Killer whales in New Zealand waters: Status and distribution with comments on foraging.

INGRID N. VISSER

Orca Research Trust, P.O. Box 402043, Tutukaka, 0153, New Zealand. ingrid@orca.org.nz

ABSTRACT

Research on New Zealand killer whales (*Orcinus orca*) has been ongoing since 1992. Photo-identification of individuals has been the basis for estimating population abundance, range, social structure, the possibility of three sub-populations and the identification of both Type B and Type C Antarctic killer whales visiting New Zealand waters. Above and underwater observations have facilitated identification of 27 prey species. The prey consisted of four main types; rays, sharks, fin-fish and cetaceans (pinnipeds have not been identified as prey). Foraging focused primarily on rays. Threats for New Zealand killer whales include fisheries interactions, pollutants (including noise pollution), boat strikes and lack of appropriate operating procedures at stranding-rescues. Classified under the New Zealand Government's Department of Conservation scheme, killer whales are ranked as "Nationally Critical" – the highest threat ranking possible under this system.

KEYWORDS: KILLER WHALE; NEW ZEALAND; PHOTO-ID; POPULATION STRUCTURE; ABUNDANCE; DIET; STRANDING, BOAT STRIKE, FISHERIES INTERACTIONS

INTRODUCTION

This manuscript reviews the previously published data on New Zealand (NZ) killer whales (*Orcinus orca*) and incorporates additional information from difficult to access 'grey' literature, as well as presenting more recent data. The NZ killer whales were first studied in 1992 and research continues. There is no single location or region along the NZ coastline that has been identified as core habitat for NZ killer whales, such as that identified for the 'Resident' type killer whales off British Columbia and Washington State (*e.g.,* Ford *et al.* 1994), therefore, it is not feasible to base the research out of just one area.

Nonetheless, it is possible to determine areas that the killer whales frequent more often, and these are predominately where they forage for elasmobranchs (Visser 1999a). This long-term research project has provided baseline information about NZ killer whales, including identification of a wide range of new prey species, identification of threats to killer whales in NZ waters, as well as recording Antarctic killer whales (Type B and Type C) in NZ waters.

METHODS

The results presented here encompass two main time frames (pre- and post-1997). The pre-1997 period was the focus of a PhD study by the author (Visser 2000b) and the second encompassed 1997 to the present day. For both time frames methods followed Visser (2000b), however for clarity some methods are described in detail here.

For both time frames the study area covered the coast of NZ out to approximately 20 miles offshore and included the offshore island groups; the Kermadec, Three Kings, Chatham, Antipodes, Snares, Auckland and Campbell Islands. The coastline of the main NZ islands is 15,650 km long (Statistics 1997), and for the purpose of this study, was divided into six Regions (Fig. 1), based loosely on naturally occurring boundaries created by geographical features. Offshore Islands were not given a Regional number, but designated as 'Offshore Islands'.

When killer whales were encountered the following data were collected; date of sighting, location, depth, water temperature, number of animals present, direction of travel, behaviour (visually observed and opportunistically photographed and recorded onto video). Additionally, photographs of individuals (dorsal fins, saddle-patches and eye-patches) (Visser & Mäkeläinen 2000), resulted in a photo-identification (photo-ID) catalogue. Photographs allowed individual identification as well as age/sex

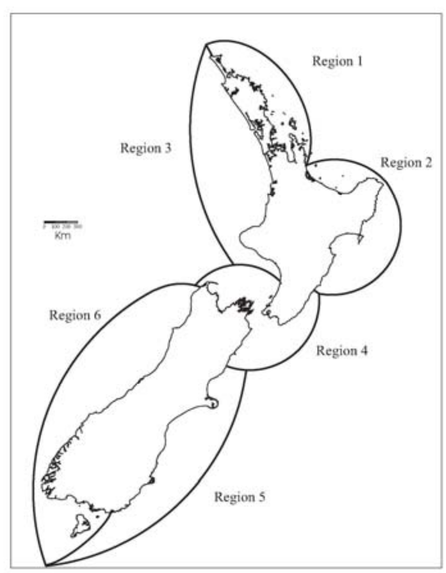


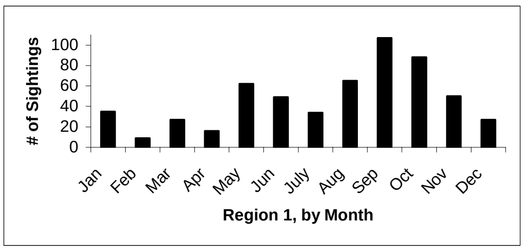
Figure 1. Regional divisions (1-6) of the New Zealand coast.

