

Protect and Restore Aquatic Ecosystems in Belize



Project Summary

The American crocodile (*Crocodylus acutus*) is currently listed as “Vulnerable” throughout its geographic range under the IUCN, however, this species is considered Critically Endangered in Belize based on data collected from the last thorough survey in the 1990s in which only 250 individuals were identified. On-going research by the Crocodile Research Coalition indicates this species is still struggling as climate change and anthropogenic impacts hinders species recovery. Particularly, pollution seems to be the biggest threat to species recovery per evidence observed by our team with research from New River and the Placencia Lagoon. Crocodiles are key biological indicators of aquatic ecosystem health given their bioaccumulation of contaminants due to their position as apex predators (and as illustrated with our results from New River). Thus, examining heavy pollution levels in crocodiles provides a good snapshot of what other animals and communities are being exposed to. This project intends to implement a population survey of *C. acutus* while simultaneously collecting data on heavy metal pollution in various coastal and caye locations throughout Belize. Identifying pollutants can help key stakeholders determine the source of pollution, thus it is intended our data can assist in re-evaluating environmental laws and strengthen policies that could initiate a new management plan to ensure the long-term survival and health of aquatic ecosystems. Overall, this project will provide a positive umbrella effect for all the biodiversity and communities within the crocodile habitats studied in this project, therefore aligning with the Belize Fund TA of the Protection for Biodiversity.

Project Goal and Objectives

The goal of this project is two-fold. First, we anticipate obtaining the most thorough population count of the American crocodile to-date, thus providing information in developing the first Species Action Plan. Secondly, we intend to conduct the most thorough eco-toxicology project in Belize, utilizing crocodiles as biological indicators of heavy metal contamination in coastal and caye aquatic habitats. Our objectives of this project is to gather the necessary data to implement the most appropriate conservation and management action plan to assist in species recovery in conjunction identifying pollutants that are threatening the survival of the American crocodile. Identifying pollutants also provides us the necessary data to protect communities that depend on

a healthy aquatic ecosystem for their livelihoods and public health. Besides the research, we plan to have community meetings/outreach events in all areas we survey to provide education on crocs, and the dangers of poor waste management. We plan to share with each community our results so they may understand what actions must be taken to protect (and restore) aquatic ecosystems, hopefully inspiring pride and stewardship in one's environment. We also intend to utilize our data to assist in enforcing regulations for future biodiversity protection.

Project Output and Activities

Project Output and Activity I: Crocodile Population Survey

The American crocodile population survey will provide the most thorough population data of this critically endangered species. Data collected will assist us along with Forest Department in creating the first Species Action Plan, which will include recommendations of mitigating negative interactions between humans and crocodiles in addition to what actions are necessary to assist in species recovery from past exploitation and current human impact.

To assist in the above output, our overall crocodile population survey will have 5 parts. First, we will conduct a habitat survey to identify current and future climatic and human threats. Second, we will conduct a nocturnal eyeshine survey which provides us an estimate count of how many crocodiles are in an area. Third, we will conduct a capture survey where we will take various morphological measurements, as well as tissue samples for heavy metal and genetic analysis. Capture surveys also allow us to conduct health examinations on individuals. Then during nesting season, we will conduct nest surveys to identify the reproductive female population as well as examine the health of hatchlings. Finally, we will conduct community outreach in each community to further educate people on coexistence, as well as provide cultural folklore and stories that connect people to crocodiles that have been lost due to colonization and aspects of modern society. In particular, we will further develop our youth wildlife program to provide a foundation for future wildlife champions and environment leaders as they can assist us with our research. Additionally, we will provide training sessions for any local NGO partners to further build capacity in regard to crocodile research and handling.

Project Output and Activity II: Pollution Analysis

Tissue samples collected from crocodile capture surveys will be stored in a freezer, whereas blood samples will be stored in a fridge for biological samples. These samples will then be sent to Clemson University for heavy metal, PFAS, and pesticide analysis. Once results are provided, we intend to organize a stakeholder meeting with government officials and community leaders to provide results, and suggestions to improve education on waste management, as well as to further enforcement and law to protect biodiversity and communities within crocodile habitat. Furthermore, we intend to revisit communities, providing an educational event to discuss pollution and its impact on the local environment, with suggestions and solutions from previous government and key stakeholder meeting. Finally, we intend to work alongside lawmakers and

government to strengthen environmental law, or provide suggestions on how to further support local law enforcement to enforce environmental laws because of the scientific data we have collected. Given we will be collecting data from various locations throughout the country, our data will not only give a local snapshot of pollution issues, but also illustrate a trend in Belize. We anticipate this information can ensure long-term conservation of biodiversity, and combating future issues of pollution.

Overall Conservation outputs

The intended long-term conservation output is to protect aquatic ecosystems, including the Mesoamerican Barrier Reef System, from the severe effects of contamination. Besides the various aquatic and terrestrial wildlife, local communities depend on healthy aquatic ecosystems for food, water, and income (i.e. Tourism and fishing). While we understand that these habitats are not inviolable from anthropogenic activities, we anticipate that this project will provide the necessary data to enforce regulations ensuring the long-term survival of the wildlife and also, importantly, for local communities to safely use these aquatic systems without pollution compromising their health and livelihoods.

Additionally, this research intends to provide the government of Belize and stakeholders with the data and supporting evidence of bioaccumulation within top-level predators such crocodiles. As expressed by the former CEO of the Ministry of Sustainable Development, Climate Change and Disaster Risk Management, the data shall guide the government of Belize and relevant stakeholders to further re-evaluate environmental laws and strengthen policies that could initiate a new management plan to ensure the long-term survival and health of aquatic ecosystems, not only for biodiversity but also for the multiple communities that depend on these environments for their livelihoods.