CROCODILE SPECIALIST GROUP NEWSLETTER

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CROCODILE

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NEWSLETTER

VOLUME 27 Number 3
JULY 2008 – SEPTEMBER 2008

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COVER PHOTOGRAPH: Captive Slender-snouted crocodiles (*Crocodylus cataphractus*) at a crocodile farm/park in Lusaka, Zambia. Photograph: Christine Lippai.

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Editorial

At the 19th CSG Working Meeting, Brazilian representatives offered the city of Manaus as a possible venue for the 20th meeting. Following the receipt of official invitation from Dr. Eron Bezerra (Secretaria de Estado da Produção Rural, Instituto de Desenvolvimento Agropecuário e Sustentável do Amazonas), I am happy to announce that the meeting will be held in Manaus, Brazil, in 2010.

The Executive Officer, Tom Dacey, visited Cambodia in July and met with Government representatives, members of the Cambodia Crocodile Farmers Association and several NGO groups (eg FFI), to discuss a proposal for the reintroduction of Siamese crocodiles (*C. siamensis*) into the wild in Cambodia [see CSGN 27(2): 5, 10]. The proposal received favourable support and an action plan is currently being developed.

Boyd Simpson has advised that he will be leaving Cambodia and FFI's Siamese crocodile conservation project in the next couple of months. He will be moving to Peninsular Malaysia to undertake an MSc on the ecology of the Malayan tapir. Although this move takes him away from crocodiles in an official capacity, he plans to become more involved in Tomistoma activities on the ground.

In August I wrote to PT REA Kaltim Plantations regarding a potential conservation-development conflict between oil palm plantations in East Kalimantan and the last remaining wild *C. siamensis* population in the Indonesian Archipelago, still sadly in need of targeted research. The CSG is seeking collaboration to develop an effective conservation program to ensure the status of this unique population of *C. siamensis* is enhanced and not compromised in their areas of operation.

I also recently wrote to the Australian Minister for the Environment, about anomalies in the Northern Territory's management program for *C. porosus*. The wild population remains robust and essentially fully recovered, and the ranching program builds from strength to strength. However, as so often happens in crocodile management success brings complacency in reporting and compliance - this is now being rectified.

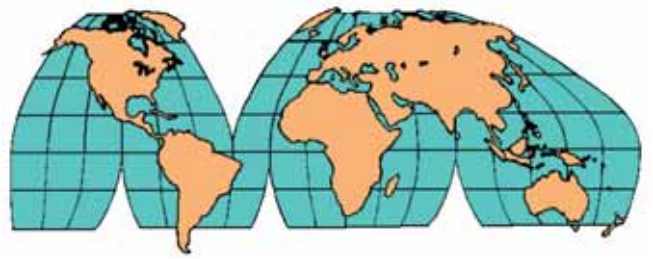
Species Newsletter No. 49 contains a special article on the "Toxic Threat to Gharials in India". The Gharial Conservation Alliance (GCA) continues to very active. Recently, the National Reptile Breeder's Expo held in Daytona raised some $US27,000 through an auction, to support GCA's efforts with gharial conservation (see pages 26-27). CSG Vice Chairman for Veterinary Science, Dr. Paolo Martelli, continues to provide training services to Indian Government veterinarians. Funds raised at the auction held during the 19th CSG meeting [see CSGN 27(2): 14] were contributed towards a telemetry project on wild gharials being undertaken by long-time CSG member Dr. Jeff Lang.

An opportunity arose for myself and Charlie Manolis (CSG Regional Chairman for Australia and Oceania) to visit the Solomon Islands in August. The SI Government has been seeking assistance for some time to formulate a management program for its *C. porosus* population, which has increased since trade/hunting ceased in 1989. Success with conservation has come at a very real cost of increasing numbers of attacks on people throughout the various islands. We met with staff of the Ministry of Fisheries and Ministry of Environment, both of which have involvement with the species. Resources are required to carry out surveys to quantify current population status and to assess different options for management.

Increasing human-crocodile conflict with *C. porosus* is also an issue for the States of Sabah and Sarawak, Malaysia. The CSG Executive Officer visited Sabah and Sarawak in September, where he met with Government and University of Malaysia officials and discussed the increasing numbers of attacks by *C. porosus*. Understandably, there is growing political pressure to address the issue and the Director of the Sabah Wildlife Department has offered to host a Borneo CSG Sub-Regional Workshop to start developing solutions. The suggestion was supported by the Sarawak Forestry Corporation. Participation of Brunei and Kalimantan (Indonesia) would be sought, and May-June 2009 is being considered for the workshop.

Professor Grahame Webb, *CSG Chairman*

Regional Reports



Latin America & the Caribbean

Mexico

NEGATIVE FATAL INTERACTION WITH AMERICAN CROCODILE IN OAXACA, MEXICO. Numerous indigenous and rural people live in the tropical part of Mexico, the majority of whom work in agriculture, extensive livestock and fisheries. However, within the context of this socio-economic reality, the human population continues to expand and use rivers, estuaries and costal lagoons that are also occupied by crocodiles. With the exception of Australia and the USA, the incidence of crocodile attacks throughout the world, including Mexico, is very difficult to quantify, for the most part because attacks are not reported (Caldicott *et al*. 2005). However, it is important to recognize the potential danger of negative interactions between humans and crocodiles and the goals of wildlife conservation (Vyas and Bhatt 2004).

Attacks by the American crocodile (*Crocodylus acutus*) on humans have been rarely reported in Mexico (Lee 1996;Sigler 2000). Attacks are probably the result of a combination of factors that include the increase of human and crocodile populations, residential development near crocodile habitat, feeding of crocodiles in areas populated by humans, and efforts to register attacks (Garel *et al*. 2005). Here we report a fatal attack by a crocodile on an adult human on the coast of Oaxaca, Mexico.

The attack happened in the Vainilla estuary (also known as Estuary of Tilapia) in the Municipality of Santa Maria Tonameca, about 40 km from Puerto Escondido, Oaxaca (Fig. 1). The estuary is considered a protected area by the community and it has been used for Ecotourism trips organized by the Sociedad Cooperativa de Servicios Playa Tilapia. People that live nearby use the lagoon for swimming and fishing for personal consumption.

Specifically, the incident occurred in a sandy section of the estuary, about 2 m from the waters' edge and in 30-50 cm deep water. At around 1600 h on 30 April 2008, Mr. Alejandro Sanchez Sanchez (42 years old, 1.70 m tall and 85 kg weight) went to the estuary to fish with his cast net, accompanied by two young children, a 14-year-old boy and two dogs. Mr. Sanchez had fished for about 5 years, and was aware of the presence of crocodiles in the lagoon.

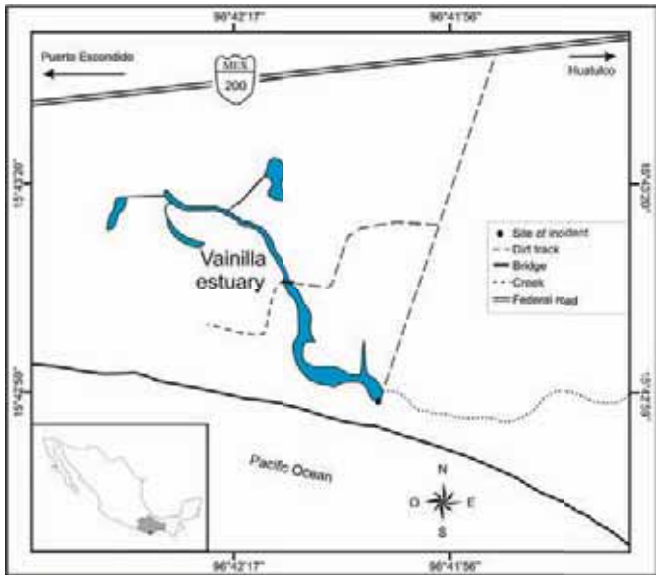


Figure 1. Location of Vainilla estuary, Oaxaca, Mexico.

At about 1615 h, while standing in the water, and a few minutes after throwing his net out, Mr. Sanchez was attacked by a crocodile. According to the children and young boy who witnessed the attack, the crocodile bit and removed the lower part of the man's right leg, which resulted in him bleeding to death.

Centro de Investigación de Vida Silvestre staff (CIVS Chacahua) of the Dirección General de Vida Silvestre (DGVS) were asked by Mr. Sanchez's family to catch and remove the crocodile responsible for the attack. A 2.3 m adult female specimen was captured and brought to Chacahua´s National Park, about 60 km from the estuary of Vainilla. Written authorization was given by DGVS in Mexico City.

A few days after the attack and capture of the crocodile, two head of livestock where attacked at different times in the same estuary near the location of the fatal incident. These two events suggested that the crocodile responsible for the fatal attack may still be there.

The causes of the attack on Mr. Sanchez are still under investigation. Reasons for attacks by crocodilians include nest defence, territoriality or for feeding (Pooley *et al*. 1989). Based on the known facts and the inability to determine the size of the crocodile with confidence, we propose four possible hypotheses for the attack:

1. Self-defence: The man accidentally stepped on the submerged crocodile.
2. Mistaken identity: The crocodile was trying to catch one of the dogs and accidentally attacked the man.
3. Nest defence; the attack occurred during the nesting season for the species (March-May).
4. The victim was seen as a "prey item" (food).

On 30 May 2008, a month after the incident in the estuary of Vainilla, the Chacahua CIVS staff found three dead crocodiles in the same estuary. The three specimens were all females (1.73, 2.64 m and 2.70 m TL) (Fig. 2). The biggest one was

in an advanced state of decomposition, and only stomach contents (chicken feathers?) were recovered. It is possible that these animals were poisoned.

Figure 2. Dead crocodile (2.64 m TL, female) found on the banks of the Vainilla estuary, Oaxaca, México.

Unfortunately these facts reflect the lack of a contingency plan to help mitigate against human-crocodile conflicts. Without doubt, cooperation between different institutions and organizations of the coast of Oaxaca (Universidad del Mar, Procuraduria Federal de Protección al Ambiente, Red de los Humedales de la Costa de Oaxaca, Organizaciones no Gubernamentales, Comisión Nacional de Áreas Naturales Protegidas, operadores de ecoturismo, etc.) will be necessary to develop and implement an effective State Action Plan for human-crocodile conflict in the coast of Oaxaca. Such a plan could be used as a model for other areas in Mexico.

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RELOCATION OF CROCODILIANS USING MAGNETS. Chiapas is one of the two Mexican states that has three species of crocodilian (*Caiman crocodilus fuscus, Crocodylus moreletii, C. acutus*) present. Approximately 55% of towns in Chiapas have at least one of these species, and potential interaction between humans and crocodilians is relatively high. For this reason, the Crocodile Museum assists through the capture, rescue and relocation of crocodilians that are considered potentially dangerous or because of their location, might be killed by local inhabitants. Annually, we attend to around 80 incidents in Chiapas, with a 90% success rate in resolving such issues, avoiding not only the death of crocodilians but also conflict with humans.

Notwithstanding relatively low sample sizes, previous experience had indicated that relocated crocodilians had a high probability of returning to their site of capture. For example, one 1.45 m long *C. acutus* captured at a water teatment plant and relocated 10 km away was recaptured at the plant 3 months later. Relocated 19 km away, it was back again after 8 months. After the third capture, magnets were applied to its head (see later) before it was relocated 15 km away, and it has not been sighted at the plant for almost two years.

