

# **CROCODILE SPECIALIST GROUP NEWSLETTER**

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# CROCODILE

# SPECIALIST

# GROUP

# NEWSLETTER

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**COVER PHOTO.** Release of one of four 1.5 year-old *C. mindorensis* rescued as hatchlings from a nest being attacked by army ants, into the wild at the crocodile sanctuary in San Isidro, during field trip following the "Forum on Crocodiles in the Philippines", February 2007 (see pages 12-16). Photograph: Merlijn van Weerd.

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

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

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**Editorial**

The year 2007 promises to be another active one for the CSG. CITES CoP14 will take place in June (The Hague, Netherlands), in which a core group of CSG members will get a chance to meet. Brazil has a proposal on the agenda to transfer their population of Black caimans (*Melanosuchus niger*), now very abundant and widespread, from Appendix I to Appendix II (see page 4). If successful, this will involve Brazil in some new management challenges as they trial a formal harvest program for meat and skins.

The CSG-Tomistoma Task Force organised a very successful “Night for the Crocs” benefit at the Miami Metro Zoo on 24 February 2007. Some 170 people attended, raising \$US3265 towards future CSG-TTF activities. Bruce Shwedick, Ralf Sommerlad, Akira Matsuda and other CSG-TTF members are to be congratulated for what has been a pioneering fund-raising effort.

The Venezuelan Crocodile Specialist Group (GECV) convened the “Third Workshop for the Conservation of the Orinoco Crocodile”, in San Carlos, Venezuela, on 18-19 January 2007 (see pages 9-10). Participants analyzed the successes and failures in 30 years of effort to improve

the status of *Crocodylus intermedius*. Current status is greatly improved, and despite the continued effort needed to maintain the recovery, all associated with this long-term program effort and vision are to be commended.

I attended the “Forum on Crocodiles in the Philippines” (31 January to 2 February 2007) which saw stakeholders from Government, industry, academia, NGOs and local communities looking frankly at each others’ programs and aspirations. The seven (7) resolutions agreed provide an updated road map for crocodile conservation, management and sustainable use in the Philippines (see pages 12-16). This includes restocking virtually extinct populations from the captive breeding facility in Palawan. The existence of wild populations of *C. mindorensis* and *C. porosus* in Liguasan Marsh, in southern Mindanao, was confirmed. A project of cooperation between Mabuyawa Foundation (Isabela Province, Luzon) and the University of Southern Mindanao was born, with a view to ensuring that the hard-earned lessons of the very successful project in Isabella can be adapted and applied in Mindanao. Andy Ross and Vic Mercado are to be congratulated for their vision in pulling this all together, and the full participation of the Isabella project gave clear guidance of how local communities can become “partners” in crocodile conservation efforts.

CSG representation in West Africa has always been constrained, and at the last Working Meeting (France, June 2006) the possibility of a CSG sub-regional meeting in West Africa (in Niger, mid-November 2007), and a regional meeting in South Africa (late November 2007), were discussed. Both these initiatives are advancing.

Crocodile management in Madagascar was a subject of concern for the CSG and CITES. A review by CITES found a number of areas in urgent need of attention and the CSG is currently looking at possibilities for assisting.

The Sepik Wetland Management Initiative in Papua New Guinea with crocodiles has been selected as a finalist in the Equator Prize ([www.undp.org/equatorinitiative/equatorprize/EquatorPrize2006/2006-finalists.htm](http://www.undp.org/equatorinitiative/equatorprize/EquatorPrize2006/2006-finalists.htm)) - congratulations of all involved in that program.

During a visit to Bolivia in March 2007, Tom Dacey confirmed with Bolivian authorities that plans for the 19th Working Meeting in Bolivia (June 2008) are well advanced.

Let me take this opportunity to remind all CSG members that in order to share information through the Newsletter, we need you all to communicate with Tom Dacey about progress being made with crocodilian conservation, management and research. What may seem inconsequential locally can provide guidance for other members, facing similar problems, in different contexts.

