Contract No. HY/2011/09
Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section between HKSAR Boundary and Scenic Hill Dolphin Monthly Monitoring

Monthly Progress Report (November 2018)

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1. Introduction

1.1. The Hong Kong Link Road (HKLR) serves to connect the Hong Kong-Zhuhai-Macao Bridge (HZMB) Main Bridge at the Hong Kong Special Administrative Region (HKSAR) Boundary and the HZMB Hong Kong Boundary Crossing Facilities (HKBCF) located at the northeastern waters of the Hong Kong International Airport.

1.2. According to the updated Environmental Monitoring and Audit (EM&A) Manual (for HKLR), monthly line-transect vessel surveys for Chinese White Dolphin should be conducted to cover the West Lantau survey area as in AFCD annual marine mammal monitoring programme.

1.3. Since November 2012, Hong Kong Cetacean Research Project (HKCRP) has been commissioned by Dragages – China Harbour – VSL JV to conduct this dolphin monitoring study in order to collect data on Chinese White Dolphins in West Lantau (WL) survey area, and to analyze the collected survey data to monitor distribution, encounter rate, abundance, activities and occurrence of dolphin calves. Photo-identification will also be collected from individual Chinese White Dolphins to examine their individual range patterns and core area use.

1.4. The present report summarizes the results of the survey findings during the monitoring month of November 2018.

2. Monitoring Methodology

2.1. Vessel-based Line-transect Survey

2.1.1. According to the requirement of the updated EM&A manual, dolphin monitoring programme should cover all transect lines in WL survey area (see Figure 1) twice per month. The co-ordinates of all transect lines are shown in Table 1.

Table 1. Co-ordinates of transect lines in WL survey area

Line No.		Easting	Northing		Line No.		Easting	Northing
1	Start Point	803750	818500		7	Start Point	800200	810450
1	End Point	803750	815500		7	End Point	801400	810450
2	Start Point	803750	815500		8	Start Point	801300	809450
2	End Point	802940	815500		8	End Point	799750	809450
3	Start Point	802550	814500		9	Start Point	799400	808450
3	End Point	803700	814500		9	End Point	801430	808450
4	Start Point	803120	813600		10	Start Point	801500	807450
4	End Point	801640	813600		10	End Point	799600	807450
5	Start Point	801100	812450		11	Start Point	800300	806500
5	End Point	802900	812450		11	End Point	801750	806500
6	Start Point	802400	811500		12	Start Point	801760	805450
6	End Point	800660	811500		12	End Point	800700	805450

2.1.2. The 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 20 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2017). 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 (a data recorder and a primary observer) made up

the on-effort survey team, and the survey vessel transited different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for dolphins and porpoises continuously through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea ahead of the vessel, between 270^{o} and 90^{o} (in relation to the bow, which is defined as 0^{o}). One to two additional experienced observers were available on 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.

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 being conducted along the connecting lines between parallel lines was labeled as "secondary" survey effort. According to HKCRP long-term dolphin monitoring data, encounter rates of Chinese white dolphins deduced from effort and sighting data collected along primary and secondary lines were similar in survey areas around Lantau Island. Therefore, primary and secondary survey effort were both presented as on-effort survey effort in this report.

2.1.8. Encounter rates of Chinese white dolphins (number of on-effort sightings per 100 km of survey effort) were calculated in WL 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 condition would be used for encounter rate analysis. Dolphin encounter rates were calculated using primary survey effort alone, as well as the combined survey effort from both primary and secondary lines.

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 Mark II 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.

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.

3. Monitoring Results

3.1. Vessel-based Line-transect Survey

3.1.1. During the monitoring month of November 2018, two complete sets of systematic line-transect vessel surveys were conducted on the 5th and 12th, to cover all transect lines in WL survey area twice. The survey routes of each survey day are presented in Figures 2-3.

3.1.2. From these surveys, a total of 68.39 km of survey effort was collected, with 98.4% 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 lines (i.e. the horizontal lines perpendicular to the coastlines) was 44.37 km, while the effort on secondary lines (i.e. the lines connecting the primary lines) was 24.02 km.

