

Offshore Geohazard Seismic Survey Ampasindava Block, Sifaka Prospect

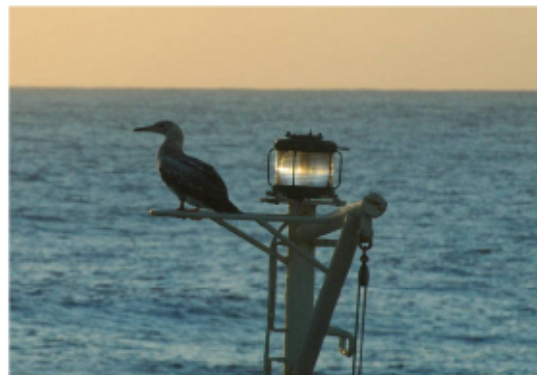
Marine Mammal Observation Report



**ExxonMobil Exploration
and Production
Northern Madagascar Limited**



**Final Report
September 2008**



**Offshore Geohazard Seismic Survey
Ampasindava Block, Sifaka Prospect**

May – June 2008

**Marine Mammal Observation Report
FINAL**

**Prepared for: ExxonMobil Exploration and Production
Northern Madagascar Limited**

**Prepared by: Maxon Consulting, Inc.
San Diego, California, U.S.A.**

September 2008

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Introduction

This report presents data on marine mammal, turtle, and bird sightings; fishing vessel observations; and water, emissions, and discharges performed during a geohazard seismic and bathymetric survey from the *M/V Teknik Perdana* from 28 May to 21 June 2008. The survey was conducted by TL Geohydrographics PTE Limited, and observations were made by Maxon Consulting, Inc. on behalf of ExxonMobil Exploration and Production Northern Madagascar Limited (ExxonMobil). The geohazard seismic and bathymetric survey and reported biological sighting data were conducted in accordance with the requirements of Article 41 of the Cahier Des Charges Environnementales (CCE), under Permit 30/08 from Office National Pour L'environnement. An environmental baseline study (EBS) also was performed, in which sediment and water samples were collected from the Sifaka Prospect. Results for the EBS are reported separately.

As part of the permit conditions, mitigation measures taken in order to avoid any disturbance to marine fauna, especially marine mammals and turtles, included following the Joint Nature Conservation Committee (JNCC) guidelines (May 2005, amended 2007). A marine mammal observer (MMO) was on watch during all daylight hours, securing a 500 m exclusion zone from the center of the air gun array and confirming compliance of soft start procedures during transiting, air-gun testing or on-line firing. Daily survey observations are presented in Appendix A; a daily log of line start and end points recorded during the seismic survey is presented in Appendix B; daily sighting reports are presented in Appendix C; a hygiene certificate is shown in Appendix D; and a log of daily bird sightings is presented in Appendix E.

MMO Survey and Scientific Personnel

Survey and scientific personnel with MMO-related responsibilities or activities, including local participants and government affiliates, are shown in Table 1. In accordance with the CCE, a Malagasy student joined the survey and was given basic training as an MMO with supporting informative documentation and electronic data sheet templates. Three representatives, one each from the Malagasy Ministry of Energy and Mines, Regional Administration, and Fisheries Administration, also were onboard to perform duties as laid out by the CCE.

MMO and biological sighting field methods

Observations were conducted during all daylight hours, weather permitting, either from the bridge (9 m above sea level), or from the monkey island (10.7 m above sea level) where a nearly 360° view was possible (see Figure 1). Using reticulated binoculars, the area around the vessel was monitored to 2450 m in all directions. When the air gun array was deployed, the exclusion zone was measured from the center of the air gun array outward forming a 500 m radius circle. When the air guns were on deck, the observers recorded sightings and the exclusion zone boundaries, relative to the center of the vessel. If any marine mammals or turtles entered the exclusion zone during the air gun activity, the gun activity was to be halted and only resumed after the animals had moved beyond the exclusion zone for at least a 30 minute period.

Soft-start or ramp-up procedures were monitored for compliance by observers whereby the exclusion zone was monitored at least 30 minutes before any shooting occurred and the soft start procedure lasted for at least 20 minutes but not longer than 40 minutes. Gun testing required a full soft start if a larger gun was being tested, e.g., shooting had to begin with the lowest to the highest powered guns. Gun shooting was to be halted in the event that line changes exceeded the time it took for a full soft start to reduce the introduction of any unnecessary noise into the marine environment.

Night time shooting followed the same protocol as day-time shooting, except that it was not possible to make visual observations. Observers worked on a two-hour rotation and were relieved for meals. Bird sightings were recorded when possible.

Table 1. Vessel personnel associated with MMO activities.

Survey Crew	Affiliation	Role	Responsibilities
Survey Personnel			
Colin McCormick	ExxonMobil	Client Representative	General oversight and liaison between vessel and scientific crew
Woo Chaw Hong	TL Geohydrographics	Party Chief	Seismic operations oversight
Scientific Personnel			
Desray Reeb, PhD.	Maxon Consulting	Lead MMO	MMO, reporting, training, MMO oversight
Ray Valente	Maxon Consulting	Secondary MMO	MMO support
Jo-Martin Andriatsimaloma	Malagasy student	MMO Trainee	Participate in MMO activities as directed
Regulatory Personnel			
Barthel Rajaomahandry	Malagasy Ministry of Energy and Mines	CCE Oversight	Monitor general SHE activities
Leon Mananjara	Regional Administration	CCE Oversight	Observe survey activities
Marcel Rakotondrasoa	Fisheries Administration	CCE Oversight	Observe survey activities, and non-related fishing activity

CCE=Cahier Des Charges Environnementales; SHE=Safety, Health, and Environment



Figure 1. MMO observations points from the *M/V Teknik Perdana*.