Professor Grahame Webb, CSG Chairman

## CITES COP14

The 14th Conference of the Parties to CITES will be held in The Hague, Netherlands, on 3-15 June 2007, and the CITES Standing Committee will meet prior to the CoP, on 2 June. A number of issues of specific interest to the CSG will be discussed at CoP14, including:

1. Brazil's amendment proposal (CoP14 Prop. 13) seeking transfer of the Brazilian population of black caïman (*Melanosuchus niger*) from Appendix I to Appendix II. Early drafts of the Brazilian proposal were reviewed by a team of CSG members [see CSG Newsletter 25(4): 3]. Concerns on the extrapolation of limited data from one area to derive a total population estimate were addressed by Brazilian authorities, who sent an addendum to the proposal to the CITES Secretariat, CSG and European Union in February 2007. There appears to be little doubt that the *M. niger* population in Brazil is large, and there is no biological reason why the population cannot be used sustainably.
2. Working document (CoP14 Doc. 46) submitted by Germany on behalf of the European Community Member States on Interpretation and Implementation of the Convention ("Trade in some Crocodylian Specimens"). The document requests the CITES Standing Committee to consider the issue of trade in small crocodylian leather goods and its impact on the conservation of the species involved, and on the effectiveness of the Convention. It specifically seeks the establishment of a working group to:
  - a) examine the actual benefits and costs of the requirement to issue CITES documents and conduct trade controls for small crocodylian leather goods;
  - b) consider possible ways and conditions to exempt small crocodylian leather goods from the provisions of CITES;
  - c) develop a proposal, if appropriate, to contribute to the improvement of the effectiveness of the Convention, providing for the exemption of small crocodylian leather goods from the provisions of CITES; and,
  - d) report to the 58th meeting of the Standing Committee on the results of its work.
3. Working document (CoP14 Doc. 43) submitted by USA on Interpretation and Implementation of the Convention, Trade Control and Marking Issues ("Effectiveness of the CITES Universal Crocodylian Tagging System"). The document directs the CITES Standing Committee to review the implementation and effectiveness of the universal tagging system [Resolution Conf. 11.12 (Universal tagging system for the identification of crocodylian skins)], and present recommendations to CoP15.

All CoP14 amendment proposals and working documents are available from the CITES website (<http://cites.org/eng/cop/index.shtml>).

It is anticipated that a number of CSG members will be participating at CoP14, and a detailed report on the meeting will be included in the next issue of the CSG Newsletter.

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## Regional Reports



### West Asia

#### India

AWARD FOR CONTRIBUTION TO CONSERVATION. Long-time CSG member Rom Whitaker's contribution to wildlife research and nature conservation in India was recently recognised when he was awarded the 2006 Sanctuary-ABN AMBRO Lifetime Service Award. An interview published in Sanctuary Asia [26(6): 32-37] provides some insights into Rom's life and work with snakes and crocodiles.

As an integral member the Gharial Multi-Task Force, Rom has recently put the current status of the wild population of Indian Gharial (*Gavialis gangeticus*) into the public eye once again through in-depth interview/reviews [eg Whitaker, R. (2007). The Gharial: going extinct again. Iguana 24(1): 24-33].

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#### Iran

MOVEMENT BEHAVIOUR OF MUGGERS: A POTENTIAL THREAT. Movement between the water resources in different seasons and for different reasons, such as searching for new habitat or food resources, has been reported as a common behavior for Mugger crocodiles (*Crocodylus palustris*), including the population in Iran (Whitaker and Whitaker 1984; Mobaraki 2004). Drought in Iran is believed to be one factor responsible for such movements. This behavior is more usual with juvenile Muggers, and has been reported several times by local people who observe footprints during work in the fields.

Movements can occur at different scales, from short distances between close ponds, to long distances between widely separated areas. In some of the latter cases the distance between different ponds means it impossible to determine the exact destination of the crocodiles. Moreover, most movement takes place at night. Some crocodiles pass through small villages, especially when they move to artificial ponds constructed by local people, and this creates some problems to the people by frightening them and attacking to their livestock.

Where crocodiles cross roads with no lighting, car strike is a potentially serious threat to the animals (Fig. 1). With such cases the final destination of the crocodiles was unclear, and due to the large areas involved, control measures and monitoring are impossible. Due to high speeds and numbers of cars, especially trucks, prevention of accidents with animals such as crocodiles would also seem impossible. Over the past three years, 5 strikes causing the death of the crocodiles were recorded. The average length of these juvenile crocodiles was 132 cm.



Figure 1. Juvenile Mugger crocodile killed by car strike.  
Photograph: A. Mobaraki.

Considering the movement behavior of Mugger crocodiles and lack of detailed information on it, tracking of movement using telemetry is considered a high priority, but funding is required. Any assistance in this regard would be greatly appreciated.

