Morelet's Crocodile *Crocodylus moreletii*

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Common Names: Morelet's crocodile, Alligator (Belize), Cocodrilo del Petén (Guatemala), Lagarto negro, Cocodrilo de pantano (México)

Range: Belize, Guatemala, Mexico

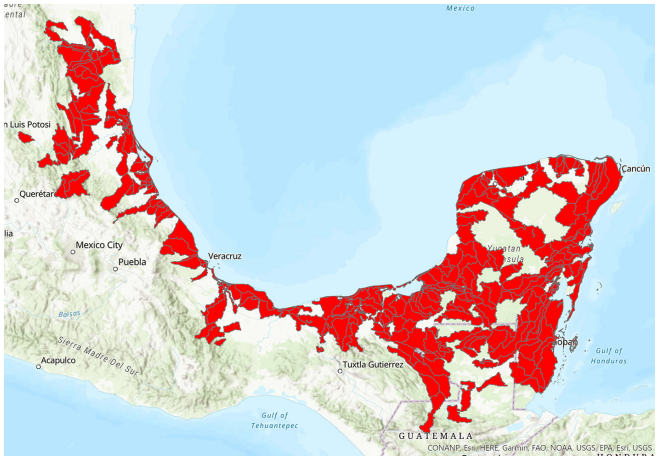

Figure 1. Distribution of *Crocodylus moreletii*.

Conservation Overview

CITES: Appendix I (Guatemala), Appendix II (Mexico, Belize)

CSG Action Plan:
- Availability of survey data: Moderate
- Need for wild population recovery: Moderate
- Potential for sustainable management: High

2018 IUCN Red List: Least Concern (last assessed June 2009; Cedeño-Vázquez *et al*. 2012).

Principal Threats: illegal hunting, habitat destruction

Ecology and Natural History

Morelet's crocodile is a medium-sized species (TL of males to 4.5 m; Platt *et al*. 2009) occurring in the Atlantic lowlands of the Gulf of Mexico (Mexico) and the Yucatan Peninsula (Mexico, Belize and Guatemala). Knowledge of this species has increased rapidly over the past few decades (Casas-Andreu *et al*. 2013; Sigler and Gallegos 2017), and a great deal of research has recently been conducted on its distribution and status in Mexico (Sigler et al. 2002; Dominguez- Laso *et al*. 2004; Cedeño-Vázquez *et al*. 2006; Cedeño-Vázquez and Pérez-Rivera 2010; Mejenes-López and Hernández-Bautista 2013; Villegas and Reynoso 2013), Belize (Meerman 1994; Platt *et al*. 1999; Platt and Thorbjarnarson 2000a; Stafford *et al*. 2003; Tellez *et al*. 2017) and Guatemala (Corado-García 2014), nesting ecology (Platt 1996; Platt *et al*. 2008; Escobedo-Galván *et al*. 2011, 2016; López-Luna *et al*. 2011; Villegas *et al*. 2017), diet and foraging ecology (Platt *et al*. 2002, 2006, 2007; Platt and Rainwater 2007; Cedeño-Vázquez *et al*. 2014, 2016; Platt *et al*. 2016), morphometrics (Platt *et al*. 2003, 2009; Platt and Rainwater 2005; Mazzotti *et al*. 2012), scalation (Platt *et al*. 2008), population ecology (Merediz-Alonso 1999; Rainwater *et al*. 1998, 2000; Leyte-Manrique and Ramírez-Bautista 2005; Platt *et al*. 2009; Platt and Rainwater 2016) and ecotoxicology (Wu *et al*. 2000a,b; Rainwater *et al*. 2002, 2007, 2008; Rainwater 2003; Wu *et al*. 2006; Trillanes *et al*. 2014; Buenfil-Rojas *et al*. 2015; Sherwin *et al*. 2016; Buenfil-Rojas *et al*. 2018).

Morelet's crocodile is characterized by a broad snout, weakly keeled osteoderms on the dorsum, and irregular scale groups on the ventral and latero-ventral surface of the tail (Platt and Rainwater 2005). The species inhabits mainly freshwater areas such as marshes, swamps, ponds, rivers, lagoons and man-made waterbodies, including large reservoirs, and occasionally occurs in brackish or saline mangrove habitats (Platt and Thorbjarnarson 1997, 2000a; Alvarez del Toro and Sigler 2001; Escobedo-Galvan *et al*. 2008; Platt *et al*. 2008; Tellez *et al*. 2017). Cave-dwelling (troglodytism) by Morelet's crocodile has been documented in Belize (Platt and Rainwater 2016).

