CROCODILE SPECIALIST GROUP NEWSLETTER

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CROCODILE

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GROUP

NEWSLETTER

VOLUME 34 Number 2
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COVER PHOTOGRAPH: Siamese Crocodile (*Crocodylus siamensis*). Photograph: Bruce Shwedick.

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The CSG Newsletter provides information on the conservation, status, news and current events concerning crocodilians, and on the activities of the CSG. The Newsletter is distributed to CSG members and to other interested individuals and organizations. All Newsletter recipients are asked to contribute news and other materials.

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Marco Schultz, Germany.

Editorial

The recent passing of CSG members Jean-Pierre Austruy (French Guiana) and Ralf Sommerlad (Regional Vice Chair for Europe) was very sad news indeed - both great champions for crocodilian conservation (see Obituaries on pages 4-5).

The CSG Steering Committee meeting held in conjunction with the 1st East and Southeast Asia Regional CSG meeting (25-29 May 2015), covered a wide range of issues and my thanks to the various working groups that continued to work through issues (see Minutes at pages 8-16). The one-day Veterinary Workshop was very successful and well attended. Our most sincere thanks to the Cambodian Government, European Union and to Flora & Fauna International, for supporting the meeting. It was attended by 200 participants from 26 countries, and was extremely well planned and implemented.

One of the highlights of the various presentations was the increasing role that the crocodile industry is playing in reintroduction programs. I wrote to the Secretary, Philippine Department of the Environment and Natural Resources, the Biodiversity Management Bureau and Crocodylus Porosus Philippines Inc. (CPPI), congratulating them on the progress made so far with releasing Philippine Crocodiles (*Crocodylus mindorensis*) in Paghungawan Marsh, Siargao Island Protected Landscapes and Seascapes (SIPLAS), Philippines. I also wrote to the Director General of the Thailand National Parks and Wildlife & Plant Conservation Department congratulating them on the "*Crocodylus siamensis* reintroduction project at Yod-Dom Wildlife Sanctuary, Thailand" with extensive input from Crocodile Conservation and Training Center, Panyafarm (CCTC) and Kasetsart University. This project, like any effort to restock *C. siamensis* in Thailand, faces many challenges, but they are being confronted with direct action.

The news about Lake Messangat (Kalimantan, Indonesia), which holds a population of *C. siamemsis*, was not good. It seems oil palm plantations and water diversion structures are impacting on both the lake water levels in the dry season and the livelihoods of local people who use the Lake for fishing. I have written to the Indonesian Minister for Environment and Forestry asking for confirmation of what appears to be escalating threats to this important population. Ralf Sommerlad had been very active in soliciting financial support for conservation research in Lake Messangat, but the current status of that work is unclear.

The CSG has received a preliminary proposal for the transfer of *C. porosus* in Malaysia from Appendix I to Appendix II of CITES for a limited wild harvest in the State of Sarawak, to help combat increased human-crocodile conflict, with a zero quota for wild specimens for the rest of Malaysia (ie Sabah and Peninsular Malaysia). The draft was sent out to senior CSG members for review, and comment received collated and forwarded back to Sarawak for their consideration, prior to finalizing the proposal for submission to CITES.

Further progress was achieved with the Madagascar Crocodile Conservation and Sustainable Use Program. The CITES trade suspension on *C. niloticus* exports was lifted in December 2014, and efforts to date have been directed at developing a workplan for the newly-formed Crocodile Management Unit, to assist in the development and implementation of a management program based on the principles of sustainable use. The International Trade Centre (ITC) has also facilitated a value chain analayis of the artisanal crocodile leather industry in Madagascar, and two workshops were recently directed at improving the capacity of the artisanal industry and improving benefits to rural livelihoods.

The 3rd SSC Leaders Group Meeting is scheduled to be held in Abu Dhabi on 15-18 September 2015. I will be attending, together with the CSG Executive Officer, Tom Dacey, and CSG Red List Authority, Perran Ross. It will be a great opportunity to interact with the Chairs of other IUCN-SSC Specialist Groups, all of which operate in different ways.

The 3rd West & Central Africa Regional CSG Meeting that was scheduled to be held in Abidjan, Ivory Coast, in November 2014, but had to be cancelled because of the Ebola outbreak in the West African region, is being reconsidered for early December 2015.

The 24th CSG Working Meeting is scheduled to be held at the Skukuza Rest Camp, Kruger National Park, South Africa, 23-26 May 2016. A veterinary workshop is proposed for Saturday 21 May and the CSG Steering Committee will hold its meeting on Sunday 22 May 2016. The theme for the Working Meeting will be "Crocodiles, Communities & Livelihoods". The meeting website is due to be launched soon.

Matthew Shirley and Marisa Tellez have been appointed Chair and Vice Chair respectively of the newly formed

CSG Future Leader's Working Group. I have also appointed Matthew Shirley as Joint Regional Chair for West and Central Africa. This initiative is aimed at ensuring a new cadre of CSG members gain wider experience with CSG issues and are prepared to take on leadership duties in the future.

Donations have begun to arrive in response to the annual letters of request sent out in June 2015, and I am personally very grateful to all who have made a contribution, past and present. The support of CSG donors, big and small, is critical to the CSG's ability to operate effectively and sustain itself.

Professor Grahame Webb, CSG Chairman.

Obituaries

Ralf Sommerlad
(1952-2015)

On 11 June 2015, Ralf Sommerlad passed away in Frankfurt, Germany. His health status had deteriorated dramatically over the past few months and hindered him from travelling and meeting with his friends and colleagues from all over the world.

Ralf was born and raised in Frankfurt, as one could easily recognize when listening to his typical broad Hessian dialect. He loved animals from his childhood, and so it was no surprise that he started his professional career as a trainee animal keeper in his home town. Even then, he was already keeping reptiles, such as chamaeleons and caimans, at home. After successfully completing his examinations, in 1970 he became an animal keeper in the reptile department of the Exotarium at Frankfurt Zoo, which at that time was still under the leadership of the famous zoo director, Prof. Dr. Bernhard Grzimek.

As Dieter Vogel, one of Ralf's best friends and one of his colleagues during that time, keeps saying, Ralf had his own ideas and a very strong opinion already at an early age. These modern conservation-oriented ideas sometimes did not go smoothly with the attitude of the old, established head keepers, resulting in Ralf leaving the zoo after only a few years. Even so, the development of Frankfurt Zoo was always important to Ralf, and he supported it whenever possible. He began work in the insurance business, initially for some large companies. However, as he liked to be his own boss, he soon founded his own insurance company in Rödelheim, a local quarter in Frankfurt in which he lived. Ralf was very committed to local business development in general and served for several years as president of the Rödelheim business association. He was also very active in local politics and enjoyed political debates.

The great passion of Ralf's life however was always crocodilians, most especially their proper husbandry under human care and their conservation in the wild. He became an active member of the AG Krokodile, a branch of the DGHT, Germany's largest Herpetological Association. His volunteer work for the AG Krokodile brought him into contact with Perran Ross and many other members of the Crocodile Specialist Group. Though he loved all crocodilians, the species that was closest to his heart was without doubt Tomistoma, known in Germany as the Sunda Gharial (*Tomistoma schlegelii*). Therefore it is no surprise that he was a founding member of the CSG's Tomistoma Task Force. He first served as the TTF's European Regional Chairman. His success in both raising awareness and funding for Tomistoma conservation resulted in him being appointed Chairman of the TTF. When he was later appointed as the CSG's Regional Vice-chairman for Europe, he left the TTF Chairman position, but he remained one the TTF's most active and vocal members.

He worked very hard with other TTF members to elevate international focus on Tomistoma and along with Rob Stuebing endeavoured to bring international attention to the Mesangat wetlands in East Kalimantan, Indonesia. Initially the focus was on protecting Mesangat for Tomistoma, but it soon became apparent that this area still held an important breeding population of the critically endangered Siamese crocodile (*Crocodylus siamensis*). Ralf's efforts brought focus and financial support for protecting Mesangat from zoological parks in Europe and in North America. It was also his hope that other Specialist Groups within the IUCN-SSC would take an interest in working together towards establishing long-term protection for the Mesangat wetlands. However, Ralf's knowledge, commitment, and sage advice was not only important for Tomistoma but also for many crocodilian species all over the world.

In 2008 Ralf took the position of Director at the Madras Crocodile Bank Trust and worked in India for a time before returning to Germany. He travelled all over the world, and made friends everywhere he visited. In Hong Kong, for example, he designed one of the best Sunda Gharial enclosures anywhere in the world in the Wetlands Park, and then organised and oversaw the transport and introduction of the animals for this exhibit. His favourite destinations however, those to which he returned year after year, were always Florida and Thailand, where he spent his time meeting with friends and observing crocodilians. Both countries had become a second home to him.

Within Germany he was, without question, the leading expert on crocodiles. Together with Ludwig Trutnau, he wrote the

most comprehensive book on crocodilian biology in the German language. He also wrote and contributed to many articles on crocodilians that have been published in both the popular and scientific literature. Ralf was the driving force behind an expert team in the development of new minimum requirements for crocodilian husbandry available to governmental authorities. He advised many zoos on the design and construction of appropriate and modern crocodile enclosures, such as those in Cologne and Leipzig. And, up until last year, he was still active in instructing zoo staff on the training of captive crocodiles for management purposes, especially in Basel, Cologne and Hamburg. Ralf also helped to establish a Crocodile Association in the Czech Republic, he became a founding board member of the Crocodilian Conservation Center of Florida, and was looking forward to assisting with a crocodilian zoo currently under development in Bangladesh.

For him it was always obvious that international cooperation was necessary for the effective protection of crocodilians. He acted as an advisor for the Reptile Taxon Advisory Group (TAG) of EAZA (European Association of Zoos and Aquaria), was for many years the only link between European zoos and the CSG, and he was instrumental in establishing the strong link between the EAZA Reptile TAG and the AZA Crocodilian Advisory Group TAG under the leadership of Kent Vliet and John Groves. With his unceasing enthusiasm, interest and encouragement, Ralf managed to infect many young people with the crocodile "virus". He encouraged several young zoo biologists in Europe to become more active in the conservation of crocodiles and in the CSG, including Frank Brandstätter (Dortmund), Gonzalo Fernandez Hoyo (Fuengirola), Pavel Moucha (Dvur Kralove), Fabian Schmidt (Leipzig), Thomas Wilms (Frankfurt) and Thomas Ziegler (Cologne). He also provided his guidance to young European field biologists, including Rene Bonke, Natascha Behler and Agata Staniewicz.

Ralf was not only passionate about crocodiles and their conservation, but about conservation of wildlife in general. His interest reached far beyond crocodilians - especially in the last years of his life, Ralf's attention turned increasingly to concerns about habitat destruction for animals worldwide. Throughout his life Ralf was an exuberant advocate for zoos. He always shared his interest and his knowledge about zoological gardens in general. Ralf had a unique sense of humour and he was an excellent imitator of Heinz Erhardt, a famous German entertainer.

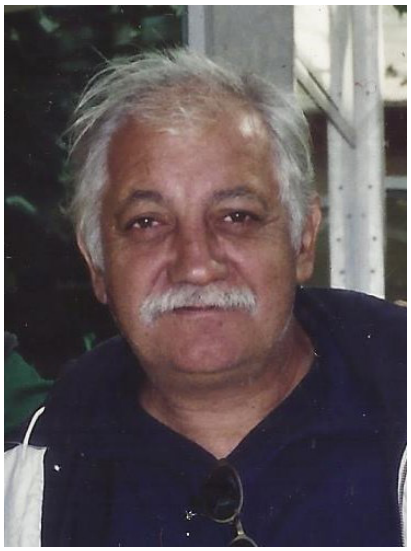
I still remember the first time I met Ralf Sommerlad: I was still in school and attended a lecture at the local herpetology group in Frankfurt, where "crocodile expert Mr. Sommerlad" was holding a lecture. His arm was in a cast and I wondered if perhaps he had been injured during the capture of a big crocodile somewhere in Southeast Asia. After the lecture, I dared bravely to ask him how this had happened. Ralf started to laugh and explained that he was also active as a local politician in the city of Frankfurt. One day, he became so annoyed during a meeting that he banged his fist down so hard on the table that he broke his hand. This story typifies him. Ralf had strong opinions, he was impulsive, and he always fought for his ideals - for the crocodiles - without regard to his own well-being.

Although Ralf knew how to enjoy life, in recent years he was more and more desperate about conservation issues in the wild. He wished for more success stories and he had concerns about some bad developments (or no developments at all) in crocodile husbandry. He knew there was still a lot for him to do - and he was keen on continuing the fight. However, he was also aware that his body was becoming too weak for him to keep pushing the issues in which he believed, and this only made him more desperate. His mind was full and his spirit to fight was alive - but his body could no longer carry on the fight. Our thoughts are with him and his big family, with his wife, his brothers, his sons and his grandchildren.

With Ralf Sommerlad we not only lost a great crocodile conservationist, we lost a dear friend. We are very sad, but at the same time we know that we need to push on - to continue doing the work of crocodile conservation - the work Ralf would still be doing if he could. This would be Ralf's wish, and how can we better thank him for all his support over these many years than by continuing his work?

Fabian Schmidt, Bruce Shwedick and Kent Vliet.

Jean-Pierre Austruy
(1955-2015)



Jean-Pierre Austruy (60 y) passed away suddenly on the night of 1 April 2015, as a result of a pulmonary embolism, at his home, in Roura, French Guiana. He suffered from cancer of the right lung for three years, and despite an operation in 2013 he was weakened by this terrible illness that eventually broke him just two weeks after his 60th birthday!

Jean-Pierre was a passionate, self-taught field herpetologist. A professional baker in Nîmes, France, Jean-Pierre studied French reptiles as a teenager hobbyist. At 20 years of age he decided to totally change his life and devote himself to

Amazonian reptiles. He settled in French Guiana, where he met and married Véronique, with whom he shared his life and his passion for reptiles.

With courage and tenacity, and with love and patience, they spent 40 years on their farm, located in the jungle, in the municipality of Roura, which eventually became the "Crocodilians Sanctuary". Jean-Pierre and Véronique fought with the French Guianan administration throughout their lives to realize their dream of an educational farm dedicated to the protection and conservation of French Guianan reptiles.

Their life was very difficult because of the meager income derived from their farm, but it allowed them to build their home, to accommodate a vivarium at first, and finally a sanctuary for the reptilian fauna of French Guiana, on more than 56 hectares. Throughout his life, Jean-Pierre, sometimes with Véronique and their daughter Karine, undertook numerous expeditions into the primary forest, going up rivers in his small dinghy, observing reptiles and the rich biodiversity of the French Guianese forest, and becoming a recognized expert with years of observations. Jean-Pierre held a Capacity Certificate for breeding Guianian reptiles and was a member of Crocodile Specialist Group.

The sanctuary has four species of caiman, and many other reptile species, with a conservation goal for endangered species. Sadly, Jean-Pierre was not able to open his "Crocodilians Sanctuary" to the public after a lifetime devoted to this goal, when illness took him just before he could complete his noble dream.

Jean-Pierre is remembered as a man of great generosity, great fidelity in friendship, a great passion for the Guianese forest and a big nature lover. He leaves a great void in our hearts.

Adieu Jean-Pierre, may your spirit reign forever over the Guianese forest, like a benevolent angel over his reptiles that have lost their protector.

Your best friend, Bruno Gattolin (D.V.M. Herpetologist)

CSG Student Research Assistance Scheme

The CSG Student Research Assistance Scheme (SRAS; http://www.iucncsg.org/pages/General-Information.html) provided funding to two students in the April-June 2015 quarter.

1. Yusuke Fukuda (Australia): Understanding movement and dispersal of saltwater crocodiles for managing human-crocodile conflicts in Australia and neighbouring countries.

2. Ariel Espinosa-Blanco (Venezuela): Population parameters, habitat quality and effect of past reintroductions on the Orinoco crocodile in Venezuela: evaluation of conservation actions.

Tom Dacey, *CSG Executive Officer, <csg@wmi.com.au>*.

Book Review

Biology and Evolution of Crocodylians, Gordon Grigg and David Kirshner, 2015; CSIRO Publishing and Cornell University Press, Ithaca New York, 14850, 672 pages, ISBN 978-0-8014-5410-3.

Gordon Grigg and David Kirshner, and their publisher, CSIRO Press, have produced a major new book about crocodilians. I initially wondered; what more can be said about this well documented group of reptiles? But in his preface, Dr. Rick Shine offers that: "Recent research has transformed our understanding of crocodylian biology and enabled us to view these leviathans with new eyes." This book makes good on that statement, providing a detailed review of foundation and recent work and many new insights and syntheses based upon them.

Gordon Grigg wrote the text and a significant contribution is David Kirshner's detailed and clear diagrams, many with color, that clarify numerous structural, anatomical and functional relationships. The publishers have been generous with so many photographs allowed, and with paper quality and binding to produce a durable contribution to our knowledge of crocodilians.

The style and content combine to make reading the whole thing through a productive and enlightening experience. The volume has a full index and detailed table of contents that serves as a quick reference to topics. Each chapter is supported by its own bibliography so that the book also functions as a ready-reference source to the group that Grigg argues persuasively, is correctly labeled 'crocodylians'. The exhaustive treatment and insightful explanations will establish the book as the go-to foundation reference for crocodylian research for many years. For example, it will (I hope) displace the nearly obligatory sentence in every introduction 'There are 23 species of extant crocodilians (Ross 1998)' with, 'There are at least 27 species of extant crocodylians, with more likely to be revealed as new techniques are applied (Grigg and Kirshner 2015)'.

The content represents Grigg's lifetime of detailed research and publication, as well as, I suspect, his research files and well worked lecture notes on several topics and a professional career devoted to understanding these fascinating animals. Throughout, the unique structure and function of crocodylians is carefully reviewed, explained, illustrated and documented. The strongest chapters are those in Grigg's direct research interest of functional physiology, so that anatomy, heart function, circulation, respiration and metabolism and osmo- and thermo- regulation are covered in exquisite and very valuable detail. Each chapter begins with a personal anecdote, and the text has many colloquial and informal asides and comments, making it a pleasant and sometimes amusing read, but the meat of it is Grigg's ability to carefully present and synthesize each topic, and Kirshner's wonderful clear diagrams. Mysteries (to me) such as the evolution and fossil relationships, anatomy and function of the heart, unique intricacies of circulation, one way airflow in the lung and the function of gastroliths are each carefully unwrapped, persuasively argued and clearly summarized. Even topics I

thought I understood like endothermy in crocs and dinosaurs, receive a new, convincing and insightful treatment. Sub sections and inserted boxes summarize basic background such as the terminology of thermoregulation (page 339) giving useful guidance to non-specialist comprehension, but relieving the expert reader from tedious reading.

The content is supported not only by Grigg's exhaustive research experience and knowledge, but additionally by extensive consultation and content, always carefully acknowledged, from over 100 colleagues and reviewers; Chris Brochu (fossils), Kent Vliet (behavior), Craig Franklin (circulation), Laurie Taplin (osmoregulation), Matt Shirley (extant species), and many others all contributed valuable depth. The book even has a couple of sight gags. Figure 11.40 purports to show Grigg testing salinity by taste - but is the amber fluid in the flask really caiman urine or just Brazilian beer? Only Laurie Taplin, Bill Magnusson and Lyn Beard know. Grigg also steps into contentious and unresolved issues, for example presenting a sympathetic presentation of Roger Seymour's contention that crocodylians come from endothermic ancestors and secondarily reverted to ectothermy for ecological reasons.

