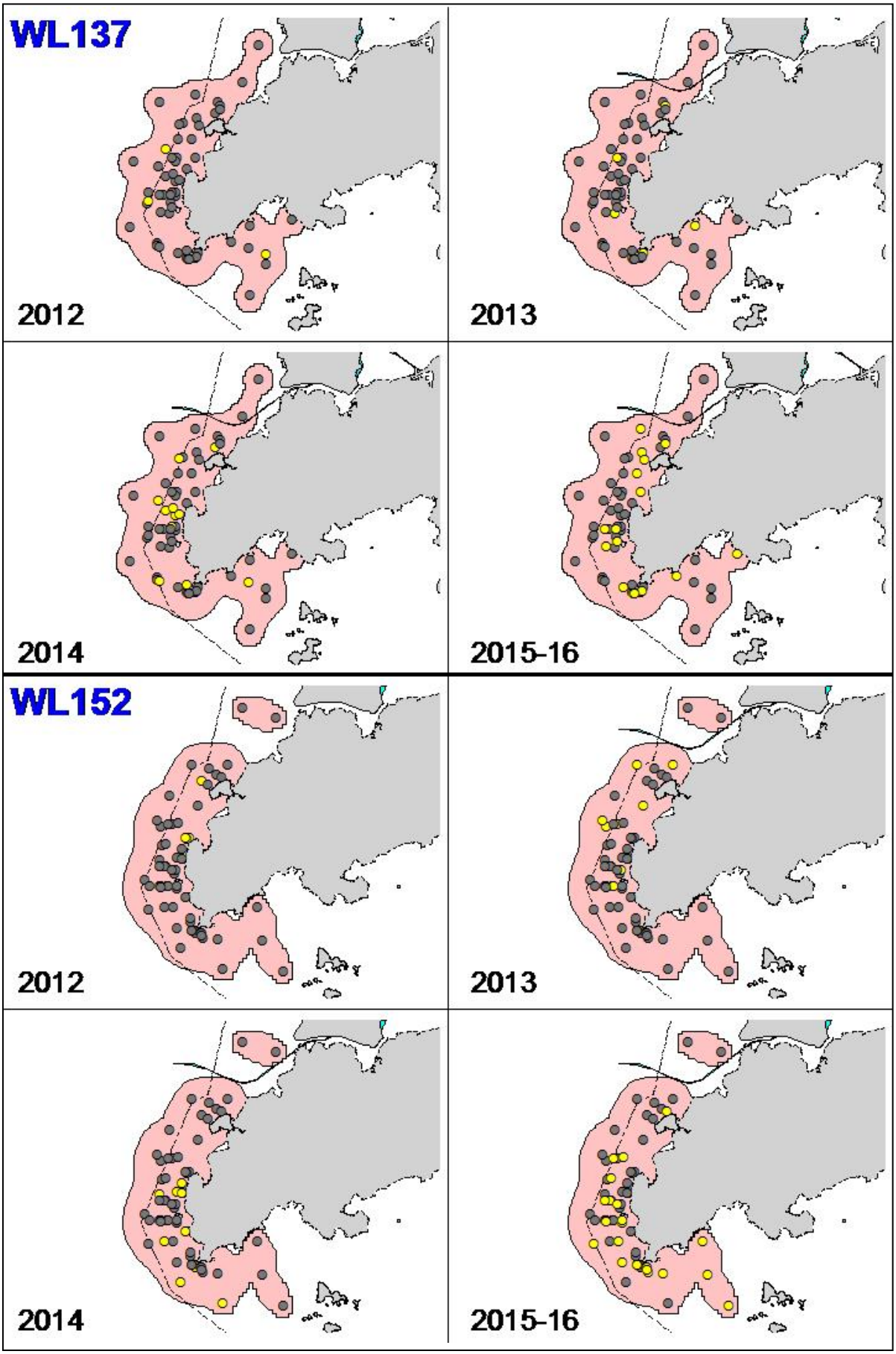
Appendix VI. (cont'd)



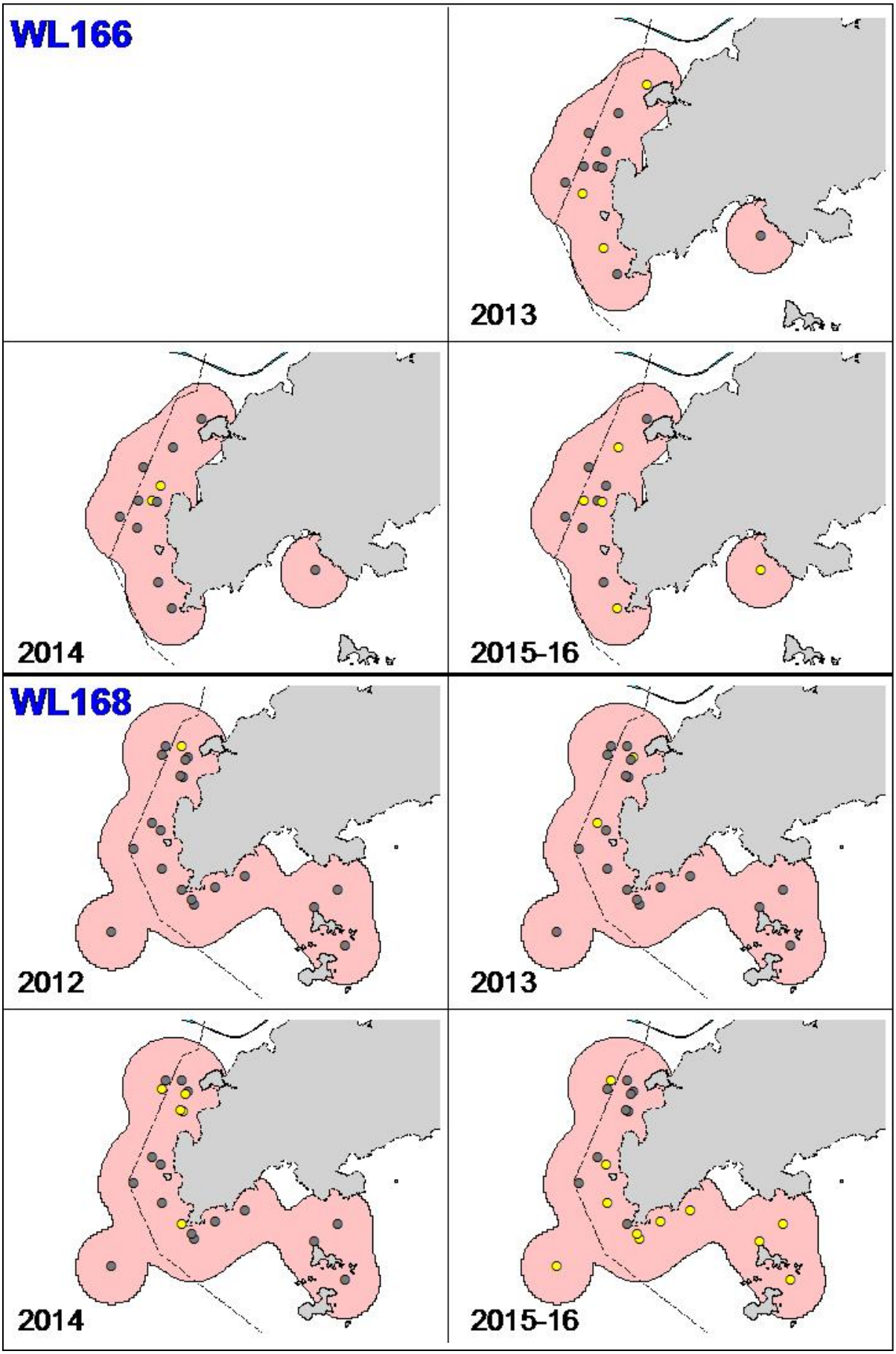
Appendix VI. (cont'd)



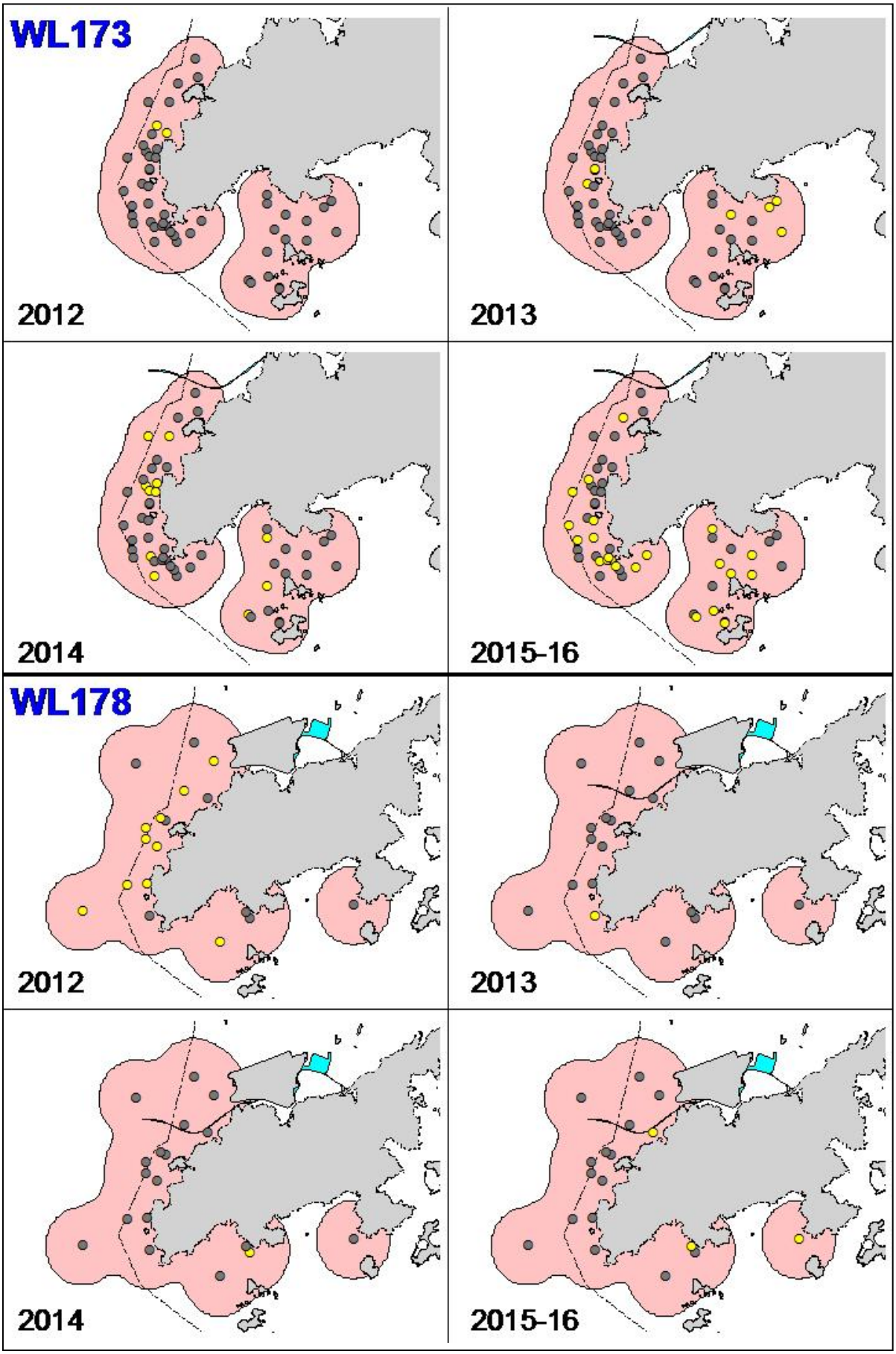