classification. Observations, photographs and video were collected both above- and under-water. Under-water observations facilitated sexing individuals as well as interpreting foraging behaviour (*e.g.,* Visser *et al.* 2000). Sighting data of identifiable animals came exclusively from photographs, not from individuals recognised in the field without being photographed. The information from photo-ID's was used to identify the distribution and range of individual killer whales and to assess if there were potential sub-populations, perhaps divided geographically. A Modified Jolly-Seber model (Buckland 1980 & 1990) was used to calculate a population estimate.

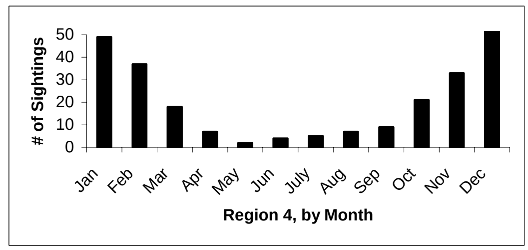
RESULTS & DISCUSSIONS

Distribution and Stock Structure

A total of 3269 killer whale sighting reports were collated. Reports for each Region were plotted to determine monthly distribution. Overall, few real patterns emerged, except Region One (Fig. 2a) and Region Four (Fig. 2b) appear to reflect a shift in distribution (*i.e.,* killer whales were more likely to be seen in Region One during September and October, and in Region Four during November to February).



(a)



(b)

Figure 2. Monthly distribution of killer whale sightings; (a) Region 1 (*n* = 569), (b) Region 4 (*n* = 247) (1985-1997). Preliminary analysis of the post-1997 data reflects similar monthly distributions.

Using the pre-1997 data, 50 individuals were seen more than five times. Their home ranges were plotted and potential sub-populations were suggested (Fig. 3). As the sample size was small, it was not possible to establish the biological significance of these differences, nonetheless, to attempt to ascertain if these potential sub-populations were a facet of distribution data only or if these groups were also reproductively isolated, preliminary genetic (mtDNA) analysis was conducted. Two tissue samples from killer whales off North Island were analysed for relatedness and found to differ by 1bp out of 995bp from the mtDNA control region (Hoelzel and Visser, unpubl. data). While this does not appear to be a high level of differentiation, haplotypes in killer whale populations in other parts of the world tend to be fixed, *i.e.,* each killer whale shares the same haplotype (Hoelzel *et al.* 1998), therefore even a 1bp difference indicates the two animals were from different matrilines and probably from different populations (R. Hoelzel, pers. comm.). One of these two killer whales sampled, live-stranded and was identified from the North-Island-only sub-population, but the other could not be identified. However, both samples were taken from locations only approximately 120 km apart (and collected in 1997 and 1998) (Visser 2000b).

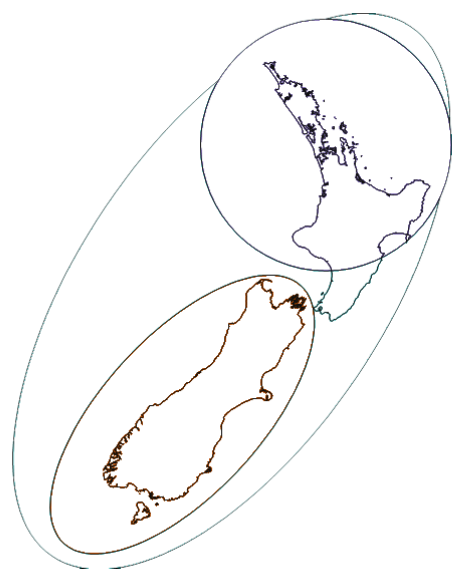


Figure 3. Graphical representation of distribution of three proposed sub-populations of New Zealand killer whales

The limited acoustic studies conducted indicate that the NZ killer whales have distinct calls, perhaps suggesting isolation of the NZ population(s), however there may be some call sharing across pods (J K B Ford pers. comm., Visser unpubl. data)

There is the possibility that the killer whales found in NZ waters move into adjoining or nearby territorial waters (*e.g.,* Australia or Papua New Guinea), however to date no matches have been made between these locations

(Visser & Bonaccorso 2003, Visser unpubl. data). One killer whale regularly observed in NZ waters has a very distinctive dorsal fin and a killer whale in Australian waters has a similar fin, which has resulted in unsubstantiated anecdotal reports of exchanges between the two populations.