MMO and Biological Sightings Results

A summary of observations and associated seismic activities are presented in Table 2; a log of observations is presented in Appendix A. Dedicated observations were conducted for 151 hours and 07 minutes during the reporting period. Shooting (testing and on-line) took place during 15 hours and 56 minutes of these observations.

Altogether, there were nine sightings of whales and dolphins (Table 3) during the reporting period. The most abundant fauna was the long-snouted spinner dolphin (*Stenella longirostris*) shown in Figure 2. There were no shutdowns or soft start delays required; and only one sighting occurred during on-line shooting.

Observers were on watch from sunrise to sunset, so actual soft start procedures were preceded by exclusion zone clearance. Ramp-up or soft start procedures adhered to JNCC regulations, except for three occasions, in which the navigators were learning the protocol and gun tests occurred without a full soft start. There were no sightings of marine mammals or other marine fauna during these events.

Communication between the MMO and navigators was conducted using hand-held VHF radios, enabling efficient and effective communications. At the request of the lead MMO, the Party Chief calculated a firing interval for the 8 air guns of 3 minutes per air-gun in order to comply with the minimum duration of 20 minutes for a soft start. After soft starts were completed, a firing interval of 8.3 seconds was followed.

A soft start log, as prescribed by the CCE, was completed by the navigators for every soft start event (Table 4). According to the calculated and observed shot intervals during soft starts, after 5 minutes the array was shooting 80 cubic inches (in³). By 15 minutes, the array was shooting 310 in³ and after 30 minutes, the array had been at full power (760 in³) for 6 to 10 minutes.

Table 2. Summary of events

Report period	28 May to 21 June 2008
Total no. of gun soft starts	16
Total no. of gun soft starts at night	11
Total no. of hours watched	151 hours, 07 minutes
Total no. of hours watched during shooting	15 hours, 56 minutes
Total no. of cetacean sightings	9

Table 3. Summary of marine mammal sightings from 28 May to 21 June 2008

Species	Number of Sightings			Average number of individuals
	Guns on	Guns off	Total	
Long-snouted spinner dolphin (<i>Stenella longirostris</i>)	1	3	4	40
Unidentified baleen whale	0	1	1	1
Sperm whale (<i>Physeter macrocephalus</i>)	0	3	3	7
Unidentified dolphin	0	1	1	1
Total	1	8	9	49

Sightings of other wildlife:

No turtles were seen during the reporting period. 'Tuna-like' fish (*M. Rakotondrasoa*) were seen on many occasions, seemingly chasing prey fish and creating white water patches (Figure 3). Tern-like birds were often seen hovering and diving into these patches, also presumably feeding. Flying fish were seen while in transit to Diego Suarez from the Sifaka Prospect study area.

Red-footed boobys (see Figure 4) were seen on three occasions; and on one occasion landed on the bow for close, positive identification.



Figure 2. Long-snouted spinner dolphins observed during the survey (photograph by D. Reeb).

Table 4. Soft Start Observation Log

Time UTC	Vessel Position		Distance to coast (km)	Depth (m)	Acoustic intensity (in ³)			Observations of effects on marine fauna
					5 min	15 min	30 min	
Date: 3-Jun-08								
13h27	14°11.028S	47°19.453E	46.3	1790	80	310	760	None
15h09	14°08.764S	47°17.388E	40	2202	80	310	760	None
18h34	14°15.109S	47°27.702E	24.3	268	80	310	760	None
21h54	14°08.762S	47°17.334E	49	2196	80	310	760	None
Date: 4-Jun-08								
00h23	14°08.713S	47°16.971E	45	2198	80	310	760	None
03h44	14°14.997S	47°27.253E	21	382	80	310	760	None
07h02	14°08.913S	47°17.652E	49	2097	80	310	760	None
10h11	14°15.369S	47°27.735E	20	367	80	310	760	None
13h47	14°08.128S	47°13.784E	52	1916	80	310	760	None
14h56	14°07.739S	47°17.929E	48	2032	80	310	760	None
18h31	15°15.260S	47°27.370E	24	518	80	310	760	None
Date: 5-Jun-08								
00h45	14°08.866S	47°16.833E	49	2178	80	310	760	None

Time UTC	Vessel Position		Distance to coast (km)	Depth (m)	Acoustic intensity (in ³)			Observations of effects on marine fauna
					5 min	15 min	30 min	
01h02	14°15.800S	47°28.133E	27	265	80	310	760	None
04h25	14°09.000S	47°16.817E	48	2186	80	310	760	None
08h30	14°40.280S	47°25.170E	35	754	80	310	760	None
09h39	14°14.275S	47°27.580E	29	342	80	310	760	None
14h08	14°08.210S	47°13.160E	57	2205	80	310	760	None
22h15	14°09.250S	47°16.883E	48	2118	80	310	760	None
Date: 6-Jun-08								
01h29	14°16.078S	47°27.933E	27	290	80	310	760	None
05h20	14°15.088S	47°26.577E	49	2169	80	310	760	None
06h55	14°09.150S	47°16.466E	46	2088	80	310	760	None
10h15	14°16.030S	47°28.010E	25	297	80	310	760	None



Figure 3. White water caused by fish in the Sifaka Prospect (photograph by D. Reeb).



