CROCODILE SPECIALIST GROUP NEWSLETTER

VOLUME 30 No. 3 • JULY 2011 - SEPTEMBER 2011

IUCN • Species Survival Commission

CROCODILE

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GROUP

NEWSLETTER

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JULY 2011 - SEPTEMBER 2011

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COVER PHOTOGRAPH: Brown Caiman (*Caiman crocodilus fuscus*). Photograph: Jemeema Brien.

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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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Editorial

It was extremely sad for the CSG to hear the news that another long-time CSG member, Charles Andrew "Andy" Ross, passed away in St. Lukes Hospital, Manila, Philippines, on 7 September 2011. Andy had been quite ill for years, but he just seemed to get over it and keep going. This time there were both heart problems and associated organ failure. On behalf of the CSG, I sent a letter of condolence to Andy's wife, Glory, and their two sons, Bob and James. Andy will be missed by many of us who had the opportunity to know and work with him, particularly in the Philippines.

Following the CSG's Regional Species Meeting in Bangkok, Thailand, letters of request were sent to the CITES Management Authorities of Thailand, Cambodia, Vietnam, Indonesia and Lao PDR, seeking their assistance to implement the various recommendations that resulted from the meeting. Range States have been requested to report back prior to the 21st CSG Working Meeting to be held in Manila, Philippines, in May 2012. In addition, I established a Task Force on Live Trade in *C. siamensis* to review options for identifying live *C. siamensis* in trade, within SE Asia and between SE Asia and China, to improve compliance with CITES. Dr. Paolo Martelli has been appointed as Chair of the Task Force, which is also scheduled to report prior to the next CSG meeting. A copy of the meeting summary can be obtained from the CSG Executive Officer (csg@wmi.com.au), and an electronic version of the Proceedings will be available on the CSG website in due course.

The 25th meeting of the CITES Animals Committee was held in Geneva, Switzerland, on 18-22 July 2011. A number of issues of interest to the CSG were discussed. The AC once again established an intercessional Working Group on the "Criteria for the inclusion of species in Appendices I and II" (Resolution Conf. 9.24 Rev. CoP15) which is arguably the main business of CITES. The issue which is open for debate is to find a solution among Parties about how to interpret the quantitative criteria for the inclusion of species in Appendix II. The current process resulted from a dispute between FAO and the CITES Secretariat on different interpretations of wording in Annex 2 (a) of the respective resolution.

The Secretariat introduced a document on "Ranching", noting that the safeguards applied when transferring a species from Appendix I to Appendix II under the ranching resolution have become much more onerous than seeking a downlisting for ranching under the normal downlisting criteria [Resolution Conf. 9.24 (Rev. CoP15)], which defeats the purpose of having a ranching resolution.

Part of the problem is that outside the world of crocodiles, ranching is not particularly well understood. For this reason, the CSG prepared an information paper on ranching (AC 25 Inf. 9 - http://www.cites.org/eng/com/ac/25/index.php) that was tabled at the AC meeting. Following consideration by a Working Group, the AC recommended adoption of the suggested amendments to Paragraph A. 2 in Annex 4 of Resolution Conf. 9.24 (Rev. CoP15) on criteria for amendment of Appendices I and II. Finding a straightforward mechanism through which transfers from Appendix I to Appendix II can be undertaken when uses are restricted to ranching (a demonstrably safe harvest method) has always been problematic.

The 61st meeting of the CITES Standing Committee (SC61) was held in Geneva, Switzerland, on 15-19 August 2011. The operation of the Working Group on "Personal and Household Effects" was extended to CoP16. The SC invited the CITES Secretariat to issue a Notification to all Parties requesting information in regard to the "Implementation of the Convention relating to Captive-Bred and Ranched Specimens" (SC61 Com.2). As Madagascar was not present at SC61, the issue of the current suspension of trade in *C. niloticus* from that country was postponed until SC62.

The Joint CSG Regional Chairs for North America, Dr. Ruth Elsey and Allan Woodward, recently undertook a review of CSG membership in their region. Some new members were added and some non-active members were deleted. Harry Dutton has retired from the position of Regional Vice Chair, and Dr. Frank Mazzotti and Dr. Thomas Rainwater have been appointed as Vice Chairs. We thank Harry for his contribution, and welcome Frank and Thomas to the CSG Steering Committee.

A reminder to all CSG members and interested people that the CSG's 21st Working Meeting will be held in Manila, Philippines, on 22-25 May 2012. Information on draft agenda, registration, etc., is available at the meeting website (www.csgmanila.com). We urge people wishing to make presentations to contact the organizers as soon as possible.

Additional meetings of interest to the CSG include; the International Crocodile Conference (Kuching, Sarawak, Malaysia, 19-21 October 2011), CITES Animals Committee meeting (Geneva, Switzerland, 15-20 March 2012), followed by a Joint meeting of the Animals and Plants Committees (Dublin, Ireland, 22-25 March 2012), CITES Standing Committee meeting (Geneva, Switzerland, 23-27 July 2012) and 16th meeting of the Conference of the Parties to CITES (Bangkok, Thailand, 3-15 March 2013).

Prof. Grahame Webb, *CSG Chairman*.

Obituary

On 7 September 2011, Charles Andrew "Andy" Ross (58) passed away at St. Lukes Hospital, Manila, Philippines, after a long battle with heart disease and related kidney failure. He passed away in the company of his wife, Glory, and eldest son, James.

Andy was born on 7 February 1953, in Bellefonte, Pennsylvania, USA, and was educated at Riverdale Country School in the Bronx, New York. It is remarkable that Andy accomplished so much in his life without university or advanced degrees.

After graduation (1971) he began volunteering at the Division of Amphibians and Reptiles at the Smithsonian Institution in Washington D.C., where he worked as a special assistant to Max Downes (visitor from Australia) on the Downes Bibliography of the Crocodila.

He and his brother, Franklin, who was responsible for getting Andy interested in crocodiles, embarked on several crocodile expeditions: a trip to Central America, including Mexico, Belize, Guatamela, Nicaragua, and El Salvador (1972-73), and an alligator project in the US Gulf states (1974). Andy also worked on Gharials and Muggers in Corbett National Park, India (1974), and manatees in Gainesville, Florida, for the US Fish and Wildlife Service (1977). Around this time Andy was appointed by Dr. George Zug to be the Smithsonian technician in Birds

In 1978-79 Andy was in Papua New Guinea working on the United Nations Development Program project titled "Assistance to the Crocodile Industry". On his way home to Washington D.C. he stopped off in the Philippines for a month's recreation, searching for *C. mindorensis*. It was here that he established new contacts and began thinking about what he could do for this "Critically Endangered" species.

Back in Washington, he took on a contract with the Smithsonian Institution and secured a two-year World Wildlife Fund/ Smithsonian Institution project on the Philippine Crocodile, returning to Manila in 1980. It was while working with the Philippine National Museum in Manila that he met Dr. Angel Alcala, who was then Dean of Biology at Silliman University in Dumaguete City, Negros Oriental. Andy became good friends with Dr. Alcala and they worked together on several projects. They conducted herpetological fieldwork on Palawan, Batanes, Negros and Mindanao Islands.

Andy helped Dr. Alcala establish in 1980 the Crocodile Breeding Facility at the Silliman Marine Laboratory, the first facility in the country to breed the Philippine Crocodile. Andy secured the male crocodile from Zamboanga City to pair with the female acquired earlier by the Facility from Pagatban River, Negros Oriental. Two papers on this project were published [Alcala, A.C., C.A. Ross and E.L. Alcala (1983). Observations on reproduction and behaviour of captive Philippine Crocodiles. Silliman Journal 34(1-4): 18-28; Ross, C.A. (2008). A question of habitat - *Crocodylus mindorensis*. National Museum Papers 14: 116-122].

Photograph: Geoff McClure.

After finishing the WWF/SI project he undertook various contracts for the Smithsonian Institution and eventually became a permanent employee in the Division of Birds. He regularly commuted to the Philippines, where he met Glory, whom he married in May 1983. Subsequently, Andy became an Assistant Curator of the National Museum of the Philippines for a number of years. While at the National Museum, Andy made frequent trips to Silliman University, where he served as Research Associate of the Silliman University-Angelo King Centre for Research and Environmental Management.

After suffering several major and many minor heart attacks and some bypass surgery, Andy stayed in the USA and stopped travelling for some 10 years. Then in 2005 Andy and Glory returned to the Philippines on a 3-month vacation and before long he was back into crocodiles. He met with

the Board of Crocodylus Porosus Philippines Inc. (CPPI), and Vic Mercado said that "When Andy met us in March 2005, crocodile conservation was not even a consideration of CPPI. We were naive crocodile farmers eager for profits. He realigned our perspective towards the symbiotic relationship of conservation and profitability. Since this was a brand new concept, he urged us to attend the 2006 CSG Working Meeting in Montelimar, France. The immersion gave birth to an awe and admiration over the level of commitment of the crocodile farmers and scientists globally".

Despite ill health, Andy never wavered in his commitment to crocodile conservation. He worked tirelessly with government officials at the Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources, and the private sector, on policies on crocodile conservation and crocodile farming. He organized the well-attended "Forum on Crocodiles in the Philippines" held at the Philippine National Museum from 31 January to 2 February 2007, and edited the Proceedings that came off the press in 2008.

Andy's last field trip in the Philippines was to Siargao Island on the Pacific coast in December 2010 to investigate the possibility of studying the ecology of *C. porosus* in the extensive mangroves of the island and of transferring some *C. mindorensis* individuals to a marshy area on the island. He was accompanied by friends William Belo, Vic Mercado, H.O. Limketkai, Angel Alcala and Arvin Diesmos. Unfortunately, not much was accomplished in this trip except for the discovery of new species of frogs.

Andy is survived by his father, Donald (89), brothers, Franklin and William, wife, Glory, and two sons, James (27) and Robert (25).

"We will remember you well Andy."

Photograph: Tom Dacey.

Tom Dacey, *CSG Executive Officer (compiled from information supplied by Franklin D. Ross, James Perran Ross, Angel Alcala and Vicente P. Mercado).*

Fundraisers for Philippine Crocodile Conservation

On 18 June 2011 the 2nd Annual Summer BBQ for Crocodilian Conservation was held at Shawn Heflick's home/facility in Palm Bay, Florida. The event, organized and sponsored by Shawn and Jen Heflick, Curt Harbsmeier, Flavio Morrissiey and Bruce Shwedick, raised $4184 for conservation of the Philippine Crocodile (*Crocodylus mindorensis*).

The BBQ event attracted over 65 guests, who were entertained with educational reptile shows provided by Gator Adventure Productions (GAP) and Reptile Discovery Programs, and tours of Shawn's reptile facility which included his albino alligator breeding enclosure. They enjoyed great food, camaraderie and took advantage of great bargains at the event's auction.

Funds raised are being sent to the Mabuwaya Foundation via the AZA's Crocodilian Advisory Group, which supported this event by providing T-shirts and other items for the auction. Auction items were also donated by Colette Adams (Philippine Croc Team Coordinator of Gladys Porter Zoo, Brownsville, Texas), Palm Beach Zoo, Tampa's Lowry Park Zoo and by businesses and individuals throughout Florida and other parts of the country. The largest single cash donation was provided by Gator Adventure Productions, based in Orlando, Florida.

We thank everyone who supported this event, especially everyone at GAP (www.gatoradventuresite.com) for their efforts and their continued support of crocodilian conservation!

Since the BBQ we have had many inquiries as to when we would organize another. As a result, we are excited to announce that we are holding a follow-up event at Shawn and Jen Heflick's home/facility on 10 December 2011. This event will be called "Croc Fest 2011". We hope that it will be even bigger and better than our June event and we are planning to have special guests and supporters coming in from around the country. Funds raised will also be sent to the Mabuwaya Foundation for community-based conservation of the Philippine crocodile.

For additional information about attending, supporting or sponsoring Croc Fest 2011, please contact any of the event organizers: Curt Harbsmeier <charbsmeier@hdalaw.com>, Shawn Heflick <shawnheflick@aol.com>, Flavio Morrissiey <flaviomorrissiey@gmail.com>, Bruce Shwedick <bshwedick@aol.com>.

Book Reviews

The Chinese Alligator: Ecology, Behaviour, Conservation, and Culture

This is by far the most complete and up to date source of information on the biology, ecology, conservation and cultural significance of the Chinese alligator (*Alligator sinensis*),

in the English language. This diminutive, unique and until recently, poorly understood species of crocodilian is thought to have inspired the legend of the Chinese dragon 'tu long', an important part of Chinese culture. The wild population of Chinese alligators is one of the most critically endangered vertebrate species in the world. The natural wetlands within which it thrived historically are now mostly used to support people. The book details the history of the species' demise and discusses the encouraging current efforts by the Government of China to conserve and recover wild populations.

The authors, the late John Thorbjarnarson and Wang Xiaoming, are both expertly qualified to write this book. Until his tragic death in 2010, "John T" as he was known to colleagues, was one of the leading experts on world crocodilians. Wang Xiaoming is a well respected Chinese conservation biologist with an intimate knowledge of the Chinese alligator. The resulting book is not only comprehensive, but has a highly personalised style owing to the integral role both authors have played in efforts to conserve the Chinese alligator over the last decade. It contains first-hand experiences and insights in what is without doubt a frontline conservation challenge. This personalised style draws in the reader and sets this book apart from many other books on crocodilians.

