

Kimbe Bay Second Marine Mammal Rapid Ecological Assessment (REA) April 2003

**Unpublished Survey Report for
The Nature Conservancy**
C/o South Pacific Office
P.O. Box 65-506, Mairangi Bay, Auckland, New Zealand

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Recommendation Summary

This Marine Mammal Rapid Ecological Assessment (REA) is the third on-water survey conducted in Kimbe Bay, Papua New Guinea. Along with previously collected data and anecdotal information, it continues to show the high biodiversity of cetacean (whale, dolphin & porpoise) species.

Eleven species of cetaceans have now been positively identified from the Kimbe Bay area, with a further two tentatively identified. Many of these species are not even listed as present in the waters of Papua New Guinea by the International Union on the Conservation of Nature in their Red Data List (IUCN, 2000).

Young animals were recorded accompanying five species of cetaceans. This, along with resting, foraging and mating behaviour which were observed for various species, indicates the importance of the area for essential biological functions. Individual animals were resighted both temporally and spatially, suggesting Kimbe Bay may be a core area of the home range for some individuals. Given these findings, the greater Kimbe Bay area should be preserved and protected.

As recommended in the first REA report (Visser, 2002a), a long-term cetacean research project is highly recommended. It will provide scientific information such as species present in the area, population demographics, foraging behaviour, site fidelity, habitat use and threats.

This information will assist the government of Papua New Guinea, and non-governmental organisations, in their role of administration and protection of the Kimbe Bay habitat and the marine mammal species found there, whose status is currently unknown.

Research Summary

Surveys were conducted over two periods; 3 – 4 April and 6 – 15 April 2003. All surveys were conducted on a dedicated research vessel provided by Walindi Plantation Resort*. The biodiversity of marine mammals in the Kimbe Bay area was assessed. Research methods included top-side and underwater species identification, behavioural observations, photo-identification of individuals and hydrophone recordings.

Twelve days were spent on the water and cetaceans were sighted on all with a total of 59 encounters recorded. During this survey seven species were positively identified; pygmy sperm whale (*Kogia breviceps*); goosebeak whale (*Ziphius cavirostris*); bottlenose dolphin (*Tursiops truncatus*); Indo-Pacific bottlenose dolphin (*Tursiops aduncus*); pantropical spotted dolphin (*Stenella attenuata*); spinner dolphin (*Stenella longirostris*) and Risso's dolphin (*Grampus griseus*). In addition, one species of cetacean was tentatively identified; densebeak whale (*Mesoplodon densirostris*). Taking into account previous surveys, this brings the total number of species observed in the Kimbe Bay area, by the author, to 11 with two further species tentatively identified.

Photo-identification was collected for 72 individuals of five species of cetaceans (bottlenose, Indo-Pacific bottlenose, pantropical spotted, spinner and Risso's dolphins) and eight matches were made both temporally and spatially for two species (bottlenose ($n = 7$) and Indo-Pacific bottlenose dolphin ($n = 1$)). Bottlenose, Indo-Pacific bottlenose and spinner dolphins were observed feeding. Mating was observed for two species (Indo-Pacific bottlenose and pantropical spotted dolphin) and young (both calves and juveniles) were observed accompanying five species (bottlenose, Indo-Pacific bottlenose, pantropical spotted, spinner and Risso's dolphin).

Hydrophone recordings were made of five species (bottlenose, Indo-Pacific bottlenose, pantropical spotted, spinner and Risso's dolphin).

The results presented here, in conjunction with previous reports, not only verify at least 11 species as present (plus two tentatively identified) in the waters of Papua New Guinea (nine of which are unlisted as present by the IUCN), but they also contribute to the knowledge of these species behaviour and distribution worldwide.

Other marine animals recorded during the surveys were: marlin - either Indo-Pacific blue (*Makaira mazara*) or striped, (*Tetrapturus audux*); mahi mahi (dolphin fish) (*Coryphaena hippurus*) and unidentified turtles. Marine birds included the common tern (*Sterna hirundo*); lesser frigatebird (*Fregata ariel*) and masked booby (*Sula dactylatra*).

