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THE NORTH ISLAND HECTOR'S DOLPHIN IS VULNERABLE TO EXTINCTION

Hector's dolphins (*Cephalorhynchus hectori*) are endemic to New Zealand. With an estimated population of fewer than 4,000 (Dawson and Slooten 1988) the species is, on the basis of current knowledge, the rarest marine dolphin. The species has a coastal distribution and a low potential for population growth (~2% per annum, Slooten and Lad 1991). Studies of mtDNA variation have shown that the species is divided into at least three (most likely four) genetically isolated, regional populations (Pichler *et al.* 1998). Photo-identification of marked individuals shows a high degree of site fidelity with an average home range of only 31 km along the coastline for individuals at Banks Peninsula (Bräger 1998). Additionally, despite high research effort, no interchange has been detected among Hector's dolphin populations off Greymouth, Westport, Jackson Bay, Kaikoura, Banks Peninsula, Moeraki, and Porpoise Bay (Bräger 1998, Fig. 1), nor at an even smaller geographic scale, between Banks Peninsula and Timaru (Martien *et al.* 1999).

High levels of incidental mortality in fisheries have been documented in the Canterbury region (Dawson 1991, Baird and Bradford 1999) and fisheries interactions are known to occur throughout the range of this species. Population modeling indicates that the species is likely to be declining in most of its range due to bycatch in gill nets (Martien *et al.* 1999). The species has been recently reclassified as Endangered; the North Island population is considered Critically Endangered (IUCN 2000). Since 1988, the Banks Peninsula Marine Mammal Sanctuary (an 1,170 km^2 area in which commercial gillnetting is effectively banned and amateur gillnetting restricted to specific times and places), has provided some protection for the Canterbury population (see Dawson and Slooten 1993 for details). To date, most information on life history, abundance, and fisheries mortality has been gathered from the South Island populations. Our purpose here is to summarize evidence that the less well-described North Island population is threatened with extinction and to bring this to the attention of scientists and managers both in New Zealand and internationally.

Genetic Distinctiveness and Declining Diversity

Analysis of mitochondrial (mt) DNA control region sequences shows that the North Island Hector's dolphin population is distinct. North Island samples, including historical samples dating to 1870, (n = 24) reveal only three mtDNA lineages (Pichler *et al.* 1998) compared to 14 in the South Island. Two of these appear to have been lost in the contemporary North Island

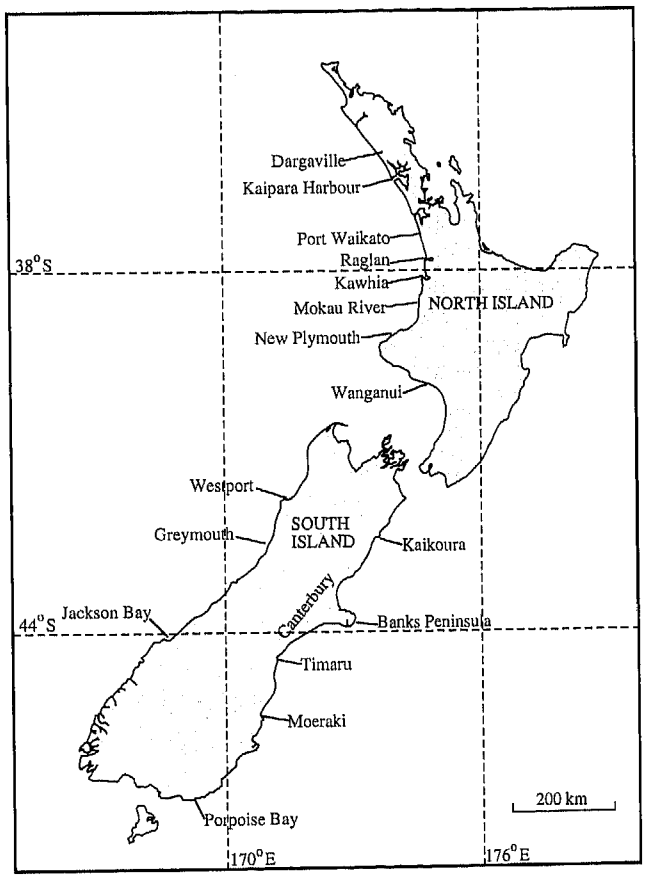

Figure 1. Map of New Zealand showing place names mentioned in text.

