Agenda Item: SC. 2.4.

Crocodile Specialist Group Steering Committee Meeting
Double Tree Hilton, Darwin, Australia
(15 April 2024)

Latin America and the Caribbean

The LAC Regional Office has been in operation for over 17 years, based in Santa Fe Province, Argentina. It fulfills a variety of functions and services, including maintaining an up-to-date database with information generated from CSG contacts and members, facilitating communication among them, assisting with SRAS funding matters, and more.

Another activity involves distributing scientific publications received from various authors. The Regional Office maintains an extensive database of studies or reports on different crocodile species and a wide range of topics. These publications are organized by year of publication and by species, making them accessible to anyone. Additionally, all contacts regularly receive information about various activities conducted regionally and globally, including courses, workshops, meetings, congresses, symposia, and others. This helps promote the participation of different interested individuals in these activities.

After having reactivated the category of "CSG contact", numerous people have been detected through suggestions that are active in relation to the activities with crocodilians, many of them are already members of the CSG. The updating of "non-member" contacts tries to ensure the efficient and constant exchange of information with different people from the region.

We also facilitate cooperation among various academic fields, scientists, NGOs (non-governmental organizations), and other institutions, providing information to specialists, researchers, officials, undergraduate, and graduate students from Latin America and the Caribbean.

Countries virtual meetings
We organized various meetings with representatives from most countries in the Latin America and Caribbean islands region. These gatherings provide us with the opportunity to connect with numerous individuals involved in crocodilian activities, some of whom were not familiar with the CSG, its mission, and objectives. Unfortunately, we encountered connectivity issues with some countries, limiting our ability to meet with them.

During each meeting, we conducted a brief presentation to introduce the CSG to new participants. The primary goal of these meetings was to foster networking and collaboration among regional stakeholders, leveraging available technologies to facilitate communication. We established a virtual platform to facilitate ongoing discussions on crocodilian conservation, encouraging the exchange of perspectives among participants. This platform also serves as a means for maintaining regular contact with CSG members and other key stakeholders through frequent virtual meetings.

Human-crocodilian interactions survey in LAC region
As part of our ongoing initiatives, we participated in the 1st Online Conference Cycle commemorating the 30th anniversary of "Human-Crocodile Interactions in Mexico 1993-2023", from September to December 2023.

LAC social media
Active engagement on Instagram and Facebook is reflected in the steadily increasing number of followers. However, a challenge remains in encouraging crocodilian enthusiasts to actively identify LAC social media channels on their own, though this is gradually changing.

In response to an initiative from women in the region, we commemorated "International Women's Day" by featuring an article in the newsletter "Women in Crocodilian Research, Management, and Conservation", published in 2022 in the CSG Newsletter [41(1)]. This initiative aimed to enhance the visibility and empowerment of women across various sectors, recognizing that this may not always be straightforward, particularly in certain cultural and social contexts.

Another significant development is the creation of an interactive database by country. This database, with defined data fields, serves as a tool for organized information storage, facilitating quick access and retrieval through technological devices. Managed by representatives from each country in the LAC region, this database allows every member or contact working with crocodiles in the region to continually update relevant information, ensuring its ongoing relevance and usefulness.

Prepared by: Lucía Fernández and Pablo Siroski
Date prepared: 31 January 2024

Argentina

Ranching of broad-snouted Caiman (*Caiman latirostris*) and yacare caiman (*Caiman yacare*) in Argentina, along with releasing juveniles into the wild population, are the only authorized initiatives for both species. Currently, Formosa Province has the only program based on ranching with trade purposes in Argentina. In contrast, the traditional Proyecto Yacaré program in Santa Fe has shifted its focus since 2020 to collecting eggs solely for conservation and research purposes, involving local communities through incentives for conservation. Notably, there has been a significant increase in the involvement of women in ranching activities, with many expressing a desire to continue participating in all stages of the process. These developments underscore a noteworthy empowerment and strengthening of women's roles in sustainable crocodilian management practices, but sadly, the activities related to ranching operations are decreasing because there would be very interesting for women as collaborators with families' incomes.

Furthermore, unconventional surveys and population studies are being conducted in various locations, including monitoring nesting sites within El Palmar and Ibera National Parks, and studying not well-known populations of caimans. Additional activities such as informational talks on reproductive biology and species characteristics, as well as night sightings for rangers and visitors, contribute to broader education, awareness efforts, and they are very useful in the design of caiman management inside of National Parks.

There are certain laboratories that work integrated with the Proyecto Yacare, and reports from them are below:

Laboratorio de Ecología Aplicada report (Centro de Investigación Científica y de Transferencia Tecnológica a la Producción, CICYTTP - CONICET) - Melina Simoncini and Carlos Piña

We have conducted studies on the characterization of meat and fat from *Caiman latirostris* and their potential uses, aiming for them to be valued as other by-products and thus be subsidiary to management programs, in addition to leather. Regarding meat produced in captivity, it has excellent characteristics (lean, good protein percentage, and fatty acid profile) and in tastings, it has been the most chosen meat by consumers (compared to other white meats such as those from other reptiles and fish). Although the meat proved to be very good, we were able to make it healthier (improving the fatty acid profile) by modifying the captive diet. We achieved the same enrichment with the fat of the caimans, and we even managed to produce oil without altering its quality. In relation to this topic, we published a book chapter on the characterization and utilization of meat and fat from reptiles from sustainable management programs, using the caiman as a model as well as other reptiles.

Regarding the captive breeding of caimans (located in the EZE), we published exploitation or cooperation behaviors identified through cameras. Regarding the work carried out on temperature sex determination, we published a review on the effect of hormones on the sex determination of caimans, as well as other reptiles.

In the wild, studies have been conducted on how body condition could determine whether a female reproduces or not. We evaluated how climatic variables affect female attributes and consequently reproductive success, and we also published a study on the survival of caiman offspring during winter. Based on historical databases, we conducted a modeling study of the population dynamics of caimans in Santa Fe province, considering possible uses.

Based on the study of changes in caiman eggshell structures during incubation, we published a paper in which these changes could be used to understand the incubation of dinosaur eggs, by evaluating the state of eggshell in fossil nests.
In terms of ongoing Work, we are continuing our studies on temperature sex determination and the effects of constant and variable temperatures on the reproductive structures and phenotypes of offspring, such as how hormones and fatty acids transferred by the mother can affect sex determination, in addition to temperature. We continue with monitoring studies of caimans in the wild using camera traps, drones, and even the application of artificial intelligence. As well as other research on female reproduction, their behaviors, and the effects of extreme events (droughts and floods) as a result of climate change.

Thesis Completed (2022-2024)

- Evangelina Viotto (2022). Population dynamics of *Caiman latirostris*: development of a predictive model for its conservation, incorporating possible scenarios of climate change and sustainable use. Doctoral thesis, Universidad Nacional de Córdoba.
- Hernán Ciocán (2023). Population ecology of reintroduced and wild *Caiman latirostris* and evaluation of their monitoring methods. Doctoral tesis, Universidad Nacional de Córdoba.

Publications (2022-2023)

1. Leiva PML, Valli FE, Piña CI, González MA, Simoncini MS. 2022. Chemical characterization and potential use of reptile fat from sustainable programs. Ethnobiology and Conservation, 11:06 (22 March 2022) https://doi.org/10.15451/ec2022-03-11.06-1-12.
2. Viotto EV, Simoncini MS, Verdade LM, Navarro JL, Piña CI. 2022. Winter survivorship of hatchling broad-snouted caimans (*Caiman latirostris*) in Argentina. Ethnobiology and Conservation, 11:18 (29 August 2022) https://doi.org/10.15451/ec2022-07-11.18-1-13
3. Pierini SE, Imhof A, Larriera A, Simoncini M, Príncipe G, Piña CI. 2022. Nest-sharing behavior of captive Broad-snouted caimans (*Caiman latirostris*): cooperation or exploitation? Amphibia-Reptilia https://doi.org/10.1163/15685381-bja10118.
4. Viotto EV, Navarro J, Simoncini M, Piña CI. 2023. Staged-based model of population dynamics and harvest of Broad-snouted caiman (*Caiman latirostris*) under different management scenarios. Ethnobiology and Conservation 12:01. https://doi.org/10.15451/ec2023-01-12.01-1-20.
5. Leiva, PML, Simoncini M, Piña CI, Labaque MC. 2023. Influence of climatic variables on corporal attributes of adult female caiman and their relationship with reproductive success. South American Journal of Herpetology, 28, 2023, 16–25. http://doi.org/10.2994/SAJH-D-21-00033.1.
6. Valli, FE, Leiva, PML, Lavandera J, Contini MC, Gerstner C, Piña CI, Simoncini M, González MA. 2023. Caiman's fat enriched with n-3 fatty acids: potential food supplement Tropical Animal Health and Production 55, 194. https://doi.org/10.1007/s11250-021-02974-y.
7. Mazaratti M, Valli F, Pierini SE, Simoncini M, Piña CI, González MA, Leiva PML. 2023. Reptile bushmeat, an alternative for the supply of high biological value proteins? Sustainability 15(9), 7448; https://doi.org/10.3390/su15097448
8. Valli F, Simoncini M, González M, Piña C. 2023. How do maternal androgens and estrogens affect sex determination in reptiles with temperature-dependent sex? Development, Growth & Differentiation, 1–12. https://doi.org/10.1111/dgd.12887
9. Fernández M., Piazza M., Simoncini M. 2023. Do ontogenetic changes during incubation interfere with the interpretation of incubation mode in dinosaur eggs? Historical Biology. https://doi.org/10.1080/08912963.2023.2257956
10. Viotto, E.V.; Leiva, P.M.L.; Pierini, S.E.; Simoncini, M.S.; Navarro, J.L.; Piña, C.I. 2024. Body Condition of Reproductive and Non-Reproductive Broad-Snouted Caiman Females. Animals 2024, 14, 1. https://doi.org/10.3390/ani14010001.

Books

11. Pedro Mayor, Alejandro Meléndez Herrada, Fernando Xicoténcatl Plata Pérez, Pedro Pérez Peña, Carlos I. Piña y Melina S. Simoncini. 2022. Protocolos para el Monitoreo y manejo de la fauna silvestre (Volumen I). COMFAUNA (Ed) Bogotá, Colombia. ISBN: 978-958-8753-83-6

Book chapters

12. Leiva P, Valli F, Piña C, González M, Simoncini M. 2022. Caracterización y aprovechamiento de carne y grasa de reptiles provenientes de programas de manejo sustentable pp. 57-83.
13. Pighin, G.A., Albornoz E.M., Piña CI. 2022. Protocolo de obtención de imágenes para detección de individuos mediante vehículos aéreos no tripulados pp. 37-56.
14. Urbina Flores DP., Arellano Alavez T., Pierini SE., Xicoténcatl Plata Pérez F. 2022. Muestreo de poblaciones de fauna silvestre mediante cámaras fotográficas sensibles al movimiento a distancia (cámaras trampa) pp. 82-112.

Laboratorio de Ecología Molecular Aplicada Report (Instituto de Ciencias Veterinarias del Litoral/UNL-CONICET) - Pablo Siroski

The Applied Molecular Ecology Laboratory (Instituto de Ciencias Veterinarias del Litoral/UNL-CONICET) is a comprehensive facility that encompasses a wide range of activities and functions aimed at advancing our understanding of various animal species, conducting biological assays, managing biodiversity, and other associated tasks. The laboratory is equipped with state-of-the-art facilities for housing and maintaining different species, including specialized boxes for animals of various sizes, as well as areas dedicated to isolation, quarantine, and rehabilitation.