In all, we have applied magnets (recovered from old car horns) to 20 individuals (13 *C. acutus*, 2 *C. moreletii*, 5 *C. crocodilus*). Crocodilians that have been "treated" with magnets have varied between 1.4 and 4.0 m total length, and distance betweeen capture and release sites has ranged from 1.3 to 120 km (Table 1).

Magnets are placed on the cranium of the crocodilian immediately after capture, and removed at the time of release. The number and placement of magnets varies according to the size of crocodilian and/or the magnets. Where considered appropriate for the crocodilian, a single magnet is placed in the middle of the cranial platform (Fig. 1). Where magnets are small and the crocodilian large, two magnets are applied at the same height above the ears (Fig. 2). Magnets are attached using duct tape.

Since 2004 none of the crocodilians on which magnets were used prior to relocation (Table 1) have been reported

at their capture site. In 80% of cases, after the magnets are removed and the animal freed, for a few seconds they appear to "search" with head movements in different directions before getting into the water. This "behaviour" has not been observed with animals that have not had magnets attached, and that have been caught, transported and released in the conventional manner.

Figure 1. Position of placement of single magnets on the cranial platform.

Figure 2. Position of placement of magnets (2) on the cranial platform where the crocodilian is large and magnets are small.

Notwithstanding the relatively small sample sizes and lack of a control group, our results suggest that the technique certainly merits further investigation. The ability of crocodilians to "home" has been reported in a number of species, but the way in which they do so remains unknown.

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Jerónimo Domínguez-Laso, *Curator of Crocodile Museum - Instituto de Historia Natural y Ecología - Regional Zoo "Miguel Álvarez del Toro", Tuxtla Gutiérrez, Chiapas, México, <museococodrilo@yahoo.com.mx>.*

Colombia

FIRST REPORT OF *CROCODYLUS ACUTUS* IN THE VIA PARQUE ISLA DE SALAMANCA, MAGDALENA, COLOMBIA. *Crocodylus acutus* presents a major conservation issue in Colombia due to exploitation levels and the lack of information on its distribution and basic ecology, thus reducing the ability for conservation planning at a national level (Rodriguez 2002). Vía Parque Isla de Salamanca (VIPIS) is an important and ecologically relevant but poorly studied area for crocodiles (Sánchez-Páez *et al*. 2004). VIPIS is located in the Magdalena Department in the Colombian Caribbean (Fig. 1) and integrates the Eco-region Cienaga Grande de Santa Marta, which is the major coastal-wetland in Colombia (4280 km^2) and is considered under the RAMSAR Convention.

There are few reports of sightings of the species around the VIPIS (Rodriguez 2002; Moreno-Bejarano and Álvarez-León 2003), but no systematic research has been made for the species inside the area. Here we present the first confirmed report of *Crocodylus acutus* in the area of the VIPIS, Magdalena, Colombia.

Table 1. Details on relocated crocodilians in Chiapas using "magnets". TL= total length; C. de C.= Chiapa de Corzo; LJ= Lacandona Jungle; NP= National Park.

Species	TL (m)	Sex	Date	Reason for Relocation	Capture Site	Relocation Site	Distance (km)
C. acutus	2.85	F	24 Sep '04	Confiscated from fishermen	El Manguito, Tonalá	Biosphere Reserve "La Encrucijada"	120
C. moreletii	1.91	F	11 Sep '05	Attacking domestic fowl	San Vicente Stream, Juárez	North Lagoon	1.3
C. crocodilus	1.74	M	15 Sep '05	Attacking domestic fowl	Las Lauras, Acapetahua	Biosphere Reserve "La Encrucijada"	3
C. crocodilus	1.60	M	15 Sep '05	Attacking domestic fowl	Las Lauras, Acapetahua	Biosphere Reserve "La Encrucijada"	3
C. acutus	1.40	M	10 Nov '05	Rescue, water treatment plant	COMEXSA C. de C.	NP "Cañón del Sumidero"	10
C. acutus	1.48	M	10 Nov '05	Rescue, water treatment plant	COMEXSA C. de C.	NP "Cañón del Sumidero"	10
C. acutus	1.62	M	4 Feb '06	Rescue	Barra San José, Mazatán	Biosphere Reserve "La Encrucijada"	15
C. crocodilus	1.49	M	4 Feb '06	Rescue	Barra San José, Mazatán	Biosphere Reserve "La Encrucijada"	15
C. crocodilus	1.59	F	4 Feb '06	Rescue	Barra San José, Mazatán	Biosphere Reserve "La Encrucijada"	15
C. acutus	2.73	M	1 Jul '06	Attacking livestock	Las Lauras, Acapetahua	Biosphere Reserve "La Encrucijada"	17
C. acutus	1.30	F	23 Sep '06	On private property	Finca los Robles, C. de C.	National Park "Cañón del Sumidero"	8
C. acutus	1.43	F	24 Jan '07	Confiscated	Ignacio Allende, C. de C.	National Park "Cañón del Sumidero"	28
C. acutus	3.20	M	10 Feb '07	Attacked horse, pig	Las Lauras, Acapetahua	Biosphere Reserve "La Encrucijada"	17
C. crocodilus	2.20	M	10 Feb '07	Attacking domestic fowl	Las Lauras, Acapetahua	Biosphere Reserve "La Encrucijada"	3
C. acutus	2.80	M	7 Mar '07	Attacking sheep	Morelia Ranch, La Concordia	La Angostura	10
C. acutus	1.93	F	15 Mar '07	Rescue	Santo Domingo R., C. de C.	NP "Cañón del Sumidero"	20
C. moreletii	2.80	M	10 Apr '07	Attacking dogs	Bethel, San Javier, LJ	Biosphere Reserve "Montes Azules"	5
C. acutus	3.45	M	10 Jun '07	Attack on human	La Merced, Acapetahua	Biosphere Reserve "La Encrucijada"	21
C. acutus	2.50	M	29 Nov '07	Attacking livestock	San Martín la Escalera, C. de C.	NP "Cañón del Sumidero"	31
C. acutus	4.0	M	28 Dec '07	Attacking livestock	Agua Tendida, Pijijiapan	Isla San José, Pijijiapan	5

The VIPIS is considered an important habitat due to the relative conservation status that it maintains. Also, it has been considered as an important habitat for other crocodile species in the country. The composition, location and natural characteristics of the area make it a suitable area for crocodile populations in the long-term (Sánchez-Páez *et al*. 2004).

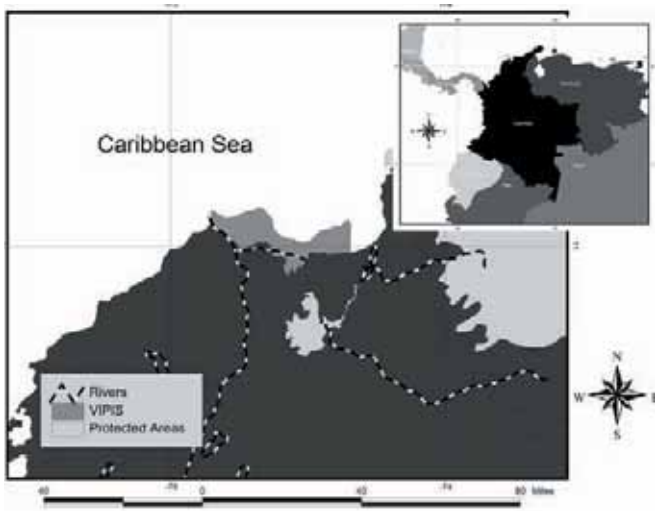

Figure 1. Location of study area.

A total of 119.0 km was surveyed in the area, covering approximately 236,600 ha for lagoons and 23.6 km for creeks. Surveys were carried out in a boat with out-board motor, or on foot, using 200,000 candlepower flashlights. The routes were surveyed between the 1900 and 0200 h with a maximum speed of 7 km/h (Ulloa-Delgado and Sierra-Díaz 2002), and always travelling against the currents in order to avoid double counting (Barrera 2004). Every animal sighted was either hand-captured or approached as close as possible for size to be estimated (Chabreck 1966; Salas 1985; INDERENA 1994; Ulloa-Delgado *et al*. 2005). We used Thorbjarnarson (1989) for classification of size classes, and adults were considered to be mature based on minimum sizes (Kushlan and Mazzotti 1989; Casas-Andreu 2003).

Fourteen (14) individuals were only observed in one creek (Caño Clarín) and one lagoon complex (Los Cocos), that represent 8% of the entire area. There were no Class VI individuals sighted, one Class V (7.1%), 4 Class III (28.6%), one Class II (7.1%) and 8 Class I (57.1%) (Fig. 2).

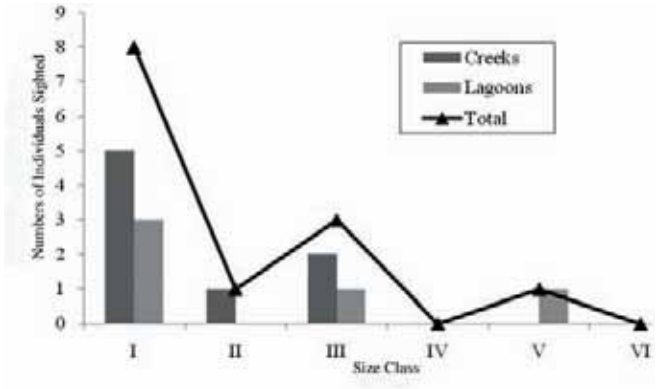

Figure 2. Size class distribution of *Crocodylus acutus* sighted during surveys.

Estimated densities of 7.78 ind/km for creeks and 2.65 ind/ha for lagoons are considered high relative to densities for *Caiman crocodilus fuscus* in the area (1.00 and 2.73 ind/km for creeks and 0.1691 and 0.0035 ind/ha for lagoons; Balaguera-Reina and Gonzalez-Maya, unpublished data).The results indicate a restricted distribution for the population in the VIPIS. The population is under intense pressure from local communities, and factors such as contamination, hunting and conflicts are common in the area. Urgent action is needed to retain these populations in the park.

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East and Southeast Asia

Philippines

CONSERVATION OF THE PHILIPPINE CROCODILE. The Davao Crocodile Park Inc. (DCPI) is a privately owned crocodile farm that is also registered with the Department of Environment and Natural Resources (DENR) as a wildlife rescue unit. DCPI is committed to the protection and conservation of *Crocodylus mindorensis*. Once found throughout the Philippines, the wild population is now small and restricted in its distribution, and the species is critically endangered. In addition, little is known about the natural history or ecology of the species nor its relationship with the Saltwater crocodile (*C. porosus*), with whose range it overlaps.

On 3 August 2007, with great effort and care DCPI moved its 43 *C. mindorensis* to Rancho Palos Verdes in Mandug, into a large, seminatural freshwater pond with an abundance of fish. It was hoped that the relocation would increase hatching and survival rates for this group of *C. mindorensis*. In July 2008 four hatchlings survived from a clutch (compared to one hatchling the previous year) and we hope that there will be more next season.

With the assistance of Leiden University (Netherlands), natural wild habitats are currently being assessed for future reintroduction of the species.

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PHILIPPINE CROCODILES LOANED TO MANILA OCEAN PARK. Five Philippine Crocodiles (*Crocodylus mindorensis*) have been loaned by the Department of Natural Environment and Resources (DENR) to the privately-owned Manila Ocean Park. A Memorandum of Understanding was officially signed during the ceremonial turnover of the crocodiles by DENR Secretary Mr. Lito Atienza. The period of the loan is three years.