Despite the relatively high numbers of killer whale sightings at other Sub-Antarctic Islands such as the Crozet Archipelago, Marion Island and the relatively close Macquarie Island (Condy *et al.* 1978, Copson 1994, Guinet & Bouvier 1995), only 16 sighting have been recorded from all of NZ's offshore islands (Sorensen 1950, Visser 2000b). It has been suggested that killer whales from NZ waters may migrate to, or from Antarctic waters (Kasamatsu & Joyce 1995, Mikhalev *et al.* 1981, Visser 1999a). Pitman and Ensor (2003) suggested that a group of killer whales stranded on the east coast of North Island in 1955 were Antarctic Type C killer whales, based on their eye-patches (*e.g.,* see Fig. 4 herein and Fig. 5 in Visser & Mäkeläinen 2000), however pigmentation patterns differed to that of other Type C records (e.g., see Berghan & Visser 2001, Pitman & Ensor 2003). All 17 animals were shot and buried, however some skeletal material was retained. Genetic analysis of this material is currently underway and may help clarify which stock they originated from.

Figure 4. Four killer whales from a 1955 mass stranding of 17 animals, on North Island, New Zealand. Note exceptionally small eye-patches, and overall 'fusiform' shape.
(Photo: 12 May 1955, Orca Research Trust Archives / Te Papa Museum, Wellington)

Visser (1999a) recorded a group of 'Type B' Antarctic killer whales (field-marks as described by (Pitman & Ensor 2003), whereby they were grey and white with dorsal capes and large eye-patches). These killer whales were sighted in May 1997 (the austral autumn) and were travelling from the north. They had fresh wounds and healed scars which were oval in shape and were presumed to be from cookie cutter shark bites (*Isistius sp.*) (Visser 1999a). No matches were made to other animals in the Antarctic Killer Whale Identification Catalogue (Berghan & Visser 2001). Since 1997 three additional sightings of Antarctic killer whales have been made, however these were 'Type C' animals (field-marks as described by (Pitman & Ensor 2003), whereby the killer whales were grey and white with dorsal capes and small eye-patches) as well as fresh wounds and healed scars, again, indicative of cookie cutter shark bites. Photo-identification matches were made between two of these additional sightings (with one probable match to the third sighting) (Visser unpubl. data), indicating that these visits to NZ waters may be more than just random occurrences. No matches were made to other animals in the Antarctic Killer Whale Identification Catalogue (Berghan & Visser 2001).

Sightings of killer whales passing through NZ waters raise complex and ecologically relevant management issues. The potential exists for cross breeding of different sub-populations, thereby increasing the size of the total meta-population. However, killer whales from different sub-populations are not thought to mix (Morton 1988) and may act antagonistically toward each other (Ford & Ellis 1999, Shore 1995).

Abundance

A Modified Jolly-Seber model (Buckland 1980, Buckland 1990) was used to calculate a population estimate in 1996 of 107 killer whale (± 24 SE), (with a 95% confidence interval). This small population appears to be further subdivided, based on distribution data (Visser 2000b, and see above).

Between 1992-1997, 117 NZ killer whales were photo-identified, however this is an accumulative total and does not take into account migration nor deaths. Although some carcasses have been recovered, photographs were poor quality and could not be matched to any animals in the catalogue. Of the 117 catalogued animals, 75% (*n* = 88) were identified on more than two occasions, 42% (*n* = 50) were identified on more than five occasions between 1992-1997 and 12% (*n* = 14) were identified on more than 10 occasions (range = 1-30). The mean number of sightings for the 117 photo-identified animals was 5.4, (M_o = 1, M_d = 9.5). Although some individuals were seen irregularly, others were seen regularly (up to 11 times in one year). Excluding the 29 animals that were only sighted once, the mean temporal sighting range was 4.7 years (M_o = 4, M_d = 8.5) with one killer whale (NZ1) seen over a 20-year period. The NZ killer whales travel, on average, 100-150km per day.