The book is well written, well illustrated and divided into eight chapters. Chapter 1 provides a brief history of the Chinese alligator leading to an account of the author's active roles and involvement in their research and conservation. Chapter 2 introduces the reader to the world of crocodilians, the processes that threaten most species world wide and the importance of sustainable use in the effective conservation of some crocodilian species. It is here that the magnitude of the problem facing the Chinese alligator becomes apparent. In a nutshell, conservation strategies based on protection and sustainable use, that have been successfully implemented for other species of crocodilian, have limited application to the Chinese alligator. They are small, grow slowly, have a low value skin, and almost no natural habitat remains in eastern China. It is difficult at this point to see any future for this species in the wild despite the optimism of the authors.

Chapters 3 and 4 are dedicated to the 'story' of the Chinese alligator in an historical and cultural context. Viewed as a water deity, many in China believe the alligator is responsible for the onset of rain, which they 'call' with their loud bellowing that can be heard from long distances just prior to the rainy season. Ironically, recent catastrophic flooding as a result of habitat destruction has been blamed by some on the alligator. As the sole remaining mega-fauna in highly developed eastern China, this is an extraordinary tale of a species whose tenacious survival in the face of extreme adversity makes it almost as legendary as the mythical dragon it is believed to have inspired.

Chapter 5 provides an extensive summary of the biology, ecology and behaviour of the species, presenting a great deal of historical information gathered by eminent Chinese biologists, combined with recent and original data. Relatively few studies have been conducted in the wild, because so few alligators exist, so most of the information comes from alligators in captivity. The section on behaviour, although based on limited observations, is particularly interesting as is the information on the construction and use of complex burrow systems by individuals and family groups. The need for a reconstruction of a year in the life of the Chinese alligator, at the end of Chapter 5 reflects the limited ecological data available. It is a strategy usually reserved for species that have become extinct, reinforcing the dire situation facing the wild population of this species.

Chapters 6, 7 and 8 detail the reasons for the demise of the Chinese alligator. The most important is clearly the widespread destruction of natural habitat for agriculture, combined with killing for food and as pests. Capture for zoos and breeding centres, greatly reduced depleted wild populations, but have ensured a substantial captive population now exists. Past and present conservation paradigms and efforts are discussed along with the critical role of government and various breeding centres.

Despite only a few hundred alligators remaining in the wild, thousands now exist in centres engaged in captive breeding. That there have been limited efforts to reintroduce captive-bred Chinese alligators to the wild in part reflects the lack of habitat and a perception that the wild alligators are vulnerable and not being protected by people. Thus some centres continue to collect wild eggs and individuals, seemingly to apply protection, but further reducing the remaining wild population.

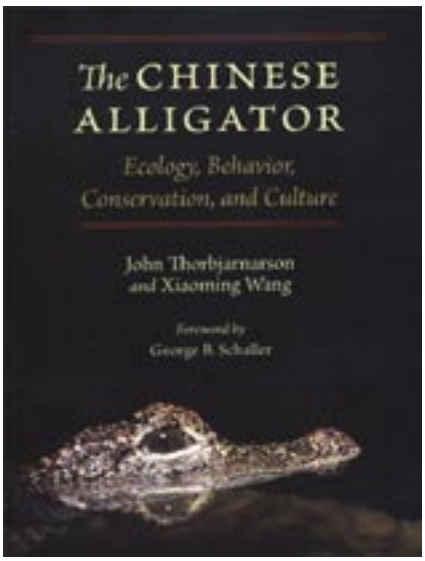
While acknowledging the important efforts of the breeding centres to increase numbers of alligators in captivity and the financial support provided by the government, the book is critical of the inability of both to distinguish between the problems of conserving captive versus the wild populations of alligator. This is perhaps best highlighted by a recent attempt by the government to down-list the status of the species through CITES, citing an annual increase in numbers based on breeding within natural enclosures at centres. The oldest and largest centre, the Anhui Research Centre of Chinese Alligator Reproduction, which carried out much of the pioneering research on captive breeding and which considers itself the primary institution which saved the Chinese alligator from extinction, now sustains itself commercially through a successful tourism facility. It is apparently concerned that a sanctuary being established nearby, where a natural wetland will be recovered and alligators reintroduced to the wild, may constitute a commercial threat to the sustainability of their conservation operation.

The frustration of the authors in their ongoing attempts to distinguish clearly between the significance of captive and wild populations, and to shift the conservation focus from captive breeding, once considered the holy grail of conservation, to conserving wild populations, is clearly apparent. Indeed, the overall message of the book is the need to build upon the conservation success of the breeding centres by focussing on efforts to restore the wild populations. This means acquiring and restoring wetland habitats, reinforcements and

reintroductions, and a possible meta-population management approach.

By the end of the book the reader can not help but feel optimistic about a possible future for the Chinese alligator in the wild, despite what may seem to be a series of intractable problems. This has as much to do with the passion and commitment of the authors', the adaptability of Chinese people, and the amazing resilience of the Chinese alligator which has persisted in one of the most developed areas of the world. This book is highly recommended as a comprehensive overview of a fascinating species written by the people who know it best.

It would be difficult as colleagues of John T. not to make one final comment about a man who was deeply involved in crocodile conservation efforts not just in China, but around the world. He was the consummate professional, always produced work of the highest quality. This book, published shortly after his death, is yet another important addition to his impressive legacy.



[John Thorbjarnarson and Xiaoming Wang (2010). The Chinese Alligator: Ecology, Behaviour, Conservation, and Culture. 265 pp. The John Hopkins University Press: Baltimore. ISBN 13: 978-0-8018-9348-3]

Matt Brien and Grahame Webb, *Wildlife Management International Pty. Limited and Charles Darwin University, <mbrien@wmi.com.au, gwebb@wmi.com.au).*

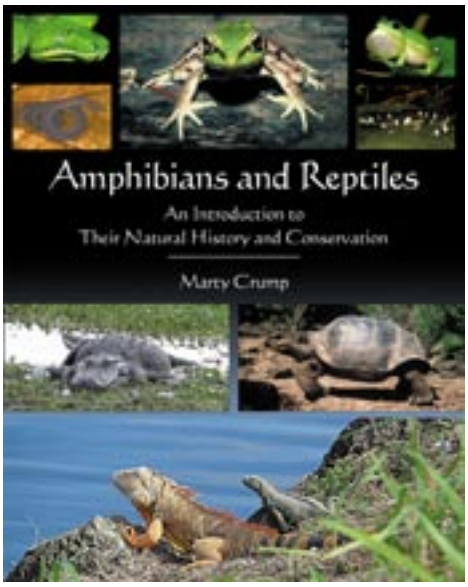
Amphibians and Reptiles - An Introduction to their Natural History and Conservation

This new book is a comprehensive, lively and extensively illustrated introduction to the fascinating world of amphibians and reptiles, and is intended for middle school-age and older readers. Award-winning author Dr. Marty Crump is a prominent herpetologist with over 40 years of experience, and a long-established advocate of amphibian and reptile conservation.

The book is well organized, clearly written, richly illustrated, and infused with substance, and informs the reader with knowledge about: the basic biology, ecology, and natural history of amphibians and reptiles; their declining populations throughout the world; the causes of these declines; and, ways in which humans can help to save these important elements of Earth's biodiversity.

Dr. Crump wrote "Amphibians and Reptiles - An Introduction to their Natural History and Conservation" because she believes that children need to appreciate nature before they can understand the value of protecting it. A chapter deals with what children can do, and should not do, to help protect and preserve amphibians and reptiles, and includes a glossary, a list of additional resources and conservation organizations, place names based on amphibians and reptiles, and an index.

The book is available in softcover with 264 pages of text, 16 pages of color photographs, and more than 130 black and white photographs and illustrations. For more information about the book, including pricing and a special "New Title Discount", visit McDonald and Woodward's website (www.mwpubco.com/titles/amphibiansandreptiles.htm) or contact them directly at 1-800-233-8787.



[Marty Crump (2011). Amphibians and Reptiles - An Introduction to their Natural History and Conservation. McDonald & Woodward Publishing: Granville, Ohio.]

Trish Newcomb, *McDonald & Woodward Publishing, <tnewcomb@mwpubco.com>.*

CSG Student Research Assistance Scheme Update

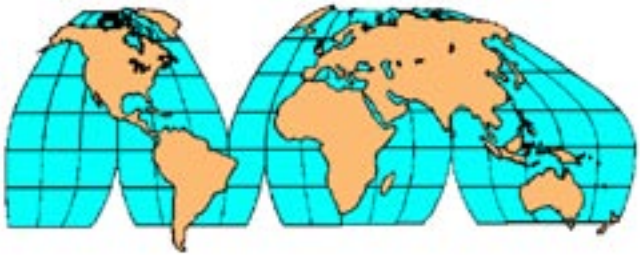
The CSG Student Research Assistance Scheme has provided funding to a further two students, bring the total to 7 in 2011 so far:

1. Alexis Bishobiri Bashonga, Makerere University, Uganda: "Conservation of the Biodiversity of the Ruzizi Congolese Plain, South-Kivu, Democratic Republic of Congo; a Potential Ramsar Site".

2. Brandon Gross, Texas Tech University, USA: "Home range and dispersion of American crocodile pre-juveniles in Playa Blanca, Coiba National Park, Panama: telemetry."

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

Regional Reports



Latin America and the Caribbean

Cuba

CUBA'S LARGEST CROCODILE RESERVE BENEFITS FROM INTERNATIONAL PROJECT. Monte Cabaniguan, the largest reservoir of American crocodiles (*Crocodylus acutus*) in Cuba, benefits from the Archipielago Sur International Project which has allowed an increase in actions for the preservation of native species in the area.

The project, sponsored by the Ministry of Science, Technology and Environment and the United Nation's Development Program, emphasises preservation actions in coastal ecosystems by means of training workshops and studies on threatened species.

Project specialists have carried out field observations of iguanas, mangroves, fishes and corals, and the results of such studies have been published. A training course on the American crocodile (*Crocodylus acutus*) was recently held in the area (page 6, this issue). Monte Cabaniguan is home to one of the largest populations of *C. acutus* in the world. Studies on *C. acutus* in Monte Cabaniguan began in 1986, and research has led to the development of very effective techniques for monitoring nests, quantification of their biology and ecology in the wild

Currently, the Don Miguel Alvarez del Toro Biological Station is involved in the study of *C. acutus* in this area, located in the south of Las Tunas Province. Another two will be established shortly with funds from the project.

More than 25 protected areas currently benefit from the Archipiélago Sur Project, which also includes the creation of methodologies for the self-financing of the areas through the reproduction of species important to the fishing industry and promotion of sustainable tourism strategies.

Source: http://www.cubaheadlines.com/2011/08/13/33077/cuba%E2%80%99s_largest_crocodile_reserve_benefits_from_int%E2%80%99l_project_society.html#ixzz1VCojYrzZ.

WORKSHOP ON CROCODILE MONITORING TECHNIQUES. On 14-20 July 2011 the well preserved coastal mangrove swamps, tidal streams and crocodile nesting beaches of the Monte Cabaniguan Wildlife Refuge, and its "D. Miguel Alvarez del Toro" Field Station, provided a very suitable venue for the first National Workshop on Crocodile Population Monitoring Techniques.

During five days and nights of intensive activity, Roberto (Toby) Ramos, Roberto R. Soberón, Manuel Alonso Tabet and Havana University geneticist Yoamel Milian, shared with 12 trainees from 11 protected areas in 7 Cuban Provinces, a comprehensive program of lectures and field practices. The curriculum included theoretical aspects of crocodile population survey and monitoring, design, preparation, and statistical tools; habitat recognition and description, capture-marking-recapture, and night spotlight survey methods, monitoring of nest, dens, footprints, and other indirect evidences, sampling techniques for population genetics research, crocodile capturing and handling, cartography, and use of most common tools and instruments (GPS, spotlights, refractometers, bathometers, etc.).

Figure 1. Dr. Roberto Soberón addresses workshop participants in the field.

The workshop was mainly directed at young specialists and technicians engaged in crocodile research and conservation projects in coastal protected areas of the Cuban Archipelago, with the aim of getting them ready to put into practice the standardized methods of crocodile population survey and monitoring scheduled for their respective areas in the present triennium.

This event was sponsored by the UNDP-GEF Project "Application of a Regional Approach to the Management of Marine and Coastal Protected Areas of the Archipelagos on

the South of Cuba", and organized by the Centro Nacional de Areas Protegidas (CNAP, Ministry of Science, Technology and Environment-CITMA) and the Empresa Nacional para la Protección de la Flora y la Fauna (ENPFF; Ministry of Agriculture), as a component of the Project's Research and Monitoring System, comprising research and monitoring programs for key ecosystems and species. The Project's research and monitoring program for Cuban (*Crocodylus rhombifer*) and American (*C. acutus*) crocodiles comprises an extensive schedule of field expeditions for the period 2011-2013, in 5 of the 6 Cuban areas identified as "Crocodile Conservation Units" (CCU) by the International Workshop "Conservation Priorities for the American Crocodile" (Gainesville, 2002).