Acknowledgements

M. & C. Benjamin of Walindi Plantation Resort hosted the author and provided logistics for the field work of both surveys. Without their incredibly kind support, neither survey would have been possible. In the field, T. Peluso assisted with surveys, logistics and data collection. J. Loga drove the boat and assisted with finding the animals. Thanks go to P. Lokani of The Nature Conservancy, Port Moresby, Papua New Guinea & S. Seeto of The Nature Conservancy, Kimbe Bay. The Whale and Dolphin Conservation Society (U.K.) provided much needed additional funding. J. Berghan kindly reviewed the report. Thank you to you all!

¹ Dr. Ingrid N. Visser
Orca Research Trust
P.O. Box 1233
Whangarei, New Zealand
Phone: (+ 64) 9 4343 043
Email: ingrid@orca.org.nz

* Walindi Plantation Resort
P.O. Box 4
Kimbe Bay
West New Britain
Papua New Guinea

Kimbe Bay Marine Mammal Research

Brief background for cetaceans

The status of Papua New Guinean cetaceans is largely unknown. All species but two (pantropical spotted dolphin and spinner dolphin) sighted during this survey are not even acknowledged as present in Papua New Guinea waters *i.e.*, in the Red Data List (Cetacean Specialist Group) for the International Union on the Conservation of Nature (IUCN 2000). Neither are marine mammals acknowledged as present in popular style books which discuss the mammals of Papua New Guinea (e.g., Flannery, 1995). A small amount of information is available in Dawbin (1972), however, much of this is anecdotal or un-referenced.

Within the Kimbe Bay area (West New Britain Island), no systematic studies recording cetacean species, nor individuals within each species, had been conducted prior to April 2002. However, anecdotal information suggested that cetaceans could be found in the area on a regular basis (M. Benjamin *pers. comm.*) and two surveys were conducted in April and July 2002 (Visser, 2002a; Visser, 2002b; Visser, 2002c; Visser, 2002d; Visser & Bonoccorso, 2003).

As cetaceans can be uniquely identified as individuals, and these features recorded through photo-identification, individuals can be tracked temporally and spatially, providing information on population dynamics and distribution (Hammond *et al.*, 1990).

Methods

Dedicated cetacean surveys were conducted from *Emma* –an ‘inshore’ vessel (7.5 m) with internal engines and prop-leg drives. Observers (x 2) height above water was approximately two meters. Naked-eye and assisted (binoculars 10 x 42 @ 6.3° arc) scans were made in an approximate 120° arc forward of the vessel. The course taken was either weather dependent or randomly chosen from physical location to location, e.g., from a reef towards a headland. Survey speed varied from approximately 10 – 18 knots depending upon sea conditions. Surveys were terminated if the sea state reached above Beaufort Force 4. Upon finding cetaceans the boat was diverted and observations made.

To photographically record species at the surface, and for photo-identification of individuals, a Nikon F100 with a 2.8f 80 – 200 mm Nikor lens, with Kodak VS100 iso slide film was used. On days where the light was low, print film of 800 – 3200 iso speed was used.

Animals were catalogued sequentially by number, with a prefix consisting of the first letter of each of the scientific names, and PNG to signify the country, e.g., the catalogue number for the first Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) would be Ta-PNG1 and for the fourth Risso’s dolphin (*Grampus griseus*) Gg-PNG4.

The hydrophone system (Offshore Acoustics) utilised a lead-zirconate piezoelectric active element with a low-noise preamplifier. The system had an operating range of approximately 10 km in calm conditions (-149 dB re 1 µPA). The frequency response was from 5Hz to 25 kHz, which covers the hearing range of humans (15Hz to 16kHz) and the sound range produced by most marine mammals (Ford, 1994).

Results

Twelve days were spent on the water during which the sea state was Beaufort Force 0 to 2 on all but one day, when sea state changed from Beaufort Force 0 to 4 and back to 0 during the day.

Cetaceans were sighted on all days with a total of 59 encounters recorded (Appendix One). Seven species were positively identified; pygmy sperm whale, goosebeak whale, bottlenose dolphin, Indo-Pacific bottlenose dolphin, pantropical spotted dolphin, spinner dolphin and Risso's dolphin. In addition, one species was tentatively identified; densebeak whale (Table 1). Including the cetacean species recorded in previous surveys (*i.e.*, melon-headed whale (*Peponocephala electra*); false killer whale (*Pseudorca crassidens*); orca (*Orcinus orca*) and shortfinned pilot whale (*Globicephala macrorhynchus*) the total number of species observed in the Kimbe Bay area, by the author, is 11 with two further species tentatively identified *i.e.*, densebeak whale and rough-toothed dolphin (*Steno bredanensis*).