By 2006 the Photo-ID catalogue included 132 animals. Despite some killer whales not being resighted for a substantial period (*i.e.,* greater than five years), the uncertainty of death of an individual based on a lack of resighting information alone is not sufficient to remove it from the catalogue. Two examples illustrate this phenomenon of infrequent resightings (and longevity); one NZ killer whale (catalogue # NZ1), was first recorded in 1977, and was not seen again until 1989 (12 years). She was then photographed in 1990 and 1991, but not resighted again until 1994. After 1994, she was photographed each consecutive year up to and including 1997 (Visser 2000b). Subsequently she was resighted in 1999, and not again until 2005 and 2006.

The high resighting rate of some NZ killer whales indicates these animals are likely to live permanently or semi-permanently around the NZ coastline. The implications of a small population(s) could raise issues from a management perspective and suggests that the NZ killer whale population requires attention.

Directed Takes

There are no current directed takes of killer whales in NZ inshore waters. In the past whaling has accounted for at least 41 individual killer whales taken, primarily from the offshore whaling industry (*e.g.,* see Mikhalev *et al.* (1981) for animals taken in the area which includes NZ Territorial waters and the NZ Ross Dependency (Hatherton 1990)). Shore-based whaling took at least six killer whales (the Tory Channel and Tauranga areas took at least three each) (Unpubl. data, Archives of the Picton Museum).

Incidental Takes

Eight killer whales have been injured or killed as a result of interactions with vessels (Visser 1999c, Visser 2000b, Visser & Fertl 2000, Visser unpubl. data). Shootings have occurred in association with the long-line fisheries (Visser 2000a) and killer whales at the northern NZ fishing grounds have been photo-identified with wounds, in one case perhaps from a fishing gaff, which appeared to have opened a flap about 40 x 40cm, exposing the internal organs as the animal swam and the flap moved (Visser, unpubl. data). In another instance a killer whale was hooked in the back and hauled alongside the vessel, where it was cut free (with the fishing gear still embedded) (Visser 2000b). It is uncertain if either of these animals survived, as they have not been resighted. 'Tuna bombs' (underwater explosives) have been used in NZ waters in attempts to deter killer whales from removing fish from fishing equipment (Visser 2000a), however, these were not successful and the killer whales continued to patrol the fishing gear from a deeper or more distant location and still removed fish.

Incidental and accidental net and line entanglements have occurred; at least five NZ killer whales in the identification catalogue have scars attributed to entanglements At least six killer whales have died from entanglement – one in a gillnet (Donoghue 1994) and the others in assorted fishing gear (Cawthorn 1981, Donoghue 1995, Visser 2000b, Visser unpubl. data). It is highly likely, given that killer whale carcasses tend to sink (Dahlheim and Matkin 1994), that there are more deaths due to entanglements which go undetected.

Habitat Degradation

Given that the NZ killer whales forage extensively inside enclosed harbours they are affected by harbour developments such as dredging, retaining walls, small-boat marinas, port developments and aquaculture. All of these will effect the quality (and quantity) of foraging habitat, primarily for benthic foraging, *e.g.,* see Visser (1999b) and will have additional impacts such as noise pollution and water quality degradation.

Noise pollution is of concern as the number of vessels around NZ increases (see below). Additionally, the proposal of marine turbines (underwater power generators driven by tidal flows) in critical habitats will affect all cetaceans in these areas. Anthropogenic noise has been shown to displace killer whales (Morton & Symonds 2002). One current proposal in NZ is to install up to 200 1Mega-Watt marine turbines in a narrow harbour entrance (2006 Resource Consent Application by Crest Energy, unpubl. data), which leads into known critical habitat for NZ killer whales.

In NZ, killer whales are known to forage extensively in areas that are suitable for marine farms (Visser 1999b, Visser 2000b, A. N. Baker unpubl. data & pers com, Visser unpubl. data). The NZ Northland Regional Council (NRC; which covers the coastal zone between 34º 25'S and 36º 05'S) has an 'open' policy on Aquaculture Management Area applications, *i.e.,* all applications in all areas will be considered. In 2004 alone, 19 applications were received, 10 of which were for inter-tidal oyster farms, seven for longline mussel farms and two for fin-fish farms. This is only one of 12 Regional Councils in NZ that may receive aquaculture applications.