Roberto Rodriguez Soberón, *Head of the National Crocodile Program, Empresa Nacional Flora y Fauna, Cuba, <rsoberon@enet.cu>.*

Mexico

MONITORING PROGRAM FOR MORELET'S CROCODILE (*CROCODYLUS MORELETII*) - MEXICO-BELIZE-GUATEMALA. Mexico's efforts on conservation and sustainable use of Morelet ´s crocodile (*Crocodylus moreletii*) goes back to the 1970s, when the species was critically endangered due to overexploitation for its skins, and when a ban was established to protect it. In line with this measure, captive breeding operations were promoted both for commercial and conservation purposes. At that time, the species was considered Endangered by the IUCN Red List (1982) and the US Endangered Species Act (1970), and it was also listed on Appendix I of CITES (1975).

In 1996, a workshop on Application of the New IUCN Criteria to Crocodilian Status Evaluation held in Argentina, at the 13th CSG working meeting, took into account a study where the species was found in more than 40 localities (including all historical ones), was in moderate densities, and with more than an estimated 10,000 reproductive individuals. The workshop concluded that *C. moreletii* should be reclassified as low risk/conservation dependent (Ross 2000). Also, Mexico's Endangered Species Act (NOM-059) was updated, placing *C. moreletii* under the "Subject to Special Protection" category (2001).

During 2002-2004, CONABIO (CITES Scientific Authority of Mexico) financed the CoPan Project in order to determine the conservation status of wild *C. moreletii* populations in Mexico. A national population of more than 80,000 individuals was estimated, including 15,000 adults and 40% juveniles. Conservative population models were also developed with data from CoPan, Belize and Guatemala, obtaining global estimations of 100,000 individuals and 20,000 adults, as well as near 400,000 km^2 of potential distribution area for the species. A PVA conservative model with several stressed factors showed a probability of extinction of 0.1380 ± 0.015 after 500 years with an initial population of only 30,000 individuals (Sánchez and Álvarez-Romero 2006).

Taking into account that the species was no longer at risk, a Reclassification Proposal for Morelet's crocodile on the US Endangered Species Act was presented by Mexico at the X Meeting of the Trilateral Committee Canada-Mexico-United States for Wildlife and Ecosystem Conservation and Management (Zacatecas, May 2005). Also, a proposal to transfer *C. moreletii* from Appendix I to Appendix II of CITES was also developed by Mexico and presented to the 15th meeting of the Conference of the Parties (CoP15, Doha, March 2010), where populations of Mexico and Belize were transferred with a zero quota for wild specimens.

Based on recommendations from the CITES Animals Committee and CoP15, as well as from the CSG, CONABIO is now coordinating the development and implementation of a monitoring program for the species in Mexico with a trinational scope (Mexico, Guatemala and Belize). This effort is aligned with activities under the Trinational Strategy for Conservation and Sustainable Use of Morelet's crocodile, adopted in 2006. The Morelet's Crocodile (*Crocodylus moreletii*) Monitoring Program will provide information on a long-term basis on conditions and trends of the main wild populations and habitat of the species.

The design of the Monitoring Program was done with the participation and cooperation of experts who attended a Trinational Workshop (Mexico City, January 2010), where agreement was reached on periodicity, populations to be surveyed, methods, coordination and equipment needs, and mechanisms to systematize and analyze information. The Monitoring Program for Morelet's Crocodile (*Crocodylus moreletti*) Mexico-Belize-Guatemala and its Procedures Manual were recently published in Spanish with the collaboration of 12 authors (Sánchez *et al*. 2011) and CSG advice. The PDF version can be downloaded at: http://www.conabio.gob.mx/institucion/cooperacion_internacional/doctos/manualf_monitoreo_cocodrilo.pdf.

The implementation scheme for the Monitoring Program considers a geographic hierarchic structure with Coordination Regions (CR), Monitoring Units (MU), Routes (R) and Sites (S) for management and operation along its distribution area. Mexico has identified 4CR, 31MU, 43R and 7S to start, while Guatemala has 3CR, 9MU and 24R, and Belize has 1CR and 6MU.

CONABIO has signed agreements with four institutions/ organizations which are responsible for implementing the program at the four Coordination Regions in Mexico. Each region has trained field teams that are already gathering information with standard methodologies described in the Procedures Manual. They will report field data on standardized formats that will be compiled in a centralized Database at CONABIO. Surveys are planned annually on the first 5 years of the program and biannually from the 6th year on.

Methods to be applied in the field include:

1. Habitat Evaluation to follow-up on environmental changes that might affect the species;
2. Nocturnal Visual Detection to obtain general and age/size encounter rates (ind/ha);
3. Capture Marking and Recapture to compile additional individual information on sex, weight, health, measurements, among others;
4. Nest data; and,
5. Identification guide for *C. moreletii, C. acutus* and possible hybrids. Annexes also include guidance on equipment and materials needed for field work, permits and marks obtaining, description of the program ´s marking system and field security measures.

The results of the 2011 surveys are expected by December 2011-January 2012, and they will be presented and reviewed in a workshop before next year's field season, in order to assess them, share lessons learnt and suggest necessary adjustments as appropriate.

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Colombia

SPECTACLED CAIMAN (*CAIMAN CROCODILUS FUSCUS*) ECOLOGY AND CONSERVATION IN CESAR DEPARTMENT, COLOMBIA. *Caiman crocodilus fuscus* is one of the most important crocodilian species in Colombia in terms of its importance for commercial and subsistence exploitation (Balaguera-Reina and González-Maya 2009). However, this over-exploitation reduced most populations of the species to critical numbers, and it was considered rare or as an "unexpected case" according to the national census, due to its reduced and fragmented populations (Rodríguez 2000).

The Caribbean populations of *C. crocodilus* are some of the most impacted in the country since this region has a long historical use of the species, and general deterioration of its natural resources and ecosystems. However, the area also includes most of the caiman breeding farms in the country. As a result, government has tried to implement a strong control system, regulating farming activities and obtaining conservation outcomes from the exploitation. This control system includes the establishment of quotas for repopulating of wild habitats (approximately 5% of annual farm hatchling production), and thereby obtain benefits from the activity while maintaining the wild sources for this profitable economic activity.

Cesar Department (= Province) is located in northeastern Colombia, on the border with Venezuela (Fig. 1) and includes five ecoregions (González-Maya *et al*. 2010), the main one being the Zapatosa Wetland Complex (Fig. 1). The department has some of the most important reptile breeding farms in the country, with one farm dedicated to Caiman production in the Aguachica Municipality. Zoocriadero El Paraíso produced 7240 and 2260 hatchlings in 2009 and 2010 respectively, with corresponding repopulation quotas of 362 and 113. As part of the ongoing work of the regional environmental authority CORPOCESAR, and under the strategic alliance with ProCAT Colombia, a more comprehensive repopulation process is being undertaken in order to generate a better conservation impact and to obtain basic information on the status of wild population in the department.

Usually, the repopulation processes in the region only included the release of quota individuals into the nearest wetlands, and usually with no follow-up processes and therefore with

no information regarding the success of the program. Also, other than the basic surveys made by the National Census (Rodríguez 2000), the main wetland in Cesar has not been evaluated, and so there is no information on population size, status, threats and conservation actions needed.

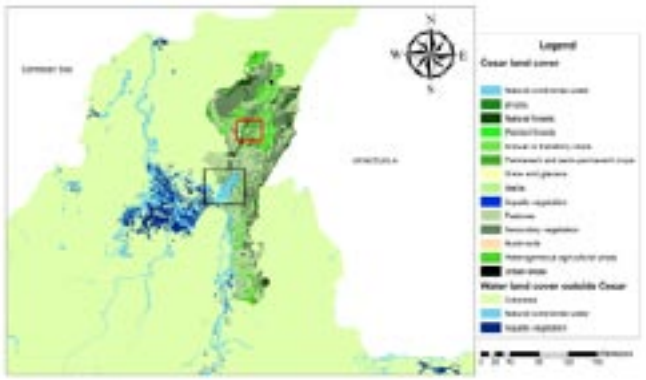

Figure 1. Location of Zoocriadero El Paraíso (small square) and study area (large square) in Cesar Department.

The current project includes:

1. Release of caimans into Zapatosa Wetland Complex;
2. Assessment of repopulation success and survival rates, and selected individuals monitoring;
3. Survey of wild populations;
4. Population ecology through radio-telemetry; and,
5. Environmental education, stakeholder empowerment and involvement.

These basic steps are essential to establish a comprehensive conservation project and to maximise the contribution of repopulation quotas to the conservation of wild populations.

This is the first approach of this nature in Cesar Department and we expect the results will greatly add to the understanding of the species' status in the department and provide the necessary tools and data for adequate conservation planning on a regional scale.

The project is already in the survey and release stage, with 475 individuals [usually Class I (≤50 cm TL), but for this study also included Class III (120-180 cm TL)] measured, marked and released into the wetland, and surveys undertaken to quantify population size, structure and recaptures. Also, the social component is being undertaken in the area, and in July the ecological and repopulation success phases will be implemented.

A preliminary result of this process was that according to local perception the relationship between local communities and caimans has been changing in recent years. Local people, mainly fishermen, understand the role of the species in the natural and biological control of other species on which it feeds, and it is thus recognized that the species is not a threat to local livelihoods. However, there are cases of removal of fish from nets or cast nets, which does not represent or is not understood to reflect economic losses for fishermen. Moreover, fishermen claim that the species is not as threatened as it was in previous decades, mainly because of local knowledge and awareness of the legal implications of hunting and the current lack of strong markets that in previous decades promoted the skin trade, and seriously decimated wild populations.

The results of social mapping clearly demonstrated that the areas where fishermen report seeing large numbers of nests and *C. c. fuscus* are the same areas where fishing takes place throughout the year. Thus, for the period between January and April each year, fishing is centered in the southern part of the wetland, and between April and December it is in the northern part. During these two periods of the year in the fishing sites the presence of caimans is constant. However, although fishermen insist that the species is not considered for food or commercial interests, consumption (eg the tail as a delicacy) sometimes occurs. It is important to note that almost 5000 people are direct users of the Zapatosa Wetland Complex resources at this time, which is an important element to be considered with regard to conservation efforts of the ecoregion.

We expect this project to be an example of repopulation processes in the country, but most importantly, we expect the results will provide the necessary information to support the decision-making in the area and to promote the recovery and conservation of caimans in this important region of the country. Also, this is a great advance in the interface and involvement of environmental authorities, academia, NGOs, local stakeholders and the private sector, where the interaction of these actors is making the process work. It is an example of how conservation initiatives should work in the tropics.

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NEW LOCALITY RECORDS FOR ORINOCO CROCODILE (*CROCODYLUS INTERMEDIUS*) IN COLOMBIA. The Orinoco crocodile (*Crocodylus intermedius*) is the only crocodilian whose geographical distribution is limited to a single hydrologic basin - the Orinoco River basin in Colombia and Venezuela. The species is categorized as "Critically Endangered" by the IUCN and "Endangered" by the Environmental Ministry of Colombia (Resolution No 676 on 21 July 1997). The Colombian populations of the species are restricted at present to four specific areas within the Arauca, Casanare, Meta and Vichada Departments (Ministerio de Medio Ambiente 2002).

On the basis of fieldwork carried out between 1994 and 1998, Lugo (1998) estimated 153 individuals throughout 70% of the species' distributional area in Colombia, within 4 populations (Fig. 1).

Figure 1. Location of the four relict *C. intermedius* populations in Colombia.

The largest population is found in the Cravo Norte, Cuiloto, Lipa and Ele River basins (central-southern region of Arauca Department), with an estimated population of 54 adults (Ardila *et al*. 2002) and successful reproduction occurring. The second site, La Macarena, in the Duda and Guayabero Rivers (southwestern region of Meta Department), has an estimated population of 25 adults with some successful reproduction (Ministerio de Medio Ambiente 2002). In 2002, Ardila *et al*. (2005) estimated the presence of 46 crocodiles, 9 observed directly and 3 from footprints (8 adults, 4 subadults), and 34 from interviews with local inhabitants. At the third site, located in the middle of the Meta River between the towns of La Primavera and La Culebra, there were an estimated 15 adults. Finally, a further 15 adults were estimated along the Vichada River in the Vichada Department (Lugo 1998). Since 2002, no new localities for the species have been reported, and these populations' threatened status seems to have intensified in the past few years. Here, we report on the results of surveys carried out in 2010 and 2011, indicating new locality records for *C. intermedius*.

On 9 December 2010 (1330 h), during a survey in the Vichada River, between Puerto Guipane (6 km from the town of Cumaribo) and Santa Rita (Vichada Department), we sighted a 3-3.5 m long Orinoco crocodile, assumed to be a male on the basis of size. Initially, the individual exhibited its cranial platform, snout and eyes at the water' surface, and was observed from a distance of 70 m for about one minute, after which it dived under water. The crocodile appeared to respond to sounds being made against the hull of the boat (hitting with a fist and moving an empty barrel) by surfacing and diving twice. The last time it surfaced, it exposed its head and entire dorsal area out of the water, and then returned to its initial position where only the head was visible. Afterwards, with its snout pointing towards the middle of the river and its body perpendicular to the bank, it displayed its entire dorsal surface again, while also lifting its head and tail out of the water in an arched position, and then moving it from side to side violently. At that point the individual lifted its head even further out of the water with its mouth open, which it violently snapped shut twice, producing two clearly audible jawclaps. Immediately after, it produced a short roar, just before hitting its head against the surface of the water (headslap).

