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Observation and identification of marine mammals during two recent expeditions to the Kermadec Islands, New Zealand

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Abstract

Marine mammals were observed on 46 occasions during two expeditions to the Kermadec Islands in 2004 and 2011. Species richness was greatest over the upper slope of the Bay of Plenty in May 2011, whereas abundance was greatest at the Kermadec Islands in November 2004. Diversity of cetaceans at the Kermadec Islands appears to be low however a systematic survey of the region is required to confirm this. Insular shelf waters and possibly sea mounts to the north of Raoul Island form an important part of the migratory corridor of southbound humpback whales (*Megaptera novaeangliae*) between mid-August and the end of November. Photo-identification, biopsy sampling and satellite tagging are required to determine source populations and habitat use by these whales. The identity of bottlenose dolphins occurring at the Kermadec Islands is confirmed as *Tursiops truncatus* based upon external morphology and mitochondrial DNA obtained from a single individual. Differences in size and behaviour of bottlenose dolphins observed at the Kermadec Islands mean collection of additional biopsy samples is required to confirm whether more than one species is present and to investigate if Kermadec bottlenose dolphins are genetically isolated from other South Pacific populations. While a number of species may migrate through the archipelago, the region may be unable to sustain large resident populations of cetaceans due to low pelagic primary productivity.

Keywords

Kermadec Islands; Hinetapeka Seamount; *Tursiops truncatus*; *Megaptera novaeangliae*; *Balaenoptera* sp.; *Arctocephalus tropicalis*

INTRODUCTION

The Kermadec Islands are a chain of small, subtropical volcanic islands located between 29° 13'S and 31° 20'S and 177° 50'W and 178° 53'W on the north Kermadec Ridge about 400 to 530 nautical miles (nm) northeast of New Zealand. They are bordered by Havre Trough (2000–3000 m depth) and Colville Ridge to the west and Kermadec Trench (8000–10000 m depth) to the east. Sea surface temperatures range from a minimum of 17°C in August/September to almost 25°C in February, mean annual range of 18–24°C (Francis 1985; Sutton *et al.* 2012). The Territorial Sea surrounding the islands is significant as the largest no-take marine reserve in New Zealand, and the only location within New Zealand waters where hermatypic corals occur (Brook 1999). Insular shelf and upper slope habitats around the islands are characterised by an abundance of apex predators, primarily Galapagos sharks (*Carcharhinus*

galapagensis), groupers (*Epinephelus daemeli*, *E. octofasciatus*) and yellowtail kingfish (*Seriola lalandi*) (Duffy & Francis 2010).

Despite a history of commercial whaling, numerous scientific expeditions and the protected status of the waters around the Kermadec Islands the marine mammal fauna of the region is poorly described. Neither the proposal or application for the Kermadec Islands Marine Reserve make any reference to marine mammals occurring within its waters, despite the archipelago forming part of the Kermadec or French Rock sperm whaling ground (Townsend 1935; Francis 1985; Department of Lands and Survey 1986). Analysis of historical whaling data shows large numbers of sperm whales (*Physeter macrocephalus*) were killed in the waters around Raoul Island and L'Esperance Rock, with captures peaking in May as they moved north to tropical latitudes (Gaskin 1973; Richards 2010). Raoul Island also forms part of a migratory corridor for humpback

whales (*Megaptera novaeangliae*) moving from the tropics to their Antarctic feeding grounds (Chilton 1911; Constantine *et al.* 2010). Other cetaceans occasionally reported from the region are southern right whales (*Eubalaena australis*) (Richards 2002, 2010), blue whales (*Balaenoptera musculus*) (Morton 1957), fin whales (*B. physalus*) (Gaskin 1968), pilot whales (*Globicephala* sp.) (Rhodes 1954; Gaskin 1968), killer whales (*Orcinus orca*) (Visser 2000) and bottlenose dolphins (*Tursiops* sp.) (Baker *et al.* 2010). Records of pinnipeds from the Kermadec Islands are limited to the remains of New Zealand fur seals (*Arctocephalus forsteri*) and possibly a southern elephant seal (*Mirounga leonina*) found in archaeological deposits at Low Flat, Raoul Island, dating from the late 13th to early 14thC AD (Johnson 1995); and a dead juvenile Subantarctic fur seal (*A. tropicalis*) found on Raoul Island (29° 15.395'S, 177° 57.089'W) on 8 July 2013 (Plot DB30, Raoul Island Weed Database, Department of Conservation, 31 July 2013).

