

Short communication

Propeller scars on and known home range of two orca (*Orcinus orca*) in New Zealand waters

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Abstract Two orca (*Orcinus orca*, Linnaeus, 1758), photo-identified as part of an ongoing study in New Zealand waters, have a series of deep scars in their dorsal lumbar-caudal regions which suggests they were caused by propellers. One of the animals, first noted to have the scars in 1982, is considerably smaller than an adult of similar age. The known home range of these orca are presented. A third orca hit by a boat is presumed dead.

Keywords *Orcinus orca*; boat strikes; propellers; New Zealand; photo-identification; stunted growth; epimeletic behaviour; home range

INTRODUCTION

Management of any species is only effective if scientific knowledge of the species is available to develop relevant policies. In turn, these policies will only be successful if continued monitoring can provide feedback for reviewing target policy. One standard method used to increase the scientific knowledge of cetaceans is photo-identification. Generally, natural markings or scars are used to identify individuals and photographs are taken to record and monitor changes or stability of these marks (Hammond et al. 1990).

There are many ways in which cetaceans gain these identifying marks and scars including bites from sharks (Corkeron et al. 1987), bites from cookie cutter sharks (*Isistius brasiliensis*), (Balcomb 1989; Gasparini 1996), intraspecific interactions (Heyning 1984; Clarke & Paliza 1988), interspecific interactions (McCann 1974; Campbell et al. 1988), barnacles (Greenwood et al. 1974), ulcers (Greenwood et al. 1974), lampreys (*Entosphenus tridentatus*) (Mead et al. 1982), parasitic copepods (*Penella* sp.) (Ivashin & Golubovsky 1978), cephalopods (McCann 1974), and remora (McCann 1974).

Some cetaceans also bear human induced scars from entanglement in nets and fishing line (Kuiken 1994; Guenther et al. 1995), bullet wounds (Dahlheim & Matkin 1994; Visser unpubl. data), branding (Scott et al. 1990), and injuries caused by collisions with boat propellers (George et al. 1994; Wells & Scott 1997).

RESULTS

One hundred and seventeen individual orca (*Orcinus orca*, Linnaeus, 1758) have been photo-identified as part of an ongoing study of the New Zealand population (Visser 1999). Two of these orca have deep scars on their dorsal lumbar-caudal regions, which are presumed to have been caused by boat propellers. Catalogue numbers (and names) are NZ25 ("Prop") and NZ51 ("Dian"). Details of each follow.

NZ25

NZ25 was first photo-identified as an adult animal in 1982. This orca is assumed to be a female, as its fin has not "sprouted" in the intervening 15 years. Sprouting refers to the period of fin growth which occurs as male orca approach sexual maturity and is thought to occur at c. 10–12 years of age (Bigg 1982). The fin grows at an increased rate after this age, until maturity, where the fin may attain heights of up to 2 m (Bigg 1982).



Fig. 1 Orca (*Orcinus orca*) NZ25 with incisions in the dorsal lumbar region. These extend into the light grey pigment area known as the "saddle patch". It appears that some healing has occurred as a dark area is visible near the lower section of the anterior incision.

