THE LIFE HISTORY OF THE GREEN ANACONDA (*EUNECTES MURINUS*), WITH EMPHASIS ON ITS REPRODUCTIVE BIOLOGY

A Dissertation

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"…Federmann…[….]..wandered out into the Llanos to the banks of a mighty river. Since there were various signs that the region at other times had been densely populated, Federmann wished to ascertain the cause of its present desolation. He learned from the several captured Indians that in the river there lived an animal so carnivorous and voracious that it had eaten many of the inhabitants. The rest had abandoned the site and fled to a remoter [sic] section to escape the ferocity of so deadly an enemy. Federmann and his soldiers considered this statement true because by night they had heard the formidable bellows of the wild beast. Some even said they had seen it and affirmed that it was a species of serpent of terrifying corpulence."

From The conquest and settlement of Venezuela. Don José de Oviedo y Baños. 1723; (p: 56).

DEDICATION

This dissertation is dedicated to

Renée Y. Owens,

my wife, who has been not only important help in the field but also an endless source of inspiration and support

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It is hard to give proper credit to all the people that have in one way or another helped me in during all this time. I will start, because it is easiest, by mentioning my sponsors. The Venezuela Council for Science and Technology (CONICIT) and the Banco Interamericano de Desarrollo (BID) partially sponsored my attendance to the University of Tennessee. My field research was sponsored by grants from The Wildlife Conservation Society, The National Geographic Society, The Convention for the International Trade of Endangered Species (CITES), The Venezuelan Fish and Wildlife Service (Profauna), and CONICIT.

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ABSTRACT

Many species of a secretive nature that inhabit remote areas are largely unknown to science and have the potential to provide the diversity of life styles and factual information that is needed to unravel important questions regarding behavioral ecology. In this contribution I present some of the relevant information regarding the reproductive biology and general natural history of the green anaconda (*Eunectes murinus,* Familiy Boidae) gathered during 7 years of data collection in the Venezuelan llanos.

Due to the novelty of the study animal I had to design methods to collect much of my data. I developed new methods for subduing and measuring the animals. I also document the efficacy of force feeding transmitters as a way to radio-tag the animals. Although the emphasis is on reproductive biology, I also present information on many other aspects of the anaconda's life history collected both systematically and opportunistically. Anacondas use relatively small home ranges in wet and dry seasons but they perform relatively long migrations from one season to the other. Anacondas seem to be generalist ambush predators that feed on wading birds at early ages, but switch to larger prey as they grow older. They risk being injured or even killed by their prey when attacking large, dangerous prey items. Anacondas experience relatively high mortality in early ages that decreases as they grow larger. Adult males always face relatively high risk of predation by caimans, which seems to be specially dense in the breeding season. Other causes of mortality are overheating, parasites and diseases.

The determinants of breeding output were analyzed in detail using data collected from wild animals. Larger females produce large clutches of large individuals, but breed less often than smaller females, incurring a smaller reproductive investment in every breeding event, as well as on an annual basis. The maximum size of females seems to be optimized to maximize their breeding output. The maximum expected size for anacondas, as well as the maximum recorded in this study, are well below the maximum reported in the literature. I discuss this contradiction in light of my findings and possible environmental differences.

The mating system of the species was analyzed using data collected from the field and from captive observations. Anacondas show a striking female biased Sexual Size Dimorphism (SSD), larger than the SSD reported for any other terrestrial vertebrate. This is especially surprising because males mate in multiple-male breeding aggregations, where larger males seem to benefit from their large size. Anacondas breed in large breeding aggregations composed of one female and 1 to 13 males. These aggregations last up to four weeks and are scattered in the landscape fairly unpredictably. Larger males seem to be selective in their mating, selecting larger females, and larger females are courted by a higher number of males. Males spend a considerable amount of time and energy in courtship and the mating season is relatively short. Hence, factual polyandry is proposed as the main mating system in the species. Multiple mating increases the breeding success of the females. Large variance in the female's breeding success related to male preference sets the scenario for the action of sexual selection on female size. The possibility of a runaway process acting on female size is proposed. I also review the mating system of other species of snakes as well as the evolutionary environment of the group and conclude that polyandry might be more widespread among snakes than formerly believed

Finally, I use my findings to review the possibilities of sustained management of the species. Due to their secretive nature, low commercial value of the skin, female biased sexual size

dimorphism, reproductive biology, and slow growth rate, I conclude that harvesting wild populations is not a likely possibility. Ecotourism is a recommended way to incorporate the anacondas into the local economic activities.

PREFACE

I started this project as an applied research effort that was intended to be used to develop the methods to use anacondas sustainably. During my research I discovered a fascinating world far more interesting than the demographic data. To the present I have gathered eight years worth of data on this species and in this dissertation I have included a sizable part of the information gathered. The focus of this volume is the reproductive biology of the anaconda; issues not covered in this volume in detail are demography, habitat use and mobility, and diet. I have included basic information of these topics needed to understand the main aspects of the dissertation but the reader will find frequent citations to my unpublished work. This dissertation was written in several chapters designed to be published independently. Even though there are abundant cross references, some information is repeated in different chapters.

Due the minimal knowledge that many readers have of the study site, I have written an extensive chapter describing the area. Also, due to the newness of anacondas as a research subject, I had to come up with my own way of finding the animals and gathering much of the data. Listening to tales and anecdotes from local inhabitants of the llanos was a key element to learning the basic elements that allowed me to develop the study methods. Studying anacondas presents a challenge even in activities as basic as measuring the animals and capturing them. Chapter two includes detailed information on the way the data were collected plus anecdotal information that could help future researchers trying to study this species.

Chapter three contains general information about the natural history of the species oriented to facilitate the understanding of the rest of this dissertation. Again, abundant accounts of anecdotes and general information are provided to assist future researchers.

Chapters four, five, and six are the main body of the text where all the information about reproductive biology is presented and the results analyzed in light of the ecological theories. Lastly, chapter 7 provides information about the conservation status of the anaconda and the perspectives of commercial use of the species. In this chapter I discuss the prospect of commercial harvest based on the information presented and also alternatives uses of the anaconda. Here I provide personal perspectives about sustainable use of natural resources in the neotropics developed over many years of dealing with these issues in Venezuela. After having worked in the Venezuelan fish and wildlife service I also include the “inside scoop” of the management programs and possible future directions.

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