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A population viability analysis for the Island Fox on Santa Catalina Island, California

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Abstract

The island fox (*Urocyon littoralis*) on Santa Catalina Island is among the most imperiled species on the Channel Islands due to a recent outbreak of canine distemper virus (CDV). The western subpopulation, which was not exposed to CDV, is a crucial element in the recovery of foxes by providing a source of animals for translocation and captive breeding. Using the program VORTEX, we developed a population viability analysis for the Santa Catalina Island fox to (1) address the likelihood of population persistence, (2) estimate the current susceptibility of the population to catastrophic events, and (3) evaluate the efficacy of current restoration strategies of releasing captive bred foxes and transplanting wild animals. Overall, we found the population to be susceptible to catastrophic events; a 50% increase in mortality every 20 years was sufficient to elevate the extinction risk above 5%. Current management activities entail the transplanting of 12 juvenile foxes annually, which may reduce the viability of the western subpopulation. A minimum population size of at least 150 foxes should be maintained in each subpopulation to reduce the risk of extinction due to demographic stochasticity. Releases of translocated and captive bred animals affect the speed of recovery on the eastern half of Catalina Island, but not the probability of extinction, which is near zero under current conditions. We conducted a sensitivity analysis for demographic parameters by incrementally varying survival, fecundity and density-dependence parameters, while holding all other parameters constant. Sensitivity analyses identified mortality and mean litter size as the most sensitive parameters, while the implementation of density-dependence and environmental variation of model parameters did not seem to affect population performance. We conclude that the population of island foxes on Santa Catalina is currently at a critically low population level, but recovery of the species appears possible.

Keywords: Island fox; Logistic regression; Management; MARK; Population viability; Sensitivity analysis; Survival; *Urocyon littoralis*; VORTEX

1. Introduction

The persistence of species on oceanic islands has played an important role in the development of ecological theory, especially biogeography and conserva-

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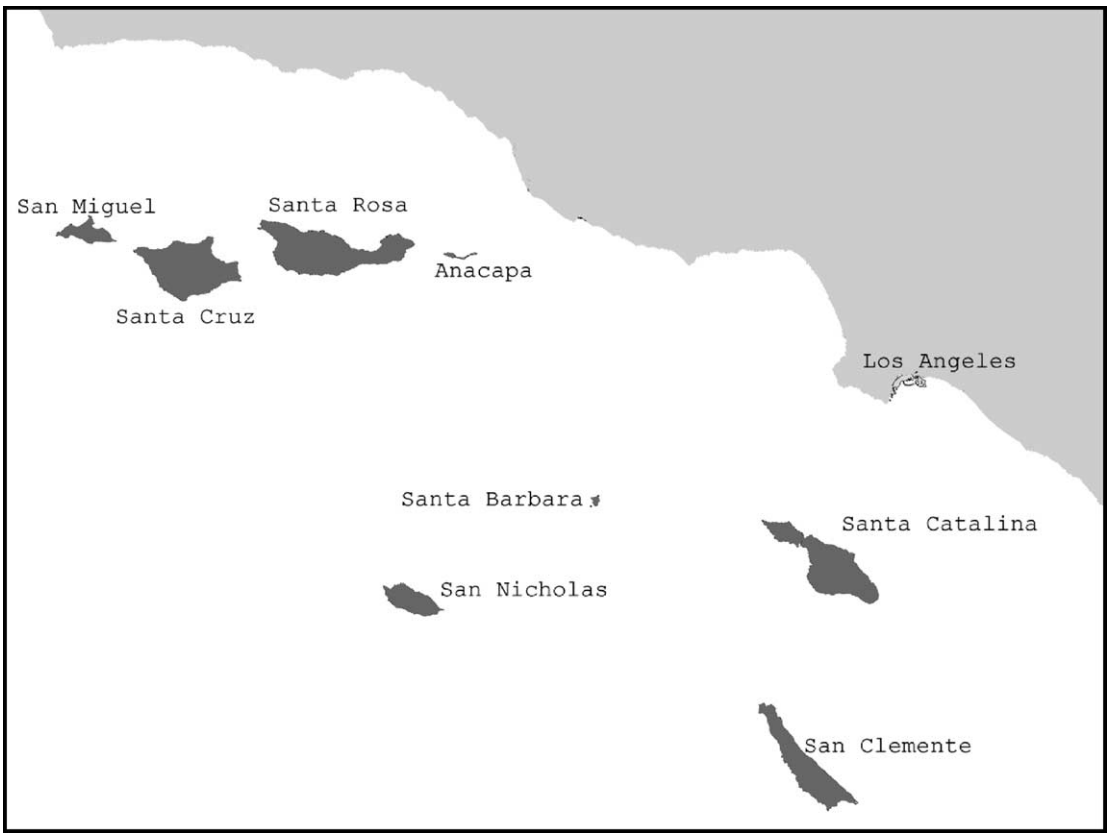

Fig. 1. Location of Santa Catalina Island among the Channel Islands off the coast of California.

tion biology (McArthur and Wilson, 1967). Islands often harbor a unique assemblage of endemic species resulting from rapid evolutionary adaptation and low competition from new immigrant species. As a result, biodiversity and endemic species on islands are often negatively affected by introduced exotic organisms (Coblentz, 1990). Consequently, many island species present pressing conservation problems due to their unique adaptation, their limited ability to compete with non-native species, their geographical and taxonomic isolation, and their vulnerability to localized stochastic events.

An example for such a vulnerable island endemic is the island fox (*Urocyon littoralis*), a relative of the mainland gray fox (*Urocyon cinereoargenteus*). This territorial and monogamous carnivore is endemic to six of the eight California Channel Islands (Fig. 1), with each island supporting a genetically unique subspecies. Weighing only 1.4–2.7 kg, it is the smallest fox species in the United States, but still the largest native land mammal on the Channel Islands. It has been classified as threatened by the California Department of Fish and Game and is currently under review for federal listing. Four of the six island fox subspecies have experienced catastrophic declines in the recent past. Populations on San Miguel, Santa Rosa, and Santa Cruz islands have declined by as much as 95% since 1993, probably due to predation by non-native golden eagles (*Aquila chrysaetos*; Coonan et al., 1998; Roemer, 1999).

The population on Santa Catalina Island has experienced precipitous declines in 1999 and 2000 due to an outbreak of CDV. Apparently, the western part of the island was spared from the CDV epidemic, suggesting that the lack of dispersal of foxes may have prevented the spread of CDV to the western part of Santa Catalina. A narrow isthmus separates fox populations on the eastern part of Santa Catalina Island (EAST) from the smaller western part (WEST, Fig. 2).