Throughout much of the southern portion of its range, *C. moreletii* occurs in macro-sympatry with *C. acutus*, and habitat relationships between these two species are now starting to be understood (Merediz-Alonso 1999; Platt and Thorbjarnarson 2000a,b; Platt and Rainwater 2005; Cedeño-Vázquez *et al*. 2006). In general *C. moreletii* occurs in freshwater habitats on the mainland, while *C. acutus* is restricted to saline mangrove

Platt, S.G., Sigler, L., Rainwater, T.R., Cedeño-Vázquez, J.R. and Villegas, A. (2019). Morelet's Crocodile *Crocodylus moreletii*. *In* Crocodiles. Status Survey and Conservation Action Plan. Fourth Edition, ed. by S.C. Manolis and C. Stevenson. Crocodile Specialist Group: Darwin. 7pp.

swamps and offshore cays and atolls. Hybridization between *C. moreletii* and *C. acutus* in the wild has been reported from the coastal regions of Belize (Hekkala 2004; Ray *et al*. 2004; Hekkala *et al*. 2015) and Mexico (Cedeño-Vázquez *et al*. 2008; Rodriguez *et al*. 2008; Gonzalez-Trujillo *et al*. 2012; Pacheco-Sierra *et al*. 2016). In southern Belize, hybridization appears to be unidirectional with crosses between male *C. moreletii* and female *C. acutus*, although the behavioral and ecological drivers underpinning hybridization remain poorly understood (Hekkala *et al*. 2015).

An excellent general account of many aspects of the behavior and ecology of *C. moreletii* remains Alvarez del Toro (1974). In the wild, females reach sexual maturity at around 7-8 years of age (TL= 1.5 m), although in captivity maturity may be attained in 4-5 years (TL= 1.3-1.5 m) (Andrews 2000; M. Muñiz, pers. comm. 2009). Females construct a mound nest of fresh and decomposing vegetation, woody debris, and soil, in which 20-50 eggs are deposited at the end of the dry season (usually mid-May to late June or early July). Hatching occurs in August and September, when the wet season is at its peak, after approximately 75-85 days of incubation (Alvarez del Toro 1974; Perez-Higareda 1980; Platt *et al*. 2008; López-Luna *et al*. 2011; Villegas *et al*. 2017).

Figure 2. Female *C. moreletii* defending a nest. Photograph: Luis Sigler.

Figure 3. Female *C. moreletii* at a burrow entrance exposed by low water levels during the late dry season in Mexico. Photograph: Luis Sigler.

The female opens the nest mound with her forefeet and mouth, uncovers the egg chamber, and transports the hatchlings in her jaws to the water. She also breaks some eggs by rolling them between her tongue and palate, facilitating hatchling emergence (Alvarez del Toro 1974; Hunt 1973, 1980). The female can be very protective of the nest and even more so of the hatchlings, and responds readily to their distress calls. This characteristic was once used by "lagarteros" (crocodile hunters) who imitated the distress call of hatchlings to lure adult females into gunshot range (Alvarez del Toro and Sigler 2001; Platt *et al*. 2008). Male *C. moreletii* are also known to respond aggressively to hatchling distress calls (Rainwater *et al*. 2000).

Figure 2. Adult male *C. moreletii*, Chiapas, Mexico. Photograph: Luis Sigler.

Conservation and Status

Populations of Morelet's crocodile were greatly reduced in many areas due to unregulated skin hunting, which occurred principally in the 1940s and 1950s (Alvarez del Toro 1974; Platt and Thorbjarnarson 2000a). A prohibition on skin hunting was decreed for the region in the 1970s, but illegal

poaching persisted into the 1980s and 1990s. Due to severe sanctions, illegal hunting is now thought to be minimal, although still considered a threat to population recovery in some localized areas. Traditional use of the species for food, medicinal, and artisanal purposes persists, especially in rural Mayan communities (Merediz-Alonso 1999; Zamudio 2004; Padilla and Perera-Trejo 2010). Chinese restaurateurs in Belize reportedly purchase illegally harvested *C. moreletii* from poachers and serve the meat as that of other species (T.R. Rainwater, unpubl. data).

Figure 8. Two *C. moreletii* illegally harvested for tail meat in Guatemala. Photograph: Valerie Corado.

Morelet's crocodile is afforded legal protection in the three Range States. From 2002 to 2004, Mexico developed the "COPAN" project to assess the presence of the species across its historical range and in outlying areas; 63 localities were surveyed in 10 States (Sigler and Dominguez-Laso 2008). In Mexico, *C. moreletii* occupies an estimated area of 396,455 km^2 (estimated by GARP algorithm and based on historical and actual localities). Total historical distribution across all three Range States has been estimated as 450,000 km^2, of which 88% lies in Mexico (CONABIO 2006).

Available survey data for the three Range States - Guatemala (Castañeda-Moya 2000), Mexico (CONABIO 2006 Rivera-Tellez *et al*. 2017) and Belize ("Meerman, pers. comm." in CONABIO 2006) - suggest the relative abundance of *C. moreletii* is similar to other crocodilians that are not endangered. Morelet's crocodile populations in Belize recovered rapidly following cessation of skin hunting, and the species is now regarded as common, even occurring within urban areas such as Belize City (Platt *et al*. 2008). In 2011 Mexico published a manual for monitoring *C. moreletii* populations (Sánchez-Herrera *et al*. 2011), which has become the standard reference for the most recent surveys in Mexico (Rivera-Téllez *et al*. 2017), Guatemala (Corado-Garcia 2014) and Belize (M. Tellez, pers. comm. 2017).