To date, research on the marine mammal fauna of the Kermadec Islands has been largely confined to historical reviews of whaling era data and shore-based counts of humpback whales around Raoul Island (Richards 2002, 2010; Brown 2010; Constantine *et al.* 2010). Here we report observations of marine mammals made during a private expedition to the Kermadec Islands in November 2004 and the Kermadec Biodiscovery Expedition in May 2011. These observations provide the first overview of cetacean distribution throughout the Kermadec archipelago. Baker *et al.* (2010) classified the conservation status of Kermadec bottlenose dolphins as Data Deficient, noting the need to collect genetic samples or specimens to clarify their taxonomic status. As well as describing the distribution and number of bottlenose dolphins observed throughout the archipelago we confirm their identification based upon external morphology and sequencing of the mitochondrial DNA control region.

METHODS

Marine mammal sightings were recorded during two expeditions originating from Tauranga Harbour, Bay of Plenty, New Zealand (37° 37'S, 176° 10'E) between November 1–14, 2004 and May 9–29, 2011. The expedition vessel in 2004 was the *Southern Salvor*, a converted oil rig support vessel, 51 m length, 544 gross tonnage. The expedition vessel used in 2011 was the *RV Braveheart*, a converted Japanese fisheries research vessel, 39 m length, 177 gross tonnage. During both expeditions the senior author kept a watch for marine mammals from the bridge while underway. Observer height above the waterline was c. 7.5 m and 4.3 m for the *Southern Salvor* and *Braveheart* respectively. At most times there were between 1–3 other people on the bridge although they were not always actively searching for marine mammals. Start and finish times and positions of each watch, and the time and position of each sighting were recorded. Positions were obtained from the vessel's GPS (datum WGS84). Binoculars were used to assist identification of marine mammals and where possible,

the vessel was diverted to confirm identification. While at the Kermadec Islands the expedition vessels spent most of the time anchored close to shore. No dedicated watch was kept for marine mammals while at anchor but all sightings made at anchor, during diving operations, or by the crews of other vessels encountered at the Kermadec Islands were logged. Dr A. N. Baker confirmed identification of sei whales (*Balaenoptera borealis*) from photographs.

A single biopsy sample was obtained from a bottlenose dolphin at L'Esperance Rock, Kermadec Islands, on May 26, 2011 using the PAXARMS Biopsy System for small cetaceans (Krützen *et al.* 2002). The sample was stored in 70% ethanol and archived at -20°C at the University of Auckland upon return. Genomic DNA was extracted by digestion with proteinase K followed by a standard phenol-chloroform extraction procedure (Sambrook *et al.* 1989). Approximately 700 bp of the mitochondrial (mt) DNA control region was amplified and sequenced using primers and methods described in Tezanos-Pinto *et al.* (2009). The sequence was submitted for species identification to the web-based program *DNA Surveillance*, as well as by BLAST search of GenBank (Ross *et al.* 2003; Ross & Murugan 2006).

RESULTS

Observer effort is summarised in Tables 1 and 2. Of the eight days spent at the Kermadec Islands in 2004, four and a half days (56%) were spent anchored in Denham Bay sheltering from northeast gales. Consequently, very little time was spent at any other island in the archipelago and L'Esperance Rock was not visited at all. In contrast, all island groups were visited in May 2011, although only four hours were spent in Denham Bay. Differences in the amount of time spent on watch during the New Zealand-Kermadec Islands and Kermadec Islands-New Zealand transits in 2011 (Table 1) reflect the poor observation conditions experienced on those legs of the expedition.

Details of 45 marine mammal sightings (8 Cetacea, 1 Pinnipedia) made during the expeditions are listed in Appendix 1. In addition, the crew of the *M.V. Ultimate Lady* reported encountering humpback whales on six occasions while fishing around Hinetapeka Seamount (28° 51.86'S, 177° 50.49'W), c. 30 nautical miles north of Raoul Island, on November 8, 2004. As no further information was provided this report has been treated as a single sighting of an unknown number of humpback whales. Thirty-six (78% of total sightings) were made during November 2004, 29 (81%) of which were made at or near the Kermadec Islands. Of the 10 marine mammal sightings made in May 2011 only three (30%) were made at the Kermadec Islands, the remainder were located over the upper slope off Mayor Island, Bay of Plenty (n = 6), and east of Coromandel Peninsula (n = 1) (Appendix 1). Overall, 33 (70% of total sightings) were made at or near the Kermadec Islands. Group sizes are summarised in Table 3. Total numbers of humpback whales and bottlenose dolphins observed could not be determined as the counts for these species almost certainly included re-sightings of some individuals.

