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To cite this article: E. Beatson , S. O'Shea , C. Stone & T Shortland (2007) Notes on New Zealand mammals 6. Second report on the stomach contents of long-finned pilot whales, *Globicephala melas* , , 34:4, 359-362, DOI: [10.1080/03014220709510095](https://doi.org/10.1080/03014220709510095)

To link to this article: <https://doi.org/10.1080/03014220709510095>



Published online: 19 Feb 2010.



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Notes on New Zealand mammals 6. Second report on the stomach contents of long-finned pilot whales, *Globicephala melas*

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Abstract We report data on the stomach contents of the long-finned pilot whale, *Globicephala melas*, recovered from a group of whales stranded on Ruakaka Beach, northeastern New Zealand, in November 2006. In nine whales for which identifiable stomach contents were recovered (three that stranded on 10 November and six that stranded on 11 November) prey remains comprised exclusively cephalopod beaks attributed to five squid species. The stomachs of a further two whales contained unidentifiable upper beaks only, while the stomachs of five whales were completely empty. No whale appeared to have been satiated immediately before stranding, given that the maximum biomass of prey recently consumed by any one whale was calculated to be <5 kg. All squids ingested represented oceanic species, found from 50 to 1000 m but more common towards the deeper end of this range. These data

both complement and contrast with the only other dietary information available for this species in New Zealand waters, reported from stomach contents of whales stranded on Farewell Spit, South Island in December 2005.

Keywords Cephalopoda; diet; *Globicephala melas*; long-finned pilot whale; New Zealand; stranding

INTRODUCTION

Pilot whales are extremely social and display strong herding behaviour, swimming in large pods of between 40 and 200 animals (Sergeant 1962; Zachariassen 1993). The long-finned pilot whale is one of few cetacean species that tends to strand *en masse*, and the tight social cohesion of these animals makes pods more likely to re-strand after they are refloated by human effort (Sergeant 1982).

Strandings are recorded year round, although they are more common over the austral summer (Brabyn 1991). Whangarei, Hawkes Bay, East Cape, Golden Bay, Stewart Island and Chatham Islands appear to be particularly dangerous places for whales (Brabyn 1991; Museum of New Zealand Te Papa Tongarewa). Unfortunate as they are, mass stranding events provide an opportunity to investigate the diets of relatively large numbers of individuals of a cetacean species that cannot otherwise be determined.

Despite the high frequency of long-finned pilot whale mass strandings in New Zealand waters, data on their diet was previously limited to that from five individuals from a single stranding event at Farewell Spit, Golden Bay, northernmost South Island (Beatson et al. 2007). This paper provides the first report on the stomach contents of long-finned pilot whales stranded on the coast of northern New Zealand, and the second account from New Zealand waters. Comparisons are made between the diets of Ruakaka-stranded whales and those reported earlier from Farewell Spit (Beatson et al. 2007).

MATERIAL AND METHODS

Between 10 and 11 November 2006, two groups (or possibly the same group twice) of long-finned pilot whales stranded on Ruakaka Beach, Northland (35°51.41'S, 174°29.03'E). At 0945 NZST on 10 November a large group of pilot whales were reported to be stranded; approximately 20 animals were successfully refloated, but 36 died (New Zealand Department of Conservation unpubl. data). Four adult whales (2 males, 2 females) were given to the local iwi (indigenous community), Ngatiwai to be flensed (boned), at which time the stomach contents of three were recovered and dispatched to Auckland University of Technology (AUT). At 0730 NZST on 11 November a suspected re-stranding was reported further down Ruakaka Beach, this time involving 46 whales; 29 were re-floated, and 17 died (New Zealand Department of Conservation unpubl. data). All 17 dead whales from the second mass stranding event were flensed by a crew organised by the Ngatiwai Trust Board; stomach contents of 13 animals were recovered and dispatched to AUT. Unfortunately the remaining 37 dead whales could not be sampled due to limitations on time and resources.

For analysis the stomach contents were rinsed through a 1.0 mm sieve, and then sorted. Cephalopod remains were fixed in 10% formalin, then preserved in 40% isopropyl alcohol. Measurements were taken with digital calipers. The methods used to identify prey species and to quantify their relative importance follow Beatson et al. (2007).

RESULTS

Eleven of the 16 stomachs examined contained prey remains, comprising 19 lower and 28 upper cephalopod beaks. The stomachs of two of these whales contained unidentifiable upper beaks only, while the remaining nine stomachs contained lower beaks attributed to five species of cephalopod (Table 1).

The two most common species in the diet of these whales were *Chiroteuthis* sp. 1 (*sensu* Beatson 2007) and *Nototodarus gouldi*. *Chiroteuthis* was numerically the

Table 1 Composition of cephalopods in the diet of 16 *Globicephala melas* stranded on Ruakaka Beach, Northland, New Zealand from 10 to 11 November 2006. M, male; F, female; FO, frequency of occurrence; IRI, index of relative importance; *, value unable to be calculated (i.e., recovered upper beaks only).

