

SECRETS OF THE DEAD:

Examining genetic kinship in Gray's beaked whales (*Mesoplodon grayi*).

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Abstract Gray's beaked whales are almost never seen alive, yet they are a common species to strand around New Zealand. Gray's are unique amongst the beaked whales in that they often strand in groups. We examined group composition and genetic kinship between, and within, groups and single strandings. MtDNA control region haplotypes and microsatellite genotypes (16 loci) were obtained for 103 whales. We found six mother-calf pairs and two half-siblings; one between two whales found 17 years and 1500km apart. Gray's beaked whales may have an atypical social system in that both sexes disperse and sub-adults form affiliations with unrelated individuals.



Images above show strandings of Gray's beaked whales: (left to right) sub-adult female, mature male, mature female, New Zealand Department of Conservation attending stranding. Credits: Department of Conservation.

Methods

- 113 individuals stranded (1993–2013); 56 individuals stranded in 19 groups (two or more individuals), and 57 individually.
- 103 individuals successfully sexed and genotyped for mtDNA control region haplotypes and 16 microsatellite loci [1].
- Pairwise relatedness and genetic kinship was inferred between all pairs of individuals [2, 3, 4].

Results

- **Six mother-calf pairs**; two that stranded as single cow-calf pairs.
- **Mean group size was 3.4 (± 0.5 SE)** for the remaining 17 groups (20 males, 32 females, excluding calves).
- **Two half-sibling relationships**; one between a male and female sampled 17 years apart, and at least 1500 km away, that may share a father (Fig.1A). The other half-sibling pair was a mature male and a female neonate found together; with a shared haplotype suggesting these whales shared a mother.
- **None of the adults within the groups were related.**
- **Mean estimated relatedness between all pairs of individuals was low (0.078)** (Fig. 1B). When parent-offspring and sibling relationships were excluded, there was no evidence that the average relatedness within groups (0.067) was significantly higher than between groups (0.065); $p < 0.414$.

Discussion

- **Animals that die together are generally unrelated**, and these groups have not formed by the retention of close kin as expected.
- **No fathers were found within the groups**, and we observed very few mixed-sex groups.
- A single group stranding of multiple males with females may be an autumn **breeding aggregation** that suggests that males form social alliances to consort females, as seen in bottlenose dolphins (*Tursiops* spp.). Solitary males tend to strand in autumn and it may be that these **'roving males'** come closer to shore in search of receptive females post-calving.
- Other studies suggest that beaked whales can show a range of social systems: sex- and age-class segregation (northern bottlenose whale, *Hyperoodon ampullatus*), fission-fusion societies, (Baird's beaked whales, *Berardius bairdii*), and groups of multiple females with at least one male (Blainvilles' beaked whales, *Mesoplodon densirostris*) [5, 6, 7]. However, genetic kinship has not been assessed in these species.
- **Gray's beaked whales may have an atypical social system amongst the beaked whales.** Both sexes disperse and sub-adults form affiliations with unrelated individuals. These affiliations of unrelated females are similarly observed in sperm whales (*Physeter macrocephalus*), and long-finned pilot whales (*Globicephala melas*), species that also mass-strand and feed on similar prey [8, 9].

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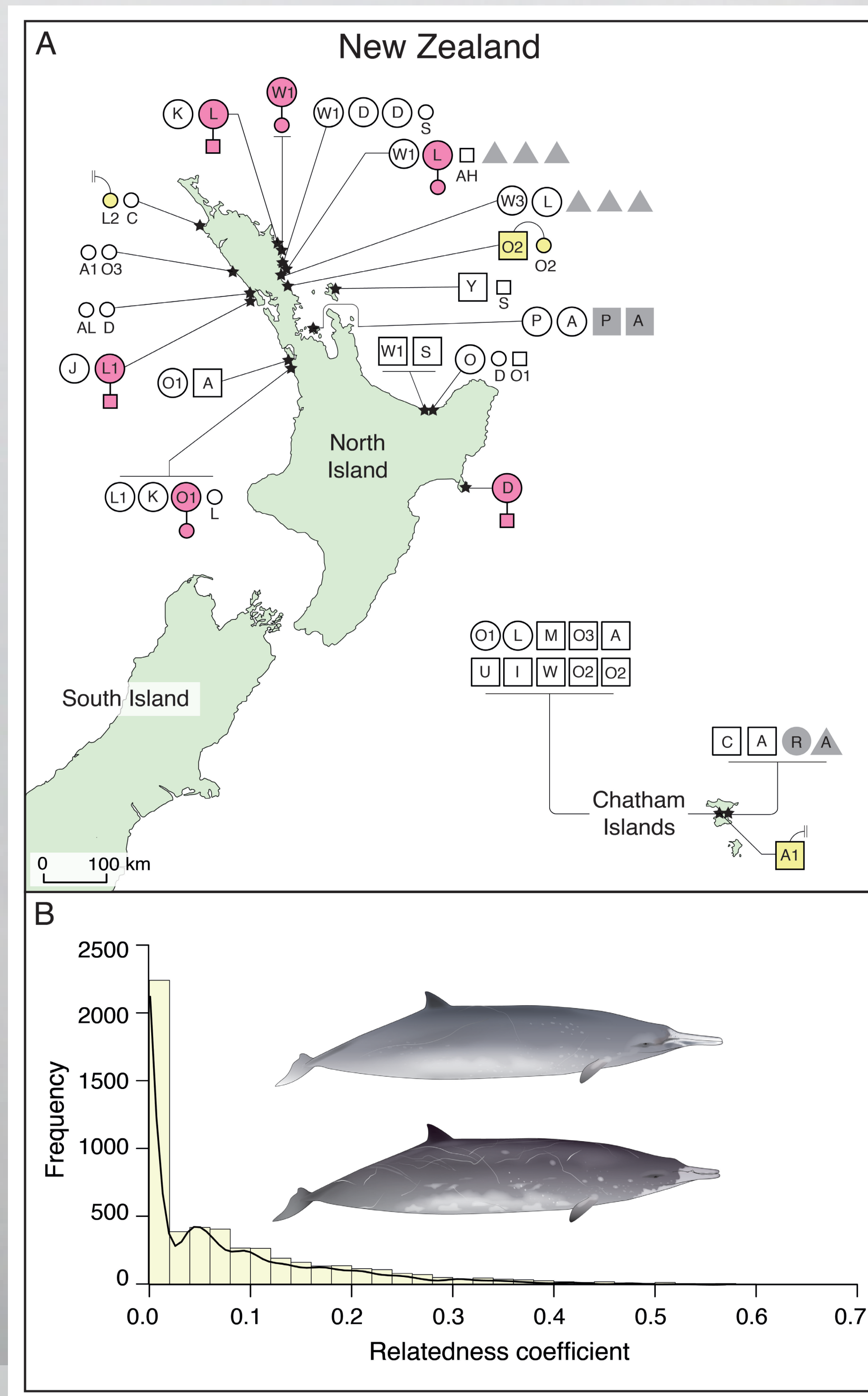


Figure 1. (A) All groups and a single stranding showing kinship relationships. Squares denote females, circles males and triangles show individuals not sexed. Grey shows individuals not genotyped, smaller symbols indicate dependents or sub-adults. Pink denotes mother-calf relationships, yellow shows half-sibs. Text with symbols indicates mtDNA haplotypes.

Figure 1. (B) Distribution of relatedness coefficients among all whales genotyped. Female (above) and male (below).