The potential negative effects of aquaculture on marine mammals were summed up into five main areas by Lloyd (2003). Of those, changed foraging success and exclusion from habitat are most likely to directly affect the NZ killer whales. It is recognised that aquaculture may compete with marine mammals for space in the coastal environment (Lloyd 2003, Würsig & Gailey 2002). NZ killer whales are known to avoid entering marine farm areas (Visser unpubl. data), which in some locations may cover extensive parts of the coastline. For example, the Marlborough Sounds, which killer whales frequent regularly, had 455 mussel farms by the year 2000 (Gall *et al.* 2000). Prey, primarily rays, are known to avoid foraging killer whales (Visser unpubl. data) and aquaculture structures provide havens. This directly impacts on the foraging success of the killer whales, as the physical nature of some of these structures excludes killer whales, and thereby prevents them foraging. Intense husbandry of filtering marine organisms (*e.g.,* molluscs) reduces the quantity of particles in the water column (Lloyd 2003, Robinson *et al.* 2002). This could have a direct impact on the naturally occurring molluscs of the area. Given that the main prey for NZ killer whales are rays, which feed primarily on molluscs (Montgomery & Skipworth 1997), this form of habitat degradation is of concern.

The NZ killer whales extensively use estuarine areas as well as main harbours (Visser 1999b, Visser 2000b), and these areas are typically adjacent to industrial and other anthropogenic sources of pollution (*e.g.,* run-off from storm water drains, untreated sewage). Coastal development in these areas is likely to result in further habitat degradation. Slow-leaching anti-fouling agents (used on the bottom of commercial and recreational vessels) are likely to accumulate in harbours where water currents are minimal, yet habitat use by the killer whales is high. Additionally, as pointed out above, the main prey type, *i.e.,* rays, feed in these same areas. The long lifespan of killer whales (50+ years, Bigg 1982, Olesiuk & Bigg 1988, Olesiuk et al. 2005) and their trophic levels result in high levels of bioaccumulation of pollutants and heavy metals (Krahn *et al.* 2006, Ross *et al.* 2000, Ross 2006). In an Australian study with over 180 samples, from nine species of cetaceans, a neonate killer whale had the highest total DDT in its blubber (28.4 ppm) (Kemper *et al.* 1994). No analyses have been conducted to investigate the levels of bioaccumulated or biomagnified toxins and heavy metals in NZ killer whales.

NZ killer whales frequent areas with high shipping usage, where oil spills from grounded vessels or chemicals dumped from bilges (Johnson 1999) are a threat. NZ has a number of offshore oil rigs and personnel have reported killer whales in their vicinity. They also regularly frequent the Whangarei Harbour where an oil refinery is located.

Over-fishing of commercial fish stocks is recognised around the world. Interactions between NZ killer whales and fisheries has spread since data was first published, with interactions reported off the west coast of South Island and North Island (Visser 2000a, Visser unpubl. data).

Life History

The longest resighting period for a NZ ♀ killer whale (including pre-1997 data) was 29 years (1977-2006). She was an adult when first identified and, using life history estimates from other populations (*e.g.,* see Olesiuk *et al.* 1990, Olesiuk et al. 2005), she was presumed to be a minimum of 12-14 years old in 1977. During November 2005 this same killer whale was observed to suckle a neonate (presumed to be her calf), indicating that she was still reproductively viable at 40-42 years old. This ♀ killer whale was resighted a total of 27 times (1977-2006).

The longest resighting period (including pre-1997 data) for a ♂ NZ killer whale (NZ6) was 17 years (1990-2007). He was an adult when first photographed and, using life history estimates from other populations (*e.g.,* see Olesiuk et al. 1990, Olesiuk et al. 2005), he was presumed to be a minimum of 11-18 years old in 1990. This male was seen a total of 46 times (1990-2006).