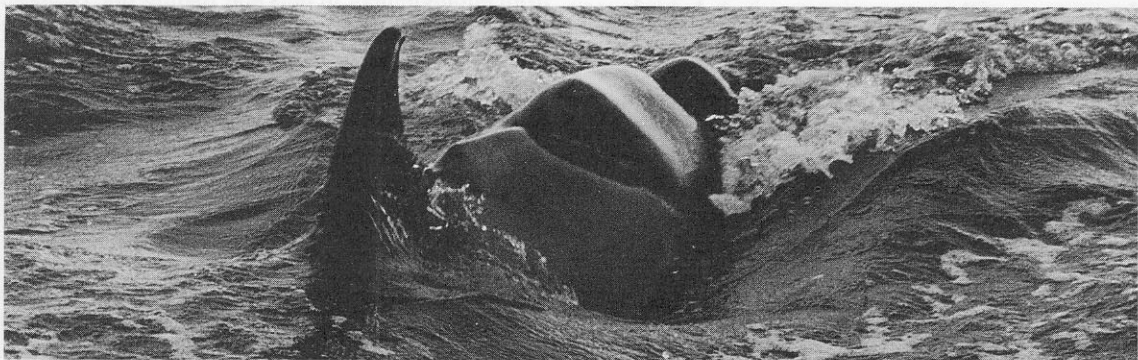


Fig. 2 Front view of orca (*Orcinus orca*) NZ25, showing depth of incisions of scars.

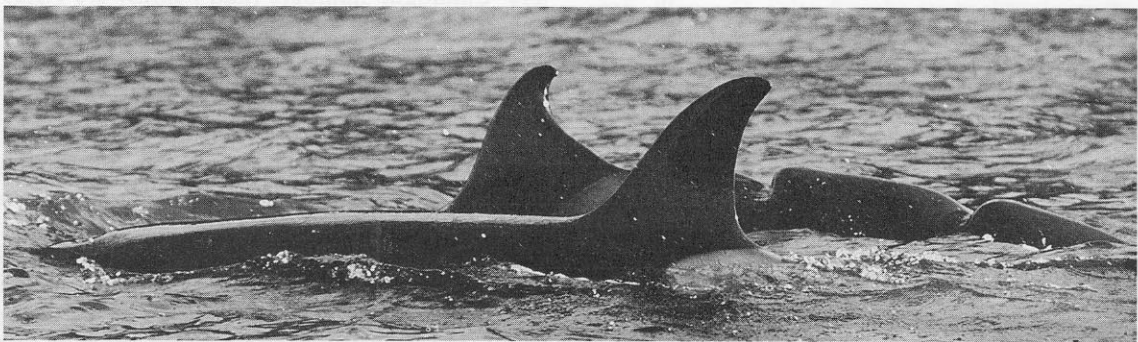
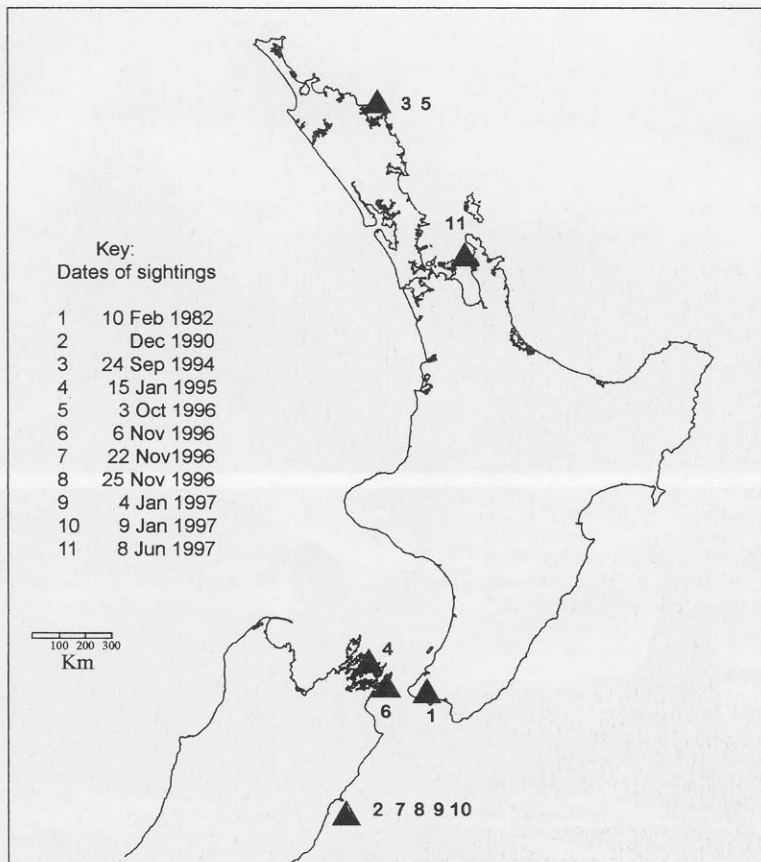


Fig. 3 Two adult female orca (*Orcinus orca*) showing small and misshapen fin of NZ25 (rear orca) when compared to a "normal" fin.

