

Status and Conservation of the Orinoco Crocodile: An Update

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Background

The Orinoco crocodile (*Crocodylus intermedius*) was classified as one of the seven most endangered species of crocodylians in the IUCN/SSC Crocodile Action Plan (Thorbjarnarson, 1992). Although it was at one time fairly abundant in the lowland riverine systems of the Orinoco River basin in Venezuela and Colombia, widespread commercial hunting led to the decimation of many populations beginning in the 1930s (Medem, 1981, 1983). Due to the scarcity of animals most commercial hunting stopped by the 1950s, although remnant populations continued to be hunted into the 1960s. Although commercial hunting is not presently a threat to the species, little evidence of recovery has been noted over the last 20-30 years. A variety of factors including intentional and incidental killing, habitat destruction, egg collecting, and the sale of young animals as pets. Biological competition with dense populations of the spectacled caiman (*Caiman crocodilus*) may also be playing a significant role in impeding crocodile population recovery.

In Venezuela, a number of private and governmental groups formed a Venezuelan crocodile specialist group whose first priority was to develop conservation programs for the Orinoco crocodile. A number of status surveys have been conducted since the late 1970s, providing an overall picture of the current status and distribution of the species in Venezuela. Nevertheless, information on the current status of the species in many areas is lacking. Ecological research has been undertaken, both in captivity and in the wild, to help planning conservation measures. A considerable amount of energy had also been devoted to establishing

three captive breeding stations for Orinoco crocodiles, resulting in a reintroduction program for juvenile crocodiles that was initiated in 1990.

In Colombia, little recent conservation work on this species had been undertaken. Prior to 1992, the only status information in Colombia consisted of surveys conducted by Dr. Federico Medem in the mid 1970s.

Priority projects listed in the Action Plan were:

1. Begin status surveys in Colombia
2. Continue the crocodile release program in the Caño Guaritico National Wildlife Refuge
3. Implement a crocodile management program in the Santos Luzardo National Park

Historical Crocodile Distribution

Colombia

Medem (1981) reported that the former range of the Orinoco crocodile in Colombia was an area of 252,530 square kilometers between the Rio Arauca in the north, and the Guayabero-Guaviare system to the south. The westernmost distribution of crocodiles was said to be the Rio Duda, a tributary of the upper Guayabero. Crocodiles were distributed throughout the principal river systems in the western llanos of Colombia: the Rio Arauca, Meta, Vichada, and the Guayabero-Guaviare. Crocodile density was reported to be high in the Arauca/Meta/Guayabero systems, but lower in the Vichada and its tributaries (Medem 1974). Crocodiles were also found in the headwaters of several rivers that lie principally in Venezuela (e.g. Capanaparo, Cinaruco).

Venezuela

As in Colombia, the former distribution of the Orinoco crocodile in Venezuela included the Orinoco River and virtually all its major tributaries in the llanos. Apparently, crocodiles also extended far up many llanos rivers and into surrounding piedmont areas in the foothills of the Andes (e.g. Rio Tucupido, Portuguesa state). Crocodiles also could be found in most of the southern Orinoco tributaries that pass through savanna and heavily forested regions (e.g. Rio Cuchivero, Rio Caura).

The biggest questions today concerning the past distribution of crocodiles are the up- and downstream limits within the Rio Orinoco drainage. Humboldt (1860) commented on the apparent lack of crocodiles from the upstream section of the Orinoco and states that crocodiles are only found up to the vicinity of the "Rio Jao" (between San Fernando de Atabato, and the mission at Esmeralda). Humboldt also states that crocodiles were found in the Rio Ventuari, but not in the Brazo Casiquiare. Recently, there have been some unconfirmed reports of crocodiles in the Casiquiare, but it is clear that if crocodiles ever did exist in the area it was at very low population levels.

