Abstract

Anthropogenic changes vastly accelerate climate change and biodiversity loss, with extinction rates being exceptionally high. Endemic species are especially prone to extinction due to their narrow geographical range, specialized ecological niches, and often small population sizes, being at the forefront of the biodiversity crisis. According to contemporary niche theory, both the ecological niche of a species and its geographical distribution are determined by the biotic environment, abiotic conditions, and its movement ability. Nevertheless, biodiversity conservation also requires gaining vast knowledge of the life history traits of threatened species, their predicted population dynamics, and extinction risk. The Beer Sheva Fringe-fingered Lizard, *Acanthodactylus beershebensis*, is an endemic species to the Negev and southern Judea Desert of Israel and is classified as critically endangered by the IUCN. Due to its small, endemic, and highly fragmented distribution, combined with the rapid degradation of its habitat, my doctoral research aimed to increase the scientific knowledge about *A. beershebensis*. In this thesis, I present key findings from my Ph.D. research, where I integrated empirical and theoretical approaches along with *in-situ* and *ex-situ* data collection to construct models and used them to predict how futurist scenarios are expected to affect the population dynamics and extinction risk of *A. beershebensis*, spatially and temporally. First, a correlative species distribution model (SDM) was created based on observations from four separate data sources. The model shows that *A. beershebensis* occurs in arid loess plains characterized by scattered and low vegetation cover, mostly on north-facing aspects, with species-specific habitat requirements limiting its distribution. In addition, the SDM enabled me to calculate the remaining suitable habitat of *A. beershebensis*. Next, deterministic and stochastic stage-structured periodic population models were constructed using life history traits and demographic rates recorded from wild-born individuals kept in captivity. The constructed models incorporate the species' life cycle and monthly stage structure correctly, illustrating that the newly discovered life history traits, females capable of producing more than one clutch of eggs during the breeding season and some adults can live more than one year, enhance the population persistence of this critically endangered lizard species. Finally, using a mechanistic approach, integrating processes of demography and dispersal dynamics, a temporal and spatially explicit species distribution model was constructed. Results of the correlative SDM model were used as

the basis spatial representation of the availability and quality of habitat patches. They were combined with information about initial population size, vital rates, and dispersal capacity to predict future population abundances via stochastic simulations. Simulations included predicted future habitat loss and examined the possible effect of a theoretical reintroduction program. The study shows that under the current conditions, the population of this critically endangered lizard species is decreasing, and with or without further habitat loss, there is a 72.50% probability that the population will decrease to below 2,000 individuals within an average of 44 years. I also illustrate that a reintroduction program could assist in increasing population growth rates only for short periods. Finally, the model recognizes areas of highly predicted occurrences with suitable habitats and low anthropogenic disturbances that may serve as potential final refuges for this species in the wild. Such a mechanistic approach is a valuable and applicative tool that can explicitly model the species' predicted population dynamics and extinction risk spatially and temporally. It is now available as an applicative tool for public use. It can be used to examine the effect of various futuristic scenarios (e.g., further land use change, climate change, area protection, and reintroductions) on the predicted population dynamics and extinction risk of this endemic and critically endangered lizard species.

Key Words: *Acanthodactylus beershebensis*, conservation, coupled SDM-population models, distribution, mechanistic modeling approach, stage-structured population model, species distribution model.