The most species recorded on a single day were five, seen on two days (13 & 14 April) (Table 1). On some days multiple encounters were made with a species (Table 2). The most number of encounters with cetaceans on any one day was nine (3 April 2003, Table 2). These nine encounters were comprised of one sighting of a single pygmy sperm whale and four sightings each of groups of Indo-Pacific bottlenose and spinner dolphins.

Taking into account these multiple encounters on each day, and using a cumulative total, the most commonly sighted species was the spinner dolphin ($n = 25$), followed by the Indo-Pacific bottlenose dolphin ($n = 18$), (Figure 1). This was followed by the bottlenose dolphin ($n = 4$), then the pantropical spotted and the Risso's dolphin with three encounters each (Figure 1).

Table 1. Number of species sighted each day in Kimbe Bay April 2003.

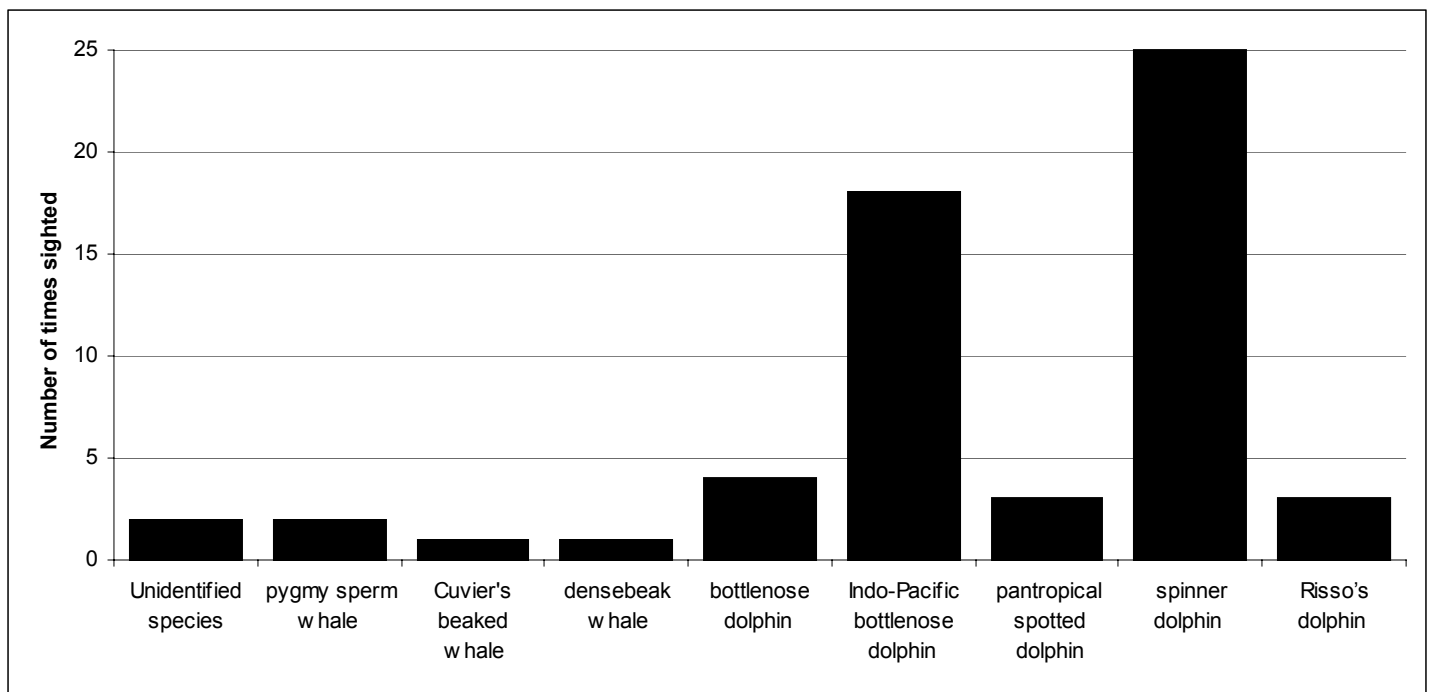
	<i>K. breviceps</i>	<i>Z. cavirostris</i>	<i>M. densirostris</i>	<i>T. truncatus</i>	<i>T. aduncas</i>	<i>S. attenuata</i>	<i>S. longirostris</i>	<i>G. griseus</i>	Unidentified species	number of species per day *
3-Apr	✓				✓		✓			3
4-Apr					✓		✓			2
6-Apr	✓				✓		✓			3
7-Apr					✓		✓	✓		3
8-Apr					✓		✓			2
9-Apr				✓	✓		✓			3
10-Apr					✓		✓	✓		3
11-Apr					✓	✓	✓			3
12-Apr							✓			1
13-Apr			✓	✓	✓		✓	✓	✓	5 + 1
14-Apr		✓		✓	✓	✓	✓		✓	5 + 1
15-Apr				✓		✓				2
number of days sighted	2	1	1	4	10	3	11	3		--