In addition to these animal care facilities, we have designated spaces for conducting general procedures and processing initial samples. Our laboratory is also well-equipped for educational and research purposes, and development offices.

We recognize the importance of utilizing natural resources through tailor-made sustainable development plans, not only for the benefit of local populations but also for the dynamics of natural ecosystems. By fostering sustainable practices, we contribute to the conservation of countless wildlife species and play a vital role in implementing state policies related to the management and reintroduction programs of biologically significant species.

Furthermore, our laboratory serves as a crucial link in socio-educational efforts against illegal wildlife trafficking, providing valuable insights and data to support conservation initiatives. Our research focuses on the application of environmental health markers, actively contributing to the preservation of natural resources. These markers are

instrumental in monitoring both natural and productive areas, enabling the early detection of potential impacts on various parameters in wildlife species.

Overall, the lab is dedicated to advancing scientific knowledge, promoting sustainable practices, and contributing to the conservation of biodiversity and the well-being of ecosystems. Some of the most important research lines include:

- Study of the general and specific physiology of wild animals to develop the necessary knowledge for implementing management and conservation strategies for both *in situ* and *ex situ* wildlife.
- Promotion of knowledge about the sustainable use of natural resources through the use and valorization of therapeutic products derived from them, as well as the assessment of environmental and anthropogenic threats that may disrupt these ecosystem services.
- Production of caiman recombinant proteins of biotechnological interest in veterinary sciences.
- Evaluation of survival and reproductive strategies of caiman in the face of a changing climate, assessing metabolic, physiological, endocrine, and genetic responses.
- Evaluation and characterization of the gastrointestinal microbiome of Broad-snouted Caiman.
- Assessment of molecular markers for early warning as indicators of environmental stress due to exposure to xenobiotics in Broad-snouted Caiman.
- Evaluation of cellular damage through biomarkers of genetic instability and gene expression as indicators of exposure to different stress conditions in Broad-snouted Caiman.
- Conservation genetics of Argentinean caimans.
- Use of environmental DNA as a method for monitoring biodiversity.
- Evaluation of the effect of commonly used pesticides on the activity of the adrenocortical axis of the Broad-snouted caiman and its impact on sustainable development programs.

These research lines contribute significantly to understanding various aspects of caiman physiology, behavior, and health, as well as providing valuable insights for conservation and management efforts.

Recent publications

1. López González EC., Odetti LM, Latorre MA, Aville OB., Contini LE. Siroski PA., Poletta GL. A comprehensive approach using multiple biomarkers to detect damage induced by pesticides in broad-snouted caiman (*Caiman latirostris*) Heliyon 8, (1): E08667 (2022)
2. Odetti, LM., EC. López González, P.A. Siroski, MF. Simoniello, GL. Poletta. How the exposure to environmentally relevant pesticide formulations affects the expression of stress response genes and its relation to oxidative damage and genotoxicity in *Caiman latirostris*. Environm. Toxicol. Pharmacol. Volume 97, January 2023, 104014 IF: 5,354; SJF: 0,87 = Q1 (Health, Toxicology and Mutagenesis).. https://doi.org/10.1016/j.etap.2022.104014
3. María Soledad Moleón, Pablo Fernando Cuervo , María Virginia Parachú Marcó, Elisa Olivia Pietrobon, Graciela Alma Jahn, and Pablo Ariel Siroski. Effects of physical restraint and endogenous adrenocorticotropin challenges on corticosterone levels and immunological indexes in the Broad-snouted Caiman (Caiman latirostris). Can. J. Zool. 101: 1–9 (2022). http://dx.doi.org/10.1139/cjz-2022-0053
4. María Soledad Moleón, Gonzalo Santiago, Samuel Hilevski, Pablo Ariel Siroski. Blood biochemistry parameters of Broad snouted caiman, Caiman latirostris subjected to stress conditions, applying micro-volume techniques. J Exp Zool A Ecol Integr Physiol. 2023;1-6.
5. Patricia S. Amavet, Gualberto Pacheco-Sierra, Marcela M. Uhart, Walter S. Prado and Pablo A. Siroski. Phylogeographical analysis and phylogenetic inference based on the cytochrome b gene in the genus Caiman (Crocodylia: Alligatoridae) in Central and South America. Biological Journal of the Linnean Society, Volume 138, Issue 3, March 2023, Pages 289–303, https://doi.org/10.1093/biolinnean/blac145
6. Lucia M. Odetti, Camila F. Chacón, Pablo A. Siroski, Ma. Fernanda Simoniello, Gisela L. Poletta. Effects of glyphosate, 2,4-D, chlorantraniliprole, and imidacloprid formulations, separately and in mixtures in *Caiman latirostris* hatchlings Toxicology and Applied Pharmacology 469 (2023) 116544 https://doi.org/10.1016/j.taap.2023.116544
7. Trinidad de los Ángeles Cordero Gil, Patricia Susana Amavet, Belkis Ester Marelli and Pablo Ariel Siroski. Evidence of venom factor-like in crocodilians. Organisms Diversity & Evolution. https://doi.org/10.1007/s13127-023-00617-8.
8. Samuel Hilevski, Hernan Ciocan, Luis Bassetti, and Pablo A. Siroski. Relationship between skin colour, conjunctivitis, and dermatitis in captive Caiman latirostris in Argentina. Herpetology Notes Volume 16: 847-854 (2023) (published online on 25 November 2023)
9. Hilevski, S., Cordero, T. y Siroski, P. 2022. Do Crocodilians Eat Plant Material? A Review of Plant Nutrients Consumed by Captive Crocodilians. South American Journal of Herpetology, 24: 1-7
10. Odetti L., MF. Simoniello, GL. Poletta. Alterations in the Expression of Antioxidant Enzyme Genes in Response to Pesticide Exposure During Embryonic Development in the Native Reptile Species *Caiman latirostris*. Bull. Environm. Cont. Toxicol 110:3 (2023).

Book chapters

11. L.M. Odetti, E.V. Paravani, M.F. Simoniello, G.L. Poletta (2022). The role of superoxide dismutase in reptiles under toxicity contexts, en: En: Owen PJ (Ed.) Advances in Animal Science and Zoology. Vol. 20, Chap. 5, pp. 167-187. Nova Science Publishers, New York, USA. ISBN: 979-8-88697-199-6.
12. L.M. Odetti, M. F. Simoniello, P. A. Siroski and G. L. Poletta (2023). The Broad-snouted Caiman (Caiman latirostris): A Model Species for Environmental Pesticide Contamination Assessment Through Molecular Markers. Chapter 11. Pp. 196-209. Issues in Toxicology No. 45. Bird and Reptile Species in Environmental Risk Assessment Strategies Edited by Guillermo Eli Liwszyc and Marcelo L. Larramendy. The Royal Society of Chemistry 2023. Published by the Royal Society of Chemistry, www.rsc.org

Laboratorio Externo de Vertebrados de la FHUC Report (Convenio MAyCC/UNL) - Alba Imhof and Alejandro Larriera

In 2020, we began on the CAI+D referred to "Biodiversidad asociada a los ambientes de nidificación de *Caiman latirostris* en humedales del espinal santafesino", which is based on a multidisciplinary approach integrating researchers from biodiversity, agricultural sciences, veterinary and icthyology and others. Due to the COVID pandemic, the work was delayed until 2022 and is currently underway. There are four CSG members in this team.

We were invited to the National Congress on Biodiversity at Iguazú Falls in Misiones Province, to participate on a round table on sustainable use of wildlife, presenting as a case story the example of the Proyecto Yacaré, past, present and future.

We are working on a regular night count survey at the campus of the Universidad Nacional del Litoral, where a *Caiman latirostris* population has been identified.

An international production for Wildlife Television was working at our facilities the last summer to record maternal care and sounds of the hatchlings at birth.

The educational community outreach program is going on, despite the scarcity in eggs numbers due to the suspension of the commercial program which collects the eggs. Over a couple of hundred peoples did have the chance to help and learn about biology and conservation of caimans.

Of course, in parts of the facilities of the Proyecto Yacare, some instances of the research carried out by the other labs occurred.

Thesis

Three theses were developed and defended in the period by Luciano Muñoz, Joaquin Zapata and Bruno Holubicky

Conference papers

1. Imhof, A. y Larriera, A. 2022 –A community-based participatory research experience on Proyecto Yacaré-Broad-Snouted Caiman Sustainable Use Program (*Caiman latirostris*) Chetumal, México
2. Holubicki Fernández Campón B, Marsico Fettolini M, Larriera, A e Imhof A. La sonrisa del yacaré, forma y función de la mandíbula y dientes en *Caiman latirostris*. 2022 -Poster - Congreso de Biodiversidad. Misiones
3. Marsico Fettolini M, Holubicki Fernández Campón B, Imhof A. 2022. Variación en la forma de la mordida en *Caiman latirostris*. XXII Congreso Argentino de Herpetología.
4. Muñoz, L., Imhof, A., Pierini, S. y Larriera, A. 2023 Relaciones interespecíficas entre *Caiman latirostris* y tortugas acuáticas en condiciones de semicautiverio. XXIII Congreso Argentino de Herpetología.

Research publications

5. Pierini, S., Imhof A., Larriera A., Simoncini M., Príncipe G., Piña C. (2022). Nest-sharing behavior of captive Broad-snouted caimans (*Caiman latirostris*): cooperation or exploitation?. Amphibia-Reptilia (2022) DOI:10.1163/15685381-bja10118.
6. Larriera, A. (2022). POLICY BRIEF Deontology or consequentialism? Ethical approach on the use and management of wildlife, illustrated by the use of caimans in Latin America. Ethnobiology and Conservation. 11:07 (22 March 2022) doi:10.15451/ec2022-03-11.07-1-5ISSN 2238-4782ethnobioconservation.com
7. Webb, G.J.W., Ross, J.P., Manolis, S.C., Larriera, A. and Lippai, C. (2021). Key points about traceability in crocodilian conservation and management? Pp. 11-17 in Traceability in Crocodylian Conservation and Management. IUCN SSC Crocodile Specialist Group: Darwin, Australia.
8. Webb, G.J.W., Ross, J.P., Manolis, S.C., Larriera, A. and Lippai, C. (2021). Why address traceability? Pp. 1-9 in Traceability in Crocodylian Conservation and Management. IUCN SSC Crocodile Specialist Group: Darwin, Australia.

Symposia: XII and XIII Argentine Herpetology Congress (AHA) Symposiums on Crocodylia

In both 2022 and 2023, Crocodylia Symposia were held within the Argentinean Herpetology Congress, aimed to provide a comprehensive platform for integrating and representing crocodilians within the realm of herpetology. The symposia

focused on sharing diverse perspectives, opinions, and information regarding Argentine species of caimans. Led by Dr. Gisela Poletta and Dr. Pablo Siroski, the symposium aimed to reflect the current state of research on caiman biology, advances in management, current challenges, and future conservation efforts. There were numerous oral presentations and posters, and they provided valuable insights into various aspects of caiman research, including genetics, evolution, environmental stress, health assessment, and reproductive consequences of climatic phenomena. The symposium facilitated fruitful discussions and highlighted the importance of continued research and conservation efforts for Argentine caiman species.