Appendix VI. (cont'd)



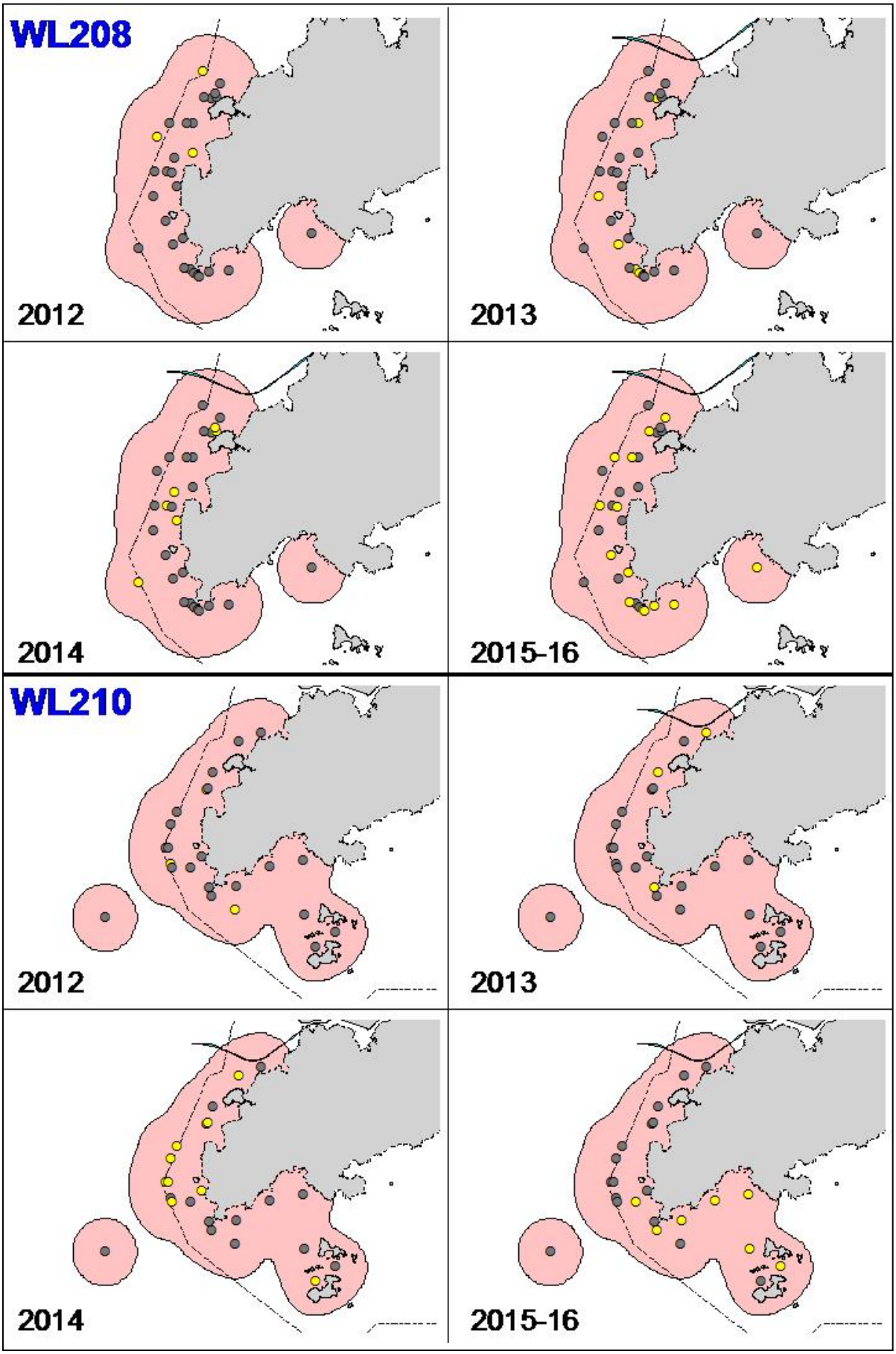
Appendix VI. (cont'd)



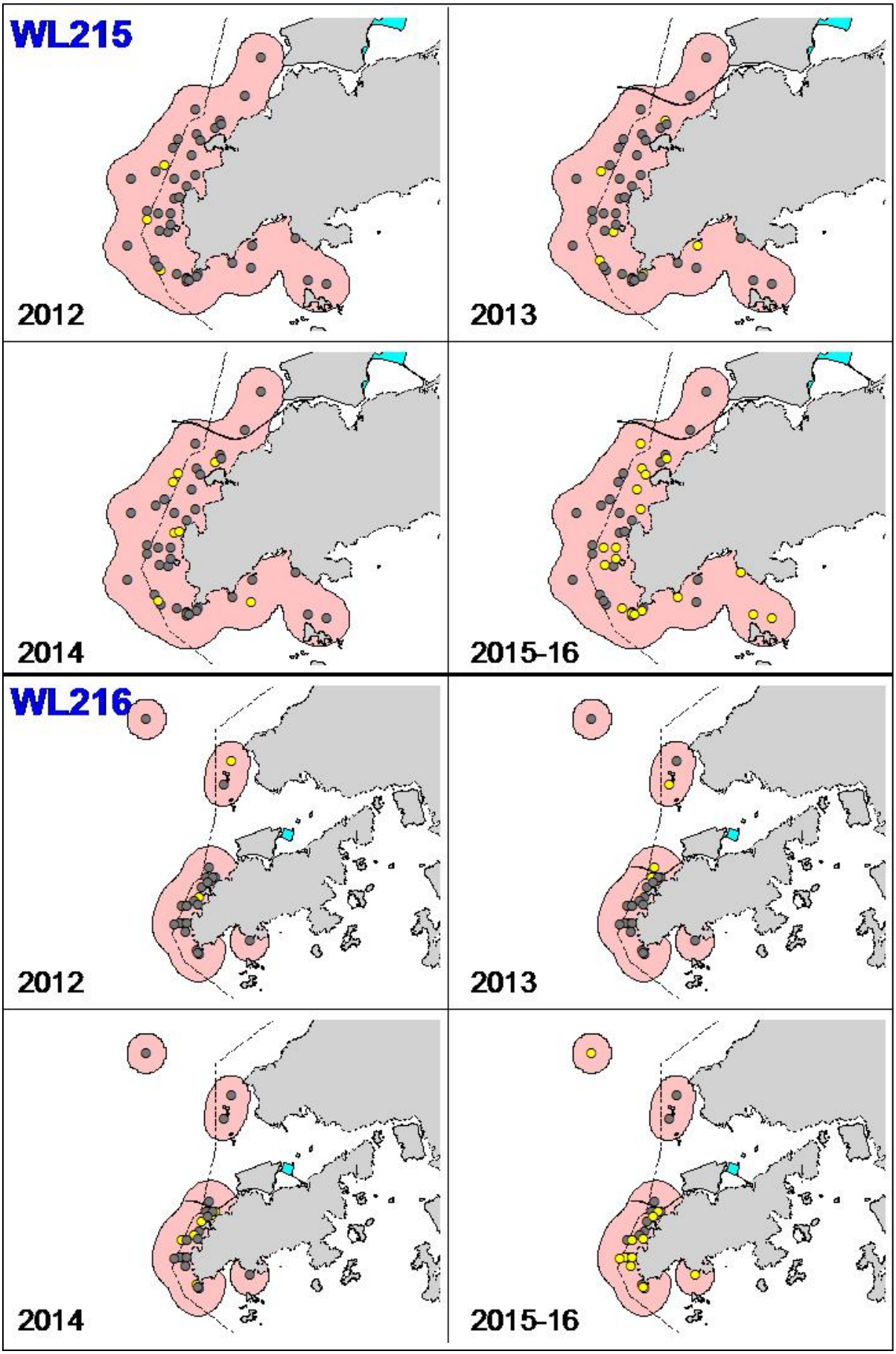
Appendix VI. (cont'd)