Figure 4. Red-footed booby on the vessel offshore west Madagascar (photograph by D. Reeb).

Fisheries advisor observations.

Observations and any contacting of other vessels encountered in the Sifaka Prospect were made by the Fisheries Advisor. One cargo ship, one tanker, and one sail boat were seen during the reporting period. Additionally, the only vessel contacted was a Malagasy 'Coast Guard' vessel, *Atsantsa*, (Figure 5) which asked for information on the *M/V Teknik Perdana's* activities and port of call. The TL Geohydrographics crew was in the process of collecting sediment cores at the time.

A small group of flying fish was recorded; and seven small sharks (approximately 1 m in length) were recorded on two different days. Schools of juvenile fish also were seen swimming near the vessel.

There were no other biological sightings to report.



Figure 5. The Coast Guard vessel, *Atsantsa* (photograph by D. Reeb).

Discharges, emissions and general vessel activity



The Regional Administration representative (see Table 1) monitored the general activities onboard, including discharges and the incineration of garbage (Figure 6). There were 17 recorded incinerations during the survey; and recorded emissions were at acceptable levels (Table 5). Solid waste that could not be incinerated (plastics and metals) was taken ashore in Diego Suarez for proper disposal on 21 June 2008. The total volume of waste disposed was 10 cubic meters (m³) and was cleared and certified by the Association Vagnono Antsiranana (Appendix D).

Figure 6 . Incinerator onboard (photograph by D. Reeb).

Table 5: Resource usage 28th May to 21st June 2008

Resource	Volume or amount
Fuel used	89.4 m ³
Water	224 m ³
Solids incinerated	23.5 m ³
Ash residue	1.32 m ³
Oil / sludge incinerated	1.14 m ³
Used oil filter landed ashore	1

Observance of the boundaries of Sahamalaza/Iles Radama Marine Protected Area (MPA)

The boundaries defining the Sahamalaza/Iles Radama MPA were entered into the vessel's navigational system. The Regional and Fisheries Administration representatives confirmed that the vessel did not breach the MPA boundaries, and that the project was in compliance with the legal specifications provided in the CCE.

The Regional Administrator attempted to contact the Port Captains at Antsiranana and Mahajanga daily at 0800 and 1600 hours to relay vessel position via satellite phone, VHF radio and/or e-mail; however, communications were not always received at Mahajanga.

Vessel movements and the locations of the completed survey lines are plotted in Figure 7 and listed in Appendix B.

Notable Events and Survey Summary

Seismic survey operations were concluded after ten days due to a mass stranding of melon headed whales (*Peponocephala electra*) in the La Loza River. The survey was put on stand-by on 06 June 2008, by which time 18 lines had been completed. The survey was cancelled on 20 June, following two weeks of down time due primarily to the whale stranding. Observations were made during an additional day in transit back to Diego Suarez, ending on 21 June 2008.

Information regarding the whale stranding, such as date and time of incident and potential cause, was not available at the conclusion of the survey or for this report; however, there is no evidence suggesting a causal relationship between vessel activities and the stranding.