The book has very few deficiencies. In careful reading I found only two very minor typos. I would have been more enthusiastic about the learning capacity of crocodylians demonstrated repeatedly in captive animals, but as much of this work in unpublished and anecdotal, Grigg's cautious treatment is understandable. The content leans very heavily on research experience on *C. porosus*, and to a lesser extent *C. johnstoni*, in Australia, largely because that is where much of the research has been done. But work on *Alligator* and others is fully covered and the extrapolation to other species or to all crocs is mostly justified or suitably cautious - and indicates a rich field of follow-up research to verify the information in more species that will inspire Masters and Doctorates for years to come. The treatment of conservation and sustainable use adopts a cautious skepticism, surprising in the light of Grigg's support for the same principles in kangaroos based again on his extensive research, but serves as a valuable counterweight to uncritical advocacy and supports a mixed conservation strategy to meet all crocodylian species' varied conservation status and needs.

Overall, this volume meets the challenge it sets by providing a new synthesis of older and recent information and a significant step forward in our understanding of the uniqueness and special function of crocodylians. What emerges is the clear view that crocs are not just slightly different reptiles, but rather that they are uniquely and fundamentally different from all other vertebrates in ways that help explain their long evolutionary history and persistence. The book's price is heart stopping, expected now in any major hard-bound and heavily illustrated work, but I think worth it as it provides collected content and thoughtful depth not available in other scattered sources. This book will take its place on my bookshelf with other basic crocodilian texts (eg McIlhenny; Medem; Webb, Manolis and Whitehead; Graham and Beard; Ross (Andy); King and Brazaitis and the CITES ID guide) to become well thumbed and dog eared as I check basic facts and remind myself of the many fascinating details of crocodylian biology. An electronic version will become available.

Perran Ross, <*pross@ufl.edu*>.

Special Issue of South American Journal of Herpetology on Crocodilian Reproduction

A number of presentations from the 23rd CSG Working Meeting (Louisiana, May 2014) were selected for review and publication in a special issue of the South American Journal of Herpetology, devoted to crocodilian reproduction.

The citations for these papers are listed below, and the abstracts are presented under Scientific Publications on pages 41-43.

Piña, C.I., Merchant, M.E. and Verdade, L.M. (2015). Introduction: Reproduction in Crocodilians. South American Journal of Herpetology 10(1): 1-3.

Budd, K.M., Spotila, J.R. and Mauger, L.A. (2015). Preliminary mating analysis of American crocodiles, *Crocodylus acutus*, in Las Baulas, Santa Rosa, and Palo Verde National Parks, Guanacaste, Costa Rica. South American Journal of Herpetology 10(1): 4-9.

Balaguera-Reina, S.A., Venegas-Anaya, M., Sanjur, O.I., Lessios, H.A. and Densmore III, L.D. (2015). Reproductive ecology and hatchling growth rates of the American crocodile (*Crocodylus acutus*) on Coiba Island, Panama. South American Journal of Herpetology 10(1): 10-22.

Portelinha, T.C.G., Jahn, G.A., Hapon, M.B., Verdade, L.M. and Piña, C.I. (2015). Hormone levels and ultrasound evaluation of *Caiman latirostris* (Crocodylia, Alligatoridae) ovulation. South American Journal of Herpetology 10(1): 23-31.

Moore, B.C. and Kelly, D.A. (2015). Histological investigation of the adult alligator phallic sulcus. South American Journal of Herpetology 10(1): 32-40.

Iungman, J.L., Somoza, G.M. and Piña, C.I. (2015). Are stress-related hormones involved in the temperature-dependent sex determination of the Broad-snouted caiman? South American Journal of Herpetology 10(1): 41-49.

Marcó, M.V.P., Piña, C.I., Somoza, G.M., Jahn, G.A., Pietrobon, E.O. and Iungman, J.L. (2015). Corticosterone plasma levels of embryo and hatchling Broad-snouted caimans (*Caiman latirostris*) incubated at different temperatures. South American Journal of Herpetology 10(1): 50-57.

Lance, V.A., Elsey, R.M. and Trosclair III, P.L. (2015). Sexual maturity in male American alligators in southwest Louisiana. South American Journal of Herpetology 10(1): 58-63.

CSG Steering Committee Meeting

(Siem Reap, Cambodia, 25 May 2015)

Steering Committee present: Grahame Webb, Alejandro Larriera, Tom Dacey, Charlie Manolis, John Caldwell, Mark Merchant, Simone Comparini, Yoichi Takehara, Choon Heong Koh, Christine Lippai, Lonnie McCaskill, Perran Ross, Paolo Martelli, Samuel Martin

Observers present: H.E. Eng Cheasan, Natascha Behler, Sukenao Iida, Olivia Plume, Srun Limsong, Ouk Vibol, Michael Meyerhoff, Rainier Manalo, Michael Cruz, Ricardo Alfonso Reina, Samson Samuel, Teri Aquino, Sally Isberg, Matthew Shirley, Akira Matsuda, Heng Sovannara, Jackson Frechette, Geoff McClure, Brian Wright, Han Sam, Sisaket Chin, Ratanapich Nhels, Agata Staniewicz, Hernando Zambrano, Jesse Davidson, Helen Crowley

Apologies (Steering Committee): Dietrich Jelden, Howard Kelly, Alison Leslie, Guy Apollinaire Mensah, Jiang Hongxing, Dr. Giam, Eric Langelet, Steve Peucker, Anslem de Silva, Ruchira Somaweera, Maheswar Dhakal, Raju Vyas, Abdul Aleem Choudhury, Asghar Mobaraki, S.M.A. Rashid, Alvaro Velasco, Alfonso Llobet, Carlos Piña, Hesiquio Benítez Dias, Marisa Tellez, Luis Bassetti, Sergio Medrano-Bitar, Manuel Tabet, Bernardo Ortiz, Jon Hutton, Ralf Sommerlad, Ruth Elsey, Allan Woodward, Noel Kinler, Frank Mazzotti, Thomas Rainwater, Yoshio Kaneko, Hank Jenkins, Don Ashley, Kevin van Jaarsveldt, Jorge Saieh, Thomas Kralle, Chris Plott, James McGregor, Steve Broad, Kent Vliet, Val Lance, Curt Harbsmeier

Apologies (other CSG members): Chris Banks, Olivier Behra, John Brueggen

1. Executive Reports

1.1. Chairman's Report

The CSG Chairman, Grahame Webb, opened the meeting at 9 am, welcomed participants and particularly thanked Cambodia for hosting the regional meeting. One minute's silence was held for the loss of two CSG members since the last Steering Committee meeting in Louisiana - Prof. Charles Santiapillai (Sri Lanka) and Rafael Crespo Jr. (USA).

Participants were advised of the following future meetings:

- 30 August-3 September 2015: 28th Meeting of the CITES Animals Committee, Tel Aviv, Israel.
- 15-18 September 2015: 3rd SSC Specialist Group Leaders Meeting, Abu Dhabi, UAE.
- 11-15 January 2016: 66th Meeting of the CITES Standing Committee, Geneva, Switzerland.
- 23-26 May 2016: 24th Working Meeting of the Crocodile Specialist Group, Nombolo Ndhluli Conference Centre, Skukuza Rest Camp, Kruger National Park, South Africa. The working meeting will be preceded by a meeting of the CSG Steering Committee on 22 May 2016.
- October 2016: 17th Conference of the Parties to CITES (CoP17), Cape Town, South Africa.

Definite amendment proposals for crocodilians at CoP17 (October 2016) will be:

- Malaysia will be submitting a proposal for the transfer of the Malaysian population of *C. porosus* to Appendix II, with zero quotas for Sabah and Peninsular Malaysia, but which allows Sarawak to implement a program better linked to the increasing human-crocodile conflict they are experiencing.

Possible amendment proponents that CSG members are aware of may include:

- Mexico has been considering a proposal to lift the zero quota in order to implement a ranching program with *C. moreletii*.
- Madagascar is considering submission of a proposal to transfer its population of *C. niloticus* from Appendix II (ranching) to Appendix II (unqualified).
- Colombia may put forward another proposal for the Cispata Bay population of *C. acutus*.
- Cambodia has been considering whether a proposal to amend the Appendices of CITES is a mechanism through which the extensive captive breeding of *C. siamensis* could be better regulated.

The Chair advised that the CSG was always prepared to assist proponents, through the review of proposals, if requested to do so.

Country Reviews: Two CSG reviews were completed within the last year: Ethiopia (see SC.3.1) and Indonesia (see SC.3.2).

Steering Committee: Dr. Mark Merchant was added as Joint Vice Chairman for General Research following the Louisiana meeting (May 2014).

The report was noted.

1.2. Minutes and Actions from SC Meeting, Louisiana

The agreed Minutes and Actions from the previous meeting were noted with the opportunity of participants to comment on any issues.

1.3. Executive Officer's Report

The Executive Officer highlighted:

- Current CSG Steering Committee membership is 67 people

- CSG membership is 541 people in 63 countries
- Regional Offices are currently maintained in Latin America and the Caribbean (Argentina), South Asia & Iran (Sri Lanka) and East and Southern Africa (South Africa)
- The CSG Student Research Assistance Scheme has seen 84 applications approved since its inception (2009), and two further applications are currently under consideration. An additional application was approved under the Fritz Huchzermeyer Veterinary Science Student Research Assistance Scheme.

The report was noted.

1.4. CSG/IACS Financial Report

The IACS bank balance at 31 March 2015 was $AUD806,360 (approximately $US547,000). The IACS Annual General Meeting was held on 31 October 2014, noting the Audit report and approving the re-election of office bearers.

The Conservation Education Fund (CEF) initiated in Louisiana with a $US5000 donation from Ashley & Associates had now been supplemented by a recent $US20,000 donation from Golden Ranch Farms (USA). The strategy and protocols for the CEF are still being developed with Don Ashley.

The Financial reports, IACS annual report and IACS audit statement were noted.

2. Regional Reports

2.1. Cambodia

Fisheries Administration, the Cambodian CITES Scientific Authority (CITES Management Authority in the Ministry of Agriculture, Forestry and Fisheries), aims to promote the conservation of wild populations and the development of sustainable crocodile farming which can contribute to wild crocodile conservation, people's livelihood and national economic growth. To achieve this a National Strategic Plan for crocodile management and development is being formulated with all internal stakeholders, including the CSG Siamese Crocodile Task Force.

Cambodia would like to propose a down-listing of *C. siamensis* from CITES Appendix I to Appendix II. Given the unique situation with large numbers of village level farms with a satellite-farm system, that do not rest easily with the CITES captive-breeding resolutions, it was recommended that early consultation be undertaken with the CITES Secretariat, the European Union and some Parties, particularly the United States of America, to seek technical advice

3. Review Updates

3.1. Ethiopia

Matthew Shirley provided an overview of the Ethiopia Review report and highlighted the report recommendations:

"1. We consider the development of a formal Ethiopian Nile Crocodile Management Plan to provide a united operational framework for crocodile conservation and management a priority.

   Issues that need to be addressed in the process of deriving this plan include:

   a. The biological and economic sustainability of both the ranching and trophy hunting programs;
   b. The implementation of a formal, preferably annual, population monitoring program;
   c. Significant improvement of reporting internally and internationally;
   d. A clear and transparent protocol for setting hatchling harvest quotas.

2. We identified several administrative and practical problems of compliance with CITES Article IV (non-detriment) and the specific requirements of the CITES "Ranching Resolution" [Resolution Conf. 11.16 (Rev. CoP15)].

3. EWCA activities with and trade of Nile crocodiles would be improved if a clear focal point for Nile crocodile issues is identified within the CITES Scientific Authority. Ideally this focal point will work collaboratively with SNNPRS.

4. The commercial viability of AMCR could be improved if a business plan were developed that fully integrates all potential aspects of the operation."

The full report by Matthew Shirley, Ludwig Siege and Meseret Ademasu is available on the CSG website at: http://www.iucncsg.org/pages/Publications.html.

The Chairman congratulated Matt and his co-authors for an excellent review report.

The report was noted.

3.2. Indonesia Review

The Chair reported on the review mission to Indonesia and outlined the issues addressed:

1. Ranching and Compliance with CITES. The extent to which Indonesia's current ranching program and skin exports were compliant with

CITES.

2. Options for conservation of crocodiles in Lake Mesangat, East Kalimantan. This has been a long standing issue for the CSG, as:

    a. The area represents one of the last global strongholds for wild *C. siamensis*.
    b. Effect of habitat modification and destruction at Lake Mesangat for oil palm plantations. Since the review visit took place, more water diversion activities appear to have taken place, lowering the water levels in the lake and threatening the survival of the crocodiles and their habitats, and the use of the lake to support local livelihoods through fishing. It appears that a UK corporation owns the leases but plantation work is being undertaken by a Malaysian company.
    c. The issue is politically complex and there does not appear to be an immediate solution.

3. Increasing Human-Crocodile Conflict, particularly in the West Timor region was an issue raised by Indonesia. The frequency of reported incidents are understated in the media.

4. General farm productivity issues.

The full report by Matthew Brien, Bruce Shwedick, Lonnie McCaskill, Widodo Ramono and Grahame Webb is available on the CSG website at: http://www.iucncsg.org/pages/Publications.html.

NOTE: Grahame Webb reported that despite the mission to Indonesia being very successful, there was increasing evidence that Lake Mesangat was still in real danger of being drained in the dry season by water diversion levees, and if so, the future of *C. siamensis* could not be guaranteed. The ability of Lake Mesangat to support local livelihoods, though fishing, was also now being questioned.

An extensive side-meeting was held to discuss the status of Lake Mesangat during the meeting and it was resolved to write to the Minister of Forestry (Jakarta) about the concerns. The first step is to conduct an analysis of aerial/satellite images, and perhaps to gain current images allowing the full extent of habitat modification to be quantified. It appears that the parent company operating the palm oil plantations has subsidiaries, including a Malaysian company, doing the actual planting. Concern was raised over funds donated for crocodile work in Lake Mesangat not being used for that purpose.

The report was noted.

4. Thematic Group Reports

Paolo Martelli, Vice-Chair of the Veterinary Science group, indicated that although only one year had passed since the last meeting it had been a densely packed year.

1. The Fritz Huchzermeyer Veterinary Science Student Research Assistance Scheme was established to honour and remember Dr. Fritz Huchzermeyer (1930-2014), founder of the Veterinary Science group, and whose contribution to crocodilian veterinary science was substantial and inspiring. The first recipient of the grant is Jose Fernando Aguilera Gonzales, who is studying the health of the American crocodile population in the Tempisque River, Costa Rica.

2. CSG Veterinary Science group mailing list and CSG Newsletter. The veterinary list had seen a surge in activity and interest last year and a bit of a dip this year. However a number of interesting cases have been shared between crocodilian veterinary professionals globally. We have contributed to the CSG Newsletter in the form of a section summarizing recent group events.

3. Workshops at the CSG meetings. The Veterinary Science group continues to be active at every CSG meeting. In 2014 the group was able to act on the commitment made in Sri Lanka in 2012 to hold workshops. This year we are holding a veterinary and husbandry workshop at a local farm, intended to help Cambodian farmers but attended by numerous other participants across the CSG membership.

4. Website updates. Resources provided by the group on the CSG website were updated with additional material, including guidelines on the humane euthanasia of crocodilians.

5. Meeting on comparative crocodile health management: the experience of Thailand and Australia. This meeting was organized by Dr. Parntep Ratanakorn on 20-21 June 2014 at Mahidol University. Dr. Cathy Shilton and Dr. Paolo Martelli, co-vice chairs of the CSG Veterinary Science group, were invited to compare and discuss the Thai and Australian experiences with crocodile diseases. The meeting was productive and the tour of some crocodile farms was very instructive.

The report was noted.

5. IUCN Red List Authority

Perran Ross highlighted species that still need to be completed, in order of priority: *Crocodylus intermedius* - CR; *Alligator sinensis* - CR; *Melanosuchus niger* - EN; *C. niloticus* - eastern clade; western clade *C. suchus*; *Osteolaemus tetraspis* - VU; *C. johnstoni* - LR.

Constraints on CSG's capacity to conduct assessments are primarily identifying teams and team leaders to collect and format the required information. The Chairman requested members to assist Perran with the assessment work and agreed with Perran's suggestion that he should select some suitable understudies from the CSG Future Leader's Group to assist with the work.

The report was noted.

6. Task Force/Working Group Reports

6.1. Tomistoma Task Force

The TTF Chair, Bruce Shwedick was unable to attend the meeting, but provided a report on recent activities. Grahame Webb provided an overview of the success of the CSG-TTF and its ability to raise funding to support various Tomistoma projects, under the umbrella of the CSG. Perhaps this is a model that could be adopted by other existing and future Task Forces.

The report was noted.

6.2. Human-Crocodile Conflict Working Group

Charlie Manolis provided a verbal report on the activities of the HCC Working Group, advising that the Working Group had previously agreed to focus on developing case studies. This had been completed and there is no further need for the Working Group at this stage. HCC remains a serious problem when conservation of large predatory crocodiles has been successful and the wild populations increase, and is clearly a serious constraint on sustaining the recovered wild populations.

It was suggested that the CSG compile everything that we have on HCC and add it to the CSG website for information. Such information does not need to be of a technical nature.

6.3. Siamese Crocodile Task Force

A report had been provided by the Chair of the Siamese Crocodile Task Force, Dr. Parntep Ratanakorn. However, as the Siamese Crocodile Task Force was meeting later the same day, it was suggested that discussion be deferred to that meeting and the outcomes reported back during the meeting.

<u>Minutes of Siamese Crocodile Task Force Meeting</u>

1. Cambodia update by Heng Sovannara. Papers describing the restocking and release programs are being presented within the meeting sessions.

    a. WCS Program - including releases
    b. FFI Program - including releases
    c. Plans to release crocodiles every year
    d. Cambodia considers that a proposal to CITES to downlist *C. siamensis* from Appendix I to Appendix II at CITES CoP17 would be beneficial, as it would allow conservation efforts to be better integrated with the large number of farms producing *C. siamensis* more as domestic animals.
    e. Update on crocodile farmers association: currently some 1000 farms, mostly small village level, producing 500,000 hatchlings annually.

2. Thailand update by Yosapong Temsiripong:

    a. Update from Department of Fisheries:
        i. Initiated the Smart Farmer Program in 2014 to standardize crocodile farmers with Good Aquaculture Practice (GAP) standard for crocodile growers and breeders.
        ii. On 23 July 2014 Department of Fisheries together with reporters paid a visit a crocodile farm and manufacturer in Ayutthaya Province.
        iii. On 25 July 2014 Department of Fisheries ran a whole day program at Bueng Boraphet Wildlife Reserve to raise awareness for crocodile conservation with the following activities:
            1. Siamese crocodile education, re-introduction and conservation exhibition
            2. Siamese crocodile health examination demonstration and blood collection.
            3. Siamese crocodile egg hatching demonstration.
            4. Siamese crocodile handling demonstration.
        iv. Improve community program to protect natural habitat for crocodile conservation at two study sites:
            1. Bueng Boraphet Wildlife Reserve, Nakornsawan Province
            2. Nam Oun Reservoir, Sakol Nakorn Province.

    b. A further release project is underway and well advanced at Yod Dome Wildlife Sanctuary, Ubon Ratchathani Province. The goal is to release 10 adults already on site. Details of this challenging program are contained in a presentation within the main meeting. As expected at any potential release site in Thailand, there has been some villager resistance, based on fear that the crocodiles will spread outside the sanctuary. This is being addressed through ongoing consultation with local people. The experiment will hopefully

provide more guidance on how to engineer or create incentives for local people to support releases of different sized animals, emphasizing the importance of public consultation and education, and the socio-economic context that will ultimately dictate success or failure.

c. Development Agency (ARDA), a Public Organisation, verbally agrees with the Department of Fisheries to support funding for conservation and husbandry research projects. In March 2013, Dr. Wimol Jantrarotai, DG, Department of Fisheries, signed an MOU with CMAT to continue a re-introduction program with private funding, which is still being sourced. CMAT has submitted 12 potential research projects; 2 conservation projects; 9 health and husbandry projects; and, a genome project.