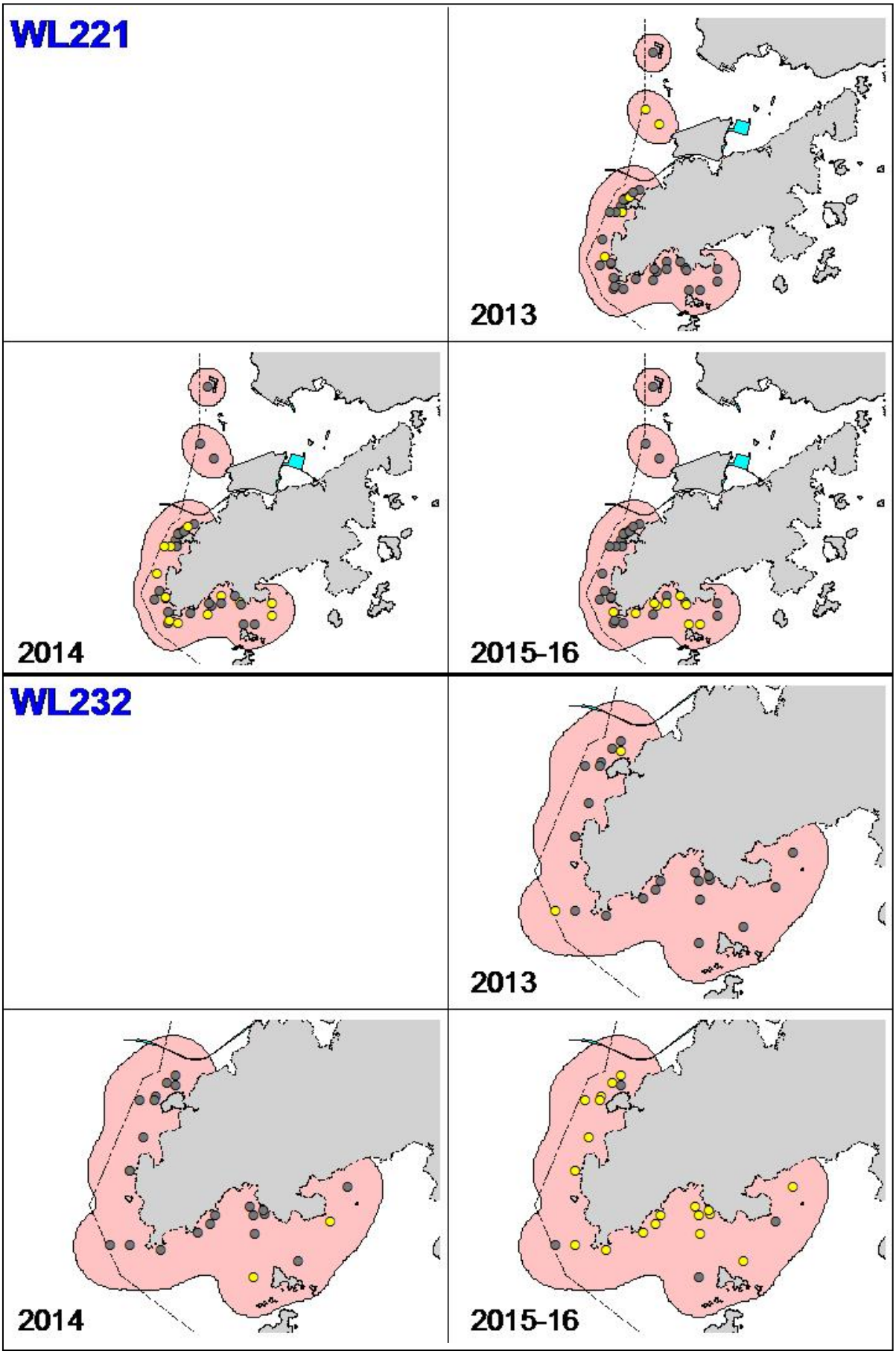


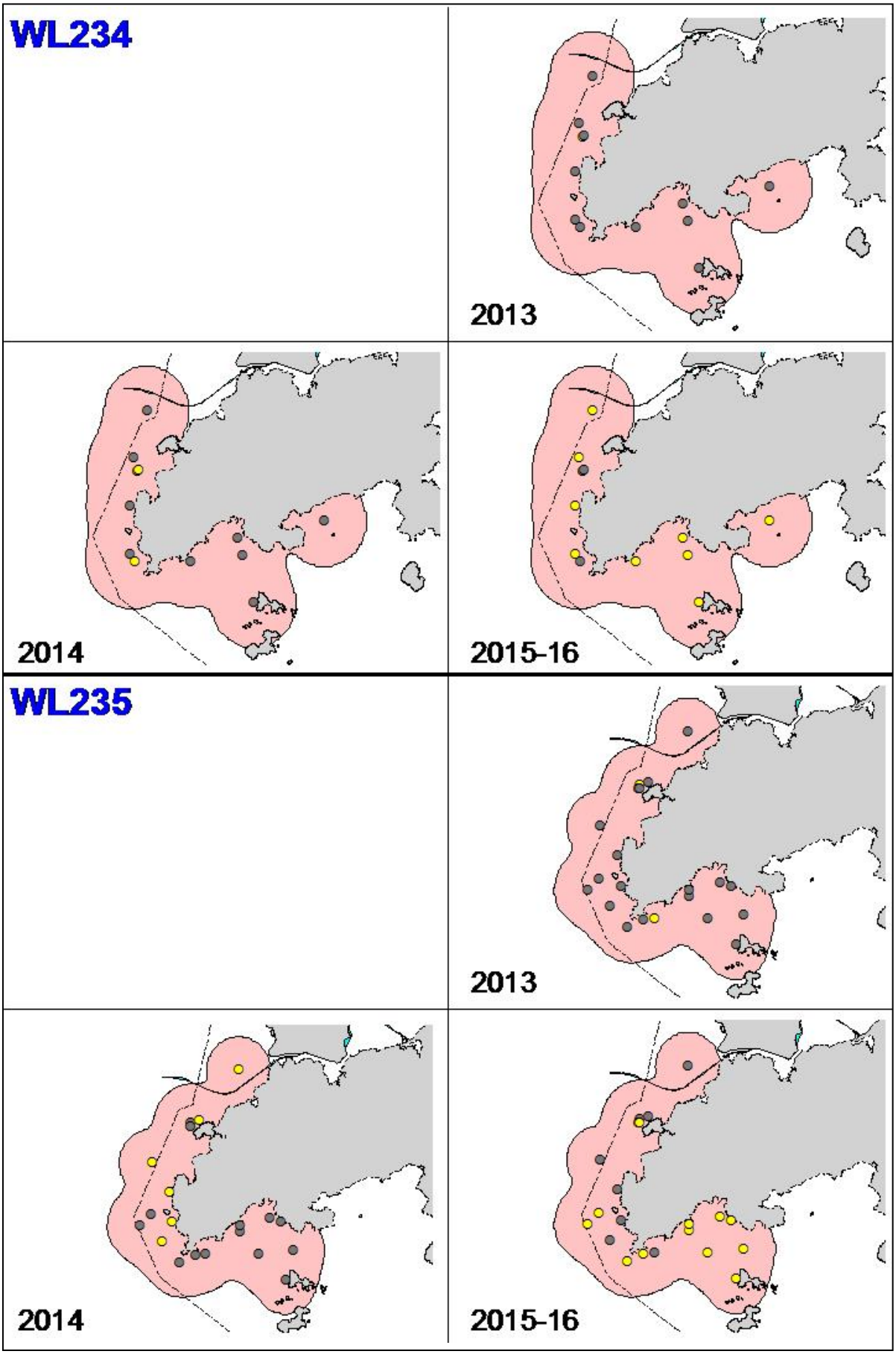
Appendix VI. (cont'd)



Appendix VI. (cont'd)




WL221
2013
2014
2015-16
WL232