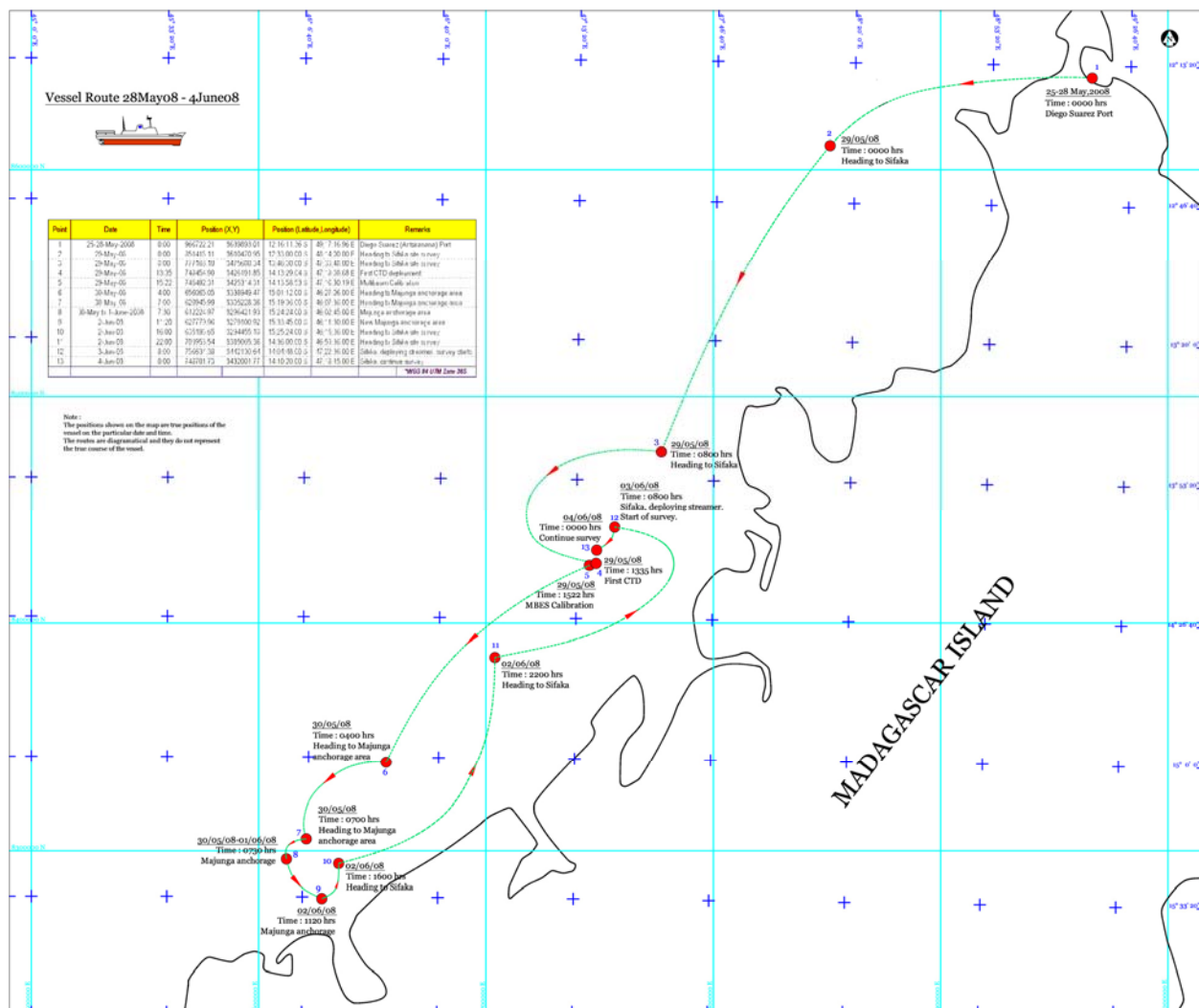


Figure 7. Survey track for the *M/V Teknik Perdana*.

Appendix A. Daily Survey Report

Date	Depth >200 m Y or N	Reason for firing (line or test)	Start of ramp-up	Time of full power	Time start of line	Time end of line	Time airguns stopped firing	Start pre ramp up watch	Whales Dolphins or Turtles seen prior to ramp-up or gun test? Y or N	Whales seen during ramp-up? Y or N	If yes, what time were they last seen?	Whales seen during Shooting or gun test? Y or N	If yes, what time were they last seen?	Reason why animals weren't seen (swell, fog, glare, dark)	Action taken if animals seen in exclusion zone R-up delay or Shutdown	Were hydro- phones used? Y or N
3-Jun-08	Y	Test	13h27	13h47	14h01	14h06	14h06	12h57	N	N		N				N
	Y	Line	15h09	15h32	15h36	17h45	17h45	na	na	na		na		Dark		N
	Y	Line	18h34	18h54	19h00	21h09	21h09	na	na	na		na		Dark		N
	Y	Line	21h54	22h05	22h18	22h33	22h33	na	na	na		na		Dark		N
4-Jun-08	Y	Line	00h23	00h43	00h51	02h51	02h51	na	na	na		na		Dark		N
	Y	Line	03h44	03h55	04h01	06h11	06h12	03h14	N	N		N				N
	Y	Test	06h20	06h24			06h50	05h50	N	N		N				N
	Y	Line	07h02	07h10	07h21	09h23	09h23	06h32	N	N		N				N
	Y	Line	10h11	10h31	10h36	12h44	12h44	09h41	N	N		N				N
	Y	Test	13h39	150cuin			13h43	13h09	N	N		N				N
	Y	Line	13h47	14h07	14h23		14h28	13h17	N	N		N				N
	Y	Line	14h56	15h16	15h27	17h40	17h40	na						Dark		N
	Y	Line	18h31	18h51	18h58	21h09	21h09	na						Dark		N
	Y	Line	21h45	22h10	22h21	00h31	00h31	na						Dark		N
	Y	Line	01h02	01h28	01h39	03h43	03h43	na						Dark		N
	Y	Line	04h25	04h48	04h53	06h57	06h57	03h55	N	N		N				N
5-Jun-08	Y	Test	08h30	08h52			08h53	08h00	N	N		N				N
	Y	Line	09h39	09h59	10h47	12h56	12h56	09h09	N	N		N				N
	Y	Test	13h42	13h50			13h50	13h12	N	N		N				N
	Y	Test	14h08	14h28	15h53	18h05	18h05	13h38	N	N		N				N
	Y	Line	18h53	19h15	19h22	21h30	21h30							Dark		
	Y	Line	22h15	22h38	22h43	00h45	00h45		N	N		N		Dark		N

APPENDIX A (continued)