The crocodiles, bred at the Wildlife Rescue and Conservation Centre (WRCC) at Puerto Princesa City, Palawan, will join Saltwater crocodiles (*C. porosus*) already housed there, and contribute to public education about the plight of the species. WRCC staff will train Ocean Park staff in the care and handling of the crocodiles.

Sources: *Katherine Adraneda, The Philippine Star, 27 August 2008; T.J. Burgonio, Philippine Daily Inquirer, 27 August 2008; Ellavyn B. de Vera, Manila Bulletin, 27 August 2008.*

SECOND "INFORMATION AND EDUCATION CAMPAIGN" HELD. The education team of "Puloy-anan alang sa Kaugmaon" (Habitat for the Future), held a meeting on 7 September 2008, as a follow-up to last summer's information and education campaign (IEC) on reintroduction of the Philippine crocodile (*Crocodylus mindorensis*) at Sto Tomas, Davao del Norte. Consensus was achieved, and the people of Purok 08, 09, 10 and 11 of New Katipunan, have finally accepted the project as their own (Fig. 1).

Figure 1. Some of the participants of the 2nd IEC with a Philippine crocodile.

The meeting was attended by 55 households, and its success was largely due to participation of Dr. Charles A. Ross, Dr. Cayetano Pomares and his conservation team from Liguasan Marsh, and LGU officials, municipal administrator Mr. Joel Bayanay and Barangay Captain Armando Torres.

The agenda comprised: a project recap by Theresa Jane Cajarte and Crisel Ignacio (education team, UP DevCom and UP VetMed); a presentation by Dr. Ross on the importance of conservation of *C. mindorensis* and his experiences with

the species for the past 26 years (Fig. 2); and, a wonderful presentation by the team from Liguasan wherein Dr. Pomares, his student, and a Liguasan resident shared their stories about peacefully coexisting with crocodiles at Liguasan in Kabacan.

Figure 2. Dr. Charles A. Ross delivers a presentation on conservation of the Philippine crocodile at the 2nd IEC.

Presentations were followed by an interactive open forum/ discussion, at which no "new" questions or concerns were raised (last summer's IEC had discussed the same questions). The representatives from the LGUs helped facilitate the consensus and were mainstays throughout the campaign. The first IEC in May 2008 recommended further IECs for the project to gain acceptance in the community, and it was indeed a pleasant surprise that this second meeting, held 4 months after the first one, generated far more positive results.

The next phase of the project involves the establishment of a memorandum of agreement with the LGU and community, for the future establishment of municipal ordinances and other possible community conservation projects. Continuous IECs are recommended, since we have seen that repetition and reinforcement are crucial for the establishment of a sound understanding of conservation, and community enthusiasm must be further stirred and held at that maximum level.

The projected release date is November 2008, and everyone is welcome to come to Davao for this! We hope to get local media coverage for the release, and we welcome suggestions and assistance from all concerned.

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China

REINTRODUCTION ACHIEVEMENT FOR CHINESE ALLIGATOR. The Chinese alligator (*Alligator sinensis*) is endemic to China and is listed in the first class national protected animals of China. It is classified as a Critically Endangered in the IUCN Red List of Threatened Species and listed in Appendix I of CITES. Following the International Workshop on Conservation and Reintroduction of Chinese Alligator, held in Hefei, China, in 2001, the State Forestry Administration (SFA) of China issued the "China Action Plan for Conservation and Introduction of Chinese Alligator" in 2002. The Chinese Alligator was also listed as the one of 15 priority species of National Wildlife Conservation Project in the Tenth Five-Year Plan. Since then, the Government of China has paid more attention to the protection and management of the wild populations and their habitats, as well as speeding up the reintroduction project.

The Anhui National Nature Reserve of Chinese Alligator (ANNRCA) initiated reintroduction activities in late 2001. The Gaojingmiao Forest Farm (GFF) was evaluated and identified as a reintroduction site by the international and national experts in 2002. The mean temperature there is 15.9°C and the mean annual rainfall is 1294.4 mm. The forestry farm has an area of 10.37 km^2 and consists of forest, grassland, water bodies and marshes. Dominant shrubbery in the area is *Pteioblastus amarus* and *Rosa laevigata* and the vegetation community type there is *Pinus massoniana*, *P. amarus* and *Pteridium aquilinum*. Before carrying out the project, aquatic organisms such as fish and snails were placed into the ponds several times to establish the food chain for the alligators.

Over the past few years, a total of 50 ha of habitat were reconstructed and restored, including recovery of vegetation, benthos and surrounding swamps. Since 2006, 21 captive-reared alligators (6, 6 and 9 alligators in 2006, 2007 and 2008 respectively) have been released into different ponds at this site, with radio-transmitters attached to track daily activities (Fig. 1). The results of radiotelemetry indicate that the released alligators have adapted to the wild habitats very well.

Figure 1. Reintroduced alligators with radio-transmitters attached to track daily activities and study adaptation to wild habitats.

On 22 July 2008, one *A. sinensis* nest containing 19 eggs (17 of which were fertile) was discovered at GFF (31°00.978'

N, 119°12.132' E) when ANNRCA staff conducted regular patrolling (Fig. 2). The nest was laid by one of the released alligators, the first discovery since the initiation of reintroduction in 2006. It proves that captive-reared alligators can adapt to restored habitats quickly and recover breeding capacity in the wild very smoothly.

The SFA proposes to hold an evaluation workshop on the reintroduction of Chinese Alligator in ANNRCA in mid-October 2008, which aims to disseminate the experiences and lessons learnt from the reintroduction project, discuss the key techniques in relation to the reintroduction, and develop a general strategy for reintroductions for the next 5 years in China.

Figure 2. The nest produced by reintroduced *A. sinensis* was located under the forest canopy at Gaojingmiao Forest Farm.

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Europe

Czech Republic

CROCODILIAN ZOO OPENED IN CZECH REPUBLIC. Protivin Croc Zoo, a new zoological garden aimed at crocodilians, was opened on 16 June 2008 in the small town of Protivin in the south of the Czech Republic (Fig. 1). The zoo's founder and director is Mr. Miroslav Prochazka.

On opening day, 11 enclosures with 12 species (25 specimens) were on display. In all, 18 species of crocodilian are held, and the goal is to eventually obtain all crocodilian species and house about 100 specimens. Of the animals already in in facility, it is worth mentioning a group of 10 *Tomistoma schlegelii*, the biggest collection outside Asia. Except for one adult female, they are all subadults. The goal is to establish 4 breeding pairs. Mr. Prochazka cooperates closely with EAZA European Studbook for Tomistomas and he is also sponsor and partner of the CSG Tomistoma Task Force.

Figure 1. Opening ceremony for the Protivin Croc Zoo. From left, Mr. George Netík (South Bohemia Councillor for Agriculture, Environment, Forestry and Rural Development), Mr. Jaromir Hlavac (Mayor of Protivin), Mr. Miroslav Prochazka (Director and owner), Ralf Sommerlad (CSG Tomistoma Task Force member) and Dr. Pavel Moucha (General Curator, Dvur Kralove Zoo). Photograph courtesy of Provitin Croc Zoo.

This specialized zoo also has the largest group (2M:2F) of Philippine crocodiles (*Crocodylus mindorensis*) in Europe, and three (1M:2F) Chinese alligators (*Alligator sinensis*). In 2005, the facility reported the first reproduction of Cuban crocodiles (*C. rhombifer*) in Europe. Since then, this endangered species is regularly reproducing at the facility. Last year the first reproduction of Siamese crocodiles (*C. siamensis*) occurred. A list of crocodile species and information about the zoo can be found at <www.crocodilezoo.eu>.

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South Asia and Iran

Sri Lanka

PRELIMINARY SURVEY OF SALTWATER CROCODILES (*CROCODYLUS POROSUS*) IN THE NILWALA RIVER, SRI LANKA. A preliminary survey of *Crocodylus porosus* inhabiting the Nilwala River, Matara, South Sri Lanka, was conducted on 17-19 March and 20-23 April 2008 (de Silva 2008). The Nilwala River in Matara is well-known in the country for its "man-eating crocodiles" over several centuries. In fact, Deraniyagala (1930) reported that the Nilwala River is one of the well-known habitats for man-eating crocodiles (*C. porosus*).

The survey included investigation of threats faced by crocodiles and examination of the status of their natural habitats (riverine mangroves), prey species, etc. We also undertook

an assessment of the knowledge, attitude and practice (KAP) of 53 "vulnerable" people living in two villages (Fort and Piladuwa, Matara) towards crocodiles. Three awareness programs were conducted on precautions that "vilnerable" people need to take to avoid attacks by crocodiles and the importance of these reptiles to river ecosystems.

Methods

Boat surveys were conducted from 0800 to 1300 h in the study area (5º 56' 42.7" N, 80º 32' 26.0" E to 5º 57' 17.4" N, 80º 33' 49.7" E) over three days to confirm the presence of *C. porosus* and to assess the status of habitats. The same river route was cruised on two nights from 2000 to 2400 h to conduct spotlight count surveys. There was a full moon during the night surveys.

Some fishermen were interviewed to obtain estimates of the number of crocodiles accidentally trapped and killed in nets. Families with members who had been killed by crocodiles and people who sustained minor injuries due to attacks, were interviewed. A structured questionnaire was administered to 53 householders living in the study area. Samples of mangrove plants and associated plants along the riverbank were collected for identification at the National Herbarium.

Results

During the day survey, 14 *C. porosus* hatchlings (<60 cm TL; Fig. 1) and 13 adults, including a large (possibly 4.5 m) specimen, were observed. Thirty-one and 39 eye-shines were observed respectively during the night survey conducted over two nights. These preliminary results suggest a population of about 50 crocodiles (all size classes) in the 5 km survey section of the 68.7 km long Nilwala River mainstream.

The KAP survey indicated that more awareness programs are needed to educate people and fishermen living in and near crocodile habitats about crocodiles.

Twenty-four species of riverine mangrove plants and associated plants were collected and identified. We observed that the Nilwala River still retains some mangrove and marsh habitats for crocodiles. Furthermore, we observed that mangrove vegetation plays an important role for hatchlings (Fig. 1), as it offers shelter from avian predators (eg several eagles were sighted) - we noted 5 hatchlings resting/hiding on the branches of a mangrove associate plant (*Dolichandrone spathacea*). There were ideal nesting habitats for *C. porosus* in many locations along the Nilwala River. In fact one of the best natural populations of *Hanguana malayana* on the island is found on the banks of the Nilwala River (5º 58' 9.1" N, 80º 33' 1.7" E).

Crocodile Attacks

Investigations were carried out on 8 people attacked and killed by crocodiles and 10 people who sustained minor injuries from attacks. Discussions with victims and their relatives about the attacks and visits to some of the attack locations indicated that the "fault" lay with the humans. We also investigated 70 abandoned and in-use "crocodile exclusion enclosures" used by people to bathe and wash clothes (Fig. 2), and three crocodile 'fences' that have been installed along the Nilwala River. Many of these crocodile exclusion enclosures were not secure (Fig. 3).

Figure 1. *Crocodylus porosus* hatchling (58 cm TL) in the Nilwala River. Note the presence of post-occipital scales. Photograph: Anslem de Silva.

Figure 2. Traditional crocodile exclusion enclosure for bathing and washing clothes. Photograph: Anslem de Silva.

Figure 3. Insecure crocodile exclusion enclosure still in use. Photograph: Anslem de Silva.