Table 1. Marine mammal observation effort recorded while underway during each expedition.

	2004		2011	
	km	hr: min.	km	hr: min.
NZ-Kermadec Islands	416.74	27: 17	264.53	14: 37.
Kermadec Islands	214.48	15: 21	247.09	41: 49
Kermadec Islands-NZ	463.94	25: 50	267.07	19: 37
Total:	1095.16	68: 28	778.69	76: 03

Table 2. Number of days spent within the Kermadec archipelago during each expedition (note: less than two hours were spent at Curtis and Cheeseman Islands on the last afternoon of the 2004 expedition).

	2004	2011
Raoul Island	6.5	9
Macauley Island	0.5	2
Curtis and Cheeseman Islands	0	3
L'Esperance Rock	0	1

Humpback whales, bottlenose dolphins and a small unidentified whale (*Balaenoptera* sp.) were the only marine mammals recorded from the Kermadec Islands (Table 3, Appendix 1). Humpback whales were only observed at the Kermadec Islands during November 2004. The number of individuals observed per sighting ranged from 1–8. Eleven pairs were observed, including seven cow-calf pairs. A further three sightings were of a cow, calf and escort (Appendix 1). Bottlenose dolphins were the most abundant cetaceans observed at the Kermadec Islands in November 2004, and the only cetaceans observed there in May 2011. Most sightings of this species were of small groups (1–8 individuals) however c. 30 individuals were sighted at Parson's Rock, Raoul Island on November 6, 2004 and several hundred were observed east of Hazard Islet, Macauley Island on November 4 and November 11, 2004 (Appendix 1).

On November 4, 2004 more than 100 bottlenose dolphins were observed in a single pod close to Hazard Islet, Macauley Island. This pod was associated with a large aggregation of feeding seabirds and pelagic fishes. On November 11, 2004 a small pod of nine bottlenose dolphins was initially sighted 2.5 km north east of Hazard Islet, and numbers around the expedition vessel steadily increased as it moved south around the eastern coastline of Macauley Island. Dolphin numbers peaked at 200–300 individuals 1.8 km southeast of Macauley Island and dropped rapidly as the vessel followed the southern coastline of Macauley Island westward. The best available navigational chart (NZ2225) shows little bathymetric detail east of Macauley Island however on both occasions the sightings of dolphins, seabirds and pelagic fishes were located in an area where the chart indicates the bottom drops steeply from 50 m to more than 120 m depth. Maximum lengths of these dolphins

Table 3. Group size and estimated number of cetaceans observed during November 2004 (In transit denotes taxa observed between the Kermadec Islands and Tauranga, New Zealand).

	No. of sightings	Group size
In transit		
<i>Balaenoptera borealis</i>	2	2-3
<i>Physeter macrocephalus</i>	1	17
<i>Orcinus orca</i>	1	2
<i>Delphinus delphis</i>	2	4-5
unidentified whale	5	1
Kermadec Islands		
<i>Balaenoptera</i> sp.	1	1
<i>Megaptera novaeangliae</i>	15	1-8
<i>Tursiops truncatus</i>	9	1-200+
Total:	36	

were estimated to be between 1.5 to 2.4 m (Appendix 1).

Despite their small size these dolphins were identified as *Tursiops truncatus* based upon their short rostrum and relatively steep head profile (Fig. 1) (Hale *et al.* 2000; Wang *et al.* 2000; Perrin *et al.* 2007). Colour pattern based upon photographs of nine individuals taken on November 4, 2004 was as follows: dark grey cape extending along the dorsum from the anterior melon to the anterior tail stock; light grey flanks, this colour extending onto sides of head below eye and underside of tail stock; lower jaw and abdomen white; area surrounding eye dark grey, dark grey stripe extending obliquely from the eye to the flipper; pale blaze extending obliquely forward from the area surrounding the vent and terminating above the flipper, upper margin dark grey to dusky in some individuals; the colour pattern of two individuals assumed to be juveniles based on their small size was similar but more defined (Fig. 1). Some large individuals exhibited numerous pale oval marks on the upper body. Examination of photographs revealed these to be scars from healed cookiecutter shark (*Isistius* spp.) bites. Unhealed, recent cookiecutter shark bites were subsequently observed on several individuals encountered off Raoul Island.