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## Latin America & the Caribbean

### Brazil

CAIMAN RESEARCH TRAINING COURSE IN THE MAMIRAUÁ SUSTAINABLE DEVELOPMENT RESERVE, BRAZILIAN AMAZON. Beginning in the 1990s, ecological research and population monitoring of black (*Melanosuchus niger*) and spectacled (*Caiman crocodilus*) caimans was carried out in the Mamirauá Sustainable Development Reserve (MSDR) with the involvement of Sociedad Civil Mamiraua and the Wildlife Conservation Society (WCS). After more than 10 years of research, it was found that black caiman populations have been recovering from past hunting over-exploitation for commercial purposes. Extremely high dry-season encounter rates for caiman (in some cases exceeding 1000 individuals per kilometre of shoreline) have been reported in certain zones of the reserve (Da Silveira, pers. comm.). As the numbers of caimans increase, so do opportunities to develop management programs that could involve local communities that share habitat with these big predators in the MSDR, and it has been suggested that management of black caiman populations in this reserve could be carried out on a sustainable basis (Da Silveira 2002).

In 2005, the Instituto de Desenvolvimento Sustentável Mamirauá (IDSM) initiated a black caiman experimental hunting program in Lago Mamirauá, and thus population monitoring research is about to start again, after some years, in order to track the population trends and generate ecological information of black and spectacled caimans in the reserve to shape the harvesting program with a scientific basis.

IDSM and WCS organized a two-week training course to provide enthusiastic students practical experience to carry out monitoring and ecological research. The training course was carried out on 16-31 October 2006.

Starting in the city of Tefé, Amazonas State, instructor John Thorbjarnarson (WCS) provided theoretical basis for the first three days. An introduction to crocodylian biology, diversity, management and nesting was assessed during this theoretical part. After that, the team moved to Mamirauá to get involved with practical issues about caiman research.

Located at the confluence of the Japurá and Solimões Rivers, some 40 km north of Tefé, the MSDR is one of the largest protected areas of Varzea in the world, with about 1.1 million ha and more than 600 protected lagoons.



The training course was divided in three main topics: night spotlight surveys; nesting biology; and, collection of stomach contents from captured animals. During the practical part of the course, the team undertook 12 night surveys in five different locations, within the focal area of the reserve. Surveys were carried out after water levels had already started to rise and many of the caiman had already started to disperse. The highest densities were seen in Lago Mamirauá, with up to 125 ind/km of shoreline, most of them between 200 and 250 cm total length (TL). Spectacled caiman were most numerous in the Paran de Mamirau location, with up to 14.2 ind/km.

During the training course, 13 black caiman nests were found at six different locations, particularly along lagoon shores. Most of the nests were located in restinga baixa, matup and chavascal habitats around interior lagoons, that in most cases are isolated from the main water course due to the presence of vegetative material and sediments in their creeks which prevent water loss and thus extreme water level variation (J. Thorbjarnarson, pers. comm.).

All black caiman nests were found very close to the water's edge (mean distance= 3.5 m) which allows the nesting female to remain close to take care of them. The presence of attendant females was recorded at three nests only. One of them was aggressive and chased the researchers as they were trying to obtain data from the nest, forcing them to escape running on the matup (floating mats). This female had been previously captured by Ronis Da Silveira's team in 1998 when it measured 254 cm TL and weighed 65.7 kg.

Average clutch size was 32.3 eggs per nest. During this course we found the most extreme variation in clutch size ever reported for *M. niger*. One nest had only 3 eggs while another located 12 m away of it, contained 62 eggs, suggesting that the female from the first nest finished laying its eggs in this second nest (Fig. 1).



Figure 1. Instructor Dr. John Thorbjarnarson (left) with training course participants at a *M. niger* nest containing 62 eggs (see text).

We found four *C. crocodilus* nests at three different locations. All of them were found relatively far from the water edge (mean distance= 19.4 m), suggesting that attendant females do not need to be located in the water to take care of their nests; two females were found hiding in the leaf litter where they were captured to obtain their sizes. Nine individuals (5 *M. niger*, 4 *C. crocodilus*; 73-362 cm TL) were captured to give students experience with measuring, sexing, weighing and marking.

One interesting finding was the recapture of one *M. niger* individual that lives close to the Arapaima floating research station in the reserve. This animal has been named "Fred" by the people living in the station, and it turns out this was the third time he has been captured in the last 8 years. In 1998, the first time it was captured by R. Da Silveira's team, Fred measured 212.4 cm TL; the second capture occurred in 1999 when he was 231.5 cm TL. In this last recapture, Fred had reached 362 cm TL (mean growth rate of 18.8 cm per year).

