CROCODILE SPECIALIST GROUP

NEWSLETTER

VOLUME 26 No. 3 • JULY 2007 - SEPTEMBER 2007

IUCN - World Conservation Union • Species Survival Commission

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Species Survival Commission

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COVER PHOTO. Wild, female American alligator (*Alligator mississippiensis*) with her newborn hatchlings (hatched 30 August 2007). The nest is the second confirmed record for *A. mississippiensis* in Oklahoma, USA. See pages 10-11 for details. Photograph: David Arbour.

CSG Newsletter Subscription

The CSG Newsletter is produced and distributed by the Crocodile Specialist Group of the Species Survival Commission of the IUCN-The World Conservation Union.

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.

The CSG Newsletter is available as:

- Hard copy (by subscription - see below); and,
- Electronic, downloadable copy (free) from "www.flmnh.ufl.edu/natsci/herpetology/CROCS/CSGnewsletter.htm".

Annual subscriptions for hard copies of the CSG Newsletter may be made by cash ($US40), credit card ($AUD55) or bank transfer ($AUD55). Cheques ($USD) will be accepted, however due to increased bank charges associated with this method of payment, cheques are no longer recommended. A Subscription Form can be downloaded from "www.wmi.com.au/csgnewsletter".

All CSG communications should be addressed to:
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Editorial

Stage 1 of the CSG project entitled "Assistance to Madagascar for the Improvement of Conservation, Management and Sustainable Use of Crocodiles" [see CSG Newsletter 26(2): 3-4] was undertaken through an on-site visit in September 2007. The CSG team consisted of Dietrich Jelden (CSG Deputy Chair), Charlie Manolis (Regional Chair for Australia and Oceania) and coordinator Christine Lippai. Following numerous meetings with Government officials and a range of stakeholders, the Minister for Environment approved the proposed CSG work plan (2007-2010).

Due to work commitments, CSG Deputy Regional Chairs Luciano Verdade (southern South America) and Giovanni Ulloa (northern South America) regretfully resigned from the Steering Committee, and have been replaced by Carlos Piña (Argentina) and Sergio Medrano-Bitar (Colombia) respectively. We thank Luciano and Giovanni for their help, welcome Carlos and Sergio to the Steering Committee and look forward to their contribution to CSG activities in Latin America.

Following discussions at the 18th CSG meeting (France, 2006) and CITES CoP14 (The Hague, Netherlands, June 2007), the CSG communicated with the Government of Japan over the listing of the Argentine population of *Caiman latirostris* and the Brazilian population of *Melanosuchus niger* on the Appendices of the Japanese *Wild Animal Protection Act*. This prevented trade, despite both species now being on Appendix II of CITES (1997 and 2007 respectively) and secure in the wild in those countries. The Japanese Government has accepted the recommendations (see page 11), opening options for legal trade based on sustainable use of the wild populations.

I also wrote to the Prime Minister of India, the Honourable Dr. Manmohan Singh about gharials, informing him that immediate and special attention needs to be applied to the National Chambal and Katerniagh Wildlife Sanctuaries. These two Protected Areas contain the only significant remaining breeding populations of wild Indian Gharials. The CSG also gave its support for an application by the Gharial Multi-Task Force (GMTF) to the Chicago Board of Trade Endangered Species Fund (CBOT) for funding for a "River Community Project for Locally Based Gharial Conservation". *Gavialis gangeticus* is once again listed as "Critically Endangered" on the IUCN Red List. The wonderful population increases achieved in the 1970s have not been sustained, and it seems we are back to where we started. The project was considered by the CSG to be the highest priority for the current round of CBOT applications.

CSG Executive Officer Tom Dacey participated in crocodile industry workshops in the Philippines in August (see pages 11-12), and in September he held meetings with Government authorities in Hanoi with regard to a proposed CSG review of crocodile conservation and management in Vietnam.

The views of the CSG Steering Committee on the establishment of a Post-graduate Grant Scheme were sought over the last 1-2 months. The objective of such a scheme is to assist and encourage students doing post-graduate research on crocodilians, particularly research directly linked to their conservation. Subject to the finalisation of suitable eligibility criteria and management arrangements, it is anticipated that such a scheme could be in place by early 2008.

The Executive Officer sent out annual letters of request to CSG donors, whose support for the CSG is critical to its ability to operate. I'm personally very grateful to everyone who has made a contribution to the CSG, past

and present. The CSG remains an active and innovative group of volunteers, who do a great deal to assist the conservation, management and sustainable use of world crocodilians.

Professor Grahame Webb*, CSG Chairman*

Erratum

On page 7 of the last issue of the CSG Newsletter [26(2)], a typographical error resulted in a proposed headstarting program in the Philippines being interpreted as having a low chance of success. This is incorrect. The paragraph should have read as follows (ie addition of the word "no"):

"Philippines: Based on experience with other crocodilian species, there is **no** reason to expect that the proposed *C. mindorensis* headstarting program at Isabela should not be successful. The CSG offered technical advice to the Philippines, should it be required."

"Master of the Order of Australia" Medal Awarded to CSG Member

In September 2007, Hank Jenkins, long-time CSG member and CSG Vice Chair for CITES, was invested with a "Master of the Order of Australia" Medal for "service to wildlife conservation and management, particularly through contributions to the development of policies for sustainable international trade in wild fauna". The medal was officially presented to Hank by Major-General (retired) Michael Jeffery, Governor General of Australia (Fig. 1), at Government House, Canberra.

Figure 1. Hank Jenkins (second from left), with wife Yung, son Cameron (far right), and Major-General (retired) Michael Jeffery. Photograph: Tom Dacey.

The award recognises Hank's significant contribution to sustainable trade in wildlife, particularly in the CITES arena. During the late 1970s and 1980s Hank was involved with population research on *Crocodylus porosus* in Kakadu National Park, but it was mainly during his terms as Chairman of the CITES Animals Committee (1992-2000) that his contribution became evident.

Since leaving government service in 2000, Hank has continued to pursue sustainable use of wildlife as a private consultant. Since 2003 he has headed up the non-profit organization, Species Management Specialists (SMS), which has provided objective advice on wildlife conservation, management and trade issues debated at CITES CoP13 (June 2004) and Cop14 (June 2007).

CSG Tomistoma Task Force Workshop

The CSG Tomistoma Task Force Workshop will be held on 23-26 March 2008, at "Crocodile Adventure", Pattaya, Thailand. Participation at the workshop is open to TTF members and to "Friends of Tomistoma" by invitation. Interested non-TTF members should contact Rob Stuebing (robstuebing@gmail.com), Ralf Sommerlad (crocodilians@web.de) or Bruce Shwedick (shwedick@aol.com) to ensure that places at the Workshop will be still available, as participation will be by invitation only.

<u>Tentative Program</u>:

23 Mch:	Arrival, Registration and Welcome Dinner
23 Mch:	Arrival, Registration and Welcome Dinner
24-25 Mch:	Workshop
26 Mch:	Workshop; transfer to Utairatch Crocodile Farm (250 km from Pattaya) in afternoon.
27 Mch:	Visit Utairatch Crocodile Farm; return to Bangkok at night.
28 Mch:	Departure

Details on accommodation will be provided as soon as they are confirmed, but it is anticipated that accommodation will cost $US60 per room per night (including breakfast). To assist with organising of accommodation, participants should advise well in advance whether family and/or partners will also be attending, and/or if they wish to share a room. People wishing to extend their stay should also inform the organisers as early as possible.

Arrival at Suwannaphoom Airport is preferable (first choice), but Donmoung Airport (second choice) is also possible. In order to arrange transport to Pattaya, please relay flight details to organisers as soon as they are available.

Participants should check whether they require a visa to visit Thailand. If a letter of invitation is required, please contact Uthen Youngprapakorn (thutcroc@ksc.th.com) who will provide one.

Registration will be by e-mail to Uthen Youngprapakorn (thutcroc@ksc.th.com), with a "cc" to Rob Steubing (robstuebing@gmail.com). Working language of the workshop will be English.

19th CSG Working Meeting

The 19th CSG Meeting will be held in the city of Santa Cruz de la Sierra, Bolivia, from 2-7 June 2008. The theme of the meeting is: "Lessons Learned on Conservation and Management of Crocodiles".