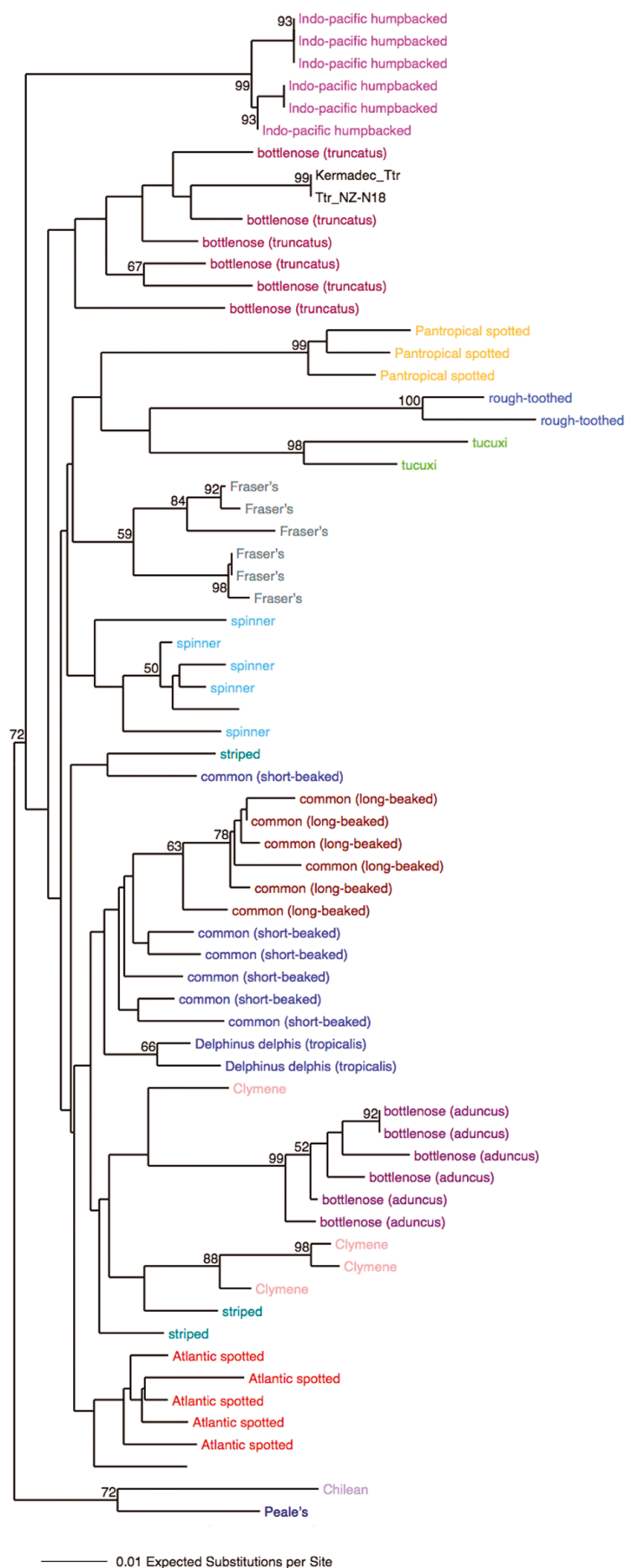
Estimated lengths of other bottlenose dolphins (excluding calves) observed at the Kermadec Islands

ranged from 2.5 m to 3 m, mean 2.6 m (S. E. 0.09, $n=6$) (Appendix 1). In contrast six bottlenose dolphins observed over the upper slope off Mayor Island, Bay of Plenty, on May 9 were all estimated to be at least 3.3 m long, with the two largest individuals being close to 3.8 m length (Appendix 1). On May 26, 2011 a single biopsy was obtained from a bottlenose dolphin, c. 2.5 m length, near L'Esperance Rock. This dolphin was part of a pod of at least eight bottlenose dolphins, the largest individuals of which were estimated to be up to 2.8 m long (Appendix 1). Analysis of mtDNA from the Kermadec sample supported the morphological identification of this dolphin as *Tursiops truncatus*. The mtDNA control region grouped closely with other reference samples of *T. truncatus* available in the program *DNA Surveillance*, and was distinct from the grouping of reference samples of *T. aduncus* (Fig. 2). Although the bootstrap support for the species grouping



