Ecology and Conservation of the Cuban crocodile (*Crocodylus rhombifer*) in Zapata Swamp, Cuba

Roberto Ramos Targarona. University of Alicante
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The Cuban crocodile, C*rocodylus rhombifer*, shows the most restricted geographical distribution among the living Crocodylia, and is the most endangered Crocodilian species of the New World. The Zapata Swamp, in Cuba, constitutes the last natural reservoir for the species. The ecology, natural history, population status and biology of the Cuban crocodile in the wild, have remained practically unknown, probably being the least documented Crocodilian species. The existence of the Cuban crocodile in Zapata Swamp has been threatened by the commercial hunt up to the early sixties of the last century, and then, by the capture of living specimens throughout that decade. Along with these detrimental factors, the hybridization with the sympatric American crocodile (*Crocodylus acutus*) is considered as a major threat for the species. At the present time, the insufficient knowledge of key aspects of the Cuban crocodile's biology and ecology, such as its present distribution, abundance, and reproductive biology, hinders the design and implementation of adequate management for conservation, and sustainable use of the species.

The overall goal of the thesis was to obtain and summarize information on such traits as abundance, distribution, reproduction, and threats on the Cuba crocodile in Zapata Swamp, in order to assess its conservation status, and to improve and implement management plans for the species in this area. The information contained in this thesis comes from research conducted in Zapata Swamp between the years 1974 and 1996, both in the wild, and in the local crocodile farm, established in 1959.

Regarding the distribution of the Cuban crocodile, this species predominated in the south central part of the Western Zapata Swamp, in a range of about 776 km^2, sympatrically sharing this habitat with the American crocodile, and the hybrids or *mixturados*. In addition, the Cuban crocodile macrohabitat was not exclusively associated to freshwater bodies; the species was present in a variety of wet habitats, on a wide range of water salinity.

The studies to estimate population size and population trends were conducted in 1993 and 1996, in the core area of approximately 300 km2. Cuban crocodiles rated to the 79.1% of the total captured individuals of the three existing forms in the study area (Cuban crocodiles, American crocodiles, and "*mixturados*"). American crocodiles rated to 17.9%, and the *mixturados*, rated 3%. The estimates of taxonomic composition obtained in 1996 showed an increase of the presence of the Cuban crocodile (84%) and hybrids (8%), and a decrease in the American crocodile (8%), compared with 1993.

The estimated Cuban crocodile density was 19.8 (12.2 to 27.2) individuals per km^2, and the population size was estimated as more than 3000 non-hatchling individuals. Across the three years period covered by the study, the population size and sex ratio remained stable, whereas the population size structure showed a slight displacement of the size classes less than 150 cm (TL), towards larger size values. The Cuban crocodile adult females rated a 15% of the total sample in 1996, which represented an increase over 1993.

The nesting season of the Cuban crocodile extended from April until the third week of July, coinciding with the end of the dry season and the onset and intensification of the rainy season, when temperatures begin to rise. Most oviposition was observed in the months of May and June. All documented nests were mound nests, with elliptic or almost circular base, made of the available substrate. The reproductive patterns and behaviors described for *C. rhombifer* show a complex

series of body postures, vocal, and non-vocal acoustic signals, mainly carried out by males, similar to the patterns already described for other species of the genus *Crocodylus*.

Morphometric studies indicate that cranial measurements constitute the main morphological difference among the three crocodilian forms occurring in the Zapata Swamp.

Under a more conservative and pessimistic interpretation of the resulting data about abundance and population size, it is possible to state that the Zapata Swamp population of the Cuban crocodile is in the order of thousands of individuals, and even more, the adult reproductive population reaches approximately above one thousand individuals. The findings of this research suggest the existence of a vigorous and self-sustainable wild population of the Cuban crocodile in Zapata Swamp. Even with the above results, it is still possible that *Crocodylus rhombifer* could be categorized as "Critically Endangered" (CR) under the criteria A1c, d, e (population reduction in the area of occupancy and extent of occurrence, caused by levels of present exploitation (eg poaching), hybridization, and competitors; IUCN 2008), whereas the current situation is uncertain because of the lack of recent information on the abundance, size and level of hybridization of the wild populations on both Zapata and Lanier swamps. Based primarily on the above mentioned lack of updated information, the author does not fully agree with the threat category of "Critically Endangered" (CR) given to *C. rhombifer* by IUCN (2008), although at least the geographical criteria support this categorization.

The results of this study reaffirm the need of keeping up to date the current status, and implement a comprehensive program for conservation and sustainable management of the Cuban crocodile in Zapata Swamp.