Provisional Timetable:
2 June: CSG Steering Committee meeting
3-6 June: Working meeting (including workshops)
7 June: Field trip

Provisional Agenda (themes):
1. Conservation, management and sustainable use of crocodilians
2. Basis for the conservation of crocodiles
3. Actions on endangered species
4. National programs on conservation and management of crocodilians
5. Local people in crocodilian conservation
6. Breeding and trade of crocodilians
7. Basic and applied research on crocodilians
8. Miscellaneous

Proposed Workshops:
1. Sustainability criteria (environmental, social, economic) for the success of national management programs.
2. Management plans as conservation tools in Latin America.
3. Aspects affecting the sustainability of crocodilian trade.
4. Local organizations in conservation and management of crocodilians.

Interested participants are invited to submit papers (oral presentations and posters), preferably within the proposed themes.

Further details on the meeting are available on the website (www.19thworkingmeetingcsg.com). Specific questions on registration and local information may be e-mailed to Karina Sauma (ksauma@19thworkingmeetingcsg.com).

New "Philippine Crocodile Society"

Following on from the "Forum of Crocodiles in the Philippines" in January-February 2007 [see CSG Newsletter 26(1): 12-16], the Philippine Crocodile Society (PCS) was recently founded.

The purpose of our society is to provide a venue for all individuals and other entities to express and act on concerns of the crocodile industry in the Philippines. These concerns are not limited to commercial production of crocodiles but all aspects of crocodile biology, research, conservation, legislation, sustainable utilization and treatment of crocodiles in captivity and in the wild.

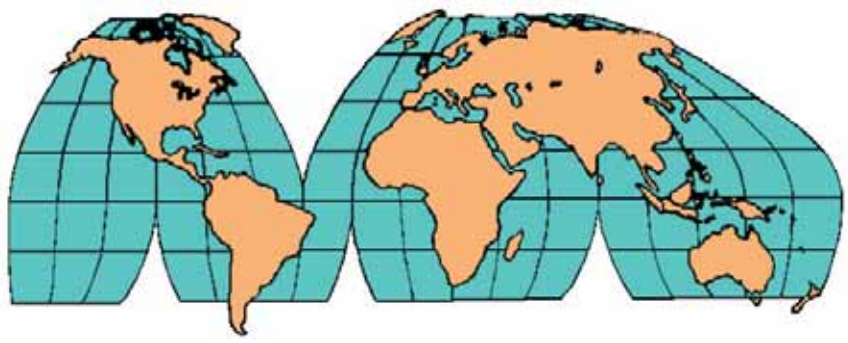
This venue may include the organization and undertaking of seminars, lectures, and workshops to educate and provide information to members and/or the public on all aspects of crocodile-related topics.

We would like to invite all individuals and institutions interested in the conservation of crocodilians to join the PCS. Help support the society and its efforts to conserve Philippine crocodiles!

The PCS's first Newsletter can be downloaded at "www.wmi.com.au/csgarticles". It outlines the society's constitution, laws, by-laws and types of membership. People or institutions interested in membership should contact me at <mario@herpaworld.com>.

Mario Lutz, *General Secretary, Philippine Crocodile Society, <mario@herpaworld.com>*.

Regional Reports



Latin America & the Caribbean

"INTRODUCTION TO FARMING OF CROCODILIANS" PUBLICATION TRANSLATED INTO SPANISH. A Spanish translation of "An Introduction to the Farming of Crocodilians" (Hutton and Webb 1992) is now available (at wmi.com.au/csgarticles). Although published in 1992, the article is still considered to be useful, and provides general guidelines on farming using case studies for the Saltwater crocodile (*Crocodylus porosus*), Nile crocodile (*C. niloticus*) and American alligator (*Alligator mississippiensis*). Translated by Dr. Andrés Seijas, it is hoped that the Spanish version will provide a valuable resource for researchers, students, farmers, etc., in Latin America and the Caribbean region.

Hutton, J.M. and Webb, G.J.W. (1992). An Introduction to the Farming of Crocodilians. Pp. 1-39 *in* A Directory of Crocodilian Farming Operations, compiled by R. Luxmoore. IUCN: Cambridge.

Andrés E. Seijas (*Grupo de Especialistas en Cocodrilos de Venezuela, Universidad Nacional Experimental de los Llanos "Ezequiel Zamora": UNELLEZ. Guanare, Venezuela*) and Charlie Manolis (*Editor, CSG Newsletter*).

Mexico

SEARCHING FOR THE NORTHERN AND SOUTHERN DISTRIBUTION LIMITS OF TWO CROCODILIAN SPECIES: *ALLIGATOR MISSISSIPPIENSIS* AND *CROCODYLUS MORELETII* IN SOUTH TEXAS, USA, AND IN NORTHERN TAMAULIPAS, MEXICO. To investigate why the distributions of *Alligator mississippiensis* and *Crocodylus moreletii* do not overlap, as well as to learn more about some cases of alligator captures on the Mexican side of the Rio Grande (Fig. 1), we planned a trip to southern Texas, USA, and northern Tamaulipas, Mexico, from 30 March to 5 April 2007.

Our first stop was Brownsville, Texas, where we visited the Gladys Porter Zoo, where Colette Adams had set up a meeting with FWS officers from the Laguna Atascosa National Wildlife Refuge. Brian Henley, one of the reptile keepers at the Zoo with knowledge of alligators in the Brownsville area, accompanied us to the Refuge.

Laguna Atascosa is the largest protected area (18,075 ha) in the Lower Rio Grande Valley. Alligator sighting is an increasingly frequent tourist attraction, since they can be seen in almost all bodies of water (lagoons and resacas). At the "Alligator Pond" we observed a pair of large specimens, as well as a frequently used trail leading to the main lagoon where another pair of alligators was sighted. According to Park Ranger Kevin Stephenson, alligators are common in many of the resacas and smaller lagoons. In one of these, we observed a pair of adult alligators taking care of their offspring from last year, as well as 2- and 3-year-old juveniles which were not as welcome by their mother anymore. During this morning visit, a total of 30 alligators of all ages and sizes were sighted, some close to 3 m in length.

Figure 1. Rio Grande near Matamoros, Tamaulipas, from the Mexican side. Photograph: Luis Sigler.

The following day, after three attempts to cross the USA/Mexico border, we headed south towards Ciudad Victoria. Oscar Hinojosa, with almost 10 years experience with Morelet's crocodile in northeast Mexico, took us to the Vicente Guerrero Dam.

There, we tried to carry out a night survey but a violent storm prevented us from doing so. According to recent 2006 data from Manuel Carrera and Oscar Hinojosa, Vicente Guerrero Dam supports one of the major populations of *C. moreletii* in Mexico; considered to be due to protection and food abundance.

Oscar Hinojosa had registered the most northern population of *C. moreletii* in El Bayuco de Oro (24°30'47.56''N, 97°51'42.42''W) in the municipality of San Fernando, but had received several reports of crocodile sightings further north. The purpose of this visit was to corroborate these reports and carry out informal interviews. We did not find any tracks in the rivers, streams and swamps that we visited, but we believe that a more precise answer would be found in night surveys and more formal interviews with people living and/or working near these waterbodies.

Our trip ended in Matamoros, Tamaulipas, where there have been some reports of *A. mississippiensis*. We visited a lake near the IMSS hospital, in the heart of the city, where an alligator was captured 7 years ago. We observed a very abundant population of turtles, especially from the genus *Apalone*. We travelled the Rio Grande through a dirt road from Matamoros to where the river ends in the Gulf of Mexico. The river looked spectacular and is a perfect habitat for *A. mississippiensis*, but apparently the species did not live in it. We interviewed some fishermen who had been there for over 10 years and they reported that they have never seen any alligators there.

The reports of sightings and capture of alligators on the Mexican side of the Rio Grande are possibly due to specimens that were released or that had escaped from private collections, but could also indicate a natural occurring migration.

Several species of aquatic reptiles share the habitat of both *A. mississippiensis* in Texas and *C. moreletii* in Tamaulipas, which is why it's difficult to think that there's a considerable geographic barrier, although it is noteworthy that the lagoons in northern Tamaulipas do not show continuity due to the arid terrains or land that has been transformed for agricultural use surrounding them. The only important body of water nearby is Laguna Madre, but it is one of the most hypersaline ecosystems on the continent, and both of these species of crocodilian prefer lower salinity levels.