* as unidentified species can not be excluded as belonging to one of the recorded species, they are listed separately

Table 2. Encounter rates for each species, by date, in Kimbe Bay during April 2003.

	<i>K. breviceps</i>	<i>Z. cavirostris</i>	<i>M. densirostris</i>	<i>T. truncatus</i>	<i>T. aduncas</i>	<i>S. attenuata</i>	<i>S. longirostris</i>	<i>G. griseus</i>	Unidentified species	Total number of encounters per day
3-Apr	1				4		4			9
4-Apr					1		5			6
6-Apr	1				4		1			6
7-Apr					1		1	1		3
8-Apr					2		3			5
9-Apr				1	1		1			3
10-Apr					1		1	1		3
11-Apr					2	1	4			7
12-Apr							2			2
13-Apr			1	1	1		1	1	1	6
14-Apr		1		1	1	1	2		1	7
15-Apr				1		1				2

Figure 1. Total number of times each species was sighted in Kimbe Bay during April 2003 (12 days).



Foraging behaviour and mixed species groupings

Foraging was observed for bottlenose, Indo-Pacific bottlenose and spinner dolphins. Indo-Pacific bottlenose dolphins were observed feeding on diamond-scaled mullet (*Ellochelon vaigiensis*), however for the other two species of dolphins the prey type could not be identified.

Two observations of mixed cetacean species were made (Table 3). In addition, when bottlenose dolphins were observed foraging on 9 April 2003, they were observed feeding on an unidentified schooling fish and in association with a large group (500+) of lesser frigatebirds (*Fregata ariel*).

Table 3. Cetacean species seen in association with each other, Kimbe Bay, April 2003.

	<i>pantropical spotted dolphin</i>	<i>bottlenose dolphin</i>	<i>spinner dolphin</i>
<i>pantropical spotted dolphin</i>		0	1
<i>bottlenose dolphin</i>			1
<i>spinner dolphin</i>			

Photo-identification, Kimbe Bay, April 2003.

Fin photographs for photo-identification were collected for 72 individuals of five different species (bottlenose dolphin, $n = 25$; Indo-Pacific bottlenose dolphin, $n = 38$; pantropical spotted dolphin, $n = 3$; spinner dolphin, $n = 1$; Risso's dolphin, $n = 5$). Photographic identification catalogues are held by Visser¹.

Rematches (at least one day apart) were made for six Indo-Pacific bottlenose dolphins and one bottlenose dolphin (Table 4). One other Indo-Pacific bottlenose dolphin (Ta-PNG34) was photographed at two locations on the same day, approximately eight nautical miles and one hour apart (Table 4).

Two Indo-Pacific bottlenose dolphins (Ta-PNG7 & Ta-PNG20) were seen on three different days (Table 4). The longest time frame between sightings of one individual was for an Indo-Pacific bottlenose dolphin (Ta-PNG20) at 10 days, the second was for a bottlenose dolphin (Tt-PNG6) at six days (Table 4).

The greatest distance an individual (Ta-PNG7) (Figure 2) was recorded moving between the first and subsequent sightings was approximately 20 nautical miles, over a three day period. The average distance this animal travelled per day was 6.7 nautical miles (Table 4).

Calves & Juveniles

Young animals (both calves and juveniles) were observed accompanying adults of five species (bottlenose, Indo-Pacific bottlenose, pantropical spotted, spinner and Risso's dolphin).