Although one of the common names of *C. intermedius* is the Orinoco Delta (or Venezuelan Delta) crocodile, very little information exists on its presence in the delta region. Large crocodilians are known to have been seen in the delta, but their specific identity could be either *C. acutus* or *C. intermedius*. Four *C. intermedius* (2 male/2 female) were collected from the upstream delta region in 1959 (Ramirez et al. 1977). Also unconfirmed reports indicate that crocodiles held in private homes in Tucupita are all *C. intermedius* (E. Cartalla, pers. comm.).

Status and Distribution 1974-Present

Colombia

The most recent data on the status of Orinoco crocodiles in Colombia is that of Medem (1974, 1976, 1981). During 1974 and 1975, Prof. Medem undertook a census of crocodiles in the western llanos of Colombia. The census was based principally on ground surveys, but also included 800 km of aerial surveys in the Intendencia de Casanare (Medem 1981).

Based on this survey, Medem reported the status of crocodiles to be critically low. The number of remaining adult crocodiles was estimated to be only 280 in all of Colombia (Intendencia de Arauca-180, Comisaria de Casanare-49, Departamento Meta-14, Comisaria de Vichada-37). Medem noted that this was not an absolute count, but suggested that no more than 500 individuals (adults and juveniles) were not detected during the survey (Medem 1981).

Venezuela

In the late 1940's, concern arose regarding the effects of the intensive hide hunting and the resulting extreme scarcity of Orinoco crocodiles (Blohm 1948, Mondolfi 1957, Medina 1960). The extremely depleted state of crocodile populations was further emphasized in later publications (Mondolfi 1965, Donoso Barros 1966a, 1966b, Rivero Blanco 1968, King 1973, Blohm 1982). Although it was widely recognized that Orinoco crocodiles were an endangered species, most status accounts were anecdotal and no quantitative survey data were available.

The first large-scale attempt to clarify the status of the Orinoco crocodile in Venezuela was that of Godshalk (1978, 1982), through the sponsorship of FUDENA. Survey results were based primarily on interviews with people knowledgeable about fauna and motorized dugout surveys of several rivers in the llanos region (Tinaco, Cojedes, Portuguesa, Orinoco, Capanaparo, Cinaruco, and Meta rivers). The results of this survey definitively showed that Orinoco crocodiles are extremely rare in Venezuela. A total of only 273 adult crocodiles were located in the survey area (based primarily on a tally of crocodiles known to riverside dwelling campesinos). Based on these survey results, Godshalk estimated that the adult crocodile population in Venezuela was approximately 1,000 (Groombridge, 1983).

After the survey by Godshalk in the mid-1970's, two aerial surveys were conducted on small, isolated crocodile populations in the Caura and the Tucupido rivers. The Caura is a medium-large, rocky, blackwater river that drains a section of the Guayanan shield region of Bolivar state. Although the presence of crocodiles in the Rio Caura had been reported by informants in Godshalk (1978), not much faith was placed in these accounts due to the hydrological and limnological nature of the river. Nevertheless, Franz et al. (1985) found crocodiles in the river section between Maripa, and the falls at Salto Para (115 km), which forms a natural barrier blocking further upstream travel by crocodiles. While the authors did not estimate the total crocodile population, they saw an absolute minimum of 9 large crocodiles, and believed a sizable population existed in the river.

In December 1982, aerial surveys of the Rio Tucupido (Portuguesa State) were conducted by Ramo and Busto (1986). The discovery was quite unexpected because the Tucupido is a small piedmont river in the foothills of the Andes. A total of 5 aerial surveys revealed a range of 5-16 crocodiles, suggesting a small, but potentially viable crocodile population. Crocodile populations in both the Caura and Tucupido are severely threatened by human encroachment. In 1988 the Tucupido river was dammed and the crocodile population remained isolated in a reservoir. In the

Caura crocodiles are killed when trapped in fishing nets, and plans are being made to divert a large quantity of the Caura's water to an adjacent watershed for a hydroelectric project.

