

Appendix B Chinese White Dolphin Monitoring Results

AGREEMENT NO. HMWSD 1/2019 (EP)
Post-Construction Monitoring of Chinese White Dolphin
(Line-transect Vessel Surveys) for the Hong Kong-Zhuhai-Macao
Bridge Hong Kong Link Road at West Lantau Waters - Investigation

Monthly Progress Report (December 2019)

Submitted by
Samuel K.Y. Hung, Ph.D.
Hong Kong Cetacean Research Project

15 December 2019

1. Introduction

- 1.1. The Hong Kong-Zhuhai-Macao Bridge (HZMB) Hong Kong Link Road (HKLR) is a designated project under the Environmental Impact Assessment Ordinance (EIAO). The Environmental Impact Assessment (EIA) Report and Environmental Monitoring and Audit (EM&A) Manual (EIA Register No.: AEIAR-144/2009) for the project were approved by the Director of Environmental Protection in October 2009 and the Environmental Permit No. EP-352/2009 (EP) was issued in November 2009. The EP has been subject to several variations and the current one is EP No. EP-352/2009/D.
- 1.2. The HZMB-HKLR was constructed under two works contracts namely Contract No. HY/2011/03 (HZMB HKLR – Section between Scenic Hill and Hong Kong Boundary Crossing Facilities (HKBCF)) and Contract No. HY/2011/09 (HZMB HKLR – Section between HKSAR Boundary and Scenic Hill). In accordance with the EP, the Contractors of Contract No. HY/2011/03 and Contract No. HY/2011/09 have separately employed their own Environmental Team (ET) and ET Leader to conduct construction phase monitoring of Chinese White Dolphin (CWD) in the North Lantau (NL) and West Lantau (WL) waters following the requirements specified in the EM&A Manual and the relevant contract specifications of the two contracts.
- 1.3. In accordance with Section 10.3 of the EM&A Manual, an ecological monitoring and audit programme is needed which will monitor potential impacts through construction and operation activities, and will verify the assessments which were made in the EIA report.

In particular, the programme should include dolphin monitoring at NL and WL waters to be set up in order to verify the predictions of impacts and to ensure that there are no unforeseen impacts on the dolphin population during construction phase. Such dolphin monitoring should cover the pre-construction phase, the entire period of construction phase and after the completion of construction works (i.e. post-construction phase).

- 1.4. The main objective of the current assignment commissioned by the Highways Department is to conduct Post-Construction Monitoring of CWD in WL waters in compliance with the requirements stipulated in the EM&A Manual and the EP for the HZMB HKLR. The post-construction monitoring should be conducted for two years upon the completion of all marine-based construction activities.
- 1.5. The marine-based construction activities for the Contract No. HY/2011/09 was completed in October 2018. Subsequently, 10 months of post-construction dolphin monitoring had been carried out by another contractor between late October 2018 and the end of August 2019, while the remaining 14 months of post-construction dolphin monitoring will be completed under this assignment, from 1 September 2019 to 31 October 2020.
- 1.6. In August 2019, Mott MacDonald Hong Kong Limited (MMHK) has been appointed as the Consultant responsible for the 14 months of post-construction monitoring of CWD in WL waters for HZMB HKLR. Subsequently, the Hong Kong Cetacean Research Project (HKCRP) has been appointed by MMHK to undertake the dolphin monitoring tasks to conduct systematic line-transect vessel surveys and the analysis of such survey data. The present report summarizes the results of post-construction monitoring survey findings during the monitoring month of December 2019.

2. Monitoring Methodology

- 2.1.1. According to the requirement of the updated EM&A manual, the dolphin monitoring programme should cover all transect lines in WL survey area (see Figure 1) twice per month throughout the entire post-construction period. 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. It should be emphasized that the following monitoring protocol is consistent and completely compatible with the baseline and construction phase dolphin monitoring methodology, which was also designed and adopted by the HKCRP team for the HZMB monitoring since 2011.
- 2.1.3. 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 past two decades of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2018, 2019). 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.
- 2.1.4. Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited through different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and fill out the datasheets, while the primary observer searched for Chinese White Dolphins 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 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 are experienced in small cetacean survey techniques and identifying local cetacean species.
- 2.1.5. 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*). Data including time, position and vessel