It continued, with its head at the water surface, expelling air through its mouth to create bubbles and finally returned to its original position with the dorsal part of its head out of the water before diving once again. This behavior is similar, with some differences, to that described by Medem (1981), Thorbjarnarson and Hernández (1993), Colvée (1999) and Antelo (2008) for captive *C. intermedius* in Colombia and Venezuela. This is the first territorial behavior pattern described for the species in the wild in Colombia.

Figure 1. Orinoco crocodile (2.4 m TL) sighted on 21 February 2011.

On 10 December 2010 (1640 h), during our return trip upstream, this crocodile was observed again at the same spot. It again responded to the sounds we made against the hull of the boat, displaying only its head above the water surface. We slammed a flat piece of wood against the water, trying to imitate the sound of another individual hitting its heads against the water surface. The individual responded by lifting its head slightly and gently opening its mouth three times.

On 9 December 2010 (1520 h), we found fresh tracks from a different crocodile 10 km downstream from where we had observed the first individual. The tracks were discovered on a sandbank at a bend in the river that connected to a small pool. The crocodile was estimated to be over 2.5 m long based on the size of the tracks. On 10 December 2010 we found tracks of a crocodile on another section of the same sandbank, indicating the animal had crossed from a lagoon to the river.

The 2010 expedition, which covered 660 km of the Vichada River, revealed the presence of two *C. intermedius* (one individual on two separate occasions and the tracks of another), both within a 20 km section of the river.

On 21 February 2011 (1740 h), an Orinoco crocodile of approximately 2.4 m length was observed at the same location where the 3.0-3.5 m specimen was sighted in December 2010. The crocodile was possibly a female, as she was near the location of a poached nest (see later). The crocodile traveled gently upstream along the left bank of the river, displaying the top of its head and at times the entire dorsal surface of its body and tail. We also found a crocodile track on the dry sandbank on the right bank of the river, which was revealed due to the low water levels. It is possible that this track was from the larger crocodile observed previously.

According to a local inhabitant's account, a nest was found on this beach on 28 December 2010. The 41 eggs in the nest were removed by locals. The nest was located at the front of the beach slope, about 200 m from the closest line of vegetation (right margin) and about 2.5 m above water level, very close to where we had found the tracks.

On 22 February 2011 (0005 h), we again observed the crocodile at the same location. It responded to our calls, which imitated a neonate's distress call. The individual surfaced and exposed its cranial platform, eyes and nostrils above the water surface. It was dazzled by the 500 lumen flashlight, which permitted us to get the boat to within 1.5 m. We were thus able to better estimate the size of its head before it sunk back into the water. At 0806 h that same morning, the crocodile was observed moving upstream along the left bank of the river, and at 0820 h swimming back down the same path. The movements of this individual could have been associated with nest care and surveillance behaviours (see above), even though it did not approach or demonstrate any aggressive or intimidating behaviours towards the researchers. Although the nest no longer contained any eggs, there are examples of females continuing to watch over nests after the eggs have been removed (Colvée 1999; Antelo 2008).

The individual observed in December 2010 was not sighted in the February 2011 survey, nor were any other *C. intermedius* observed along the 250-km stretch of the Vichada River surveyed at that time; more specifically from the area known as El Retorno, approximately 20 km upstream from Puerto Güipane (Cumaribo) to Cejal, about 230 km downstream from the same port. Over 525 km were traveled during 6 days of expedition.

We are not aware of any records of *C. intermedius* in this part of the Vichada River, although local inhabitants provided information that permitted us to estimate that there were perhaps 7 adults in the stretch between Cumaribo and the mouth of the river (Lugo 1998). Previously reported individuals (Rodríguez 2002) were located over 130 km upstream from the point where we observed our specimens, between the Muco River and the La Raya community.

These results, combined with the information obtained from local inhabitants, who seem not to have seen any hatchlings or juveniles in the last few years, indicate that the number of *C. intermedius* in this remaining population is not recovering and that crocodiles are very dispersed along the course of the river and possibly in associated lagoons and adjacent pools. Further research is needed to confirm the current conservation status of this crocodile population.

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South Asia and Iran

India

FIRST RECORD OF GHARIAL NEST HATCHING IN YAMUNA RIVER, UTTAR PRADESH, INDIA. The National Chambal Sanctuary is known to be the only major breeding population for Gharial (*Gavialis gangeticus*) in India. Surveys undertaken in the 1970s revealed breeding populations in the Chambal, Katerniaghat and Chitwan, and the Ramganga and Son Rivers confirmed breeding populations post-restocking (Stevenson and Whitaker 2010). Restocking has generally failed to establish viable Gharial populations in any new locations. The Chambal River has by far the largest subpopulation of wild breeding Gharial, with around 48% of the total population (IUCN 2011).

In 2007, 77 nests were found within the Chambal Sanctuary while 24 were found in Katerniaghat Wildlife Sanctuary (Rao 2007). In 2006, 2007 and 2008 two nests were located in the Son River Sanctuary (Andrews 2006; R.K. Sharma, pers. comm.). Recent reports confirm that stray animals may persist in the upper Brahmaputra River.

On 2 June 2011, a Society for Conservation of Nature volunteer (Munendra) observed a female Gharial carrying hatchlings in her mouth and releasing them into the water. She repeated this several times, by which time around 46 hatchlings had been transported to the water. The female remained at the site, guarding the hatchlings (Fig. 1), as has been observed in other crocodilians.

Figure 1. Hatchling Gharials resting on adult female.

The area where these events were recorded was part of the National Chambal Sanctuary, and specifically 12 km away from the Yamuna and Chambal confluence in the upstream Yamuna River (26º 30.799 N, 79º 14.897 E). The open sand bar on which the nest was located is around 100 m long and 3 m in height, and the sand is finer than Chambal sand. The nest was situated as high as 1.5 m and 2 m away from the water surface/edge. Our literature search indicated that this is the first record of Gharial nesting in the Yamuna River.

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NEW THREAT ON MUGGER (*CROCODYLUS PALUSTRIS*) POPULATION OF VADODARA CITY, GUJARAT, INDIA.

The Mugger Crocodile (*Crocodylus palustris*) is one of the most adaptable and widely distributed crocodilian species in West Asia, including Iran, Pakistan, India and Bangladesh, Bhutan, Nepal and Sri Lanka (Whitaker and Andrews 2003). This threatened species is legally protected under the Indian Wildlife (Protection) Act as Schedule-I species and evaluated as Vulnerable by the IUCN. It is found in various types of habitats including large rivers, large lakes, small puddles, village tanks and roadside ditches. The Mugger population of Vishwamitri River, Vadodara, is a somewhat unique population in that is found within a densely populated urban area of Vadodara City (Vyas 2010a).

Vyas (2010b) noted various minor to major threats on the population, including water pollution, habitat encroachment, development on the river banks (pseudoscientific and unethical developments by urban planners) and the pet trade. Recently two incidences were observed that resulted in mortality of large-sized adult Muggers. These animals were sliced apart by speedy vehicles and trains. Thus, train and haphazard vehicular traffic emerge as the most recent threats to the urban Mugger population. The details of both the incidences are as follows:

1. The first incident was observed on a broad-gauge railway line connecting Vadodara and Mumbai. On 2 October 2010, in early morning, a phone call from an anonymous informant reported the presence of a 1.6 m Mugger near Makarpura Railway Station. The call was received by a staff member of Urban Wildlife Rescue Station (UWRS) of Vadodara City, run by State Forest Department. UWRS staff immediately rushed to the scene to rescue the injured animal. Unfortunately the female Mugger died before the rescue team reached it. The animal was severely injured on various parts of the body, including damage to the anterior 10-15 cm portion of the snout, about 20-30 cm of the tail cut by the train, and numerous injuries on the head and belly (Fig. 1).
2. The second incident occurred on Sama-Harni Road, which links Vadodara to Ahemedabad via National Highway No. 8. On 7 July 2011, in the early morning, an adult Mugger was found dead by one of the Volunteers of the Crocodile Group. The 1.55 m long male was lying at the edge of the road near Sama, Vadodara. No injuries were noted on the animal's body, except that the intestines (about 2 m) were stretching out of the cloaca (Fig. 2) and there were some superficial scratches on the back. The position of the body and the injuries suggested that a small vehicle had driven over the animal, and postmortem examination supported this.

Figure 1. Adult Mugger (*Crocodylus palustris*) killed by a train at Makarpura Railway Station, Vadodara, Gujarat. Photograph: Manoj Thakar.

Figure 2. Mugger killed by a vehicle at Sama-Harni Road, Vadodara City. Photograph: Raju Vyas.

Both "accidents" occurred within 500-800 m of the Vishwamitri River. As Muggers can move overland between waterholes, particularly due to unfavourable conditions (eg drought) (Vyas 2001, 2003), there is always the possibility that some individuals may be accidently killed by trains or road vehicles. Vyas and Bhavsar (2009) reported on a Mugger fatally injured by a train in April 2009, and a sub-adult Mugger was found near Lal Baug area in November 2005, having been struck by road traffic (Anil Gohel, pers, comm.). The oldest report was from Bhuj, Kutch, the drought prone region of the State, where a 2 m long Mugger was found dead on the

Bhuj-Nakhatrana Highway, about 5 km from Pragsar Lake, after being trampled under a vehicle (Viaykumar 1997).

Direct mortality of crocodiles through "train" or "road kill" has been recorded in *C. palustris* in Sri Lanka (Flash News 2011), and in other crocodilian species, including *C. acutus* (Todd *et al*. 1989), *C. johnstoni* (Dillon 2011; Wilson 2011), *C. porosus* (C. Manolis, pers. comm.) and *Alligator mississippiensis* (Flynt 2008). The negative impacts of vehicular traffic on herpetofauna are well reviewed, with various aspects of threats, by Andrews and Jochimsen (2007). It is proven and noted, that the road and railway tracks, as key modes of transport, are one of the direct threats to many species, especially vertebrates such as amphibians or at times large mammals.

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Science

Recent Publications

Fukuda, Y., Webb, G., Manolis, C., Delaney, R., Letnic, M., Lindner, G. and Whitehead, P. (2011). Recovery of Saltwater crocodiles following unregulated hunting in tidal rivers of the Northern Territory, Australia. The Journal of Wildlife Management 75(6): 1253-1266.

Abstract: Saltwater crocodiles (*Crocodylus porosus*) in the Northern Territory of Australia were protected in 1971, after a severe population decline resulting from 26 yr of intense commercial hunting. By that time wild saltwater crocodiles were rarely sighted anywhere and they were commercially extinct in areas where they had once been abundant. Standardized monitoring by spotlight surveys started in 1975 and provided relative density indices over time (1975–2009) as a unique record of the post-protection recovery of a wild crocodilian population. We examined the survey data for populations at 12 major tidal rivers, individually and as a single subpopulation. The pattern of recovery in the subpopulation in both abundance and biomass was approximated by logistic curves, predicting 5.26 non-hatchling crocodiles weighing 387.64 kg sighted per kilometer of river in 2010. We predicted potential carrying capacity as 5.58 non-hatchling crocodiles (5.73% higher than 2010) weighing 519.0 kg (25.31% higher than 2010). Individual rivers showed largely different abundance and biomass among rivers. The statistical model that best described the recovery in individual rivers was not

always logistic. However, where it was logistic, expected carrying capacity of different rivers showed considerable variation in abundance and biomass. The variation indicates different habitat quality among the rivers. Recovery occurred despite various consumptive uses, particularly a widespread egg-harvest program, which has been an integral part of the incentive-driven conservation program for saltwater crocodiles in the Northern Territory since 1983. We suggest that the saltwater crocodile population of the Northern Territory is achieving full recovery from uncontrolled hunting in 1945–1971. Although saltwater crocodiles are considered an important natural resource, their increase in number, size, and distribution is posing management issues for public safety. Continuation of human–crocodile conflict management through public education and strategic removal of problem crocodiles will be essential.

Ayalasomayajula, S., Subramaniam, R., Gallo, A.A., Dufreche, S., Zappi, M. and Bajpai, R. (2011). Potential of alligator fat as source of lipids for biodiesel production. Ind. Eng. Chem. Res. (doi: 10.1021/ie201000s).

Abstract: A large amount of alligator fat (AF) is produced by alligator meat processing industry and disposed in landfills or discarded as waste. The AF can be used as a potential feedstock for biodiesel production due to its high lipid content. In this work, recovery of lipids from the AF tissue was studied by solvent extraction as well as by microwave rendering. Microwave rendering resulted in AF oil recovery of 61% by weight of the frozen AF tissue obtained from producers. The fatty acid profile of the lipid showed that palmitic acid (C16:0), palmitoleic acid (C16:1), and oleic acid (C18:1) were the dominant fatty acids accounting for 89-92% of all lipids by mass. 30% of the fatty acids were saturated and 70% were unsaturated. The biodiesel produced from AF oil was found to meet the ASTM specifications of biodiesel concerning kinematic viscosity, sulfur, free and total glycerin, flash point, cloud point and acid number.