Transformation of the Rio Grande delta has been going on for a couple of decades since at least two dams were built to retain its water for agriculture. Some depressions in the soil, which were at one time part of the Rio Grande delta, are now called "Resacas". It is in these waterbodies that some alligators have been found on the Texas side,

however these have been removed as they were considered a risk to nearby human populations.

We hope to return to the site and carry out night surveys to more precisely detect the range limits of these two crocodilian species.

Luis Sigler (Dallas WA), John Thorbjarnarson (Wildlife Conservation Society), Oscar Hinojosa Falcón (Cd. Victoria, Tamaulipas) and Brian Henley (Gladys Porter Zoo).

2ND CROCODILE'S WEEK IN VILLAHERMOSA CITY, TABASCO, MEXICO. The southeastern Mexican state of Tabasco comprises part of the natural distribution of *Crocodylus moreletii* (swamp crocodile, Morelet's crocodile), which is one of the three species with high skin quality and is a valuable commodity in international trade. Tabasco State also possesses one of Mexico's most important conservation areas - the Biosphere Preserve of Centla Swamps (RBPC). Due to the ecological, scientific, cultural and commercial importance that *C. moreletii* represents, the Universidad Juarez Autonoma de Tabasco (UJAT) and the Division Academica de Ciencias Biologicas (DACBiol) through the Crocodile Program, the Moreletii RBPC Project and the Direction of Natural Resources of the Secretary of Farming, Forest and Fisheries Development (SEDAFOP), organized the 2nd Crocodile's Week. The objective was to exchange experiences on handling and conservation of wild Mexican crocodilians (*C. moreletii*, *C. acutus*, *Caiman crocodilus fuscus*), and to promote the participation of students and interested parties in the crocodile resource. This event took place on 2-5 July 2007, in Villahermosa City, the capital of Tabasco State.

This event focused on imparting a theoretical-practical course with the main objective to provide basic knowledge on handling and techniques to assist in the development of scientific research on Mexican crocodilians.

The theoretical component was delivered at the "Ramon Margalef" lecture theater of DACBiol, where personal experiences as well as techniques necessary for population studies were shared (eg statistics, capture and handling). The schedule was structured in a way that participants could have with all the written information available about the general aspects of the Crocodylia and the experience at hand with crocodile specialists working in programs with wild populations. The following topics were covered:

1. General introduction: Order Crocodylia; crocodilians of Mexico.
2. Legislation: The Crocodylia; official Mexican Norms (NOM) and CITES; permissions for carrying out research (scientific collection).
3. Tools for Population Evaluation: Population studies as a species conservation support strategy; Information Technology tools as general support GIS (eg Geographic Information Systems).
4. Crocodile Manipulation: Capture, handling and transportation; biometrics, marking and liberation; determination of sex by (a) taking biological samples for determination of sex by hormone assay, and (b) taking tissue and blood samples for DNA testing.
5. Methodologies and Analysis of Information: Methodologies used for the study of wild crocodile populations; data analysis (population estimations through several methods, advantages and disadvantages).

There first of two practical sessions was held at the "Granja de Lagartos" of the SEDAFOP, where capture and handling (yearlings, juveniles, sub-adults and adults) of captive *C. moreletii* were covered. The second practical session took place at night in the "Las Ilusiones" lagoon, and consisted of spotlight surveys by boat, and capture techniques (see photographs below).

Course instructors were: Prof. Helios Hernandez-Hurtado and Prof. Pablo S. Hernandez-Hurtado [Animal Management Unit (UMA) Reptilario Cipactli of the Centro Universitario de la Costa, Campus Puerto Vallarta, Universidad de Guadalajara], Prof. Jesus Garcia-Grajales (Campus Puerto Angel of the Universidad del Mar and the UMA La Ventanilla, municipality of Santa Maria Tonameca, Oaxaca) and Prof. Marco A. Lopez-Luna

(Division Academica de Ciencias Biologicas of the Universidad Juarez Autonoma de Tabasco).

There were a total of 43 attendees; 34 undergraduate and postgraduate students, professors, researchers, governmental personnel and producers, etc., and 9 participants from diverse academic institutions and research centers located in different states of Mexico (eg Puebla, Federal District, State of Mexico, Veracruz, Chiapas and Tabasco). The organizers of the 2nd Crocodile's Week were Prof. Fernando Rodriguez-Quevedo and Prof. Eunice Pérez-Sánchez (Division Academica de Ciencias Biologicas and responsible for the Moreletii RBPC Project).

The main goal of the course was fulfilled, providing basic and updated knowledge on the handling of the species and tools for undergraduate and postgraduate thesis development. In the same way, we had the participation of people from local rural communities. They had the chance to express the local problems they have with *C. moreletii*, and requested assistance to be able to conserve the resource.

We would like to thank the Fondos Mixtos of the Consejo Nacional de Ciencia y Tecnologia (CONACYT) for its support that allowed the 2nd Crocodile's Week (as well as the Moreletii RBPC Project in the Reserve of the Biosphere Centla Swamps) to take place. We also thank the Universidad Juarez Autonoma de Tabasco through the Division Academica de Ciencias Biologicas, and the SEDAFOP for all of their assistance and support.

Fernando Rodríguez-Quevedo (Crocodile Program, DACBiol/UJAT), Eunice Pérez-Sánchez (Moreletii RBPC Project, Fondos Mixtos CONACYT/DACBiol-UJAT), Natalia Ovando-Hidalgo, Aarón Córdova-Carrillo, Raúl Cámara-Castillo G. and Francisco García-Ulloa (Universidad Juárez Autónoma de Tabasco, División Académica de Ciencias Biológicas, Km 0.5 de la Carretera Villahermosa-Cárdenas, entronque a Bosques de Saloya; CP. 86150, Villahermosa Tabasco, México); Tel. 52 (993) 156 5667, Fax: 52 (993) 354 4308, E-mail: biecalyc@hotmail.com, fernando.rodriguez@cicea.ujat.mx).

West Asia

Nepal

GHARIAL CONSERVATION PROGRAM (*GAVIALIS GANGETICUS*), NEPAL: NOTE ON POPULATION STATUS IN BARDIA NATIONAL PARK, DECEMBER 2005 AND APRIL 2007. The Indian Gharial (*Gavialis gangeticus*) is one of the most endangered crocodilian species in the world, and was recently listed on the IUCN Red List as "Critically Endangered". Historically occurring in the northern part of the Indian subcontinent, including rivers in Pakistan, Burma, North India, Nepal and Bhutan, wild gharial populations are currently known to exist only in India and Nepal. The gharial was saved from extinction in the 1970s thanks to captive rearing and restocking programs in India and Nepal. However, despite these efforts the wild population has been reduced to less than 200 adult crocodiles [see CSG Newsletter 26(2): 7-9].

In Nepal, gharial are distributed in isolated remnant populations in the Narayani River system (Chitwan National Park), Karnali and Babaï Rivers (Bardia National Park), and Koshi River (Koshi Tappu Wildlife Reserve) (Maskey 1989). Since 1981, due to the Gharial Conservation Project (Kasara, Chitwan National Park) initiated by the Government of Nepal, wild populations have been reinforced through the release of young captive-reared crocodiles. Despite a higher survival rate in Bardia rivers than in Chitwan rivers (Maskey and Percival 1994), the population reinforcement has been stopped in the Karnali, Babaï and Koshi Rivers since 1995, but is still occurring in the rivers of Chitwan. Even if the gharial population in Chitwan National Park is known and regularly monitored, population status in the other protected areas is only based on surveys made in 1992 and 1993. Ten (10) adult gharials were considered to be living in the Karnali River, 12 in the Babaï River and 10 in the Koshi River (Maskey *et al*. 2006).

During a visit to the Bardia National Park in December 2005 and April 2007 our objective was to update information on sthe tatus of gharial populations in the park's river. This information was recorded as far as possible by direct observations of crocodiles made during river surveys and completed by interviewing nature guides.

Survey Area and Methodology

Created in 1976 as a reserve, Bardia National Park covers an area of 968 km^2 in the Teraï zone on the banks of Karnali and Babaï in western Nepal. In 1990 and 1991, 50 gharials were released into the Babaï River, and in 1992 and 1993 23 into the Karnali River (Maskey 1994). The last count made in 1993 indicated that 12 wild adult females and 38 released gharials were living in the Babaï River and 5 wild adult females and 10 released crocodiles were living in the Karnali River.