speed were automatically and continuously logged by a 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 would then be 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 were 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 have been similar in survey areas around Lantau Island. Therefore, both primary and secondary survey effort would be presented as on-effort survey effort.
- 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 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.
- 2.2.2. One to two professional digital cameras (*Canon* EOS 7D Mark II model), each equipped with long telephoto lenses (100-400 mm zoom), were available on board for researchers to take sharp, close-up photographs of dolphins as they surface. 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 were 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 December 2019, two complete sets of systematic line-transect vessel surveys were conducted on the 2nd and 4th, 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 65.72 km of survey effort was collected, with 40.1% of 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 43.27 km, while the effort on secondary lines (i.e. the lines connecting the primary lines) was 22.45 km.
- 3.1.3. During the monitoring surveys conducted in December 2019, three groups of eight Chinese White Dolphins were sighted. Two of the three dolphin groups were sighted on primary lines during on-effort search (Appendix II). None of these dolphin groups was associated with operating fishing vessel during the monitoring month.
- 3.1.4. Distribution of the dolphin sightings made during December's surveys is shown in Figure 4. Two of the three sightings were made to the northwest of Tai O Peninsula, while another sighting was made at the offshore waters to the west of Kai Kung Shan (Figure

4).

3.1.5. During the December'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 December'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: December 2 nd	0.0	0.0
	Set 2: December 4 th	6.2	24.6

Table 3. Overall dolphin encounter rates (sightings per 100 km of survey effort) in December'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	5.9	7.6	23.5	26.6

3.1.6. The average group size of Chinese White Dolphins during December's surveys was 2.7 individuals per group. All three dolphin sightings were consisted of small groups of 1-4 animals per group during the monitoring month (Appendix II).

3.2. *Photo-identification Work*

3.2.1. A total of six different individual Chinese White Dolphins were identified six times during the December's surveys (Appendix III and IV).

3.2.2. Notably, two of these individuals (WL28 and WL288) were a mother-calf pair being re-sighted in this month's monitoring surveys.

3.3. *Conclusion*

3.3.1. In this month of post-construction dolphin monitoring in WL waters, marine construction

activities have been completed and as a result, no adverse impact on Chinese White Dolphins from the HZMB works has been observed.

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. 2018. Monitoring of Marine Mammals in Hong Kong waters: final report (2017-18). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department, 174 pp.
- Hung, S. K. 2019. Monitoring of Marine Mammals in Hong Kong waters: final report (2018-19). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department, 140 pp.
- Jefferson, T. A. 2000. Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. Wildlife Monographs 144: 1-65.

