Bioacoustics and Behavior of American Crocodiles in Belize



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CGS SRAS Report: Bioacoustics and Behavior of American Crocodiles in Belize

Dear esteemed SRAS grant committee members,

I am writing to provide a final report detailing the results of my research supported by the Crocodile Specialist Group Student Research and Assistance Scheme.

December of 2015, I was awarded a grant through the IUCN/SSC- Crocodile Specialist Group Student Research and Assistance Scheme. My original application entitled, Investigating Bioacoustics and Behaviors of American Crocodiles in Belize, proposed novel research of American crocodile vocal communication and behavior. The objectives of my project were to catalogue American crocodile acoustics signals, investigate crocodile response to playback experiments, and determine time-activity budgets for American crocodiles in Belize. In August of 2017 I completed the proposed project in fulfillment of my Master's degree. As the project timeline was finite I had to reevaluate my original proposal and did not conduct playback experiments. Instead, I narrowed my research scope to focus on the structure and production of distress calls by all size classes of American crocodiles, and completed the behavioral study of activity budgets as proposed. I have also included a summary of complimentary research I performed evaluating the efficacy of tail tags and natural pattern markings to distinguish individual crocodiles in the field.

In this report I provide a summary of work completed and results. The research presented in this report could not have been completed without the assistance of the Crocodile Specialist Group Student Research and Assistance Scheme. Thank you for your support of this project and please look forward to the published results of my research and my continuing involvement in crocodylian conservation and management.

Sincerely,



Miriam Boucher

Summary

American Crocodiles (*Crocodylus acutus*) are broadly distributed throughout coastal and lowland wetlands in the Americas. Despite their being large, charismatic megafauna, the study of American Crocodile ecology is still lacking. As such, I assessed the behavior and bioacoustics of American Crocodiles in Belize to address the paucity of data regarding these two facets of American Crocodile ecology. I conducted behavioral observations from three sites in the coastal zone of Belize. I categorized American Crocodile behavior and recorded activity duration for observed behaviors. In conjunction with behavioral data, I also assessed study sites to quantify the intensity of anthropogenic impact. My results determined that American Crocodiles spent the highest proportional time performing maintenance activities to fulfill basic biological needs. However, the proportion of social and agonistic activities differed between sites, and was greatest at sites with higher human disturbance. The results from this project establish activity-budgets for American Crocodiles in Belize as well as indicate adverse behavioral responses to anthropogenic impact that should be further considered in management decision-making, as should bioacoustics.

American Crocodiles, like most crocodylian species, have a repertoire of acoustic signals used to communicate intraspecifically. Of the acoustic calls produced, distress calls play an important role as they elicit a defense response from nearby conspecifics, enhancing juvenile survivorship. I recorded American Crocodile distress calls from three sites in the coastal zone of Belize. Calls were recorded from hatchling, juvenile, sub-adult, and adult American Crocodiles. I measured temporal and spectral parameters of the calls to describe the call structure of this species for each size class. I compared call

parameters among size classes and determined that call structure remained similar among size classes but call parameters differed. I found that hatchling and juvenile distress calls were highly modulated and higher in frequency, whereas sub-adult and adult calls were longer in duration, lower in frequency, and had less modulation. I determined that call parameters could be used to successfully classify 82.4% of individuals into the correct size class. I also recorded call production by captured individuals as not every capture resulted in successful acoustic recording. Proportion of calls produced by captive individuals differed by size class and site. I found that American Crocodiles at sites with high anthropogenic impact produced distress calls at a higher proportion. My results indicate that anthropogenic activity in crocodile habitat may be impacting the acoustic ecology of American Crocodiles in Belize.

In compliment to the behavioral and acoustical study of American Crocodiles in Belize, I implemented novel marking techniques through tail spot pattern coding and visual tagging. I collected photographs of the lateral tail sides of 105 individual American and Morelet's (*Crocodylus moreletii*) crocodiles throughout Belize. I used existing tail spot pattern coding methodology developed for Nile Crocodiles (*Crocodylus niloticus*), and adapted this technique to create a second method. The original coding protocol, the numeric code, was 84% successful in differentiating tail spot patterns from American and sympatric Morelet's Crocodiles. The second method, the additive code, integrated irregular scale groups and vertical caudal scutes into the original coding system. I was 99% successful in differentiating individual crocodiles using the additive code. In conjunction with tail spot coding, I applied flexible, self-piercing, plastic tags to tail scutes to mark sub-adult and adult American Crocodiles. I used the tail tags to verify spot pattern recapture and facilitate individual identification for behavioral observation.

The use of these tags is beneficial to behavioral studies and short-term population monitoring and offers an opportunity to augment current marking techniques. I determined that spot pattern coding and visual tagging are effective means to individually identify crocodiles in Belize and are a tool that can be easily implemented by current managers as well as integrated into community based citizen science initiatives.

Dissemination:

Results from this project have been disseminated in various ways. In May of 2016 I presented the preliminary results of my bioacoustics work on American Distress calls at the CSG Meeting in Skukuza, South Africa. Following the presentation of those results I presented the preliminary results of my behavior and activity budget results at the Mesoamerican Society for Biology and Conservation Congress meeting in August of 2016, in Belize City. I presented the results of my individual identification methodology at the 2016 The Wildlife Society Meeting held in Raleigh, North Carolina. My last conference attended was the Northeast Fish and Wildlife Association Meeting in Norfolk, Virginia. I presented the final results of my bioacoustics research as well as implications for the effects of anthropogenic activity on wildlife communication and behavior. I anticipate presenting the full results of my bioacoustics research at the upcoming CSG Meeting in Santa Fe, Argentina. I hope to compliment my original work with the results of a comparative analysis of American and Morelet's crocodile distress calls. In addition to academic presentations, the information and results of my work have been adapted into community education presentations by the Crocodile Research Coalition in Belize. The individual components of my work have also been submitted for peer-reviewed publication and will be shared with the committee upon their publication.