According to Rivera-Téllez et al. (2017), recent mean (± 95% confidence interval) encounter rates (crocodiles/km of survey route) for *C. moreletii* in Mexico (3.4 ± 1.3 in 2014; 4.5 ± 2.8 in 2015) are similar to those estimated in 2004 and again in 2011, suggesting a stable wild population. Using these mean encounter rates together with the area of suitable habitat (22,833 ± 24 km), Rivera-Téllez *et al*. (2017) estimated a population of *C. moreletii* in Mexico of 78,157.3 ± 82.1 and 104,815.4 ± 110.1 in 2014 and 2015, respectively.

Following the down-listing of *C. moreletii* to Appendix II of CITES in 2010, any breeding center in Mexico with the proper registration with the CITES Management Authority [Dirección General de Vida Silvestre of the Ministry of Environment and Natural Resources (SEMARNAT)] can export products and sub-products legally produced in its facilities. At the time of writing this action plan (2018), 14 breeding centers in Mexico had been established for the purpose of producing and selling fine leather for export. In 2017, total annual production of these farms was approximately 3000 *C. moreletii* skins for export and an additional 1000 skins for domestic markets within Mexico (Asociación de Productores de Cocodrilos en México A.C.; M. Muñiz, pers. comm. 2017). In August 2017 Mexico approved a pilot project for egg harvesting in the state of Quintana Roo. With federal and state funding, a facility was constructed for the artificial incubation of *C. moreletii* eggs collected from the wild. The harvest quota for wild eggs is based on technical studies and hatchlings will be reared to a marketable size for the leather industry.

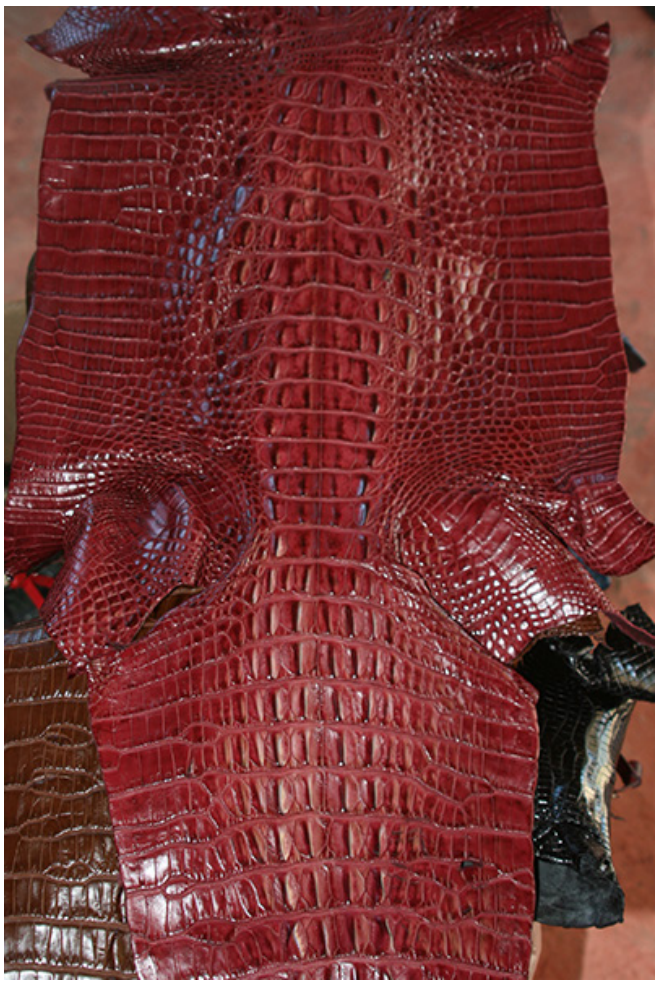

Figure 7. Commercially tanned *C. moreletii* skin from Mexico. Photograph: Manuel Muñiz.

Priority Projects

High priority

1. **Status and distribution in Guatemala**. Status surveys and ecological and genetic studies should be completed. Because expansion of the agricultural frontier and cattle ranching are encroaching on crocodile habitat and recent data are lacking, the status of *C. moreletii* must be quantified as a first step towards developing and implementing a management plan.

2. **Tri-national strategy for conservation and sustainable use**. The three Range States have agreed to develop a strategy to: 1) control illegal trade along their frontiers; 2) unify and standardize methodology and technology for enhanced management; and, 3) promote a solid front for export of *C. moreletii* products.

Moderate priority

3. **Develop management plan for Belize.** Although baseline information on the distribution and status of *C. moreletii* is available, monitoring long-term population trends is a prerequisite before an effective national management plan can be implemented.

4. **Develop a sustainable use program in Mexico.** With the information derived from the "COPAN" Project, there are some localities where a ranching could be based on Management Units for the Conservation of Wildlife (UMA), established by SEMARNAT. If the egg harvest program in Quintana Roo State proves successful, this model can be duplicated in other regions of Mexico.

Figure 5. Sub-adult *C. moreletii* in mangroves surrounding Chetumal Bay, Quintana Roo, Mexico. Photograph: J. Rogelio Cedeño-Vázquez.

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