Stomach contents were obtained from 4 *M. niger* and 2 *C. crocodilus*. The most common items found were parts of adult and larval insects, although three of the individuals had empty stomachs.

The team returned to Tef for the last two days, where time was spent analyzing data, discussing and presenting the final results.

#### Acknowledgements

John Thorbjarnarson (WCS), as the course instructor, gave the students a very good approach to crocodylian biology and revised a previous version of this manuscript. Instituto de Desenvolvimento Sustentvel Mamirau organized the course and provided the students with the opportunity to be involved with crocodylians in the Mamirau Reserve. Paulo Henrique G. Oliveira from IDSM was in charge of all logistics issues and participated in the whole course as a student.

#### Literature

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MONITORING CAIMAN POPULATIONS SUBJECT TO HIGH COMMERCIAL HUNTING IN THE

PIAGAÇU-PURUS SUSTAINABLE DEVELOPMENT RESERVE, CENTRAL AMAZONIA, BRAZIL. The Piagaçu-Purus Sustainable Development Reserve (PP-SDR; Fig. 1) is situated between the Solimões (Amazon) and Purus Rivers and is the origin of many of the caiman that are involved in an extensive network of illegal trade (Da Silveira 2003), with an estimate of at least 50 tons of dried-salted caiman meat being traded from the area (Marioni *et al.* 2006).

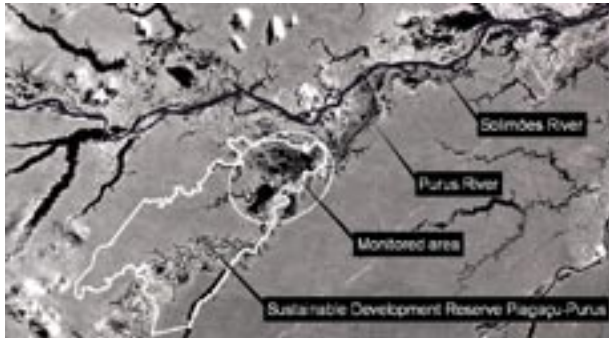


Figure 1. Location of the Piagaçu-Purus Sustainable Development Reserve.

**2005 Surveys:** We carried out 17 surveys during the dry season of 2005, when 279.5 km of shoreline in 22 different water bodies were surveyed and a total of 4729 caimans counted (18.3% were identified to species). *Caiman crocodilus* made up a higher proportion of sightings than *Melanosuchus niger* (63% and 37% respectively), and the mean density (expressed as the number of counted individuals per km of shoreline surveyed) was 15.3 ind/km (SD= 10.5) (Table 1). During the 2005 census we also observed one *Paleosuchus trigonatus*. The population size structure indicated that 94% of *M. niger* were less than 100 cm SVL and 16% of *C. crocodilus* were greater than 60 cm SVL.

**2006 Surveys:** Between 21 and 30 October 2006 we again collected data on the relative abundance and population size structure of *M. niger* and *C. crocodilus*. We carried out 10 spotlight surveys along the shores of 20 water bodies (11 lakes, 9 canals), 11 (55%) of which had been mapped out in 2005 (Table 1).

We counted 5531 caimans over a distance of 267.7 km. Of these sightings, 10.1% could be identified to species. The most abundant species was *C. crocodilus*, representing 62% of the identified caimans, similar to that recorded in 2005 (63%). *Melanosuchus niger* represented more than 50% of the identified individuals in only 6 water bodies. Density ranged from 4.1 to 59.5 ind/km (mean= 20.7, SD= 13.4) (Table 1).

Size was estimated for 8.8% of observed caimans. More than 95% of *M. niger* were less than 100 cm SVL, which represents sub-adult classes of both sexes. We did not observe any *M. niger* greater than 115 cm SVL. For *C.*

*crocodilus*, 15% were greater than 60 cm SVL, which is the size at which females are presumed to become sexually mature in the region (Da Silveira 2001). These data were similar to those gathered in 2005 (ie 94% and 16% respectively).

Table 1. Density (number of individuals per km of shoreline surveyed) of caimans (*M. niger* and *C. crocodilus*) in waterbodies surveyed in 2005 and 2006, in the Piagaçu-Purus SDR. C.= canal, L.= lake.