3. Discussion of CITES downlisting in Thailand and Cambodia:

a. Thailand's proposals at CoP16 to downlist *C. porosus* and *C. siamensis* were not reviewed by the CSG until after submission, and they relied too heavily on "intended" rather than "implemented" conservation actions - they did not win support from the Parties.

b. The CSG considers the situation in Thailand, Cambodia and Vietnam to be quite unique and not one envisaged by CITES when it was drafted. Namely, some 3000 village level farms in the region, which commercially raise what are essentially domestic animals, when the remnant wild populations are seriously depleted and in Thailand and Vietnam, close to extinction. Furthermore, the satellite farming situation is the only one that seems to be able to work (versus registering 3000 farms), yet satellite farming is not really sanctioned by Resolution Conf. 12.10 (Rev. CoP15) nor forewarned in the Convention text. Hence it may require the Parties to fully consider this production system and make some determination or resolution. Advice from a range of Parties and from the CITES Secretariat on this exceptional case may be needed.

c. The issue of a regional versus national approach may need to be considered, along with the implications of any future general trade agreement allowing free trade between the Range States.

d. High-end fashion companies are increasingly required to ensure the supply chains of raw products (crocodile skins) are legal, sustainable and verifiable and ideally assist the livelihoods of local people involved in production.

e. Multi-national/regional approach through ASEAN-WEN for enforcement of Wildlife Act.

4. Still a need to strengthen networking of the SCTF in the region through:

a. Technical visits and gap analysis;
b. Convening meetings to examine specific issues;
c. Fostering cooperation between all people involved in release and restocking.

5. Crocodile Health Research Centre (CHRC) established at Faculty of Veterinary Science, Mahidol University, Thailand:

a. Diagnosis of crocodile diseases for farmers in the region.
b. Research in crocodile health management.
c. Capacity building for crocodile veterinarians and farmers in the region.
d. Networking with other crocodile veterinarians in the world.

6.4. Crocodilian Capacity Building Manual

Perran Ross presented his report advising that the CCBM was to be an online living "Wikipedia" style living document. Contents of the CCMB are introductory accounts for major topics and links to key literature and other resources. To date 27 out of 40 sections had been completed. The next step will be to release the available material for open review and "crowd source" updating and revision.

It was agreed that CCBM be incorporated into the CSG website as soon as possible and updated as further information becomes available. Although not publically released at this stage the draft material can viewed at: http://www.iucncsg.org/pages/CCBM.html.

The report was noted.

7. General Business

7.1. Management of *Caiman crocodilus fuscus* in Colombia

By way of background, the CSG has a long history of acknowledging the technological sophistication of the crocodilian farming industry in Colombia, which is based on captive breeding, but the CSG

has an equally long history of expressing concerns about the laundering of wild skins (or skins derived from ranched juveniles grown on farms) by farms and traders. Very extensive discussions about this illegal trade, which has been ongoing, were undertaken most recently at the last CSG Working Meeting (Louisiana, May 2014), as documented in the Minutes, accepted unanimously as a true and accurate record at this meeting (see SC.1.2 above).

CSG Deputy Chairman, Alejandro Larriera, introduced Mr. Ricardo Reina from the Ministerio de Ambiente y Desarrollo Sostenible (MADS) which is the National Ministry and CITES Management Authority of Colombia. We are most grateful to Mr. Reina for attending and updating the CSG Steering Committee on the considerable progress that has been made since the 2014 meeting.

Mr. Reina circulated a brochure entitled "Sustainable use of Caiman crocodilus in Colombia", as a further resource associated with his verbal report.

Since the CSG Meeting in Louisiana the National Ministry (MADS) has carried out on-site reviews of 44 farms, confirming irregularities in 7 (16%) which had been receiving annual CITES Export Certificates. These farms have been banned from receiving any further CITES Export Certificates.

During 2015, jurisdiction for controlling and regulating farms will be returned to MADS (national level) after a long period in which it had been the responsibility of the Autonomous Regional Corporations (State or Provincial level).

Various other changes have been self-imposed by Colombia. For example the cutting of the 10th scute on the tail of captive-bred hatchlings has now been mandatory for 7 years, so that all exported skins should now have the "scar button".

MADS now has inspectors checking skins at the point of export for both the correct tags and to ensure the tail with the 10th scute removed and healed, is included. It was recognized that it will be necessary to improve surveillance instruments and controls within the schemes that already exist, and an agreement with the National University of Colombia, to apply genetic technics to traceability issues, is under consideration.

Experiments with mixed model farming (production through captive breeding and sustainable ranching) will be boosted in 2015-2016. The first step is to obtain cultural, social, economic and ecological knowledge of both *C. crocodilus* and the human communities associated with their use. In 2015 an agreement was signed between the Colombian CITES Management Authority and the Institute of Natural Sciences of the National University of Colombia (CITES Scientific Authority), to apply this strategy on four pilot sites during 2015-2016. Generating agreements between local communities and captive breeding farms will be part of this process.

Colombia considers that it may take another 5 years (2010) before any final program incorporating captive breeding and wild harvest, through ranching or direct harvest, will be finalized and fully implemented.

A new "National Plan for the Sustainable Use of *Caiman crocodilus*" is being developed. The primary objective is to increase the efficiency of *C. crocodilus* controls and tracking patterns of use.

It remains the intention of MADS to assess farms with regard to production capacity in 2015, using a series of theoretical criteria and indicators, as a basis for issuing CITES Export Quotas in the immediate future.

NOTE: The CSG Chairman congratulated Colombia for ceasing to issue CITES permits to the 16% of farms that the Ministry discovered had no capacity to fulfill production through captive breeding, yet had been exporting skins against those permits. Increased controls and inspections were considered a proactive intervention against illegal trade. Increasing investigations into ways legal ranching and perhaps wild harvest could integrated into the Colombian production systems, currently restricted to captive breeding, is welcomed.

That it may take a further 5 years before a legal ranching system is fully integrated with production from captive breeding could be problematic to Colombia. It suggests the Parties to CITES, including the EU, will be prepared to continue accepting skin shipments with a captive breeding source code, despite various routes through those shipments may continue to include ranched animals. This is an issue that should be discussed with the CITES Standing Committee Working Group looking at the misuse of source codes.

In the Colombian CITES notification (Notification 2014/033) exports of skins without the hatchling scar on the tail tip is wisely prohibited, which excludes flanks (unless paired with the tail tip and scar). This prevents the ongoing harvest of wild skins for flanks (without the hatchling scar).

A possible option for Colombia to consider would be to pass domestic legislation permitting an experimental ranching program, while the ranching program was being developed, and perhaps marking them with a different cut tail scute, so a ranching source code could be used for them.

Given the complexities of the issues the Chair undertook to have further discussions with the Colombians present at the meeting. An informal but extensive meeting was held with Grahame Webb (CSG Chair), Alejandro Larriera (CSG Deputy Chair), Hernando Zambrano (CAICSA S.A.S, Colombia) and Ricardo Reina (MADS, Colombia), in which consensus was reached about the need to address the source code issue expediently, with discussion of various options and constraints for doing so, in the hope that it may assist the current efforts by MADS to meet its long-term goals.

7.2. CITES Animals and Plants Committees Working Group on Captive Breeding

A report had been provided by CSG Deputy Chairman Dietrich Jelden, who unfortunately was unable to attend the meeting.

CSG Deputy Chairman, Alejandro Larriera, who participated in the deliberations of the Working Group on Captive Breeding, provided a verbal update, highlighting the two major problems involved: the incorrect misuse of source codes; and, the deliberate misuse of source codes.

The report was noted.

7.3. Madagascar Crocodile Conservation and Sustainable Use Program

Grahame Webb introduced the item and gave a broad overview of the diversity and complexity of the issues in Madagascar. Charlie Manolis (CM) introduced a brief background to the Madagascar Crocodile Conservation and Sustainable Use Program (MSSCUP), which was established in late 2014 with financial support from Kering, to assist Madagascar to improve its management based on sustainable use and improvement of benefits to livelihoods.

MCCSUP was officially launched in October 2014, and a Crocodile Management Unit (CMU) was established within the Direction General des Forets (DGF) to act as the focal point for all crocodile issues. In April 2015 CM and Christine Lippai (CL) visited Madagascar to assist CMU/DGF to develop a workplan for 2015, using a novel Report Card Format, developed for this purpose.

A draft workplan has now been developed and is about to be finalized, which will enable the commencement of some key activities, including regulation of the artisanal crocodile leather industry, wild harvest, problem crocodile program, egg harvest, ranches, etc. The wild skin and egg harvests provide indices of the wild population, and together with population surveys should provide Government with a mechanism to monitor the impact of harvesting.

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It is clear that the current Appendix-II listing based on ranching is not appropriate for Madagascar, and it has long been suggested that Madagascar seek an unqualified Appendix-II listing, that would cover the wild skin harvest as well.

The CSG's Student Research Assistance Scheme is an avenue through which the MCCSUP can invest specifically to encourage Malagasy students to research crocodiles, and thus contribute to capacity building. This has generated a good deal of interest at the University.

Helen Crowley (HC) advised that Kering, a key supporter of the MCCSUP, wants companies associated with it to engage in sustainable sourcing of raw products, to improve traceability, sustainability and where possible, assistance to livelihoods. HC gave a brief outline of their cooperation and collaboration with the International Trade Centre and the IUCN-SSC Boa and Python Specialist Group, to achieve the same goals with python skins, which is meeting with considerable success. Hence their interest and support to achieve more robust management of the crocodile skin industry in Madagascar.

NOTE: The two key CSG Members involved with MCCSUP to date have been Christine Lippai and Charlie Manolis who will be conducting a further capacity building mission to Madagascar in June 2015.

7.4. Junior CSG Program

The report prepared by CSG member, Kelly Silvano, was elaborated by Mark Merchant, highlighting:

<u>Overall Management of the Program</u>
Kelly Silvano - Director of an NGO Collective ConSERVation (CC) has implemented a program in the USA, which is endorsed by the CSG and IACS, but managed completely by CC with assistance from some key people. Memberships, programs, events and financials discussed. Others involved include:

Shawn Heflick - Director at Crocodile Manor and Crocodile University. A major sponsor and assists with Junior CSG Program in many ways: coordinates sponsorships, develops working concepts, provides marketing strategies and promotional venues.

Jennifer Andringa - Animal Keeper at Disney Animal Kingdom. Responsible for the continuing education for members; manages the Twitter and Instagram feeds; corresponds with members, keeping them involved with activities.

Support from other CSG Members

Mark Merchant, CSG advisor and overall program guidance. Flavio Morrissiey, major sponsor of the Junior CSG Program and provides animals for use at events. Rob Carmichael, promotional and fundraising; speaker at TAG meetings on behalf of Junior CSG Program. Matt Shirley, provided updated range maps for the poster. Soham Mukherjee, provided numerous photos for the Junior CSG poster.

Activities

- Through social media we reach out to children, providing them with educational and entertaining information regarding alligators and crocodiles
- Attend events to bring awareness to children about crocodilians and how they can become members of a group of people dedicated to maintaining the species.
  - EcoAdventures with Mei Len and Brady Barr - Millersville, MD
  - Exotic Pet Amnesty Day - Kissimmee FL
  - 5K Run for Gharials - Clemont, FL
  - Canadian Reptile Breeders' Expo - Toronto, ON
  - North American Reptile Breeders' Conference - Tinley, IL
  - Croctoberfest - Wildlife Discovery Center - Lake Forrest, IL
- As memberships increase, so will the activity level. We have television personalities lined up to record interactive videos for the members and future members will be encouraged to:
- get involved with a species via a blog from a research project;
- take or draw pictures of their favorite species and send it to us; and,
- seek out information, articles, etc., regarding the conservation of a species.

Partnerships and Sponsors

- Mazuri, a division of Purina and is responsible for their exotic pet foods
- 4% of all sales of their crocodilian diets will be donated each quarter
- Promotional items such as water bottles, notepads, lunchbags, etc., are being shipped to us for giveaways at our events.
- Updates on the Junior CSG program will appear in their quarterly newsletter.

Sponsors who have committed to $US2500 or more:

- Shawn Heflick, Crocodile University
- Flavio Morrissiey, Gator Adventure Productions
- Grant Crossman, Canadian Reptile Breeders' Expo

The report and update were noted.

NOTE: The Chairman congratulated Kelly Silvano, Shawn Heflick, Jennifer Andringa and Mark Merchant for implementing this important new initiative. The ground roots experience being gained was invaluable for assessing options for expanding the concept as a global network. The Chairman later met and discussed future options and concepts with Shawn Heflick.

7.5. Future Leadership Working Group

A late paper provided by Matthew Shirley was added to the agenda so people had not had an opportunity to review the document.

Matthew Shirley addressed the meeting outlining the background to the establishment of a Future Leader's Task Force/Future Leadership Working Group. At this point in time Matthew and Marisa Tellez were the chief liaison officers for the group.

Grahame Webb reiterated the need for the CSG to begin selecting suitable younger members for development as future leaders in the CSG. He stated that the science side of things is not a problem, however, the important issue is the diversity of skills required for a wider range of complex issues associated with ground roots conservation, particularly bio-politics.

Action: Recommended that the paper provided by Matthew Shirley be submitted to the CSG Executive for consideration, discussion and decision.

NOTE: The Executive Members discussed the paper and in consultation with Matt Shirley and Sally Isberg from the Future Leaders Working Group decided that efforts should be made to give a more intensive leadership course to at least four members of the group selected by Matt Shirley, supported by donors or CSG core funds, and to maximize their representation at CITES CoP17.

8. 24th CSG Working Meeting - Kruger National Park, South Africa, 23-26 May 2016

Christine Lippai updated the meeting on progress with the next proposed CSG Working Meeting in South Africa (May 2016). Accommodation at the Skukuza Rest Camp has been block-booked for the event and a special code will be developed - most likely CSG2016SouthAfrica - that will have to be presented to the SANParks booking office to benefit from a special discounted accommodation rate for CSG delegates. The ME Tourism has waived the daily Conservation Fee, which could amount to quite a substantial amount for foreign visitors ($US25 per day).

The meeting website is about to be completed and will be up and running by the end of the month. The Logo has been designed and the theme will be "CROCODILES, COMMUNITIES & LIVELIHOODS".

A veterinary workshop will be organised for Saturday 21 May - details will be posted onto the website. The CSG Steering Committee meeting will be held on Sunday 22 May 2016.

The 4-day event will include the following themes, which will be refined over the next couple of months, but are in general: Trade; Husbandry; Veterinary & Research; and Conservation & Ecology.

Social events will be organised each evening; Welcome Banquet on Monday; Braai at a Boma in the Bush on Tuesday; Poster Cheese & Wine on Wednesday; and closing Banquet and Auction on Thursday.

Golf Tournament: Some people may recall that a golf tournament was held at the Victoria Falls meeting in 1992. Some CSG members have suggested that it might be good to host another golf tournament. A notification will be included onto the website to have an idea of the level of interest in organising such an event. A golf course is available at the Skukuza Rest Camp and golf equipment can be arranged.

The report was noted.

The meeting closed at 1200 h.

Tom Dacey, *CSG Executive Officer, <csg@wmi.com.au)*.

First East and Southeast Asia Regional Crocodile Specialist Group Meeting (Siem Reap, Cambodia, 26-29 May 2015)

The First East and Southeast Asia CSG Regional Meeting was held at the Angkor Paradise Hotel, Siem Reap, Cambodia, on 25-29 May 2015. The Siamese crocodile (*Crocodylus siamensis*) was the focus of the meeting, in light of the current status of the species in the wild.

It is a measure of the interest in *C. siamensis* conservation, management and use in the region that 201 participants from 27 countries attended the meeting (Argentina, Australia, Belgium, Cambodia, Canada, China, Colombia, Denmark, France, Germany, Holland, India, Indonesia, Ireland, Italy, Japan, Korea, Lao PDR, Malaysia, Philippines, Poland, Singapore, Spain, Thailand, United Kingdom, USA, Vietnam).

A Veterinary Workshop, conducted by the CSG Veterinary Science group, was held on 25 May, and attracted more than 100 participants. The workshop had a good mix of topics, well targeted to Cambodian crocodile farmers, including: farming history, realities and present challenges, strengths an limitations in Cambodia, egg collection, handling and incubation, biosecurity, hatchling nutrition and husbandry, common diseases, antibiotic resistance, necropsy of dead animals, etc. Such workshops are now becoming an integral part of CSG meetings.

Figure 1. The veterinary workshop was well attended. Photograph: Christine Lippai (top), Charlie Manolis (bottom).

On the second day, participants were welcomed by H.E. Mao Vuthy (Deputy Governor, Siem Reap Province), H.E. Eng Cheasan (Director General, Fisheries Administration), Prof. Grahame Webb (CSG Chairman), Mr. Dehoux Georges (Attache of EU delegation in Cambodia), prior to the meeting being officially opened by H.E. Ty Sokhun (Secretary of State, Ministry of Agriculture, Fisheries and Forestry). Participants were then welcomed by traditional cultural dancers.

Figure 2. Participants were welcomed by traditional dancers. Photograph: Christine Lippai.

Over the next 3 days a presentations on the Cambodian experiences, crocodile health, diseases and genetics, and

conservation, management and research, were delivered. Of particular interest were the results of recent reintroduction programs undertaken in Thailand (*C. siamensis* at Yod-Dom Wildlife Sanctuary) and Philippines (*C. mindorensis* in Paghungawan Marsh, Siargao Island), which led to general discussions on other proposed *C. siamensis* reintroduction programs for Cambodia and Thailand. It was also of interest to leran of the involvement of a farm in Peninsular Malaysia in a reintroduction program for *C. porosus*.

During the final plenary session considerable emphasis was placed on the needs of the Cambodian farmers to improve captive husbandry, and the desire to seek the transfer of the Cambodian population of *C. siamensis* to Appendix II of CITES.

No meeting is ever complete without the various social functions. Cambodia outshone in this department and everyone was made welcome and relaxed by the welcoming and closing dinners, cultural dancing, etc.

On the last day a field trip enabled participants to enjoy the Tonle Sap Great Lake and Crocodile Farm and visit the famous Angkor Wat temple.

Figure 3. Fisheries Administration staff did a wonderful job, contributing to the logistics of a successful meeting. Photograph: Charlie Manolis.

Figure 4. Participants at working meeting. Photograph: Christine Lippai.

Figure 5. Simone Comparini, member of the CSG Industry group. Photograph: Christine Lippai.

Figure 6. CSG Chairman Grahame Webb (right) in discussion with CSG Deputy Chairman Alejandro Larriera (middle) and Jesse Davison (left).