Fig. 4 Location of sightings of orca (*Orcinus orca*) NZ25 ("Prop") ($n = 11$) from 1982 to 1997.



NZ25 has three deep V-shaped cuts in the dorso-lumbar region. Generally, only two of the cuts are visible at any one time, as the third is on the posterior portion of the tail stock. Each is deep enough to be clearly seen, and although healed, large pieces of flesh are obviously missing. When viewed laterally, the cuts appear to penetrate almost to the spinal column. The anterior of the incisions protrudes into the light grey pigment area known as the "saddle patch" (Fig. 1). It appears that during the healing process some closing of this wound has occurred as a dark area is visible near the lower section of the scar (Fig. 1), suggesting the cut may have originally been deeper. When viewed from the front the depth of these cuts is apparent (Fig. 2).

NZ25 is considerably smaller than orca of similar age in the New Zealand population. She is at least 15 years old (and may be much older), and therefore she should fall into the length category of 5–6 m

(Bigg 1982). From observations of her next to other orca, and next to the research boat, she is estimated to be no longer than 4.5 m. The fin of NZ25 is also considerably smaller than the fin of a female orca estimated to be of similar age (Fig. 3). Bigg (1982) estimates that an orca of NZ25's length (regardless of age) should have a fin some where between 0.3 and 0.45 m in height, but it is estimated that her fin is no more than 0.3 m. The other female in Fig. 3 is estimated to be c. 5.7 m long, and her fin, according to Bigg (1982), should be somewhere between 0.6 and 0.75 m, which is consistent with observations made in the field (Fig. 3). It is also obvious that the fin of NZ25 is misshapen, in that it is hooked over, and more in line with the shape of an orca calf fin, than that of an adult.

From the size of the animal and the size and shape of her fin, I have made the assumption that the injury may have occurred whilst she was reasonably young



Fig. 5 Orca (*Orcinus orca*) NZ51, incisions in the dorsal caudal peduncle region are more posterior when compared to NZ25.

and therefore it is likely that energy was used to repair the injury, rather than develop body and fin size (Robbins 1993).

NZ25 has been resighted on 11 occasions during a 15-year period (1982–97) (Fig. 4). The minimum distance that she would have travelled between the northern most sightings (Bay of Islands, sightings 1 and 3) and the southern most sightings (Kaikoura, sightings 2, 8, 7, 9, and 10) is 3900 km. However, she has been resighted in the Bay of Islands on two occasions, and off the Kaikoura coast on five occasions. Therefore the minimum distance reported here should be multiplied at least 4 times. Taking into account the temporal spacing of these sightings, NZ25 has travelled a minimum distance of 15600 km in 6 years.

On 3 October 1996, NZ25 was photographed near the Bay of Islands (sighting 5, Fig. 4). Thirty-four days later she was photographed in the Marlborough