Waterbody	2005		2006	
	km	Density	km	Density
L. Arapapá	6.6	2.7	-	-
C. Uauaçú	8.1	5.3	5.8	4.1
L. Ayapuá direita	24.6	2.6	10.9	4.2
L. Embaúba	2.9	5.9	-	-
C. do L. Ayapuá	18.4	8.0	-	-
P. Itapuru	27.0	9.5	12.1	9.3
C. do L. Monguba	6.3	10.0	7.4	9.5
C. Verde	-	-	2.1	12.9
C. do Jacaré	20.5	11.5	-	-
C. do Arumã	20.7	12.5	-	-
L. Grande	1.2	19.2	2.3	13.0
L. Itapuru Mirim	12.1	9.8	19.3	13.0
C. do Cuiuanã	24.3	18.6	25.0	13.9
C. do Tracajá	-	-	2.6	15.4
C. do Bacuri	20.1	25.0	23.1	15.6
L. Itapuru Grande	12.5	11.1	21.6	16.8
C. do L. Tavares	-	-	10.3	20.9
L. Leitão	18.0	23.7	30.0	22.6
L. Monguba	5.2	23.3	-	-
C. do Xibui	-	-	22.9	23.6
L. Simão	-	-	7.3	24.7
C. do Ipixuna	10.0	25.9	-	-
C. do L. Grande do Cauá	-	-	13.3	28.7
L. Marajazinho	-	-	6.0	33.0
L. Carro	12.0	36.8	-	-
C. do Cauá	29.0	39.2	39.3	33.9
L. Grande do Cauá	-	-	2.4	39.6
L. Marajá	-	-	4.0	59.5
<b>Totals</b>	<b>279.5</b>	<b>15.3</b>	<b>267.7</b>	<b>20.7</b>

Notwithstanding the different distances in the 11 areas surveyed in both 2005 and 2006 (Table 1), the mean densities were similar in each year, at 15.3 and 14.2 ind/km respectively.

We have been monitoring the illegal trade of caiman meat in the region since December 2004 and our data suggests that more than 60% of the harvested caimans were hunted in the northern sector of the PP-SDR. It is in some lakes from this region where we found the highest relative abundance of caimans over a 2-year period. However, mean densities in the PP-SDR area are low compared to other sites in the Amazon (Da Silveira 2001; Ruffeill 2004) and the size structure estimated for *M. niger* and *C. crocodilus* during a 2-year period indicates possible over-hunting of the larger size classes.

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NESTING OF *MELANOSUCHUS NIGER* AND *CAIMAN CROCODILUS* IN THE PIAGAÇU-PURUS SUSTAINABLE DEVELOPMENT RESERVE, CENTRAL AMAZONIA, BRAZIL. Between 25 November and 10 December 2006, we were in the Piagaçu-Purus Sustainable Development Reserve (PP-SDR) to locate caiman nesting areas. We searched for *Melanosuchus niger* and *Caiman crocodilus* nests along the shores of 25 waterbodies (24% already visited in 2005),

principally in the northern part of the reserve. We found 81 nests (7 *M. niger*, 74 *C. crocodilus*). Three (43%) of the *M. niger* nests had already hatched, and we did not observe any females attending the nests. The clutch sizes recorded from two nests were 28 and 41 eggs (mean egg length= 8.14 cm, SD= 0.16; mean egg width= 5.08 cm, SD= 0.15; mean egg weight= 121.7 g, SD= 5.9).

Females were found in the vicinity of 36 (48.6%) of the *C. crocodilus* nests, hidden under tree roots, fallen trees or leaves. Estimated size of these females ranged from 45 to 80 cm SVL. Eleven nests were opened and clutch size varied between 2 and 35 eggs (mean clutch size= 24.9; mean egg length= 6.18 cm, SD= 0.51; mean egg width= 3.84 cm, SD= 0.22; mean egg weight= 53.71 g, SD= 8.56). Most nests contained eggs (73.0%), 17.6% had already hatched and 9.4% were predated. Local people were responsible for 57 % of predated nests, and the remainder were probably predated by Brown capuchin monkeys (*Cebus apella*), lizards (*Tupinambis teguixim*) or jaguar (*Panthera onca*). Predation by jaguar was registered once, eating only 4 eggs and also killing and consuming part of the female guarding the nest (Fig. 1).



Figure 1. Female *C. crocodilus* predated by jaguar as it was guarding its nest. Photograph: Ezequias Breláz.