The Babaï River appears to be more suitable for young reintroduced individuals, with a survival rate of 78% one year after release compared with 50% in the Karnali River [the latter rate is also observed in Chitwan National Park (Ballouard *et al*. 2004)].

Two surveys were undertaken; the first on 22-23

December 2005 was during winter, which is considered the optimal time for census. The second survey was undertaken on 25-27 April 2007, during the hot season. Forty kilometres of the Karnali river was surveyed by canoe up to the border with India. Due to the unstable political situation in the Babaï area, it was only possible to make observations on the Babaï Bridge in 2005 and from the bridge to 2 km upstream in 2007 (Fig. 1). For each gharial sighting (eg Fig. 2), the status of the animal was estimated, distinguishing immature from adult and identifying sex. In the same way, other aquatic species were recorded.

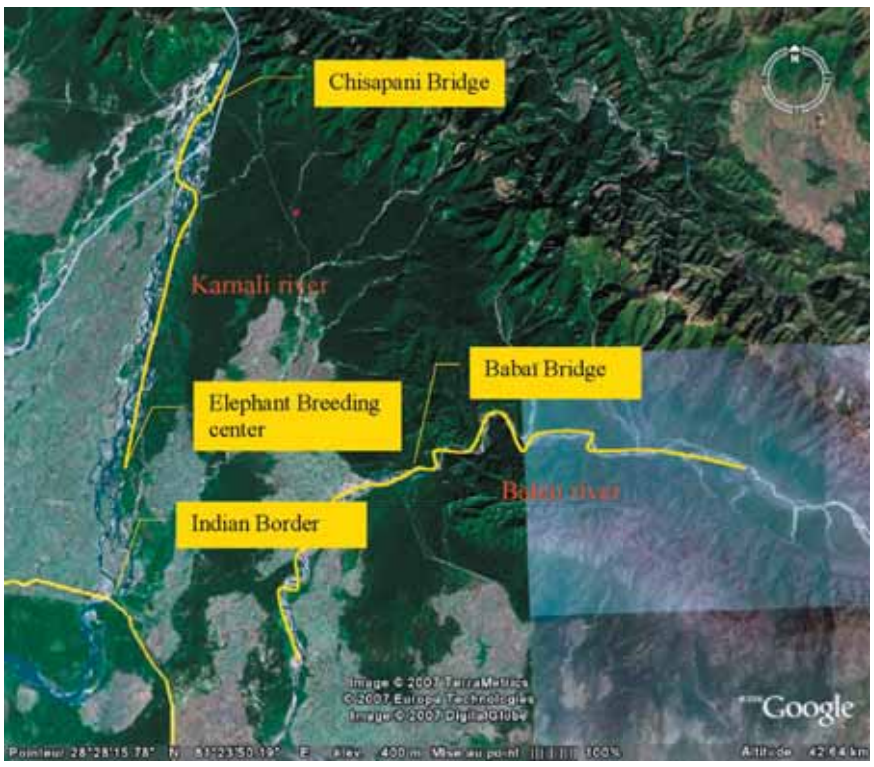


Figure 1. Survey area in the Bardia National Park (Google Earth, 2007).


Figure 2. Gharial in the Babaï River.

Results

In 2005 we observed only one adult female gharial in the Karnali River, in an area named “Lan mali”. However, human disturbance was particularly high at this time, which may have affected sightability. According to nature guide Gun Bahadur at Karnali Lodge, two females and one male should have been observed. One gharial also used to be seen on the “Elephant channel”, close to the survey endpoint.

In 2007 we also observed a female gharial at Lan mali, which may have been the same one that we observed in 2005. Moreover, according to the boating guide, one young gharial was been observed in this area two years earlier. His estimate of its size would mean that this crocodile was the result of natural hatching! But this should be taken with some caution. Although at that time human disturbance in the park was almost non-existent, this female was the only gharial that we’ve seen on the river. Finally, we completed the survey with the sighting of one female gharial and one mugger down from “Bagh machan”.

In 2005 we observed one female gharial from the Babaï Bridge on the Babaï River although four gharials used to be able to be observed. During this visit we saw people fishing with nets down to the dam where gharial used to settle. Moreover, according to Gun Bahadur, who has not seen these gharials this year, poison is used to catch fish. According to him, the status of these gharials was very uncertain.

In April 2007 we again saw these four gharials and two muggers. Nevertheless their survival status is very tenuous, and we observed fishing net tangled around the snouts of two females. Moreover we witnessed poison pollution upstream of the dam - in an area covering more than 2 km we found dead fish, including golden mahseer (*Tor putitora*) on each side of the river (Fig. 3). During the opening of the dam, we observed the male gharial eating dead fish coming from upstream. One mugger was observed 800 m upstream of the dam, at a deep pool where golden mahseer were hunting.


Figure 3. Poisoned golden mahseer in the Babaï River.

In summary, for the Karnali River the paucity of direct observations of gharial indicate that the size of the population is very low. Although the survey conditions were not optimal, information from local guides indicate that the Karnali River population consists of no more than 5 individuals, comprising three females, one male (that we haven't seen) and one sub-adult or juvenile. In the Babaï River, the minimum size of the gharial population is 4 individuals, just down from the Babaï Bridge. Unfortunately the status of the population in the gorges, where individuals used to be observed, is unknown. But according to a ranger (Jet Bahadut Kadka), some gharials were sighted around "Sakligath" about 5 years ago. We hope that despite high poaching in the area that these gharials are still alive!

Gharial Conservation: Challenges and Opportunities

Despite the low number of gharial observed and the visible threats (poison and fishing nets), Bardia National Park presents good potential for gharial conservation. Indeed, in comparison with Chitwan National Park where the main population of gharial in Nepal exists, human pressure (eg disturbance, sand mining, wood harvesting, fishing) is low and rivers present favourable habitats for gharial (Maskey *et al*. 1995; Ballouard *et al*. 2004). Moreover, prey availability appears to be good. Hall *et al*. (2001) noticed that the Babaï River, which is famous for fishing golden mahseer, has a high species richness with more than 33 species of fish. The presence of other aquatic and emblematic species such turtles, otters and dolphins is also a good indicator of river health.

Taking into consideration the low populations in the Bardia and Karnali Rivers and the overall conservation status of the gharial, the relaunching of a gharial conservation program in Bardia appears to be essential. Different components need to be put into place:

- Relaunch the release of captive-reared gharial in Bardia rivers to reinforce the existing population.
- Augment the population reinforcement with studies and surveys in order to improve biological and ecological knowledge and adapt specific management.
- Develop a Gharial Breeding Centre in Bardia, to preserve the Nepalese gharial "captive bank" currently concentrated in the Kasara Breeding Centre in Chitwan National Park. Within the context of national management it could be an opportunity to allow genetic mixing with the Chitwan crocodiles.
- Reinforce the law and improve vigilance in order to preserve gharial from human threats.
- Include local communities in the project through the development of communication, sensitisation and participation (eg for building of breeding centre).

Nepal is the only country after India where gharial still occur. In the current context of biodiversity reduction in the world, it is a new challenge for Nepal to develop this Gharial Conservation Project in Bardia and more broadly in the country and save one of most emblematic species of crocodile in the world.

Aknowledgements

We wish to express our sincere thanks to Dr. Tirtha Man Maskey for his encouragement to carry out this research program. We also like to thank equally the rangers of the Gharial Conservation Project and the Tiger Tops Naturalist's team.

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North America

USA

Val Lance recently found a publication entitled "First confirmed record of American alligator nesting in Oklahoma" (Arbour and Bastarache 2006). I was quite interested to see this finding; although the range of the American alligator includes the extreme southeastern part of Oklahoma (Joanen and McNeese 1987) and further

details on the Oklahoma range are described by Sievert and Sievert (2005) in the Arbour and Bastarache (2006) publication.

Arbour and Bastarache (2006) describe finding an alligator nest (Fig. 1) on 28 July 2005 on a corner of a reservoir levee, with an active trail and alligator tracks. Regular checks of the nest were conducted, and on 8 September Mr. Arbour found the nest had hatched; 19 hatchlings were counted. One unhatched egg remained in the nest, which had been infested by fire ants.