Interestingly, all attacks occurred whilst people were either bathing or washing clothes where there were no enclosures. Around five of the enclosures examined were relatively new, and were constructed using steel (eg galavanised pipe and wire mesh; Fig. 4).

Figure 4. New steel crocodile exclusion enclosure constructed a few months after a fatal attack on a woman at the site. Photograph: Anslem de Silva.

Threats

We observed two major human-associated threats to crocodiles and their habitats in the Nilwala River.

1. Killing of supposed 'man-eaters', destroying eggs to control the population growth of the species, killing of hatchlings, juveniles and sub-adults trapped in fishing nets (some drown in fishing nets) are major threats to crocodiles in the area. Throughout our boat surveys we observed several large and hatchling water monitors (*Varanus salvator*) (Fig. 5) which are predators on crocodile eggs and hatchlings (Deraniyagala 1939). In addition, several eagles and hawks were observed.

2. Vast areas of riverine mangroves and mangrove associate plants along the Nilwala River have been cut down for firewood, cleared for agricultural purposes, as well as for other development projects (Fig. 6).

Figure 5. Water monitor, *Varanus salvator*. Photograph: Anslem de Silva.

Figure 6. Riverbank cleared for human habitation and development. Photograph: Anslem de Silva.

Legislation

1. Total protection is afforded by the 7th amendment to the Act (No. 49 of 1993). The Department of Wildlife Conservation is empowered to enforce the provisions to protect crocodiles.
2. Legal protection is afforded under the Fisheries and Aquatic Resources Act, No. 2 of 1996. The Department of Fisheries and Aquatic Resources can act to protect crocodiles under this Act.
3. Police are empowered by the Fauna & Flora Protection Ordinance to enforce the provisions to protect crocodiles.
4. Act 1 of the Customs Gazette of 1969 prohibits the export of crocodile skins.

Crocodylus porosus is listed in Appendix I of CITES. Previously listed as "Threatened" (IUCN Sri Lanka 2000), *C. porosus* is currently listed as "Near Threatened" in the 2007 Red List of Threatened Fauna and Flora of Sri Lanka (IUCN Sri Lanka & MENR 2007).

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RECORD OF *CROCODYLUS POROSUS* NEST FROM SRI LANKA. One of the first detailed reports of a *Crocodylus porosus* nest from Sri Lanka was in 1865 (Boake 1865). Subsequently, Abercromby (1913), Symons (1921), Deraniyagala (1930, 1937, 1939) and Phillips (1941) also reported on nests of the species from Sri Lanka.

Here, we report on a *C. porosus* nest observed at Katukurunda South, Habaraduwa (6º 01' N, 80º 18' E), southwest Sri Lanka. Of particular interest with this nest were:

- its proximity to a human settlement (300 m) and areas grazed by cattle;
- distance (3 km) from the largest waterbody (Koggala Lake), with a network of small streams in between; and,
- information from residents in the area indicating that they had not seen or heard of crocodiles in the area for 30 years. [A recent survey showed a healthy population of around 50 *C. porosus* (including 13 hatchlings) in a 3 km stretch of the Nilwala River (de Silva 2008a,b), about 30 km south of this location.]

The area in which the nest was located consisted of a marsh with few mangrove and mangrove associate plants such as *Acrostichum aureum* (Sinhala = kerang koku), *Leersia hexandra* (Sinhala = batadella), *Echinochloa crusgalli* (Sinhala = welmaruk), *Commelina benghalensis* (Sinhala = girapala) and *Panicum repens* (Sinhala = atawara) and grasses. There was also a coconut plantation nearby.

The nest was constructed of surrounding vegetation (eg *L. hexandra*, *E. crusgalli* and grass), including some coconut (*Cocos nusifera*) leaves. It was 63 cm high and had a diameter of 150 cm. The temperature inside the nest was 26.5ºC and the outside temperature was 28.5ºC [recorded around 1200 h on a cloudy day (24 June 2008)]. The nest was in an open area without any shade, and merged into the surrounding vegetation. During the previous days there had been heavy monsoon rains and the nest was almost completely surrounded by water at the time of observation.

The clutch consisted of 36 eggs, some of which were white and others which were off-white with a light yellow shade - most eggs appeared healthy. Mean measurements from 4 eggs were 72.0 mm (length), 45.3 mm (width) and 91.3 g (weight). The female was not observed during this initial visit, but egg and clutch size suggested that she was relatively small in size.

Figure 1. Female *C. porosus* defending her nest. Photograph: Madura de Silva.

In early August the nest was re-visited by researchers, and the female was observed at the nest (Fig. 1). She had rebuilt the nest after it had been opened during our inspection of the eggs, and was confirmed as being around 2.1-2.4 m long - around the size that the smallest female *C. porosus* would be expected to begin nesting.

Local people are concerned about the proximity of the female, and it is possible that the wildlife department may relocate her to another site.

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India

BEHAVIOURAL OBSERVATIONS OF GHARIAL. The gharial pond at Madras Crocodile Bank Trust (MCBT) contains 6 females, and 2 large males with good sized "gharas". The larger dark coloured male gharial is about 4.9 m long, the smaller lighter coloured male is about 4.6 m long - females are about 4-4.9 m TL. Animals are housed in a kidney-shaped pond, about 44 m long and 14.5-18.0 m wide.

At MCBT gharials usually nest around mid-March, with courtship and mating behaviors being seen in January to March. Little is known about Indian gharial behaviour, especially interactions between adult males (Kalaiarasan and Rajarathinam 2005; Maharana 1982; Singh and Rao 1990; Whitaker and Basu 1983). In January-February 2008, I was able to make some opportunistic observations of behavioral interactions between the adult gharial in the MCBT breeding pond.

Observations were made from about 20 January onwards, and included males chasing (swimming rapidly) females and males chasing each other - the latter sometimes resulted in brief clashes. Usually fights were brief and lasted no more than 5 minutes.

Figure 1. Male gharials (*Gavialis gangeticus*) " fencing". Photograph: Payal Narain.

This fight that I witnessed and photographed on 8 February, started at about 1415 h and continued for 30 minutes. Both males appeared to try to submerge/climb on top of the other, and they "fenced" with their snouts. Some of the movements looked like a synchronized swimming performance, with both animals turning to face the same direction together, and then whirling back to face each other and "crossing swords" once more (Fig. 1). They appeared to use their heads and snouts to club each other. The water swirled and boiled around them - showing the washing machine effect of their powerful torsos and tails. They slapped their jaws on the water surface between encounters, as well as emitting a pressure cooker like hiss.

After about 20 minutes, both male gharial were bleeding - one from the jaw and one from the bulbous "ghara" on the end of its snout. Since they did not show signs of stopping and may have been in danger of causing further damage to each other, we intervened by throwing in fish as a distraction to stop the fight. Further attacks and fights took place after 8 February, into early March. Subsequently the first gharial nest was found on 14 March.

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I would like to thank the Madras Crocodile Bank Trust where I got this unique opportunity. Also I thank Mr. Anandan from Vadanemelli village who diligently watched the gharials for any extraordinary behaviour and who repeatedly summoned

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GHARIALS ESCAPE FROM ZOO DURING FLOODING. Flooding of the Subernarekha and Kharkai Rivers on 18 June resulted in three Indian gharials (*Gavialis gangeticus*) and one crocodile being washed out of the Tata Steel Zoological Park, Jamshedpur, situated about 230 km west of Calcutta. The crocodile remained within the zoo grounds, and one gharial was caught nearby soon after the event, but the whereabouts of the remaining two gharial was not immdiately known.

On 28 June a gharial was sighted at Galudih, about 35 km away, but attempts to catch it were unsuccessful due to strong currents in the Subernarekha River. On 14 July the second of the missing gharials was caught near Jhargram, Kharagpur (Bengal), by local fishermen. It was in the Rohini, a tributary of the Subernarekha River, about 90 km from Jamshedpur.

By 26 July, zoo officials had given up hope of finding the third gharial. It was unlikely to be in any of the Jharkhand rivers, and it may have found its way into rivers of Bengal. In case of the two gharials that were recovered, officials had received information from fishermen, police and local people that allowed the animals to be recaptured.

Sources: The Telegraph (Calcutta, India), *29 June, 15 July, 16 July, 26 July 2008*.

FISHERMEN EMPLOYED TO DEAL WITH "PROBLEM" CROCODILES. The Orissa Forest Department has hired fishermen to relocate Saltwater crocodiles (*Crocodylus porosus*) entering into areas of human habitation in and around Bhitarkanika Wildlife Sanctuary.

The situation with crocodiles is considered to have reached a flashpoint, with crocodiles attacking humans and cattle becoming a regular feature. Complaints are coming in on almost a daily basis, creating a problem for forest authorities.

Fourteen experienced fishermen have been recruited on an annual contract to chase straying crocodiles back to their original habitat in the Bhitarkanika River system. Six crocodiles have been chased back using indigenous methods and 6 more were trapped and later released in the wild.

Source*:* Times of India, *8 July 2008*.

Iran

NATIONAL MANAGEMENT AND CONSERVATION PLAN FOR MUGGER CROCODILE. A small population of Mugger crocodiles (*Crocodylus palustris*) is distributed in the southeastern part of Iran, in Sistan and Baluchestan Provinces, the western most range of the species,. The population appears to be isolated and scattered within the area, and has been divided to several sub-populations.

The main habitats can be classified into natural and artificial habitats, bringing crocodiles in close contact with local people. The main distribution area is designated as a "Protected Area", named Gandou (local name for crocodile), considering its importance for the crocodile population. Although there have been many natural threats to the crocodiles in the past (eg drought), the population has survived and maintained itself in different situations.

Of importance to the crocodile population in the area is that local people respect crocodiles and never harm them - there is no threat of egg harvest or hunting. However, at times crocodiles are considered a problem as they attack people's livestock. On the other hand Mugger crocodiles are classified as a "national endangered" species and are legally protected. This situation provides a high potential for management and conservation activities and programs.

Given the need for conservation activities, a "National Management Plan for the Mugger Crocodile Population in Iran" was prepared and submitted to the relevant offices of the Department of Environment (Deputy for Natural Environment, Wild Life Bureau, Provincial Office) for proper planning and implementation. The budget for the proposed activities is to be secured by DOE, and any other international support is most welcome. Indeed we are looking for international support, which would accelerate our works and measures.

The plan consists of four main approaches, each of which has several activities:

1. Research works and complementary studies
   1.1. determination of exact distribution of crocodiles
   1.2. annual census of the population
   1.3. identification of more nesting sites/nests
   1.4. establishment of crocodile research center

2. Conservation of crocodiles in natural habitats
   2.1. planning for habitat management programs
   2.2. modification of the extent of "Gandou Protected area" to cover the majority of crocodile habitats
   2.3. planning for population recovery programs in different areas
   2.4. recognition/identification of suitable locations for establishment of rearing/farming centers (site selection)
   2.5. monitoring of crocodile population
   2.6. introduction of some habitats as the "Crocodile Sanctuary"

3. Captive breeding
   3.1. establishment of captive breeding centers
   3.2. planning and implementation of ranching and farming programs
   3.3. aiming to rear and release 40-50 yearling crocodiles to natural habitats/sanctuaries annually
   3.4. using local people capacities for establishment of farms/rearing centers

4. Public awareness/education and ecotourism
   4.1. public awareness and environmental education of local people and stakeholders and related governmental and non-governmental bodies
   4.2. national and international coordination and cooperation for research and conservation activities
   4.3. planning for eco-tourism activities in the area
   4.4. compensation to local people for crocodile attacks on livestock

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North America

USA

MISSISSIPPI ANNOUNCES ALLIGATOR HUNTING SEASON ON PRIVATE LANDS. The Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) has announced its intention to open a private lands alligator hunting season in 7 counties (Hinds, Holmes, Issaquena, Madison, Rankin, Warren, Yazoo).