Rivera-Sylva, H.E., Frey, E., Guzmán-Gutiérrez, J.R., Palomino-Sánchez, F. and Stinnesbeck, W. (2011). A *Deinosuchus riograndensis* (Eusuchia: Alligatoroidea) from Coahuila, North Mexico. Revista Mexicana de Ciencias Geológicas 28(2): 267-274.

Abstract: Diagnostic remains of *Deinosuchus* have been discovered in the Aguja Formation (Late Cretaceous, Late Campanian) near the town of La Salada (northwestern Coahuila, Mexico) and are described here for the first time. The material comprises 6 teeth and tooth fragments that were found associated with postcranial material such as two osteoderms and a cervical and caudal vertebra and is referred here to *D. riograndensis*. The association with a variety of herbivorous dinosaurs and trionychid turtles suggest a predator-prey interaction, which is confirmed by the occurrence of a vertebra with a *Deinosuchus* bite mark. The *Deinosuchus* remains from La Salada represent the southern-most occurrence of the genus known to date.

Schachner, E.R., Manning, P.L. and Dodson, P. (2011). Pelvic and hindlimb myology of the basal archosaur *Poposaurus gracilis* (archosauria: Poposauroidea). Journal of Morphology (doi: 10.1002/jmor.10997).

Abstract: The discovery of a largely complete and well preserved specimen of *Poposaurus gracilis* has provided the opportunity to generate the first phylogenetically based reconstruction of pelvic and hindlimb musculature of an extinct nondinosaurian archosaur. As in dinosaurs, multiple lineages of basal archosaurs convergently evolved parasagittally erect limbs. However, in contrast to the laterally projecting acetabulum, or "buttress erect" hip morphology of ornithodirans, basal archosaurs evolved a very different, ventrally projecting acetabulum, or "pillar erect" hip. Reconstruction of the pelvic and hindlimb musculotendinous system in a bipedal suchian archosaur clarifies how the anatomical transformations associated with the evolution of bipedalism in basal archosaurs differed from that of bipedal dinosaurs and birds. This reconstruction is based on the direct examination of the osteology and myology of phylogenetically relevant extant taxa in conjunction with osteological correlates from the skeleton of *P. gracilis*. This data set includes a series of inferences (presence/absence of a structure, number of components, and origin/insertion sites) regarding 26 individual muscles or muscle groups, three pelvic ligaments, and two connective tissue structures in the pelvis, hindlimb, and pes of *P. gracilis*. These data provide a foundation for subsequent examination of variation in myological orientation and function based on pelvic and hindlimb morphology, across the basal archosaur lineage leading to extant crocodilians.

Reed, D.A., Porro, L.B., Iriarte-Diaz, J., Lemberg, J.B., Holliday, C.M., Anapol, F. and Ross, C.F. (2011). The impact of bone and suture material properties on mandibular function in *Alligator mississippiensis*: testing theoretical phenotypes with finite element analysis. Journal of Anatomy 218(1): 59-74.

Abstract: The functional effects of bone and suture stiffness were considered here using finite element models representing three different theoretical phenotypes of an *Alligator mississippiensis* mandible. The models were loaded using force estimates derived from muscle architecture in dissected specimens, constrained at the 18th and 19th teeth in the upper jaw and 19th tooth of the lower jaw, as well as at the quadrate-articular joint. Stiffness was varied systematically in each theoretical phenotype. The three theoretical phenotypes included: (i) linear elastic isotropic bone of varying stiffness and no sutures; (ii) linear elastic orthotropic bone of varying stiffness with no sutures; and (iii) linear elastic isotropic bone of a constant stiffness with varying suture stiffness. Variation in the isotropic material properties of bone primarily resulted in changes in the magnitude of principal strain. By comparison, variation in the orthotropic material properties of bone and isotropic material properties of sutures resulted in: a greater number of bricks becoming either more compressive or more tensile, changing between being either dominantly compressive or tensile, and having larger changes

in the orientation of maximum principal strain. These data indicate that variation in these model properties resulted in changes to the strain regime of the model, highlighting the importance of using biologically verified material properties when modeling vertebrate bones. When bones were compared within each set, the response of each to changing material properties varied. In two of the 12 bones in the mandible, varied material properties within sutures resulted in a decrease in the magnitude of principal strain in bricks adjacent to the bone/suture interface and decreases in stored elastic energy. The varied response of the mandibular bones to changes in suture stiffness highlights the importance of defining the appropriate functional unit when addressing relationships of performance and morphology.

Zhu, H., Zheng, T. and Wu, X. (2011). A review on the conservation genetics of *Alligator sinensis*. Sichuan Journal of Zoology 2011-02.

Abstract: Conservation genetics,a combination of conservation biology and molecular genetics, is a discipline mainly focusing on the genetic factors related with the risk of extinction and how to lower such risk by employing genetic management methods. In the past few decades, genetic studies have played great roles in the theory and practice of biodiversity conservation. This paper reviewed several molecular marker techniques, including AFLP, mtDNA D-loop, RAPD, microsatellite DNA, and MHC analysis of the Chinese alligator (*Alligator sinensis*), which made several advances in conservation genetics, eg sample collection, genetic diversity, individual identification, breeding management, and wild release. Meanwhile, several suggestions about the conservation of *A. sinensis* were put forward: 1. Reconstruct the pedigree of the Chinese alligator, 2. Increase the effort put into wild releases, 3. Enforce gene exchange among breeding populations, 4. Learn management experience from *A. mississippiensis*.

Hekkala, E., Shirley, M., Amato, G., Austin, J., Charter, S., Thorbjarnarson, J., Vliet, K., Houck, M., DeSalle, R. and Blum, M. (2011). Splitting an ancient icon: mummy DNA resurrects a cryptic Nile crocodile. Molecular Ecology (doi:10.5061/dryad.s1m9h).

Abstract: The Nile crocodile (*Crocodylus niloticus*) is an ancient icon of both cultural and scientific interest. The species is emblematic of the great civilizations of the Nile River valley and serves as a model for international wildlife conservation. Despite its familiarity, a centuries-long dispute over the taxonomic status of the Nile crocodile remains unresolved. This dispute not only confounds our understanding of the origins and biogeography of the "true crocodiles" of the crown genus *Crocodylus*, but also complicates conservation and management of this commercially valuable species. We have taken a total evidence approach involving phylogenetic analysis of mitochondrial and nuclear markers as well as karyotype analysis of chromosome number and structure to assess the monophyletic status of the Nile crocodile. Samples were collected from throughout Africa, covering all major bioregions. We also utilized specimens from museum collections, including mummified crocodiles from the ancient Egyptian temples at Thebes and the Grottes de Samoun, to reconstruct the genetic profiles of extirpated populations. Our analyses reveal a cryptic evolutionary lineage within the Nile crocodile that elucidates the biogeographic history of the genus and clarifies long-standing arguments over the species' taxonomic identity and conservation status. An examination of crocodile mummy haplotypes indicates that the cryptic lineage corresponds to an earlier description of *C. suchus* and suggests that both African *Crocodylus* lineages historically inhabited the Nile River. Recent survey efforts indicate that *C. suchus* is declining or extirpated throughout much of its distribution. Without proper recognition of this cryptic species, current sustainable use-based management policies for the Nile crocodile may do more harm than good.

Takehito Ikejiri (2010). Morphology of the Neurocentral Junction during Postnatal Growth of Alligator (Reptilia, Crocodylia). PhD Thesis, University of Michigan. 193 pp.

Abstract: The two main parts of a vertebra, the centrum and neural arch, form independently during early developmental stages in nearly all vertebrates, and they typically fuse together in later growth stages. Fusion between centrum and neural arch is the result of ossification of a thin cartilage layer (neurocentral synchondrosis) between them. The timing of neurocentral fusion varies considerably within the vertebral column and among species, especially in archosaurian reptiles, and may be related to changes in body size and/or locomotion. Despite the importance of neurocentral fusion to our understanding of archosaur evolution, basic information about this process and how it changed through time remains poorly understood. In this dissertation, morphology of neurocentral sutures and vertebrae in crocodilians (Reptilia, Archosauria) is explored. In Chapter 2, the detailed cell- and tissue-level morphology of neurocentral sutures in the vertebrae of Alligator mississippiensis is documented. In chapter 3, complexity of neurocentral sutures are quantified, and changes related to differences in vertebral position, ontogenetic age, and phylogeny are examined. In Chapter 4, allometric changes in vertebrae of Alligator are quantified and investigated in relation to key ontogenetic events. As seen in some craniofacial bones in various vertebrates, neurocentral fusion may affect changes in relative size and shape of certain vertebral structures (e.g., centrum, neural spine, transverse processes, neural canal) during growth. In chapter 5, data examined in crocodilians (chapters 2-4) are applied to various fossil archosaurs from the Early Mesozoic to investigate the origin and evolutionary significance of two unique features of neurocentral sutures, delayed neurocentral fusion and complex neurocentral sutures

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Eme, J., Altimiras, J., Hicks, J.W. and Crossley, II, D.A. (2011). Hypoxic alligator embryos: chronic hypoxia, catecholamine levels and autonomic responses of *in ovo* alligators. Comparative Biochemistry and Physiology Part A: Molecular and Integrative Physiology (doi:10.1016/j.cbpa.2011.07.010).

Abstract: Hypoxia is a naturally occurring environmental challenge for embryonic reptiles, and this is the first study to investigate the impact of chronic hypoxia on the in ovo development of autonomic cardiovascular regulation and circulating catecholamine levels in a reptile. We measured heart rate (fH) and chorioallantoic arterial blood pressure (MAP) in normoxic ('N21') and hypoxic-incubated ('H10'; 10% O_2) American alligator embryos (*Alligator mississippiensis*) at 70, 80 and 90% of development. Embryonic alligator responses to adrenergic blockade with propranolol and phentolamine were very similar to previously reported responses of embryonic chicken, and demonstrated that embryonic alligator has α and β-adrenergic tone over the final third of development. However, adrenergic tone originates entirely from circulating catecholamines and is not altered by chronic hypoxic incubation, as neither cholinergic blockade with atropine nor ganglionic blockade with hexamethonium altered baseline cardiovascular variables in N21 or H10 embryos. In addition, both atropine and hexamethonium injection did not alter the generally depressive effects of acute hypoxia - bradycardia and hypotension. However, H10 embryos showed significantly higher levels of noradrenaline and adrenaline at 70% of development, as well as higher noradrenaline at 80% of development, suggesting that circulating catecholamines reach maximal levels earlier in incubation for H10 embryos, compared to N21 embryos. Chronically elevated levels of catecholamines may alter the normal balance between α and β-adrenoreceptors in H10 alligator embryos, causing chronic bradycardia and hypotension of H10 embryos measured in normoxia.

Young, M.T., Bell, M.A., De Andrade, M.B. and Brusatte, S.L. (2011). Body size estimation and evolution in metriorhynchid crocodylomorphs: implications for species diversification and niche partitioning. Zoological Journal of the Linnean Society (doi: 10.1111/j.1096-3642.2011.00734.x).

Abstract: Metriorhynchids were a peculiar group of fully marine Mesozoic crocodylomorphs, some of which reached large body size and were probably apex predators. The estimation of their total body length in the past has proven problematic. Rigorous size estimation was provided using five complete metriorhynchid specimens, by means of regression equations derived from basicranial and femoral length against total body length. The use of the Alligator femoral regression equation as a proxy to estimate metriorhynchid total body length led to a slight underestimation, whereas cranial regression equations of extant genera resulted in an overestimation of body length. Therefore, the scaling of crania and femora to total body length of metriorhynchids is noticeably different from that of extant crocodylians, indicating that extant crocodylians are not ideal proxies for size reconstruction of extinct taxa that deviate from their semi-aquatic morphotype. The lack of a correlation between maximum, minimum, or the range of generic body lengths with species richness demonstrates that species diversification is driven by factors other than just variation in body size. Maximum likelihood modelling also found no evidence for directionality in body size evolution. However, niche partitioning in Metriorhynchidae is mediated not only by craniodental differentiation, as shown by previous studies, but also by body size variation.

Zeng, C.J., Ye, Q. and Fang, S.G. (2011). Establishment and cryopreservation of liver, heart and muscle cell lines derived from the Chinese alligator (*Alligator sinensis*). Chinese Science Bulletin 56(24): 2576-2579. (doi: 10.1007/s11434-011-4622-9).

Abstract: The Chinese alligator, *Alligator sinensis*, is a critically endangered species. A conservation project of gene resources for an endangered species first involves the preservation of organs, tissues, gametes, genomic DNA libraries and cell lines. The present study is the first to establish and cryopreserve cell lines of liver, heart and muscle tissues from the Chinese alligator. The study revealed that there was a large discrepancy in cell migration time in primary cultures among liver (11-12 d), heart (13-14 d) and muscle (17-18 d) tissue pieces. The differences in time in primary cell culture suggested that it was relatively easy to build visceral-derived cell lines for reptiles. Biological analysis showed that the population doubling time for thawed cells was approximately 36 h. Karyotyping revealed that the frequency of Chinese alligator cells showing chromosome number as 2n=32 was 88.6-93.4%. Chinese alligator cell lines established here provide a vital resource for research and are likely to be useful for protection of this rare and critically endangered species. Furthermore, the establishment of these methods may supply technical and theoretical support for preserving genetic resources at the cellular level for other reptile species.

