Modeling the Effects of Invasive Species on Crocodilian Populations

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Invasive species are a growing threat to biodiversity. Crocodilians have been impacted by many invasive species including pythons and cane toads, and the effects on these apex predators and their ecosystems are not well understood. A model was created using Python code to explore the effects of invasive species on crocodilians. The model includes eight species: crocodilians and seven prey species. A novel adaptation of the Lotka-Volterra equations was developed to model the complex predator prey interactions. This adaptation accounts for many species, species that act as both predator and prey, and a timescale of months with reproduction once a year. Invasive species effects impacting individual species, pairs of species, and combinations of species representing current invasive species were modeled and found to cause one of two ecosystem responses: 1) the crocodilian population increases and other populations decline; 2) the reptile population increases and other populations decline. The magnitude of effects only affected the timescale of the response. Invasive species effects stopping midway through the simulation, to represent invasive species eradication, caused the same responses at a slightly later timescale. The model was validated by comparisons with observations of responses to invasive species in the wild. Following an invasive species establishment, the best first step is to determine which species are impacted as this indicates which ecosystem response will occur and informs management to protect the ecosystem. The model created is very versatile and can be modified to explore the effects of any invasive species on any ecosystem.

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