Selective harvest of sooty shearwater chicks: population dynamic effects using a periodic matrix model

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Selectivity of harvesting is important because individuals with different characteristics contribute differently to population growth. Removal of individuals with higher than average survival or reproductive output (high "quality" individuals) can have a disproportionate impact on demography. This impact can be evaluated by incorporating quality states and selective harvest in a demographic model. The sooty shearwater is a long-lived pelagic seabird that nests on islands in the southern oceans. They are harvested on islands off New Zealand by Rakiura Maori. Two aspects of the harvest are unusual; i) chicks rather than adults are harvested, and ii) the harvest is restricted to a short period during the breeding season. Evidence suggests that the harvest selects heavier chicks, which have higher survival probability. To evaluate the impact of this selectivity on sustainability of the harvest we developed a periodic stage-classified matrix model including chick quality. Using a periodic model allowed us to include one non- harvest and two harvest periods, of different lengths, within each year. We use the model to explore the joint effects of harvest intensity and selectivity. Selectivity has major effects on population growth at high but not at low harvest intensities. At the harvest intensities estimated for the New Zealand sooty shearwater population, selection of high quality chicks does not appear to reduce sustainability. This modelling approach can be applied to other populations in which harvesters select individuals of different quality during particular parts of the life cycle. We will discuss some issues arising in such applications.

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