Figure 7. Participants visited farms during the veterinary workshop (top) and the field trip (bottom). Photograph: Charlie Manolis (top), Christine Lippai (bottom)

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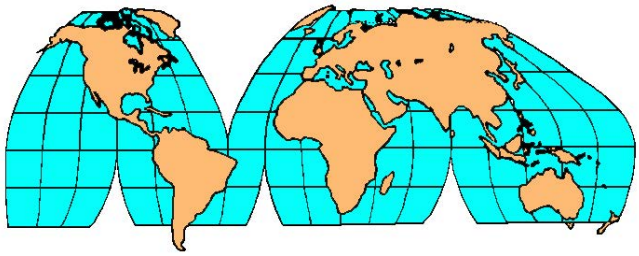
Regional Reports



Latin America and the Caribbean

Colombia

II SYMPOSIUM OF COLOMBIAN CROCODILIANS. On 2 December 2014, the II Symposium of Colombian Crocodilians was organized under the IV Colombian Congress of Zoology in Cartagena, Colombia. Twenty-seven papers and 21 posters were presented, addressing a diversity of issues, including conservation, ecology, genetics, management, commerce, law, population, ethno-zoology status and environmental education. The symposium was attended by around 100 participants from Argentina, Brazil, Colombia, Panama, Mexico, Spain and Venezuela, who shared their experiences and knowledge in research, conservation and sustainable use of wild populations of Central and South American crocodilians.

The symposium was organized by the Palmarito Foundation, represented by Rafael Antelo, and Sergio Medrano and Giovani Ulloa. Participants received a copy of "Biology and Conservation of Crocodylia in Colombia" delivered by staff of the Humboldt Institute (Colombia). Finally, the artist Nelson Barragán performed two songs typical of the Llanos region, where he claims against the threat to the Llanos ecosystems.

The most outstanding conclusions and recommendations were:

- The experiences of conservation and sustainable use of *Crocodylus intermedius* in Venezuela and *Caiman latirostis* in Argentina are successful and can serve as an example for Colombia.
- Different sectors related to the crocodilian skin production in Colombia have expressed their will to join a combined cycle, known as ranching, which is considered as an alternative for sustainable management of wild populations. Such systems generate specific and clear incentives for the involvement of local communities in the conservation of these species and their environment.
- The trade presentation reflected the importance of Colombian production in the world market, which underlines the need for progress on programs that generate more economic benefits to local communities and conservation.
- It is urgent to start the reintroduction of captive specimens of *C. intermedius* in the natural environment. Genetic results indicate that captive populations constitute a single management unit and therefore any captive healthy crocodile is a candidate to be reintroduced. While it is interesting to conduct genetic studies of wild populations, the absence of this should not be an obstacle in the process of reintroduction. These reintroductions should be accompanied by monitoring processes that establish the success of reintroduction. The Venezuelan case is a good example of restoration of populations by reintroducing captive-bred crocodiles.
- To harmonize all these processes of sustainable use, it is important that the environmental authorities of Colombia support local initiatives to make changes to the CITES legislation and local laws.
- It is necessary to take actions that allow us to fill the information gaps on the status of wild populations and biology of the 6 species of Colombian crocodilians.
- It is recommended to create a database to compile the research information carried out in the country, to facilitate the development of management policies of Colombian crocodilians.

Rafael Antelo *(Scientific Director, Palmarito Foundation, Colombia)* and Álvaro Velasco *(Director, Fauna Silvestre, Venezuela)*.

FIRST ORINOCO CROCODILE REINTRODUCTION IN COLOMBIA. On 26 May 2015 the first reintroduction of the critically endangered Orinoco crocodile (*Crocodylus intermedius*) in Colombia took place. Twenty-one crocodiles were released in the Caiman Lagoon (5º26'00.44"N, 68º42'23.77"W), adjacent to the Tomo River and within the Tuparro National Natural Park (Vichada Department). This initiative was led by National Natural Parks of Colombia (NNPC) and the Palmarito Foundation, and financed by Ecopetrol, Wildlife Conservation Society (WCS), GHL Group and Conconcreto, and supported by the Government of Casanare, Corporinoquia, The Alexander von Humboldt Biological Resources Research Institute and the Natural Heritage Fund.

The National Program for the Conservation of the Orinoco Crocodile, in force since 1998, includes among others the following activities:

a) Identification of potential habitat for the reintroduction;
b) Define a reintroduction protocol; and,
c) Monitoring of reintroduced populations.

In November 2014 NNPC and the Palmarito Foundation prepared the Orinoco crocodile reintroduction protocol for Colombian National Parks, which provides pre- and post-reintroduction activities, the characteristics of the crocodiles to be released, the socio-environmental characteristics of the site of reintroduction and the monitoring plan.

The Caiman Lagoon was chosen during a field visit in January 2015 on the basis of the following characteristics:

a. It is within the historical distribution area of the Orinoco crocodile;
b. It is within a protected area of 548,000 ha;
c. On the other bank of the Tomo River is an Air Force base of 61,000 ha, which protects the area from illegal activities and supports the conservation program;
d. It presents the environmental characteristics necessary for the survival of crocodiles (food, refuge, sand beaches and gallery forest);
e. The presence of bioindicator species of the good health of the ecosystem: jaguar (*Panthera onca*), tapir (*Tapirus terrestris*), giant river otter (*Pteronura brasiliensis*) and curassow (*Mitu tomentosum*);
f. There are no human communities nearby and no commercial fishing activity;
g. The only economic activity in the river is sport fishing, practiced during the dry season (December-early April);
h. 96% of the people interviewed (sport fishing guides and landowners located 50 km from the lagoon) support the reintroduction program in the area. They think that the return of crocodiles favours sport fishing and can be a tourist attraction; and,
i. Indigenous communities living on the border between Colombia and Venezuela do not use this part of the territory to hunt or fish.

Night (223 km) and day (around 1000 km) surveys were carried out to look for wild crocodiles, but we did not find any crocodiles or tracks on the banks, or evidence of nests. Although local people claim that there are still crocodiles in the Tomo River, our research suggests that or they are extinct or are just isolated individuals.

The released Orinoco crocodiles were hatched and bred at Wisirare Park (Orocué, Casanare Departament). Adult males and females were first bred at the Roberto Franco Tropical Biological Station, but transferred to Wisirare in 2002. Palmarito Foundation has been in charge of Wisirare since December 2011. Twenty of the crocodiles were 3 years of age, mean total length of 94.2 cm and mean weight of 2.53 kg. One crocodile of unknown age (probably 5 years) was 173 cm long and weighed 17.7 kg. Sex ratio was 1:2 (7 males, 14 females). All crocodiles were marked by scute-clipping and had a microchip inserted into the tail. Twelve of them were equipped with a VHF transmitter, so that they can be radio-tracking every month. Prior to the reintroduction, the health of the crocodiles was evaluated by a WCS veterinarian and tissue samples were given to National University of Colombia.

Figure 1. Orinoco crocodile being released with radio-transmitter attached.

This is a great new for the Orinoco crocodile conservation in Colombia. If these crocodiles are able to survive, the plan is to continue year after year with reintroductions to establish a new wild population.

Rafael Antelo, *Scientific Director, Palmarito Foundation, <megapicu@hotmail.com>*.

Brazil

THEORETICAL AND PRACTICAL SYMPOSIUM: "TOOLS FOR WILDLIFE CONSERVATION". On 21-24 November 2014 a practical-theoretical course was held by the Laboratório de Estudos Herpetológicos e Paleoherpetológicos (LEHP), at the Universidade Federal Rural de Pernambuco (UFPRE), in Recife, Pernambuco, Brazil. Entitled "Tools for Wildlife Conservation (Ferramentas para conservação da vida silvestre)", the course was divided into 3 days of fieldwork at the Tapacurá Ecology Station (UFPRE-PROCAMPI) and one day of lectures in the auditorium of the Biology Department of the University of Pernambuco. Invited professors, Dr. Luis Bassetti (Brazil), Dr. Mark Merchant (USA) and Dr. Pablo Siroski (Argentina), were responsible for the fieldwork, delivery of the classroom lectures, and participated in a series of meetings to share ideas and experiences with Brazilian students. The course was aimed at undergraduates, graduates and professionals from different areas, and was attended by approximately 100 people.

The lectures were oriented at different theoretical aspects of crocodilian ecology, and were designed to introduce the following topics: Crocodile Specialist Group; international regulations; management programs and experiences in

various countries; involvement of local communities in work with crocodilians; general physiology; advantages and disadvantages of laboratory complemented with field work and vice versa; and, biochemistry in the conservation of wild animals. After each lecture, many interesting and important exchanges were generated among speakers and students pertaining to each topic. In order to complement the theoretical part, a series of activities that involved local professors, students and invited speakers were conducted.

Tapacurá Ecological Station was created in 1975, has a total area of 776 ha, was previously occupied by a sugar plantation, and where the São Bento Agricultural College operated for 19 years. The college was moved to another location and thus gave rise to UFRPE, in the municipality of São Lourenço da Mata. The aim of the station is to provide an area to conduct different types of research in the fields of botany, zoology and ecology. Research at the station is focused on developing habitats for the conservation of forest resources and fauna in the Brazilian Atlantic Forest. The site also includes a river basin formed by the Tapacurá River. The university uses this ecosystem to teach environmental education and as a research base for conducting studies in areas such as the spontaneous recuperation of soils, re-use of soils that have been fallow for lengthy periods, and reintroduction of plant and animal species now extinct in the region.

Night-time activities included the monitoring of wild populations of Broad-snouted caiman (*Caiman latirostris*), and evaluation and interpretation of previous surveys to determine which indicators were considered relevant or significant. In addition, many caimans were captured. Also, in the monitoring area but prior to the meeting, two *Paleosuchus palpebrosus* were caught. Both teachers and students were doing studies in the same areas and collecting interesting data, which will be very useful as a starting point for discussion of different work methodologies.

Some of the most important points emphasized in the fieldwork included crocodilian capture techniques, how to determine stomach contents, sampling and preservation of different tissues for a variety of purposes, different ways to mark individual animals, general and specific morphometric measurements and their utility, among others. In addition, some of the instructors communicated how these data could be used to identify animals in the future, track movements of individual animals, analyze spatial distribution, feeding, habitat preferences, nesting habitat, etc.

At the end of the course, many people were interested in CSG issues and offered to collaborate with the group, contributing data about *C. latirostris* and *P. palpebrosus* in northeastern Brazil. Some students showed interest CSG SRAS grants.

At the end of this 4-day course, we concluded that is an interesting place to develop studies relating to more studies concerning many areas of crocodilian ecology. We were encouraged by the enthusiasm of the students and faculty to discover and learn more about the interesting world of crocodilians.

Luis Bassetti, *<luisbassetti@terra.com.br>*.

Venezuela

V COURSE OF ECOLOGY AND CONSERVATION OF VENEZUELAN CROCODILES. The V Course of Ecology and Conservation of Venezuelan Crocodiles, hosted by the Venezuelan Crocodile Specialist Group (GECV), with support from Dallas World Aquarium, Krocodille Zoo, Unelllez, Fudeci and Posada La Fe, was held on 4-6 March 2015 at Masaguaral Ranch (Guarico State, Venezuela). Twenty students from 8 Venezuelan universities attended, together with two veterinary professionals, one a university professor and the other working with wildlife.

Theoretical topics presented during the course were: a) introduction to crocodilian order; b) status of *Crocodylus intermedius* and conservation plan; c) status of *C. acutus* and conservation plan; d) techniques for surveys and population estimations; e) captive breeding and ranching programs with *C. intermedius*; f) factors may affect the crocodile rising in captivity; g) sanitary aspects in eggs, hatchlings and adults crocodiles in captivity; h) threats on crocodiles; i) Dallas World Aquarium program; j) human-crocodile conflict; k) *Caiman crocodilus* commercial program in Venezuela; l) remote sensing in crocodile studies; m) crocodiles habitat indicators; n) international skin trade; and, o) ecotourism, food, farms and national parks related with crocodiles.

In the field, all participants participated in: night counts and size class estimations; habitat description; caiman capture and body measures; weight and sex; analysis of stomach contents; egg collecting; and, managing juveniles in the farm.

The main goal of this course was to introduce participants to studies on crocodiles and generate the interest to work with order in their university dissertations. Three possible dissertations were generated after the course, one with *C. acutus* in Turiamo Bay (Aragua State), and two involving medical and parasites in captive breeding program with *C. intermedius*.

Alvaro Velasco B., *Chairman, Venezuelan Crocodile Specialist Group*.

Mexico

RECENT REPORTS OF FATAL ATTACKS ON HUMANS BY CROCODILES IN MEXICO. The New World has four species of crocodilian which on rare occasions are responsible for fatal attacks on humans; American crocodile (*Crocodylus acutus*), Morelet's crocodile (*C. moreletii*), Black caiman (*Melanosuchus niger*) and American alligator (*Alligator mississippiensis*), although even the smaller caiman species can be potentially dangerous to small children. Mexico has the highest frequency of reported crocodilian attacks in the New World (although still significantly lower than most Old World countries where crocodilians are endemic).

Thus far in 2015 there have been two fatal crocodile attacks reported within Mexico, relatively high for the country (CrocBITE 2015). *Crocodylus acutus* and *C. moreletii* were responsible for one fatal attack each, in Quintana Roo and Tabasco States, along the Caribbean/Gulf Coast. A third fatal attack was also reported from the Santa Ana Estuary in Lazaro Cardenas, Michoacan State, but the veracity of this attack has been called into question and so it is not included here.

Fatal attacks by *C. acutus* are rare but have been well documented, particularly within Costa Rica (Bolanos-Montero 2011) and Mexico (Cupul-Magana *et al*. 2010), and incidents in recent years have shown that *C. moreletii* on rare occasions is also responsible for human deaths (Sideleau and Chenot-Rose 2014). Information derived from the CrocBITE database indicates an average of 2.9 fatal attacks per year for *C. acutus* (19% fatality rate) and an average of 0.57 fatal attacks per year for *C. moreletii* (11.8% fatality rate) for the period 2007-2014, throughout the range of both species.

In Mexico there have been, including incidents in 2015, 7 reports of fatal *C. acutus* attacks (2 Jalisco State, 2 Oaxaca State, 1 Michoacan State, 1 Chiapas State, 1 Quintana Roo State) and 4 reports of fatal *C. moreletii* attacks since 2007 (3 Tamaulipas State, 1 Tabasco State). Only the most recent fatal *C. acutus* occurred along the Caribbean coast, the remainder occurred along the Pacific Coast. Here, details on the two most recently reported fatal attacks in Mexico are presented.

Incident #1

On the evening of 11 April 2015 a 31-year-old male was reportedly attacked and drowned by what was likely an American crocodile, while swimming in Bojorquez Lagoon (which is a portion of Nichupte Lagoon) (21°07'32.8"N, 86°45'31.6"W) at km8.5 along Avenida Kukulcan in the main hotel zone of Cancun in Quintana Roo State. A friend who witnessed the attack apparently contacted the authorities at 1845 h and the victim's body was recovered the following morning at around 0630 h, approximately 100 m from the Clipper Club Hotel (CrocBITE 2015). While the location of the attack is more suggestive of *C. acutus*, *C. moreletii* is also present in Cancun and evidence suggests that there is significant hybridization between the two species within the Yucatan Peninsula (Cedeno-Vazquez *et al*. 2008).

Incident #2

On 16 April 2015 a 48-year-old male was reportedly attacked and killed by a Morelet's crocodile while spear-fishing alongside another man within a stream in Balancan (17°48'18.8"N, 91°32'12.1"W) of Tabasco State, at approximately 1400 h. His body was later recovered. The victim had his previously caught fish with him at the time of the attack and it is believed that the blood from the fish may have attracted the crocodile. The crocodile responsible is claimed to have been 5 m in length (CrocBITE 2015), which is almost certainly an exaggeration, as *C. moreletii* is known to reach a maximum size of 4.5 m (Platt *et al*. 2010).

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Belize

AMERICAN CROCODILE, *CROCODYLUS ACUTUS*, POPULATION, NESTING, HATCHLING AND HABITAT ASSESSMENT UPDATE IN NORTHERN AND SANDBORE CAYES, LIGHTHOUSE ATOLL, BELIZE. In January 2013 and July 2014, the American Crocodile Education Sanctuary (ACES) conducted systematic spotlight surveys and daytime nest site reconnaissance for the American crocodile (*Crocodylus acutus*) in Northern and Sandbore Cayes, Lighthouse Atoll, Belize.

On the evening of 21 January 2013, four adult *C. acutus* were encountered along a 11.2 km survey route (encounter rate= 0.4 crocodiles/km). No hatchling, yearling or juvenile crocodiles were spotted. On 22 January 2013, daytime reconnaissance did not yield any signs of crocodile activity and no nesting sites were found. Prior to the onset of the spotlight survey one sub-adult was sighted. Only two adult crocodiles were encountered during this 2.5 km survey route (0.8 crocodiles/km). However, due to the crocodiles' sizes and proximity, it is highly probable that these two animals were counted on the previous night (Chenot-Rose 2013).

Considering inclement weather conditions during the 2013 census, and the inherent margin of error in 'spotlight surveys' due to possible missed crocodiles hiding in mangrove vegetation and inaccessible interior lagoons (Bayliss 1987), the researchers conducted this second reconnaissance during the hatching season in July 2014. Hatching season for the American crocodile in nearby Turneffe Atoll is from late June to mid-July, following the onset of Belize's annual wet season (Platt and Thorbjarnarson 1997, 2000b; Platt *et al*. 2004). The 2014 censuses of Northern and Sanbore Cayes in Lighthouse Atoll include a habitat viability assessment based on salinity sampling and depth soundings in Northern Caye.

Occurring in the Caribbean, the northeastern parts of South American, both coastal zones of Central America and Mexico, and reaching as far north as the southern tip of Florida, USA (Thorbjarnarson 1989; Platt and Thorbjarnarson 2000a; Thorbjarnarson *et al*. 2006; Mazzotti *et al*. 2007) *C. acutus* [also known as *C. florindanus* and *C. americanus*, as a synonym of *Lacerta crocodylus* (Cuvier 1807)]. Considered to be "Vulnerable" by the International Union for Conservation of Nature (IUCN), *C. acutus* is primarily a coastal crocodilian (Thorbjarnarson 1992; Ross 1998; Mazzotti 2007; Brien *et al*. 2008). However, in Belize *C. acutus* is most prevalent in offshore cayes and atolls (Platt and Thorbjarnarson 2000a, 2000b; Platt and Rainwater 2005). Recognized as a "threatened species" *C. acutus* is fully protected under the Belize Wildlife Protection Act (Chapter 220) by the Belize Forest Department, Ministry of Forestry, Fisheries and Sustainable Development (McField *et al*. 1996; Platt and Thorbjarnarson 2000a; Chenot-Rose 2013). Considering that Turneffe Atoll reportedly has the largest congregation of *C. acutus* and the most active nesting grounds in the country (Platt and Thorbjarnarson 2000a; Platt *et al*. 2004), and the fact that in 2009 Rainwater and Platt recorded reduced numbers and reduced nesting activity, the investigation of the status of *C. acutus* populations in nearby cayes, such as Northern and Sandbar Cayes, Lighthouse Atoll [previously described by Stoddart (1962), Platt *et al*. (1999) and Chenot-Rose (2013)], should be highly regarded.

This 3-night/2-day field research commenced 17 July and finished on 20 July 2014. A team of two crocodilian researchers led by Vincent Rose, Founder of ACES, conducted spotlight surveys (Bayliss 1987) utilizing the same techniques as the previous year and described by Chenot-Rose (2013). The entire perimeter and all major interior lagoons of Northern Caye were explored, including several barely accessible interior swamp areas that were not previously investigated. Additionally, the perimeter of Sandbore Caye and the traversing waters between the two cayes were also surveyed by spotlight.