Figure 1. Alligator nest located in 2005. Photograph: David Arbour.

I contacted David Arbour to learn whether he had been able to follow the fate of the hatchlings (growth, survival, dispersal, etc.) or if any subsequent nests had been discovered. He responded to my inquiry immediately, and thinks perhaps they have seen two individuals from this clutch in surveys carried out in 2007. They did not see any nests in 2006, and believe the local population consists of some 15 alligators.

They found one nest in 2007, which hatched on 30 August 2007, and he was able to count 30 hatchlings (see front cover). This nest was about 150 yards (137 m) from the 2005 nest, and Mr. Arbour thinks it is a different female, as the female from 2005 was quite timid, while the female attending the nest in 2007 was very aggressive.

These findings suggest the status of the American alligator in Oklahoma may be improving. We look forward to continued updates from Mr. Arbour and his colleagues.

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East and Southeast Asia

Japan

On 13 September 2007, 90 days after CITES CoP14 (The Hague, Netherlands, June 2007), the Japanese Ministry of Environment officially declared the deletion of *Caiman latirostris* (Argentine population) and *Melanosuchus niger* (Brazilian population) from the Appendix to the *Wild Animal Protection Act*. This will now allow skins and products of these two species from the respective countries to be imported into Japan.

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Philippines

CROCODILE INDUSTRY WORKSHOPS. During August, Crocodylus Porosus Philippines Inc. (CPPI) organised several crocodile workshops on the Island of Mindanao.

From 23-24 August, a "Slaughtering and Skinning Workshop" was held at Kapalong and Sto Tomas, Davao del Norte, in cooperation with Pag-asa Farms - J.K. Mercado & Sons Agricultural Enterprises. Inc. A new electro-stunning device, used for the first time in the Philippines, was very successful. Training was delivered by Greg Mitchell (Papua New Guinea) to some 20 trainees, and 28 crocodile skins were processed ready for export to Horiuchi Trading Co. Ltd. (Japan).

At the end of this workshop, a round table discussion was held between industry participants and representatives of the four Philippine Government departments responsible for the husbandry, welfare, slaughtering and export of crocodile products: specifically, Animal Welfare Division, Bureau of Animal Industry (Dr. Angel Antonio B. Mateo); National Meat Inspection Service (Dr. Roseller L. Manalo, Rogelio V. Peñamora and Julio C. Sobrepeña Sr.); Protected Areas and Wildlife Bureau (Angelita

P. Meniado and Nermalie M. Lita); Palawan Wildlife Rescue and Conservation Center (Ronnie Q. Sumiller and Renato A. Cornel). Extensive discussions were held on all of the Philippine's requirements and regulations covering the welfare, farming, handling, and slaughtering of crocodiles and the sale and export of crocodile meat and skins.

From 25-26 August a "Crocodile Handling Workshop" was conducted with the cooperation of Sonny Dizon at his Davao Crocodile Park, Davao City. This workshop was conducted by Paolo Martelli (Chief Veterinarian, Ocean Park, Hong Kong) and involved participants from the majority of crocodile farms in the Philippines. Tom Dacey, CSG Executive Officer also attended and participated in the workshops.

Vicente P. Mercado, *President, Crocodylus Porosus Philippines Inc*.

Indonesia

A workshop entitled "Revitalising Indonesia's Crocodile Farming and Processing Industry" was held in Jakarta on 16-17 July 2007. The workshop was well attended, with staff from the Ministry of Marine Affairs and Fisheries (MMAF), the Directorate of Forest Protection and Nature Conservation (PHKA) of the Ministry of Forestry, Ministry of Trade (DPR1), and crocodile farmers from Java, Sumatra, Kalimantan and Papua Province.

MMAF Minister, Mr. Freddy Numberi, confirmed that the crocodile industry in Papua Province was of economic significance to the local indigenous people, and suggested that an industry that was vibrant and extensive in the 1990s was now reduced. The goal of the workshop was to initiate discussion on ways in which the industry could be enhanced, particularly in Papua Province, and whether the experiences from Australia could assist them.

Peter McInnes (ARDEP, Australia) gave a presentation on research in the Australian crocodile industry. He outlined some of the most significant research outcomes (eg Meat Handbook, electro-stunner) and future research priorities for the industry (eg nutrition, genetic selection, reproduction, processing, marketing), and stressed the Australian crocodile industry's significant contribution to publically-funded research projects.

Charlie Manolis (WMI, Australia) presented an overview of the role of international conventions (eg CITES) and the CSG in international trade, trends within the international crocodilian skin markets, and general farming principles (eg incubation, hatchling care, juvenile care, captive breeding, skin quality). Of particular significance he highlighted results from the 18th CSG meeting (France, 2006) - specifically how international manufacturers now operate with the key "high-value" crocodilian species in trade (ie *C. niloticus*, *Alligator mississippiensis*, *C. siamensis, C. novaeguineae*), and the emphasis on skin quality.

Indonesia has four species of crocodilian: *C. porosus* and *C. novaeguineae* are traded commercially (CITES Appendix II), and *C. siamensis* and *Tomistoma schlegelii* which are not traded commercially (CITES Appendix I) and which are of conservation significance.

Tonny Soehartono (PHKA) indicated that there are now 16 farming operations in Indonesia. Current harvest quotas for ranched and wild *C. porosus* and *C. novaeguineae* in Papua Province are zero wild skins, 10,000 ranched juveniles and 15,000 wild skins, 15,000 ranched juveniles respectively. Most (75%) crocodile skins are traded in wet blue form, with the remainder as crust-tanned skins or as finished leather (products). Changes are being considered to the export requirements for skins, from wet blue (current) to crust condition by 2008, and to finished leather by 2010. The argument that crust tanning will lead to increased employment is not convincing.

The second day of the workshop involved a field trip to PT. Ekandinya Karsa, comprising a crocodile farm and tannery, situated just out of Jakarta. The opportunity was taken during the field trip to discuss more openly the prevailing views of the farming segment of the industry.

The following points summarise the discussions at the workshop:

- Crocodile management is the responsibility of PHKA (CITES Management Authority) and LIPI (CITES Scientific Authority). Although changes in legislation place crocodiles under MMAF, it does not at this time have any established infrastructure or enforcement capability to manage the crocodile resource.
- The Crocodile Farmers Association is not operating effectively, and largely exists in name only. Members are aware of this, and efforts are being made to present a more united front.
- A closer relationship between Government and industry would certainly assist all stakeholders involved in the industry.
- Common with many other countries, changes in Government personnel means there is little institutional memory in Government on crocodiles.
- Establishment of tanneries in Papua Province is considered prohibitive, due to high costs of freight for salt, access to chemicals, overseas markets, etc.
- The trade chain that begins with harvesters (field), who supply collectors (village), who supply buyers (area) - who may also be farmers. Ranched juveniles can be held for considerable time by harvesters, collectors and buyers, and may be in very poor physical condition by the time they reach farms. Mortality can be high.
- Wild skins vary greatly with regard to quality. Buyers tend to pay the one price, regardless of quality (eg scars

from sago palm, spear holes, improper preservation, etc.).
- Current harvest quotas, particularly for wild skins (see above) are considered too low, and some illegal trading may be occurring. A zero quota for wild *C. porosus* skins was established by LIPI as there had been no monitoring surveys undertaken for this species since 1998. The quota for wild *C. novaeguineae* skins was based on recent monitoring data.

A meeting was also held with Hellen Kurniati (CSG Regional Vice Chair for East and Southeast Asia), and population monitoring for *C. porosus* and *C. novaeguineae* in Papua Province and *C. siamensis* in Kalimantan was discussed. For *C. porosus,* surveys to quantify population trends have not been carried out since 1998 (Kurniati and Rumbarar 1999), although surveys of *C. novaeguineae* have been carried out more recently (Kurniati and Manolis 2003). Assessing the population status of *C. siamensis* is considered a priority, but the nature of the habitat makes standard surveying (spotlight) difficult (Kurniati *et al.* 2005).

The CSG recognizes the importance of the crocodile industry in Papua New Guinea and Indonesia for rural communities. A healthy vibrant industry can have positive flow-on effects for such communities. But compliance with CITES underpins use and ongoing trade in the crocodile resource.

The Indonesian crocodile industry has been operating for over 20 years, and a review of crocodile management may be timely. This could help to identify potential problems and to guide Government and industry into the future.