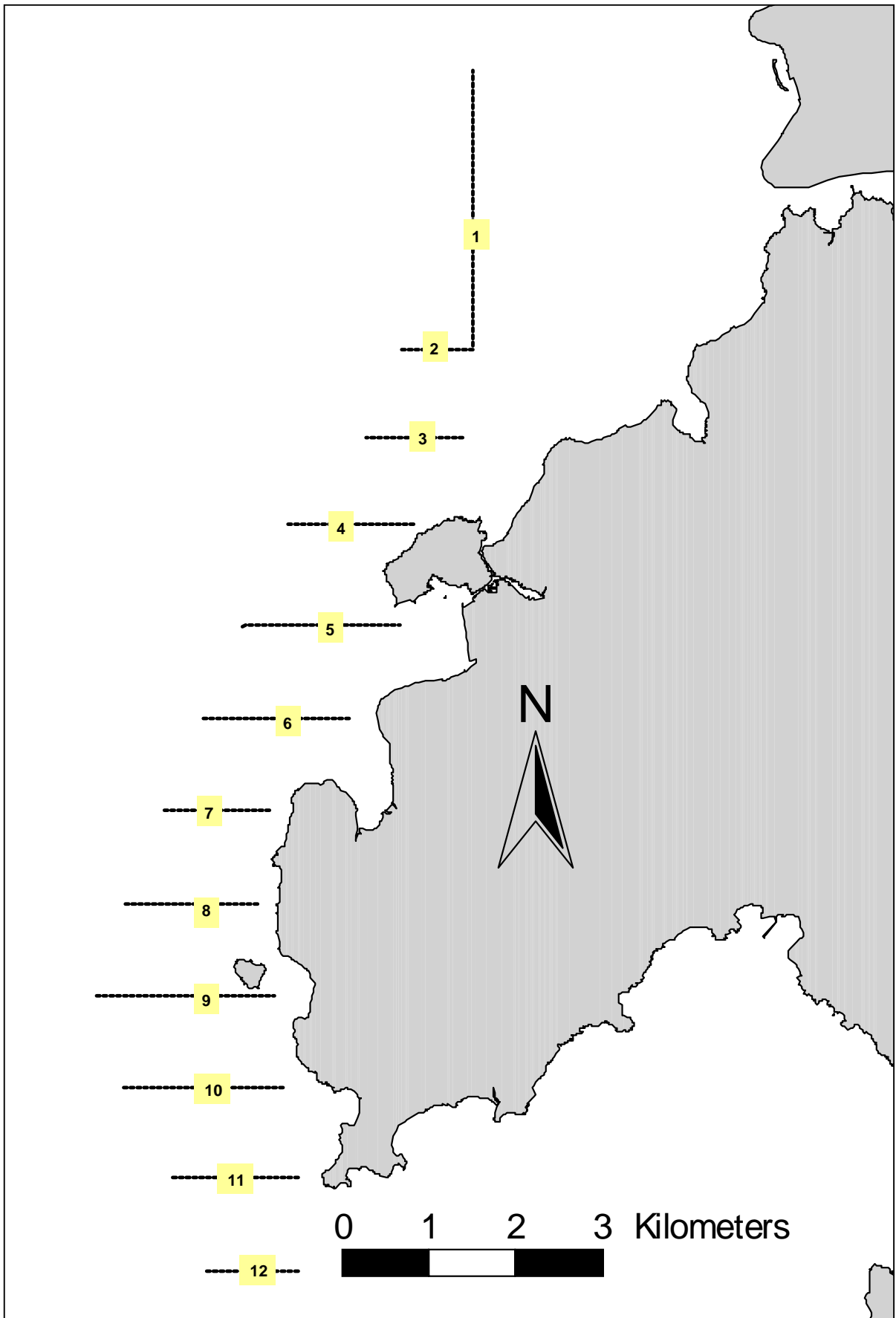


Figure 1. Transect Line Layout in West Lantau Survey Areas

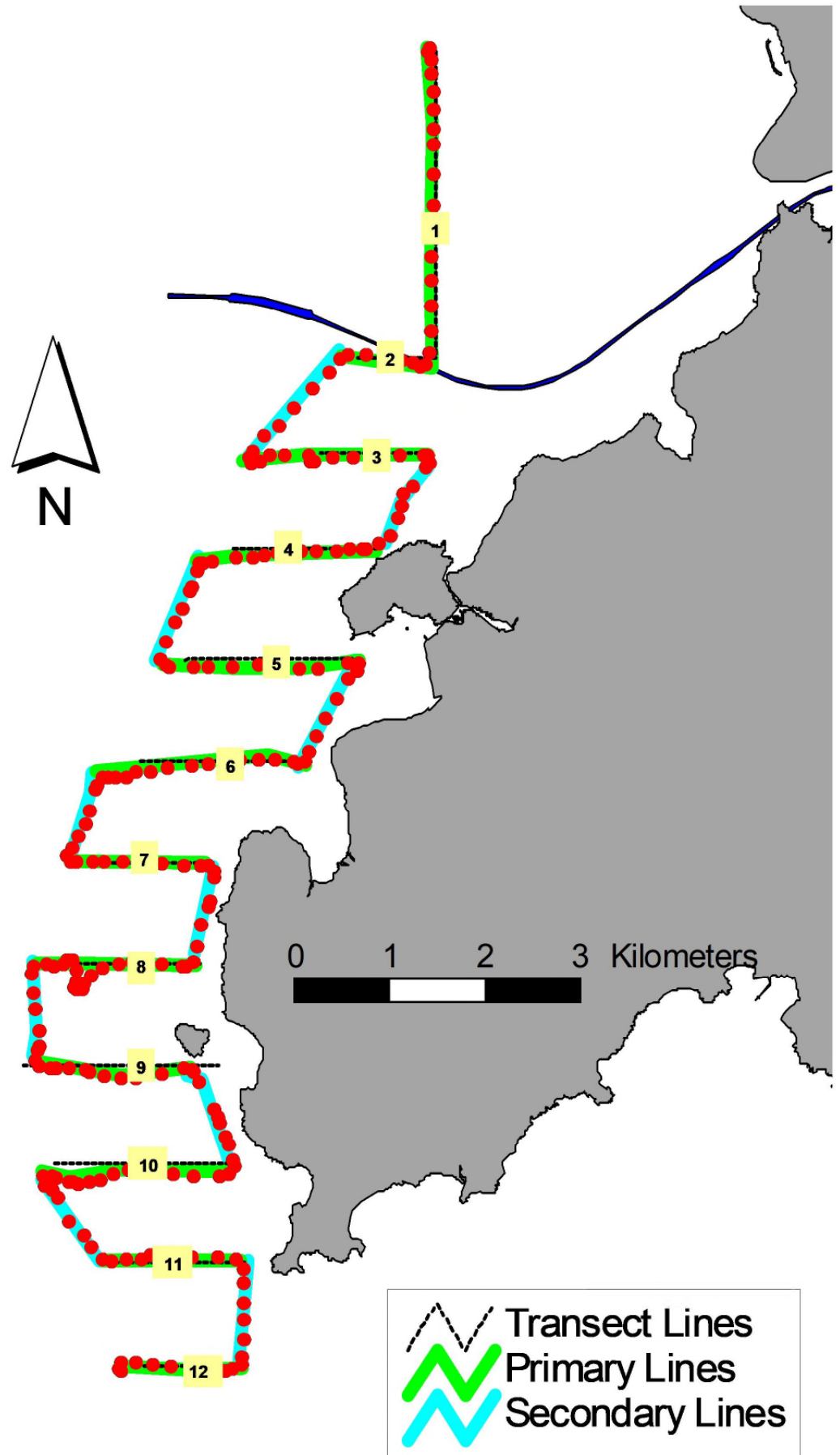


Figure 2. Survey Route on December 2nd, 2019 (note: red dots represent the tracked positions of survey boat logged continuously by GPS throughout the course of the survey)