Sustainable Use of Reptiles

The Symposium "Sustainable Use of Reptiles" was celebrated on 23 November 2023. Attendees and invited speakers, whose work related to conservation and use of reptiles and links with local communities, participated in the Congress. At the end of the presentations, there was discussion and exchange among the participants, highlighting key points and current challenges. The taxonomic groups discussed were turtles, lizards, crocodilians and anacondas. Several CSG members organized and participated in the Symposium (Alejandro Larriera, Melina Simoncini, Carlos Piña, Sofía Pierini, Pamela Leiva and Alba Imhof).

Prepared by: Pablo Siroski
Date prepared: 31 January 2024

Belize

1. *Crocodylus actus* research

In 2023, Aces Wildlife Rescue, in collaboration with University College Cork, conducted the most comprehensive American crocodile population assessment on Ambergris Caye to date. The rapid and ongoing development of Belize's foremost tourist destination has led to the unchecked destruction of vital mangrove wetland habitats on the island, posing significant threats to the remaining populations on the Caye and the delicate, unique ecosystem of the surrounding islands. The primary objective of this assessment was to ascertain the present condition of the population by examining data collected by Aces a decade ago. This examination aimed to determine the impact of the observed expansion and destruction of remaining wetland habitats on the crocodile population and the availability of crucial nesting habitats. All historical nesting sites were evaluated to assess their ongoing suitability for nesting. Aces additionally is delving into the trend of human-crocodile interactions. Aces has diligently documented all such occurrences for over a decade on Ambergris Caye, and aims to quantify the primary factors contributing to negative human-crocodile interactions.

The Crocodile Research Coalition (CRC) is collaborating with Turneffe Atoll Sustainability Association (TASA) with regard to creating an annual monitoring program of the American crocodile to monitor it's population. Turneffe Atoll is considered the last stronghold for the American crocodile in Belize, in addition to an important source population for *C. acutus* on the mainland. July 2023 was the second year the CRC conducted eyeshine and capture surveys with TASA around the atoll. Three nests were observed in 2023, and there are plans to expand and explore for more nest survey sites in 2024. In the last decade, erosion along the beach and cayes has increased drastically threatening suitable habitat for nesting. The CRC and TASA are currently looking at other potential nesting spots where intervention of beach erosion can be implemented.

During July 2023-August 2023, graduate student Gary Moscarelli from National University of Cork investigated the increase of crocodiles exhibiting aggressive and dangerous behavior towards tourists and locals on the island of Ambergris Caye. These unnatural levels of aggression displayed by the crocodiles are seemingly isolated to populations directly affected by illegal feeding practices driven by the island's ever expanding tourism industry. In this study, comprehensive behavioral surveys were carried out to assess a group of crocodiles known to be exposed to consistent human interaction via illegal feeding events. The habituation of wild crocodiles in Belize poses significant threats to the safety of local community members and tourists visiting the island, as well as endangering further this already threatened species. Habituation can lead to individuals being more susceptible to poaching as well as lethal retaliation from concerned local community members. More information about this study can be found in the reference at the end of this report.

In September-December 2023, Yannick Hendricks from University of Coppenhagan collaborated with the CRC to evaluate how American crocodiles were utilizing and distributing themselves across a habitat, primarily the Placencia Lagoon in southern Belize. The objectives of his study were to (1) determine gross population abundance and density estimates, and (2) provide baseline microhabitat use data for the American crocodile within an urban-influenced coastal lagoon. Findings of past studies on microhabitat use and habitat suitability in other crocodilians were used to test some of the hypotheses in this study. It was expected that smaller size classes (i.e., hatchlings and juveniles) would utilize areas of lower depths compared to larger size classes (i.e., sub-adults and adults). Also, it

was expected that the smaller size classes would utilize areas of higher percentage cover compared to the larger size classes and that distribution would be non-random across all size classes. Furthermore, it was expected that crocodiles would be less abundant in areas where arboreal vegetation was absent, and that the degree of human activity would impact relative densities. Moreover, this study has an objective to identify which microhabitat components were most utilized by the American crocodiles in the Placencia Lagoon with aim to establish baseline habitat use data for the American crocodiles in the Placencia Lagoon.

2. *Crocodylus moreletii* research

The CRC in collaboration with Friends for Wildlife Conservation, and Northern Arizona University initiated an investigation into a population of Morelet's crocodiles that are inhabiting caves in Central Belize in September 2023 and is on-going. The investigators are determining if the crocs are transient or permanent residents of these caves. Besides the ecological uniqueness of this research, the investigators are also looking for any connection with the ancient Maya civilization to the presence of the crocs in these caves given evidence illustrates ancient ceremonial practices occurred in these caves. The ancient Maya highly revered crocodiles as observed in their creation story, the Maya calendar, etc.

The CRC collaborated with Princeton doctoral student Yeraldi Loera on her thesis project that examines transcriptomic responses and possible mechanisms of adaptation in response to pesticides. In an increasingly polluted world, anthropogenic contaminants have become a significant threat to wildlife globally. Entering an organism through water, soil, food, and air, these toxic chemicals alter biological functioning and can act as a source of human-mediated selection in chronically exposed populations. Uncovering the mechanisms by which this selection may impose adaptive resistance to toxic contaminants can help to understand and predict the long-term evolutionary consequences of exposure. Studies on wildlife inadvertently exposed to chronic levels of contaminants are ideal study subjects for documenting biological responses to exposure. However, few studies have connected these adverse responses across the biological hierarchy to help identify the underpinning mechanisms of adaptation. As long-lived generalist apex predators, crocodilians are uniquely suited for studies on persistent pesticide bioaccumulation within an individual through time, as well as the biomagnification of contaminants across trophic levels of the food chain. Previous studies have measured high concentrations of endocrine-disrupting pesticides, including DDT, in the waterways, eggs, and tissues of *C. moreletii* in Belize. The effects of these endocrine disruptors have not yet been studied in this population but have been meticulously analyzed as estrogenic disruptors of reproductive function in closely related American alligators at Lake Apopka, Florida. By comparing the genetic regulatory underpinnings of blood and tissue samples from pesticide-exposed Morelet's crocodiles in Belize, Yeraldi aims to describe parallel or stochastic mechanisms of disruption or adaptive responses to chronic contaminants.

In September 2022, CRC Biologist Jonathan Triminio was awarded Year 2 of the ECOP grant by the Marine Conservation Action Fund. This grant allowed the research team to conduct monthly surveys in the polluted New River watershed in northern Belize, resulting in valuable preliminary data including 5 years worth of contiguous crocodile population and individual morphometric and health data. Although the pollutant(s) responsible for the fish and crocodile epidemic have not yet been identified, the team has shipped 60 samples of *C. moreletii* tissue and claw samples to their collaborators at the NCSU Laboratory, with results expected by mid-2024.

Between June 2022 and January 2024, the team surveyed a total of 78 km of river habitat and observed 161 crocodiles resulting in an encounter rate (ER) of 2.06 crocodiles per kilometer (Table 1). The crocodile population density has shown minimal variability throughout the years of monitoring, and it has been determined to be currently stable. In 2018/2019, the ER was at 2.66 crocodiles per kilometre, and in 2022, the ER was 2.44. Nonetheless, monitoring this population is still crucial for the project's viability, especially since there is still evidence of fish kill and eutrophication in some parts of the river system. Since January 2023, the team has managed to carry out 11 capture surveys, which allowed them to obtain a total of 42 tissue samples. The mark and recapture surveys showed that most captured crocodiles seemed to be in good physical condition. However, adult and sub-adult crocodiles would exhibit skin discoloration, sloughing and lethargy in rare cases, suggesting a prolonged exposure to the pollutant(s). Conversely, hatchlings and juveniles commonly display an adhesive algae substance throughout their bodies impacting their ability to successfully hunt and evade predators (Fig. 1).

Part of the fieldwork was conducted in conjunction with a PhD study by Yeraldi Loera, which examines pesticide exposure using blood samples of *C. moreletii*. This study will be integral in filling knowledge gaps regarding pollution issues in Belize.

3. General information

Major threats crocodiles in Belize face (in order from highest to lowest): development/destruction of habitat, particularly of key nesting habitat; pollution; illegal hunting; and gillnets.

The CRC hosted their first half/and full marathon in October 2023. This marathon was to raise funds for various conservation efforts locally, and was also a good source of outreach to various people across country.

The CRC is currently analyzing data to draft up a Conservation and Management Action Plan for crocodiles of Belize. Given recent genetic data, there are only a few populations of Morelet's American crocs left in Belize. These particular populations will require particular action plans, however species action plans for both species have been dismissed given the majority of crocodiles in-country are hybrids.

The CRC conducted 88 outreach activities, mostly in the Stann Creek District (the majority being in-person), reaching 5080 people in 2023.

4. Related publications

Moscarelli, G. and M. Tellez (2023). Effects of illegal feeding practices and urbanization on behaviour of wild American crocodiles (*Crocodylus acutus*) on Ambergris Caye, Belize. Crocodile Specialist Group Newsletter 42(1): 9-12.
Greco, Robert M., J. Brocca, M. Tellez, R.J. Espinal, J.E. Peña, R. Peña Perez, C. Serra, S. Beckley, and A.E. Rosenblatt (2023). Population Status of American crocodiles (*Crocodylus acutus*) in the Dominican Republic. Journal of Herpetology 57(4): 418-427.
Wynne, J.J., M. Tellez, K.Hartwell, S. Reneau, G. Welch, K.D. Voyles, M. Cal, D. Castillo, and J. Champion (2023). Cave-dwelling crocodiles of Central Belize. International Journal of Speleology 52(1): 75-81.
Wilkie, C.J., M. Tellez, G. Jones, and M.J. Genner (2024). Population genetic structure of Morelet's and American crocodiles in Belize: hybridization, connectivity, and conservation. Conservation Genetics https://doi.org/10.1007/s10592-023-01590-7

Prepared by: Dr. Marisa Tellez
Date completed: 31 January 2024

Bolivia

Market issues have seriously affected the implementation of many of the management plans outlined within the National Program for the Sustainable Use of Yacare (*Caiman yacare*) in Bolivia. Currently only the Tacana Indigenous Territory continues to harvest a few hundred animals annually, mainly for meat (they have a contract and supply vacuum-packed meat to a supermarket chain), while the hides from these animals are destined for local artisans.

According to information provided by the new National Director of Biodiversity, this office is looking for funds with the intention of reactivating the national lizard program. From this, it will be important that we hold conversations with the CSG to see to what take steps can be taken, at different levels, to recover the markets that value the skins produced from wildlife.

Andres Rodriguez reports the following research carried out:

1. Publication of an article in 2022 on *Caiman yacare*, current potential distribution and effects of climate change on the species.
2. In review, in the journal "Diversity and Distributions", is an article on abundance models, distribution, and effects for the conservation of both species of *Paleosuchus*.
3. Andres Rodriguez's doctoral tesis, is in its final phase, involves ecological and modeling aspects of the 11 species of New World crocodilians. With this information, we will be able to know ecological aspects of the species in the New World and update their potential distribution based on literature records collected in recent years.

Prepared by: Alfonso Llobet Querejazu
Date prepared: 31 January 2024

Brazil

1. Northern Region

In 2023, the threats to caiman populations were more severe due to a historic lower water level in the rivers and floodplain lakes in the Brazilian Amazonia. For the first time, we identified dehydration as the cause of death for *Caiman crocodilus* and *Melanosuchus niger* in their natural habitat. The number of large *M. niger* (greater than 4 m TL) found in the harbors and beaches of Manaus was higher than in previous years. One big individual had to be rescued and relocated to a zoo due to the lack of wet habitat near the city.