Date	Depth >200m Y or N	Reason for firing (line or test)	Start of ramp-up	Time of full power	Time start of line	Time end of line	Time airguns stopped firing	Start pre ramp up watch	Whales Dolphins or Turtles seen prior to ramp-up or gun test? Y or N	Whales seen during ramp-up? Y or N	If yes, what time were they last seen?	Whales seen during Shooting or gun test? Y or N	If yes, what time were they last seen?	Reason why animals weren't seen (swell, fog, glare, dark)	Action taken if animals seen in exclusion zone R-up delay or Shutdown	Were hydro- phones used? Y or N
6-Jun	Y	Line	01h29	01h51	02h01	02h53	02h53							Dark		N
	Y	Test	05h28	05h50			05h55	04h58	N	N		N				N
	Y	Line	06h55	07h17	07h28	09h38	09h38	06h25	N	N		N				N
	Y	Line	10h15	10h37	10h48	12h55	12h55	09h45	N	N		N				N
	Y	Line	13h35	13h55	14h04	16h12	16h12	13h05								N

N=no; Y=yes; m=meters; h=hour; na=not applicable

APPENDIX B

Line start and end points of 18 2D seismic lines completed during the survey period.

Survey Datum: WGS 84									
Line Name	SOL Easting (m)	SOL Northing (m)	SOL Latitude deg dec min	SOL Longitude deg dec min	EOL Easting (m)	EOL Northing (m)	EOL Latitude deg dec min	EOL Longitude deg dec min	Length (m)
S08101A	763549.88	8426376.17	14°13'18.050 S	47°26'31.884 E	750305.87	8433418.63	14°09'33.402 S	47°19'08.004 E	15000.00
S08102A	763455.98	8426199.58	14°13'23.825 S	47°26'28.815 E	750211.98	8433242.04	14°09'39.176 S	47°19'04.933 E	15000.00
S08103A	763362.09	8426022.99	14°13'29.600 S	47°26'25.747 E	750118.08	8433065.45	14°09'44.950 S	47°19'01.861 E	15000.00
S08104A	763268.19	8425846.40	14°13'35.375 S	47°26'22.678 E	750024.18	8432888.86	14°09'50.723 S	47°18'58.790 E	15000.00
S08105A	763174.29	8425669.81	14°13'41.150 S	47°26'19.609 E	749930.29	8432712.27	14°09'56.497 S	47°18'55.718 E	15000.00
S08106A	763080.40	8425493.22	14°13'46.925 S	47°26'16.541 E	749836.39	8432535.69	14°10'02.270 S	47°18'52.647 E	15000.00
S08107A	762986.50	8425316.64	14°13'52.699 S	47°26'13.472 E	749742.49	8432359.10	14°10'08.044 S	47°18'49.575 E	15000.00
S08108A	762892.60	8425140.05	14°13'58.474 S	47°26'10.403 E	749648.60	8432182.51	14°10'13.818 S	47°18'46.503 E	15000.00
S08109A	762798.71	8424963.46	14°14'04.249 S	47°26'07.334 E	749554.70	8432005.92	14°10'19.591 S	47°18'43.431 E	15000.00
S08110A	762704.81	8424786.87	14°14'10.024 S	47°26'04.265 E	749460.80	8431829.33	14°10'25.365 S	47°18'40.360 E	15000.00
S08111A	762610.91	8424610.28	14°14'15.798 S	47°26'01.196 E	749366.91	8431652.75	14°10'31.138 S	47°18'37.288 E	15000.00
S08112A	762517.02	8424433.69	14°14'21.573 S	47°25'58.127 E	749273.01	8431476.16	14°10'36.912 S	47°18'34.216 E	15000.00
S08113A	762423.12	8424257.11	14°14'27.348 S	47°25'55.058 E	749179.11	8431299.57	14°10'42.685 S	47°18'31.144 E	15000.00
S08114A	762329.22	8424080.52	14°14'33.122 S	47°25'51.989 E	749085.22	8431122.98	14°10'48.459 S	47°18'28.072 E	15000.00
S08115A	762235.33	8423903.93	14°14'38.897 S	47°25'48.920 E	748991.32	8430946.39	14°10'54.232 S	47°18'25.000 E	15000.00
S08116A	762141.43	8423727.34	14°14'44.672 S	47°25'45.850 E	748897.42	8430769.80	14°11'00.006 S	47°18'21.928 E	15000.00
S08117A	762047.53	8423550.75	14°14'50.447 S	47°25'42.781 E	748803.53	8430593.22	14°11'05.779 S	47°18'18.856 E	15000.00
S08118A	761953.64	8423374.17	14°14'56.221 S	47°25'39.712 E	748709.63	8430416.63	14°11'11.553 S	47°18'15.784 E	15000.00

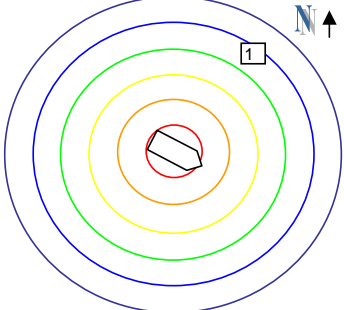
deg=degrees; dec=decimal; min=minutes; m=meter; S=south; E=east; SOL=start of line; EOL=end of line; WGS 84=World Geodetic System 1984; 2D=2 dimensional