2013
2014
2015-16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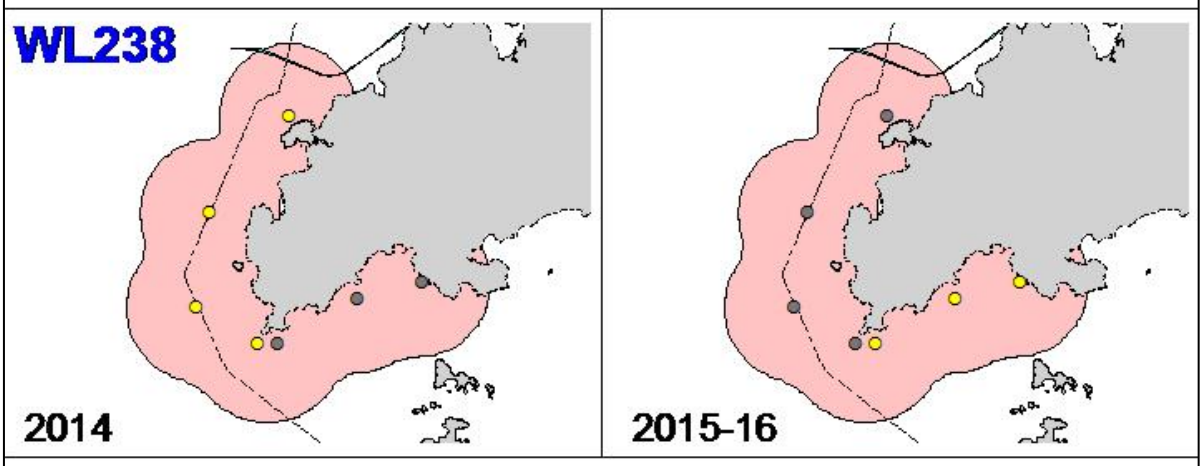
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