The season will run from 26 September to 4 October. Landowners with 20 acres or more of permanent surface water within these counties may be eligible to receive harvest vouchers, allowing the harvest of one alligator for the first 20 acres of surface water and one for each additional 100 acres of surface water. Landowners will be allowed to transfer couchers to residents or non-residents 16 years or older.

Voucher holders are required to attend and complete the "MDWFP Private Lands Alligator Hunting Training Course". Upon successful completion of the course, voucher holders will be eligible to purchase a "Private Lands Alligator Hunting Permit" at a cost of $US100 for residents and $US200 for non-residents. Additional information is available at "www.mdwfp.com/alligator".

Source: Press Release (15 July 2008), *Mississippi Department of Wildlife, Fisheries and Parks, 1505 Eastover Drive, Jackson, MS, USA.*

Africa

Burkina Faso

VILLAGE OF SACRED CROCODILES. A village of around 27,000 inhabitants, Bazoulé, its chiefs and its young people chose tourism and their culture to accompany their sustainable local development. Located about 30 km from the capital of Ouagadougou, the village has a pond in which more than 100 crocodiles (*Crocodylus niloticus*) are living, a site which now supports an ongoing important tourist flow of approximately 10,000 to 12,000 visitors per annum.

The crocodile is a sacred animal here, and is the totem for the inhabitants of Bazoulé, with which they have always lived in perfect harmony. They respect it as much as they venerate it. The children of the village play, fish and bathe among the sauriens. Some crocodiles give up the pond temporarily during the dry season when water levels are low, and take refuge in and near the village, in the relative freshness of the concessions near the pond.

A sacred animal, the crocodile is the object of ritual sacrifice, and a furnace at the pond testifies to these ceremonies.

Annually the committee of village elders organizes a series of festivals around the crocodiles. On these occasions, chickens, donkeys, goats, etc., are sacrificed to ensure protection against enemies of the village and to ward off bad spirits.

These reptiles are venerated, touched and admired, and are integrated into the cultural and traditional environment of the village. A crocodile which dies is buried like a human being, with all the rites and practices as any of the villagers who had died.

Inhabitants, visitors, and others come to request fertility, happiness, success, fortune or other social protection from the crocodiles against a promise of recognition (chickens, goats, sheep asses, oxen, etc.). There is also a park of tortoises (*Geochelone sulcata*) close to the pond, in which there is also great pride. For the village, the tortoise has the same significance or meaning as the crocodile.

The Association for Tourism and Development of Bazoulé (ATDB) is organized by young people from the village who had the wish to abandon attractions from the nearby capital and develop tourist activities which promote both tourism and conservation of the environment at Bazoulé.

We are happy to have been given the opportunity to send this article on the life of the crocodiles together with the inhabitants of Bazoulé. We had a chance to participate at the 18th CSG meeting in June 2006 in Montélimar, France. We profited in similar manner as in Montélimar when we attended the first CSG sub-regional meeting in West Africa, held in the National Parc 'W' in Niger in late 2007. These international meetings have allowed us to realize the importance and the role crocodiles play in the world. Accordingly we have undertaken initiatives to generally sensitize the public on the protection and conservation of this crocodile pond. In order to incorporate that spirit into the heads of the open-minded young population we initiated the development of dice games to inform, teach, sensitize young people, children or visitors to the site on the lifecycle of crocodiles and their role in the natural environment.

We are also proud to know that participants at the 19th CSG meeting in Bolivia in June 2008 had talked about Bazoulé in the corridors. We would like to thank La Ferme aux Crocodiles in Pierrelatte (France), Samuel Martin and his team, as well as Dietrich Jelden (CSG), for their determination to assist us in our efforts to save this natural environnement. We also very much thank the whole Crocodile Specialist Group and those crocodilian specialists worldwide who fight for the conservation and maintenance of that fauna.

We of course would like to invite all those who have the possibility to pass by Bazoulé to visit the village with its holy crocodiles. Thank you very much for thinking of our ancestor crocodiles.

Alphonse Kaboré, *President, L' Association Tourisme et Developpement de Bazoulé, Mare aux crocodiles sacrés de Bazoulé, Burkina Faso, <alphka17@yahoo.fr>. [Assistance with translation into English provided by Dietrich Jelden].*

Egypt

LAKE NASSER CROCODILE PROGRAM. The Nile crocodile (*Crocodylus niloticus*) has traditionally played a very important role in the history of Egypt and the Nile River. The god Sobek, with the body of a man and head of a crocodile, was worshipped to venerate the strength of the crocodile while preventing "evil" interactions. In his honor, temples at Fayoum and Kom Ombo were erected during the Greek-Roman Period 200 BC. Currently, displayed inside each of the temples are mummified crocodiles and a series of man-made pools that were likely used for keeping crocodiles as pets and guardians for ancient priests. During this time, and until the late 18th century the Nile crocodile was widespread throughout the Nile River and Nile Delta, however, by the mid-19th century it was largely restricted to the Nile River south of Aswan (Anderson 1898; Flower 1933; Baha El Din 2006). Unfortunately, modern Egyptians did not have the same reverence for the power and myth of the crocodile and by the 1960s it was hunted to near extinction in Egypt (Marx 1968; Baha El Din 2006).

Surveys for biodiversity prior to the construction of the High Dam at Aswan, conducted in the 1950s and 1960s along the Nile River, revealed no crocodiles (M. Fouda, pers. comm.). Construction of the High Dam began in 1959, with the water impoundment initiated by 1964 (Bishai *et al*. 2000). Lake

Nasser is one of the largest man-made lakes in the world (the other being Lake Volta in Ghana) stretching some 480 km south into Sudan and, while variable, can reach up to 35 km in width (Bishai *et al*. 2000). The shoreline is variable with the rise and fall of the water level, though at the highest it is approximately 7844 km largely owing to its irregularity and the extensive khors (flooded valleys creating finger-like branches). Water temperature ranges from 20°C in winter to 26-34°C in summer (Bishai *et al*. 2000).

Two surveys have been conducted for crocodiles in the last 10 years. The first was conducted by the Lake Nasser Authority over 3 trips during February and March 1998, reaching no further than 20 km south of the High Dam (Ibrahim 1998). The surveys consisted crocodile counts and "Eyelids of Morning" type research where 6 crocodiles were killed for additional analysis. In total, 13 crocodiles ranging in size from < 2.5-5 m were detected, and from this the total population in Lake Nasser was estimated to be no more than 1000 crocodiles. The second survey was conducted by the South Area Protectorates, Nature Conservation Sector, EEAA, over a 6-day period. The team traveled from the High Dam south to Korosko via the west bank and returned north via the east bank, covering over 80% of the lake shoreline (Salem and Asran 2006). Nineteen crocodiles ranging in size from 2-4 m were detected, and the population was estimated to be less than 2000 individuals in the entire Lake Nasser.

Both surveys were conducted exclusively during the day and were wrought with technical errors. Additionally, resulting estimates of population size were calculated using rudimentary relationships of detections/unit area extrapolated to the area of the entire lake (ie not just suitable habitat). In addition to surveys for crocodiles, both initiatives conducted simple questionnaires with local fisherman to determine local knowledge of crocodile population size, distribution and degree of threat. While these surveys provide little in the way of valuable quantitative data, they do provide insights into the distribution of crocodiles and perceptions of threats to the Lake Nasser fishing community.

At CITES CoP14 (May 2007) Dr. Moustafa Fouda, Director of the Nature Conservation Sector, Egyptian Environmental Affairs Agency, contacted the CSG with an urgent request for assistance in assessing the crocodile population in Lake Nasser and determining whether there was potential for sustainable use under the regulations imposed by both Egypt and CITES (Dacey 2007). This request for assistance was underscored by anecdotal evidence of a rapidly developing illegal harvest of crocodiles in Lake Nasser. In light of recent taxonomic investigations suggesting that crocodiles in Egypt may be a different species of "Nile crocodile," any crocodile initiative in Lake Nasser has a unique opportunity to serve as a model for creating sustainable use programs involving threatened or endangered species. If management regimes for an endangered species are in place before it is on the brink of extinction then our efforts to conserve them will be more effective.

Since its inception, the field of conservation biology has been viewed as a reactionary discipline. While this may still be the case, it is clear that a shift is necessary in conservation to a paradigm that recognizes the value of proactive conservation approaches. This project will make this shift by assessing the potential of the Nile crocodile in Lake Nasser as a sustainable resource by investigating concurrently the economic, social, and biological pillars of sustainability. Our program aims to assess the crocodile population of Lake Nasser (Fig. 1) and work with key stakeholders to assess the negative impacts of crocodiles and the potential to utilize crocodiles as a sustainable resource. The project was initiated June 2008.

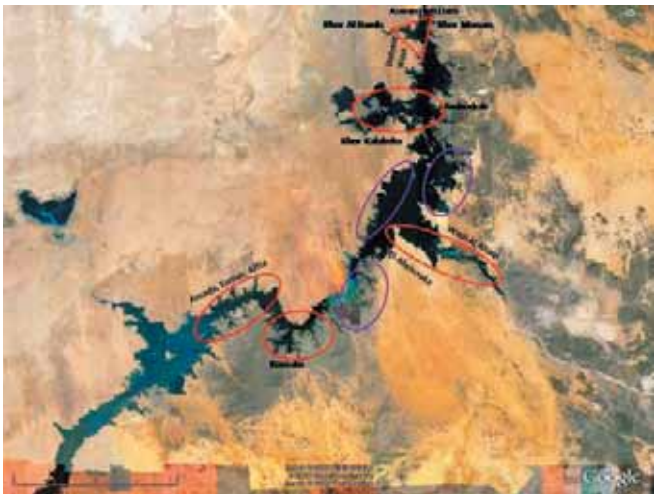

Figure 1. Lake Nasser crocodile survey sites (enclosed by circles and triangles). Primary survey locations are: Site 1- Khor Al Ramla, Dahmit West, Khor Manam; Site 2- Khor Kalabsha, Amberkab; Site 3- Wadi Al Allaqi, El-Mehrakka; Site 4- Khor Singari, Korosko, Abu Handal, El-Malki; Site 5- Amada, Tomas, Afia. Secondary survey locations (should time and resources allow) are: Site 6- Mirwaw, Khor Mariya, Khor Wadi Abyad; Site 7- Kushtamno, El-Daka, Kourta, Sayala; Site 8- El-Soboui, Khor El-Sabakha, Khor Wadi El-Arab.

Additionally, a significant, yet unstated, objective of this project is to establish a group of Egyptians capable of managing the Lake Nasser crocodile population. To this end, the primary goal of the initial project session was to conduct training courses with the crocodile team in a variety of ecology and conservation theoretical topics. The team has had extensive experience in the Lake working with biodiversity and local communities, but by their own admission has no knowledge regarding specific techniques for crocodiles or for robust estimates of population size. The training consisted of two major components: classroom lectures and critical conservation thinking (conducted at the EEAA office in Aswan); and, field training (conducted on site in Lake Nasser). Much of this information was generally applicable to other taxa so the classroom and critical thinking components were open to all South Area Protectorate NCS, and other EEAA - Aswan, staff. Non-team NCS members and local University students will be invited to accompany the team on crocodile surveys should space permit, as a form of continued capacity development.