Encountered crocodiles were approached for total length (TL) estimation and categorized as: hatchlings (<30 cm); yearlings (30-70 cm); juveniles (70-90 cm); sub-adults (90-180 cm); adults (>180 cm); or "eyes only" (EO). This expedition also included nocturnal nest observations and extensive daytime nest site surveys. Nest sites were determined by the presences of crocodile/s, crocodile trails/tracks, highly disturbed areas, and/or the presence of eggs/eggshells. To determine the viability of available hatchling habitat(s), salinity samples were documented for predetermined locations in Northern Caye via a Grainger handheld salinity/specific gravity refractometer; and, salt concentrations in water samples were recored in parts per thousand (ppt). Finally, the depth of Northern Caye's two largest interior lagoons was recorded using a weighted string that was marked and measured.

17 July: A spotlight survey and nest site investigation were conducted around the entire perimeter of Northern Caye using a 7.92 m motorized skiff powered by a 60hp Yamaha outboard motor (average speed= 5 km/h).

18 July: Northern Caye's beaches were walked (average speed= 0.6 km/h) for an extensive nest survey. Particular attention was paid to the area where hatchlings were spotted the previous evening. One eggshell was found in the immediate vicinity of the previously sighted hatchlings, indicating a single successful nesting area. The afternoon was spent clearing access areas into the two major interior lagoons via machete. With the onset of sunset, the next spotlight and plausible nest site surveys of Northern Caye's two

major interior lagoons were completed via two-man kayak (average speed= 3 km/h). Additionally, a small, southern, interior lagoon was accessed after being cleared by machete and surveyed via foot. No feasible nest site locations were observed.

19 July: An extensive nest survey was conducted along the coastline via foot and while clearing Northern Caye's minor interior swamp areas. GPS data are not available for this survey due to the strenuous clearing; however, the area covered is the same as documented in the tracks from the evening spotlight surveys. There were no signs of any nesting activity in the interior of Northern Caye. The final evening's expedition began with a spotlight survey of Sandbore Caye's perimeter via motorized skiff and concluded in Northern Caye's minor northern interior swamp areas via foot. All survey routes are shown on Figure 1.

Figure 1. Survey routes, salinity and water depth.

This 2014 census yielded 20 non-hatchling crocodile sightings along a 30.3 km survey route (0.7 NH/km). In the course of this 3-night spotlight reconnaissance, all 20 non-hatchlings were encountered in Northern Caye - none were spotted around Sandbore Caye. One of the two adult crocodiles spotted on 17 July in the proximity of the hatchlings and nesting area was most likely the same adult crocodile spotted on 19 July in the minor interior northern lagoon with the 16 hatchlings. Similarly, due to the modest size of the island; the proximity of crocodile sightings, and the ability of the crocodiles to easily move into and out of the interior lagoon/swamp areas, one should consider the possibility that EO crocodiles spotted on 17 July along the coastline could very well be the same crocodiles spotted on 19 July in the nearby interior swamps. Only by capturing and tagging the crocodiles could one know for sure the exact number of animals present.

All 19 hatchlings were in close enough proximity to have hatched from the same nest. Given that only one eggshell located during daylight reconnaissance was in the same area (17°27'19.61"N, 87°30'12.19"W) as the hatchlings (16 at 17°27'17.52"N, 87°30'11.46"W; 2 at 17°27'20.05"N, 87°30'10.24"W; 1 at 17°27'21.36"N, 87°30'10.58"W), it is likley that there was only one successful nest in Northern Caye in 2014. Four of the hatchlings were captured for assessment - all were underweight and considered to be dehydrated (Fig. 2), conceivably due to the high salinity levels in the lagoons . All four hatchlings were transported to the ACES in Ambergris Caye where they were rehabilitated, tagged and later released.


Figure 2. Underweight and dehydrated hatchlings (see text).


Figure 3. All minor interior lagoon/swamp areas were approximately 0.14 m deep.

Despite the onset of Belize's rainy season, which begins in early June (Johnson 1983; Platt 1996), salinity in Northern Caye ranged from 37 ppt in coastal areas to 48 ppt in the smaller interior lagoons and swamp areas. While adult and sub-adult *C. acutus* are not affected by salinity, juvenile, yearling and especially hatchling survival rates are negatively affected by salinities above 20 ppt, with levels above 40 ppt having the maximum negative influence (Schubert *et al.* 1996; Mazzotti 2007). Salinity levels at the location of the hatchlings sighted, which where in close proximity to the identified nest site, ranged from 37 ppt seaside to 40 ppt in the interior swamp area where the majority of the hatchlings were observed. Such high salinity renders nursery habitats unsuitable and causes osmotic stress in hatchlings, thus reducing survival rates (Platt and Thorbjarnarson 2000a). Additionally affecting hatchling and juvenile survival rates, the estimated average depth of all minor interior lagoon/swamp areas was approximately 0.14 m (Fig. 3), resulting in relatively high water temperatures and potentially limiting resident prey fish and other species. The major eastern

interior lagoon was recorded as having a maximum depth of 2.44 m, and the smaller western lagoon was 2.13 m at its deepest point.

In conclusion, despite inadequate nesting habitats, limited food sources, hypersaline nursery lagoons/swamps and the lack of a freshwater source [the "man-made freshwater pond" referred to by Platt *et al*. (1999) was completely dry in July 2014], the increase in the number of non-hatchling *C. acutus* sighted during this survey relative to previous years supports the theory that non-hatchling *C. acutus* in Lighthouse Atoll are transient individuals most likely from nearby Turneffe Atoll (Platt *et al*. 1999; Platt and Thorbjarnarson 2000a; Chenot Rose 2013). Furthermore, the extremely low number of sub-adults, juveniles and hatchlings lends validity to this researcher's belief that Northern and Sandbore Cayes' nursery habitats are not sufficient to support a viable self-sustaining population of the American crocodile.

It is recommended that a 2015 assessment of both cayes include: all spotlight surveys to be completed in one evening if possible to limit the possibility of duplicate counts; encountered crocodiles to be captured, marked and released at point of capture for future identification; resampling of salinity at the same sites as in 2014; and, to additionally record water temperatures which could be affecting hatchling survival rates. Finally, due to the inherent variability of spotlight surveys (Bayliss 1987; Platt *et al*. 2004) attaching GPS tracking devices to adult *C. acutus* could reveal important migration information about species in Belize's atolls and cayes.

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East and Southeast Asia

Cambodia

TRIAL RELEASE OF SIAMESE CROCODILES IN TONLE SAP BIOSPHERE RESERVE, CAMBODIA. The Siamese crocodile (*Crocodylus siamensis*) is considered one of the most critically endangered crocodilians in the world (Simpson and Bezuijen 2010). During the past 50 years, wild *C. siamensis* populations throughout Southeast Asia have been decimated by illegal hunting for skins and meat, wanton killing, government-sponsored extermination programs, habitat loss, and over-collecting to stock commercial crocodile farms (Platt and Tri 2000; Stuart and Platt 2000; Simpson and Bezuijen 2010; Kanwatanakid-Savini *et al*. 2012; Bezuijen *et al*. 2013; Guérin 2013). Furthermore, although hundreds of thousands of *C. siamensis* are now held on commercial crocodile farms in Southeast Asia, the genetic integrity of this burgeoning captive population has been compromised by widespread hybridization with estuarine (*C. porosus*) and Cuban crocodiles (*C. rhombifer*) (Suvanakorn and Youngprapakorn 1987; Thorbjarnarson 2001; FitzSimmons *et al*. 2002; Starr *et al*. 2009).

In Cambodia, *C. siamensis* populations are severely depleted and highly fragmented; most consist of 1-2 individuals and <150 adults are thought to survive in the wild (Simpson and Bezuijen 2010). Moreover, most of these remnant populations are threatened by continued illegal harvesting for crocodile farms, incidental drowning in fishing gear, and on-going loss of critical wetland habitat (Platt *et al*. 2002, 2004; Simpson and Bezuijen 2010). The latter is a particularly acute concern as planned and proposed hydropower developments are likely to inundate many sites now inhabited by Siamese crocodiles (Simpson and Bezuijen 2010). Given the magnitude of these threats, Simpson and Bezuijen (2010) predict that 50% of the known breeding populations of *C. siamensis* in Cambodia are likely to be extinct by 2020.

The long-term recovery of *C. siamensis* in Cambodia hinges on a combination of: effectively protecting existing populations; and, successful repatriation programs (Platt *et al*. 2004; Daltry and Starr 2010). Repatriation as defined by Dodd and Seigel (1991) includes both reintroduction (restoring a population to native habitat where it is now extinct) and population augmentation (releasing animals to bolster an existing small and usually non-viable population; sometimes referred to as "reinforcement"). Siamese crocodiles are an excellent candidate species for repatriation because wild populations are greatly depleted, a pool of captive animals is available for release, captive-reared crocodiles adapt quickly to life in the wild after liberation (Elsey *et al*. 1992, 2000), and for various reasons, repatriations of reptiles generally have a far higher likelihood of success than those of birds and mammals (Germano and Bishop 2008). Indeed, Siamese crocodiles have already been repatriated into protected natural habitats in Vietnam, Thailand, Lao PDR and Cambodia, albeit with varying levels of success (Polet 2004; Temsiripong 2007; Daltry and Starr 2010; Platt *et al*. 2014).

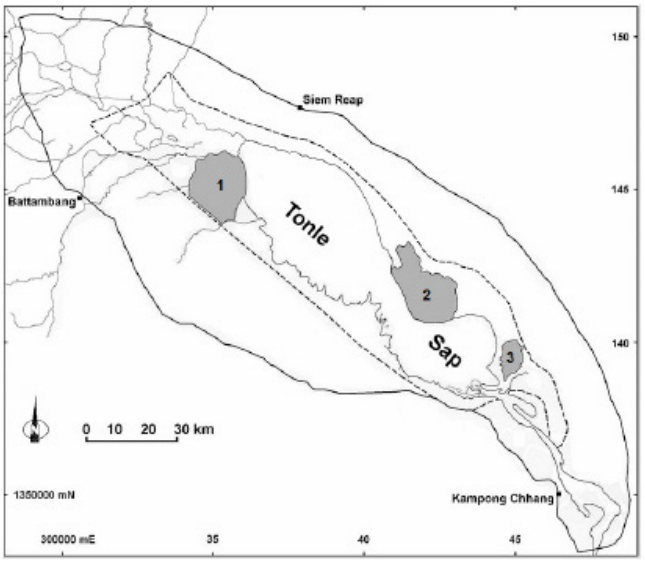

Figure 1. Tonle Sap Biosphere Reserve, Cambodia. Solid line denotes boundary of Transition Zone, and Buffer Zone is encompassed by dashed line. Core Areas are shaded and numbered (1. Prek Toal; 2. Moat Khla - Boeng Chhmar; 3. Stoeng Sen).

Tonle Sap, located in the central plain of Cambodia, is the largest permanent freshwater lake in Southeast Asia (Scott 1989). In 1997 the lake and surrounding wetlands was designated as the Tonle Sap Biosphere Reserve (TSBR) by

UNESCO's Man and the Biosphere Program (Campbell *et al*. 2006). TSBR (Fig. 1) consists of three strictly protected core areas (Prek Toal, Moat Khla - Boeng Chhmar, and Stoeng Sen) totaling 70,837 ha, surrounded by buffer and transition zones of 510,768 and 899,652 ha, respectively, where sustainable resource use is permitted (Campbell *et al*. 2006).

Historic sources suggest *C. siamensis* was once common throughout the Tonle Sap ecosystem (eg Campbell 1860; Kimura 1969). However, surveys conducted in the early 2000s found that only small populations of questionable viability remained in TSBR, and these were largely confined to the three core areas (Platt *et al*. 2004). The near-extirpation of *C. siamensis* from TSBR was primarily the result of years of chronic over-harvesting to stock a flourishing cottage industry of small crocodile farms at floating villages (Fig. 2) on the lake and in the surrounding region (Platt *et al*. 2004). Platt *et al*. (2004) concluded that repatriation of *C. siamensis* into core areas of TSBR was a viable management option provided adequate levels of protection could be achieved.

Figure 2. Crocodile pen at a floating village on Tonle Sap (top). Large numbers of Siamese crocodiles and hybrid crocodiles are held in these pens (bottom) and occasional escapes may have introduced hybrids into the Tonle Sap ecosystem. Photographs: Steven G. Platt.

Recognizing the importance of restoring apex predators to the Tonle Sap ecosystem, the Wildlife Conservation Society Cambodia Program, in collaboration with the Cambodian Ministry of Environment and Fisheries Administration conducted a trial release of Siamese crocodiles into the Prek Toal Core Area (PTCA) of TSBR during 2013. Our objectives were to: 1) determine if repatriated crocodiles would establish territories and remain within the core area; 2) determine home range and habitat use of repatriated crocodiles, and based on these results; 3) assess the feasibility of conducting a larger repatriation with the ultimate goal of restoring a viable population of Siamese crocodiles to TSBR.

PTCA was deemed a suitable repatriation site for several reasons. First, small numbers of *C. siamensis* are thought to survive in PTCA (Platt *et al*. 2004) and releasing crocodiles into this area could potentially spur the recovery of an existing population. Second, PTCA hosts some of the largest breeding colonies of wading birds (storks, ibises, and cormorants) in Southeast Asia (Campbell *et al*. 2006), and as such receives a great deal of law enforcement attention throughout the year making it unlikely that released crocodiles will be poached. Third, the large wading birds colonies in PTCA offer an abundance of food resources to crocodiles in the form of eggs and nestlings that fall from the nest, and regurgitate (eg fish and crustaceans) spilled by parent birds into the water while provisioning offspring (Burtner 2011).

A group of 11 Siamese crocodiles confiscated by Fisheries Department personnel from fishermen in Prek Toal Village (2007-2012) were selected as potential candidates for repatriation. This group originated from TSBR and consisted of a large adult male (TL c. 280 cm) captured in 2010 after becoming entangled in a fishing net, and 10 smaller crocodiles (TL c. 100-130 cm) reportedly collected as hatchlings from a single nest in 2006. To insure that only genetically-pure *C. siamensis* were released into the wild, blood and skin samples were collected from each crocodile and sent to Kasetsart University (Thailand) for analysis. Test results indicated that 7 of the 11 (63.6%) crocodiles (large male and 6 smaller crocodiles) were *C. siamensis* × *C. porosus* hybrids and therefore unsuitable for repatriation.

We speculate the adult male was probably an escapee from one of the many floating crocodile farms on the lake rather than a truly wild crocodile, but the occurrence of both hybrid and genetically pure hatchling crocodiles purportedly captured together at one nest is more problematic. In our opinion, the most probable explanation is that prior to being implanted with microchips (see below), some of the wild hatchlings were inadvertently mixed with hybrid hatchlings from a farm. However, we cannot rule out the possibility that these hatchlings are the result of a wild, genetically-pure female *C. siamensis* mating with both genetically-pure and hybrid male crocodiles. Multiple paternity appears commonplace among crocodilians (McVay *et al*. 2008; Lance *et al*. 2009; Lewis *et al*. 2013), and although not yet reported for *C. siamensis*, almost certainly occurs in this species as well. Furthermore, because *C. porosus* historically occurred in Tonle Sap (Platt *et al*. 2006) hybrids could also be the product of natural crossings between the two species. Hybridization would

have been even more likely when over-harvesting reduced populations of both *C. siamensis* and *C. porosus* to critically low levels and mate choice became limited to a small pool of surviving individuals. While rare, apparently natural hybrid swarms have been reported among other species of crocodilians, although the mechanisms driving hybridization remain poorly understood (Hekkala 2004; Machkour-M'Rabet *et al*. 2009).

The four crocodiles identified as genetically-pure *C. siamensis* were screened for infectious diseases by a veterinarian, and two were outfitted with VHF radio transmitters (Holohil® AI-2F) for monitoring post-release dispersal and habitat use. Transmitters were mounted on the dorsal surface of the tail between the double caudal scutes. AVID® microchips were implanted in each crocodile to insure future identification. In early March 2013, the four crocodiles were transferred to a pre-release holding pen in Prek Spot Stream near the geographic center of PTCA. The holding pen was constructed of bamboo fencing, measured 6 × 8 m, and encompassed dry land suitable for basking and deeper water (approximate depth = 130 cm) where crocodiles could submerge.

Originally we planned to conduct a "soft release" by confining crocodiles in the holding pen until it was overtopped by wet season floodwaters in late June or July, allowing the animals to self-release (eg Platt *et al*. 2014). Confinement is assumed to habituate animals to the repatriation area and dampen post-release dispersal, making it more likely that stable territories will later be established (Knox and Monk 2013). However, in mid-March one of the radio-tagged crocodiles suddenly died and it was decided to release the three surviving crocodiles several days later. Although we were unable to determine the why the crocodile died, this mortality coincided with unseasonably high air and water temperatures and an extensive fishkill in Tonle Sap. Crocodile farmers in Prek Toal also reported the death of large numbers of captive animals during the same period.

Figure 3. Shrub swamp near the site where three Siamese crocodiles were repatriated in Prek Toal Core Area of Tonle Sap Biosphere Reserve. Lack of boat access during the dry season hampered our attempts to conduct post-release monitoring in this complex wetland habitat. Photograph: Simon Mahood.

The release of the three remaining crocodiles occurred in late March when water levels in Tonle Sap were approaching the annual minimum, restricting boat travel and precluding access to many areas of flooded habitat (Fig. 3). Low water levels seriously hampered post-release monitoring efforts and our numerous attempts to relocate the telemetered crocodile proved unsuccessful. However, conservation personnel observed the telemetered animal and at least one other crocodile in a deep pool near the wading bird colonies on multiple occasions during the 2013 dry season. Although the ultimate fate of the three released crocodiles is unknown, the high level of protection afforded to the repatriation area makes their continued survival likely.

In conclusion, our trial release was only partially successful and highlights the difficulties of monitoring repatriated crocodiles in the complex flooded habitats of TSBR, especially during the dry season when low water levels severely curtail boat access. Because determining dispersal patterns and survival rates of released animals is essential for evaluating the success of any repatriation project (Dodd and Seigel 1991), we recommend that future efforts employ GPS-based satellite transmitters (Campbell *et al*. 2013) or passive acoustic telemetry (Rosenblatt and Heithaus 2011) rather than VHF telemetry for monitoring of repatriated crocodiles. Furthermore, given the dearth of peer-reviewed reports regarding the relative merits of soft versus hard release in the repatriation of crocodiles, we recommend that future efforts be designed to test whether confinement for a pre-determined period will dampen dispersal and foster the establishment of stable territories among released crocodiles. Difficulties aside, repatriation appears to be a feasible strategy for restoring Siamese crocodiles to TSBR, and although much obviously remains to be learned, larger-scale experimental efforts appear warranted.

On a final note, our preliminary finding with regards to hybridization has several important implications for the future restoration of *C. siamensis* to TSBR. First, because the founder stock originated locally, it has long been assumed the large captive population on floating farms in the lake was a reservoir of genetically-pure *C. siamensis* that could be drawn upon for repatriation (Platt *et al*. 2004, 2011). Our recent findings challenge this assumption, and the seemingly high prevalence of hybrids among this population makes it imperative that every crocodile selected for repatriation be tested to insure it is indeed a genetically-pure *C. siamensis*. Second, the surviving wild population of *C. siamensis* in PTCA (Platt *et al*. 2004) may already be genetically compromised through the occasional introduction of hybrid crocodiles escaping from floating farms. If such is the case, it will be necessary to either find some means of eliminating hybrids from the population (Frankham *et al*. 2005) or alternately, to repatriate large numbers of genetically pure *C. siamensis* in hopes of reducing the relative frequency of hybrid alleles within the wild population through "genetic swamping". Although a laudable goal, completely eliminating hybrid alleles from the population is probably unrealistic, and ultimately some level of hybridization must be accepted if wild crocodiles are to be functionally restored to TSBR. Until that happens, TSBR

will remain without the ecosystem services rendered by these important apex predators (Bondavalli and Olanowicz 1999; Mazzotti *et al*. 2009; Rosenblatt and Heithaus 2011).