Wang, Z.H., Yao, H., Ding, Y.Z., Thorbjarnarson, J. and Wang, X.M. (2011). Testing reintroduction as a conservation strategy for the critically endangered Chinese alligator: movements and home range of released captive individuals. Chinese Science Bulletin 56(24): 2586-2593 (doi: 10.1007/s11434-011-4615-8).

Abstract: The Chinese alligator (*Alligator sinensis*) is considered the most critically endangered crocodilian as a result of the near total loss of its habitat and its extremely small and fragmented wild populations. Plans for population recovery lie mostly with wetland restoration and the reintroduction of captive-reared animals. We carried out a first-trial release of 3 adult Chinese alligators (1M, 2F) into a pond at the Hongxing conservation site, Xuancheng, southern Anhui Province; the animals were radio-tracked from May to October in 2003. We hypothesized that after a period of adaptation, the alligators would establish definable home ranges. Two (1M, 1F) of the 3 alligators were monitored for the whole of the tracking period. The male had an annual home-range size of 7.61 hm^2, and the female 4.00 hm^2. Water temperature and pond water level were two important factors influencing the alligators' distributions, and daily movements. The radio-tracked alligators had overlapping home ranges, which notably included the one substantial island in the pond; that island is the only known nesting site of the local native wild alligators. Aggressive interactions between the released alligators and native wild alligators were observed during the breeding season around this island. All the three

reintroduced alligators survived the winter of 2003 and were alive in the same pond in 2008. We concluded that the Hongxing conservation site provided a suitable habitat for the reintroduced alligators. However, the low water level in the pond resulting from farmland irrigation in August and September can be a substantial threat to the alligators' survival. Therefore, regulations on irrigation in summer and autumn are needed to balance the water needs of the alligators and agriculture.

Hamlin, H.J., Lowers, R.H. and Guillette Jr., L.J. (2011). Seasonal androgen cycles in adult male American alligators (*Alligator mississippiensis*) from a barrier island population. Biol. Reprod.

Abstract: The seasonal patterns of two primary plasma androgens, testosterone (T) and dehydroepiandrosterone (DHEA) were assessed in adult male alligators from the Merritt Island National Wildlife Refuge, a unique barrier island environment, and home to the Kennedy Space Center in Florida, USA. Samples were collected monthly during 2008 to 2009, with additional samples collected at more random intervals in 2007 and 2010. Plasma T concentrations peaked in April, coincident with breeding and courtship, and declined rapidly throughout the summer. Although reproductively active, smaller adult males differed in seasonal plasma T patterns versus their larger counterparts during the breeding season. Both size classes showed significant increases in plasma T concentration from February to March at the beginning of the breeding season. However, smaller adults did not experience the peak in plasma T concentrations in April as observed in larger adults, and concentrations were significantly lower than those of larger males for the remainder of the breeding season. Plasma DHEA concentrations peaked in May, and were significantly reduced by June. This is the first study to demonstrate the presence of DHEA in a crocodilian, and the high plasma DHEA concentrations that paralleled their reproductive activity, suggests a reproductive and/or behavioral role in adult male alligators. Similar to some birds, plasma DHEA concentrations were considerably higher than T during the non-breeding season, suggesting a potential role in maintaining non-breeding seasonal aggression.

Nevarez, J.G., Cockburn, J., Kearney, M.T. and Mayer, J. (2011). Evaluation of an 18-micron filter for use in reptile blood transfusions using blood from American alligators (*Alligator mississippiensis*). Journal of Zoo and Wildlife Medicine 42(2): 236-240.

Abstract: Blood transfusions are a common therapeutic procedure in small animal medicine and have been investigated in some exotic species but little information is available about their safety and efficacy in reptiles. In human pediatrics and small animal practice, the Hemo-Nate®18-µ filter is used to prevent embolic clots and particulate waste from entering the recipient during a transfusion. The goal of this study was to determine the hemolytic effect of an 18-µ Hemo-Nate filter for whole blood cell transfusions in reptiles using the American alligator (*Alligator mississippiensis*) as a reptilian model. Results revealed no significant difference in free plasma hemoglobin between the unfiltered and filtered samples (P= 0.21). There was no difference in the prefiltration and postfiltration packed cell volume (PCV) (P= 0.41). Results suggest that an 18-µ Hemo-Nate filter does not cause hemolysis or decrease the PCV of small quantities of alligator blood.

Espinal, M. and Escobedo-Galván, A.H. (2011). Population status of the American crocodile (*Crocodylus acutus*) in El Cajon Reservoir, Honduras. The Southwestern Naturalist 56(2): 212-215.

Abstract: During 2005 and 2007, we examined status of populations of the American crocodile (*Crocodylus acutus*) in three rivers at El Cajon Reservoir in central Honduras. Number of crocodiles per kilometer of survey varied by river and time of study. Most observations were of hatchlings and yearlings, but juveniles, subadults, and adults also were observed. Sex ratio in the reservoir was 11.4 male.female. Assuming that sex ratio and size-class structure were representative of the overall population, our study suggests that the population in El Cajon Reservoir is stable.

Lauridsen, H., Hansen, K., Wang, T., Agger, P., Andersen, J.L., Knudsen, P.S., Rasmussen, A.S., Uhrenholt, S. and Pedersen, M. (2011) Inside Out: Modern Imaging Techniques to Reveal Animal Anatomy. PLoS ONE 6(3): e17879 (doi:10.1371/journal.pone.0017879).

Abstract: Animal anatomy has traditionally relied on detailed dissections to produce anatomical illustrations, but modern imaging modalities, such as MRI and CT, now represent an enormous resource that allows for fast non-invasive visualizations of animal anatomy in living animals. These modalities also allow for creation of three-dimensional representations that can be of considerable value in the dissemination of anatomical studies. In this methodological review, we present our experiences using MRI, CT and µCT to create advanced representation of animal anatomy, including bones, inner organs and blood vessels in a variety of animals, including fish, amphibians, reptiles, mammals, and spiders. The images have a similar quality to most traditional anatomical drawings and are presented together with interactive movies of the anatomical structures, where the object can be viewed from different angles. Given that clinical scanners found in the majority of larger hospitals are fully suitable for these purposes, we encourage biologists to take advantage of these imaging techniques in creation of three-dimensional graphical representations of internal structures.

Van Vuuren, L. (2011). KwaZulu-Natal: it's man versus croc: conservation. Water Wheel 10(4): 13-18.

Abstract: Historically, crocodiles were abundant throughout the lower lying and coastal areas of KwaZulu-Natal, but today the last remaining wild crocodiles are restricted to the

northeastern corner of the province, from the Tukhela River northwards in an area known as Zululand. Within Zululand, viable crocodile populations are found north of the Mfolozi River with Lake St Lucia and Ndumo Game Reserve hosting two of the three largest populations in South Africa. The diversity of crocodile habitat found here, which include rivers, streams, large natural lakes and estuaries, swamp forests, pans and wetlands, is unrivalled in southern Africa.

Wheatley, P.V. (2010). Understanding Saltwater Tolerance and Marine Resource Use in the Crocodylia: A Stable Isotope Approach. PhD Thesis, University of California, Santa Cruz. 175 pp.

Abstract: Today, crocodylians are primarily freshwater-adapted today, though estuarine populations of *Crocodylus acutus* and *C. porosus* are notable exceptions. But beginning in the 1980s scientific work involving phylogeny, biogeography and osmoregulatory physiology suggested that Crocodylia had been more adept in coastal and marine environments in the past. Here I use stable isotopes as natural tracers of inputs to modern and fossil crocodylians to explore their current and past reliance on marine resources. Using carbon and oxygen isotope ratios from the carbonate portion of tooth bioapatite, I estimate the marine resource use of modern coastal populations of *C. acutus* and *Alligator mississippiensis* by comparing them to marine reptiles and inland populations of *A. mississippiensis*. Coastal *A. mississippiensis* and *C. acutus* feed from marine foodwebs in roughly equal percentages (~60% and ~70% respectively). I estimate the amount of seawater ingestion for *C. acutus* to be 80% on average (*A. mississippiensis* is an obligate freshwater drinker). Thus, many of the osmoregulatory behaviors assumed to be necessary for *C. acutus* (such as actively seeking out fresh drinking water) may not be necessary. I examine the long-term diet of *A. mississippiensis* from Rockefeller Wildlife Refuge, Louisiana, by measuring carbon and nitrogen stable isotope ratios in alligator prey items and the bone and tooth collagen of the alligators themselves. I use a Bayesian mixing model to estimate the percent contribution of various prey to alligator tooth collagen and, separately, alligator bone collagen. Because reptiles constantly replace their teeth, tooth collagen is a much more recent record of dietary input than is bone collagen. I take advantage of these different time frames to examine differences between adult and juvenile diet. My work documents a movement to a more diverse and generalized diet (incorporating more brackish water taxa and terrestrial mammals) when alligators reach a total length of about 1.3 m. Results point the importance of nutria, potentially when alligators are growing quickly, and the possibility of seasonal prey items being of importance. To estimate marine resource use and to pinpoint the origin of saltwater tolerant physiology in fossil crocodylians, I analyzed the carbonate and phosphate portions of tooth enamel from crocodylians and their close relatives for carbon and oxygen isotope ratios. I find an origin for saltwater tolerance at least as old as the common ancestor of Crocodylia + Dyrosauridae (Cretaceous) and perhaps as old as the common ancestor of Crocodylia + Metriorhynchidae (Jurassic), depending upon the phylogenetic hypothesis employed. I also found strong evidence of marine food dependence for several crocodilians, including seagrass ecosystem dependence for tomistomines and pelagic resource consumption in the dyrosaurids. Though modern crocodylians are largely freshwater focused, the group as whole had strong ties to the marine realm in the past. This physiology easily allows for the possibility of long-range oceanic dispersals to explain the biogeography of many lineages of crocodylians.

Wormser, C., Pore, S.A., Elperin, A.B., Silverman, L.N. and Light, D.B. (2011). Potentiation of regulatory volume decrease by a P2-like receptor and arachidonic acid in American alligator erythrocytes. Journal of Membrane Biology (doi: 10.1007/s00232-011-9377-3).

Abstract: This study examined the role of a P2 receptor and arachidonic acid (AA) in regulatory volume decrease (RVD) by American alligator red blood cells (RBCs). Osmotic fragility was determined optically, mean cell volume was measured by electronic sizing, and changes in intracellular Ca^{2+} concentration were visualized using fluorescence microscopy. Gadolinium (50 μM), hexokinase (2.5 U/ml), and suramin (100 μM) increased osmotic fragility, blocked volume recovery after hypotonic shock, and prevented a rise in intracellular Ca^{2+} that normally occurs during cell swelling. The P2X antagonists PPADS (50 μM) and TNP-ATP (10 μM) also increased fragility and inhibited volume recovery. In contrast, ATPγS (10 μM), α,β-methylene-ATP (50 μM) and Bz-ATP (50 μM) had the opposite effect, whereas 2-methylthio-ATP (50 μM) and UTP (10 μM) had no effect. In addition, the phospholipase A2 (PLA2) inhibitors ONO-RS-082 (10 μM), chlorpromazine (10 μM), and isotetrandrine (10 μM) increased osmotic fragility and blocked volume recovery, whereas AA (10 μM) and its nonhydrolyzable analog eicosatetraynoic acid (ETYA, 10 μM) had the reverse effect. Further, AA (10 μM), but not ATPγS (10 μM), prevented the inhibitory effect of a low Ca2+-EGTA Ringer on RVD, whereas both AA (10 μM) and ATPγS (10 μM) caused cell shrinkage under isosmotic conditions. In conclusion, our results are consistent with the presence of a P2-like receptor whose activation stimulated RVD. In addition, AA also was important for volume recovery.

Katdare, S., Srivathsa, A., Joshi, A., Panke, P., Pande, R., Khandal, D. and Everard, M. (2011). Gharial (*Gavialis gangeticus*) populations and human influences on habitat on the River Chambal, India. Aquatic Conservation: Marine and Freshwater Ecosystems 21(4): 364-371.

Abstract: The gharial, *Gavialis gangeticus* (Gmelin 1789), a piscivorous reptile of Asian river systems, is increasingly threatened by diverse human pressures. Three survey expeditions were launched to monitor gharial populations, notable wildlife, and the activities and attitudes of local people in a 110 km stretch of the Chambal River in the National Chambal Reserve (NCS), India. Only 15% of gharial observed in December 2009 were in the upstream 54% of the surveyed river length. This coincides with the highest density of disturbance including water pumps, fishermen, and the highest growth in fishing activity since December

2008. Although fishing is recognized as a significant threat to gharial, no strong relationship was found between numbers of gharial and fishermen. However, numbers of water pumps, indicative of the intensity of agricultural activity, had a negative relationship with gharial numbers. This relationship was strengthened by omitting the upstream (Pali to Rameshwaram) survey reach, the tourist area of the NCS, which is also potentially affected by upstream reaches. The downstream 46% of surveyed river length in December 2009 supported 85% of gharial (consistent with trends in other surveys), including 91.6% of males and 81.8% of juveniles. This reach is classified as a High Population Recorded Area of high potential conservation importance, also containing better habitat quality and lower human disturbance. A positive relationship was found between gharial numbers and sand habitat features. However, the Davar to Ghoonsai survey reach had low gharial numbers despite abundant sand features, perhaps due to a substantial length of the Ghoonsai sand bank having been converted or agriculture. This may have significant implications for gharial conservation.