Acknowledgements

Participation by Peter McInnes and Charlie Manolis at the workshop was made possible through financial support from the Australian Centre for International Agricultural Research (ACIAR). The assistance of John Murray, ACIAR Indonesian Country Manager, throughout the visit was greatly appreciated.

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[Note: During a later visit to Indonesia (August 2007), it was confirmed that planning for population monitoring surveys for both species is now underway].

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Africa

Ethiopia

In the last issue of the CSG Newsletter [26(2): 14-16], Rom Whitaker provided some observations on Nile crocodiles in Lake Chamo during a visit to the area in June 2006. The full report ("Sustainable Use of the Lake Chamo Nile Crocodile Population"), submitted to African Parks (Ethiopia) Nechsar National Park Project, is now available at: www.wmi.com.au/csgarticles.

Europe

ON THE AGE OF SOME CROCODILIANS IN EUROPEAN ZOO COLLECTIONS. After the surprisingly finding of a 34-year-old, adult Philippine crocodile (*Crocodylus mindorensis*) at Wroclaw Zoo (Poland), I compiled some information on a few older crocodilians in European zoo collections.

The oldest crocodilian held in Europe was an American Alligator (*Alligator mississipiensis*) named "Cabulitis" at Riga Zoo (Latvia), which is reported to have lived at this zoo for 72 years! Guna Votola, collection manager at Riga Zoo, wrote the following details: "Riga Zoo received it on 1st April 1935 as the donation from Latvian School museum, nothing is known about the place of birth. There was no data about the size on arrival. All together 2.2 [male:female] young Mississippi alligators were donated in 1935 to Riga zoo; females died on 1971 and 1977 at Riga Zoo, the other male was traded to Kyiv Zoo in 1965. The remain male alligator was measured in 1950 (2.3 m), 1952 (2.7 m), in 1955 (2.9 m) and in 1966 (3.0 m). In 1971 it was recorded that he was very aggressive, so naturally the precise measuring was not possible any more. There are only brief notes about this alligator. He had skin problems in 1952, but was treated successfully by adding A and D vitamins to the horse meat. In 1970 for several months he stopped to eat. Also in 1979 he did not eat for the long period, restarted to eat in only 1980. Now we estimate that he is about 3 m long, in general his condition is good." Sadly, Guna Vitola reported that Cabulitis died on 21 August 2007, with old age as the likely cause of death.

A male New Guinea Freshwater crocodile (*C. novaeguineae*) lived at Berlin Zoo Aquarium (Germany) for almost 54 years, before being transferred to the private collection of Uwe Ringelhan in 2006. Neither its age, size at arrival in Berlin nor the exact place of origin are recorded. This animal has been kept for decades in a mixed crocodilian species exhibit, as was usual in many European zoo collections. It is still in good condition.

Another fairly famous crocodile is "Max" the Saltwater crocodile (*C. porosus*) at Dresden Zoo (Germany) (Fig. 1). This male lives alone, is relatively docile crocodile, and is about 4 m long. He has been at Dresden Zoo for 52 years. His exact age and the place of origin are unknown. When I first saw him in 2005 he was in excellent condition.

Figure 1. Max, the Saltwater crocodile, at Dresden Zoo. Photograph: Dresden Zoo.

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Science

Recent Publications

Steven G. Platt, Thomas R. Rainwater, Scott Snider, Anthony Garel, Todd A. Anderson and Scott T. McMurry (2007). Consumption of large mammals by *Crocodylus moreletii*: field observations of necrophagy and interspecific kleptoparasitism. Southwestern Naturalist 52(2): 310-317.

Abstract: The consumption of large (>15 kg) mammals by Morelet's crocodile (*Crocodylus moreletii*) is poorly documented. We present field observations of necrophagy and interspecific kleptoparasitism (defined as the stealing of food from an individual by another individual) involving the consumption of domestic cattle (*Bos taurus*) and Baird's tapir (*Tapirus bairdii*) carcasses, respectively, by Morelet's crocodile in Belize. Our single observation of kleptoparasitism occurred when an adult crocodile fed upon and attempted to hijack a tapir killed by a jaguar (*Panthera onca*). Crocodiles gained access to the interior of carcasses by tearing through the abdominal wall (tapir) or expanding an opening made by feeding vultures (cattle); feeding then progressed to the limbs, neck, and head. Crocodiles quickly located and congregated at cattle carcasses, possibly attracted by large flocks of feeding vultures. Feeding aggregations were composed solely of adult crocodiles; juveniles and subadults were probably excluded by the presence of larger, dominant individuals. Crocodiles required 72 to 96 h to consume cattle carcasses. While our observation of kleptoparasitism is among the few yet reported for any crocodilian, we speculate that this foraging strategy is more widespread and has likely been overlooked by previous investigators, owing to the difficulty of observing feeding behavior in the wild. Collectively our observations suggest that large mammals represent an important, albeit rare and hitherto overlooked, food resource for adult *C. moreletii* in Belize.

[A PDF of this paper is available from Thomas Rainwater at <trrainwater@gmail.com>]

Oliver Wings (2007). A review of gastrolith function with implications for fossil vertebrates and a revised classification. Acta Palaeontologica Polonica 52(1): 1-16.

Abstract: Misleading interpretations of "gastroliths" in fossil taxa have complicated the use of this term in palaeontology. This paper reviews the definitions and ascribed functions of gastroliths. According to the suggested definition, gastroliths are hard objects within the digestive tract of animals - without specification of the mechanisms that are responsible for their accumulation. To further improve definitions, the origin-based terms "bio-gastrolith", "patho-gastrolith", and "geo-gastrolith" are introduced. The term "exolith" is introduced for isolated clasts with a possible history as geo–gastroliths. Hypotheses about the function of stomach stones in fossil and extant taxa are reviewed, discussed and supplemented with new research. Trituration and mixing of foodstuff are the generally accepted functions of gastroliths in many vertebrates, including birds. In contrast, ballast provided by swallowed stones is considered to be of limited importance for buoyancy in aquatic animals. Other functional hypotheses include mineral supply and storage, stomach cleaning, maintenance of a beneficial microbial gut flora, destruction of parasites and alleviation of hunger. Accidental ingestion of sediment, either by

being mistaken for prey, by being attached to it, during playing or due to pathological behaviour, is considered to be common. Different functions may overlap in various taxa.

Oliver Wings, Leon Claessens and Corwin Sullivan (2007). Crocodilian gastroliths past and present: their distribution and function. Proceedings of European Association of Vertebrate Palaeontologists (Abstract).

Abstract: Gastroliths (stomach stones) have been found associated not only with many fossil crocodyliform taxa (including the marine taxa *Steneosaurus* and *Dyrosaurus*, and the amphibious *Diplocynodon*), but also with most extant Crocodylia. They are especially common in *Crocodylus* and *Alligator*, but distribution and quantity of gastroliths within individuals of certain taxa are highly variable, thus complicating the identification of their possible function(s). While several potential functions for gastroliths have been suggested previously, the two most widely accepted hypotheses are 1) that the gastroliths contribute to digestion through trituration of foodstuffs and 2) that they provide buoyancy control in water by acting as ballast. Here we report observations with a bearing on the former hypothesis. Several quartz pebbles of suitable size were examined via SEM and subsequently offered to a juvenile alligator (*Alligator mississippiensis*). After these artificial gastroliths were ingested by the alligator, their positions and movements were observed and filmed via X-ray cinematography at regular intervals, before and after feeding. Video sequences show that the gastroliths only gradually changed their positions within the alligator's stomach, in contrast to gastroliths in bird gizzards, which move constantly due to muscular contraction of the stomach. After approximately nine months the alligator was euthanized and all gastroliths retrieved. A second SEM examination of the surface of each gastrolith revealed no evidence for alteration: original structures down to a size of 10 microns were traceable again. The lack of abrasion was confirmed by the identical mass of the stones before and after their stay in the alligator stomach. We conclude from the X-ray cinematography observations and from the lack of mass loss and surface alteration that the influence of gastroliths on digestion in crocodilians is negligible. Ballast provided to crocodyliforms by gastroliths is also considered to be of only limited importance for buoyancy, but this requires further study and confirmation. It is possible that many crocodyliforms have swallowed stones merely by accident. However, the widespread occurrence of gastroliths in diverse crocodyliform taxa may also indicate that there are other, previously unrecognized benefits to gastrolith ingestion.