Survey Trip 1

The first survey was conducted on 4-11 July 2008, to Khor Al Ramla, Dahmit West and Dahmit East (Fig. 2). These areas were chosen due to their perceived suitability for crocodiles, anecdotal information suggesting a robust population size, and their proximity to Aswan in the case of any logistical problems. The primary purpose of this trip was to train the team (see above) and to pilot the fisherman questionnaire. Due to the aptitude, work ethic and capacity of the team the secondary purpose (ie conduct the first project survey) was also successfully achieved. The trip was led by Matthew Shirley and attended by Ashraf Hussain Ibrahim Salem, Ekrammy Mohamed Elabassery, Amr Abd El Hady and Mohammed Saad El Din Hassam Mekki.

Figure 2. Survey route (white line; 182.7 km) and crocodile sightings (white circles; N= 125) for Trip 1. Counter-clockwise from the top are: High Dam, Khor Al Ramla, Dahmit West and Dahmit East.

In general, the western shore areas (Khor Al Ramla and Dahmit West) are comprised of gently sloping, rocky or sandy shores. Within 10-20 m of the waterline was a border of *Tamarix* sp. representing the high water mark and above this was generally a band of sandy beach suitable as nesting habitat. The area is additionally characterized by a 2-8 m band of aquatic vegetation at the interface of the lake and the shore. Human presence and fishing activity were detected in low density. Both localities are incredibly suitable for crocodiles, as reflected in the survey results.

In contrast, the eastern survey area (Dahmit East) is characterized by rocky cliffs and steeply sloping, rocky shorelines, though interspersed with patches of habitat similar to the western shore of the lake. Human presence and fishing activity was even less here where only a handful of operations were detected. In general, the eastern shore of the lake offers suitable crocodile habitat in the form of solitude, but the low density of fishing activity suggests a lower prey-base (likely due to deeper water), and there is a relative lack of suitable nesting habitat.

A total of 182.7 km was surveyed (72.1 km Khor Al Ramla, 44.2 km Dahmit West, 66.4 km Dahmit East) by spotlight, with 132 crocodiles ranging in size from hatchlings to ±4 m adults being detected (Table 1). Nesting activity was observed on three occasions: a nest in the midst of hatching (22 eggs, 10 successfully hatched); a nest site actively guarded by a female but no eggs or hatchlings found; and, the presence of newly hatched crocodiles.

Figure 3. Lake Nasser Crocodile team members Ekrammy Mohamed Elabassery (right) and Mohammed Saad El Din Hassam Mekki (centre) interview a local fisherman (left).

Questionnaires were conducted with 8 different fishermen (Fig. 3). The results were used to adapt the format of the questionnaire for future use (questionnaire is available on request). Preliminarily, local fishermen indicated that their primary concern was not for their lives but rather for their livelihoods. All interviews detected the presence of an on-going, illegal crocodile harvest, with perhaps as many as 3000 live hatchlings and 200 skins (adults) exported annually.

Table 1. Results of spotlight surveys (0.5 m size categories) carried out in July 2008. H= hatchlings, Y= yearlings, EO= eyes only, RD= relative density (total/distance), NHD= non-hatchling/yearling density (H and Y excluded).

				Total Length (m)												
Site	km	H	Y	1.0-1.5	1.6-2.0	2.1-2.5	2.6-3.0	3.1-3.5	3.6-4.0	4.1-4.5	4.6-5.0	>5.0	EO	Total	RD	NHD
Khor Al Ramia	72.1	10	4	2	5	5	0	2	5	0	0	0	20	53	0.735	0.541
Dahmit West	44.2	0	21	4	2	1	2	1	1	0	0	0	23	55	1.244	0.769
Dahmit East	66.4	1	8	4	2	2	0	0	0	0	0	0	7	24	0.361	0.226
Total	182.7	11	33	10	9	8	2	3	6	0	0	0	50	131	0.717	0.662

Further investigation on this issue is warranted. The newly formed questionnaire will be able to detect robust trends in local knowledge, current practices, and future willingness to participate in management programs.

Following these preliminary activities the next step will be to identify key personnel within stakeholder groups to serve as point contacts and decision-makers. We will organize a stakeholder workshop for December 2008 in Aswan to determine the future potential of management programs and the interactions of the different stakeholder communities.

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Gambia

ESTABLISHING A BASELINE FOR THE REPOPULATION OF THE AFRICAN DWARF CROCODILE AND SLENDER-SNOUTED CROCODILE AT THE WESTERN LIMIT - THE GAMBIA. The African Dwarf (*Osteolaemus tetraspis*) and Slender-snouted (*Mecistops cataphractus*) crocodiles are considered to be the least known crocodilians in the world (Ross 1998). They often occur sympatrically, preferring forested rivers and wetlands, throughout the Upper Guinea and Congo Basin forest biomes in West and Central Africa. Both species have been highly susceptible to anthropogenic threats, including deforestation and illegal harvest, over the past century and as a result there have been large-scale local and regional extinctions (Jones 1991; Shirley *et al*. 2008). At the western limit of their distribution, neither species has been reliably recorded in The Gambia for over 20 years.

In looking to the future of crocodile conservation in this area, the Croco's Ark Trust has recently been established in The Gambia with the explicit purpose of captive breeding for repopulation of these two species once commonly found throughout the Gambia's riverine, swamp, and mangrove habitats. Affiliated and necessary research regarding the status of wild populations and suitable habitat distribution will be conducted concordantly. Sensitization and education of the public (Gambian and eco-tourist alike) regarding crocodile conservation shall be addressed.

It is the aim of the parties involved to re-establish sustainable populations of these two species of crocodiles that, with monitoring and Government protection, may thrive with minimal intervention. It is for the benefit of native ecosystems, international wildlife conservation, and Gambians alike that this initiative is proposed.

This *ex situ* operation has begun construction of the crocodile facility and secured guarantees of founder stock from European zoos, as well as, initiated contact with the Abidjan Zoo (Cote d'Ivoire) to secure breeding adult *M. cataphractus*. The IUCN reintroduction guidelines require that wild populations are restocked with genetically similar captive animals; unfortunately, for *Osteolaemus*, this is not as straightforward as it would seem. Recent genetic studies have unveiled the existence of highly divergent, cryptic taxa where what was once believed a single species is now likely comprised of 3 or more unique taxa (Eaton *et al*. 2008). The dearth of samples from Senegal and Gambia have precluded our ability to know if the populations there comprise a fourth unique, now Critically Endangered, species or if they are simply critically endangered populations of the West Africa species.

Gambia is considered an ideal location for a crocodile re-introduction for multiple reasons, including their ecological value, but perhaps most importantly their cultural significance. Gambians don't associate crocodiles with aggression or death. Instead, crocodiles have a sacred place within the culture. For example, three crocodile pools exist in the Gambia: Kachikally Crocodile Pool in Bakau; Mama Folonkoo in Kartong; and,

the Crocodile Pool in Berending. These pools are held in high regard by indigenous Gambians, and women often frequent the pools for prayer and for blessings of enhanced fertility or improved chances for conceiving a male child.

The value of crocodiles within the culture may even be seen on the national currency: the dalasi coin is imprinted with a crocodile (Fig. 1), and the watermark on paper money of the Gambia is a side view of a crocodile head.

Figure 1. One (1) dalasi coin.

Prior to any *ex situ* conservation efforts, it is critical that we establish a baseline of data regarding the status and distribution of wild populations for these two species. Despite the popularity of Sacred Pools in the Western and Northern Divisions (Moiser and Barber 1994, 1997), the status of wild crocodile populations in The Gambia have never been thoroughly assessed and the latest information of any value is almost 20 years old (Jones 1991). In light of this dearth of knowledge, we will additionally work with the Department of Parks and Wildlife to initiate surveys of wild crocodilians and provide training that will serve as a platform from which these initiatives may continue.

The 2008-2009 Gambian crocodile program was initiated 29 August 2008 with logistics and administrative meetings with Alpha Jallow (Director) and Mawdo Jallow (Research Director) at the Department of Parks and Wildlife Management and Matthew Shirley (University of Florida). The meeting was also attended by Luc Paziaud (The Gambia Reptile Farm, Croco's Ark Trust), Kathryn Ingenloff (US Peace Corps, Croco's Ark Trust) and Leslie Coleman (US Peace Corps).

Two surveys were conducted at Abuko and Tanbi National Parks. No crocodiles were observed at the latter, and only 8 *C. niloticus*, were observed at the former. Tentatively these results suggest that the artificial pools created by Jones *et al.* in the late 1980s, which at that time successfully facilitated the reproduction of *O. tetraspis*, were not successful in the long-term. However, it is the end of the rainy season and thus water levels are incredibly high and much of the forest fragment is flooded. Surveys will continue throughout the year, and new surveys will additionally be conducted at the Kiang West, Boabolong, and River Gambia National Parks, as well as, at yet to be determined unprotected areas in the forested south of the country bordering the Casamance region of Senegal.

Acknowledgements

We would like to acknowledge the enthusiasm of The Gambian Department of Parks and Wildlife Management, in particular Alpha Jallow and Mawdo Jallow, for embracing both the *ex situ* and *in situ* initiatives. We would also like to thank the St. Augustine Alligator Farm, St. Augustine, Florida, USA, and J. Perran Ross for their donations of equipment to support long-term monitoring of crocodiles in The Gambia.

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Niger

After attending the 1st West African subregional CSG meeting in Tapoa, Niger, we conducted surveys and collected genetic samples from crocodiles on the Niger River and its tributaries in SW Niger. Surveys were conducted from 15-30 November 2007 in Niger's National Parc W and along the Niger River. Discussions of follow-up activities were initiated with the administrative staff of the Parc W.

Surveys in Parc W

Work in Parc W began with training exercises for local

conservation staff, followed by surveys of crocodiles and sampling for future molecular systematic and ecology studies. Preliminary activities were conducted during the meeting with Mitch Eaton, Richard Fergusson and Matt Shirley leading participatory training activities for participants and park staff to observe and learn basic crocodile survey and capture techniques.We demonstrated the safe capture and handling of live Nile crocodiles (*Crocodylus niloticus*).After the meeting we conducted additional training activities through population surveys, where Parc W staff learned more extensive survey, capture and assessment techniques.

Surveys and sampling were carried out within Parc W along the Tapoa River (Figs. 1 and 2), from the park headquarters at the village Tapoa on 15 and 23-26 November. Surveys, including double-observer counts, took place on 15 and 24 November, while efforts to collect blood samples were made on all occasions.

Figure 1. Tapoa River, Parc W.

Figure 2. Tapoa River survey route. Blue line in the middle represents the 3.8 km survey route along the Tapoa River. The river continues N x NE through the Tapoa Gorge before curving down to meet the Niger River. The mouth of the Tapoa was surveyed, indicated by the small blue line extending from the Niger River survey route in the NE of the image ("Tapoa River Mouth"). To the west, the Tapoa River extends in an almost straight line into Burkina Faso.

The Tapoa River is a relatively narrow, presumably shallow, heavily sedimented river that runs from Burkina Faso into Niger. It forms the northwestern boundary of the park and drains into the Niger River. The river is dammed above the Tapoa gorge 1 km from the main entrance to the park at the village Tapoa. Upstream from the dam, the river is only navigable for 3.8 km before becoming overgrown and too shallow. On 24 November MS continued on foot for 1-2 km to investigate the feasibility of sampling further upstream, however, the river became virtually dry. Habitat surrounding the river is consistent with Sudanian savannah woodland (Sahel), while the banks of the river are generally sandy, beach type habitat ideal for nesting of *C. niloticus*.