population (see below). The remaining lineage differs by one diagnostic nucleotide substitution from all fourteen lineages from South Island populations (Pichler *et al.* 1998). Such a distinct difference indicates very low levels of maternal geneflow (less than one female per generation) between the North and South Island populations. Further support for reproductive isolation is found at the nuclear level, where the North Island Hector's dolphins have unique microsatellite alleles at three of ten loci surveyed.[1] A further four loci of these ten have alleles that are either fixed or at high frequency in the North Island, yet are rare in South Island populations.[1]

Genetic distinctiveness over such a small geographic scale is unprecedented in marine mammals and is comparable to that found between some recognized species and subspecies of cetaceans. The two species of common dolphin, the

[1] Personal communication from F. Pitchler, D. Robineau, R. N. P. Goodall and C. S. Baker. F. Pitchler, School for Biological Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand, May 2000.

short-beaked (*Delphinus delphis*) and the long-beaked (*D. capensis*) differ by only a single fixed mtDNA control region nucleotide (Rosel *et al.* 1994). A subspecies of common dolphin in the Black Sea (*D. d. ponticus*) is also diagnosed by a single substitution in the mtDNA control region (Rosel *et al.* 1994). Three populations of right whale, considered sub-species by Rice (1998), the North Atlantic (*Baleana glacialis glacialis*), the North Pacific (*B. g. japonica*), and the Southern Ocean (*B. g. australis*) are distinguished by a small number of substitutions in the control region (Rosenbaum *et al.*, in press). Based on such comparisons and on proposed criteria for defining units of conservation, (Vogler and DeSalle 1994, Moritz 1994), we suggest the North Island Hector's dolphin should be recognized as a subspecies or Evolutionary Significant Unit.

To evaluate potential loss of genetic variation due to decline in geographic range and abundance of the North Island Hector's dolphin, Pichler and Baker (2000) extracted DNA from all known museum specimens (1870–1988, $n = 13$). Comparison of these to diversity in all contemporary samples from beachcast dolphins and skin scraping (1988–1998, $n = 11$) showed that of the three maternal lineages found in the historical sample, only one was found in the contemporary sample. Such low levels of gene diversity are seen in only a few other marine mammals, all of which have undergone precipitous population declines; the vaquita (*Phocoena sinus*) has one lineage (Rosel and Rojas-Bracho 1999), the north Atlantic right whale has five lineages (Malik *et al.* 2000) and the northern elephant seal (*Mirounga angustirostris*) has two lineages (Hoelzel *et al.* 1993). Hector's dolphin is the only one of these species for which recent loss has been established directly from historical samples.

Reduced Distribution and Low Abundance

The distribution of North Island Hector's dolphin appears to have undergone a marked reduction over the last 100 yr. Earlier this century, strandings were distributed around most of the North Island. Since 1970, when systematic records of strandings have been collected, a total of 45 individuals have been found beachcast or stranded on the North Island. Most occurred along the northwest coast from about Dargaville to Wanganui. Within this limited range, the distribution has recently contracted further. From 1970 to 1990, records show 15 beachcast dolphins from the New Plymouth area, but only one in the decade since (Russell 1999).

Results of boat surveys are consistent with this regional contraction and further show low abundance. The current distribution seems to be restricted to the area from Dargaville to the mouth of the Mokau River, with the main concentration between Kaipara Harbour and Port Waikato. Strip transect surveys in 1985 (Dawson and Slooten 1988) covered the area from the Kaipara Harbour to Wanganui. A maximum of 22 dolphins were sighted, all between Raglan and Port Waikato. After correcting for visibility and inshore coverage, the regional population was estimated to be 134 (95% bootstrap confidence interval of 55–269; Martien *et al.* 1999). Surveys of the same coastline in 1998–1999 using similar methodology sighted a maximum of 11 dolphins,

again all in the north, between Port Waikato and Kaipara. Abundance has not been calculated from these recent surveys due to uncertainties in offshore distribution and the fraction missed within the survey strip. It seems likely, however, that the population has declined and is now under 100 animals (Russell 1999).