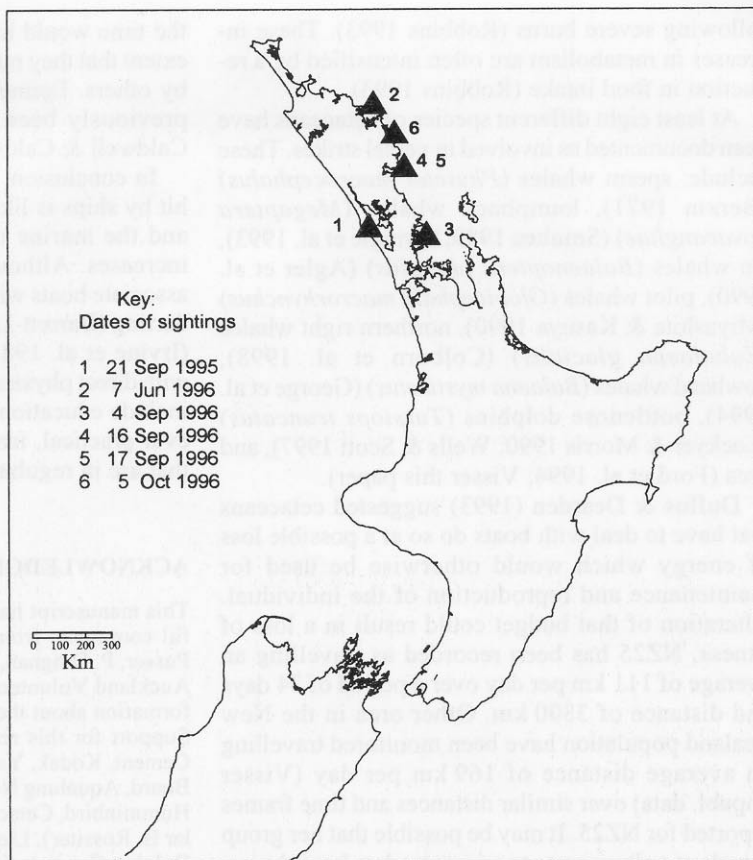
Sounds (sighting 6, Fig. 4), a minimum distance of 3800 km. From this it can be calculated that she was travelling 111 km per day, on average.

NZ51

NZ51 has two cuts in her dorso-caudal region that are further down the tail stock (Fig. 5) when compared to those on NZ25. The anterior cut is the deeper of the two (Fig. 5). She had a calf accompany her on each of the six occasions she has been sighted, suggesting she is an adult female of at least 7 years old (Bigg 1982).

NZ51 was first sighted on 21 September 1995 and has been resighted on five other occasions during a 15-month period (1995–96). She has been sighted on the west coast of the North Island, in the Kaipara Harbour (sighting 1, Fig. 6) and on five occasions

Fig. 6 Location of sightings of orca (*Orcinus orca*) NZ51 ("Dian") ($n = 6$) from 1995 to 1996.



on the east coast. The minimum distance travelled between the Kaipara Harbour and Kawau Channel (sighting 3, Fig. 6) is 2100 km, assuming she took the shortest route and travelled around the northern tip of the island. Had she travelled around the southern tip the minimum distance is 5100 km. Individuals have been known to travel from Waitemata Harbour (Auckland) to Wellington Harbour in 11 days (Visser unpubl. data), therefore either scenario is feasible.

Unidentified orca

One other orca (a juvenile) is known to have been hit by a boat in New Zealand waters. The incident occurred on the 11 September 1993, in the outer Waitemata Harbour. A boat approached a group of orca and while orca were being observed near the bow, the boat hit a juvenile animal at the stern. The boat reported the strike to Coastguard and later reported that the propeller shaft had to be straightened after hitting the orca (T. Chappel, Auckland Coast Guard pers. comm.). The orca was bleeding

profusely from wounds on its head and back. Soon after the strike it was seen to slowly submerge and after 15 min it had not resurfaced. Other orca repeatedly dove in the location where it was seen to submerge (T. Chappel, Auckland Coast Guard, pers. comm.). This animal was presumed to have died from the vessel strike.

DISCUSSION

Although whales and dolphins are generally considered to be accustomed to swimming in close proximity to boats and ships without striking and injuring themselves on the propellers, scars on animals, such as those reported here, indicate that accidents do happen, and can cause severe damage to the animal. The injuries caused by boat propellers are often significant and may cause death (Sergeant 1979). Injuries markedly increase metabolism, for example; energy expenditure increases from 7 to 33% during the healing of bone fractures and up to 125%

following severe burns (Robbins 1993). These increases in metabolism are often intensified by a reduction in food intake (Robbins 1993).