In the same region between September and October 2005, we had located 56 nests (50% *M. niger*) along the shores of 13 water bodies. Some (28%) of these nests had been predated, mostly by local people, 3% had already hatched and the rest contained eggs.

We found caiman nests in all waterbodies searched in 2005 and 2006, indicating that the area is widely used by *M. niger* and *C. crocodilus* for breeding. Less than one-third of the nests had been predated, and based on interviews with local people we found that caiman eggs are mostly collected incidentally when nests are encountered during other activities (ie fishing or timber extraction). We did not observe any commercial trade for caiman eggs in the lower Purus region, and people use them principally for subsistence.



Although the human influence on the fate of nests is low, and probably does not affect the overall hatchling success of either species, there is intensive hunting pressure on adult female caimans in the PP-SDR. Nevertheless, most of the hunted caimans are sub-adults which have not reached the size of sexually mature individuals.

In the PP-SDR, discussions on a future harvesting program of crocodylians are being carried out with local stakeholders (hunters, traders, local authorities, etc.) involved in the meat trade. The protection of nesting areas and consequently breeding females, will be an important factor to achieve a sustainable management of crocodylians in the PP-SDR.

#### Acknowledgements

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## Venezuela

WORKSHOP III ON THE CONSERVATION OF THE ORINOCO CROCODILE IN VENEZUELA. Convened in San Carlos, Venezuela, on 18-19 January 2007, the general aim of the workshop was to analyze activities undertaken over the last 30 years to improve the population status of *Crocodylus intermedius* and to evaluate successes and failures which could help in the preparation of a new program to guide actions in the short-term, to approach the final goal of complete recovery.

The workshop was attended by 77 people from public and private institutions and organizations, not only from Venezuela but also from Colombia, USA and Europe. The Venezuelan Crocodile Specialist Group (GECV) was responsible for the organization of this event, which was made possible due to the economic support of the Dallas World Aquarium and the Wildlife Conservation Society. Among the participants were 27 representing universities and research institutions, 11 from NGOs, 7 from zoos, and 22 from public institutions, most of them (17) from

the Ministry of the Environment (MINAMB).



Figure 1. Participants at Workshop on the Conservation of the Orinoco Crocodile.

We are still working on the resolutions and recommendations of the workshop, which will be organized as a “Strategy for the Conservation of the Orinoco Crocodile”, but some significant issues can be highlighted at this time.

First of all, we have to recognize that the efforts represented by the release into the wild of 5073 captive-reared crocodiles have borne fruit, at least in the El Frío Ranch and surrounding areas of Apure State, where according to an unpublished report presented by José Ayarzagüena, a small population of the species is now established, with several females nesting every year. However the consolidation and long-term viability of that population requires the implementation of a permanent program for monitoring and protection by MINAMB, particularly in the Guaritico Wildlife Refuge, where there is no presence of wildlife officials.

Secondly, the participants sent a message to local, regional and national government authorities calling to their attention the environmental situation of the Cojedes River, where the largest known population of the Orinoco crocodile is found. The degradation of the ecological integrity of this river, affected by several factors such as sewage and industrial discharge, canalizations and riparian forest destruction, as well as the direct impact on crocodiles by illegal hunting and human depredation of nests, have reduced the chances of long-term survival of the species. Since 1992 the declaration of a protected area in the Cojedes River, such as a wildlife reserve, has been proposed. That proposal has the support of the GECV, but after 17 years it has yet to be implemented.

It was clearly recognised that the population status of the Orinoco crocodile is better than it was 30 years ago, but the species is far from recovery. Although the release

of captive-reared Orinoco crocodiles will continue, the emphasis of the strategy to be implemented in the following years must be centered in the protection of the remaining population and its habitats, working closely with local people - without their participation any program is doomed to failure.

Andrés E. Seijas, *Grupo de Especialistas en Cocodrilos de Venezuela (GECV)*, <aeseijas@cantv.net>.

## **East and Southeast Asia**

ASIAN CROC CONSERVATION AND EDUCATIONAL INITIATIVE. In August 2006, National Geographic Channels International (NGCI) funded a 6 country tour to promote crocodile conservation and education. The 1-month tour involved educational lectures at zoological facilities, museums, and universities, for local school children (Fig. 1). The series of lectures reached over 5000 students across the 6 target countries, and was covered by over 100 media interviews. Dr. Brady Barr, National Geographic's resident herpetologist and former US public school educator, conducted the informative lectures for the children, and in conjunction with local zoos provided hands-on encounters with representatives of Asia's crocodilians.