Human Impacts

Hector's dolphins are regularly caught in (commercial and amateur) gillnet fisheries in South Island waters, with a smaller bycatch in trawl fisheries (Dawson 1990, Baird and Bradford 1999). There is direct evidence that bycatch in gill nets also occurs off the North Island. Of 45 dolphins cataloged in the stranding record, cause of death was determined for 14. Of these, seven dolphins were found with clear gillnet entanglement marks and an additional four had cut fins or slit bellies which may have been associated with removal from nets. Cause of death for the remaining three dolphins was: a blunt trauma, a breach birth/blunt trauma, and a possible shark predation (Russell 1999). The most recent net-marked dolphin found beachcast in the North Island was in 1997. Although the NZ Marine Mammal Protection Act (1978) requires reporting of fisheries-related mortality, no entangled dolphins have been reported directly to the New Zealand Department of Conservation. This has raised concern that bycatch has been going unreported.

Martien *et al.* (1999) used deterministic population models to quantify the impact of commercial gillnetting on North Island Hector's dolphins. There are no direct estimates of bycatch for the North Island population (*e.g.,* from an observer program). Quantitative bycatch estimates are available only for the Canterbury area (central east coast of the South Island). Martien *et al.* (1999) used this bycatch rate (per dolphin, per metre of net used, per year, per km^2), and applied it to estimates of dolphin abundance and gillnet effort for the North Island population. They estimated that the abundance of North Island Hector's dolphins has declined to ⅓ of the population size in 1970, when commercial gillnetting became widely established. This analysis indicates that continued commercial gillnetting would result in extinction of this population within a few decades (Martien et al. 1999). Amateur gillnetting and bycatch in trawling were not included in the model. There is no information on the level of fishing effort for recreational gillnetters. Trawling could not be included because, although Hector's dolphins are known to be caught in trawling operations (Baird and Bradford 1999), no estimate of catch rate (per trawl) is available. Therefore, the potential human impact on this population could be greater than that predicted by Martien *et al.* (1999).

A recent meeting of stakeholders (fishers, conservation groups, scientists, and government officials) concluded that mortality due to human impact must be reduced to zero to allow the population to recover. Even in the absence of human impacts the abundance of North Island Hector's dolphins will remain low and this distinct population may be vulnerable to extinction for decades to come. To reduce human impacts to the low levels required, it will be

necessary to avoid using fishing methods known to entangle dolphins (gillnetting, and to a lesser extent trawling) in areas favored by Hector's dolphins. On the basis of recent data on distribution and abundance, as reviewed here, appropriate north and south boundaries would be Dargaville and the Mokau River. More data on the distribution and abundance of the North Island population will be useful in refining the boundaries of such protected areas in future. However, delaying precautionary management while waiting for further research would substantially increase extinction risk.

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OBSERVATION OF A MALE-BIASED SEX RATIO IN THE GULF OF ST. LAWRENCE FIN WHALES (*BALAENOPTERA PHYSALUS*): TEMPORAL, GEOGRAPHICAL, OR GROUP STRUCTURE SEGREGATION?

Knowledge about the migration, behavior, and structural organization of fin whales is limited. Although fin whales (*Balaenoptera physalus*) are characterized as a migratory species, they do not seem to have a single breeding ground as found with the North Atlantic humpback whales (*Megaptera novaeangliae*) (Mattila *et al.* 1989). On the contrary, fin whales in the North Atlantic are believed to be divided into several subpopulations (Bérubé *et al.* 1998). Data on the sex of fin whales obtained from whaling records have been used to estimate the sex ratio in many areas, including the Gulf of Alaska and the Bering Sea, West Greenland, and the northwestern and northeastern North Atlantic (Aguilar and Lockyer 1987, Kapel 1979, Mitchell 1974, Tarasevich 1967). A recent study of the North Atlantic and Mediterranean Sea fin whales detected an even sex ratio for all but two sampling areas (Bérubé *et al.* 1998). The first skewed sex ratio was detected in a sample of 33 Icelandic fin whales taken during whaling operations prior to the international moratorium on