3.1.3. During the monitoring surveys conducted in November 2018, three groups of 13 Chinese White Dolphins were sighted. All three dolphin groups were sighted on primary lines during on-effort search (Appendix II). None of the dolphin groups was associated with any operating fishing vessel during the monitoring month.

3.1.4. Distribution of the dolphin sightings made during November's surveys is shown in Figure 4. All three groups were sighted in the northern portion of the WL survey area (Figure 4). Two of them were sighted adjacent to the HKLR09 alignment, while another sighting was made at the offshore waters to the west of Tai O Peninsula (Figure 4).

3.1.5. During the November's surveys, encounter rates of Chinese White Dolphins deduced from the survey effort and on-effort sighting data made under favourable conditions (Beaufort 3 or below) are shown in Tables 2 & 3.

Table 2. Dolphin encounter rates (sightings per 100 km of survey effort) per set during November's surveys in West Lantau (WL)

		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	**Primary Lines Only**
West Lantau	Set 1: November 5th	0.0	0.0
	Set 2: November 12th	13.5	58.4

Table 3. Overall dolphin encounter rates (sightings per 100 km of survey effort) in November's surveys on primary lines only as well as both primary lines and secondary lines in West Lantau (WL)

	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**
West Lantau	6.8	4.5	29.3	19.3

3.1.6. The average group size of Chinese White Dolphins was 4.3 individuals per group during November's surveys, which was slightly higher than the averages in previous months of monitoring surveys.

3.1.7. Besides a group with only one animal, the other two dolphin groups were medium in size with six animals per group each (Appendix II).

3.2. Photo-identification Work

3.2.1. Eleven different individual Chinese White Dolphins were identified 11 times during November's surveys (Appendices III and IV). All 11 individuals were re-sighted only once during the monitoring month.

3.2.2. Notably, one of these individuals (WL98) was accompanied by her young calf during their re-sightings in this month's monitoring surveys.

3.3. Conclusion

3.3.1. In this month of dolphin monitoring, marine construction activities have been completed under this contract. No adverse impact on Chinese white dolphins was noticeable from general observations.

3.3.2. Due to the monthly variation in dolphin occurrence within the study area, it would be more appropriate to draw conclusion on whether any impacts on dolphins have been detected related to the construction activities of this project in the quarterly EM&A report, where comparison on distribution, group size and encounter rates of dolphins between the quarterly impact monitoring period (i.e. September-November 2018) and baseline monitoring period will be made.

4. References

- Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, L. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, London.

- Hung, S. K. 2017. Monitoring of marine mammals in Hong Kong waters: final report (2016-17). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 162 pp.

- Jefferson, T. A. 2000. Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. Wildlife Monographs 144:1-65.