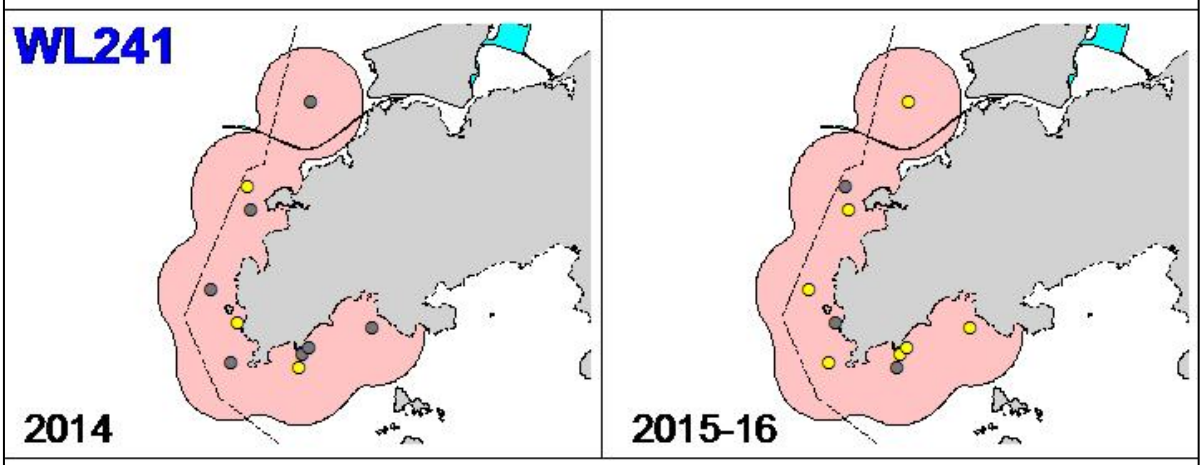
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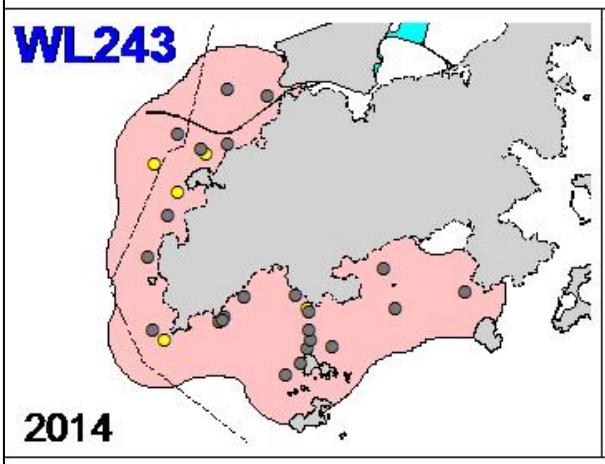
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