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China

ASSESSING POTENTIAL REINTRODUCTION SITES FOR CHINESE ALLIGATORS IN ANHUI PROVINCE, CHINA. The Chinese alligator (*Alligator sinensis*) is regarded as the most critically endangered crocodilian in the world (Xing 2010). Fewer than 150 Chinese alligators survive in the wild, and these occur in small populations at widely scattered locations; the largest population at any particular site numbers no more than 20 individuals and contains <10 adults (Thorbjarnarson and Wang 1999, 2010; Thorbjarnarson *et al*. 2002). Sites occupied by wild Chinese alligators are typically small patches of marginal habitat embedded within an agricultural landscape. Agricultural lands surrounding occupied habitats effectively isolate these populations, blocking dispersal, and precluding inter-population genetic

exchange. Moreover, the limited areal extent of occupied habitats prevents any significant increase in the size of wild alligator populations (Thorbjarnarson and Wang 2010).

In contrast to the tenuous conservation status of wild populations, *ex-situ* propagation has been remarkably successful and thousands of Chinese alligators (>14,000 in 2015; Lu Shunqing, unpubl. data) are maintained at two government-operated conservation-breeding centers in China (Thorbjarnarson and Wang 2010; Platt 2012). An action plan prepared in 2001 strongly recommended that new wild populations be established by releasing captive-bred alligators into suitable, but currently unoccupied habitat (Jiang *et al*. 2006; Thorbjarnarson and Wang 2010). The Chinese alligator is an excellent candidate for reintroduction because wild populations are nearing extinction, the species reproduces readily in captivity, and a burgeoning pool of captive animals is available for release (Thorbjarnarson and Wang 2010). Reintroduction of the Chinese alligator was accorded high priority by the Crocodile Specialist Group (Xing 2010) and forms the cornerstone of the conservation vision outlined by Thorbjarnarson and Wang (2010), which calls for establishing a network of relatively small wild populations managed together with the much larger captive population as a single "conservation metapopulation".

Small-scale reintroductions of captive-bred Chinese alligators have already been undertaken at Gaojinmiao Forest Reserve (Anhui Province), Hongxing Conservation Site (Anhui Province) and Dongtan Wetland Park (DWP) (Shanghai Province) (Thorbjarnarson and Wang 2010; Wang *et al*. 2011; Lu *et al*. 2014). The successful outcome of these efforts has demonstrated the potential for reintroduction as a conservation strategy for restoring wild populations of Chinese alligators. Given that a population of at least 2500 free-living adults must be achieved before the future of the Chinese alligator can be considered secure in the wild (Thorbjarnarson and Wang 2010), there is an obvious need to identify habitats where additional, but much larger reintroductions might be conducted. To this end, we critically evaluated a number of potential reintroduction sites for Chinese alligators in the Yangtze River floodplain of Anhui Province during April 2015. Here, we report the results of our assessment, provide recommendations for future conservation actions, and outline a draft reintroduction plan for Chinese alligators at one site.

Methods

We closely collaborated with officials from the State Forestry Administration (SFA) in Anhui Province to develop a list of potential reintroduction sites for Chinese alligators. Only nature reserves and wetland parks were considered as potential reintroduction sites. Although both are classified as protected areas, nature reserves and wetland parks have differing management priorities. Nature reserves are tasked with the protection of wildlife and natural resources to the exclusion of other activities, while wetland parks are managed for tourism, and the protection of wildlife and natural resources, although important, is of secondary concern. Despite the emphasis on tourism, wetland parks can be suitable reintroduction sites as demonstrated by the successful restoration of a small, but growing alligator population at DWP near Shanghai (Lu *et al*. 2014).

We qualitatively assessed each potential reintroduction site based on the presence (or absence) of habitat suitable for foraging, burrowing, and nesting. Because studies of wild Chinese alligators were not undertaken until the species had reached critically endangered status and the few remaining wild populations are confined to suboptimal habitats (irrigation reservoirs surrounded by rice fields or upland forest), determining what actually constitutes suitable alligator habitat is somewhat conjectural. Historic accounts (eg Pope 1940) provide some guidance in this regard as does reference to what is known about habitat use by the American alligator (*Alligator mississippiensis*), a closely related congener (Thorbjarnarson and Wang 2010).

The foremost criterion in our assessment of each site was the presence (or absence) of significant areas (>200 ha) of heavily vegetated wetlands. Based on our observations of reintroduced Chinese alligators at DWP (Lu *et al*. 2014), vegetated wetlands appear to be critical nursery habitat for hatchlings, and important as foraging habitat for other size classes. For the most part, the wetlands we prioritized as alligator habitat were dominated by *Zizania caduciflora*, *Echinochloa* sp. and *Nelumbo* sp. We also noted the presence of small islands and embankments that could serve as nesting and burrowing sites for reintroduced alligators. Lastly, we determined if adjacent land use was likely to result in human-alligator conflicts should alligators disperse from the release area. If land use appeared incompatible with alligator conservation (eg fish and duck farms) we considered what measures might be required to mitigate potential conflicts (eg fencing). To estimate the number of alligators that a particular site could potentially support (ie carrying capacity), we used a value of one adult alligator per 2.5 ha (Thorbjarnarson and Wang 2010) and multiplied this number by the hectares of habitat deemed appropriate for alligators.

Results

We assessed nine potential reintroduction sites for Chinese alligators in Anhui Province (Table 1).

Table 1. Potential reintroduction sites for Chinese alligators in Anhui Province evaluated during April 2015. Sites are listed alphabetically.

Location	Visited	Latitude (N)/Longitude (E)	
Baidang Lake	24 April	30.8399°	117.3411°
Caizi Lake Wetland Park	21 April	30.7522°	117.0822°
Chenyao Lake	24 April	30.8779°	117.6420°
Huang Da Lake	23 April	30.0289°	116.5225°
Long Gan Lake	23 April	29.9760°	116.2715°
Po Lake	23 April	30.0971°	116.4863°
Pogang Lake	24 April	30.6817°	117.1320°
Wuchang Lake	22 April	30.2621°	116.7846°
Xizi Wetland Park	21 April	30.7688°	117.0489°

Here, we describe the physical environment of each site and discuss issues relating to alligator conservation. Of the 9 sites, we identified one high priority site where the reintroduction of captive-bred Chinese alligators is likely to be successful. We also identified a secondary site, which despite its relatively small size consists of high quality habitat and could serve as an additional release site for alligators in the future.

1. Baidang Lake

   Baidang Lake is managed as a Nature Reserve and encompasses about 4000 ha of mostly open water with a limited area of marsh (<100 ha). A canal links Baidang Lake with the Yangtze River and water levels fluctuate according to river stages. Owing to the small area of marsh and a complete lack of nesting habitat, we regard Baidang Lake as wholly unsuitable for alligator reintroduction.

2. Caizi Lake Wetland Park

   Caizi Lake Wetland Park consists of approximately 100 ha along the shore of Caizi Lake. Habitat within the park is largely open water with some seasonally flooded wet meadow, and includes a 10 ha wooded island connected to the mainland by an earthen causeway. Woodland on the island has little understory due to intensive grazing by water buffalo. Water levels in Caizi Lake fluctuate about 5.0 m each year, peaking in July, declining during August-October, and then stabilize from November-May, and begin to rise at the onset of the summer rains in late May. Given the small area of available marsh habitat, we consider it unlikely that Caizi Lake Wetland Park could support a viable population of reintroduced alligators.

3. Chenyao Lake

   Chenyao Lake encompasses approximately 2300 ha of mostly open water with <100 ha of vegetated marsh. The lake is surrounded by a high levee to prevent flooding of adjacent farmland. A canal links Chenyao Lake to the Yangtze River and lake levels fluctuate according to river levels. Chenyao Lake has little to offer as a reintroduction site; vegetated marsh, small islands for nesting, and substrates suitable for burrowing are completely lacking. Furthermore, fish farming occurring throughout the lake is an obvious source of potential human-alligator conflict. As such, Chenyao Lake warrants no further consideration as a potential reintroduction site for Chinese alligators.

4. Huang Da Lake

   Huang Da Lake encompasses approximately 28,000 ha within Huayanghe Lakes Provincial Nature Reserve. However, much of this area is open water and only about 130 ha of vegetated marsh are available for alligators within the reserve. The lake is linked to the Yangtze River by a system of canals, and lake levels fluctuate according to river levels. Given the small area of potential alligator habitat, we regard Huang Da Lake as unsuitable for the reintroduction of Chinese alligators.

5. Long Gan Lake

   Long Gan Lake (LGL) is included within Huayanghe Lakes Provincial Nature Reserve and encompasses approximately 22,000 ha. of which about 200 ha are considered suitable alligator habitat (Fig. 1). LGL is slated for development as a wetland park in the near future and plans call for restoring areas of currently degraded wetlands. Despite its small area, we consider LGL to be high quality alligator habitat. Much of LGL has been used for lotus (Nelumbo sp.) cultivation, and supports dense stands of floating and emergent macrophytes and mats of duckweed that constitutes excellent nursery and foraging habitat for alligators. Moreover, several small islands offer nesting sites for female alligators. Additional islands could readily be constructed at strategic locations throughout LGL to increase the number of potential nesting sites. Pumping stations regulate water levels in LGL, which could be managed to avoid drowning alligators over-wintering in burrows and protect nesting sites from flooding. Fishing, which is currently permitted in LGL must be curtailed or better yet, completely prohibited if alligators are released at this site. Although the area of potential habitat is minimal (ca. 200 ha), with minor habitat modifications and appropriate management, LGL could support a small population of reintroduced alligators that would function as part of the larger conservation metapopulation.

Figure 1. Long Gan Lake is a shallow waterbody with abundant aquatic macrophytes. Small islands such as those pictured could serve as nesting sites for reintroduced female alligators. With minor habitat modifications, Long Gan Lake could support a small, but significant population of wild Chinese alligators.

6. Pogang Lake

   Pogang Lake is managed as a nature reserve and encompasses approximately 1000 ha, most of which is an expansive body of open water. The small amount of marsh that formerly occurred around the periphery of the lake was recently converted to fish ponds. Indeed, the lake appears to be almost wholly devoted to aquaculture. For this reason, Pogang Lake warrants no further consideration as a reintroduction site for Chinese alligators.

7. Po Lake

Po Lake consists of approximately 14,000 ha of open water and marsh protected as a nature reserve. A site visit by one of us (LS) in 2009 found extensive areas of heavily vegetated marsh that appeared to be suitable alligator habitat. Given the amount of available alligator habitat, Po Lake was considered a promising reintroduction site at that time. Unfortunately, during the intervening six years the nature reserve has been converted to an intensive pearl farming operation and little vegetated marsh remains. Because current management practices are incompatible with alligator conservation, Po Lake is considered unsuitable for alligator reintroduction.

8. Wuchang Lake

Wuchang Lake is included within the Anhui Yanjiang Wetland Nature Reserve. Administration and oversight of Wuchang Lake is currently the responsibility of the local management bureau, but is likely to be transferred to the national level in the near future. Wuchang Lake consists of an eastern (6000 ha) and western (4000 ha) lake separated by a causeway, but linked by a narrow channel. The western lake is devoted to commercial aquaculture operations, while the eastern lake is relatively undisturbed and includes several extensive tracts of marsh dominated by *Z. caduciflora* (Figs. 2 and 3).

A canal and floodgate system connects Wuchang Lake with the Yangtze River, and stable water levels are maintained throughout the year so as not to disrupt fish farming operations in the western lake. Fishing is also permitted in eastern Wuchang Lake, but carried out under contract with the nature reserve. If necessary, fishing contracts could be cancelled to eliminate the potential threats fishing gear would pose to reintroduced alligators. Lands adjacent to the nature reserve are largely devoted to cultivation of aquatic macrophytes with some limited eel farming. Released alligators could pose a threat to the latter. Two guard stations are located on Wuchang Lake and reserve staff conduct regular patrols, primarily to protect and monitor wetland birds.

We visited several sites on eastern and western Wuchang Lake. Two areas of eastern Wuchang Lake appear particularly promising as alligator reintroduction sites. Saikou-Hongqi Zha (30.3176°N; 116.7925°E) consists of 1500 ha of marsh along the canal linking eastern Wuchang Lake to the Yangtze River. Although an embankment along the canal offers potential nesting and burrowing sites, the construction of several small islands in this area would enhance nesting opportunities for reintroduced alligators. A number of lotus ponds are located on slightly higher ground adjacent to the marsh, but alligators pose no threat to this activity. A second, somewhat smaller area (30.2621°N; 116.7846°E) of >1000 ha of marshland could serve as a secondary reintroduction site for alligators. However, several small eel farms (Fig. 4) are located adjacent to the lake in this area, and serious conflicts could arise should reintroduced alligators venture onto these farms and begin consuming eels. A fence could be constructed to bar alligators from entering these farms, although this option would entail some cost. Until adequate fencing is in place, we recommend that any release of alligators should be confined to Saikou-Hongqi Zha.

Figure 2. Google Earth imagery of eastern Wuchang Lake showing two sites visited in April 2015. Note extensive marshes around periphery of lake. We recommend that Chinese alligators be released near Saikou-Hongqi Zha (Site One). Several eel farms are located adjacent to Site Two. Wuchang Lake has the potential to eventually support a population of 800-1000 wild Chinese alligators.

Figure 3. Extensive marshes in eastern Wuchang Lake offer excellent habitat for reintroduced Chinese alligators.

Figure 4. Small eel farm adjacent to Wuchang Lake. Fencing will be necessary to prevent access by reintroduced alligators and avoid potential conflict with farmers.

9. Xizi Wetland Park

Xizi Wetland Park (XWP), located along the shore of Caizi Lake, includes 130 ha of natural *Phragmites* marsh and 100 ha of man-made fish and duck ponds. The park derives much of its income from the farming and sale of fish (catfish and carp), softshell turtles (*Pelodiscus sinensis*), and domestic geese. Tourism provides additional income, although visitation is apparently not high ("several hundred visitors on a typical weekend") despite the proximity of XWP to Anqing. Park managers are interested in establishing a small population of alligators to boost revenues from tourism.

While the area of natural marsh within XWP is extremely limited, the fish ponds are suitable for adult alligators, although vegetated habitat for hatchlings and juveniles and nesting sites for females are currently lacking. Pond embankments are an excellent burrowing substrate, but burrowing could damage or even collapse embankments. The abundant fish (particularly carp) could serve as an excellent food source for adult alligators, although large catfish are likely to consume hatchling alligators. XWP is bordered by commercial fish farms and human-alligator conflict is inevitable if alligators were to disperse from the release area. Owing to the limited amount of natural and anthropogenic habitat, extensive modifications (eg island construction) necessary to create foraging and nesting habitat, and the near-certainty of human-alligator conflict, we consider XWP unsuitable for reintroducing alligators.

Conclusions and recommendations

Of the 9 sites we visited during this assessment, eastern Wuchang Lake appears to offer the best prospects for a successful reintroduction of captive-bred Chinese alligators. Our conclusion is based on several factors. Foremost, Wuchang Lake is a nature reserve where wildlife protection is the paramount mission. Second, at least two large expanses of densely vegetated marsh within eastern Wuchang Lake appear to offer excellent habitat for reintroduced alligators. Third, water levels in Wuchang Lake are maintained at relatively stable levels by a canal linking the lake with the Yangtze River. Stable water levels are critically important as flooding during the winter months can drown hibernating alligators in their burrows (Thorbjarnarson and Wang 2010) and high water in mid- to late summer can inundate nests. Fourth, land use adjacent to eastern Wuchang Lake is for the most part compatible with alligator conservation. Finally, given the amount of available marsh habitat (ca. 2500 ha), eastern Wuchang Lake has the potential to ultimately support 800-1000 adult alligators. Should this goal be achieved, the Wuchang Lake population would be the single largest wild population of Chinese alligators, and comprise 40% of the 2500 free-living alligators that must be established in the wild before the species can be considered ecologically secure (Thorbjarnarson and Wang 2010).

Several habitat modifications must be undertaken before any alligators can be released at eastern Wuchang Lake. First, small islands (0.25-0.5 ha) should be constructed at scattered locations in the marsh near Saikou-Hongqi Zha to provide nesting sites for female alligators. Such islands can be constructed by dredging small ponds and depositing the spoil in an elevated mound adjacent to the excavation. Once vegetation is established on the island (usually within a single growing season), females will no doubt construct nests on the elevated substrate and remain in the adjacent pool to attend the nest and hatchlings. Artificial islands also may serve as burrowing substrates for reintroduced alligators. Additionally, barrier fences may need to be constructed to prevent the movement of alligators from eastern Wuchang Lake into adjacent lands where eels are being raised. Lastly, fishing leases on eastern Wuchang Lake should be cancelled prior to releasing alligators. Our previous experience at DWP where two of six adult alligators released into the park drowned in submerged crab nets indicates that fishing gear can pose a serious hazard to reintroduced alligators (Lu *et al*. 2014).

In addition to eastern Wuchang Lake, we recommend that serious attention be given to reintroducing alligators at Long Gan Lake. Although relatively small (ca. 200 ha), the shallow lake is densely vegetated and appears to be excellent alligator habitat. Several existing islands offer suitable nesting sites and additional islands could readily be constructed. Long Gan Lake is slated for development as a wetland park and reintroduced alligators would no doubt represent a significant tourist attraction. Despite its relatively small area, Long Gan Lake could potentially support a population of 50-80 adult alligators and play an important role in the larger conservation metapopulation (Thorbjarnarson and Wang 2010).

Because previous small-scale efforts have demonstrated that reintroduction is an effective strategy for restoring wild populations of Chinese alligators (Thorbjarnarson and Wang 2010; Wang *et al*. 2011; Lu *et al*. 2014), we strongly urge that larger numbers (20-30 adult alligators) be released during any future reintroductions. Larger reintroductions are more likely to succeed and will increase the trajectory of population recovery (Germano and Bishop 2008). In contrast to previous reintroductions in which alligators were transferred from captivity and released into the wild with no opportunity to become familiar with the release site (hard release), we recommend that future reintroductions use a soft-release approach, that is, alligators would be penned on-site for a predetermined period. Penning is assumed to habituate animals with the repatriation area and dampen post-release dispersal, making it more likely that stable territories will later be established (Knox and Monk 2013). We also suspect that after being released, alligators will exhibit a high-degree of fidelity to burrows constructed within the holding pen, further dampening post-release dispersal.

To briefly summarize, our draft reintroduction plan for eastern Wuchang Lake will involve the release of 20-25 captive-bred alligators (5-8 males, 15-17 females) obtained from the government-operated conservation breeding center in Anhui Province. Unrelated individuals will be selected from the breeding center to maximize genetic heterozygosity in the reintroduced population. We propose to release young

but sexually mature alligators (ca. 8-10 years old), which are less likely to wander than older adults. Alligators will be selected in April shortly after emerging from winter brumation, given a rigorous health assessment to insure that each individual is free from infectious diseases in accordance with IUCN reintroduction guidelines, and permanently marked by notching a unique combination of single and double caudal scutes (Jennings *et al*. 1991). VHF transmitters with an expected battery life of 1.5-2.0 years will be attached to as many alligators as possible (depending on funding constraints) to monitor post-release dispersal and habitat use.