Carlos I. Piña, Melina Simoncini, Pablo Siroski and Alejandro Larriera (2007). Storage of *Caiman latirostris* (Crocodylia: Alligatoridae) eggs in harvest containers: effects on hatchability. Aquaculture 271: 271–274.

Abstract: In crocodilian ranching operations 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. In the ranching program for *Caiman latirostris* in Santa Fe, Argentina, gauchos do not collect eggs on the day nests are found, but rather on the day before the collectors arrive to pick them up and transport them to incubators. This is based on the untested assumption that the probability of increased mortality in the wild nests would be less than that likely to be encountered if eggs were collected on the day they were found and stored in the gaucho's house. This study tested whether storing the eggs in the houses for between 0 and 16 days, had any significant effect on hatching success. None could be demonstrated, suggesting that eggs should be collected when they are found, thereby avoiding risks of predation and flooding in the field prior to collection.

García-Grajales, J., Buenrostro-Silva, A. and Escobedo-Galván, A.H. (2007). Analisis de los métodos usados para estimar la abundancia de las poblaciones silvestres de cocodrilianos (Crocodylia) en México. Ciencia y Mar XI(31): 23-32.

Abstract (translation): We analyzed information about studies on abundance of wild crocodilian populations in México and the methods for the quantification of these populations. We reviewed 27 papers written between 1992 and early 2007. Only 37.0% were theses, 29.7% were articles in popular science magazines, 25.9% were specific articles on crocodilians, 3.7% were works published in proceedings of meetings, and 3.7% were technical reports. We found that all studies had duration of one year approximately and there was variation of methods between different localities. Of the 27 papers reviewed, 92.6% used the conventional method of spotlight counts while 7.4% used capture-recapture method using the geometric estimator of the capture frequency model for analysis. With this information we undertook an analysis of the advantages and disadvantages of the methods used for the estimation of wild crocodilian population abundance. On the basis of this analysis we propose a sampling design involving the use of two alternate methods for the same site: 1) spotlight count using the method of the maximum number of observed individuals; and, 2) the capture-recapture methods using the geometric estimator of the capture frequency model. This approach seeks to standardize the methodology for the quantification of wild crocodilian populations giving insights into the understanding of the population dynamics and conservation status of the crocodilian species of Mexico.

Mark A. Read, Gordon C. Grigg, Steve R. Irwin, Danielle Shanahan and Craig E. Franklin (2007). Satellite tracking reveals long distance coastal travel and homing by translocated estuarine crocodiles, *Crocodylus*

porosus. PLoS One 2(9): e949.doi:10.1371/journal.pone.0000949.

Abstract: Crocodilians have a wide distribution, often in remote areas, are cryptic, secretive and are easily disturbed by human presence. Their capacity for large scale movements is poorly known. Here, we report the first study of post-release movement patterns in translocated adult crocodiles, and the first application of satellite telemetry to a crocodilian. Three large male *Crocodylus porosus* (3.1-4.5 m) were captured in northern Australia and translocated by helicopter for 56, 99 and 411 km of coastline, the last across Cape York Peninsula from the west coast to the east coast. All crocodiles spent time around their release site before returning rapidly and apparently purposefully to their capture locations. The animal that circumnavigated Cape York Peninsula to return to its capture site, travelled more than 400 km in 20 days, which is the longest homeward travel yet reported for a crocodilian. Such impressive homing ability is significant because translocation has sometimes been used to manage potentially dangerous *C. porosus* close to human settlement. It is clear that large male estuarine crocodiles can exhibit strong site fidelity, have remarkable navigational skills, and may move long distances following a coastline. These long journeys included impressive daily movements of 10-30 km, often consecutively.

Helios Hernández Hurtado, Rafael García de Quevedo Machain and Pablo S. Hernández Hurtado (2006). Los cocodrilos de la costa Pacífico occidental (Michoacán, Colima y Jalisco) de México. Pp. 375- 389 *in* Los Recursos Pesqueros y Aquícolas de Jalisco, Colima y Michoacán, ed. por Ma. del Carmen Jiménez Quiroz and Elaine Espini Barr. Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, Instituto Nacional de la Pesca y Centro Regional de Investigación Pesquera de Manzanillo: Manzanillo, México.

Resumen: En este capítulo se analiza la información publicada e inédita generada hasta diciembre de 2004 sobre el *Crocodylus acutus* Cuvier (1807), en la región de la costa Pacífico occidental de México. Para ello la información se organizó en cuatro temas: 1) Biología, abundancia y distribución de la especie. 2) Historia, protección y explotación. 3) Problemática y relación entre hombre y cocodrilo. 4) Unidades para la conservación, manejo y aprovechamiento sustentable de la vida silvestre (UMAS) y zoológicos como estrategia de conservación de cocodrilos. Con lo anterior se determina la situación de las poblaciones y la conservación en cautiverio de la especie en la región.

[A pdf version of this article is available at: www.wmi.com.au/csgarticles].

Submitted Articles

Thomas Ziegler and Sven Olbort (2006). Genital structures and sex identification in crocodiles. Crocodile Specialist Group Newsletter 26(3): 12-13.

Abstract: A review of crocodilian genital morphology and sex identification based on genital structures is given. The most distinct sex character in crocodiles is the male erectile penis, that usually grows disproportionately faster as compared to the growth of the female clitoris. The crocodilian copulation organ is unpaired and normally hidden inside the cloacal slit in the resting state. It consists of a cone-like process of the anterior ventral cloacal septum. The outer genital organ usually is cylindrical, somewhat laterally compressed and buttressed by originally pair wise built connective tissue structures. Spongy tissue with dilated blood lacunas enable the penis to bulge by accumulating blood. Although the shape of the bulging penis is only slightly changed, the protrusion of the copulation organ from the cloaca opening is additionally supported by muscle pressure. For mating, the protruded penis is almost semicircularly bent towards the venter. In this condition, the medially located sperm groove, that stretches dorsally to the anterior tip of the copulation organ, is turned away from the venter. Such a groove is also discernible in the clitoris, but remains functionless. The tip of the outer genital organs shows structures that are comparable to the mammalian glans and can be distinguished between the lappet-shaped tip on which the sperm groove extends and a blunter structure that is demarcated from the tip by a small groove.

A historical review shows that external genitals in male and female crocodilians are known for a long time. More than 100 years ago, the crocodile cloaca and its outer genital organs were extensively described. At that time it was yet known that the size of the clitoris of about 1 m large crocodiles approximately equals that of male copulation organs of similar sized specimens. It was also known that the outer genitals of equal sized sexes almost revealed the same differentiation of the sperm groove and of the terminal genital structures. First evidence was provided for a sex identification based on genital morphology by demonstrating that in larger crocodiles the structurally identical clitoris is smaller-sized compared to the male copulation organ, and former stagnates in growth. It was also well known at that time that differences exist in the development of the outer genital structures and that both penis and clitoris protrude from the cloaca in early embryonic stages, but disappear into the cloaca some time before the hatching process.

For correct sex identification, thus evaluating the size and the structures of the crocodilian copulation organ, usually the penis or clitoris of a previously immobilized crocodile is protruded by inserting a finger into the cloaca. With the application of this palpation method, the smaller clitoris normally can only be pressed out a few millimetres beyond

the cloaca at best, whereas the larger penis should be well palpable and distinctly protruding as a relatively rigid and longish cone-shaped organ, at least in larger specimens. To identify the sex in younger crocodiles, a veterinary vaginal speculum serves best to obtain detailed insights into the cloaca and its structures. Another possibility is the protrusion of the copulation organ by lateral compression of the cloacal region together with a cautious bending of the tail towards the crocodile venter. However, for a successful sex identification, the aforementioned methods all deserve skills in the recognition of the relative size differences and the different peculiarities of the male and female genital structures, especially in juveniles.