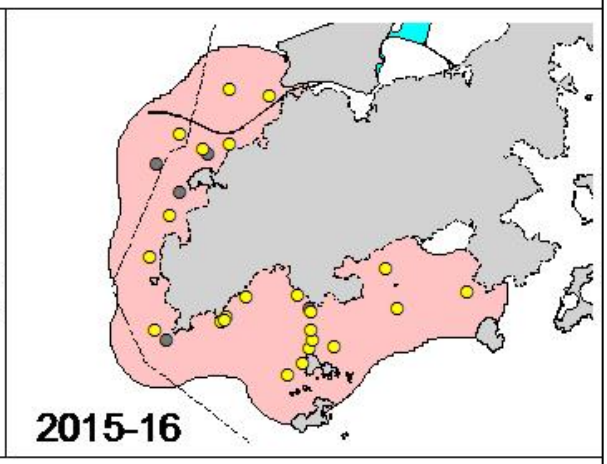
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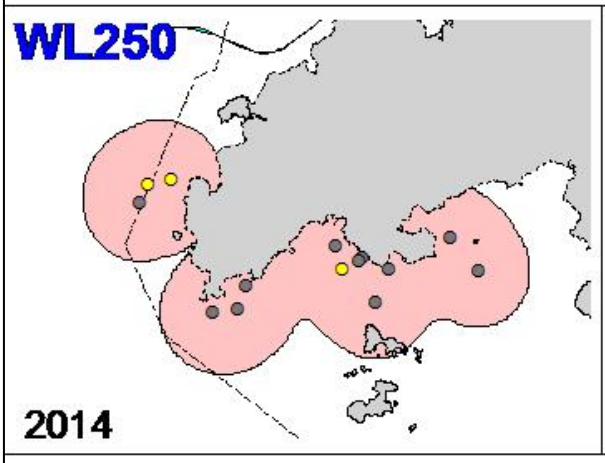
