

The Impact of Fisheries on the Welfare of New Zealand Sea Lions

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Word count: 997

Introduction

The New Zealand sea lion (*Phocarctos hookeri*) is one of the rarest and most localised pinnipeds in the world, with a global population between 10,000 and 12,000, and 86% of all breeding occurring at the Auckland Islands (Chilvers, 2008a). The potential impact of fisheries on the welfare of this species, both direct (through by-catch – becoming caught in fishing nets) and indirect (through resource competition) have not been quantified. Three recent papers address the issue, allowing a clearer picture of the habits of the sea lion to emerge and thus demonstrating where and how their welfare is compromised.

Discussion

It is clear that more research into NZ sea lions is required to effectively improve their welfare and limit their interactions with fisheries (Chilvers, 2008a). Chilvers (2008a) monitored the interaction between the sea lions and the squid trawl fishery with a particular focus on the animals caught as by-catch, as well as methods currently used to allow sea lions to escape the nets. This was achieved by involvement at the fishery and by looking at data from the fishery. The sea lion/fishery interaction was also investigated by attaching satellite transmitters to lactating females to determine their fidelity to foraging sites and gain a wider understanding of their feeding patterns (Chilvers, 2008b). Through knowledge of how deep the sea lions dive, where they forage and how often they return, the interaction with fisheries is made a lot clearer than by purely investigating by-catch cases. Meynier *et al.* (2008) made use of the by-catch animals to determine the components of the sea lion diet and to analyse resource competition from commercial squid and red cod fishing. The method here made use of frozen stomach contents, which were divided into digested and fresh fractions to allow more information to be gained about the sea lion's feeding habits using fish otoliths. These papers together shed light on a way forward that will ensure this species' welfare is not compromised for commercial gain.

Prey considered common to the diet of sea lions are opalfish, rattail, arrow squid, octopus and red cod (Meynier *et al.*, 2008), which all aggregate at the sea floor. One of the most unique attributes of the NZ sea lion is that they are benthic divers (i.e., they dive to their physiological limit to forage for food, up to 250m deep for lactating sea lions) (Costa & Gales, 2000; Chilvers, 2008b). Areas where sea lions tend to dive can be up to 50km from breeding grounds where lactating females have left their pups ashore. Meynier *et al.* (2008) suggest that this is probably due to the guaranteed energy profit when the cost of benthic diving is considered as opposed to the outcomes of diving nearer to the rookery. Local commercial fisheries operate annually from February-May, which overlaps with the first 4-5 months of sea lion lactation (Chilvers, 2008b). Chilvers (2008a) suggests the direct competition for the same food source at a crucial time for the sea lions is the reason for the high number of lactating females represented in total by-catch. Strong site fidelity (Chilvers, 2008b) also exacerbates this issue as interaction therefore increases. Resource competition compromises the food supply of sea lions and their ability to rear offspring, and this is a pressing welfare issue.

By-catch has been an ongoing fisheries issue since 1978 (Chilvers, 2008a). The direct impact of by-catch on the NZ sea lion population is not on only one individual, but three. Most lactating females caught (82%) are also pregnant, so loss of the female also compromises the welfare of her unborn pup and her suckling pup (Chilvers, 2008a). Sea Lion Exclusion Devices (SLEDs) have been used since 2001 and while these successfully offer an escape route for the sea lions, concerns have been raised about their survival after escape and damage caused to them by the design of the SLEDs (Chilvers, 2008a). By-catch is most concentrated in the 50% kernel range (the range fishing trawlers are within for 50% of their fishing trips) (Chilvers *et al.*, 2005), which suggests that current measures taken, such as marine protection areas being closed to fishing, may not be the most effective way to protect

and limit interaction between the species and fisheries (Chilvers, 2008a). By-catch is a pressing welfare issue because of the number of sea lions drowned and the persistence of head injuries from the nets.

While the results of studies are widespread and allow a greater awareness of the sea lion/fishery interaction, limitations do occur in each study. The prevalence of lactating females in the studies conducted skews the data, because not much is known about the diving and feeding habits of immature males or females, nor mature males (Chilvers, 2008b). The small sample size of the foraging fidelity study means that its results are limited to lactating females, with the habits of non-lactating females unknown in this field of research (Chilvers, 2008b). The predominance of squid in the diet of by-catch animals, especially in the fresh portion, is a bias as they have been caught in squid nets, while in the digested portion smaller fish may be underrepresented as their otoliths are easily destroyed by gastric acid (Meynier *et al.*, 2008).

Conclusion

A number of ways to enhance sea lion welfare are suggested by these studies. Insight into the diet of the NZ sea lion enables competition for the squid and red cod resource to be identified, supporting calls for fisheries to be moved elsewhere. The high prevalence of lactating females killed in by-catch requires Marine Protected Areas to be moved, so that both breeding and foraging areas are protected. The existence of SLEDs to address by-catch is a positive development that will decrease drowning deaths, but the design needs revision so that sea lions are not injured on their way out of the nets. The current sea lion/fishery interaction requires amendment for the welfare of each sea lion individual as well as the long-term survival of the species as a whole.

References

- Chilvers, B.L. (2008a) (in press) New Zealand sea lions: *Phocarctos hookeri* and squid trawl fisheries: bycatch problems and management options. *Endangered Species Research* 5(2-3), 193-204.
- Chilvers, B.L. (2008b) Foraging site fidelity of lactating New Zealand sea lions. *Journal of Zoology* 276, 28-36.
- Chilvers, B.L., Wilkinson, I.S., Duignan, P.J., Gemmill, N.J. (2005) Summer foraging areas for lactating New Zealand sea lions *Phocarctos hookeri*. *Marine Ecology Progress Series* 304, 235-247.
- Costa, D.P., Gales, N.J. (2000) Foraging energetics and diving behaviour of lactating New Zealand sea lions, *Phocarctos hookeri*. *The Journal of Experimental Biology* 203, 3655-3665.
- Meynier, L., Mackenzie, D.D.S., Duignan, P.J., Chilvers, B.L., Morel, P.C.H. (2008) Variability in diet of New Zealand sea lion (*Phocarctos hookeri*) at the Auckland Islands, New Zealand. *Marine Mammal Science* DOI: 10.1111/j.1748-7692.2009.00283.x (online in advance of print).