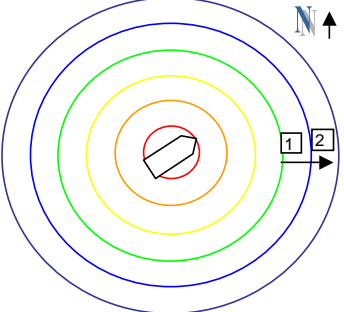
APPENDIX C

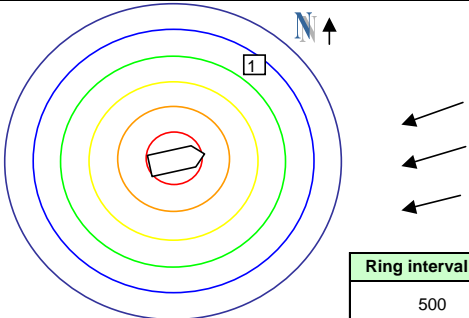
Sighting Report

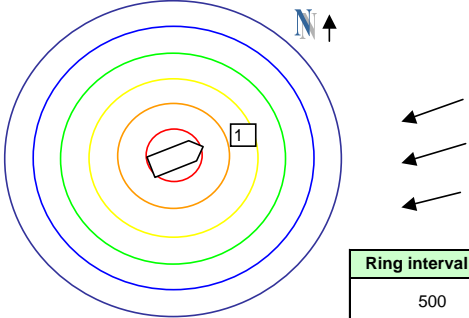
Date	Time (UTC)	Watch status <small>(dedicated or opportunistic?)</small>	Observer(s) who made sighting	Latitude/Longitude when first sighted	Water depth (m)			
3-Jun-08	12h03	Dedicated	Ray Valente	14°13.064S 47°25.713E	561			
Species sighted			Certainty of identification <small>(sure, most likely, best guess)</small>	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted	
Spinner dolphin (<i>Stenella longirostris</i>)			most likely	50-100	unknown	2000 m	270°	
Physical description <small>(length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)</small>				Direction of animal's travel <small>(show direction of travel of animals in relation to the vessel)</small>				
Dark grey coloring, average sized dolphins, pointy dorsal fins and long rostrums.								Ring interval (m)
								500
				Vessel heading (degrees)	Air guns firing? yes or no?	Closest distance to air guns (m)		
				230	No	2000		
				Activity of vessel				
Underway at less than 10 knots; testing of streamers but no air guns were deployed								

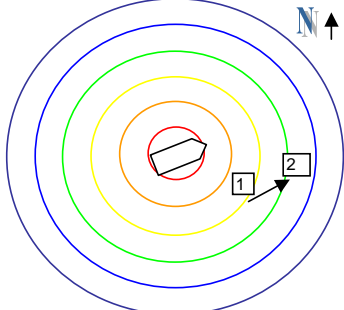
Date	Time (UTC)	Watch status <small>(dedicated or opportunistic?)</small>	Observer(s) who made sighting	Latitude/Longitude when first sighted	Water depth (m)			
5-Jun-08	13h55	Dedicated	Ray Valente	14°08.618S 47°13.526E	2000			
Species sighted			Certainty of identification <small>(sure, most likely, best guess)</small>	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted	
Spinner dolphin (<i>Stenella longirostris</i>)			best guess	2 or 3	unknown	2120 m	360	
Physical description <small>(length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)</small>				Direction of animal's travel <small>(show direction of travel of animals in relation to the vessel)</small>				
A small dolphins, distinct dorsal fin and body shapes.								Ring interval (m)
								500
				Vessel heading (degrees)	Air guns firing? yes or no?	Closest distance to air guns (m)		
				315	No	2120		
				Activity of vessel				
On survey line but air guns had been malfunctioning and were out of the water for service								

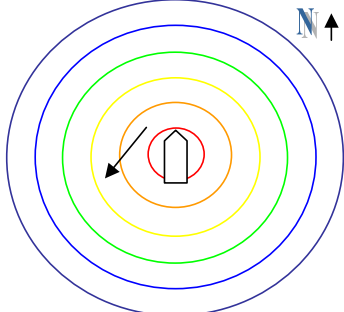
Date	Time (UTC)	Watch status (dedicated or opportunistic?)	Observer(s) who made sighting	Latitude/Longitude when first sighted			Water depth (m)
6-Jun-08	08h34	Dedicated	Desray Reeb	14°12.418S 47°22.877E			1000
Species sighted			Certainty of identification (sure, most likely, best guess)	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted
Spinner dolphin (<i>Stenella longirostris</i>)			Sure	1	0	500 m	15°
Physical description (length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)				Direction of animal's travel (show direction of travel of animals in relation to the vessel)			
Pointy dorsal fin, grey tri-color body pattern, light ventral surface, long rostrum.							
1. Spashes observed intermittently, then one dolphin breached and flipped its whole body into the air, exposing its ventral surface to the observer. As soon as it re-entered the water it disappeared.				Vessel heading (degrees)		Air guns firing? yes or no?	Closest distance to air guns (m)
				117°		Yes	500
Behavior of animals				Activity of vessel			
				On survey line			