The known maximum length (recorded from strandings) for NZ killer whales is ♀ = 6.5 m, ♂ = 7.7 m. Calves have been observed during all months of the year, but are more frequently seen in the austral autumn-winter months. Neonate calf (*i.e.,* with foetal folds and/or yellow colouration) strandings have been most prevalent in April, when three out of a total of 10 stranded neonates were recorded between 1975-2007.

Ecology

Twenty-seven species of prey have been recorded in the NZ killer whale diet. Of these, 11 have not been recorded elsewhere. The prey consisted of four main types; rays, sharks, fin-fish and cetaceans, although other prey types (birds, cephalopods and coelenterates) were occasionally taken. Pinnipeds have not been identified as prey. Rays were the most common prey type, by number of individual killer whales foraging and by the number of rays taken. There is very little, if anything, known about the movements of any of the ray species found in NZ waters. This lack of data adds to the uncertainty of maintenance and management of the killer whale population(s).

In NZ, the typical killer whale group size (*i.e.,* 12 killer whales) falls between the typical group size of killer whales from the Pacific North East; 'Transients' (3 killer whales) who are primarily carnivorous and 'Residents' (20 killer whales) who are primarily piscivorous (Baird 1994, Baird & Dill 1996, Bigg 1982, Bigg *et al.* 1987, Ford et al. 1998). Therefore, group size in NZ killer whales may be a function of foraging strategies and prey (Visser 2000b), as was found for killer whales by Baird & Dill (1996).

One of the three proposed NZ sub-populations (see above) appears to be generalist or opportunistic foragers, feeding on all four prey types, another sub-population slightly less so, feeding on three prey types and the third sub-population appears to be a specialist forager, taking only one prey type (cetaceans) killer whales.

In comparison to other areas, NZ has a high rate of killer whale strandings including mass-strandings (≥ 3 animals). Between *circa* 1922-2006 NZ has recorded 44 killer whale strandings which involved at least 80 animals (Anonymous 2007, Visser 2000b, Visser unpubl. data). Live strandings involved 40 killer whales, of which 19 were refloated (either rescued or self-rescued) and eight of these have been resighted on multiple occasions and over long-term time frames (> 10yrs). One juvenile killer whale (NZ63), stranded in 1993 and had her first calf in 2001 (both mother and calf have been resighted every year since). The resightings of numerous previously-stranded NZ killer whales suggests that stranded killer whales should be considered viable.

The largest mass-stranding of NZ killer whales was 17 animals, followed by 12 and then four individuals. Since 1972, NZ has records of five mass-stranding events (involving 25 killer whales) (Anonymous 2007, Visser unpubl. data). NZ Killer whales have remained alive on the beach for up to 23 hours and have been successfully rescued and resighted (Visser & Fertl 2000). It has been shown that NZ cetacean strandings do not relate to lunar phases (Bates 1995) nor geomagnetic topography (Brabyn 1994). However, all records where location was known show NZ killer whale strandings occurred on shallow sandy beaches or harbour sandbars, indicating a link to foraging, as this type of habitat is conducive to benthic foraging for rays (Visser 1999b).

Twenty-one killer whales which live-stranded on NZ shores were shot by authorized personnel. The 'Standard Operating Procedure' for NZ killer whales (Department of Conservation 2005) needs to be urgently reassessed and revised, in particular the section on single-animal euthanasia.

Other

Under the Marine Mammals Protection Act (1978), administered by the NZ Department of Conservation, the first marine mammal tourism permit in NZ waters was issued in 1987, for the Kaikoura coast (East coast of South Island). By 1992 (the date this study was instigated), 16 permits had been issued around the country and by mid 1999 the number had increased to 74 in over 26 sites nationally. With a further five permits issued in Northland alone (and two more applications submitted) the potential for disturbance to marine mammals increased significantly (Visser 2000b).

Status

When first classified in 1997, despite insufficient data and only anecdotal reports of sightings, distribution and abundance, the NZ population of killer whales was given the erroneous category of ‘Common’ (Taylor & Smith 1997). Reclassification, following the work of Visser (2000b), to NZ’s highest threat ranking, *i.e.,* ‘Nationally Critical’ (equivalent to the status of Critically Endangered in the IUCN Red Data listing) had two caveats which made erroneous assumptions; (1) that the species was Secure overseas; and (2) the species was Nationally Stable . These caveats should be removed.