Figure 1. Adult (upper) and juvenile (lower) *Tursiops truncatus* east of Hazard Islet, Macauley Island, November 4, 2004. Images © Brent Stephenson, Eco-Vista Photography & Research

Figure 2. (right) A neighbour-joining reconstruction of mtDNA control regional sequences from the Kermadec bottlenose dolphin, with reference samples available in *DNA Surveillance*. The sequence of the haplotype NZ-N18 (GenBank_EU276390) was included after matching with a BLAST search of GenBank. The support for groups is based on 1,000 bootstraps as implemented in *DNA Surveillance*.



in *DNA Surveillance* was not high, this is typical for species within the subfamily Delphininae. The GenBank search returned high similarity (>98% identity) to many other sequences attributed to *T. truncatus* and an exact match (100% identity) to the haplotype NZ-N18 (GenBank # EU276390). This haplotype is common among bottlenose dolphins from North Island, New Zealand (Tezano-Pinto *et al.* 2009). The phylogenetic reconstruction was repeated in *DNA Surveillance* with both the Kermadec sample and the NZ-N18 haplotype to show this close relationship (Fig. 2).

DISCUSSION

The data reported here were not collected as part of a systematic marine mammal survey and therefore are not a representative sample of marine mammal distribution within the Kermadec Islands Marine Reserve or the waters adjoining it. Most sightings made at the Kermadec Islands were recorded incidentally to diving operations on shallow subtidal, primarily rocky reef habitats. Consequently observer effort was heavily biased towards areas of insular shelf less than 30 to 40 m depth, particularly those around Raoul Island. Nevertheless, this paper presents the most comprehensive marine mammal observations reported from the region, including the first report of humpback whales (*Megaptera novaeangliae*) from Hinetapeka Seamount, and the first formal record, with genetic identification, of the bottlenose dolphin *Tursiops truncatus* from the north Kermadec Ridge.

These preliminary surveys suggest marine mammal diversity in coastal waters of the Kermadec Islands is low. Humpback whales, a small unidentified balaenopterid and bottlenose dolphins were the only species recorded during two expeditions to the archipelago (Appendix 1). A sighting of a minke whale in Stella Passage, Curtis and Cheeseman Islands, in October 1985 was also reported to us (M.P. Francis pers. comm.) but could not be identified to species. It is possible that both *Balaenoptera acutorostrata* and *B. bonaerensis* occur at the Kermadec Islands (Baker 1999). Although there appear to be no records of humpback whales being killed by whalers around the Kermadec Islands it is well known that southbound humpback whales migrate through the archipelago from mid-August to the end of November (Chilton 1911; Gaskin 1968; Richards 2010). However, until relatively recently the significance of the Kermadec Islands for this species was not fully appreciated (Constantine *et al.* 2010). The expedition in November 2004 occurred towards the end of the period (August to November) that humpback whales are reported to occur around the Kermadec Islands, nevertheless 15 sightings involving at least 37 individuals, including a large number of cow-calf pairs, were made over an 11 day period. Although it is not known how many of these whales were double counted this represents a relatively large number of whales compared to recent sightings around mainland New Zealand (Gibbs & Childerhouse 2000). Subsequent shore-based counts conducted by Department of Conservation staff on Raoul Island have shown that during the peak of the migration in October more than

150 humpback whales may be present around the island on a single day (Brown 2010; Constantine *et al.* 2010). Satellite tagging has shown that some New Caledonian whales migrate through the Kermadec Islands and may linger there for at least six days (Garrigue *et al.* 2010) but source populations for the bulk of the whales passing the Kermadec Islands remain unknown (Constantine *et al.* 2010). Further research, including photo-identification, genetic sampling and satellite tagging is required to answer this question. Satellite tagging of humpback whales on breeding grounds throughout Oceania would considerably improve understanding their movements in the region and could potentially identify other oceanic features forming part of this migratory corridor.