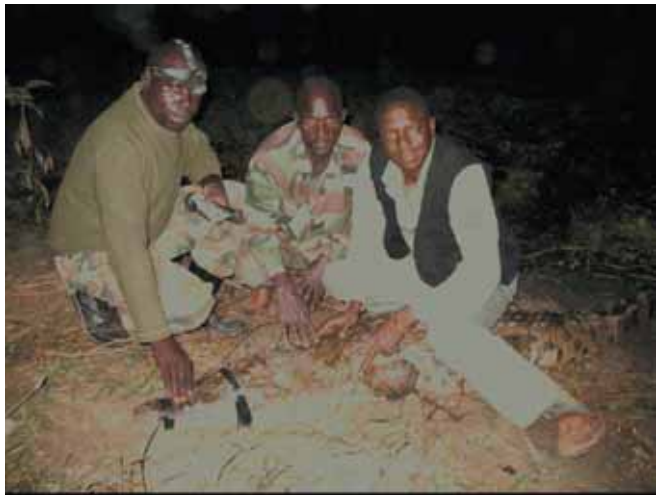

Figure 3. Hamissou Halilou Malam Garba (right), Adjunct Conservateur of Parc W, and staff during training exercises with a 2.5 m *Crocodylus niloticus*.

All survey nights in the Tapoa River followed the same route upstream for 3.8 km before returning downstream again. On 15 November an upstream survey was used to derive an initial estimate of abundance and size structure (Table 1) and train Hamissou Halilou Malam Garba (HHMG), Adjunct Conservator of Parc W, in spotlighting techniques and size estimation (Fig. 3). This survey yielded 182 crocodile sightings in 3.5 km (52 crocodiles/km), with a very heterogeneous size structure, making this section of the Tapoa River one of the most densely populated areas for *C. niloticus* in West Africa. During the return journey, MS and ME conducted an independent double-observer count in which both observers searched for individuals independently and once every minute recorded counts to RF. On 24 November MS conducted both an independent and dependant double-observer count with an American Peace Corps volunteer.

The independent count consisted of both observers independently counting crocodile sightings and recording the total after 3.0 km. Observer 1 (MS) counted 113 animals while observer 2 counted 64. When conducted correctly, double-observer counts can account for inter-observer detection bias. The dependant double-observer count was conducted with MS as the secondary observer counting animals unseen by the primary observer, and the volunteer acting as the primary observer counting all observed animals. This type of double-

observer count effectively sets up a mark-recapture scenario. These results are currently being analyzed. No other species of crocodile was positively identified during these surveys, and we are confident that all observed were *C. niloticus*.

Animals were captured for sampling and biometric assessment on all occasions listed above. We captured, sampled and measured a total of 36 *C. niloticus*. Captured animals ranged in size from hatchlings to 250 cm TL. All animals had morphological characteristics congruent with *C. niloticus* captured in other West and Central African localities.

One survey was also conducted along the northeastern park boundary on the Niger River. Along the park side (the western side), the bank of the Niger River is often steep and heavily vegetated with relatively little open, sandy beach area necessary for basking and nesting. Outside the park (the eastern bank), the land is flat and largely devoid of vegetation, though sparsely populated. The river itself averaged 200 m wide (range 40-500 m), is heavily sedimented, and flows quickly during the wet season. On 16 November we surveyed 20 km from the village Karekopto upstream to Korogoungou, including several kilometres up inundated tributaries and the Tapoa River mouth. Two crocodiles were seen in one small tributary, both unidentified and unapproachable (Table 1). Parc W staff and village residents along the Niger River stated that crocodiles are occasionally seen in the river, but readily admit these are rare occurrences.

Surveys of the Niger River

From 17-18 November, MS, ME, RF and HHMG surveyed the Niger River from the village Korogoungou to Niamey for a total 120 km (Fig. 4). The Niger River outside the park averaged 200 m wide (range 40-500 m), is heavily sedimented, and flows quickly during the wet season. The banks are largely flat and unvegetated.

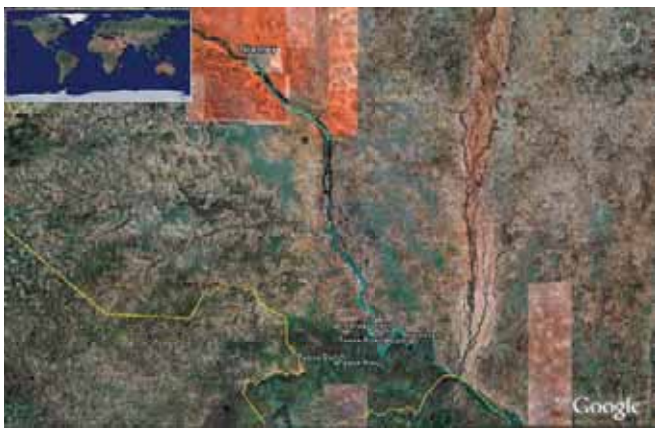

Figure 4. Niger River survey route. The 120 km survey of the Niger River started at the halfway point in the W at the village Karekopto and ended in Niamey. The vlue line represents the survey route. Note that the middle, unshaded section was also surveyed.

Villages were encountered frequently, but most were small, consisting of 2-10 residences, and there was relatively little livestock presence. Although peak rainfall occurs around August in the region, the timing of our surveys corresponded to the near-high water mark of the Niger River with water-levels several meters above the low-water mark. The high waters and flooded side-channels reduced the likelihood of observing crocodiles if present. Peak water levels typically occur in January/February.

Each survey day was initiated with 20 km of diurnal surveys followed by 40 km of nocturnal spotlighting. During spotlighting, observers were rotated every 10 km. Only a single crocodile was sighted with certainty (± 1.0 m), and two other sightings were unconfirmed. Interviews with villagers, wildlife management authorities and our boatmen suggested that crocodiles are encountered very infrequently (likely less than every 5 years) and normally during the dry season.

Recommendations

Due to the challenges of conducting crocodile surveys during periods of elevated river levels, and for comparative purposes, further survey work should take place in Niger before conclusive results can be drawn regarding the status of crocodiles in this region. Because of the high density of *C. niloticus* observed in the Tapoa River, we recommend that repeat dry season surveys of the Tapoa River and the Niger River in the vicinity of the park are carried out, including a first time survey from Karekopto south to, and up, the Mékrou River (the southwestern border of the park). Additionally, other rivers and waterholes throughout the park (as appropriate) and the Niger River upstream from Niamey should be surveyed. Finally, traditional medicine and religious markets should be surveyed for evidence of trade in crocodile products and more extensive interviews conducted to determine the origin of products, their uses, and the potential for establishing a formalized, regulated trade in crocodilian products within this market.

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Science

Recent Publications

Ruth M. Elsey (2007). Precocious reproductive development in a farm-raised and released American alligator, *Alligator mississippiensis*. Herpetological Bulletin 102: 11-14.

Abstract: An alligator trapper from Cameron, Louisiana

recently reported harvest of a small "nuisance" alligator (total length = 142.24 cm) which upon internal examination contained 12 hardshelled eggs within one oviduct. The alligator had been released from a commercial alligator farm as part of Louisiana's alligator egg ranching program 27.75 months prior to being caught. Prior to release, it had been marked with numbered tags attached to the webbing between the toes on the rear feet and by a permanent tail-notch. Based on the size and date of release, the alligator was less than four years old when harvested. To my knowledge this is the smallest female alligator in which reproductive development has been documented.

Josefina Iungman, Carlos I. Piña and Pablo Siroski (2008). Embryological development of *Caiman latirostris* (Crocodylia: Alligatoridae). Genesis 46: 401-417.

Abstract: A standard development embryological series is the primary basis to organize information of any embryological study and is also used to determine the age of eggs and embryos in field conditions. In this article, we calibrate developmental series of the broad-snouted caiman, *Caiman latirostris*, against an established series for *Alligator mississippiensis*. Morphometric measures and extent of the opaque-shell banding were also related to embryo age. In earlier stages, external morphological features alone can account for embryo age, but we suggest that morphometric measurements should be introduced later in the development. Unlike morphologic and morphometric attributes, the opaque patch was not a useful age predictor. As expected, a close correlation between embryonic development of *C. latirostris* and *A. mississippiensis* was observed.

Platt, S.G., Rainwater, T.R., Thorbjarnarson, J.B. and McMurry, S.T. (2008). Reproductive dynamics of a tropical freshwater crocodilian: Morelet's crocodile in northern Belize. Journal of Zoology 275: 177-189.

Abstract: Morelet's crocodile *Crocodylus moreletii* has not been well-studied and many aspects of its life history are unknown. In particular there is a notable paucity of information on nesting and reproductive ecology. We studied the nesting ecology of Morelet's crocodile in northern Belize from 1992 through 1995. Nesting occurs at the onset of the wet season in mid-June and continues through mid-July (mean oviposition date = 1 July ± 10 days). Eggs hatch from mid-August through mid- to late September. Nesting effort at our primary study site remained relatively constant during 1992, 1993, and 1995, but nearly doubled in 1994; this appeared to reflect a regional trend. Natural and man-made islands are heavily used as nesting sites. Nesting success in 1993 and 1994 was consistently higher on natural islands when compared to man-made islands or shoreline sites. Nest losses were primarily due to flooding and raccoon (*Procyon lotor*) predation. Losses from predation were greatest in 1994 when unseasonably low water levels facilitated predator access to nests. Females probably reach sexual maturity in 7 to 8 years after attaining a total length of 150 cm. Mean clutch size (25.0 ± 7.6; range= 9 to 42; n= 73) did not differ among years. Mean clutch size, egg width, egg length, egg mass, and clutch mass were positively correlated with female snout-vent length (SVL). Mean egg width was the best predictor of female SVL. A partial correlation analysis of egg and clutch attributes found that independent of female SVL, egg mass increases with increasing clutch size.

Dieter Gramentz (2008). Zur Abundanz, räumlichen Verteilung und Bedrohung von *Crocodylus porosus* im Bentota Ganga, Sri Lanka. Elaphe 16(3): 41-52. (in German).

[Translation: Dieter Gramentz (2008). Abundance, distribution and threats to *Crocodylus porosus* in Bentota Ganga, Sri Lanka. Elaphe 16(3): 41-52.]

Submitted Articles

GIVING BIRTH TO A CROCODILE? SOLVING CAPTAIN COOK'S EXTRAVAGANT AND ABSURD PROBLEM. In February 2005 we conducted a crocodile survey along the Pacific coast of Luzon. In Palanan a fisherman, Berto Mijares, told us a story of an enchanted crocodile in the mangroves around his village: "*A woman gave birth to a twin: a girl and a crocodile. They grew up together. The parents placed the crocodile in a tub in the kitchen of the house. They fed it daily. The crocodile grew. After a few years the parents could no longer afford the meat. They said to the crocodile: you have to go to the sea and catch your own food. They gave the crocodile a silver necklace and released it. The crocodile vowed always to protect his human sister. Sometimes the crocodile visits the family and offers a pig or a sea-turtle*." Berto claimed he regularly sees the crocodile with the silver necklace, and that this enchanted crocodile will never attack people.