Conclusions

Thirty percent of NZ’s land has been reserved for biodiversity (Anonymous 1998), but marine reserves are few with only 0.1 % of the territorial seas around the main islands of NZ fully protected (Parliamentary Commissioner for the Environment 1999). Moreover, these include only one small (less than 2 km^2) area inside a harbour where killer whales are known to feed on rays. Consideration of reserving greater marine areas, including harbours, would potentially assist killer whales and a wide range of other marine biodiversity. These would also help limit the spread of aquaculture which is encroaching on critical killer whale habitat. Research on population sizes and ecology of rays could also assist in the management of NZ killer whale populations.

Although the NZ population(s) of killer whale is/are most likely part of a total world meta-population, as only one migrant per generation is considered enough to connect a population to others (Mills & Allendorf 1996) the local population(s) is/are small. They are certainly well below the 500 individuals suggested by Soulé (1987) as necessary for a viable population. As the overall NZ killer whale population appears to be further divided into sub-populations, the risk of local extinction may be high. Caughley (1994) pointed out that small populations may face threat from extinction due to the intrinsic nature of the size of the population. Even if the NZ killer whales are not subdivided into separate populations, their overall small numbers warrant a declared Conservation Management Plan. This should primarily focus on mitigation of the impacts that are threats to the population; *i.e.,* 1) Fisheries Interactions (prey reduction, entanglement, determent methods), 2) Habitat Degradation (aquaculture, noise pollution, pollution), 3) Vessel Interactions (boat strikes) and 4) Stranding Rescue Procedures (euthanasia of single animals, level of response).

Table 1. Summary of species as prey for New Zealand killer whales (*n* = 26 species)

Of note is that no pinnipeds (although abundant) and only one species of penguin (although 13 species are found in New Zealand waters) have been observed as prey.

Prey Type	Prey species taken in NZ, and recorded elsewhere	Prey species only recorded in New Zealand	Total # of species in NZ	Source
Coelenterates	salp, unidentified species		1	(Visser 2000b)
Molluscs	octopus, unidentified species		1	(Visser 2000b)
Rays		short tailed stingray, *Dasyatis brevicaudatus* long tailed stingray, *Dasyatis thetidis* eagle ray, *Myliobatis tenuicaudatus* torpedo ray, *Torpedo fairchildi*	4	(Visser 1999b) (Fertl *et al.* 1996) (Visser 2000b)
Sharks	blue shark, *Prionace glauca* basking shark, *Cetorhinus maximus*	mako shark, *Isurus oxyrinchus* school shark, *Galeorhinus galeus* thresher shark, *Alopias vulpinus* smooth-hammerhead shark, *Sphyrna zygaena*	6	S. Dawson, pers. comm. (Visser 2000a) (Visser 2000b) (Visser et al. 2000) (Visser 2005)
Fin-Fish	yellow fin tuna, *Thunnus albacares* sunfish, *Mola mola* Swordfish (unknown species) two unidentified species	bluenose, *Hyperoglyphe antarchia* kahawai, *Arripis trutta*	7	(Visser 2000a) (Visser 2000b) Visser (unpubl. data)
Cetaceans	common dolphin, *Delphinus delphis* bottlenose dolphin, *Tursiops truncatus* sperm whale, *Physeter macrocephalus* pilot whale, *Globicephala melas* humpback whale, *Megaptera novaeangliae* southern right whale, *Eubalaena australis* Bryde's whale *Balaenoptera edeni*	dusky dolphin, *Lagenorhynchus obscurus*	8	(Constantine *et al.* 1998) (Sorensen 1950) (Visser 1999d) Visser & Wiseman (unpubl. data)
Pinnipeds			None verified	(Visser 2000b)
Birds		blue penguin, *Eudyptula minor*	1	(Visser 2000b)
TOTAL	**16**	**11**	**27**	

ACKNOWLEDGEMENTS

Financial support for this research was provided by various sponsors, supporters and funding agencies (see www.orcaresearch.org). Thanks to Emer Rogan and Jemma Miller for their support and assistance. Alan Baker assisted with references for Aquaculture. Jo Berghan and Philippa Brakes kindly provided comments to improve the manuscript. This research was carried out under a permit issued by the Department of Conservation, NZ.

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