Date	Time (UTC)	Watch status (dedicated or opportunistic?)	Observer(s) who made sighting	Latitude/Longitude when first sighted			Water depth (m)
12-Jun-08	08h36	Opportunistic	Capt Falalyev/DR	12°07.843S 48°36.585E			1030
Species sighted			Certainty of identification (sure, most likely, best guess)	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted
Unknown baleen whale			Best guess	1	Unknown	2120	90°
Physical description (length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)				Direction of animal's travel (show direction of travel of animals in relation to the vessel)			
3 short, long blows seen from the bow.							
1. Weather had hampered observations until lunch time when we were NW of Nosy Anambo. Capt alerted MMOs at lunch that he had seen a whale. MMOs verified blows and collected data. 2. 3 blows were seen in the space of 4 minutes and then no more after 08h40. Whale seemed to be moving in an easterly direction.				Vessel heading (degrees)		Air guns firing? yes or no?	Closest distance to the ship (m)
				66°		No	2120
Behavior of animals				Activity of vessel			
				In transit to Diego Suarez			

Date	Time (UTC)	Watch status (dedicated or opportunistic?)	Observer(s) who made sighting	Latitude/Longitude when first sighted			Water depth (m)
12-Jun-08	08h54	Opportunistic	DR	12°06.724S 48°39.276E			1030
Species sighted			Certainty of identification (sure, most likely, best guess)	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted
Sperm whale (<i>Physeter macrocephalus</i>)			Sure	3-5	Unknown	2460	20°
Physical description (length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)				Direction of animal's travel (show direction of travel of animals in relation to the vessel)			
Blows angled at approx 40° , rounded blowhole, back and rounded ridge-like dorsal fin seen on a grey body.							
Behavior of animals				Vessel heading (degrees)		Air guns firing? yes or no?	Closest distance to the ship (m)
1. Blows were seen from the flying bridge. After 2 minutes there were no further signs of the whale.				70°		No	2460
				Activity of vessel			
				Transit to Diego Suarez			

Date	Time (UTC)	Watch status (dedicated or opportunistic?)	Observer(s) who made sighting	Latitude/Longitude when first sighted			Water depth (m)
12-Jun-08	09h00	Opportunistic	DR	12°06.417S 48°39.973E			1030
Species sighted			Certainty of identification (sure, most likely, best guess)	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted
Sperm whale (<i>Physeter macrocephalus</i>)			Sure	1	Unknown	1230	65°
Physical description (length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)				Direction of animal's travel (show direction of travel of animals in relation to the vessel)			
Blows at approx 40° angle, no clear dorsal fin, logging behaviour.							
Behavior of animals				Vessel heading (degrees)		Air guns firing? yes or no?	Closest distance to the ship (m)
1. Two consecutive blows were seen, the whale was moving in an easterly direction. The whale could no longer be detected after 5 minutes.				70°		No	1230
				Activity of vessel			
				Transit to Diego Suarez			

Date	Time (UTC)	Watch status (dedicated or opportunistic?)	Observer(s) who made sighting	Latitude/Longitude when first sighted			Water depth (m)		
12-Jun-08	09h15	Opportunistic	DR/RV/JM	12°05.555S 48°41.963E			1030		
Species sighted			Certainty of identification (sure, most likely, best guess)	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted		
Sperm whale (<i>Physeter macrocephalus</i>)			Sure	3-5	Unknown	1230	120°		
Physical description (length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)				Direction of animal's travel (show direction of travel of animals in relation to the vessel)					
Blows at approx 40° angle, no clear dorsal fin, logging behaviour, grey bodies									
				Ring interval (m)					
				500					
				Vessel heading (degrees)		Air guns firing? yes or no?		Closest distance to the ship (m)	
				70°		No		1230	
Behavior of animals				Activity of vessel					
1. Blows seen from the flying bridge. Two blows seen simultaneously, followed by one blow from behind these two suggesting at least 3 whales. 2. The whales exhibited slow-moving, logging behaviour. 2. Whales seemed to be moving slowly in a north-easterly direction and tracking was discontinued after 17 minutes.				Transit to Diego Suarez					

Date	Time (UTC)	Watch status (dedicated or opportunistic?)	Observer(s) who made sighting	Latitude/Longitude when first sighted			Water depth (m)		
12-Jun-08	09h18	Opportunistic	JM	12°04.971'S 43°43.396'E			1030		
Species sighted			Certainty of identification (sure, most likely, best guess)	No. of animals	No. of juveniles	Range from guns when first sighted	Bearing when first sighted		
Spinner dolphin (<i>Stenella longirostris</i>)			Best guess	1	0	615	40°		
Physical description (length, shape, color and pattern, scars or marks shape and size of dorsal fin, shape of head and blow characteristics)				Direction of animal's travel (show direction of travel of animals in relation to the vessel)					
Dark coloured dolphin-like body and size.									
				Ring interval (m)					
				500					
				Vessel heading (degrees)		Air guns firing? yes or no?		Closest distance to the ship (m)	
				0°		No		615	
Behavior of animals				Activity of vessel					
1. A dolphin breached high into the air, followed by a lower breach. The sun obscured the ability to see any defining features. The dolphin appeared to be moving in a south-westerly direction.				Transit to Diego Suarez					

APPENDIX D

Hygiene certification for garbage taken onshore, Diego Suarez 21 June 2008

A.V.A « ASSOCIATION VAGNONO
ANTSIRANANA »

BUREAU MUNICIPAL D'HYGIENE
COMMUNE URBAINES
DE DIEGO-SUAPEZ

ATTESTATION

Nous soussigné l'Association A.V.A en présence du Médecin
chef du B.M.H (Bureau Municipal d'hygiène) de Diégo Suarez, attestons avoir
fait, assisté le ramassage d'ordure ménagère à bord du navire scientifique
« Teknik Perdana » et encadré le transport jusqu'au lieu de décharge officiel, ce
Samedi 21 Juin 2008 vers 11h00mn

Cet Attestation est établi pour servir et valoir ce que de droit.