It appears likely from our observations and anecdotal evidence that the only potentially resident cetacean population at the Kermadec Islands are bottlenose dolphins. Sightings reported by Department of Conservation (DOC) staff stationed on Raoul Island indicate dolphins, probably bottlenose dolphins, are present throughout the year but are sighted more frequently during summer. Sightings of small pods containing up to eight bottlenose dolphins were made off Curtis Island and east of Raoul Island during 11 expeditions to the archipelago between 1983 and 2005 (Dr. Roger Grace pers. comm.). In addition, there are reports of seven sightings of bottlenose dolphins at the Kermadec Islands between September 19 and October 2, 1996; two at Macauley Island, one 12.3 km southwest of Smith Bluff, Raoul Island, and four along the northern coastline of Raoul Island (Keith Gregor pers. comm.). DOC staff and the crews of the *Southern Salvor* and RV *Braveheart* also report regularly sighting small groups of bottlenose dolphins off Smith and Hutchinson's Bluffs during resupply trips to Raoul Island.

Two species of bottlenose dolphin, *Tursiops aduncus* and *T. truncatus*, occur in the Indo-West Pacific and are sympatric in some parts of their range. *T. aduncus* is generally smaller than *T. truncatus*, with a longer beak, paler colouration and dark ventral spotting in adults (Hale *et al.* 2000; Wang *et al.* 2000; Perrin *et al.* 2007). A third species, *T. australis*, was described from southern Australia by Charlton-Robb *et al.* (2011) but has yet to be accepted. *T. truncatus* occurs in coastal and pelagic habitats in temperate and tropical regions worldwide. In some regions "coastal" and "offshore" forms or ecotypes of *T. truncatus* can be morphologically, isotopically and genetically distinguished from each other (Segura *et al.* 2006; Tezano-Pinto *et al.* 2009). Morphological and behavioural traits distinguishing coastal and offshore forms of *T. truncatus* are not consistent between regions and analysis of gene flow suggests habitat specialisation has occurred independently in different ocean basins (Tezano-Pinto *et al.* 2009). In the western North Atlantic offshore *T. truncatus* are generally larger and more robust than coastal *T. truncatus* (Hersh & Duffield 1990; Kenney 1990; Mead & Potter 1990), whereas in the Gulf of California the coastal form is larger than the offshore form (Segura *et al.* 2006). *T. truncatus* occurring in coastal waters around North and South Islands of New Zealand are generally larger than the bottlenose

dolphins observed at the Kermadec Islands, particularly those forming the large pods observed off Macauley Island in November 2004. Length data for 87 adults and sub-adults obtained from the New Zealand Whale Stranding Database ranged from 1.41–3.82 m. Mean length was 2.72 m (S. E. 0.06) and 53% were between 2.71 and 3.3 m long. Given the apparent size difference between Kermadec bottlenose dolphins and coastal New Zealand *T. truncatus*, and the genetic isolation of Northland, Marlborough Sounds and Fiordland *T. truncatus* from each other (Tezanos-Pinto *et al.* 2009) it is somewhat surprising that the mtDNA haplotype of the individual sampled at L'Esperance Rock is identical to other *T. truncatus* from North Island, New Zealand. However, given the widespread distribution of some mtDNA haplotypes in this global species (or species complex), additional samples and nuclear markers are needed to evaluate the genetic isolation of the Kermadec population. It is also worth noting that the behavioural and slight size differences observed between the bottlenose dolphins seen in small pods of 3–8 individuals and those in the very large pods observed off Macauley Island in November 2004 suggest that two ecologically and possibly genetically distinct groups of bottlenose dolphins may occur at the Kermadec Islands (e.g. Mead & Potter 1990; Segura *et al.* 2006).