Date	11 November 2006																Total	FO	% Num	Mass (kg)	% Mass	IRI
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16						
Whale no.	-		-		M		M		F		-		F		F		F		M			
Sex	-		-		M		M		F		-		F		F		F		M			
Species in diet																	Total	FO	% Num	Mass (kg)	% Mass	IRI
Chiroteuthidae																	8	0.3	40	0.2	1.3	13.4
<i>Chiroteuthis</i> sp. 1	4	2															2					
Cranchiidae																	2	0.2	10	0.4	2.1	2.3
<i>Tenuthowenia pellucida</i>	1																1					
Histioteuthidae																	1	0.1	5	0.1	0.4	0.6
<i>Histioteuthis macrohista</i>	1																1					
Ommastrephidae																	7	0.7	35	14.6	87.1	33.1
<i>Nototodarus gouldi</i>	1	1	1	1	1	1	1	2	1								1	0.1	5	1.6	9.2	0.7
Pholidoteuthidae																	1					
<i>Pholidoteuthis massyae</i>	1	0	4	2	1	2	4	2	9	2	1	0	0	0	0	0	1	0.1	5	1.6	9.2	0.7
Total upper cephalopod beaks	1	0	4	2	1	2	4	2	9	2	1	0	0	0	0	0	28					
Total lower cephalopod beaks	4	1	4	0	1	1	1	1	5	0	1	0	0	0	0	0	19					
Total cephalopod beaks combined	5	1	8	2	2	3	5	3	14	2	2	0	0	0	0	0	47					
Reconstructed biomass of prey (kg)	0.1	0.2	1.4	*	1.6	3.0	1.7	1.6	4.7	*	2.6	0	0	0	0	0	16.8					

most abundant, contributing 40% of the total number of lower cephalopod beaks recovered from the stomach contents of whales. Although the lower rostral length (LRL) of beaks ranged from 3.1 to 4.2 mm, and the estimated mantle lengths (ML) ranged from 87 to 114 mm, the reconstructed ingested mass of this species contributed only 1% of the total cephalopod prey ingested by these whales, giving it an overall index of relative importance (IRI) of 13. The *Nototodarus* beaks ranged from 4.5 to 6.1 mm LRL, and estimated MLs of 214–272 mm. This species had an overall index of relative importance of 33, accounting for 35% by number and 87% by reconstructed mass of the total cephalopod prey ingested.

Based upon the incidence of identifiable lower beaks in the stomachs of these whales, the estimated total biomass of prey found in the stomachs ranged from 0.1 kg in whale 1 to 4.7 kg in whale 9 (median 1.6 kg). Using the calculations of Sergeant (1962), which assume that an average-sized pilot whale of c. 4 m length and 1000 kg weight requires a minimum of 11 kg of food to fill its stomach, we estimate that the stomachs of the nine whales sampled herein (that contained lower beaks) ranged from 1 to 43% full (median 15%).

No stomach contents were seen to be regurgitated by any of the whales involved in either stranding event, nor were any squid beaks or other dietary remains found cast up along the shore over the 2 days we were present during these stranding events.

DISCUSSION

Fast swimming, muscular squid of the genus *Nototodarus* comprised the largest biomass recorded in the stomach contents of the nine long-finned pilot whales reported herein. Although beaks of *Nototodarus gouldi* and *N. sloanii* cannot be reliably differentiated, and both species live within the geographic and bathymetric foraging range of long-finned pilot whales, beaks from this Ruakaka stranding are attributed to *N. gouldi* on geographic grounds, as *N. sloanii* is not known from northeastern New Zealand. *Nototodarus* also dominated the diets of five whales of the same species stranded at Farewell Spit in 2005 (Beatson et al. 2007).

The total bathymetric distribution of all ontogenetic stages of *Nototodarus*, determined from fisheries data and from comprehensive museum collections from the New Zealand EEZ, extends to about 500 m (Mattlin et al. 1985). The presence

of juvenile *Nototodarus* and of the benthic octopus *Pinnoctopus cordiformis* in the stomach contents of pilot whales from the Farewell Spit stranding had previously led us to believe that these long-finned pilot whales were feeding at depths shallower than 150 m (Beatson et al. 2007). However, although juveniles of some species reported from the diets of whales stranded at Ruakaka may be found in waters as shallow as 50 m, the presence of mature, deep-water squid such as *Histioteuthis macrohista* and *Pholidoteuthis massyae* (Table 1) suggests that long-finned pilot whales in New Zealand waters also feed at depths exceeding 500 m, or possibly even down to 1000 m (S. O'Shea pers. obs.; Anderson et al. 1998). The lack of beaks attributable to any coastal species of squid or octopus in the stomachs of any sampled whale, the lack of observed regurgitation, and the lack of beach-drift beaks of any cephalopod (or other) taxon, all indicate that none of these animals had recently fed in coastal waters.

ACKNOWLEDGMENTS

We acknowledge the Department of Conservation, particularly Bryce Lummis, and members of Ngatiwai, for the assistance that was provided to us in the collection of these stomach content samples. We also acknowledge Anton Van Helden and Bruce Marshall (both from the Museum of New Zealand Te Papa Tongarewa) for providing access to The New Zealand Whale Stranding Database, and cephalopod collections, respectively, and Carolyn King and two anonymous reviewers and for their valued comments on an earlier draft of this manuscript. This study was supported by funding from Auckland University of Technology.

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