Fait à Diégo Suarez le 21 Juin 2008

LE PRESIDENT


RANDRIANASOLO Gérald

LE MEDECIN CHEF DU B.M.H


BOANARIJESY Jean Claude

APPENDIX E

Daily bird sightings

Date	Time UTC	Observer	<i>Teknik Perdana</i> Position		ID	# of birds	Description
28-May-08	11h00	RV	12°13.439S	49°25.384E	Unknown	1	Tern-like, long thin tail - white wings and body. Grey/black rim on top of wings.
28-May-08	12h40	RV	11°56.479S	49°20.564E	Unknown	2	Long, thin wings, black on top, white body
28-May-08	13h01	DR	11°53.492 S	49°18.649E	Unknown	6	Long, thin wings, black on top, white body
28-May-08	14h18	DR	11°55.664S	49°05.735E	Unknown	1	Long, thin wings, black on top, white body, black line above eye.
29-May-08	04h19	DR	13°39.202S	47°37.196E	Unknown	2	Tern-like, long thin tail - white wings and body. Grey/black rim on top of wings.
29-May-08	04h43	DR	13°43.322S	47°35.332E	Unknown	1	Black body with white stripe along middle of body, long, thin tail.
29-May-08	05h04	DR	13°46.904S	47°33.670E	Unknown	2	Small white bird, grey wings
29-May-08	07h26	JM	14° 10.136S	47°23.033E	Unknown	1	White bird
29-May-08	08h23	JM	14°15.566S	47°20.623E	Unknown	1	White bird
30-May-08	04h49	RV	15°23.706S	46°03.558E	Unknown	Flock	10km away, white birds with grey wings, possibly feeding.
30-May-08	04h55	JM	15°24.056S	46°03.261E	Unknown	2	Small white bird, grey wings
30-May-08	07h08	DR	15°24.479S	46°02.738E	Unknown	Flock	Many white birds with grey wings seen feeding.
30-May-08	12h25	DR	15°24.489S	46°02.742E	Unknown	Flock	10km away - SW, white birds with grey wings, possibly feeding.
30-May-08	14h05	DR	15°24.493S	46°02.741E	Unknown	School	Big tuna-like fish chasing smaller fish, lots of white water, 10km NE.
31-May-08	07h55	DR	15°24.496S	46°02.764E	Unknown	Flock	270° fish jumping, birds feeding approximately 1km away
31-May-08	09h55	JM	15°24.486S	46°02.810E	Unknown	1	Medium sized bird, black body with white stripe down the mid-region.
31-May-08	14h31	DR	15°24.490S	46°02.817E	Unknown	1	Red-footed Boobie, greyish colouring on top, possibly juvenile.
1-Jun-08	05h22	DR	15°24.452S	46°02.779E	Unknown	Flock	White, grey-winged birds feeding, 2km away at 132°.
1-Jun-08	06h00	DR	15°24.463S	46°02.773E			Small fishing vessel
2-Jun-08	03h59	DR	15°24.477S	46°02.827E	Unknown	Flock	white birds with grey wings, 195 deg, SSW, feeding.

Date	Time UTC	Observer	<i>Teknik Perdana</i> Position		ID	# of birds	Description
2-Jun-08	05h15	JM	15°24.469S	46°02.827E	Unknown	Flock	white, grey-winged birds feeding
2-Jun-08	05h40	JM	15°24.529S	46°02.808E	Unknown	Flock	white, grey-winged birds feeding
3-Jun-08	10h04	JM	14°06.380S	47°17.835E	Unknown	2	white, grey-winged birds
3-Jun-08	14h15	DR	14°10.207S	47°17.835E	Unknown	1	Red footed Boobie, greyish colouring on top, moulting, orange feet.
4-Jun-08	06h53	DR	14°08.629S	47°17.070E	Unknown	1	Red-footed Boobie around vessel
9-Jun-08	08h59	DR	14°14.009S	47°21.437E	Unknown	Flock	Small white birds and larger tern-like birds feeding amidst leaping fish - 2 km away.
10-Jun-08	12h00	Crew	14°11.016S	47°19.315E	Unknown	2	Large tern-like birds with long white tails observed from the stern.
10-Jun-08	13h30	DR	14°11.430S	47°19.224E	Unknown	1	Tern-like bird, large, grayish under wings, stripe over eye or on head.

DR=Desray Reeb; RV=Raymond Valente; JM=Jo-Martin Andriatsimialoma; h=hour; NE=northeast; SW=southwest; SSW=south-southwest; km=kilometers; deg=degrees;