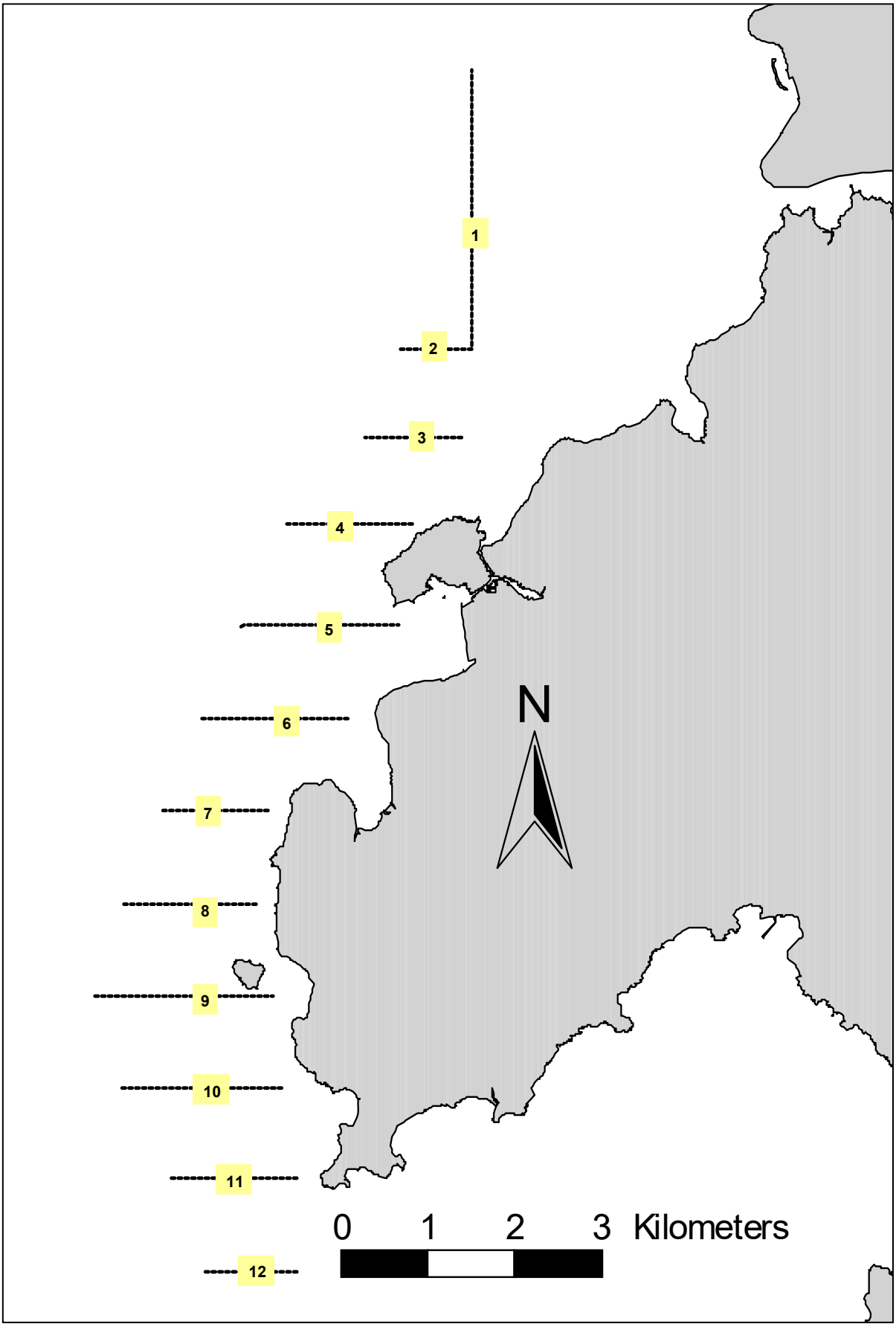

Figure 1. Transect Line Layout in West Lantau Survey Areas

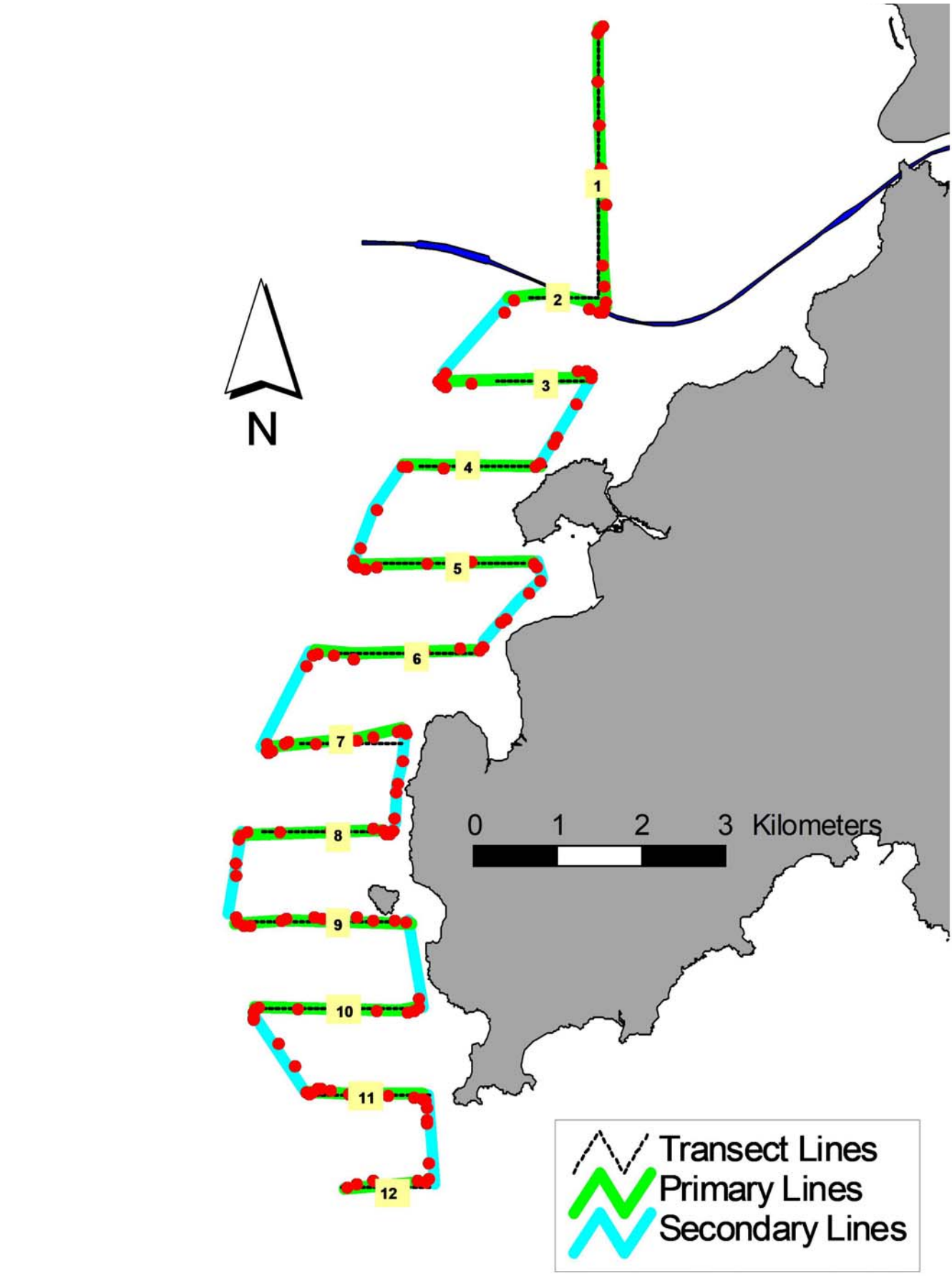

Figure 2. Survey Route on November 5th, 2018 (note: red dots represent the tracked positions of survey boat logged continuously by GPS throughout the course of the survey)