Joshi, R., Singh, R. and Negi, M.S. (2011). First record of mugger crocodile *Crocodylus palustris* (Lesson, 1831) from the Rajaji National Park, North India. International Journal of Biodiversity and Conservation 3(9): 444-450.

Abstract: First record of Mugger crocodile *Crocodylus palustris* (Lesson, 1831) from Rajaji National Park, north India, is described and illustrated. This is the first record of the order Crocodilia and genus *Crocodylus* for Rajaji National Park. On 8th and 9th of December 2010, two Mugger crocodiles were observed basking in sandy bed of Ganges near to Bhimgora barrage (Haridwar City) on the very edge of Rajaji's boundary adjoining to Haridwar Forest Division. We used ground survey method to identify new potential habitats and to examine the distribution and presence of the species from December 2010 to February 2011. Field observations indicated that the distributional range and upward movements of Mugger crocodile is increasing in the Ganges River. Besides, their movement range was found increasing in adjoining areas of Haridwar and in the Rajaji National Park. Still no any record is available, which confirms the presence of this crocodilian species near Haridwar City and in Rajaji National Park and based on this evidenced study, one more reptilian species - *Crocodylus palustris* can be added to the list of reptilian fauna of the Rajaji National Park. This new record of mugger crocodile's presence in some pockets of Rajaji National Park, Haridwar Forest Division and in higher elevation of Ganges towards Rishikesh requires further investigations.

Simoncini, M.S., Piña, C.I., Cruz, F.B. and Larriera, A. (2011). Climatic effects on the reproductive biology of *Caiman latirostris* (Crocodylia: Alligatoridae). Amphibia-Reptilia 32(3): 305-314.

Abstract: Reproductive aspects, like number of nests produced per season or clutch size (number of eggs per nest), of broad-snouted caiman (*Caiman latirostris*) may be affected by a climatic variables such as rainfall and temperature. The success of caiman reproduction is not only affected by the amount of rainfall, but also by the time elapsed during which it takes place. In this study, we present evidence of a positive relationship between the number of nests produced and the amount of precipitation on the water heads ("Bajos Submeridionales") during March. Surprisingly, there was not a significant relationship when considering local rainfall and temperature. During one event of El Niño phenomena the number of caiman nests was the highest in eight years of monitoring, besides a remarkable low number of nests were produced during La Niña. There was not a significant relationship between clutch size and rainfall or temperature. This information is useful for the ranching programs, because managers will be able to estimate, nine months in advance, the number of nests for harvesting. Another positive aspect is that this information can be used to establish nests' searching strategies, and number of eggs to incubate and hatchlings to raise. Thus, this will help planning management strategies in support of conservation efforts for the species during extreme climatic events.

Pauvolid-Corrêa, A., Morales, M.A., Levis, S., Figueiredo,L. T.M., Couto-Lima, D., Campos, Z., Nogueira, M.F., da Silva, E.E., Nogueira, R.M.R. and Schatzmayr, H.G. (2011). Neutralising antibodies for West Nile virus in horses from Brazilian Pantanal. Mem. Inst. Oswaldo Cruz, Rio de Janeiro 106(4): 467-474.

Abstract: Despite evidence of West Nile virus (WNV) activity in Colombia, Venezuela and Argentina, this virus has not been reported in most South American countries. In February 2009, we commenced an investigation for WNV in mosquitoes, horses and caimans from the Pantanal, Central-West Brazil. The sera of 168 horses and 30 caimans were initially tested using a flaviviruses-specific epitope-blocking enzyme-linked immunosorbent assay (blocking ELISA) for the detection of flavivirus-reactive antibodies. The seropositive samples were further tested using a plaque-reduction neutralisation test (PRNT90) for WNV and its most closely-related flaviviruses that circulate in Brazil to confirm the detection of specific virus-neutralising antibodies. Of the 93 (55.4%) blocking ELISA-seropositive horse serum samples, 5 (3%) were seropositive for WNV, 9 (5.4%) were seropositive for St. Louis encephalitis virus, 18 (10.7%) were seropositive for Ilheus virus, 3 (1.8%) were seropositive for Cacipacore virus and none were seropositive for Rocio virus using PRNT90, with a criteria of ≥ four-fold antibody titre difference. All caimans were negative for flaviviruses-specific antibodies using the blocking ELISA. No virus genome was detected from caiman blood or mosquito samples. The present study is the first report of confirmed serological evidence of WNV activity in Brazil.

Muniz, F.L., Da Silveira, R., Campos, Z., Magnusson, W.E., Hrbek, T. and Farias, I.P. (2011). Multiple paternity in the Black Caiman (*Melanosuchus niger*) population in the Anavilhanas National Park, Brazilian Amazonia. Amphibia-Reptilia 32(3): 428-434.

Abstract: The formation of dominance hierarchies in which the female mates with a large dominant male is common among crocodilians. However, there is the possibility of polyandry, in which females mate with multiple partners during a single breeding season and generate offspring with multiple paternity. In the present study, eight pairs of heterologous primers developed for *Alligator mississippiensis* and *Caiman latirostris* were used to determine whether multiple paternity exists in the Black Caiman, *Melanosuchus niger*. For such, we analyzed 34 Black Caiman offspring from the Anavilhanas Archipelago in the Negro River (state of Amazonas, Brazil). The specimens came from 6 groups, each containing 5 or 6 hatchlings. Paternity exclusion and genetic identity indices were calculated to test the robustness of the microsatellite loci. Simple allele counts and maximum likelihood estimation of family clusters were used to determine the likelihood of occurrence of multiple paternity. Among the eight loci tested, five were effective at determining paternity, with paternity exclusion values close to 1.0 (QC= 0.92) and genetic identity values close to zero (IC < 0.01). Using the simple allele count, six cases of multiple paternity were detected and confirmed in three hatchling groups by four different microsatellite loci. However, maximum likelihood analysis indicated multiple paternity in all the groups analyzed, with five family clusters identified in one hatchling group alone. Considering that this species is listed according to IUCN as Lower Risk/ Conservation Dependent, our results have direct conservation implications. Multiple paternity increases effective population size by maintaining genetic variation, and thus could be an important mechanism to maintain genetic diversity in isolated local populations.

Platt, S.G., Monyrath, V., Sovannara, H., Kheng, L. and Rainwater, T.R. (2011). Nesting phenology and clutch characteristics of captive Siamese crocodiles (*Crocodylus siamensis*) in Cambodia. Zoo Biology 30 (doi: 10.1002/ zoo.20418).

Abstract: The Siamese crocodile (*Crocodylus siamensis*) is considered one of the least studied and most critically endangered crocodilians in the world. Although few wild populations remain, more than 700,000 *C. siamensis* are held on commercial crocodile farms in Southeast Asia. Despite conservation concerns, many aspects of *C. siamensis* life history remain poorly known, particularly with regards to its reproductive biology. We studied nesting phenology, clutch characteristics, and other aspects of *C. siamensis* reproductive biology on crocodile farms in Cambodia during 2000 and 2001. Oviposition among captive crocodiles began in February and continued into early June. The mean (±1 SD) oviposition date based on pooled data from 2000 and 2001 was 5 April ± 24 days. Mean oviposition date differed significantly between 2000 and 2001, possibly as a result of annual variability among nesting cues. The mean incubation period was 72 ± 3 days and eggs hatched from 5 May to 18 August. Mean clutch size (25.0 ± 8.8 eggs; n= 183) differed significantly between years, possibly resulting from the >2.5-fold increase in sample size during 2001. There was no correlation between clutch size and oviposition date during either 2000 or 2001. A single female produced two clutches during 2001, complimenting previous reports of double-clutching among *C. siamensis*. The mean length and width of 515 eggs were 78.2 ± 4.9 and 48.1 ± 2.5 mm, respectively; mean egg mass was 90.8 ± 16.5 g (n= 471). One unpipped egg contained a set of twins.

Parachú Marcó, M.V., Piña, C.I. and Larriera, A. (2011). Presence of Red Fire Ants (*Solenopsis invicta* Buren) in Broad-Snouted Caiman (*Caiman latirostris*) nests. J. Herpetol.

Abstract: *Solenopsis invicta* in *Caiman latirostris* nests is suspected to be a possible cause of death in caiman hatchlings, but this has not been documented within the native distribution of this ant. In crocodilian ranching programs, wild eggs are collected from the field, and delays between collection and transportation to incubators are usually minimized in the hope of maximizing embryo survival. We analyzed nests harvested during five consecutive nesting seasons of *C. latirostris* to determine the phenology of *S. invicta* colonization of caiman nests. The final percentages of colonized caiman nests for each season were calculated. Densities of *S. invicta* mounds built on bare ground were analyzed to establish if there was any relationship with the proportion of caiman nests colonized by the end of nesting season. We also evaluated whether *S. invicta* had preferences among habitats to establish their mounds. We found no relationship between *S. invicta* mounds densities and final percentage of *C. latirostris* nests with red fire ants. The presence of *S. invicta* mounds among years was similar between different nesting habitats at the beginning of each season. We found that *S. invicta* can colonize *C. latirostris* nests during the breeding period, and that colonization of nests is higher than 50% in seasons where rainfall was 200 mm at the beginning of the season (December and January). In contrast, during years in which rainfall was below 200 mm, caiman nest colonization was reduced.

Siroski, P.A., Poletta, G.L., Fernandez, L., Ortega, H.H. and Merchant, M.E. (2011). Ultraviolet radiation on innate immunity and growth of broad-snouted caiman (*Caiman latirostris*): implications for facilities design. Zoo Biology 30.

Abstract: Sunlight is a key environmental factor in almost all ecosystems, and it is necessary for many physiological functions. Many vertebrates require ultraviolet (UV) radiation to perform different physiological processes. Artificial light is used to supplement UV in captive animals, through appropriate photoperiods and UV wavelengths. Previous studies reported that repeated exposure to artificial UV radiation may cause damage to the immune system. Taking into account the importance of UV effects and the serum complement system, the relationship between them was investigated. The study lasted 90 days and was carried out in plastic chambers. Ninety six broad-snouted caiman (*C. latirostris*) were assigned to four treatment groups with two replicates each: total darkness (TD), 8 hr per day (8 hr) and 16 hr per day (16 hr) of artificial UV/visible light exposure, and normal photoperiod of natural light (NP). Snout-vent length was measured to determine animal growth. Hemolytic assays were performed to evaluate the effects of artificial UV/visible light, TD, and NP on the

serum complement system. Results showed that animals grew more in the NP group. The capacity of *C. latirostris* serum to hemolyze sheep red blood cells was higher in the NP group than when they are maintained in constant light-dark cycles (8 and 16 hr) or in TD. These data demonstrate that artificial UV should be considered as a potential hazard for captive crocodilians if it is not properly managed, and this should be taken into account in the general design of facilities for reptilian husbandry.

Ploeg, J., Cauillan-Cureg, M., Weerd, M. and Persoon, G. (2011). 'Why must we protect crocodiles?' Explaining the value of the Philippine crocodile to rural communities. Journal of Integrative Environmental Sciences (doi:10.1080/1943815X.2011.610804).

Abstract: What are valid arguments to protect the Philippine crocodile in the wild? And how are we to explain the normative foundations of biodiversity conservation to rural communities in the developing world? Conservationists mainly rely on economic values to justify *in situ* wildlife conservation. In this article, we argue that these utilitarian reasons are often based on inaccuracies and flawed assumptions. By focusing narrowly on economic incentives, conservationists risk undermining their credibility and obscuring other valid reasons to protect nature. Cultural and intrinsic values can also form a strong motivation for poor people in non-western societies to conserve biodiversity. In the northern Sierra Madre on Luzon, respect for nature, interest in wildlife ecology and pride in the occurrence and conservation of a rare and iconic species proved to be effective incentives to protect the Philippine crocodile.

Rossini, M., García, G., Rojas, J. and Zerpa, H. (2011). Hematologic and serum biochemical reference values for the wild Spectacled Caiman, *Caiman crocodilus crocodilus*, from the Venezuelan plains. Veterinary Clinical Pathology 40(3): 374-379.

Abstract: Background: Commercial farming of *Caiman crocodilus crocodilus* has had an impact on the use of this species for meat consumption and the leather industry. Spectacled Caimans comprise part of the South American plains biodiversity. Misinterpretation of laboratory data is a risk owing to the limited hematologic and serum biochemical values available for this species. Objective: The aim of this study was to determine hematologic and serum biochemical values for wild Spectacled Caimans from the Venezuelan plains. Methods: Blood samples were collected form the caudal tail vein of 100 Spectacled Caimans (40 males and 60 females) from the plains located in the State of Apure. Values for RBC count, PCV, hemoglobin concentration, WBC absolute and differential counts, and thrombocyte counts were obtained using manual methods, and RBC indices were calculated. Serum biochemical analysis included measurement of alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase, and creatine kinase activities and concentrations of total protein and albumin. Comparisons between sexes were analyzed using the Mann-Whitney test. Results: Reference values for wild Spectacled Caimans were determined. Minor differences in hematologic values, particularly for RBC counts, were found compared with previously published values for this species. Serum biochemical values were similar to those available for other crocodilians. There were no significant differences between males and females. Conclusions: Minor differences between the values obtained for wild Spectacled Caimans and those previously published for this species may be related to differences in methodology and environmental conditions. Availability of hematologic and serum biochemical reference values will be useful for accurate diagnosis and management of disease in this species.