In general, the crocodilian sex determination and therewith the differentiation of the gonads occurs prior to hatching. However, the state of the outer genital organ's differentiation in juvenile crocodiles apparently is species-specific. In some *Alligator*, *Caiman* and *Crocodylus* discernible differences (size, coloration, shape and structure) do exist between the penis and clitoris of freshly hatched juveniles, except for females, which were incubated at relatively high temperatures, and in which the dimensions of the outer genital organs resemble those of males. Contrary, a proper sex identification based on the outer genital structures seems to be impossible or difficult at least in juvenile *Gavialis* and *Tomistoma*. Therefore, further research on the genital morphology related to both sexes is highly recommended. Not before specific differentiation and size of copulatory organs of all crocodile species are better understood, including age-dependent and individual variation, genital morphology based sex identification will provide more reliable results in the future. Furthermore it must be taken into account, that not only different incubation temperatures influence growth and length of the outer genital organs in crocodiles, but also human impact on the natural habitat, such as the contamination by hormones, which can effect abnormal growth of the outer genital organs.

[The complete paper, including 15 figures and references, can be downloaded at www.wmi.com.au/csgarticles].

CROCODYLUS RHOMBIFER, C. ACUTUS AND *C. MORELETII* SOMETIMES KEY WRONG.

Crocodylus rhombifer: The CITES Identification Guide for Crocodilians (Charette 1995) and Fuchs (2006) both state that *C. rhombifer* lacks scale-row inclusions on the under surface of its body and tail. However, in actuality this species can sometimes have scattered and minor ventral scalation irregularities on the belly (transverse rows) and also some tiny inclusions (1-3 relatively small size scales) under the tail, along and/or crossing the ventral caudal midline (see Ross 1998).

The ventral scalation of *C. rhombifer* is generally regular, and the few little flaws in the symmetry would not attract much attention, unless the CITES key was being used with an unidentified *C. rhombifer* skin with scale inclusions. The presence of anterior subcaudal scale inclusions of any kind would not lead to *C. rhombifer* being identified by the key.

Crocodylus acutus: The majority of commercial *C. acutus* belly skins should not key out using the CITES guide, in which the diagram of scalation inclusions restricted to the lateral surfaces of the anterior third of the post-cloacal tail is not an original drawing. It was inaccurately copied from a figure in Brazaitis (1989), which was also not specimen-based, but was an artistic modification of an original King and Brazaitis (1971) illustration of the basicaudal region of a tanned *C. niloticus* belly skin - not a *C. acutus*.

Thus the 1989 and 1995 drawings are fiction, and both technically misrepresent the species and the scalation character in question. There are too many inclusions of too many scales, and there is too much bilateral symmetry implied - the pictured condition in the CITES guide is not expected to occur in nature (Ernst *et al*. 1999).

In the Ross and Ross (1974) sample of 63 *C. acutus* specimens, a limit of no more than three small proximal irregularities occurred on the combined left and right lateral basicaudal surfaces of any individual postcloacal tail, and never did these inclusions occur in perfect bilateral symmetry, contradicting the symmetrical implications in the 1989 and 1995 diagrams. Rather, in *C. acutus* each irregularity may consist of 1-3 scales (Ross and Ross 1974), with one scale being the most common.

Crocodylus moreletii: The underside of the proximal half of the post-cloacal tail in *Crocodylus moreletii* has been reported to exhibit a special scalation irregularity pattern (incomplete whorls and intercalary or supernumary rows) either 100% of the time (Ross and Ross 1974; Ross 1987; Brazaitis 1973; Wermuth and Fuchs 1983; Charette 1995) or 66% of the time (King and Brazaitis 1971; Fuchs 2006).

I have always assumed that when King and Brazaitis (1971) reported approximately one-third of their Morelet's crocodile sample as lacking the special subcaudal scalation character (sic), that it was a problem of misidentification of *C. acutus*. King and Brazaitis (1971) did not indicate sample size, so it is unknown what statistical relevance the "66%" had. In contrast, Ross and Ross (1974) sampled 111 mostly wild *C. moreletii* (see Ross 1997), and Ross and Mayer (1983) reported the specimen numbers and locality data for 10 *C. moreletii*, all of which had basicaudal irregularity in the form of extra transverse scale-rows in the proximal third of the sub-dorsal and post-cloacal tail.

Fuchs (1974), Brazaitis (1973), Wermuth and Fuchs (1983) and Charette (1995) do not mention the 66% frequency, so the reference to it in Fuchs (2006) may represent the original King and Brazaitis (1971) data

without acknowledgment, or new research. If the latter is correct, no data on sample size are presented with which to confirm the significance of the frequency.

In addition, it is likely that none of Fuchs' (2006) commercial belly skins had their heads, dorsal armor and natural coloration available for species identification. The neck scales of *C. moreletii* can be a diagnostic tool in some circumstances (Ross and Ross 1987). Some of the important identifying cranial characters can be seen when the head is covered with natural skin, but at least one very reliable feature on the skull. The transverse palatal suture between the maxillary and premaxillary bones can only be viewed on live animals by radiographic photography, but it is obvious on cleaned skulls, and specimens in alcohol can have a flap of palate skin cut (three lines) with a knife, and then folded-back to reveal the bare bone (Ross 1987). For diagnostic characters of *C. moreletii* by means of neck scales and cranial features, see Ross (1987).

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Obituary

Jesus C. Miranda (2 July 1944 - 1 July 2007)

Crocodiles have an image problem in the Philippines. Buwaya, Pilipino for crocodile, has become synonymous with greed, treachery and corruption. In the tabloids politicians are often portrayed as hungry crocodiles. Jesus Miranda defied cultural prejudice and public mockery when he threw his political weight behind the conservation efforts for the Philippine crocodile. As the mayor of San Mariano, a small and remote town in the Province of Isabela on the island of Luzon, he proclaimed the Philippine crocodile the flagship species of his municipality. It marked the start of a community-based effort to save this critically endangered crocodile in the wild.

As the quintessential Filipino politician, Jesus Miranda would invite you in his office, cracking jokes about crocodiles and opening a bottle of brandy. He would recall his childhood days when crocodiles could be seen in the river in front of their house in barangay Disulap. Or he would boast how he had shot a crocodile in the forest in the 1960s for the barbeque. But his actions as municipal mayor were unprecedented in the Philippines: he prohibited the killing of crocodiles and declared a municipal Philippine crocodile sanctuary in his beloved Disulap River. And when he confiscated a juvenile crocodile that was captured by local fishermen, he showed that he meant serious business. As such he broke the circle of political negligence, apathy and local extinctions that characterized *in-situ* Philippine crocodile conservation for a long time.

It reads like a classic tale of a logger turned conservationist. As a member of the ruling political clan (his father had been a three-term mayor and his family owned the largest logging company in San Mariano), Jesus had witnessed first-hand the environmental destruction brought by three decades of corporate logging and a human population explosion. His political career started in 1986, when after the fall of the Marcos dictatorship he was appointed to the municipal council. In 1992 he ran for mayor, a post he would hold for 12 years. Perhaps it was a sense of guilt, perhaps it was machismo. Or perhaps he just enjoyed the distraction. Whatever his ultimate motives, Jesus Miranda changed the way we think of crocodile conservation in the Philippines. He stressed the importance of communication and education to mobilize local support for crocodile conservation. In his vision, rural development is not a threat to crocodiles but an integral component of conservation. He prioritized the construction of farm-to-market roads to remote villages where crocodiles survived, dug water pumps and built rural healthcare stations. He won over the poor rural communities in the remote uplands of the northern Sierra Madre. Jesus took pride in the fact that this rare and endangered animal survived in the wild in San Mariano. It made his town stand out and life a little more exciting.

He was diagnosed with cancer in 2005. He underwent chemotherapy, selling most of his property to pay for the medical bills. He died, 63 years of age, in July 2007, in a Manila hospital. Jesus Miranda is survived by his wife, 10 children, 16 grandchildren and 78 Philippine crocodiles in San Mariano.

Jan van der Ploeg, <*vanderploeg@cml.leidenuniv.nl*>.

Amazing Pics!

This American alligator was recovered from the 2005 harvest in Louisiana (USA) by one of our wildlife technicians, Russell Perry, a few days before Hurricane Rita. It is assumed that the alligator bit the cork float on a gill net at some stage, and the float became lodged on the bottom jaw, which had grown around it. The cork could be rotated around the jaw while it was in place (top photo), but with some work it could be pried off. Note the indentation left after the float was removed (bottom photo) and how worn the teeth are that should have grown under the float. Photographs: Ruth Elsey.

Ruth Elsey, *CSG Regional Chair for North America, <relsey@wlf.louisiana.gov>*.

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