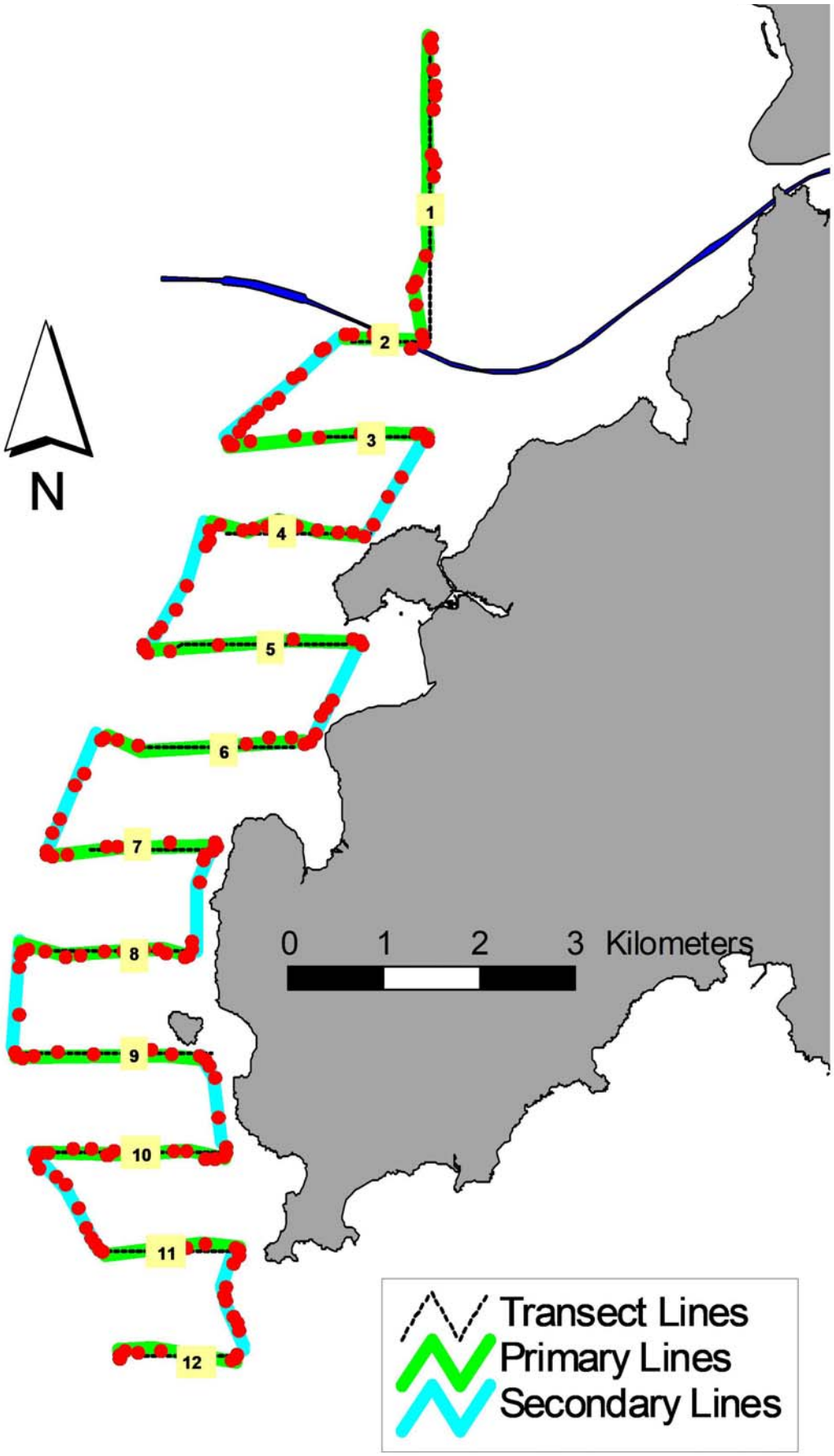

Figure 3. Survey Route on November 12th, 2018 (note: red dots represent the tracked positions of survey boat logged continuously by GPS throughout the course of the survey)