Manzanilla Fuentes, A.G., Seijas, A.E. and Rossini, M. (2011). Hematological values of juvenile Orinoco crocodiles (*Crocodylus intermedius*) in Venezuela. Revista Científica, FCV-LUZ 21(4), 360-364.

Abstract: The hematological values of blood samples taken from 81 *Crocodylus intermedius* of both sexes and from 6 months to 2.5 years of age were analyzed. Seventy-two of these crocodiles came from a rearing facility, where they have been maintained since hatching, and the remaining 9 were recaptured from the wild, where they have been released 5 to 18 months before. The average total length (TL), snouth-vent length (SVL) and weight was 791 mm, 399 mm and 1567 g, respectively. Mean hemoglobin value was 8.57 g/dL. The heamatocrit average was 24.76% and leukocytes counted to 6605/mm^3. There were no differences between sexes for the above mentioned values. Leukocyte counts showed a slight trend to decrease with crocodile's size. The differential count of leukocytes resulted in a higher proportion of heterophils (55.8%) followed in importance by lymphocytes (31.8%). These data are considered relevant, since the species is considered as critically endangered and due to the lack of physiological values that could be used as standard for comparisons for *C. intermedius*. They could be used by veterinarians and biologists working with conservation programs for the species in rearing facilities or zoos, to diagnose deceases in the species they work with.

Woodward, A.R., Percival, H.F., Rauschenberger, R.H., Gross, T.S., Rice, K.G. and Conrow, R. (2011). Abnormal alligators and organochlorine pesticides in Lake Apopka, Florida. Wildlife Ecotoxicology 3: 153-187 (doi: 10.1007/978-0-387-89432-4_5).

Abstract: Lake Apopka is a 12,400-ha hypereutrophic lake in central Florida that was the recipient of nutrient and pesticide pollution from adjacent agricultural operations for 50 years. The abnormal American alligator (*Alligator mississsippiensis*) population in Lake Apopka has been the object of a number of studies including investigations of a population crash, the epidemiology of egg failure, and anomalous endocrine function. Several hypotheses of the causes of these abnormalities have been proposed and examined by multiple research organizations over the past three decades. Initially, organochlorine pesticide (OCP) contamination was considered

the most likely factor causing poor reproductive success. DDE concentrations in alligator eggs sampled in 1984-1985 were approximately 4 mg/kg and toxaphene concentrations were approximately 2.5 mg/kg. These levels were known to cause reproductive failure in certain birds. However, transmissible diseases, population age and density, cyanotoxins, nutritional deficiencies, and combinations thereof, were also investigated for their contribution to poor alligator reproductive success. Investigations of an alligator mortality and reproductive failure event on Lake Griffin, a lake similar to Lake Apopka but with lower OCP levels, revealed analogous reproductive abnormalities that were associated with a dietary thiamine deficiency. Thiamine deficiency appeared to be associated with a diet of almost exclusively gizzard shad, which contain thiaminase, an enzyme that breaks down thiamine. OCP contaminants may contribute to these maladies, perhaps through endocrine disruption and increased stress. The findings of the past 30 years of work at Lake Apopka have affected local management decisions as well as policy at the national level.

Hastings, A.K., Bloch, J.I., and Jaramillo, C.A. (2011). A new longirostrine Dyrosaurid (Crocodylomorpha, Mesoeucrocodylia) from the Paleocene of north-eastern Colombia: Biogeographic and behavioural implications for New-World Dyrosauridae. Palaeontology 54(5): 1095-1116.

Abstract: Fossils of dyrosaurid crocodyliforms are limited in South America, with only three previously diagnosed taxa including the short-snouted *Cerrejonisuchus improcerus* from the Paleocene Cerrejon Formation of north-eastern Colombia. Here we describe a second dyrosaurid from the Cerrejon Formation, *Acherontisuchus guajiraensis* gen. et sp. nov., based on three partial mandibles, maxillary fragments, teeth, and referred postcrania. The mandible has a reduced seventh alveolus and laterally depressed retroarticular process, both diagnostic characteristics of Dyrosauridae. *Acherontisuchus guajiraensis* is distinct among known dyrosaurids in having arosaurids. Results from a cladistic analysis of Dyrosauridae, using 82 primarily cranial and mandibular characters, support an unresolved relationship between *A. guajiraensis* and a combination of New- and Old-World dyrosaurids including *Hyposaurus rogersii*, *Congosaurus bequaerti*, *Atlantosuchus coupatezi*, *Guarinisuchus munizi*, *Rhabdognathus keiniensis* and *Rhabdognathus aslerensis*. Our results are consistent with an African origin for Dyrosauridae with multiple dispersals into the New World during the Late Cretaceous and a transition from marine habitats in ancestral taxa to more fluvial habitats in more derived taxa.

Escobedo-Galván, A.H., Cupul-Magaña, F.G. and Velasco, J.A. (2011). Misconceptions about the taxonomy and distribution of *Caiman crocodilus chiapasius* and *C. crocodilus fuscus* (Reptilia: Crocodylia: Alligatoridae). Zootaxa 3015: 66-68.

Gramentz, D. (2011). *Crocodylus palustris* and *Crocodylus porosus* in Sri Lanka - threat and "protection". Reptilia 74: 18-27.

Sommerlad, R., Schmidt, F. and Ziegler, T. (2011). Threatened crocodiles in European zoos? Reptilia 74: 12-17.

Sommerlad, R. (2011). Crocodiles - giant reptiles in danger. Reptilia 74: 4-10.

Submitted Articles

HISTORICAL PHOTOGRAPHIC RECORD OF A CROCODILE, MEKONG RIVER, CAMBODIA. Some of the travel narratives of early explorers in Indochina provide important sources of historical information on the status of crocodiles in Cambodia, Laos, Myanmar, Thailand and Vietnam, but such records, usually brief anecdotes, are rarely accompanied by photographic evidence. This image (Fig. 1), taken by French photographer G. Barbat, in the early 1900s, is the only historical photographic record of a crocodile from northern Cambodia of which we are aware.

Figure 1. Crocodile shot in the early 1900s along the Mekong River, Kratie Province, Cambodia. Photographer: G. Barbat. Reproduced from Engelmann (2001).

Barbat worked in Indochina between 1908 and 1914 and focused on hunting themes in Cambodia (Degroise 2011). The image was originally issued as a postcard, and a caption under the image of the original states 'Bas-Laos, Caïman des rapides de Sambor' [crocodile at the Sambor rapids]. The hunter in the image is unknown and no other captions, watermark, stamp or other details are present (F. Engelmann, pers. obs.). Neither author of this note has encountered the image within published historical literature from Indochina in the course of relatively intensive searches for crocodile records (MRB) or other photographs (FE), and the context of the photograph (eg an exploratory expedition) is unknown. The 'Sambor rapids' are small, seasonally exposed rocky rapids within the mainstream of the Mekong River near Sambor Town (located at 12°46'26"N, 105°57'50"E), Kratie Province, northeastern Cambodia. The original image is held in the personal collection of FE and appears in a book of historical photographic portraits of Indochina (Engelmann 2001). The species in the photograph is presumed to be Siamese Crocodile (*Crocodylus siamensis*), the only

crocodilian known to occur in northern Cambodia, but this cannot be confirmed. The large, raised squamosal ridges of the cranial platform visible on this specimen are apparently distinctive of some adult *C. siamensis* (Smith 1919) but are not determinate in themselves (Brazaitis 1973 and references therein).

The size of this crocodile, clearly over 3 m total length (TL), is approaching the maximum known size of *C. siamensis* (3.5-4 m TL; Smith 1919). For *C. siamensis*, confirmation of species identity based on morphological features also requires examination of dorsolateral and ventral scalation (Smith 1919; Brazaitis 1973; Ross and Mayer 1983; Ross 1990, 1992), but sufficient detail cannot be derived from the image for identification purposes.

Most survey sightings or local reports of crocodiles from inland freshwater sections of the Cambodian Mekong are assumed to be *C. siamensis* (Platt *et al*. 2004; Simpson and Han 2004; Simpson *et al*. 2006; Bezuijen *et al*. 2009), yet very few wild crocodiles have actually been examined to confirm this. Saltwater crocodiles (*Crocodylus porosus*) historically occurred in at least one inland Mekong waterbody, the Tonle Sap Lake (Platt *et al*. 2006), around 200 km downstream from Kratie Province, and its historical presence in northeastern Cambodia cannot be discounted.

Few other crocodile records are available from the Mekong River in northeastern Cambodia. Recent herpetological surveys along the Mekong near Sambor Town did not detect any crocodiles, but 16 local reports of sightings between the 1950s and 2006 were collected, including seven reports since 2003 of crocodiles or nests (Bezuijen *et al*. 2009). The Mekong north of Sambor Town supports many islands and channels, some of which retain extensive forested habitats and are relatively undisturbed, and some crocodiles may persist (Bezuijen *et al*. 2009). Further north along the Mekong River, in Stung Treng Province, Carne (1872: in translation) observed 'an enormous [dead] alligator' on the riverbank, and Wharton (1966) observed hunting of crocodiles by local communities along a Mekong tributary bordering Cambodia and Laos. Small numbers of crocodiles currently persist in Stung Treng along some sections of the Mekong and tributaries (Simpson and Han 2004; Simpson *et al*. 2006; Timmins 2006), but remnant populations in northeastern Cambodia are probably all near extirpation.

Acknowledgments

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ROSS BROTHERS FOOLED BY ART-FAKES. Filling the top half of page 233 in Ross (1989), there is an uncaptioned picture that appears at first glance to be an obverse printing of a famous and prominent figure from Seba (1734; plate 6). This same "obverse" version has been incorporated into the logo for the CSG's 21st Working Meeting to be held in Manila, Philippines, in 2012 (www.csgmanila.com), and is currently identified at the meeting website as being the Seba (1734) picture in obverse (Fig. 1). However, the head and snout proportions differ between the two pictures, and there are numerous other ways to tell the two illustrations apart.

Figure 1. Manila meeting logo, courtesy of Charles Andrew Ross.

In Figure 1, along the profiled upper edge of the animal's body (and the base of its tail) there is a downward sloping and gently curved and clearly discernible series of dorsal scale keels, each of which sticks up in strong contrast to the white background. Each keel is somewhat pointed, and resembles a worn and dulled tooth of a saw. Each of these saw-tooth crests theoretically corresponds with a transverse row of dorsal armor. In both pictures the elbow joint of an arm sticks up behind the body, and the dark coloration of the arm makes it difficult to see the body scutes directly in front of it. The starting point for my count is the first completely visible keel immediately posterior to the elbow obstruction. Similarly, on both of these two versions of this picture, the middle of the tail curls extravagantly forward and returns toward the body, and the darkness of this loop-the-loop curl of the tail intersects or almost intersects the body (actually the base of the tail), and thus my stopping point is the last clearly discernible whole keel located anterior to the obstruction caused by the forward directed curl of the tail.

In the Ross (1989) and Manila logo version, there are 17 whole keels visible, while in contrast the Seba (1734) version has only 12. Separately, there are also two additional versions of the same basic picture. The "plate 3, figure 1" animal in Bonnaterre (1789) has 20 crests (saw teeth in this defined series), while the 1989 Florida Museum of Natural History graphic in CSG Newsletter 8(1): 9 (small and lightly inked) and 8(4): 45 (larger and darker), and discussed in Ross (1990) and the 1990 Newsletter editor's additions, has at most 7 keels in the series located between the anterior and posterior obstructions

With 17 keels in my defined zone, the picture of unknown origin (Fig. 1) is definitely not from Seba (1734), and it is not from Bonnaterre (1789). Although it is theoretically possible that Seba's (1734) picture is an imperfect obverse copy of this Ross (1989) and Manila meeting graphic, it is more probable that the Seba picture was published first, and the other three pictures were actually copies of it. Thus, given parsimony, the Manila logo is not Seba's (1734) "plate 106, figure 1", but is rather a separate art work "after Seba" (meaning based entirely on Seba's figure, without reference to Seba's or any other physical specimen).

None of these four versions depict a real crocodile. It has too many toes on its hind feet, too many claws on its front feet, the teeth are stylized and simplified, the ear is wrong, and. the dorsal scales are stylized and technically wrong in some details. Andy Ross says that he remembers photographing the accompanying picture from the U.S. National Museum's copy of Seba, and currently thinks that his version is merely an obverse of the Seba (1734) original. In contrast, I ask if anyone knows where Andy Ross could have gotten this picture. It differs from my copy of Seba (1734), which is the 2001 reprinting of Seba's plates by Taschen in Germany, titled: "Cabinet of natural curiosities" (587 pp). It is certain that the 1989-1990 Newsletter version is not the Bonnaterre (1789) picture, and not from Seba (1734) either. Clearly I was wrong in 1990 when I said that it was the Seba illustration. Today I assert that the citation for the "Gainesville" graphic is also unknown.

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