In 1986-87, Ayarzagüena (1987) conducted a series of aerial surveys in the Portuguesa River drainage, concentrating in the Cojedes and Sarare River systems. Bolstering the previous findings of Godshalk (1978, 1982), this area was found to contain a dense concentration of crocodiles that were severely threatened by habitat destruction and pollution. Large sections of the rivers have been channelized, and extensive agricultural activity surrounds the area. Additionally, plans are being drawn up to dam an upstream section of the Cojedes River, with potentially disastrous consequences for the crocodiles. Recently, nocturnal spotlight counts in the Cojedes/Sarare system have been continued by A.E. Seijas and C. Chávez (Seijas, 1992). M. Fernandez, a student at UNELLEZ is currently conducting an assessment of the nesting activity of crocodiles in the region.

From 1985-1988, Thorbjarnarson and Hernández (1992) carried out a series of aerial and nocturnal spotlight surveys in the states of Apure, Guárico, Aragua, Bolívar, and Portuguesa. The largest population located was in the Capanaparo River in Apure state, a number of smaller populations were surveyed, including one in the Camatagua reservoir. A very diffuse population of crocodiles was found in other parts of the low-lying llanos savanna habitat amidst a dense population of spectacled caiman (*Caiman crocodilus*). The results of ecological investigations of the reproductive ecology of crocodiles in the Capanaparo River and in captivity were published by Thorbjarnarson and Hernández (1993a,b).

Conservation Program in Venezuela

Venezuelan Crocodile Specialist Group.

Since the early 1980s a group of private and governmental organizations have been meeting regularly to discuss issues concerning the conservation of Venezuela's five species of crocodilians. Over the years much of the agenda has been devoted to coordinating a conservation program for the Orinoco crocodile. A large number of institutions have been actively involved in discussing the problems, or actively participating in the on-going field programs, including:

Fundación para la Defensa de la Naturaleza (FUDENA)
Universidad Nacional Experimental de los Llanos Ezequiel Zamora (UNELLEZ)
Ministerio del Ambiente y los Recursos Naturales Renovables (MARNR)
Servicio Autónomo de Fauna (PROFAUNA)
Instituto Nacional de Parques (INPARQUES)
Fundo Pecuario Masaguaral
Agropecuaria Puerto Miranda
Hato El Frio
Agencia Española de Cooperación Internacional
The Wildlife Conservation Society

Aside from these organizations, funding for Orinoco crocodile conservation programs has also been provided by the Smithsonian Institution, World Wildlife Fund (USA), WWF-International, the National Geographic Society, Econatura, and Corpoven.

Captive Rearing

The first captive breeding of Orinoco crocodiles took place in the Parque Loeffling in Puerto Ordaz, Bolivar state in the 1970s. Since that time, captive breeding and rearing of Orinoco crocodiles has become an important component of the Venezuelan program. At present four captive rearing stations are in operation: Fundo Pecuario Masaguaral, Agropecuario Puerto Miranda, Hato El Frio, and UNELLEZ/Guanare.

The Masaguaral center, initiated in 1984, is currently the largest in terms of production, with 100-150 hatchlings produced annually. The center, established by the Tomás Blohm in conjunction with Fudena has nine adult females and four adult males. Annual egg production is in excess of 300, but high egg inviability rates (ca. 50%) lower production. Masaguaral has also served as a rearing center for crocodiles from wild nests in the Capanaparo River, as part of a headstarting program. The Puerto Miranda center, operated by Almaca, a cotton producing company, was only recently opened, but has the largest stock of adults (8 females:8 males). One nest was produced in 1993, and three in 1994. Currently all adults are housed in one large (ca. 0.75 ha) lagoon. Additional pens are being constructed to isolate smaller breeding groups to achieve higher reproductive success. Headstarting of crocodiles from the Capanaparo has also been carried out at Puerto Miranda.