Five holding pens (ca. 0.5 ha) will be constructed at scattered locations in the Saikou-Hongqi Zha area to confine alligators prior to release. Each pen will include both terrestrial and aquatic habitat enclosed by heavy gauge wire fencing buried at least 1.0 m below ground to prevent alligators from digging out. Alligators will be transferred to the pens (4-5 alligators/pen) in May 2016 and held there for 11 months. Supplemental feeding (fish, ducks, etc.) will be necessary during the confinement period, although care will be taken to prevent alligators from associating humans with food. This will be accomplished by using an automated system to deliver food at irregular intervals. Because alligators often remain concealed in burrows for lengthy periods, even during the active season (April through October), radio-telemetry will be used to confirm that alligators remain in the pens and escapes have not occurred. A section of each pen will be removed in April-May 2017 with the expectation that alligators will self-liberate. Post-release monitoring will begin immediately upon removal of the fence and continue for the life of the transmitter batteries.

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Indonesia

DETAILS OF FATAL SALTWATER CROCODILE ATTACK IN WEST MANGGARAI REGENCY, FLORES, EAST NUSA TENGGARA PROVINCE, INDONESIA WITH NOTES ON CURRENT AND HISTORICAL DISTRIBUTION. Saltwater crocodiles (*Crocodylus porosus*) (referred to locally as "buaya muara") were historically widely distributed throughout the Lesser Sunda Islands - historical records exist for Flores, Lombok, Sumba, Sumbawa and Timor. The species has since been extirpated from many of these areas, including the islands of Komodo (Auffenberg 1980) and Lombok (Klock 2008). Surveys of suitable *C. porosus* habitat in Flores in 1972 yielded no sightings and some of the local population stated that crocodiles had been previously hunted to extirpation for their skins, although a fatal attack was reported from the Reo area of Manggarai Regency in 1967 (Auffenberg 1980).

In recent years, attacks by *C. porosus* have frequently been reported from the East Nusa Tenggara Province, but only one attack has been reported from the West Nusa Tenggara Province (Nowa village, Woja sub-district, Dompu Regency, Sumbawa Island in 2008). Attacks in East Nusa Tenggara have recently been reported from the islands of Flores (2012, 2015), Lembata (2011-2014), Rote (2014), Sumba (2014, 2015) and Timor (frequently). These reports suggest that populations of *C. porosus* at the very least remain in eastern Sumba, throughout Timor, Lembata, and at some locations on Flores. While most reports of crocodile attacks in East Nusa Tenggara come from West Timor (particularly from Kupang Regency), the recent attacks and sightings in Flores suggest that the species may potentially be rebounding or re-colonizing the island, and recent reports from areas further west (eg Bali in 2014; Bali Post 2014) suggest that there may be extensive sea-faring by crocodiles within the region.

On 6 October 2012 a child was reportedly killed by a crocodile while trawl-fishing at Siru village in Lembor sub-district of West Manggarai Regency (CrocBITE 2015) and in December 2013 multiple crocodiles were reportedly preying upon domestic livestock at the mouth of the Wai Pesi River in Reo (BBKSDANTT 2014). On 15 April 2015 a man was reported to have been killed by a crocodile within the Nanga Nae River at Macang Tanggar village in Komodo sub-district of West Manggarai Regency, near Labuan Bajo; here I present the details of this recent attack.

The Nanga Nae River (8°31'39.7"S, 119°51'49.4"E) lies a little over 3.2 km south of the city of Labuan Bajo and little over 14.5 km northeast of Rinca Island in Komodo sub-district of West Manggarai Regency. At approximately 0900 h on 15 April 2015 a 35-year-old male resident of Macang Tanggar village entered the Nanga Nae River (at 8°33'07.2"S, 119°52'15.8"E; approximately 6.4 km upstream of river mouth) to bathe after tending to his cattle. A commotion in the water was heard by nearby residents but the attack was not directly witnessed. The man's body was recovered at approximately 1400 h around 400-500 m downstream of the attack site. One large wound was present on the body but all extremities were intact. Apparently two goats had been killed by a crocodile(s) two weeks prior to this fatal attack and residents reported seeing 4-5 crocodiles in the river in the 4 days following the attack.

Figure 1. Searching for the body of the 35-year-old male victim of crocodile attack on 15 April 2015. Photograph: Balai Besar KSDA.

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RECENT REPORTS OF SALTWATER CROCODILES WITHIN EAST JAVA AND BALI PROVINCES IN

INDONESIA. The limited historical information available suggests that the Saltwater crocodile (*Crocodylus porosus*) was once widely distributed throughout Java and the Lesser Sunda Islands. Records of attacks from the CrocBITE database (www.crocodile-attack.info) reveal human-crocodile conflict occurred throughout East Java during the early 20th Century, particularly around the city of Surabaya (Madura Island, southern Malang Regency) and along the Bengawan Solo River. The most recent attack records from East Java came from the Jember Regency in the 1950s, although it is possible that attacks have gone unreported or were only reported locally in the decades since then. The Saltwater crocodile was also present in Bali and is said to have been particularly abundant within Ekas Bay of neighboring Lombok Island (West Nusa Tenggara Province) during the early 20th Century (Mertens 1930). While most evidence suggests the species has since been mostly extirpated from these areas (Crocodilian.com 2012), media reports of itinerant animals are increasing. The following is a brief summary of recent media reports of what are presumably wild Saltwater crocodiles (as opposed to crocodiles which have escaped/been released from captivity) within East Java and Bali Provinces.

East Java

- On 15 June 2014 a Saltwater crocodile claimed to be around 3 m in length was captured by fishermen on a beach on Goa-Goa Island (7°07'29.9"S, 114°46'40.5"E) of Pulau Ra'as sub-district in Sumenep, approximately 72 km east of Madura Island. The fishermen were reportedly planning to sell it to anyone interested (Detik News 2014). Some unofficial sources claim that a population of Saltwater crocodiles still exists within the Kangean Islands (6°57'26.4"S, 115°27'07.5"E) (which also lie within East Java Province) approximately 56 km east of Goa-Goa Island and that fatal attacks on humans have occurred there (Indonesia Traveling 2015; Lueras 2002).

- On 23 February 2015 a Saltwater crocodile of around 2 m length was caught in a fisherman's net within the Kaliwutu mangroves of Kedungasri village (8°31'53.3"S, 114°21'09.5"E) in Tegaldlimo sub-district of Banyuwangi Regency. The crocodile was apparently then transported by members of BKSDA and park officials into nearby Alas Purwo National Park (8°41'03.4"S, 114°26'55.9"E) (Jawa Pos 2015).

- In late May 2015 multiple crocodiles were sighted (and some photographed; Fig. 1) basking along the Porong River (a tributary of the Brantas River) at Tambakrejo village (7°32'37.5"S, 112°38'47.6"E) in Krembung sub-district of Sidoarjo (Detik News 2015). Officers from BBKSDA East Java were deployed to monitor the situation and remarked that the crocodiles may have moved upstream due to the destruction of suitable mangrove habitat downstream. The officers also advised the local people to reduce riverside activities in order to minimize potential conflict with the crocodiles (BBKSDA JATIM 2015).

Figure 1. Crocodile photographed along the Porong River of East Java in May 2015. Photograph: Rudy Amin.

Bali

- In November 2014 Saltwater crocodiles were sighted in the waters around the island of Nusa Penida, which lies approximately 10.5 km southeast of the main island of Bali. At least one of these crocodiles was photographed on the sea floor by a diver at Nusa Lembongan. The report claims that crocodiles are also sighted in the waters around Nusa Gede, closer to the main island. A ceremony was apparently conducted by local residents in an effort to prevent the crocodiles from having any negative impacts on the local tourism industry (Bali Post 2014).

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Science

Submitted Publications

UNUSUALLY HIGH ALLIGATOR NEST DENSITY. Wild American alligators (*Alligator mississippiensis*) are usually solitary nesters, and construct mound nests of vegetation as previously described (Joanen 1969). In some areas of coastal Louisiana, nest density can be as high as one nest per five hectares (Joanen and McNease 1989). A more recent study (Reagan 2000) evaluated spacing patterns of alligator nest sites, and found 64 (17.6%) of 364 nests with and without eggs were located within 30.5 m of each other. A smaller study of 20 nests in Florida noted the closest adjacent nests were approximately 160 m apart (Goodwin and Marion 1978). Additional studies in Florida by Woodward *et al*. (1984) and Jennings *et al*. (1987) report alligator nests in Florida occur in a clustered pattern.

We recently rediscovered an old slide which shows an unusually high concentration of alligator nests in the wild in coastal Louisiana. During the annual coast-wide nesting survey conducted in late June/early July 1986 (detailed methodology for the nesting survey as per McNease *et al*. 1994) an unusual observation of densely clumped alligator nests was seen on one of the transect lines in Lafourche Parish in southeast Louisiana (Fig. 1). Seven nests are clearly visible from the slide taken while travelling above the area via helicopter. Five nests appeared active and encircled by adjacent water, and two appeared to be inactive, possibly false nests as per below. The private wetlands were in a freshwater marsh that was deteriorating and the small land mass presented a rare piece of higher elevation land evidently quite suitable as a nesting site. A rookery was located adjacent to the nesting island site. Dead trees were also noted but enough vegetation remained to allow for alligator nest construction.

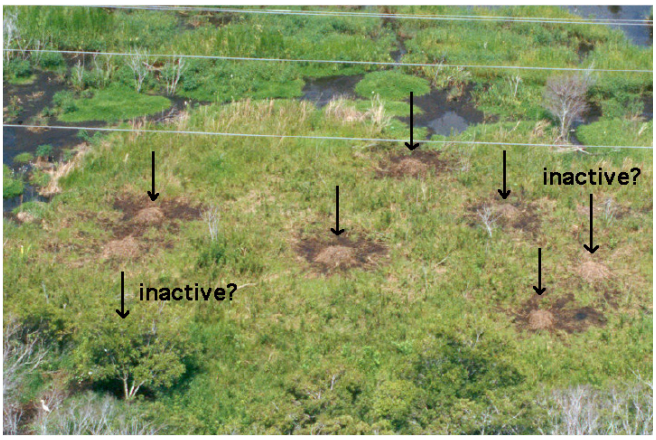

Figure 1. Unusual image from 1986 of 7 American alligator nests (some are possibly false nests) in close proximity in coastal Louisiana.

This observation occurred just as Louisiana's egg ranching program (Elsey *et al*. 2001) was initiated, indeed 1986 was the first year egg ranching was allowed on private wetlands. Only three egg ranching permits were issued that year, and those properties did not include the location of this nesting observation. Thus, we do not know how many of the 7 nests seen/photographed contained eggs. Almost certainly some of the nests seen may be false nests. False nesting occurs in many crocodilians, and has been well described in alligators (Joanen 1969; Goodwin and Marion 1978; Deitz and Hines 1980; Platt *et al*. 1995).

As noted by Reagan (2000), Woodward *et al*. (1984) suggest alligator nesting is limited by physical limitations on nest construction material or space, reduced fecundity due to poor nutrition, and agonistic behavior that restricts mating opportunities. Of interest, Jennings *et al*. (1984) found numerous habitat variables (shade, nest height above water level, vegetation density, distance to nearest high ground or water) provided no insight as to alligator nest site selection in their study. We have observed high concentrations of alligator nests in flotant marsh with high concentrations of nutria (*Myocastor coypus*) and limited high ground/vegetation for nesting material. Occasionally marshes located adjacent to areas affected by late controlled burns or summer lightning fires can provide nesting material otherwise unavailable in the burned areas and support dense alligator nesting [see discussion in Elsey (1996)].

Regrettably just two years after this observation, the site had been completely converted to open water due to saltwater intrusion causing complete loss of the deteriorating

fragmented marshland seen in Figure 1. Coastal erosion and wetlands preservation remain high priority concerns for landowners in Louisiana; maintenance of quality habitat for alligator nesting is a factor considered in wetlands enhancement and mitigation.

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HOW TWO FLORIDA COMMUNITIES COPE WITH CROCODILIANS. In Southwest Florida most real estate developments of both multiple- and single-family densities, were created on land that was subjected to drastic alteration in order to attain buildable standards. Although approved at the time by permitting agencies, in the majority of cases this was nothing less than outright ecological destruction. The standard practice was to create freshwater spoil ponds, common in subdivisions and on golf courses that were built on filled land. Thus, the permitted development standards of those times now provide habitat for American alligators (*Alligator mississippiensis*) in areas where 60 years ago their habitat was restricted to natural water bodies.

It is common knowledge that the Florida population of *A. mississippiensis* has skyrocketed since the species was determined to be endangered and protected by a 1967 law that preceded the US Endangered Species Act of 1973. The species was determined to be fully recovered in 1987 and are now a management nightmare. When I served on the now-defunct American Alligator Council between 1963 and 1966 we were brainstorming ways to keep them from extinction. During that era many of us thought we were coming close to losing them. It has been reported that well over a million alligators now exist statewide in Florida. Land development has negatively impacted all terrestrial wildlife species; however, the creation of artificial permanent water bodies due to development has actually enhanced the success of the alligator in Florida.

Two Southwest Florida communities have developed strategies to cope with the growing alligator population. The first of these is the City of Sanibel. Its municipal boundary includes all of Sanibel Island. Sanibel consists mostly of protected lands and has a long record of alligator management. City officials continue a workable program, but it will require further adjustment over time. The other community, a small condominium development known as Eagle Ridge Lakes, is about 21 km inland from Sanibel. An alligator management/ education program in this community has worked well over an 8-year period.

From 1956 until 1959, I was state-permitted as an individual researcher to capture, tag, and release alligators in Collier County, Florida. This is a coastal county in Southwest Florida, and most of my work was conducted in an area known as the Big Cypress Basin. Irresponsible development standards, permitted by both Florida and Collier County, beginning in about the year my study was terminated, have destroyed the majority of this unique ecosystem. Today, Americans are financially engaged in a massive restoration project that hopes to return a small part of this once huge ecosystem to its predevelopment hydrological and wildlife integrity.

In 1958 I relocated to Sanibel Island, a barrier island in adjoining Lee County, to accept a position with the US Fish and Wildlife Service (USFWS), on what was then known as the Sanibel National Wildlife Refuge, where I served as refuge biologist for the next 32 years. Although the refuge owned only 100 acres and leased about 2000 more at the time, all of Sanibel Island was included within a closed area that was primarily established to protect migratory birds by Presidential Proclamation No. 2758 on 2 December 1947. Refuge manager W.D. Wood (1903-1990) and I, the only two employees at the time, both had federal law enforcement authority and were commissioned Florida deputy wildlife officers until that dual commission policy ended in about 1978. We enforced both state and federal wildlife laws throughout Sanibel Island and adjacent lands.

In 1959 I continued my capture, tag, and recapture alligator study within the closed area of Sanibel Island and managed a growing nuisance alligator program on the island until 1971. During that time I operated my alligator program under federal purview since I was operating within the refuge/closure boundary. I never requested state authorization for any of my alligator research. Later, by 1971, this study became privatized and others obtained state permits to continue the program.

Eventually all of my alligator data (both Collier County and Sanibel Island) was turned over to the chairman of the Sanibel Island-based Southwest Florida Regional Alligator Association. This group assumed responsibility for alligators on the connected barrier islands, Sanibel and Captiva, in 1971. The database contained records of 2000 alligators (1500 from Collier County and 500 from Sanibel Island). Unfortunately, it has all since been lost.

I should add that in 1974 I was elected to two terms (serving until 1980) on the newly formed Sanibel City Council when the island incorporated to control its own destiny. This was at a time when the popularity of feeding alligators in the Sanibel Island wetlands was out of control. Stores on the island were selling marshmallows to hordes of visitors expressly so they could feed the floating morsels to alligators. Recognizing, through personal observations, the potential peril involved in this practice I wrote an ordinance prohibiting the feeding of alligators within the corporate limits of the City of Sanibel. Ordinance 75-29 was passed unanimously and the feeding of alligators was banned on Sanibel Island. Signage, press coverage, and public contacts by police and wildlife officers were successful over time, and alligator feeding is no longer a common practice. Apparently state officials thought this pioneering move by Sanibel was leading edge. In 2006 Rule 68A-25-001 was added to the Florida Wildlife Code, and feeding alligators was banned statewide.

Today, Sanibel Island presents a questionable situation for the survival of a successful resident population of alligators because of harvest policies applied to "nuisance" alligators on the island. After two alligator-related human deaths occurred there, the city council altered the island's alligator management practices. Large alligators were responsible for the Sanibel Island fatalities - one occurred in 2001 and another in 2004. The latter was the result of a direct and unprovoked attack by a 3.66 m alligator on a woman who was crouched and working on the landscape near a water body. The former involved an elderly man who attempted to defend his leashed dog from a charging 3.35 m alligator.

Since the policy change, any alligator over 1.22 m that occurs on private lands can be subjected to harvest by state alligator trappers. If a resident complains loudly enough to city officials and the alligator displays behaviors unlike a "wild" alligator, it is removed. It is important to note that all alligators above the threshold size are not randomly killed. If the reported alligator is determined to be a nuisance (dangerous), it is subject to harvest. The result of this policy over time is obvious if one considers the transiency of alligator populations, and the species' reproductive strategy (eg sexual maturation sizes). Sanibel Island's alligators are a long-established insular population and although recruitment from off-island sources does occur, it is limited in scope.

The City of Sanibel remains unique in its attitude toward crocodilians. A resident American crocodile (*Crocodylus acutus*), after living in an established territory on Sanibel Island for 16 years, suddenly began to build nests and deposit eggs in 1997. These always proved to be non-viable through 2009 (the individual died in 2010). To encourage wildlife authorities to release a male crocodile into the female's territory, the city took action. On 20 April 1998, the Sanibel City Council adopted Resolution No. 98-89; A Resolution Declaring Sanibel a Crocodile Refuge and Endorsing Efforts to Establish a Breeding Population; and Providing an Effective Date. Officials of the Florida Fish and Wildlife Conservation Commission and the USFWS rejected the release of any relocated crocodiles, or translocation of a male from elsewhere in the state, into Sanibel's habitat. In 2010 a nuisance adult female was released on the refuge and as of 2015 it has moved only 8.5 km away onto a golf course. It will soon be longing for a mate.

In 1990 I retired from the wildlife refuge, renamed the J. N. "Ding" Darling National Wildlife Refuge in 1967 to honor the life achievements of Jay Norwood "Ding" Darling. He was a nationally syndicated American editorial/conservation cartoonist who accomplished much for wildlife conservation in the USA. He wintered on Captiva Island from 1935 to 1959 and was the chief advocate for the establishment of the Sanibel National Wildlife Refuge that came into being in 1945.

After nearly 50 years of residency on Sanibel my wife and I finally chose to relocate to the mainland in 2005. We moved into a small condominium development where a large freshwater body is just a few feet away from our lanai. At the time we took up residence about four medium-size alligators lived in this pond on a permanent basis. Overall there have never been more than a dozen alligators of all size classes (with the exception of when hatchlings are infrequently produced by the female using "our" pond) present in the other three water bodies on the property. It is important to know

that the unfenced western boundary of the condominium association's land abuts land owned by Lee County that is managed as part of the county's Six-Mile Cypress Slough Preserve. We see nothing beyond our lanai but water and wilderness (a major reason we selected this location). There is a seasonal temporary interchange of at least one ±3.05 m sexually active male alligator that moves from this protected wetland into the pond closest to our residence looking for a little action.