From September to December 2023, we conducted 116 km of spotlight surveys to evaluate the abundance and size structure of *C. crocodilus* and *M. niger* in the municipalities of Iranduba (43 km), Careiro da Varzea (33 km) and Manacapuru (40 km), located in the Manaus Metropolitan Region. We counted 8735 caimans, of which 89% (7804) were in Manacapuru, specifically in the Piranha Sustainable Development Reserve (PSDR). Abundance (number of caimans/km of shoreline) in four water bodies of the PSDR varied from 76 caimans/km in a canal to 593/km in the confluence of a canal and a lake (mean = 304.6 ± 199.5). In this confluence, we estimated the size of 89 *M. niger*, of which 43% were larger than 180 cm SVL and 19 were larger than 200 cm SVL. In general, 93% of the 906 individuals identified in the PSDR were *M. niger*. The Wildlife Conservation Society/John Thorbjarnarson Fellowship 2022 to Washington Mendonça supported all these activities.

In November 2023, Washington Mendonça finished his PhD and published two articles. The first was published in Journal of Wildlife Management, evaluating the physiological responses of tourism activities on Amazonian caimans. This article found that the use of photographic flashes during tourism can induce acute stress with increased corticosterone levels in *M. niger* (Mendonça et al., 2023a). The second was published by Journal of Wildlife Diseases, which evaluated the reference intervals of 11 blood biochemical parameters in *M. niger* and *C. crocodilus* (Mendonça et al., 2023b). Both articles are results of studies that were supported by the IUCN SSC CSG Student Research Assistance Scheme application to Washington during fields data gathered and laboratory analyses.

During the peak of the dry season in November 2023, two caiman attacks were recorded along the Solimões/Amazon River (Manacapuru and Caapiranga municipalities). One of them was confirmed as *M. niger*. We also found, for the first time, individuals of *C. crocodilus* and *M. niger* poached by anglers from Manaus. In all cases, just tails were removed.

Reported by: Ronis Da Silveira, Idamara F. Santa Cruz and Washington C. S. Mendonça

Researchers from the Environmental Impact Characterization Laboratory (LCIA) at the Federal University of Tocantins (UFT), have been conducting research in one of Brazils' most biodiverse areas. Located in the western part of the state of Tocantins, an important ecological corridor formed by Conservation Units (Araguaia National Park, Cantão State Park, and Ilha do Bananal/Cantão Environmental Protection Area) has been visited since 2021 to expand knowledge about the reproductive ecology, population status, and environmental impacts on the Black Caiman.

From 2021 to 2023, more than 60 water bodies, including rivers, streams, and inland lakes, were visited by the Araguaia National Park (PARNA) and the Cantão State Park (PEC). After three years of intense field work, more than 30 Black Caiman nests were found by researchers. Basic information on the reproductive biology of the species is being collected, such as: nest density, egg morphometry, clutch size, hatching success, among others. These activities are part of the research projects coordinated by Professor Thiago C. G. Portelinha, and his masters' student, Barthira R. Oliveira. In her thesis project, Barthira intends to characterize the nesting areas and reproductive aspects of the Black Caiman in the northern portion of PARNA. It will be possible to understand aspects of the ecology and reproductive dynamics of the species in the region, in addition to establishing strategies and expanding efforts to conserve reproductive sites, potential areas for reproduction, and areas with high population densities. The projects aim not only to expand ecological and biological knowledge of the species, but also to assess the environmental impacts resulting from land use, human presence, and the use of pesticides on the population ecology and reproductive biology of caimans in and around Conservation Units. During 2021, other masters' (Andersom A. Caproni) and PhD. (Fábio B. Gamba) students also participated in the activities.

The research projects are supported by the Wildlife Conservation Society (John Thorbjarnarson Fellowship for Reptile Research Grant Agreement) and Fundação de Amparo à Pesquisa do Tocantins (FAPT/Naturantins - Meio Ambiente).

Reported by: Thiago C.G. Portelinha

2. Northeast Region

The Laboratório Interdisciplinar de Répteis e Anfíbios (L.I.A.R.) at Universidade Federal Rural de Pernambuco (UFRPE), Brazil, coordinated by Dr. Jozelia Maria de Sousa Correia and Dr. Ednilza Maranhão dos Santos have been conducting systematic surveys in the northeastern Brazil to better comprehend the ecology and conservation of caimans within Atlantic Forest habitats.

The institutional project: Ecology and Conservation of Crocodilians in Pernambuco – "*Projeto Jacaré*", provides logistical support and legal apparatus, to investigate aspects of abundance, distribution, reproductive ecology, health, diet, and genetics of wild broad-snouted caimans (*Caiman latirostris*) and dwarf caiman (*Paleosuchus palpebrosus*) populations. The project is coordinated by Dra. Jozelia Correia and composed professors from UFRPE and the other universities, researchers from partner institutions, PhD candidates and undergraduate students. Beyond research for conservation, the project presents several other goals. These include the promotion of scientific dissemination and popularization in schools and local communities and training local agents from environmental agencies for better practices of caiman capture, restraint, and proper release in urban areas and training human resources in herpetology.

In 2023, the *Projeto Jacaré* conducted field, conducted especially by researchers Paulo Mascarenhas-Junior and Rafael Barboza, research involving night counts, captures (Figure 1), biometrics, mark, biological sampling in three main targeted areas: APA Aldeia-Beberibe and its surroundings, which is the largest Atlantic Forest fragment within the urban area of Recife, Pernambuco's state capital, and Tapacurá Reservoir, a large water body located in São Lourenço da Mata Municipality, about 60 km from Recife. We also worked in a partnership with *Centro de Triagem de Animais Silvestres* (CETRAS- Tangará), a screening center for rescued animals hosted by Pernambuco's environmental agency. We collected information from rescued caimans and guided their release back into the wild.

In these areas, several specific research and educational activities with local communities have been conducted. Below, we detail achievements and current works developed in these areas from January to December 2023:

Figure 1. Activities of the *Projeto Jacaré* developed by Interdisciplinary Laboratory of Amphibians and Reptiles (L.I.AR/UFRPE), Pernambuco state, Brazil. a: Capture and restraint of a wild broad-snouted caiman; b: GPS-telemetry transmitted attached to an adult broad-snouted caiman; c: Hatchling of broad-snouted caiman; d: Educational activities involving reptiles with local schools in Camaragibe municipality.

Graduate student projects

- Paulo Mascarenhas-Junior: Padrões de Ecologia Populacional de *Caiman latirostris* (Alligatoridae) em Ambiente Lêntico com Fragmentos de Mata Atlântica, Nordeste do Brasil;
- Rafael Barboza: Da ecologia reprodutiva ao conhecimento ecológico local de um crocodiliano, o jacaré-do-papo-amarelo (*Caiman latirostris*);

- Rayssa Santos: Contaminação por metais e efeitos ecotoxicológicos em *Caiman latirostris* (Daudin, 1802) (Crocodylia, Alligatoridae) em ecossistemas lênticos de mata atlântica no nordeste do Brasil
- Carlos Rodrigues: Ecologia Parasitária e Ecotoxicologia de *Caiman latirostris* (Daudin, 1802) na Bacia do Rio Capibaribe
- Leandro Melo: Uso da Tomografia Computadorizada para Estudos de Fígado e Pulmões na Perinatologia de jacarés-de-papo-amarelo (*Caiman latirostris*, Daudin 1802)

Undergraduate student s

Two bachelor monographs: Mayara Negromonte and Anna Barbosa

Four undergraduate research projects: Lucas Vieira, Malu Caminha, Gabriela Lucena and Gabriel Brandão

Short communications and original articles

1. Mascarenhas-Junior, P. B., Correia, J. M., & Simões, P. I. (2023). Tracking crocodylia: a review of telemetry studies on movements and spatial use. Animal Biotelemetry, 11(1), 21. (Figure 1 b)
2. Santos, R., Mariz Jr., C., Mascarenhas-Junior, P. B., Barboza, R. S., Santos, E., Correia, J. M., Carvalho, P. S. Nondestructive evaluation of metal bioaccumulation and biochemical biomarkers in blood of broad-snouted caiman (*Caiman latirostris*) from northeastern Brazil. Environmental Toxicology and Chemistry. Accepted.
3. Barboza, R. S. L., Negromonte, M. G., Neto, C. F. R. S., Mascarenhas-Junior, p. B., Caminha, M. M., Santos, E. M., Correia, J. M. S. First record of twin hatchlings in *Caiman latirostris* (Daudin, 1802) in the Atlantic Forest, Brazil. Journal of Environmental Analysis and Progress. Accepted.
4. Neto, C. F. R. S., Barboza, R.L.S., Santos, E. M., Correia, J. M. S. Predation of a neonate caiman, Caiman latirostris (Daudin, 1802) by red fire ants Solenopsis sp. in Atlantic Forest, North-eastern Brazil. Tropical Ecology. Accepted.
5. Mascarenhas-Junior, P. B., Strickland, B., Heithaus, M., Simões, P., Correia, J. Factors influencing detection, distribution and population dynamics of the broad-snouted caiman (*Caiman latirostris*) in an altered environment in north-eastern Brazil. Journal of Zoology. Submitted.
6. Mascarenhas-Junior, P. B., Strickland, B., Heithaus, M., Santos, R, Barboza, R., Simões, P., Correia, J. Effects of fishing activities on the broad-snouted Caiman (*Caiman latirostris*) population in a Brazil reservoir. Aquatic Conservation: Marine and Freshwater Ecosystems. Submitted.
7. Mascarenhas-Junior, P. B., Barboza, R., Caminha, M., Lucena, G., Rodrigues, C. F., Simões, P., Correia, J. GPS-telemetry as a method to access nest attendance by a female broad-snouted caiman (*Caiman latirostris*). The Herpetological Journal. Submitted.
8. Barboza, R.L.S., Correia, J. M. S., Souto, A., Schiel, N. "I prefer a safe place": The influence of anthropic disturbance on nesting and parental care of a crocodilian, the broad-snouted caiman. Animal Ecology. Submitted.

Workshop Conservação de crocodilianos na Mata Atlântica

The workshop was aimed at the conservation of caimans within Atlantic Forest, with an overview of the current research on caiman within the biome. Moreover, this meeting was an opportunity to discuss conservation strategies, strengthen the connection between professionals in different areas of herpetology, and encourage more early-carrier researchers to study caimans in Brazil. The workshop was made possible through a partnership between the Marcos Daniel Institute (IMD) through the Caiman Project, the Chico Mendes Institute for Biodiversity Conservation (ICMBio), and the Federal Rural University of Pernambuco (UFRPE) through the Interdisciplinary Laboratory of Amphibians and Reptiles (represented in the presentations by researchers Jozelia Correia, Paulo Mascarenhas-Junior, and Rafael Barboza).

Educational activities

Researchers and collaborators of *Projeto Jacaré* were involved with several educational actions during 2023. Those activities included multiple expositions in school, public commons, parks and Conservation Units (legally protected areas). The main target group were students from local schools, but also involved the general public, including professors, tourists and residents from areas surrounding forest fragments. The exposition gathered 11 schools. One of most important exposition made by the project was the "*Semana Nacional da Ciência e Tecnologia: Vida na Água, vida na Terra – O Conhecimento Abrindo Fronteiras e Rompenod Barreiras Por Meio das Ciências Básicas*", funded by the Brazilian government. This activity was performed within L.I.AR. lab and in *Dois Irmãos* State Park, a Conservation Unity within urban area of in Recife, spanning an entire week of reptile and amphibian expositions. Moreover, in partnership with the environmental rescue agency of Camaragibe city, another exposition was made with local schools. The incredible world of amphibians and reptiles joined 10 schools during this activity. In total, more than 2000 people visited those expositions (Figure 1).