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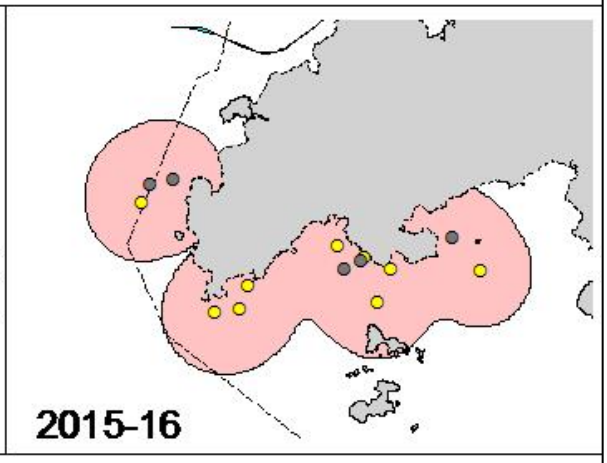
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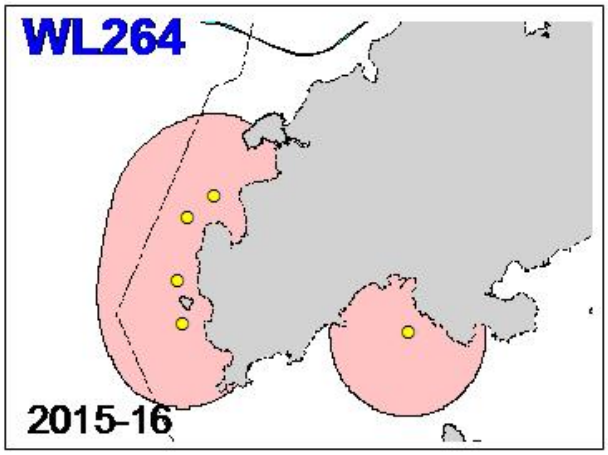
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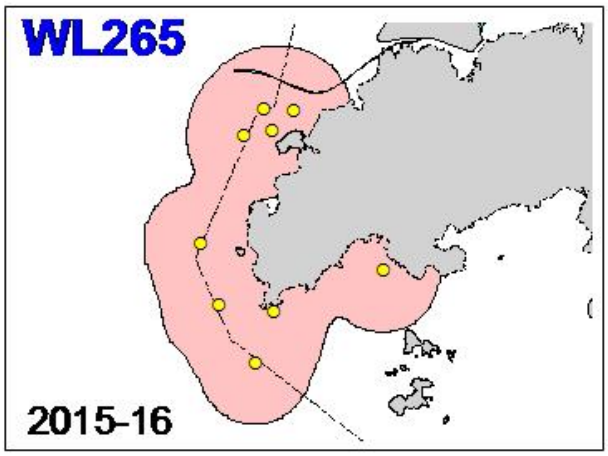
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