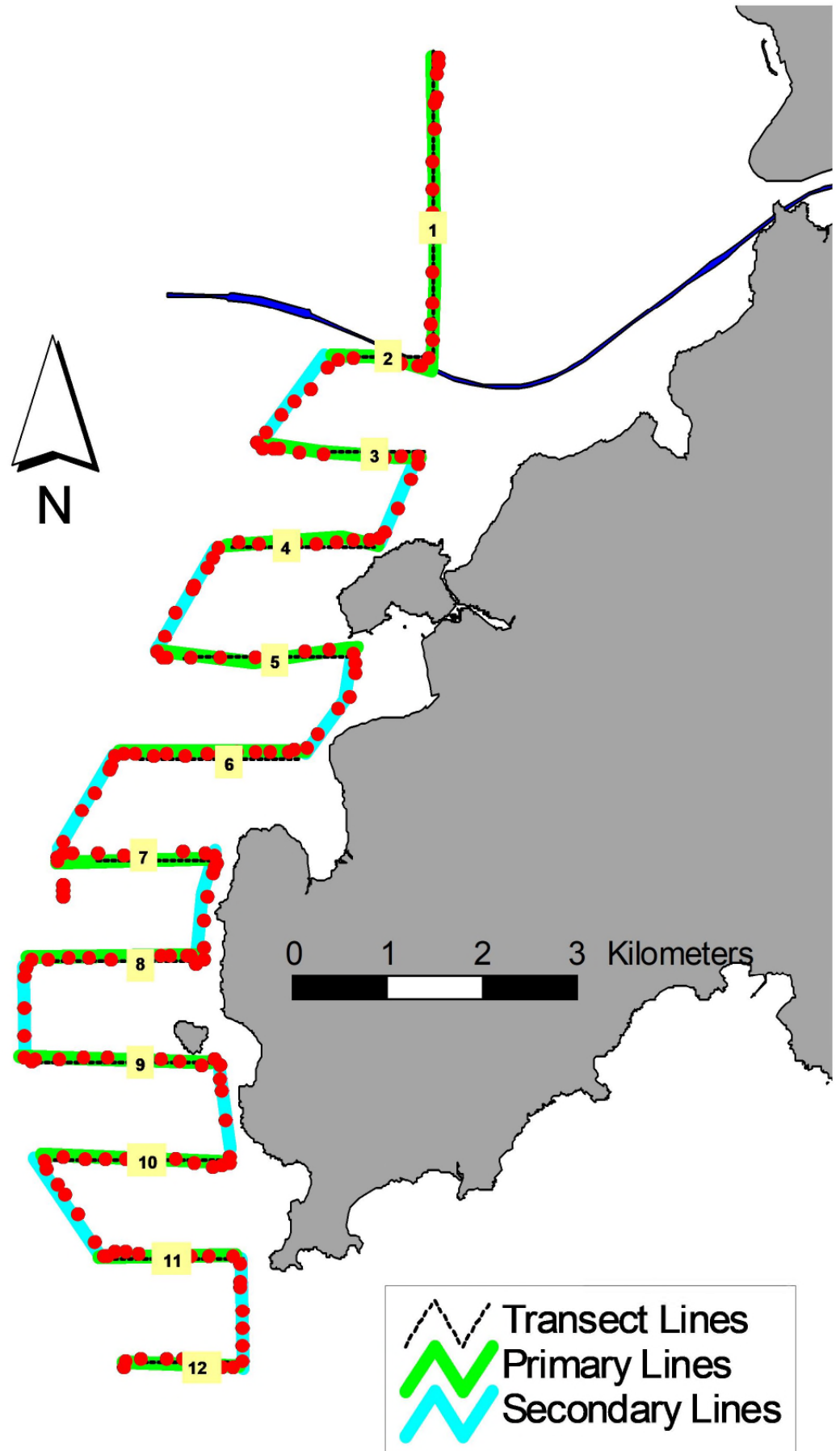


Figure 3. Survey Route on December 4th, 2019 (note: red dots represent the tracked positions of survey boat logged continuously by GPS throughout the course of the survey)