The Indo-Pacific bottlenose dolphin Ta-PNG20 was accompanied by a young calf (Figure 3), on each occasion it was photographed ($n = 3$), which suggested that it was a female. All pantropical spotted dolphins which were photographed with extensive spotting were accompanied by a calf or juvenile (e.g., Figure 4), suggesting these spotted individuals were adult females. One pantropical spotted dolphin calf was noted to have clearly-marked foetal folds and a dorsal fin which was folded over, indicating that it was a neonate.

Figure 2. Photo-identification matches for the Indo-Pacific bottlenose dolphin Ta-PNG7. The first sighting (a) and third sighting (b) were three days & approximately 20 nautical miles apart (Table 4).



(a) 3 April 2003



(b) 6 April 2003

Figure 3. Ta-PNG20, accompanied by a young calf. Ta-PNG20 and calf were resighted three times over a 10 day period. All sightings were within four nautical miles of the first sighting (Table 4).



Figure 4. All pantropical spotted dolphins which were photographed with extensive spotting (e.g., rear animal) were accompanied by a calf or juvenile (e.g., fore animal).



Table 4. Photoidentification re-match dates and locations (with distance from previous sighting in Nautical Miles (NM)). All latitudes and longitudes are given in minutes from 05° S / 150° E.

Catalogue #	3-Apr-03	4-Apr-03	6-Apr-03	7-Apr-03	9-Apr-03	10-Apr-03	11-Apr-03	11-Apr-03*	13-Apr-03	15-Apr-03	Total Distance	Average per Day
Tt-PNG6					21.24 30.4 S. Wulai Is					13.08 19.8 13.36NM W. Kimbe Is	13.36	2.2 NM
Ta-PNG5			25.33 5.93 Nth Walindi	18.4 5.85 6.93NM S.E. Restorf							6.93	6.93 NM
Ta-PNG7	16.03 6.89 N.E. Restorf	18.68 6.47 2.68NM E. Restorf	1.74 10.54 17.42NM N. Huessener								20.1	10.05 NM
Ta-PNG12	16.35 7.14 N.E. Restorf			18.4 5.85 2.42NM S.E. Restorf							2.42	0.60 NM
Ta-PNG15					17.36 7.71 W. Susan's	16.84 6.72 1.12NM N.W. Restorf					1.12	1.12 NM
Ta-PNG20	16.35 7.14 N.E. Restorf	18.68 6.47 2.42NM E. Restorf							18.78 5.17 1.30NM		3.72	0.37 NM
Ta-PNG21	16.03 6.89 E. Restorf	18.68 6.47 2.68NM E. Restorf									2.68	2.28 NM
Ta-PNG34							0.47 3.11 E. Restorf	1.89 11 7.89NM E. Restorf			7.89	7.89 NM

* two 11 April 2003 dates are given as one animal was sighted twice on this date

Recommendations

Additional surveys for marine mammals

- This survey, and previously collected data, suggests that a long-term cetacean research project in Kimbe Bay is feasible.
- Additional surveys would help to identify possible monthly trends in cetacean distribution.
- Due to time constraints for platforms of opportunity, it is suggested that a dedicated vessel would be most appropriate.
- Very little is known about cetaceans in Papua New Guinea waters and any further research would enhance the knowledge gathered here.

Revision of the status of cetacean species found in Papua New Guinea waters

- The results presented here verify at least eleven species (with a further two tentatively identified) as present in the waters of Papua New Guinea. Eleven of these were previously unlisted as present by the IUCN (see Table 5), therefore appropriate listing of the cetacean species recorded here, within the IUCN Red Data List, would be advised.

Publication of information

- Data should be presented in scientific manuscripts.
- Information should be presented in popular style magazines to allow data access for the general public.

Publications resulting from surveys

Visser, I. N. (2002a). Kimbe Bay Preliminary Marine Mammal Rapid Ecological Assessment (REA), July 2002. Unpublished Report. Unpublished Survey Report for The Nature Conservancy, C/o South Pacific Office, P.O. Box 65-506, Mairangi Bay, Auckland, New Zealand

Visser, I. N. (2002b). Kimbe Bay Preliminary Cetacean Survey Report. Unpublished report submitted to Walindi Plantation Resort and Mahonia na Dari Conservation and Research Centre, P.O. Box 4, Kimbe, West New Britain, Papua New Guinea

Visser, I. N. (2002c). Preliminary cetacean survey in Kimbe Bay, New Britain, Papua New Guinea. *SEAMAM II. Second international conference on the marine mammals of Southeast Asia*, July 22 – 23, Dumaguete City, Philippines, 31.

