

# METAPOPULATION DYNAMICS OF FLORIDA KEY DEER

Patricia M. Harveson<sup>1</sup>, Roel R. Lopez<sup>1</sup>, Nova J. Silvy<sup>1</sup>, William E. Grant<sup>1</sup>, Philip A. Frank<sup>2</sup>

<sup>1</sup>Department of Wildlife and Fisheries Sciences, Texas A&M University

<sup>2</sup>US Fish & Wildlife Service, National Key Deer Refuge

## Key Deer Range in the Lower Florida Keys



## INTRODUCTION

Metapopulation dynamics of species that occur in patchy or island subpopulations are an important consideration in the conservation of endangered species. Key deer (*Odocoileus virginianus clavium*) are endemic to the Florida Keys and occur on 11 island-complexes in the lower keys from Big Pine Key to Sugarloaf Key. While deer numbers have increased notably, the majority of the population occurs on 2 of the islands, Big Pine and No Name Keys. Deer dispersal between islands is possible due to short distances and shallow water depth between islands. Key deer have been documented to actively disperse between islands but at very low rates (11% males, 3% females). However, increased population densities could possibly increase dispersal rates as island populations on Big Pine and No Name Keys approach carrying capacity.

We examined the probability of deer colonizing other islands with a viable population, an important consideration in the recovery of Key deer, using a sex- and stage-structured metapopulation model. Our objectives were to (1) evaluate the effects of distance and dispersal rate on Key deer island subpopulations, and (2) estimate the probability of Key deer colonizing other surrounding islands with a viable population.

## MODEL OVERVIEW

- The metapopulation model consists of 11 sex- and stage-structured stochastic submodels for each island complex.
- Key deer were classified into 3 age-classes: fawn (<1 year), yearling (1-2 years), and adult ( $\geq 2$  years).
- Model parameter estimates for survival, maternity, and initial abundances were taken from comprehensive Key deer studies from December 1968 to June 1972, and January 1998 to December 2000.
- Carrying capacity was estimated for each island based on habitat type.
- We ran 120 model simulations using STELLA (version 7.0.1).
- As island populations approached carrying capacity, density dependence was used in each submodel to reduce population growth by decreasing maternity using a linear recruitment model capped at a maximum maternity of 1.05 fawns/breeding female/year.
- We varied dispersal in our simulations to observe effects of possible increases in rates as the Key deer population approaches carrying capacity on NNK and BPK. A linear relationship between density and dispersal was assumed for each of the 11 island-complexes. We modeled the population using dispersal set at the following rates: low (0.01F, 0.02M) medium (0.03F, 0.06M), and high (0.05F, 0.10M).

## Conceptual Key Deer Metapopulation Model



## MODEL EVALUATION

We evaluated the model by comparing the results of our simulations with the population growth that has occurred during the past 30 years. The population growth projected on Big Pine Key from 1970 to 2000 was consistent with current population estimates.

## MODEL RESULTS

In analyzing our results, we focused on the total Key deer metapopulation and the subpopulation on Sugarloaf Key (the furthest deer inhabited island). Results from the metapopulation model suggest that the total population of Key deer will continue to increase. Results also suggest that the subpopulation on Sugarloaf Key will increase at a slow rate under all 3 dispersal scenarios over the next 20 years.

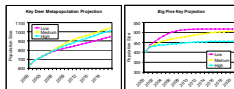


Fig. 1 Key deer metapopulation projections under 3 dispersal scenarios, 2000-2020.

Fig. 2 Key deer population projections under 3 dispersal scenarios for Big Pine Key, 2000-2020.

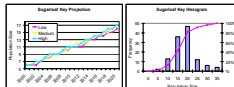


Fig. 3 Key deer population projections under 3 dispersal scenarios for Sugarloaf Key, 2000-2020.

Fig. 4 Histogram of Sugarloaf Key deer population projections under the medium dispersal scenario, 2000-2020.

## DISCUSSION

Model results suggest that Key deer have a low probability of colonizing Sugarloaf Key with a viable population due to dispersal alone. Other methods for increasing deer density, such as translocations, are recommended.