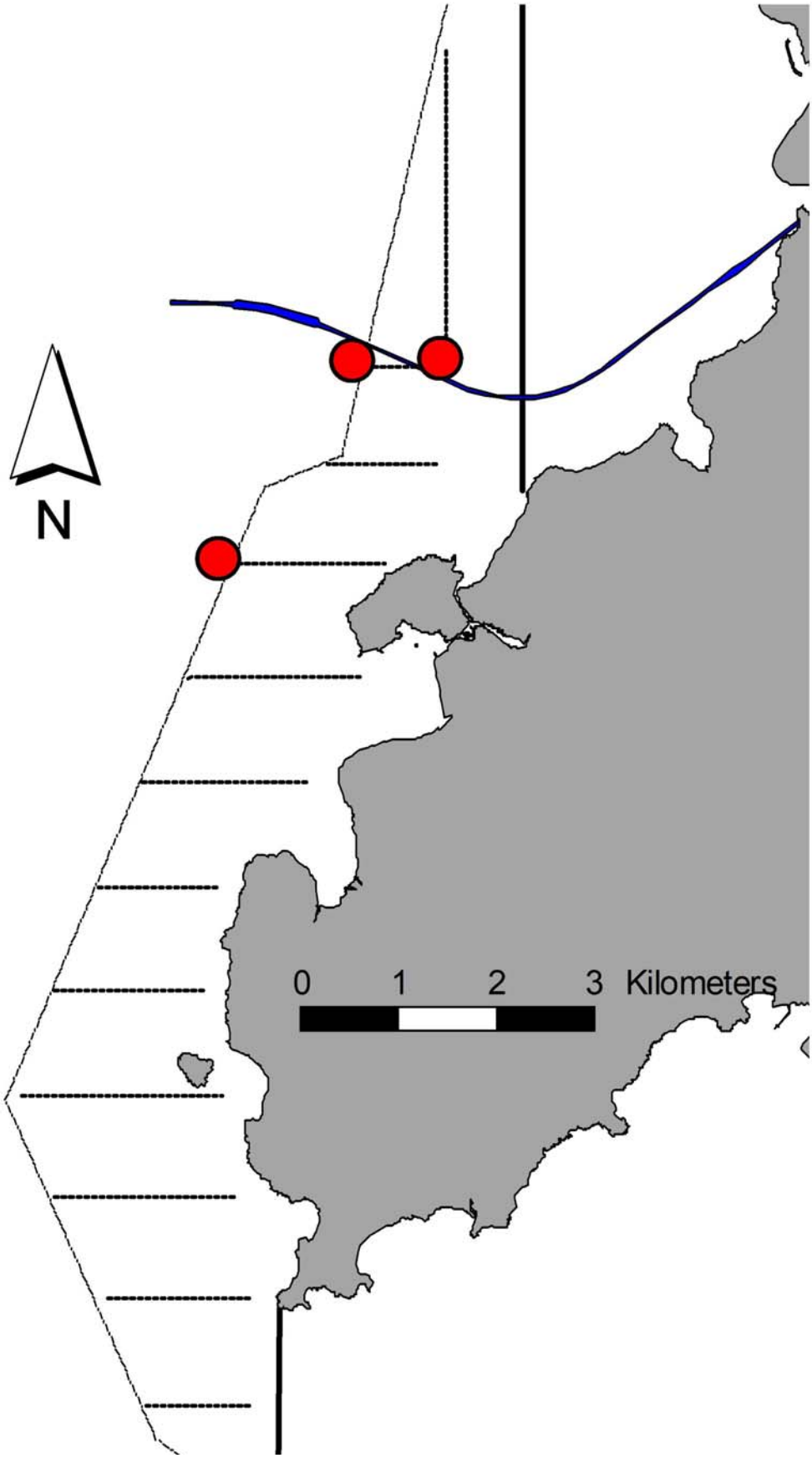

Figure 4. Distribution of Chinese White Dolphin Sightings during November 2018 HKLR09 Monitoring Surveys

Appendix I. HKLR09 Survey Effort Database (November 2018)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
5-Nov-18	W LANTAU	2	8.56	AUTUMN	STANDARD36826	HKLR	P
5-Nov-18	W LANTAU	3	13.55	AUTUMN	STANDARD36826	HKLR	P
5-Nov-18	W LANTAU	2	7.06	AUTUMN	STANDARD36826	HKLR	S
5-Nov-18	W LANTAU	3	3.43	AUTUMN	STANDARD36826	HKLR	S
5-Nov-18	W LANTAU	4	1.10	AUTUMN	STANDARD36826	HKLR	S
12-Nov-18	W LANTAU	1	5.05	AUTUMN	STANDARD36826	HKLR	P
12-Nov-18	W LANTAU	2	17.21	AUTUMN	STANDARD36826	HKLR	P
12-Nov-18	W LANTAU	1	4.10	AUTUMN	STANDARD36826	HKLR	S
12-Nov-18	W LANTAU	2	8.33	AUTUMN	STANDARD36826	HKLR	S

Appendix II. HKLR09 Chinese White Dolphin Sighting Database (November 2018)

(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance; ND = Not Determined; 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
12-Nov-18	1	1026	6	W LANTAU	1	299	ON	HKLR	815538	803672	AUTUMN	NONE	P
12-Nov-18	2	1052	6	W LANTAU	2	166	ON	HKLR	815507	802775	AUTUMN	NONE	P
12-Nov-18	3	1131	1	W LANTAU	1	512	ON	HKLR	813594	801421	AUTUMN	NONE	P

Appendix III. Individual dolphins identified during HKLR09 monitoring surveys in November 2018

ID#	DATE	STG#	AREA
SL44	12/11/18	1	W LANTAU
SL58	12/11/18	2	W LANTAU
SL59	12/11/18	2	W LANTAU
WL15	12/11/18	1	W LANTAU
WL98	12/11/18	2	W LANTAU
WL208	12/11/18	2	W LANTAU
WL217	12/11/18	1	W LANTAU
WL257	12/11/18	2	W LANTAU
WL268	12/11/18	2	W LANTAU
WL284	12/11/18	1	W LANTAU
WL294	12/11/18	1	W LANTAU

Appendix IV. Photographs of Identified Individual Dolphins in November 2018 (HKLR09)

Appendix IV (cont'd).