Visser, I. N. (2002d). First photo-identification matches for Papua New Guinea killer whales. *Orca Symposium, September 23 - 28, 2002*, Noirt, France.

Visser, I. N. (2002e). Whale watching at Walindi - Air Niugini Inflight Magazine.

Visser, I. N., & Bonoccorso, F. J. (2003). New observations and a review of killer whale (*Orcinus orca*) sightings in Papua New Guinea waters. *Aquatic Mammals. In press*,.

Visser, I. N. (2003a). Whale Research in Papua New Guinea waters - DiveLog New Zealand Magazine.

Visser, I. N. (2003b). Papua New Guinea - the undiscovered cetacean hot-spot - *Whale and Dolphin Conservation Society Magazine* 2003

Visser, I. N., Fertl, D., & Peluso, T. (in prep). Observations of marine mammals in Kimbe Bay, Papua New Guinea. *to be submitted to a scientific journal*.

IUCN

The IUCN (2000) aims to provide a global index of the state of all species of animals and plants, including their distribution around the world. In addition, they wish to identify and document those species most in need of conservation attention.

The results presented here verify at least eleven species (with a further two tentatively identified) as present in the waters of Papua New Guinea (eleven of which were previously unlisted as present by the IUCN).

Table 5. Species Status from Red Data listing (IUCN 2000) for Papua New Guinea waters.

Species	Status within the IUCN Red Data List	Present in Papua New Guinea waters? (IUCN Red Data List)	Confirmed or Tentative sighting and survey date
pygmy sperm whale	No listing in Red Data List for any region of the world	Not listed as present	Confirmed April 2003
goosebeak whale	Data deficient [#]	Not listed as present	Confirmed April 2003
densebeak whale	Data deficient [#]	Not listed as present	Tentative April 2003
rough-toothed dolphin	Data deficient [#]	Not listed as present	Tentative April 2002
bottlenose dolphin	Data deficient [#]	Not listed as present	Confirmed April 2003
Indo-Pacific bottlenose dolphin	No listing in Red Data List for any region of the world	Not listed as present	Confirmed April 2002 & 2003
pantropical spotted dolphin	Lower risk, conservation dependent [*]	Recorded	Confirmed April 2003
spinner dolphin	Lower risk, conservation dependent [*]	Recorded	Confirmed April 2002 & 2003
Risso's dolphin	Data deficient [#]	Not listed as present	Confirmed April 2002 & 2003
melonheaded whale	No listing in Red Data List for any region of the world	Not listed as present	Confirmed April 2002
false killer whale	No listing in Red Data List for any region of the world	Not listed as present	Confirmed April 2002
killer whale	Lower risk, conservation dependent [*]	Not listed as present	Confirmed April 2002
shortfinned pilot whale	Lower risk, conservation dependent [*]	Not listed as present	Confirmed April 2002

[#] There is inadequate information to make a direct, or indirect, assessment of this species risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution is lacking. Data Deficient is therefore not a category of Threat or Lower Risk. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available.

^{*} Has been evaluated and does not satisfy the criteria for any of the categories of Critically Endangered, Endangered or Vulnerable. However, this species has also been evaluated under a conservation program which is the focus of a continuing species-specific or habitat-specific targeted plan towards the species in question, the cessation of which would result in the species qualifying for one of the threatened categories above, within a period of five years.

Appendix One. Dates and locations of sightings for each cetacean species during April 2003.