The low diversity of cetaceans recorded at the Kermadec Islands may reflect the preliminary nature of our data, or the islands' location toward the centre of the South Pacific subtropical gyre. There are no strong fronts or water mass boundaries in the vicinity of the Kermadec Islands and mean flows tend to be weak and dominated by eddies (Sutton *et al.* 2012). Chlorophyll peaks in spring (July to September) at more than 0.25 g.m⁻³ and then declines to less than 0.1 g.m⁻³ during summer and early autumn. Although chlorophyll values tend to be higher in waters overlying the ridge than those further away from it, mean values are very low, c. 0.1 g.m⁻³, typical of those toward the centre of the subtropical gyre (Sutton *et al.* 2012). Remote sensed ocean colour data do suggest higher productivity in coastal waters around the islands but these observations need to be confirmed by in-situ measurements (Sutton *et al.* 2012). In this regard, it is notable that Oliver (in Chilton 1911) reported extremely dense swarms of the euphausiid *Thysanoessa gregaria* in Denham Bay, Raoul Island, during September and October 1908 and that these coincided with the arrival of considerable numbers of humpback whales in the bay. Similarly, we observed intense pelagic activity east of Macauley Island in November 2004 but none in May 2011. Small squids and flying fish were also attracted to the expedition vessel's lights every night in November 2004 but none were observed in May 2011. It therefore seems possible that pelagic productivity around the Kermadec Islands is insufficient to sustain large resident populations of pelagic cetaceans, particularly in winter. Although bottlenose dolphin appear to be present around the islands for most of the year it is not known if any are permanently resident. Regardless of their residency status bottlenose dolphins occurring around the Kermadec Islands may be dependent upon benthic prey

for a large part of the year. Likely prey species include a variety of small flatfishes and the goatfish *Upeneus francisi* which are abundant on shallow soft sediments around the islands (C.D. pers. obs.).

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APPENDIX 1: Marine mammal sightings made during expeditions to the Kermadec Islands from Tauranga, New Zealand.

Species	Position (WGS 84)	Location	Date	Time	No.	Comments
<i>Balaenoptera borealis</i>	37° 22.230' S 176° 22.361' E	se of Mayor Island	1/11/2004	14:00	3	10–13 m length
<i>Delphinus delphis</i>	36° 40.249' S 176° 57.043' E	Oheua Ridge	1/11/2004	19:25	4	
<i>Balaenoptera borealis</i>	34° 41.220' S 178° 38.912' E	southern Havre Trough	2/11/2004	11:38	2	
<i>Delphinus delphis</i>	34° 11.458' S 179° 03.827' E	southern Havre Trough	2/11/2004	18:41	5	
<i>Tursiops truncatus</i>	30° 14.621' S 178° 23.997' W	east of Hazard Islet, Macauley Island	4/11/2004	6:25	>100	all < 2.5m length
<i>Tursiops truncatus</i>	29° 17.615' S 177° 59.266' W	sw entrance to Denham Bay, Raoul Island	4/11/2004	14:08	8	largest about 2.5m length
<i>Tursiops truncatus</i>	29° 16.643' S 177° 57.511' W	Denham Bay	5/11/2004	2:00	unknown	
<i>Megaptera novaeangliae</i>	29° 16.643' S 177° 57.511' W	Denham Bay	5/11/2004	6:55	6	
<i>Megaptera novaeangliae</i>	29° 16.643' S 177° 57.511' W	Denham Bay	5/11/2004	7:30	2	
<i>Megaptera novaeangliae</i>		Smith Bluff, Denham Bay	5/11/2004	14:30	1	
<i>Tursiops truncatus</i>	29° 16.643' S 177° 57.511' W	Denham Bay	5/11/2004	21:30	7	
<i>Megaptera novaeangliae</i>	29° 16.643' S 177° 57.511' W	Denham Bay	6/11/2004	6:00 - 8:30	8	at least 2 cow- calf pairs
<i>Tursiops truncatus</i>	29° 17.710' S 177° 58.305' W	Parson's Rock, Denham Bay	6/11/2004	12:00	30	
unidentified whale	29° 16.643' S 177° 57.511' W	Denham Bay	6/11/2004	19:20	1	
<i>Megaptera novaeangliae</i>	29° 16.643' S 177° 57.511' W	Denham Bay	7/11/2004	6:25	2	
unidentified whale	29° 16.643' S 177° 57.511' W	Denham Bay	7/11/2004	7:50	1	
unidentified whale	29° 16.508' S 177° 58.658' W	c. 500 m off Hutchinson Bluff, Denham Bay	7/11/2004	8:18	1	