Reported by: Jozélia Correia and Paulo Braga Mascarenhas-Jr

The Caatinga domain, in northeastern Brazil, is the largest seasonally dry tropical forest biome in the world (Fernandes et al. 2022). The region is characterized by semiarid climate with severe water scarcity, being highly vulnerable to the impacts of climate changes.

Despite the predominance of ephemerous rivers and provisory water bodies, the region harbors three crocodilian species: *Caiman crocodilus*, *C. latirostris* and *Paleosuschus palpebrosus*. However, basic information about the ecology, natural history and conservation aspects of these species is scarce (Correia et al. 2021), making it difficult to establish conservation strategies.

In the state of Ceará, two species are known to occur: *C. crocodilus* and *P. palpebrosus*. *C. crocodilus* occurs along the Poti River drainage and the western coastal basin (Roberto et al. 2020), being classified as least concern in the list of endangered fauna species of Ceará (SEMA, 2022). On the other hand, *P. palpebrosus* is classified as vulnerable in the state of Ceará, with restricted distribution in the Mundaú and Poti Rivers (Lima and Borges-Nojosa, 2011; Roberto & Loebmann, 2016). Recently, *C. latirostris* was recorded in the state (Barreto-Lima et al., 2023), but there are still doubts about the origin of the individual recorded and if there is an established population.

To develop conservation strategies for the crocodilian species of Ceará, it is necessary to know the basic aspects of their distribution, natural history, and potential threats. We have been mapping the species distribution using different tools, interviewing local communities and searching the popular press about crocodilians such as local television and social media. This is the initial step to develop future monitoring and conservation projects for the species in the state of Ceará.

Reported by: Igor Joventino Roberto

3. Midwest region

Global climate change has different negative effects around the world, and the 2019-2021 extreme drought observed in the Pantanal appears to stem from these effects. Aquatic and semi-aquatic species occur in abundance in the Pantanal, due to the large supply of seasonally floodable environments. The pantanal Caiman, *C. yacare*, which in the 1990s had an estimated population of around 3 million individuals, is experiencing population decline due to the scarcity of water in the remaining rivers, lakes and reservoirs. The species responds to droughts by adopting survival strategies such as estivation in the mud and inside the forest.

On a regional scale, the lack of rain in the summers of 2019-2021 may be caused by the reduction in the flow of warm, humid air from the Amazon to the Pantanal. This phenomenon is known as “flying rivers”, which carry moisture from the Amazon forest, determining the occurrence of rain in the Central-West and Southeast of Brazil (Pearce 2020). Recently, “flying rivers” are being replaced by dry winds, which increase evapotranspiration rates, resulting in drought. The presence of dams on the rivers that flow into the Pantanal is another factor that contributes to this water scarcity. There are 144 hydroelectric projects installed or under construction which may have cumulative impacts on the Pantanal flood pulse.

The destruction of riparian forests also threatens the Pantanal, through sediment deposition, accelerating the silting of Pantanal rivers. Additionally, forest fires intensify every year, reaching areas of the plain that would normally be flooded. In 2020, around four million hectares burned in the Pantanal, killing approximately 17 million vertebrates, including 85,000 caimans.

We recommend three general measures for the conservation of the Pantanal as a whole and five specific management actions to minimize the effects of drought on caiman populations in the Pantanal.

The most important recommendations for the maintenance of the Pantanal caiman are: 1) the non-implementation of infrastructure that affects the annual pulse of floods of the Paraguay River and its tributaries, whether large or small dams or permanent changes in the course of water such as landslides and/or straightening of the course, which aim to “optimize” the existing natural waterway; (2) the creation of a National Park to conserve the sources of the Paraguay River; (3) cease deforestation in the southern Amazon and begin the recovery of deforested areas, aiming to restore the “flying rivers”, and avoid disruption of the rain in the Pantanal. Is it too much to ask to save caimans? Perhaps, but by saving it, we will be saving the Pantanal as a whole and probably contributing to the climate stability of important productive areas in southeastern Brazil.

In addition to these, we make some specific recommendations: 1). Do not interfere with the behavioral responses of caiman to water scarcity, such as when they are buried in mud or foliage or grouped in shallow lagoons or migrating on dry ground. Avoid translocations of individuals due to the risk of introducing and spreading pathogens and zoonoses. In extreme cases, we recommend consulting groups of experts and debating the scientific basis of the action, which, if carried out, must follow IUCN recommendations. Increase water supply in pre-existing artificial or natural water bodies, either through drilling semi-artesian or artesian wells, or digging wells with a backhoe. These measures aim to minimize the caimans mortality, but can benefit all of the Pantanal's terrestrial and aquatic fauna in dry years; 4). Do not collect eggs, hatchlings, or adults for economic purposes (captive breeding) during years of severe drought in the Pantanal, as these populations are under water and food stress, with reduced reproductive potential and population recruitment. Establish a large-scale population and genetic monitoring program for the

Pantanal caiman and other vertebrates associated with the seasonal environment, in order to allow conservation actions to be implemented in a timely manner if a reduction in populations to critical levels is detected. (Campos et al. (2022). Direções para mitigar os impactos da seca extrema nas populações de jacarés (Caiman yacare) no Pantanal. Oecologia Australis 26(3): 403-410).

Reported by: Zilca Campos

Normally, the Pantanal region has cycles of drought and fire, but in recent years, mainly due to climate change and anthropogenic modifications, these have worsened, especially in 2020 and 2021. However, in 2023, 92.6% of the authorized nests were collected, denoting a change in the pattern observed in previous years. This represents an improvement in nest production estimates, as well as in the organization of fieldwork. Thus, of the 1266 nests authorized in 2023, 1173 nests were collected resulting in 29,498 eggs being collected (average of 25.15 eggs/nest).
Within this scenario, the numbers of eggs collected in the two management programs and during the years are presented below:

Caimasul Farming Program

Year	# females	Nests Collected	Eggs Collected	Hatchlings
2022	1300	213	5968	
2023	1500	403	11,641	7205

Caimasul Ranching Program

Year	# Caimans observed	Harvested area (ha)	Nest quota authorized	Nest quota requested	Nests Collected	Eggs Collected
2017	143,169	38,378	9,702	2451	747	21,338
2018	135,856	55,349	8,233	3810	1336	32,270
2019	145,628	42,319	4617	2708	1374	35,453
2020	129,172		8199	7305	379	9257
2021	6857	64,244	28,885	2000	442	10,902
2022		126,867	3781	2000	1002	24,595
2023	131,526	47,558	1266	1398	1173	29,498

Reported by: Eduardo Borges and Flávia Mantero da Silva

4. Southeast Region

Luciano Verdade is retiring from his position at the University of São Paulo. He is also finishing his Thematic Project Intitled "Wildlife management in agricultural landscapes: patterns and processes", funded by São Paulo Research Foundation (FAPESP), which included studies on applied ecology of the broad-snouted caiman, besides mammals and birds. For a brief period, he will act as the head of the Wildlife Management Consultancy (WMC), which will focus on the development of a wildlife monitoring program in agricultural landscapes of southeastern South America and Southern Europe. Luciano will keep cooperating with Luis Bassetti on the management and conservation of Brazilian caimans.

Reported by: Luís Bassetti

Environmental Education is a cornerstone of the Caiman Project, serving as a direct interface with individuals. We believe that Environmental Education, and its various foundations are powerful in shaping ways of being and existing in the

world. In 2022 and 2023, the Environmental Education of the Caiman Project worked to propagate that the environment is a place for all living beings, emphasizing the need to preserve and respect all forms of life on the planet.

In 2022, the Environmental Education program of the Caiman Project reached 33,850 people in events (29,395), schools (3616), and the Conhecer Program (613). In 2023, the Environmental Education activities of the Caiman Project focused on inclusion and diversity in their actions. The "Caiman Project for Everyone - Inclusive Environmental Education" aimed to cater to children and young people with disabilities or Global Developmental Disorders (GDD). The goal of this work is to understand the need to expand Environmental Education activities to make them accessible and inclusive for everyone. We made accessibility adaptations in our work materials, such as 3D pieces for diversities, high-relief materials for the visually impaired, clay and/or playdough resources for children with autism and Asperger's, and a sensory line for children and young people with Downs syndrome.

Approximately 1000 people have been served since the implementation of the diversity project. At the same time, we maintained our regular activities in events, courses, and schools, totaling 42,721 people so far. Starting in 2024, the Environmental Education activities of the Caiman Project will be extended to the new project hub, the Caiman Cultural Center, located in Serra, ES, aiming to embrace and serve a larger audience, emphasizing Brazilian culture and biodiversity.

During the years 2022 and 2023, the Caiman Project, focused on the conservation of crocodilians in Brazil, playing an essential role in preserving this species. The project concentrated its activities on field excursions in various conservation units and private properties, focusing on population surveys and carrying out operations to rescue and rehabilitate urban alligators. The results indicated a total of 47 individuals captured and evaluated during rescue and field capture operations, while the population census counted 256 caimans within and in the surrounding areas of the state's conservation units, as well as in the population census fields in the green belt of ArcelorMittal Tubarão, where the largest free-living population in Espírito Santo is found. In total, in 2022, the Caiman Project operated for 160 days in the search for the capixaba alligators. In the following year, 2023, the Caiman Project intensified its efforts, recording captures of 47 individuals and counting 266 records during the population census, totaling 114 days in campaigns. These numbers reflect the project's ongoing commitment to monitor, protect, and promote harmonious coexistence between the human population and this species, which is fundamental to the local ecosystem.

Reported by: Yhuri Nóbrega

Crocodylia Brasil - CrocBR

During 2023, Crocodylia Brasil promoted a series of online presentations with different themes, encouraging students and professionals to learn more about crocodilians. These presentations took place throughout the year, providing free and open-access knowledge.

27/04/2023 - Luís Bassetti: Conflitos humanos x crocodilianos - A importância de se conhecer a microflora presente no ambiente.

18/05/2023 - Ronis Da Silveira: Abundância espaço-temporal do gigante amazônico.

15/06/2023 - Alejandro Larriera: Convención CITES – La biopolítica en el campo de la conservación.

10/08/2023 - Fábio Muniz: Contribuições para o conhecimento genético e evolutivo do *Paleosuchus palpebrosus.*

21/09/2023 - Augusto Kluczkovski: Apontamentos sobre o processamento de carne dos jacarés amazônicos.

01/11/2023 - Washington Mendonça: Avaliação e implicações do estresse de interação e intervalo de referência bioquímica do sangue de *Melanosuchus niger* e *Caiman crocodilus.*

In 2024, CrocBR intends to invite speakers from other parts of the world, presenting different realities, but with the same goal: Conservation of crocodilians.

Reported by: Ronis Da Silveira and Luís Bassetti

Prepared by: Luís Bassetti
Date prepared: 31 January 2024

Costa Rica

Interactions with *C. acutus* continue to occur and the protocol that had been approved to deal with them is not being used The government does not justify why, which leads to situations such as last year when there was a fatal attack (a boy jumped a drugged river) and the crocodile was killed. Unfortunately, more than one Crocodile was killed in the attempts to rid the targeted crocodile.