Indigenous communities throughout southeast Asia think that women give birth to crocodiles. This belief has been extensively documented in the archives and the ethnographic literature from the region. One of the oldest written records is from the Visayas, where the Spanish friar Francisco Alcina wrote in 1668: "*One of [the] parishioners gave birth to a crocodile twin. She was the wife of Pakotolini of Tubig, who had been raised in a Jesuit house as a church boy, and the little creature was delivered together with a normal child. The parents moved away to get rid of it, but it not only followed them but regularly brought them a wild hog or deer, or large fish*." (cited in Scott 1994: 114-115).

Father Alcina didn't question the physiology of delivering a crocodile. But more scientifically-oriented observers wondered how women could bear crocodiles. During his first trip around the world from 1768 to 1771, Captain James Cook noted that the Bugis in Sulawesi "*believe that women, when they are delivered of children, are frequently at the same time delivered of a young crocodile, as a twin to the infant: they believe that these creatures are received more carefully by the midwife, and immediately carried down to the river,*

and put into the water. The family in which such a birth is supposed to have happened, constantly put victuals into the river for their amphibious relation, and especially the twin, who, as long as he lives, goes down to the river at stated seasons, to fulfill this fraternal duty, for the neglect of which, it is the universal opinion that he will be visited with sickness or death. What could at first produce a notion so extravagant and absurd, it is not easy to guess, especially as it seems to me totally unconnected with any religious mystery, and how a fact which never happened, should be pretended to happen every day, by those who cannot be deceived into a belief of it by appearances, nor have any apparent interest in the fraud, is a problem difficult to solve. Nothing however can be more certain that the firm belief of this strange absurdity among them, for we had the concurrent testimony of every Indian who was questioned about it, in its favour. It seems to have taken it's rise in the islands of Celebes and Boutou where many of the inhabitants keep crocodiles in their families; but however that be, the opinion has spread over all these eastern islands, even to Timor and Ceram, and westwards as far as Java and Sumatra, where, however, young crocodiles are, I believe, never kept. These crocodile twins are called Sudaras" (1842: 312-313).

Also the Dutch missionary Albert Kruyt, who lived 40 years in Central Sulawesi, wondered where the belief in human-crocodile siblings came from. In his essay "De krokodil in het leven van de Posoërs" (The crocodile in the life of the Poso) Kruyt described the important role of crocodiles in cosmology: "*The people feel so connected with these animals that they believe that a woman can bear a crocodile. In my life I have met three people who were convinced they had a crocodile twin brother. The village chief of Bo'e, located 4 km from Pendolo, is one of them. Several elders assured me: 'when that man was born, his mother also delivered a small crocodile. First, they placed the animal in a bowl; when he became too big he was put in a manger filled with water; when he couldn't move anymore they filled an old boat with water wherein he could enjoy himself. When this became too small, we released him in the lake.' The crocodile served his family. On special occasions his parents or his twin brother went to the lake and called: 'Boutou, tomorrow we celebrate.' The following morning there always was a deer or a wild pig that Boutou had killed and placed on the bank. 'But now it doesn't happen anymore', regretted the twin brother of the crocodile. 'When the soldiers came to our land and shot at the crocodiles without the animals having done anything, the crocodiles withdrew and don't want to deal with us anymore*'" (1901: 9).

These traditional beliefs have been remarkably resilient over time. In the Philippines, indigenous communities still believe they are intimately related to crocodiles. The Magindanaon in the Ligauasan Marsh, for example narrate that: "*after the datu (male royal) was born a small crocodile emerged from the mother's womb to the surprise of the couple. Believing that the creature was their son's twin, they kept it in a separate cradle besides that of the infant datu. As the datu grew so did the crocodile. The couple showered it with the same care as they did with their son. When the datu was adolescent, the crocodile was so enormous it could no longer fit in a cage in the house. After much thought, the couple decided to free the crocodile in the river*" (Mangansakan 2008: 135). Also the Manobo, the indigenous people inhabiting the Agusan Marsh, think people are born with a spirit crocodile twin. The Tagbanua on Palawan believe crocodiles will aid their human relatives in times of distress. And the Kalinga in the northern Sierra Madre on Luzon tell stories of enchanted crocodiles: "A *mother gave birth to a girl and a crocodile. They grew up together. But one day the father got angry with the crocodile and tried to kill it. The crocodile escaped but his tail was chopped off. You can still see this twin crocodile without tail in the river. We call him putol. The crocodile regularly visits and protects his sister*." Perhaps not surprisingly, these are the only areas where crocodiles survive in the wild in the Philippines.

For years these crocodile-twins and the role they play in the conservation of crocodiles have puzzled me. Do people actually think that women give birth to crocodiles? Fishermen like Berto Mijares know very well that crocodiles lay eggs. He helped his wife delivering six children. But he was convinced that women could also give birth to a crocodile. I never really understood it until my daughter Lisa was born. To my great surprise, she was followed by … a crocodile! The midwife handled the placenta with great care: a large cake with scutes on it. It seemed to be alive. It did not really, I admit, look like a crocodile hatchling. But I immediately understood why people attach spiritual powers to the afterbirth, why they believe it is alive, and why rituals are performed for its proper disposal. Obviously, Father Alcina could never have figured that out. And Captain Cook was most probably at sea when his children were born; otherwise he would never have considered this a 'strange absurdity.'

After the birth of a child the Javanese placed the placenta and the umbilical cord, decorated with fruits, flowers and small lights, in the river as a gift to the crocodiles (Wilken 1885: 69). When I see Berto Mijares I will tell him I released my daughter's twin-crocodile spirit in the canal in front of our house in Leiden. I'm sure he will understand.

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JUVENILE AMERICAN ALLIGATOR BURROWING ACTIVITY. On 14 June 2008 at Lettuce Lake Park in northeastern Hillsborough County, on the outskirts of Tampa, Florida, I observed a juvenile American alligator (*Alligator mississippiensis*) displaying unique burrowing behavior.

The observation period occurred from 1540 to 1600 h. The weather was mostly sunny with winds from the west at 14 km/h, and air temperature was 32°C. Lettuce Lake Park contains a small tributary to the Hillsborough River that is subject to seasonal drying. In this portion of the river, the water level had continued to drop for approximately a month. During the observation period, there was some canoe and kayak traffic in the main channel on this portion of the river, but this human activity was too distant from the alligator to disturb it. There was closer human activity in the form of people walking down a nearby boardwalk, but the alligators of this area are used to this human presence and it does not appear to affect their behavior.

At 1551 h I observed a juvenile alligator with only its head above the water located about 3 m from the bank. I did not see its entire length, but based on its proportions I estimated it to be about 45 cm long. The alligator was facing the center of the tributary channel, and had buried itself in the silt/mud on the bottom of the river up to its neck. At 1553 h it submerged in about 7-12 cm of water, and resurfaced at 1555 h. It came up for air and with only its head above the water, and then submerged again at 1557 h. Figure 1 shows the alligator in the mud, the burrowing effect clearly visible behind its head.

Figure 1. Completely submerged juvenile alligator burrowed in mud in shallow water.

During an earlier observation period in close proximity about a week prior, it appeared that a similar-sized specimen (perhaps the same one) buried itself or was lying in a small hole underwater, but I could not discern details because of the distance, 9-10 m away. Today, it was obvious that the alligator had dug a small hole underwater in which it was positioned. I believe this to be deliberate behavior to counter the falling water levels. I expect the specimen to continue this behavior, gradually moving towards the main portion of the river as the water level continues to drop in the tributary. Is this local behavior, or is this instinctive? I offer three hypotheses.

1. The alligator may conduct this burrowing behavior to reduce its temperature with the available mud providing an ideal insulator.

2. The alligator may burrow in reaction to the reduction of the aquatic habitat in this tributary of the Hillsborough River caused by seasonal precipitation variances.

3. This burrowing behavior may be conducted to reduce the alligator's vulnerability from predators. This portion of the Hillsborough River hosts a high concentration of aquatic birds, many of whom can prey on juvenile alligators. However, this specimen is now too large to be in such danger, leading me to believe the first hypothesis is the most likely.

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Expo Raises Funds for Indian Gharial

EXPO RAISES $US27,000 FOR INDIAN GHARIAL. Each year, the National Reptile Breeder's Expo held in Daytona, Florida, raises money for private sector reptile and amphibian conservation through an auction. This year, despite a tropical storm hanging over Daytona, the auction was not only a success, but we had our largest audience to date.

Funds raised through this year's Expo Auction will benefit the critically endangered Indian gharial (*Gavialis gangeticus*). This unique crocodilian, considered safe after a massive captive breeding and reintroduction campaign in the late 1970s and 1980s, has been found to have lost tremendous ground over the last 8 years. Today there are less than 200 breeding adults in the wild, scattered over 7 sanctuaries, and last winter saw a mysterious and devastating die-off of over 117 gharial in the National Chambal River Sanctuary. Almost 30% of the sanctuary's next breeding generation (adult females and sub-adult males) are now gone. Expo funds are headed directly to gharial conservation programs in India, including head-start programs, habitat protection and continued investigations into the die off at the National Chambal River Sanctuary.

The Director of the Gharial Conservation Alliance (GCA), Rom Whitaker, was in attendance throughout the Expo and gave a presentation on the plight of the gharial just prior to the auction. While he was extremely excited to see the crowds of fellow reptile enthusiasts in attendance at the auction, he was ecstatic over the evening's fundraising success. "Words cannot describe the gratitude I feel towards all who helped make this weekend such a promising one for gharial conservation," said Rom. "Many thanks to everyone who donated their precious time and resources in order to help us preserve and protect

the dwindling number of them that remain. You can do a great deal with very little money in India; fortunately, now we can do a great deal many times over with the money raised here."

Total funds raised over the 7 years in which the benefit auctions have been held now exceeds $121,000. More importantly, it is not just about how much money is raised, but how well it is spent. Private sector conservation efforts are much more careful with their spending than are government agencies, institutions and large international organizations. Funds are unable to be used for travel, overheads and other expenditure that do not directly benefit the species. In four of the years of the auction, money raised has gone directly to important conservation projects in developing nations where US dollars go much further than they do in this country.

We hope to be able to have the 2009 auction benefit some species of amphibian since the previous 7 auctions have all been for reptiles. We thank Wayne Hill for sponsoring the auction and Reptiles Magazine and Herpster.com for sponsoring our pre-auction social.

Dave Lee, *Benefit Coordinator, <torresinc@aol.com>*

Did you Know?

Crocodiles are the national animal for the island nations of Cuba and East Timor. In the case of Cuba it is the endemic Cuban crocodile (*Crocodylus rhombifer*), and for East Timor it is the Saltwater crocodile (*C. porosus*), the only crocodilian species known from the island.

Crocodiles also feature on the coat of arms of various countries, for example, as the Solomon Islands (Saltwater crocodile *C. porosus*) (Fig. 1); Lesotho (Nile crocodile *C. niloticus*) (Fig. 2); and, Jamaica (American crocodile *C. acutus*) (Fig. 3).

Figure 1. The coat of arms of the Solomon Islands depicts a shield flanked by a shark and a Saltwater crocodile.

Figure 2. The coat of arms of Lesotho, which depicts a Nile crocodile on a shield, is also on the national flag.

Figure 3. An American crocodile sits atop the royal helmet of the British monarchy and mantling of the Jamaican coat of arms.

In the case of Lesotho, the crocodile was the symbol of the royal family of the Koena Dynasty, founded in the early 19th Century. Interestingly, crocodiles do not occur in Lesotho. In Papua New Guinea, crocodiles feature on the flags of Gulf Province (Fig. 4) and East Sepik Province (not shown).

Figure 4. Flag of Gulf Province, Papua New Guinea.

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