Date	Species	Latitude (S)	Longitude (E)	Approximate area	Group Size	Photo Id	Hydrophone
3-Apr-03	Indo-Pacific bottlenose dolphin	05° 16.35	150° 07.14	North East of Restorf Island	6 + 4	Yes	No
3-Apr-03	Indo-Pacific bottlenose dolphin	05° 16.40	150° 07.08	North East of Restorf Island	1	No	No
3-Apr-03	Indo-Pacific bottlenose dolphin	05° 16.03	150° 06.89	North East of Restorf Island	20	Yes	No
3-Apr-03	Indo-Pacific bottlenose dolphin	05° 15.95	150° 07.92	North East of Restorf Island	10	No	Yes
4-Apr-03	Indo-Pacific bottlenose dolphin	05° 18.68	150° 06.47	East of Restorf Island	30	Yes	No
6-Apr-03	Indo-Pacific bottlenose dolphin	05° 25.33	150° 05.93	North of Walindi Plantation Resort	6	Yes	No
6-Apr-03	Indo-Pacific bottlenose dolphin	05° 17.69	150° 06.66	East of Restorf Island	10	No	No
6-Apr-03	Indo-Pacific bottlenose dolphin	05° 01.74	150° 10.54	Northern end of Cape Huessener	6	Yes	No
6-Apr-03	Indo-Pacific bottlenose dolphin	05° 21.89	150° 06.78	North of Walindi Plantation Resort	2	No	No
7-Apr-03	Indo-Pacific bottlenose dolphin	05° 18.40	150° 05.85	East of Restorf Island	6	Yes	No
8-Apr-03	Indo-Pacific bottlenose dolphin	05° 18.67	150° 07.12	East of Restorf , near Christine's reef	approx. 10	No	No
8-Apr-03	Indo-Pacific bottlenose dolphin	05° 12.37	150° 22.88	Kimbe Island, northern side	11	No	Yes, no sounds
9-Apr-03	Indo-Pacific bottlenose dolphin	05° 17.36	150° 07.70	East of Restorf , near Christine's reef	10 + 6 + 5	Yes	No
10-Apr-03	Indo-Pacific bottlenose dolphin	05° 16.84	150° 06.71	North West of Restorf Island	8 + approx. 10	Yes	No
11-Apr-03	Indo-Pacific bottlenose dolphin	05° 00.45	150° 03.11	Past lighthouse on Willemse Peninsula	approx. 10	Yes	No
11-Apr-03	Indo-Pacific bottlenose dolphin	05° 01.89	150° 10.89	Northern end of Cape Huessener	10+	No	No
13-Apr-03	Indo-Pacific bottlenose dolphin	05° 18.78	150° 05.17	West of Restorf Island	10 to 12	Yes	No
14-Apr-03	Indo-Pacific bottlenose dolphin	05° 25.78	150° 31.47	Cape Hoskins	5 to 8	No	No
9-Apr-03	bottlenose dolphin	05° 21.241	150° 30.39	Wulai Island	80 +	Yes	Yes
13-Apr-03	bottlenose dolphin	05° 01.02	150° 09.90	North of Cape Huessener	60 to 80	Yes	Yes

Appendix One cont'd. Dates and locations of sightings for each cetacean species during April 2003.

Date	Species	Latitude (S)	Longitude (E)	Approximate area	Group Size	Photo Id	Hydrophone
14-Apr-03	bottlenose dolphin	05° 25.75	150° 32.31	Cape Hoskins	5	No	No
15-Apr-03	bottlenose dolphin	05° 13.08	150° 19.81	West of Kimbe Island	5	No	Yes
3-Apr-03	spinner dolphin	05° 17.34	150° 16.76	North of Walindi Plantation Resort	approx. 20	No	No
3-Apr-03	spinner dolphin	05° 20.93	150° 05.98	North of Walindi Plantation Resort	approx. 50 + 50	No	No
3-Apr-03	spinner dolphin	05° 20.52	150° 07.16	North of Walindi Plantation Resort	approx. 30	No	No
3-Apr-03	spinner dolphin	05° 20.59	150° 07.27	North of Walindi Plantation Resort	approx. 80	No	No
4-Apr-03	spinner dolphin	05° 24.38	150° 06.45	North of Walindi Plantation Resort	8	No*	No
4-Apr-03	spinner dolphin	05° 21.75	150° 07.56	North of Walindi Plantation Resort	6	No	No
4-Apr-03	spinner dolphin	05° 21.34	150° 06.99	East of Restorf Island	approx. 20	No	No
4-Apr-03	spinner dolphin	05° 21.23	150° 06.47	East of Restorf Island	approx. 20	No	No
4-Apr-03	spinner dolphin	05° 25.88	150° 21.54	Reasons Reef	approx. 5	No	No
6-Apr-03	spinner dolphin	05° 17.31	150° 06.55	Between WPR and Restorf Island	approx. 20	No	No
7-Apr-03	spinner dolphin	05° 23.44	150° 05.82	Between WPR and Restorf Island	approx. 20	No	No
8-Apr-03	spinner dolphin	05° 22.23	150° 05.67	Between WPR and Restorf Island	30+	No	Yes
8-Apr-03	spinner dolphin	05° 12.37	150° 22.88	Kimbe Island, northern side	30+	No	Yes, no sounds
8-Apr-03	spinner dolphin	05° 26.35	150° 21.38	Reasons Reef	approx. 50	No	No
9-Apr-03	spinner dolphin	05° 26.08	150° 21.29	Reasons Reef	50+	No	Yes, faint sounds
10-Apr-03	spinner dolphin	05° 12.09	150° 22.60	Northern side of Kimbe Island	80+	No*	Yes
11-Apr-03	spinner dolphin	05° 24.85	150° 06.79	North of Walindi Plantation Resort	20+	No	No
11-Apr-03	spinner dolphin	05° 03.99	150° 15.12	North of Cape Huessener	100+	Yes	No