Last year, the government approved a project to create a new protocol for attention to interactions. This project includes objectives related to monitoring, the human dimension and the assessment of the issue.

I am starting a project to try to design a counting and monitoring protocol using drones.

Prepared by: Laura Porras
Date prepared: 1 February 2024

Cuba

The crocodile conservation program in Cuba includes the *in situ* and *ex situ* management of the two species Crocodylus that inhabit the Cuban archipelago. In addition, it aims to make sustainable use of the population of *Caiman crocodilus fuscus* introduced on the Isle of Youth.

The *in situ* program includes nine closed-loop breeding farms, of which three maintain populations of *C. rhombifer* and the rest *C. acutus*. Currently, the objective of these institutions is conservation and research, and the programs for raising and release within the species distribution range is a priority. A project is currently being carried out to rebuild the Zapata breeding farm, and the incubation area was improved with the help of the Cuban government and foreign organizations (see list below). Unfortunately, the current state of other infrastructure, and the limitations in general to support captive populations, demand the execution of strategies aimed at the reorganization of the entire animal mass.

Ex situ conservation actions are carried out in eight localities within the Cuban Protected Areas System with research projects focused on the practical applications of *C. rhombifer*. Among others, a baseline of hematological values for *C. rhombifer* adults was obtained, and the potential of environmental DNA for the monitoring of crocodiles in natural spaces and the biodiversity of the ecosystems they inhabit, were shown.

The SMART monitoring tool was also implemented to update the distribution map of the species present in Cuba. Also, an initiative is being promoted to resume the management of the population of babillas (*C. crocodylus fuscus*) on the Isle of Youth and the release of specimens of *C. rhombifer* raised in captivity. However, the threats that *C. rhombifer* and *C. acutus* face today persist in some regions and intensify throughout their range of distribution. The increase in illegal harvesting, mainly motivated by the growing economic crisis existing on the island, and the modification of habitat caused by human activity and climate change, are additional challenges.

Finally, with the support of Cuban government and foreign organizations, training actions were developed for Cuban specialists (National Workshop of the GECC), along with environmental education actions in several of the local communities near crocodile habitat. Also, funds from these institutions facilitated the participation of Cuban specialists in a symposium entitled "Current paradigms in the conservation and use of crocodiles in Latin America," within the framework of the CIMFAUNA held in November 2023 in Colombia.

Institutions that support the conservation of crocodiles in Cuba:
Antonio Núñez Jiménez Foundation for Man and Nature, Bronx Zoo, Company for the Conservation of the Zapata Swamp, Flora and Fauna Company, Gatorland, Saint Louis Zoo and Wildlife Conservation Society.

Prepared by: Gustavo Sosa and Etiam Perez
Date prepared: 31 January 2024

Guatemala

Research regarding crocodiles has been focused on *C. moreletii* populations in Guatemala with population density studies initially conducted by Castañeda (1998/99) and Castañeda *et al.* (2000), mainly in El Petén. Later, Corado-García *et al.* (2020) estimated encounter rates and anthropogenic threats toward *C. moreletii* populations in ten different water bodies in El Peten. Before 2018, there were no records of *C. acutus* populations in Guatemala. In 2019, Corado-Garcia and collaborators carried out the first population density study and insights into anthropogenic impacts on *C. acutus* in Río Dulce National Park, Sarstún River, and Bocas del Polochic Wildlife Reserve, located in the Caribbean slope. A total of 56.3 km was surveyed, spotting 120 crocodiles in the three water bodies, largely concentrated in the wildlife reserve, which resulted in an overall encounter rate of 2.13 crocodiles/km. However, only one capture was possible since most of the individuals were very wary. Due to misconceptions toward the crocodiles, since the locals perceived them as dangerous and man-eating, which leads to negative interactions during fishing, aquatic transportation activities and nests invasion.

Then in 2022, Corado-Garcia and collaborators along with the Protected Areas Council of Guatemala (CONAP), a project in Petén Itzá Lake was carried out due to conflicts between crocodiles and cattle farm owners. During consultation workshops between cattle owners, restaurant and hotel owners located near the lake, it was concluded that some hotels were feeding the crocodiles as an attraction activity to tourists. This has a negative impact on livestock farms since the young cattle were being attacked by crocodiles. In order, to promote the correct coexistence between crocodiles and humans, a conservation management plan was developed and approved in 2023 by the honorable council of CONAP. In 2024, it will be locally implemented in Petén, by the government, to mitigate illegal feeding of crocodiles and encourage its conservation by regulating some tourist activities with the species.

A project with *C. acutus* will be executed in the south coast of Guatemala this year in collaboration with the CrocDocs. This is the first time a crocodile project will be implemented in the Pacific slope. The project is focused mainly on the American crocodile but since there are no previous studies in the area, we might find *C.crocodilus* or *C. moreletii* as well based on some reports received by CONAP last year.

Prepared by: Valerie Corado García
Date prepared: 31 January 2024

French Guiana

Since the summer 2022, four new projects on caimans have been launched in French Guiana as well as some diverse talk that were open to everyone.

Regarding publications

Lemaire, J. 2023. Using crocodylians for monitoring mercury in the tropics. *Ecotoxicology*. https://doi.org/10.1007/s10646-023-02703-1
Lemaire, J., Mangione, R., Caut, S., Bustamante, P. 2024. Mercury biomagnification in the food web of Agami Pond, Kaw-Roura Nature Reserve, French Guiana. Helyion, in Press.

Prepared by: Jeremy Lemaire
Date prepared: 31 January 2024

Jamaica

The American crocodile is Jamaica's largest native reptile and is currently threatened by habitat loss through wetland reclamation for development and human encroachment. In Jamaica, there has been an increase in the number of human-crocodile interaction cases as the animals become displaced and seek out new areas (storm drains, sewage and fish ponds). Since the early 2000s there have also been increased reports of crocodiles being illegally hunted for local consumption. The National Environment and Planning Agency (NEPA) has the mandate to ensure the conservation of the American crocodile *(C. acutus)*, under both national laws and international agreements. The revised Crocodile Management Plan (2020) aims to *'ensure the maintenance of viable populations in the wild through research and effective conservation strategies'* with the first short term objective to '*Conduct a country wide crocodile survey to determine its population status and to evaluate the suitability of habitats for the American crocodile in Jamaica'.*

In March 2022, the first island-wide crocodile survey was completed. This collaborative project between the NEPA, in collaboration with the University of the West Indies (UWI), Mona Campus and the University of Florida (Croc Docs), and spearheaded by Treya Picking as part of her Masters thesis. During this time, 105 spotlight surveys were conducted across 35 habitats. A habitat analysis has been completed using historical and current data. The next stage is to publish the research and work towards implementing the recommended conservation strategies.

Treya Picking is now working towards establishing a crocodile initiative, working closely with Government and non-government entities, to implement various projects including outreach programs, research and long-term monitoring. Funding has been secured to develop new educational material to raise awareness and to implement the monitoring programs. In addition, other activities such as community-based warden programs, enforcement exercises and strengthening wetland protection are also a part of the initiative.

The Holland Crocodile Conservation Sanctuary established by Lawrence Henriques has been continuing its conservation program, which involves captive breeding, rescue and rehabilitation, outreach and head-starting. Since 2021, five health screens of the facility's captive population have been conducted. This has become an important training exercise which brings together both local and international entities such as NEPA, Veterinary Services Division, the Hope Zoo, Gatorland Global, professional individuals and volunteers. The results from the island-wide crocodile research continue to guide the head-start program. Currently, the focus of the program is recovering the crocodile population of the Holland Bay wetlands, which has become depleted overtime due to illegal hunting and habitat degradation.

To date, the Hope Zoo continues to work closely with NEPA and other government stakeholders to assist with crocodile rescue and rehabilitation, human-crocodile conflict issues, the on-going island-wide population survey, and various necropsy examinations involving the mortality of wild crocodiles. These efforts have been spearheaded by Joey Brown, General Curator at Hope Zoo.

Prepared by: Treya Picking
Date completed: 31 January 2024

México

1. Research and new information

Researcher	Project
Asela Marisol Buenfil-Rojas, Hisato Iwata (Host Researcher) Collaborators in Mexico: 7; Collaborators in Japan: 5	Integrated assessment of chemical pollution and its impacts on wild *Crocodylus moreletii* Main updates: Metal analysis of scutes, blood and claws of 30 crocodiles from 5 sites. POPs analysis of 29 samples of blood plasma of crocodiles from 5 sites. RNA extracted, sequenced by Illumina RNA-seq and 32 libraries generated from 16 individuals from 3 sites. Working on exportation of the 2nd batch of samples. Preliminary results will be presented at the 27th Working Meeting.
Birgit Schmook, Jonathan S. Pérez Flores, Pierre Charruau	Negative human-crocodilian interactions in the RB Banco Chinchorro and the APFF Mangroves of Nichupté. PROREST-CONANP. June-December 2022

Emigdio Marín Enriquez, Pierre Charruau	The use of unmanned vehicles for ecology and oceanography studies in the area of Mazatlan, Sinaloa. 1 year (2022). Program for the Promotion and Support of Research Projects (PROFAPI), Autonomous University of Sinaloa.
CONABIO GEC-MX	The Mexican CITES Scientific Authority coordinated the implementation of the Monitoring Program of the American crocodyle with the support of Universities and Civil Society Organizations in four regions that includes the Caribbean Sea and the Mexican Pacific. The report of the first season (2021) of monitoring of river crocodile (*Crocodylus acutus*) will be published by mid-2024.
Benjamín Castillo Elías and Herlinda Gervacio Jiménez	Management of the river crocodile (*Crocodylus acutus*) under captivity conditions in the municipality of Acapulco, Guerrero, Mexico: 1. To determine the population structure and morphological variations in river crocodile specimens in captivity conditions to promote the conservation of the species in the locality San Andrés Playa Encantada, Barra Vieja, Municipality of Acapulco, Guerrero, Mexico (Years 2022 and 2023 in the process of publication). 2. To perform statistical tests to determine the correlation between Rostral Length and Total Length in *Crocodylus acutus* individuals in Acapulco, Guerrero, Mexico (Years 2022 and 2023 in the process of publication). 3. Proposal for the establishment of a Management Unit for the Conservation of Wildlife "UMA: Centro Recreativo Cocodrilario Acutus" for the *Crocodylus acutus* species in Acapulco, Guerrero, Mexico (in process from 2023 to date).
Yessenia Sarmiento Marina – YEDMALIM A.C.-FMCN-USFS-REBIEN	Monitoring the health and quality of the mangrove ecosystem on the Pacific coast of Chiapas, Mexico, March 2023-January 2024: 1. Monitoring of crocodilians (Crocodylus acutus and Caiman crocodilus) in Laguna Buenavista of the La Encrucijada Biosphere Reserve. 2. Social appreciation of crocodiles and caimans in three ejidos of the core area "El Palmarcito" of the La Encrucijada Biosphere Reserve (REBIEN). 3. Environmental education events: ecological importance of crocodilians and preventive measures of human-crocodile interactions in the La Encrucijada Biosphere Reserve.
Edgar Sarmiento Marina CONANP, CI MEXICO, BIOCONCIENCIA A.C. Y YEDMALIM A.C. Periodo 2022 - 2024	Monitoring of populations of the river crocodile (Crocodylus acutus) and caiman (Caiman crocodilus), use of phototrapping in localities of the palmarcito nucleus zone in the REBIEN. Chiapas-Oaxaca Sustainable Landscape Project.