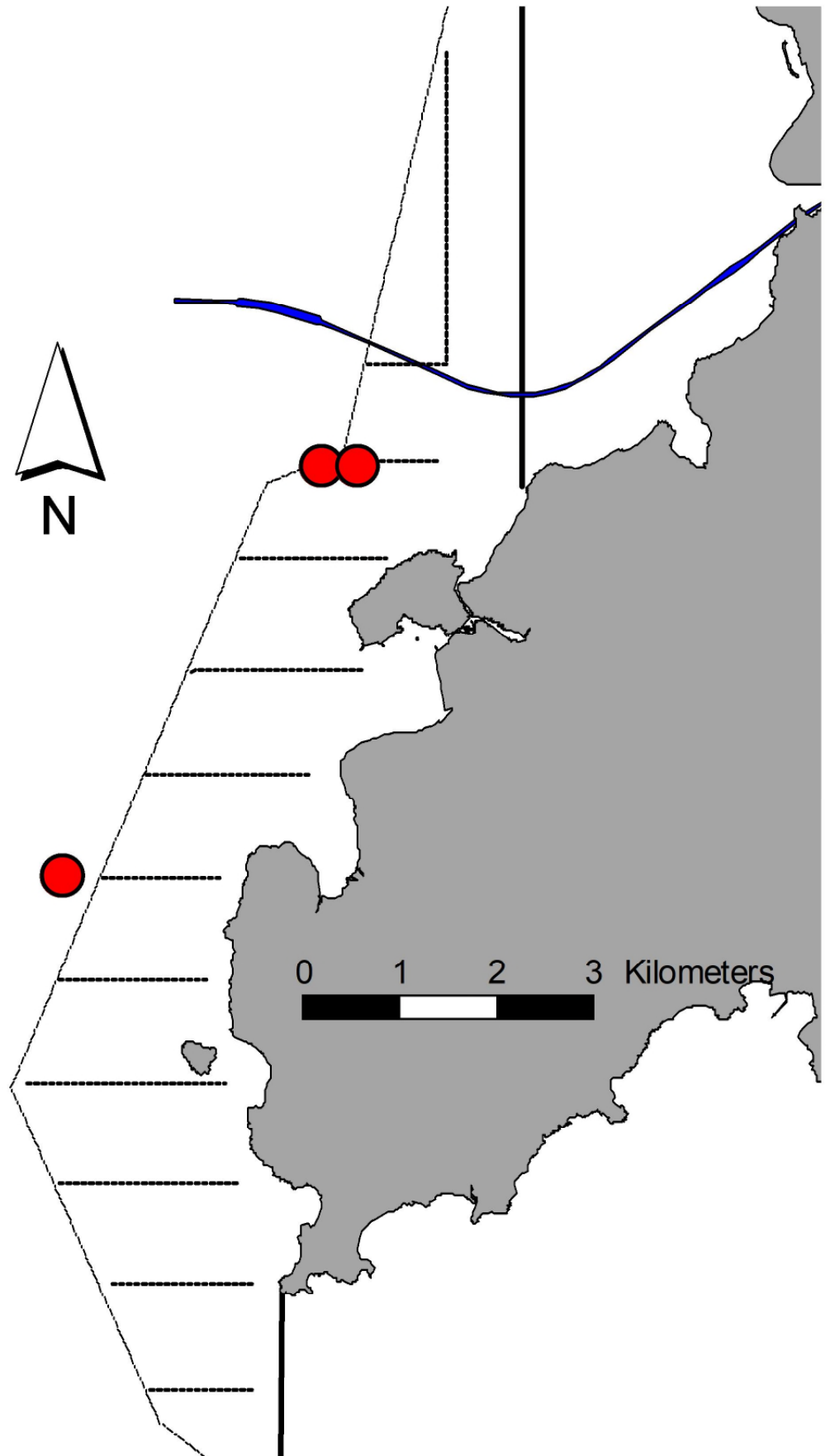


Figure 4. Distribution of Chinese White Dolphin sightings during the monitoring surveys conducted in December 2019

Appendix I. Survey Effort Database for HZMB Post-construction Monitoring in West Lantau Waters (December 2019)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
2-Dec-19	W LANTAU	3	0.77	WINTER	STANDARD36826	HYD-HZMB	P
2-Dec-19	W LANTAU	4	12.36	WINTER	STANDARD36826	HYD-HZMB	P
2-Dec-19	W LANTAU	5	8.73	WINTER	STANDARD36826	HYD-HZMB	P
2-Dec-19	W LANTAU	3	1.20	WINTER	STANDARD36826	HYD-HZMB	S
2-Dec-19	W LANTAU	4	5.95	WINTER	STANDARD36826	HYD-HZMB	S
2-Dec-19	W LANTAU	5	4.30	WINTER	STANDARD36826	HYD-HZMB	S
4-Dec-19	W LANTAU	3	16.23	WINTER	STANDARD36826	HYD-HZMB	P
4-Dec-19	W LANTAU	4	5.18	WINTER	STANDARD36826	HYD-HZMB	P
4-Dec-19	W LANTAU	3	8.14	WINTER	STANDARD36826	HYD-HZMB	S
4-Dec-19	W LANTAU	4	2.86	WINTER	STANDARD36826	HYD-HZMB	S

Appendix II. Chinese White Dolphin Sighting Database for HZMB Post-construction Monitoring in West Lantau Waters (December 2019)

(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
2-Dec-19	1	1040	1	W LANTAU	4	18	ON	HYD-HZMB	814466	802443	WINTER	NONE	P
4-Dec-19	1	1040	4	W LANTAU	3	18	ON	HYD-HZMB	814466	802814	WINTER	NONE	P
4-Dec-19	2	1136	3	W LANTAU	3	21	ON	HYD-HZMB	810453	799775	WINTER	NONE	S

Appendix III. Individual dolphins identified during HZMB post-construction monitoring in West Lantau waters (December 2019)

ID#	DATE	STG#	AREA
WL28	04/12/19	1	W LANTAU
WL42	04/12/19	2	W LANTAU
WL109	04/12/19	2	W LANTAU
WL230	04/12/19	1	W LANTAU
WL233	04/12/19	1	W LANTAU
WL288	04/12/19	1	W LANTAU



Appendix IV. Photographs of Identified Individual Dolphins from December 2019