

Mathematical Modeling of a *Caiman crocodilus yacare* population

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Abstract

A nonlinear age structured model was constructed to simulate the population dynamics of the *Caiman crocodilus yacare* in the "Esteros de Iberá", in northern Argentina. Our model considers the marsh water depth dependence in the survival of eggs, hatchlings and juveniles; which is determined by specific mortality functions like predation and desiccation mortalities. Nesting cohort and cannibalism are density and water depth dependent. We also consider the egg incubation temperature as the environmental factor determining sex. In addition, the program includes eggs collection and harvesting options.

Introduction

Caiman crocodilus yacare is a commercially valuable crocodylian found in the Llanos de Mojos region in the southeastern tributaries of the Amazon in Bolivia, in the adjacent Mato Grosso (Pantanal) region of Brazil and southward through the Paraguay River basin of Paraguay and northern Argentina. The "Esteros de Iberá", in northern Argentina, was the habitat for about 200.000 *C. c. yacare* in 1980. The goal of this work is to analyse the possible human influence on Iberá *C. c. yacare* population dynamics. In order to accomplish this objective, we developed a simulation program to examine consequences of various crocodile management strategies.

Mathematical Model

The egg incubation temperature determines the sex of the crocodiles. Based in results from field studies we have assumed that low temperatures (below 30C) produce only females, intermediate temperatures (in the 30C-32C range) produce 40% males, and higher temperatures produce only males. Woodward and Murray (1993) have presented an age structured model based on the crocodile key life-history data. In their work they suggested that crocodylians are very territorial and tend to lay eggs in the same place every year and this place would be as similar as possible to the site they were born.

We adopted the idea of Woodward and Murray in developing our model, dividing the region in three nesting regions: wet marsh (cold), dry marsh (warm) and levee (hot). Furthermore, we have assumed there is a limited number of nesting sites in each region. So just a percent of the nesting females obtain success in laying eggs in their preferred region (where they were born), the remaining females are forced to lay eggs in another region. In particular, a limited number of marsh nest sites will avoid a totally female population.

Results

Actually we have already modeled and developed a simulation program for the *C. c. yacare* evolution. The simulations indicate a low risk of extinction for *C. c. yacare* in the Iberá region if the harvesting respects a minimum size of huntable crocodiles but the population can become endangered if no minimum size be established. Eggs collection appears as a good strategy for conservation if some rules are adopted in relation to the number and sex of the released crocodiles.

References

Woodward, D. E. and Murray, J. D. On the effect of temperature dependent sex determination on the sex ratio and survivorship in crocodylians *Proc. R. Soc. Lond. B* (1993) 252 149-155

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