2. Management and conservation actions

Leader	Project
CONABIO GEC-MX	The Crocodilian Specialists Group of Mexico (GEC-MX) prepared its work plan for the year 2024 where activities will be carried out on monitoring and ranching, use of specimens from the wild, traceability of skins, S.O.S. groups on human-crocodile interactions and environmental education, and organization of the next ordinary meeting on the second half of 2024.
CONABIO GEC-MX	The "Programa de monitoreo de los cocodrilianos de México: *Crocodylus moreletii, Crocodylus acutus* and *Caiman crocodilus*" was an adaptation of the "Programa de monitoreo de cocodrilo de pantano (*Crocodylus moreletii)* Mexico-Belice-Guatemala" (Sánchez-Herrera et al., 2011) to extend it to the three species of crocodilians of Mexico. It aims to lay the foundations for monitoring the status and trends of the main wild populations of these species, throughout their distribution range in our country. The data obtained supports a better decision making process regarding the conservation, management and sustainable use of the species.
CONANP/REBIEN GEC-MX	S.O.S. Crocodile Training Workshop for personnel of the Municipal Civil Protection Secretariats; at the National School of Civil Protection, Chiapas Campus on preventive

Edgar Sarmiento Marina	measures and attention to negative interactions with crocodiles and caimans in the localities located in the Puerto Arista Beach Sanctuary and La Encrucijada Biosphere Reserve. August 05, 2023.
CONANP/REBIEN GEC-MX Edgar Sarmiento Marina	Exchange of Experiences of Community Monitors of the Sustainable Landscapes Project Oaxaca - Chiapas, Mexico, with priority species: River Crocodile, Jaguar, Spider Monkey and Bicolor Mangrove. From August 16 to 19, 2022 at Centro Ecoturística, Escobilla; Oaxaca
CONANP/REBIEN GEC-MX Edgar Sarmiento Marina	Workshop on the Training of Community Civil Protection Committees in Human – Crocodile Contingency Prevention Actions. Crossroads; Chiapas, Mexico. October 2022
CONANP/REBIEN GEC-MX Edgar Sarmiento Marina	Participation and Exchange of Experiences "Human-Crocodile Interaction on the Coast of Chiapas" La Encrucijada Biosphere Reserve at the Centro Servicios Ecoturísticos de la Ventanilla S.C. DE R.L. DE C.V. May 2023

3. **Production and trade**

During 2022, according to the CITES Trade Database, Mexico reported two export events of Crocodylia. The first one involves export of leather products of *C. crocodilus* to Guatemala (GT). These were registered for trade purposes, originating as bred in captivity (source code C). The second event involves skins of *C. moreletii* to France (FR). These were also registered for trade purposes from captive breeding (source code C).

For the same year, Mexico reported 10 re-export events of Crocodylia: four regarding *Alligator mississippiensis*, three for *Crocodylus niloticus*, two for *C. crocodilus*, and one *Crocodylus porosus*. These re-export events were also for leather and skins, all for trade purposes. Source codes did vary, five events were reported as wild origins (W), four as ranched origins (R) and only one as bred in captivity (C).

Also, during 2022 according to the CITES Trade Database, Mexico reported 58 import events of Crocodylia. All of them involve import of leather and skin products from the species *C. crocodilus, C. porosus, C. niloticus, C. latirostris,* and *A. mississippiensis*. Source codes varied with 24 reporting wild origins (W), 17 from ranched origins (R),16 from captive breeding (C) and only one reported it as Appendix-I animals bred in captivity (D). The main exporters were Italy (30) followed by France (12) as well as Spain (5), Colombia (3), Germany (2), Austria (2), Tanzania (1), Ireland (1), Panama (1), and Portugal (1).

It is worth noting that not all trade information for the year 2023 has yet been captured in the CITES database. For that reason, the Administrative Authority of CITES in Mexico (DGVS-SEMARNAT) was consulted. In 2022 they granted 23 CITES authorizations for exports of *C. moreletii*, 21 of them were reported as bred in captivity (C) and two of them were biological samples reported from wild origins (W). 19 of them were for the USA and one for France. The biological samples were exported to Canada and Japan. In 2023, DGVS-SEMARNAT granted 49 CITES authorizations for exporting *C. moreletii* to the USA, all from captive breeding (C). So far, for 2024 DGVS-SEMARNAT has granted 2 authorizations for exporting *C. moreletii* to the USA from captive breeding (C).

4. **Publications**

Book chapters

- Charruau P, J Ávila-Cervantes, JS Pérez-Flores. 2022. Chapter XII. The American crocodile of Banco Chinchorro atoll. Pp: 129-140. In: L Sigler, D Navarro (eds.) The Crocodylia of México by Miguel Álvarez del Toro. Independently published. ISBN: 979-8449785329. https://www.researchgate.net/publication/361439246_The_American_crocodiles_of_the_Banco_Chinchorro_atoll
- Cruz-Morales, G. y G. Barrios-Quiroz. 2022. Implementación y desarrollo de una estrategia socioambiental para la coexistencia humano-cocodrilo en la costa de Oaxaca (México).Pp: 90-104 En del Moral S. J. F. et al. Coexistencia entre fauna silvestre y seres humanos. Análisis de experiencias en el contexto latinoamericano. Comfauna-Fundación Natura

Scientific papers

- Castillo Ipiña, Jesús Alfredo; Rivas Eguia, Pedro de Jesús Osiris; Alfaro de la Torre, Ma. Catalina; Espinosa Reyes Guillermo. 2023. Uso y aplicación de Vehículos Aéreos No Tripulados (VANT) para la búsqueda de nidos de cocodrilo de pantano en la Ciénaga de Tamasopo, San Luis Potosí, México. Ciencia, Tecnología e

Innovación para el Desarrollo de México. Año 14, PCTI 227-2023-12-07. ISSN 2007-1310. https://pcti.mx/articulos/pcti-227-uso-y-aplicacion-de-vehiculos-aereos-no-tripulados-vant-para-la-busqueda-de-nidos-de-cocodrilo-de-pantano-en-la-cienaga-de-tamasopo-san-luis-potosi-mexico/

- Cedillo-Leal, C. G. Cruz-Morales and G. Barrios-Quiroz. 2023. NON-FATAL HUMAN-CROCODILE INTERACTION WITH Crocodylus moreletii IN ALTAMIRA, TAMAULIPAS. Crocodile Specialist Group Newsletter. 42(3):13-15
- Charruau P, D Ichbia, GA Gónzalez-Desales, SG Platt. 2022. Reproductive dynamics of an isolated population of American crocodiles (*Crocodylus acutus*) based on long-term monitoring data. *Journal of Herpetology* 56(2): 196-202. https://doi.org/10.1670/21-019
- Charruau P, MA Morales-Garduza, MA López-Luna, JG Reyes-Trinidad, MA Ramírez-Pérez, JA López-Hernández, R García-Morales. 2023. Herpetofauna of the Chaschoc lagoon wetlands, Tabasco, Mexico. *Revista Latinoamericana de Herpetología* 6(2): 75-92. https://doi.org/10.22201/fc.25942158e.2023.2.616
- González-Desales GA, P Charruau, MM Zarco-González, O Monroy-Vilchis. 2023. Factors influencing egg predation of two sympatric crocodilians in Mexico. *Herpetological Conservation and Biology* 18(2): 404-414. https://www.herpconbio.org/Volume_18/Issue_2/Gonzalez-Desales_etal_2023.pdf
- González-Sánchez VH, JD Johnson, O Frausto-Martínez, LM Mejía Ortiz, A Pereira-Corona, M del P Blanco-Parra, P Charruau, CA Niño-Torres. 2023. The Herpetofauna of the Insular Systems of Mexico. *Diversity* 15(8): 921. https://doi.org/10.3390/d15080921
- Marín-Enriquez E, P Charruau, LA Félix-Salazar. 2023. Discovery of a suburban wetland refuge for a depleted American crocodile (*Crocodylus acutus*) population in northwestern Mexico, using a commercial Unmanned Aerial Vehicle. *Tropical Conservation Science* 16: 1-7. https://doi.org/10.1177/19400829231209848
- Rainwater TR, SG Platt, P Charruau, SA Balaguera-Reina, L Sigler, JR Cedeño-Vázquez, JB Thorbjarnarson. 2022. *Crocodylus acutus* (amended version of 2021 assessment). The IUCN Red List of Threatened Species 2022: e.T5659A212805700. https://dx.doi.org/10.2305/IUCN.UK.2022-1.RLTS.T5659A212805700.en
- Sánchez Álvarez B, F Pérez Garduza, A Monroy Ojeda, VM Santiago Plata, S López Mondragón, P Charruau. 2023. Bird-herpetofauna interactions in the Usumacinta river basin, Mexico. *Revista Latinoamericana de Herpetología* 6(1): 127-134. https://doi.org/10.22201/fc.25942158e.2023.01.594

Thesis

- 2022. Distribución y preferencia de hábitat del cocodrilo de pantano (Crocodylus moreletii) en la zona norte de la Reserva de la Biosfera Sian ka´an, Quintana Roo, México/ thesis presented by Jesus Vazquez Ramos in order to obtain the degree of Bachelor of Biology; advisor Alejandro Villegas Castillo
- 2022. Metales pesados en la población cautiva de *Crocodylus acutus, Crocodylus moreletii y Caiman crocodilus chiapasius* del Zoológico Miguel Álvarez del Toro (ZooMAT) y el campamento tortuguero de Puerto Arista, Chiapas / diagnosis of the situation that to opt for the degree of Master in Veterinary Medicine and Zootechnics, presented by Kristell Jimena Zapatero Vázquez; main thesis tutors Carlos Gutiérrez Olvera, Juan Carlos Ramírez Orejel, José Manuel Aranda Coello
- 2022.Propuesta de programa de manejo, aprovechamiento y conservación del cocodrilo de pantano (Crocodylus moreletii) en la Ciénega de Tamasopo, San Luis Potosí. Thesis to obtain the degree of Master of Environmental Sciences. Submitted by: LCAS. Castillo Ipiña Jesús Alfredo, under the direction of Guillermo Espinosa Reyes, Valente Vázquez Solís, Javier Fortanelli Martínez, Ma. Catalina Alfaro de la Torre.

Talks

- 2023 Ponencia: 1er Curso-Taller de atención integral para primera respuesta a la interacción humano-cocodrilo (Instructor). La Ventanilla, Santa Maria Tonameca, Oaxaca, Gabriel Barrios Quiroz
- 2023 Ponencia: Translocación y movimientos de Crocodylus moreletii en una zona urbana de Tamaulipas México. XV Congreso Internacional de Manejo de Fauna Silvestre de la Amazonía y Latinoamérica, Santa Marta, Colombia. CIMFAUNA, César N. Cedillo Leal, Gabriel Barrios Quiroz y Armando H. Escobedo Galván
- 2023 Ponencia: Atención de interacciones negativas humano-cocodrilo en zona urbana, Grupo SOS Cocodrilo Tampico. XV Congreso Internacional de Manejo de Fauna Silvestre de la Amazonía y Latinoamérica, Santa Marta, Colombia. CIMFAUNA, César N. Cedillo Leal, Gabriel Barrios Quiroz, Sergio Padilla Paz y Mauricio González Jauregui
- 2023. Ponencia: Datos de ecología reproductiva de *Crocodylus acutus* obtenidos del monitoreo a largo plazo en una Reserva Natural Privada en Guatemala. XV Congreso Internacional de Manejo de Fauna Silvestre de la Amazonía y Latinoamérica, Santa Marta, Colombia. Javier A. Benítez-Moreno et al.
- 2023. Del apareamiento a la eclosión: los retos del cocodrilo para nacer. 1er Simposio Conservación de vertebrados silvestres y su ambiente: Reptiles y aves, Ciudad de Xalapa, México. Ponente Magistral Invitado. Pierre Charruau.
- 2023. Adaptaciones de una población aislada de cocodrilo Americano en un atolón del Caribe mexicano. XVI Reunión Nacional de Herpetología, Ensenada, México. Ponente invitado. Pierre Charruau.
- 2023. ¿Qué, cómo y con qué fin se recogen datos y muestras sobre los cocodrilos? Conferencia impartida durante el LagartoFest 2023, Villahermosa, Tabasco, México. 20 de agosto. Pierre Charruau.