Species	Position (WGS 84)	Location	Date	Time	No.	Comments
<i>Megaptera novaeangliae</i>	29° 13.408' S 177° 57.067' W	off Ravine 8, Raoul Island	7/11/2004		2	cow-calf pair
<i>Tursiops truncatus</i>	29° 13.408' S 177° 57.067' W	off Ravine 8, Raoul Island	7/11/2004		1	
<i>Megaptera novaeangliae</i>	29° 14.558' S 177° 52.927' W	Boat Harbour, Meyer Island	7/11/2004	15:50	2	cow-calf pair
<i>Tursiops truncatus</i>	29° 14.558' S 177° 52.927' W	Boat Harbour, Meyer Island	8/11/2004	0:00-02:20	6	feeding on flying fish attracted to lights, 1 calf
<i>Megaptera novaeangliae</i>	29° 14.558' S 177° 52.927' W	Boat Harbour, Meyer Island	8/11/2004	14:13	2	cow-calf pair
<i>Megaptera novaeangliae</i>	29° 16.624' S 177° 57.523' W	Denham Bay	9/11/2004	7:20	1	
<i>Megaptera novaeangliae</i>	29° 16.624' S 177° 57.523' W	Denham Bay	9/11/2004	10:25	3	cow, calf and escort
<i>Megaptera novaeangliae</i>	29° 16.630' S 177° 57.547' W	Denham Bay	10/11/2004	6:40	1	
<i>Megaptera novaeangliae</i>	29° 16.630' S 177° 57.547' W	Denham Bay	10/11/2004	6:55	1	
<i>Megaptera novaeangliae</i>	29° 16.630' S 177° 57.547' W	Denham Bay	10/11/2004	7:23	3	cow, calf and escort
unidentified whale	29° 16.630' S 177° 57.547' W	Denham Bay	10/11/2004	17:15	1	
<i>Tursiops truncatus</i>	30° 13.041' S 178° 23.670' W	east of Hazard Islet, Macauley Island	11/11/2004	8:14-9:15	200–300	most 1.5m-1.8 m in length, one c. 2.5 m
<i>Megaptera novaeangliae</i>	30° 16.287' S 178° 26.164' W	south of Macauley Island	11/11/2004	15:14	3	cow, calf and escort
<i>Tursiops truncatus</i>	30° 16.287' S 178° 26.164' W	south of Macauley Island	11/11/2004	15:14	12–20	
<i>Balaenoptera</i> sp.	30° 20.541' S 178° 27.650' W	south of Macauley Island	11/11/2004	16:53	1	
unidentified whale	32° 27.560' S 179° 54.108' W	Havre Trough, c. 40 nm west of Star of Bengal Bank	12/11/2004		1	
<i>Orcinus orca</i>	32° 56.575' S 179° 44.802' E	Havre Trough, c. 65 nm sw of Star of Bengal Bank	12/11/2004	15:07	2	adult male and subadult male
<i>Physeter macrocephalus</i>	35° 15.377' S 178° 04.292' E	Havre Trough, c. 35 nm nw of Rumble Three	13/11/2004	7:50	17	
<i>Arctocephalus forsteri</i>	37° 22.117' S 176° 21.332' E	se of Mayor Island	9/05/2011	14:07	3	depth 215 m
<i>Globicephala</i> sp.	37° 13.2' S 176° 27.8' E	Mayor Valley	9/05/2011	15:20	30	in 4 groups, depth 800 m
<i>Delphinus delphis</i>	37° 9.226' S 176° 30.834' E	Mayor Valley	9/05/2011	15:47	50–100	depth 902 m
<i>Tursiops truncatus</i>	37° 7.444' S 176° 31.322' E	Mayor Valley	9/05/2011	16:03	6	3.3–3.8 m length, depth 951 m

Species	Position (WGS 84)	Location	Date	Time	No.	Comments
<i>Globicephala</i> sp.	37° 6.401' S 176° 31.789' E	Mayor Valley	9/05/2011	16:17	7	depth 978 m
<i>Globicephala</i> sp.	37° 6.481' S 176° 32.005' E	Mayor Valley	9/05/2011	16:22	11	
<i>Tursiops truncatus</i>	29° 13.977' S 177° 56.385' W	0.5 nm off Ravine 8, Raoul Island	19/05/2011	11:25	4	adults 2.5–3 m length, 1 calf, depth 16.4 m
<i>Tursiops truncatus</i>	30° 13.468' S 178° 26.322' W	Macauley Island	21/05/2011	13:50	3	1.8–2 m length
<i>Tursiops truncatus</i>	31° 25.963' S 178° 54.042' W	L'Esperance Rock	26/05/2011	10:00	8	1 calf, adults 2.5–2.8 m length
unidentified beaked whale	35° 57.435' S 176° 29.829' E	c. 26 km nw of Colville Knolls	28/05/2011	8:30	1	depth 1000 m