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CAN WE RESTORE WATERFOWL POPULATIONS BY RESTORING AQUATIC MACROPHYTES? EXPERIMENTS IN A NEW ZEALAND LAKE

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The black swan population of Hawksbury Lagoon, a very shallow (z = 40 cm) eutrophic coastal New Zealand lake, collapsed in April 1993. After being stable for more than 3 years at a mean of 250 birds (10 ha^{-1}) it declined to below 10 in a 2 week period with the advent of an algal bloom, higher water levels, increased turbidity of the water, and loss of aquatic macrophytes. In August (Southern spring) an attempt was made to restore the population by lowering the water level to allow more light to reach the lake bottom, and reestablish the benthic flora on which the swans feed. This attempt enjoyed a spectacular success initially, with a progressive increase in the biomass of benthic algae to 30 gm^{-2} by February, and a tightly coupled increase in the swan population to 25 ha^{-1}, the highest ever recorded for the lake. This success was, alas, short-lived. The benthic light climate deteriorated again in association with high phytoplankton biomasses and sediment resuspension by wind, the benthic flora again collapsed, and the swans departed. Swan grazing did not contribute significantly to this loss of vegetation. A model for sediment resuspension suggests that the benthic algal biomass almost reached the threshold necessary to suppress wave resuspension of sediment, and the experiment will be repeated in 1994, in an effort to switch the ecosystem to a state in which benthic plants are dominant and the swan population is high.

This and earlier studies indicate that there are discontinuities in the swans' numerical response at both high and low macrophyte biomasses. Biomasses as low as 3 gm^{-2} support good populations, but below 2 gm^{-2} the birds are effectively absent. Conversely, studies of faecal distribution indicated that when the biomass of filamentous algae became very high, swans were largely excluded from the areas of the lake in which patches of algae grew close to the surface, and the total population declined. Calculations based on grazing consumption and algal growth rates in spring- autumn indicate that benthic algae need to attain a biomass of only 6 gm^{-2} to ensure escape from complete suppression by swan grazing. Once this threshold biomass is exceeded, their potential for regulation of the algae is slight. Swan faeces similarly contribute little to the nutrient pools or nutrient dynamics of the lake.

The very close correlation between swan population density and benthic plant biomass (r^2= 0.95) during the present study, indicates that a management strategy which is effective in restoring the benthic vegetation will be beneficial to the swan population of this lake. In earlier studies we have also shown that winter populations of black swans are significantly correlated with plant biomass for lakes spanning a wide range of size and trophic status.