- 2023. ¡Preguntale al Sr. Cocodrilo! 1er Encuentro de Celebrando la Biodiversidad. El Colegio de la Frontera Sur y Ayuntamiento de Centro, Villahermosa, México. 27 de mayo. Pierre Charruau.
- 2022. Y …¿Cómo se reproducen los cocodrilos? Conferencia impartida durante el LagartoFest 2022, Villahermosa, Tabasco, México. 27-28 de agosto. Pierre Charruau.
- 2023. "Los Crocodylia de México: Ciencia y Sociedad". Clan de Herpetología: Día Nacional del Cocodrilo, realizado el 23 y 24 de agosto en la Universidad de Ciencias y Artes de Chiapas (UNICACH), sede Tuxtla Gutiérrez, Chiapas. Ponente. Yessenia Sarmiento Marina.
- 2023. Importancia ecológica de crocodilianos y medidas preventivas de interacciones humano-cocodrilo en la Reserva de la Biosfera La Encrucijada (REBIEN). Eventos de educación ambiental realizados en comunidades de la REBIEN durante los meses de junio, noviembre, diciembre 2023, y enero 2024. Se realizó la distribución de materiales de difusión del tema. Yessenia Sarmiento Marina y Edgar Sarmiento Marina.
- 2023. CONVERSATORIO SOBRE EL CONOCIMIENTO DE LOS CROCODYLIA en Conmemoración del 23 de agosto Día Nacional del Cocodrilo: MVZ. Luis Sigler Moreno. - Gerente de la colección de reptiles del Dallas World Aquarium (DWA), USA; Biol. Edgar Sarmiento Marina. - Técnico Superior de la Reserva de la Biosfera La Encrucijada; S.O.S. Cocodrilo Chiapas – México; Biol. Armando Andrade Esquivel. - Representante del S.O.S Cocodrilo Nayarit; Nayarit – México; Biól. Gabriel Cruz Morales. - Asesor y responsable técnico de Servicios Ecoturísticos de la Ventanilla S.C. DE R.L. DE C.V S.O.S. Cocodrilo Oaxaca – MÉXICO. 23 de agosto de 2023
- 2023. Charla en el Programa Defensa Animal con Franny Garibaldi con el Tema: Importancia del Cocodrilo en la Reserva de la Biosfera La Encrucijada 29 de agosto del 2023. Edgar Sarmiento Marina Conanp – Encrucijada.
- 2023. Ponencia: Análisis de hidrocarburos aromáticos policíclicos y sus efectos en cocodrilo de pantano (Crocodylus moreletii) en la Ciénega de Tamasopo San Luis Potosí. XV CIMFAUNA. Santa Marta, Colombia; noviembre 2023. Pedro de Jesús Osiris Rivas Eguia; Jesús Alfredo Castillo Ipiña; Omar Cruz Santiago; María Catalina Alfaro de la Torre; Eleno Uriel Sanjuan Meza; César Arturo Ilizaliturri Hernández y Guillermo Espinosa Reyes.
- 2023. Ponencia: Estrategia de conservación y estructura poblacional del cocodrilo de pantano *(Crocodylus moreletii*) en un sitio Ramsar, SLP., México- XV CIMFAUNA. Santa Marta, Colombia; noviembre 2023. J. Alfredo Castillo, P.J Osiris Rivas, Catalina Alfaro, Eleno Sanjuan, César Ilizaliturri y Guillermo Espinosa.
- 2023. Conferencia: Importancia de los cocodrilos para el bienestar de los ecosistemas. Día Internacional de la Madre Tierra en el Museo Laberinto de las Ciencias y las Artes, San Luis Potosí, México, abril 2023. Guillermo Espinosa Reyes, Jesús Alfredo Castillo Ipiña, Pedro de Jesús Osiris Rivas Eguía, Uriel Alexander Herrera.

5. Other issues

Leaders	***Activities***
26° Reunión CSG-IUCN, Chetumal, México. 3-9 july 2022. CONABIO SEDARPE ECOSUR UMA Cocodrilia along with a National Coordinating Committee	More than 200 participants from at least 35 countries attended the event. Three workshops (drones, veterinary and taxonomy) and four working groups (human-crocodile interaction, zoos, industry, IUCN Red List) were held. There were 4 keynote lectures, 84 oral presentations and 66 posters on display. In the parallel public forum, 25 talks were presented and 77 audiovisuals were screened. This parallel forum reached over 11 thousand people through the social networks of the National Commission for the Knowledge and Use of Biodiversity (CONABIO) and the National Commission of Natural Protected Areas (CONANP) The proceedings of the Meeting with all the abstracts of the oral presentations and posters can be consulted at: https://www.biodiversidad.gob.mx/planeta/csg2022/pdf/CSG26-Abstracts-Program.pdf
Get Together – GEC-MX, Chetumal, México. 4 july 2022.	The meeting with 35 national experts reviewed topics of interest, including advances in the monitoring of Mexican species, ranching, traceability of skins, S.O.S. crocodile groups on human-crocodile interaction and planning of the next formal meeting of the group (see section 2 on GEC-MX work plan for 2024).

Prepared by: Hesiquio Benitez
Date prepared: 31 January 2024

Perú

Assessment Guide for C. acutus in Northern Peru - It is reported that an assessment guide for *C. acutus* in the northern region of Peru is being finalized. This document is in the validation stage and awaits approval from the competent authorities. The implementation of this guide will be crucial for the monitoring and conservation of the local crocodile population.

Export of C. crocodilus - The legal export of five individuals of *C. crocodilus* was carried out with an average size of 1.50 meters in total length. It is important to note that these specimens come from captive breeding facilities, thus ensuring traceability and sustainability of the activity. One of the exported individuals was albino. These specimens were destined for the Asian market, and the export was carried out in accordance with both national and international legal frameworks.

Seizure of Illegal Meat from C. crocodilus and M. niger - In June 2023, a significant intervention related to the illegal exploitation of crocodiles was carried out. A boat transporting illegal meat from *C. crocodilus* and *M. niger* was intercepted. This shipment was intended for the local market in Iquitos. The intervention demonstrates the ongoing need for law enforcement efforts to combat poaching and the illegal trade of protected species. For more information on this intervention, the following link here.

AIDER is currently developing a monitoring protocol for *C. acutus*, commonly known as the "Tumbes crocodile," in the Tumbes National Reserve. This initiative is led by Angel Llompart, a biologist specializing in herpetology. As part of this effort, field trips are conducted in collaboration with park rangers to spot the species and identify nesting areas. So far, three nesting zones have been identified. Subsequently, park rangers reported sightings of small individuals near these zones. This activity follows AIDER's assumption of a management contract with SERNANP for the National Protected Areas (NPA), including the El Angolo Hunting Reserve, Cerros de Amotape National Park, and Tumbes National Reserve. The latter two areas are known to have populations of *Crocodylus acutus*.

Prepared by: Diego Joao Freitas and Angel Llompart
Date prepared: January 2024

Venezuela

1. ***Caiman crocodilus crocodilus* wild harvest**
   In 2022 the wild harvest was only 5000 individuals to be exported the flanks to Europe, while in 2023, the wild harvest was 2500 individuals.

2. ***Crocodylus intermedius* conservation program**
   362 Orinoco crocodiles were released in both 2022 and 2023. With the support of Indianapolis Zoo, we built 7 new ponds in Leslie Pantin Zoo in Paya Aragua state, with the capacity to raise 250 *C. intermedius* per year, individual to be released into the wild. In January 2023, we transported 7 Orinoco crocodiles to Krokodille Zoo (Denmark) to establish the first breeding center in Europe. There was one mature male and female pair as well as five juvenile males to create 5 new couples in the zoo. All hatchlings produced will be sent to Venezuela to release into different areas. The journey of these crocodiles from Venezuela to Denmark was filmed and a documentary was produced by Rio Verde (here) with the name “Caiman del Orinoco, un largo viaje a Dinamarca”. A collaboration between Herpetofauna Foundation (Holland), Rio Verde and the Venezuela Crocodile Specialist Group design edited and

printed a drawing book for children in Spanish and Pume (indigenous) languages to be distributed in the communities close to Capanaparo river.

4. Regional trade

The statistic is updated to 2021. During 2021, the number of crocodile skins exported increased, in comparison the previous year, to 1,060,028 skins from all the world. From Latin America only 335,229 skins were exported where 315,630 coming from Colombia principally to Mexican market. After realized conversation with some Colombia traders, they communicated that one on the reason affected the interest of Colombia and South American skins is the illegal skins from South of Asia to China.

Prepared by: Alvaro Velasco B
Date prepared: 31 January 2024

Trinidad &Tobago

The island of Trinidad boasts of its oil and gas production which fuels the country's economy. However, over time ageing assets within the oil sector poses many threats such as oil spills in the area of operation as well as upstream and downstream pollution plumes. Much of the country's native biota is affected by the direct and indirect effects of the hydrocarbon pollution within the terrestrial and aquatic environments (Fig 1).

The Serpentarium & Reptile Conservation Centre of Trinidad and Tobago (RCCTT) have been busy rescuing spectacled caimans and various wildlife which were exposed to these oil spills (Figs. 2 & 3). The Serpentarium and RCCTT have place recognition of crocodilians individuals, that have been completely immobilized by the direct impacts of human wildlife conflicts and oil spills hence, they must be place in permanent housing for ongoing rehabilitation and solace. Additionally, observations are noted on feeding pattern, mobility, and mortality rates.

There were six areas affected by the oil spills from the period June 2022-January 2024 in Trinidad. These areas are as follows: 2022 - Guayaguayare; 2023 - Oropouche River, Cedros, Guapo, Rancho Quemado.

There is a dire need for further research on toxicological effects including mortality rate and offspring bone deformity effects to determine the future of the species. Moreover, outreach programs are conducted in public spaces such as local malls and other venues throughout the county. This conservation drive targets all members of the public in all age groups (Fig 4). Much emphasis is placed on crocodilian conservation and taxonomy since Trinidad is now known for having two species of crocodilians.

Figure 1 (left): Hydrocarbon leakage into the Guayaguayare river 2022; Figure 2 (right): *Caiman crocodilus* rescues from the oil spill in the area of Guayaguayare 2022.

Figure 3 (left): *Caiman crocodilus* rescued from the oil spill from the area of Rancho Quemado 2023. Figure 4 (right): Outreach at Trincity Mall, August 2023.

Prepared by: Marisa Tellez
Date completed: 31 January 2024