There are 204 condominium units in our community and at capacity these house about 400 residents. Within a few weeks of the start of our residency the tranquility of my waterfront view was disturbed when state-licensed alligator trappers responded to a nearby resident's telephoned complaint. The complainant was a woman who acted unilaterally and reported her crocodilian fears to our property manager, who then called the state's alligator hotline. Licensed trappers quickly responded and three alligators ranging between ±1.22 and ±1.83 m in length were hooked, reeled to shore, trussed, and placed in the bed of a pickup truck. They were hauled away and euthanazed to accommodate their transformation into their profitable parts.

This event launched a debate between gator-huggers and gator-haters in the neighborhood. Some conversations were volatile and created a low level of civil unrest between the two factions. In a discussion I had with two of my neighbors (one happened to be the president of the condominium association), I suggested that there should be an oversight step in place and alligators that may be, or may not be, potential candidates for removal should be evaluated first. I agreed to take on that responsibility and in a few weeks the association's board of directors appointed me to the position of alligator complaint evaluator.

My first step was to notify the state of the board's action. After an amicable discussion, bolstered by the fact that we and our alligators live in a gated community, state nuisance alligator officials issued an alligator harvest permit (No. 13181) to me on 31 July 2007. Thereafter, alligator trappers could no longer enter the property to remove an alligator without my authorization. For 8 years this protocol has worked very well, and I'm pleased to say only one alligator was removed from the property (with my OK). That incident was the result of a misunderstanding by alligator trappers who had been dispatched based on a resident's phone call to a new property manager who had not been advised of our existing policy. She called in the area's primary trapper who inadvertently overlooked that I held the harvest permit. This was corrected. I take this voluntary position very seriously. In the now rare event I receive an alligator complaint I immediately respond and evaluate the animal's behavior. Quite often the only issue raised is when the largest (±2.74 m) year-round resident alligator hauls itself out of the pond to bask in a location that a walker assumes is too close to a walkway. My first behavioral test is to walk toward the animal at a brisk pace to see if there is a fast enough flee response. This resident animal has learned on which bank it may safely bask and not be disturbed by the likes of me. I have yet to have an alligator not react as a wild individual should - immediately fearful of humans in their reaction to approach - and display its fright with a speedy dash into the water.

Another aspect of my work as alligator complaint evaluator is dissemination of information about our alligators to residents and visitors. I happily discuss alligator biology frequently on an impromptu level and on an almost daily basis. I also hold alligator seminars in our clubhouse periodically for interested residents. Well after dark and following the indoor discussion the group joins me for a walk around two of our ponds so they may experience seeing alligator eyeshine - if any alligators are out and about - and ask further questions.

This program has worked remarkably well and we now have an alligator-integrated neighborhood. More Florida communities should use this tactic for managing alligators, but more importantly such a proactive approach as I provide as an alligator complaint evaluator should be applied in coastal developments in Southwest Florida. A growing number of American crocodiles have moved into such communities, and the human residents have not seriously considered coexistence with crocodiles. As a result the species continues to have difficulty in becoming established, particularly in Southwest Florida, because of human interference (eg complaints leading to trapping and relocation). It will be a stretch, but just as my neighbors have adjusted so well to living with alligators others can learn to coexist with crocodiles. It is time for someone, or a group, to step up and do something to change attitudes.

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Recent Publications

Lewin, S. (2015). Prehistoric swagger. Scientific American 312: 18.

Abstract: Modern-day alligators may illustrate how dinosaurs went from two-legged to four-legged.

Zhu, X. (2015). The evolvement and development of Chinese Dragon. Cross-Cultural Communication 11(3).

Abstract: Chinese Dragon is an art product exclusively owned by China. It is called an art product for it is a supernatural artistic creation which does not exist in the natural world. The image of Chinese Dragon is a combination of the ideal, the aspiration, the wisdom and the strength of Chinese people, and the development of history, it has formed several representative features and became the symbol of Chinese nation. In the folk artworks, the image of Chinese Dragon is expressed richly and in great volume, and they are usually made with exquisite craftsmanship and outstanding style, which is breathtaking to the beholders. This paper, through analyzing the formation and evolvement process of Chinese Dragon, a traditional Chinese artistic figure, probes into the

national spirit and glorious culture that Chinese Dragon has bestowed on Chinese nation. Such spirit and culture are a fairly splendid, time-honored and precious national cultural heritage which deserves our attention and research.

Murray, C.M., Rheubert, J.L., Easter, M.E., Merchant, M. and Crother, B.I. (2015). Heterophil/lymphocyte alterations as a measure of stress in American alligators in relation to anthropogenic disturbance in a Louisiana intermediate marsh. J. Mar. Sci. Eng. 3(2): 267-275.

Abstract: Numerous anthropogenic factors represent environmental threats to Gulf Coast wetland ecosystems and associated fauna. American alligators (*Alligator mississippiensis*) have been subject to long-term management and used as ecological and physiological indicators of habitat quality in response to anthropogenic events and stochastic natural disasters. The present study monitored heterophil to lymphocyte ratios (an indicator of stress), in American alligators in a Louisiana intermediate marsh from 2009 to 2011, a time period that coincides with an oil inundation event that occurred in 2011. Sixteen alligators were observed and processed morphometrically (total length, snout-vent length and body mass). Heterophil to lymphocyte ratios were negatively correlated with size, suggesting larger American alligators were physiologically more resilient to the disturbance, more able to actively avoid these poor conditions, or are less affected by localized disturbance.

Mpofu, C.N.B., Mhlanga, M. and Moyo, N. (2015). Pond type and pre-tanning processes affects size and quality of captive Nile crocodile skins. Journal of Agricultural Advances 4(4): 42-48.

Abstract: The skin of *Crocodylus niloticus* is one of the best among alligator species. Understanding proper rearing of crocodiles and processing of their skins is very essential for farmers because quality is very crucial in marketing the skins. A study was done to assess the effects of processing stages and pond type on crocodile skin size and quality. A total of 400 skins were assessed, of which 200 skins were from each pond. The skins had their belly sizes measured before and after being subjected to the processing stages. The skins were also graded in terms of quality after every stage. Data analysed using a paired t-test for initial and final skin size within and across ponds showed that there was a significant (P= 0.00) effect of pond type on both initial and final skin size. Earth ponds showed high skin size but had a low quality compared to cement ponds. Further, there was a significant effect of processing stages on final quality (P value= 0.00). The conclusion of the study was that crocodile rearing environment and skin processing techniques influence final size and quality of skins. As such, it was recommended that producers monitor rearing conditions and pre-tanning processing stages in order to improve skin quality, minimise losses due to shrinkage and thus maximise profits.

Nell, L.A. and Frederick, P.C. (2015). Fallen nestlings and regurgitant as mechanisms of nutrient transfer from nesting wading birds to crocodilians. Wetlands (10.1007/s13157-015-0664-0).

Abstract: Positive interspecific interactions can shape fundamental wetland ecosystem dynamics, including energy transfer and spatial distribution of nutrients. Birds, by foraging in one location and nesting in another, commonly act as between-ecosystem nutrient vectors. However, the distribution of nutrients within nesting areas and mechanisms of transfer to other trophic levels are poorly understood. We report on measurements of available food transferred from nesting long-legged wading birds to American alligators (*Alligator mississippiensis*) in the Everglades of Florida, USA. Using throughfall traps, a historic dataset on nesting success and a literature-parameterized alligator energy budget, we estimated the potential food available to alligators via regurgitant and nestling carcasses, and compared that to alligator food requirements. Although dropped regurgitant is of little importance to scavenging alligators, we estimate that nestling carcasses throughout the ecosystem could support the energetic requirements of hundreds of alligators for periods of several months. This resource occurs during the dry season, when alligator thermoregulatory opportunities are relatively scarce and female alligators are mobilizing resources for egg-laying. Our results indicate that through fallen nestlings, wading bird nesting colonies have strong potential to benefit alligators. This facilitative exchange may be globally widespread, forming a keystone process in many tropical and subtropical wetlands.

Roman, J. (2015). The wild American dream: a discussion of the origins and evolution of the Endangered Species Act and its connections to international trade and well-being. Quinnipiac Law Review 33(3): 537-566.

Budd, K.M., Spotila, J.R. and Mauger, L.A. (2015). Preliminary mating analysis of American crocodiles, *Crocodylus acutus*, in Las Baulas, Santa Rosa, and Palo Verde National Parks, Guanacaste, Costa Rica. South American Journal of Herpetology 10(1): 4-9.

Abstract: Studying the mating system of wild populations of American crocodiles, *Crocodylus acutus*, has important conservation implications. We conducted a preliminary analysis of the mating system of *C. acutus* in Las Baulas (2007 and 2008), Santa Rosa (2007) and Palo Verde (2008 and 2009) National Parks in Guanacaste, Costa Rica. We captured hatchlings during crocodile surveys and analyzed them with nine polymorphic microsatellite loci to determine relatedness values. High relatedness values indicated that full and half siblings were sampled in a single locality and season. We found full siblings between the years that hatchlings were collected in Las Baulas and Palo Verde National Parks, which suggested mate fidelity. The mate fidelity and high relatedness values could be a consequence of the smaller number of adult crocodiles found within these areas or indicative of a small

number of dominant males in the populations. Our results support the need to conduct future studies describing the mating system and nesting success within populations of *C. acutus*. Understanding of these population factors is crucial to the continued success and maintenance of viable populations of *C. acutus*.

Balaguera-Reina, S.A., Venegas-Anaya, M., Sanjur, O.I., Lessios, H.A. and Densmore III, L.D. (2015). Reproductive ecology and hatchling growth rates of the American crocodile (*Crocodylus acutus*) on Coiba Island, Panama. South American Journal of Herpetology 10(1): 10-22.

Abstract: We assessed the reproductive ecology of the American crocodile (*Crocodylus acutus*) on Coiba Island, Panama from January-December 2013. We examined nest site characteristics from January-April and hatchling survivorship from April-December. Ten nests were examined at three nesting localities where 30% of the nests were found under forest canopies and 70% were exposed to sunlight (distance to nearest tree = 280 ± 110 cm). Half of the nests were built closer to the sea and the other half closer to bodies of freshwater (700 ± 360 cm). The nest dimensions were 17.5 ± 7.8 cm from the top of the clutch to the surface, 42.9 ± 9.9 cm from the bottom of the clutch to the surface, and 35.9 ± 3.6 cm wide at the top of the nest cavity. The average soil conditions in the nests consistently had high concentrations of potassium (69.3 mL/L) and manganese (9.2 mg/L), moderate concentrations of phosphorus (6.6 mg/L) and iron (3.7 mg/L), and low concentrations of zinc (0.5 mg/L) and copper (0.0 mL/L). Cation exchange capacity showed consistently high concentrations of calcium (2.2 cmol/kg), moderate of magnesium (1.1 cmol/kg), and low in aluminum (0.1 cmol/L). Volumetric water content was about 25.0 ± 2.6% at the bottom and 22.8 ± .3% in the middle of the clutches. Hatching success was 88.9%, of which 68.3% hatched by themselves or with the mother's aid and 20.6% hatched with our aid. Mean size of the mother was 219 ± 6.2 cm total length (TL) and 115.9 ± 3.0 cm snout-vent length (SVL). The incubation period was estimated to be 85-88 days. TL and SVL growth rate of those individuals were 0.03-0.16 cm/day and 0.00-0.09 cm/day, respectively. Population size was estimated to be 218.6 hatchlings in 22.4 km^2; the hatchling population declined 65.7% after the first 2 months (May and June) and 95.9% by July, leaving only 0.5% remaining by December. This is the first study to assess nest-site characteristics and estimate hatchling survival in a Pacific population of American crocodiles.

Portelinha, T.C.G., Jahn, G.A., Hapon, M.B., Verdade, L.M. and Piña, C.I. (2015). Hormone levels and ultrasound evaluation of *Caiman latirostris* (Crocodylia, Alligatoridae) ovulation. South American Journal of Herpetology 10(1): 23-31.

Abstract: Although there is much information available about reproduction in *Caiman latirostris*, knowledge related to steroid hormone levels and follicle development for wild adult females is still lacking. In this study we monitored and assessed the development of follicles and eggs and correlated these results with plasma steroid hormone levels in 32 adult females captured in Santa Fe, Argentina. Fieldwork was carried out over two reproductive seasons (October-January) between 2010 and 2012. Using an ultrasound device to take images of the reproductive structures of adult females, we observed individuals with vitellogenic follicles (n= 5), eggs (n= 4), atretic follicles (n= 11), and inactive reproductive structures (n= 12). We found no reproductive females smaller than 65 cm snout-vent length. High levels of estradiol were found during the ovulation period (November) only in reproductive females. Reproductive females showed no differences in progesterone levels during the study period (November-January) compared to non-reproductive females; however, reproductive females showed higher progesterone levels during nesting (December). We found no differences in progesterone levels between reproductive females and females with atretic follicles at the end of the nesting period (January). Ultrasound imaging was found to be an efficient technique to study reproductive structures at the beginning of reproductive cycle of the broad-snouted caiman. Isolated analyses of hormonal levels are not sufficient to determine the reproductive condition of *C. latirostris* females.

Moore, B.C. and Kelly, D.A. (2015). Histological investigation of the adult alligator phallic sulcus. South American Journal of Herpetology 10(1): 32-40.

Abstract: Male intromittent organs serve two primary reproductive functions: the physical entry into the female body during copulation and the effective delivery of gametes resulting in internal fertilization. Here we present a histological examination of the adult male American alligator phallus semen delivery apparatus, the sulcus spermaticus. While the highly collagenous basal crurae and more distal shaft of the alligator penis contain the rigid structures that facilitate cloacal intromission, the sulcus is more functionally intricate. Here we show the sulcus spermaticus (an open groove that runs along the ventral aspect of the phallic shaft) to be a spatially heterogeneous reproductive structure containing a complex architecture of multiple tissue types. Sulcus morphology markedly changes from its proximal origin between the crurae to its distal exit from the phallus tip. At the proximal origin of the sulcus, the ductus deferens vent semen into an expanded lumen lined by a convoluted secretory epithelium. Along the length of the phallic shaft, an arrangement of longitudinally and radially oriented smooth muscle bundles may act via rhythmic contractions to produce peristaltic sperm conveyance through the sulcus. An extensive vascular network of blood and lymph vessels putatively engorges the sulcus tissues during reproductive activity, increasing tension on an internal network of connective tissues and leading to localized inflation and increased tissue rigidity. We hypothesize that this engorgement works to seal the sulcus groove and allow the structure to convey semen through a functionally closed tube. Further, numerous epithelial secretory cells contribute seminal fluids to the ejaculate and may aid in as yet uncharacterized aspects of

sulcus functioning. Together, these observations establish that the sulcus spermaticus is far more than a simple furrow in the phallus shaft for sperm conduction: it contains elements that form a complex functional gamete delivery system.

Iungman, J.L., Somoza, G.M. and Piña, C.I. (2015). Are stress-related hormones involved in the temperature-dependent sex determination of the Broad-snouted caiman? South American Journal of Herpetology 10(1): 41-49.

Abstract: In some reptiles, gonadal outcome is regulated by temperature during a critical period of the embryonic development. Gonadal steroid hormones are seen as effectors of the gonadal differentiation process. Recently, stress and glucocorticoids (GCs), stress-related hormones in vertebrates, have been considered as potential modulators of the sex determination process in some vertebrates that present temperature-dependent sex determination (TSD). In reptiles, corticosterone is the main GC produced, and its administration to eggs causes a bias in sex ratio in some lizards. In this context, we aim at assessing whether dexamethasone (Dex), a potent synthetic glucocorticoid, can modify the sex ratio in *Caiman latirostris*, a species with strong TSD. As a first step, we incubated embryos at masculinizing temperatures (33°C; 100% males). Different doses of Dex were topically applied to the eggshell at stage 20, prior to gonadal differentiation. We assessed embryonic development at stages 22 and 25 and evaluated some physiological and morphological hatchling traits. Embryonic mortality was not affected by dexamethasone manipulation. No effects of Dex on sex ratio were found and all animals analyzed histologically possessed testes. However, older embryos and hatchlings from Dex treated eggs were heavier, larger, and hatched earlier than control individuals. Our results do not account for Dex involvement in the process of ovarian differentiation, at least under a strong masculinizing temperature. Nevertheless, they suggest that Dex might accelerate embryo development by enhancing intermediate metabolism and/or by stimulating growth hormone secretion.

Marcó, M.V.P., Piña, C.I., Somoza, G.M., Jahn, G.A., Pietrobon, E.O. and Iungman, J.L. (2015). Corticosterone plasma levels of embryo and hatchling Broad-snouted caimans (*Caiman latirostris*) incubated at different temperatures. South American Journal of Herpetology 10(1): 50-57.

Abstract: The temperature-sensitive period is the time during development during which sex determination occurs in vertebrates that undergo temperature-dependent sex determination, such as in caimans. The interplay among temperature and steroid hormones is also known, and it has been suggested that stress hormones (corticosterone) might influence sex ratios in some reptiles. To explore this, we measured the levels of corticosterone in *Caiman latirostris* to determine if incubation temperature (31°C, 33°C, and 34°C) affects plasma corticosterone levels. Differences among nests were observed in plasma corticosterone. However, hormone levels showed no significant differences between sexes or incubation temperatures in *Caiman latirostris* embryos or hatchlings. Corticosterone levels were 0.01-2.2 ng/ mL in embryos incubated at 31°C (100% of females), 0.01-4.65 ng/ mL in those incubated at 33°C (100% of males), and 0.01-6.31 ng/mL in embryos incubated at 34°C (100% of males). Corticosterone levels were higher in hatchlings, being 1.11-39.18 in those produced at 31°C, 2.85-22.36 at 33°C, and 2.72-39.05 ng/mL at 34°C.

Lance, V.A., Elsey, R.M. and Trosclair III, P.L. (2015). Sexual maturity in male American alligators in southwest Louisiana. South American Journal of Herpetology 10(1): 58-63.

Abstract: Very little is known about the attainment of puberty in reptiles. In the American alligator (*Alligator mississippiensis*) males are assumed to be sexually mature at about 1.8 m in total length, but it is not clear at what size they produce testosterone, spermatozoa and mate successfully. We re-examined this question by studying plasma testosterone levels in blood samples from a large sample of alligators (~1500) collected every month of the year and ranging in size from approximately 61 cm (2 ft) to 360 cm (11.5 ft). Testosterone values ranged from 0.05-115.41 ng/mL. All size classes of alligators exhibited a seasonal cycle in testosterone levels, but the concentrations were size-dependent: the larger the alligator the higher the testosterone. In all size-classes testosterone reached a peak in the breeding season (March-May). Mean testosterone in the largest size-class during breeding was 75 ng/mL whereas in the smallest size-class peak testosterone was less than 3 ng/mL. The smallest size-class (59-89 cm) showed an additional rise in testosterone in late summer. The attainment of sexual maturity in alligators appears to be closely associated with growth and is a gradual process lasting several years. Sexually immature alligators show a seasonal pattern of testosterone secretion similar to that of adults, but the values are significantly lower.

Pooley, S. (2015). Using predator attack data to save lives, human and crocodilian. Oryx (doi: http://dx.doi.org/10.1017/S0030605315000186).

Abstract: As human populations grow and transform undeveloped terrestrial and aquatic habitats, human–wildlife conflict inevitably increases. This is particularly problematic for large predators and the humans who live alongside them. Relatively little research has been conducted on alleviating adverse human encounters with one of the most significant predator species in Africa, the Nile crocodile *Crocodylus niloticus*. This short communication raises questions about some of the general statements made to explain the incidence of attacks by crocodiles. Some of the limitations of the data on such attacks are considered, with recommendations on what kinds of data are required. Data collection and analysis, and how they can inform more effective mitigation efforts, are discussed.

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