Effect of black swan foraging on seagrass and benthic invertebrates in western Golden Bay

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Thesis Abstract

Waterfowl are known to be capable of influencing wetland ecology in a number of ways, sometimes to the detriment of other species that also inhabit this type of environment. Western Golden Bay including Farewell Spit is one of the largest areas of intertidal sand flat habitat in New Zealand and supports a wide array of species including internationally important populations of bar-tailed godwits (*Limosa lapponica*) and red knot (*Calidris canutus*). These species, particularly red knot, have declined in number over the last the 25 years at this site. Another numerous species at this site, the black swan (*Cygnus atratus*), has been suggested as a possible contributor to the observed decline in wader numbers through their impact on the habitat. This thesis presents the findings of a research project on the role of black swans in the tidal seagrass (*Zostera muelleri*) ecosystem in western Golden Bay carried out between October 2007 and October 2008.

In an effort create a clear picture of what role the black swans play in this environment the project focused on four major aspects of swan-ecosystem interactions. The first of these looked at the activity patterns of black swan. This showed the swans' activity is largely dictated by the tidal cycle with foraging occurring during the intertidal period when the seagrass is accessible while roosting is mostly confined to around high and low tides.

The second part of the project explored the influence black swans have on the tidal seagrass landscape through their foraging habits. This showed that while swan foraging occurs across the tide flats it is concentrated on denser patches, on both small (meters) and large (hectares) scales. Experimental grubbings showed that the grubbing activity of swans is capable of forming and expanding bare sand patches within seagrass beds and that these bare patches can persist for at least two months.

The third part of the project focused on the direct impacts of swan foraging on the seagrass and associated benthic invertebrates. Exclusion plots showed that at some sites swan foraging can significantly reduce *Zostera* biomass and invertebrate biodiversity.

The final aspect examined was the role of swan in biomass and nutrient cycling. A faecal deposition survey showed swans consume 23.40 g DW ha^{-1} day^{-1} of *Zostera*. The average intake rate was 27.25 g DW ha^{-1} day^{-1}. Nutrient analysis of seagrass

showed that shoot material has significantly higher N, P, Ca and fibre than rhizome and that rhizome has significantly more soluble carbohydrates than shoots.

On the basis of the swans' direct and/or indirect influences on *Zostera muelleri* beds and the associated invertebrate fauna, swans could arguably be considered to be a major ecosystem engineer in the intertidal sandflats of Golden Bay.