At least eight different species of cetaceans have been documented as involved in vessel strikes. These include: sperm whales (*Physeter macrocephalus*) (Berzin 1971), humpback whales (*Megaptera novaeangliae*) (Smulter 1989; Swingle et al. 1993), fin whales (*Balaenoptera physalus*) (Agler et al. 1990), pilot whales (*Globicephala macrorhynchus*) (Miyashita & Kasuya 1990), northern right whales (*Eubalaena glacialis*) (Colborn et al. 1998), bowhead whales (*Balaena mysticetus*) (George et al. 1994), bottlenose dolphins (*Tursiops truncatus*) (Lockyer & Morris 1990; Wells & Scott 1997), and orca (Ford et al. 1994; Visser this paper).

Duffus & Dearden (1993) suggested cetaceans that have to deal with boats do so at a possible loss of energy which would otherwise be used for maintenance and reproduction of the individual. Alteration of that budget could result in a loss of fitness. NZ25 has been recorded as travelling an average of 111 km per day over a period of 34 days and distance of 3800 km. Other orca in the New Zealand population have been monitored travelling an average distance of 169 km per day (Visser unpubl. data) over similar distances and time frames reported for NZ25. It may be possible that her group travels at a slower rate to accommodate her injuries.

Cetaceans may become habituated to boats (Shane 1990), but this may not prevent them from becoming damaged by propellers. In New Zealand many of the orca may be termed "propeller positive" as they actively seek out the wash caused by propellers and have been seen to open their mouths around spinning propellers (Visser unpubl. data).

Ford et al. (1994) recorded two orca in British Columbia that had been hit by boats and survived. One had the top of its dorsal fin reduced to a ragged stump, about half normal height and the other had V-shaped notches along her tail stock, similar to those shown on NZ25. Ford et al. (1994) also reported a third interaction between a ship and a young orca, where the orca was hit by the propeller. The slashes from the propeller were clearly visible on the orca, and were bleeding profusely. The calf was seen alive for 15 days, supported by other members of its group, but is now considered dead, as it has not been resighted since 1973.

The two New Zealand orca reported here have been observed over a number of months or years. The injuries appear to be completely healed, but at

the time would have debilitated the animals to the extent that they may have been attended or supported by others. Epimeletic (care giving) behaviour has previously been noted for orca (Tomilin 1957; Caldwell & Caldwell 1966; Ford et al. 1994).

In conclusion, the number of cetaceans that are hit by ships is likely to increase as shipping traffic and the marine mammal "ecotourism" industry, increases. Although some cetaceans can learn to associate boats with adverse conditions (e.g., biopsy darting (Barrett-Lennard et al. 1996); capture boats (Irvine et al. 1981)) they may not associate boats with direct physical injury. Preventive measures may include education of the boating public, and where ever practical, installing propeller guards on boats that are in regular contact with cetaceans.

ACKNOWLEDGMENTS

This manuscript has been improved by extremely helpful comments from J. Craig, D. Fertl, J. Berghan, T. Pusser, P. Duignan, and D. Mayson. T. Chappell and the Auckland Volunteer Coast Guard provided valuable information about the third orca involved in a boat strike. Support for this research has come from Golden Bay Cement, Kodak, Yamaha, New Zealand Lotteries Grant Board, Aqualung New Zealand, Safety at Sea, Dive Log, Humminbird, Cetacean Society International (in particular B. Rossiter), Lion Foundation, PADI NZ, Whale and Dolphin Conservation Society (UK), and the Ministry for the Environment. Private grants from R. Jacks, K. McIntyre, C. McLachlan, O. Clemens, and W. Inman have supported this research. A permit to conduct orca research was issued by the Department of Conservation.

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