The Hato El Frio breeding center, initiated in 1976, is the oldest functioning center in Venezuela. Three adults (2 females) are housed in a small breeding pond. In the past nest management has consisted of leaving the eggs in the breeding enclosure, resulting in low hatching success, or animals escaping after hatching. This year (1994) eggs will be collected prior to hatching. El Frio has also served as a rearing center for hatchlings and juveniles collected from the Cojedes River. These animals have been released in the nearby Caño Guaritico refuge. The El Frio center is operated by the Agencia Española de Cooperación Internacional. The UNELLEZ breeding center located in Guanare was established in 1985, currently has two breeding pairs of crocodile, plus several other animals nearing adult size. This center has also served as a rearing center for hatchling crocodiles collected from the Cojedes and Tucupido Rivers.

Reintroduction and Headstarting

The crocodile release program was inaugurated in April 1990 with the release of 31 crocodiles adjacent to the Caño Guaritico refuge. Since that time 914 crocodiles have been released, principally into the Capanaparo River (576) and the Caño Guaritico region (316). Other crocodiles have been released in the Matiyure River (a private wildlife refuge- 4 total), and the Tucupido reservoir (18). All the animals released into the Capanaparo were headstarted animals collected from wild nests along that same river. Crocodiles released into the Caño Guaritico were headstarted animals from the Cojedes River, and captive bred animals from Masaguaral, UNELLEZ, and El Frio.

For 1994 approximately 80 more captive bred crocodiles will be released into the Caño Guaritico, and 25 headstarted crocodiles into the Capanaparo. Additionally, surveys are being conducted to conduct a first release into the Mocapra River in the Aguaro-Guariquito National Park (approximately 25 crocodiles).

Follow-up surveys, including a year-long radio telemetry study (conducted by Maria Muñoz and Miro Benitez) in the Capanaparo River, are being conducted at the two principal

release sites. (Due to recent civil unrest, no work has been conducted in the Capanaparo since 1992, but plans are being made to reinstate work there in 1995). Funding is being sought for the continuance of these programs.

Conservation Program in Colombia

Little work was been conducted on Orinoco crocodiles in Colombia since the mid-1970s. However, beginning in 1994, Mirian Lugo, Director of the Estación de Biología Tropical Roberto Franco, in Villavicencio, Colombia, is to carry out crocodiles surveys in parts of the Colombian llanos (M. Lugo, pers. comm.). Initially, a two year project will center on the Vichada, Casanare, Arauca, Meta, and Guaviare/Guainía regions. INDERENA is also developing plans to carry out crocodile surveys in the Arauca region (F.W. King, pers. comm.). Conservation and management programs for Orinoco crocodiles, as well as all Colombian crocodilians, are based on farming. Farms are given licenses to develop experimental breeding programs. Two farms have been authorized to each collect two adult males and eight adult females from wild populations to serve as a breeding nucleus. The eventual aim of the program is to develop sustained yield harvest of farmed Orinoco crocodiles, but not until survey programs are underway (F.W. King, in litt, 22March 1994). In many parts of the Colombian llanos surveys are difficult to carry out due to civil unrest, and the ultimate success of the program will depend to a large extent on how successful INDERENA is in carrying out status surveys and implementing control mechanisms to ensure animals are not taken from the wild.

Conclusions

The Orinoco crocodile continues to be one of the world's most threatened crocodilians. Continued hunting and habitat destruction are taking their toll on many of the few remaining populations. Nevertheless, there is cause for optimism.

The first surveys for crocodiles in Colombia in over 20 years are now underway. In Venezuela, a great deal has been accomplished over the last 10 years in terms of Orinoco crocodile conservation. A working group of professionals, from both private and governmental organizations, has been active in planning and implementing conservation programs for this critically endangered species. Status surveys, ecological research, habitat protection, and the captive rearing and release of crocodiles have all formed important parts of the overall program. Last year, plans for coordinating Orinoco conservation activities over the next five years were drawn up. If these plans are implemented the crocodile will have a good chance for significant population recovery in Venezuela. The only thing lacking at the present time to implement the plan is funding. The Venezuelan government is presently strapped for cash and only minimal funding is provided to Profauna or INPARQUES. Private groups such as FUDENA are trying to raise funds from in-country sources, but this is only meeting part of the need. An estimated \$70,000 is needed for each of the first three years of the program to guarantee proper implementation.

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