Appendix One cont'd. Dates and locations of sightings for each cetacean species during April 2003.

Date	Species	Latitude (S)	Longitude (E)	Approximate area	Group Size	Photo Id	Hydrophone
11-Apr-03	spinner dolphin	04° 59.87	150° 04.88	North of Cape Huessener	30+	No	No
11-Apr-03	spinner dolphin	05° 01.93	150° 11.05	North of Cape Huessener	approx. 30	No	No
12-Apr-03	spinner dolphin	05° 25.99	150° 21.46	Reasons Reef	approx. 80	Yes	Yes
12-Apr-03	spinner dolphin	05° 14.11	150° 30.29	May Reef	approx. 40	Yes	No
13-Apr-03	spinner dolphin	05° 22.24	150° 06.02	Between WPR and Restorf Island	20 to 30	No	No
14-Apr-03	spinner dolphin	05° 25.90	150° 21.48	Reasons Reef	80+	Yes	No
14-Apr-03	spinner dolphin	05° 25.75	150° 32.31	Cape Hoskins	approx. 30	No	No
3-Apr-03	pygmy sperm whale	05° 22.52	150° 07.24	North of Walindi Plantation Resort	1	Yes	No
6-Apr-03	pygmy sperm whale	05° 23.04	150° 07.06	North of Walindi Plantation Resort	1	No	No
7-Apr-03	Risso's dolphin	05° 13.78	150° 23.05	South of Kimbe Island	approx. 40	Yes	Yes
10-Apr-03	Risso's dolphin	05° 10.57	150° 24.22	North of Kimbe Island	6 + 2	Yes	Yes
13-Apr-03	Risso's dolphin	05° 01.46	150° 12.47	North of Cape Huessener	1	No	No
11-Apr-03	pantropical spotted dolphin	05° 03.99	150° 15.12	North of Cape Huessener	3 to 5	No	No
14-Apr-03	pantropical spotted dolphin	05° 20.60	150° 13.56	Between Otto's & WPR	40	Yes	No
15-Apr-03	pantropical spotted dolphin	05° 14.29	150° 19.76	South West of Kimbe Island	30	Yes	Yes
13-Apr-03	densebeak whale	05° 21.73	150° 15.89	Between Restorf & WPR	1	No	No
14-Apr-03	Cuvier's beaked whale	05° 23.71	150° 35.21	Between Cape Hoskins & May Reef	1	No	No
13-Apr-03	Unidentified species	05° 10.22	150° 15.88	Near Ingles Shoals	1	No	No
14-Apr-03	Unidentified species	05° 25.68	150° 35.71	Between Cape Hoskins & May Reef	1	No	No

Appendix Two. Contact details of survey personnel

Principal Investigator

Dr. Ingrid N. Visser
Orca Research Trust
P.O. Box 1233
Whangarei
New Zealand
Telephone + (64) 9 43 43043
ingrid@orca.org.nz
www.orcaresearch.org

Researcher

Tammy Peluso
Walindi Photo
P.O. Box 4
Kimbe
West New Britain Province
Papua New Guinea
Telephone/fax + (675) 9834386
tammy@IslandEffects.com

Walindi Plantation Resort Proprietor

Max & Cecelie Benjamin
Walindi Plantation Resort
P.O. Box 4
Kimbe
West New Britain Province
Papua New Guinea
Telephone: + (675) 983 5441
Fax: (675) 983 5638
www.walindi.com
info@Walindi.com

Boat Driver/Survey Assistant

Joe Loga
C/- Walindi Plantation Resort
P.O. Box 4
Kimbe
West New Britain Province
Papua New Guinea

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