Figure 1. Dr. Brady Barr provides hands-on encounter with a crocodile for school children at Zoo Negara, Malaysia.

The emphasis was on education and conservation of Asian crocodile species, most notably the Chinese alligator (*Alligator sinensis*), false gharial (*Tomistoma schlegelii*), and the Philippine crocodile (*Crocodylus mindorensis*). Locations for the event included: Zoo Negara (Malaysia), Taipei Zoo, National Taiwan Normal University (Taiwan), Taman Safari Wildlife Park (Indonesia), Singapore Zoo (Singapore), Hong Kong Wetland Park, and Oceans Park (Hong Kong).

The Croc Initiative received such a positive response from conservationists and educators that a follow-up tour of similar format has been organized by NGCI for March 2007. This initiative has been entitled "Save Asia's Crocs" and is tentatively planned for the cities of Singapore, Bangkok and Chiang Mai (Thailand), Shanghai and Beijing (China), and Seoul (South Korea).

Dr. Brady Barr, <Bradybarr@aol.com>.

## **Brunei**

Fauna and flora surveys undertaken in 2000 and 2001 in the Pulau Selirong Forest Recreation Park (PSFRP) documented the occurrence of the Saltwater crocodile (*Crocodylus porosus*) (Charles 2002). On 23-29 May and 8-19 July 2006 systematic surveys of crocodiles were undertaken by Jack Cox and Forestry Department personnel, in PSFRP and other areas of Brunei Bay, northeastern Brunei Darussalam (Cox 2006) (Fig. 1).



Figure 1. Southeastern coast and interior of Brunei Bay, Brunei Darussalam. Night count routes (dotted lines) and crocodiles sighted (dots and age class code) are included for rivers/tributaries surveyed north of the partly depicted Temborong River system. Survey numbers refer to location sequence in Table 1 in Cox (2006).

Pulau Selirong is a near-pristine 2566 ha island of conserved mangrove communities in Brunei Bay. No evidence of crocodiles was found at Pulau Selirong during the 2006 surveys, but *C. porosus* were recorded in low numbers in most rivers of Brunei Bay (0.33 ind/km; 34 crocodiles in 103.5 km; Table 1, Fig. 2).



Figure 2. Abdul Qawi (Forestry field staff) and juvenile *C. porosus*.

Hatchlings (N= 2) and yearlings (N= 4) were sighted in the Duwau Besar, Temborong and Labu Rivers (Table 1;

Fig. 2), suggesting small breeding units persist there. Most crocodiles encountered were wary and did not allow a close enough approach to estimate size (59% eyes only).

The effect on local populations of historical and allegedly recent hunting for skins is undocumented, but has probably reduced abundance. The dominant mangrove-nipah forest edge and littoral in the middle and lower reaches of surveyed rivers is largely undisturbed. Outside Pulau Selirong, sustainable harvesting of mangrove poles and timber is permitted inland, and fishing with nets during the day and spears at night is widespread but infrequent. Good potential exists to rehabilitate the crocodile resource in Brunei Bay through a suggested course of conservation, ecotourism and sustainable utilisation.

#### Acknowledgements

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#### Literature

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Cox, J. (2006). *Initial Surveys of Crocodiles and Habitat at Pulau Selirong Forest Recreation Park and Other Areas of Brunei Bay, Brunei Darussalam, May and*

Table 1. Crocodile night counts in the Pulau Selirong area, Brunei, May and July 2006. Replicate surveys are shown in italics, and numbers were excluded from totals. Surveys undertaken under unsuitable conditions are not shown [see report (Cox 2006) for complete details].

Location	Date of Survey	Adults	Juveniles	Yearlings	Hatchlings	Eyes Only	Survey Distance (km)	Encounter Rate (ind/km)
Sg. Temburong	27 May	1	2	1	0	6	20.5	0.49
<i>Sg. Temburong</i>	<i>15, 17 July</i>	<i>1</i>	<i>2</i>	<i>2</i>	<i>0</i>	<i>4</i>	<i>20.5</i>	<i>0.44</i>
Sg. Mataiang	26 May	0	0	0	0	0	3.7	0.0
<i>Sg. Mataiang</i>	<i>13 July</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>3.7</i>	<i>0.0</i>
Sg. Raya/Palu Palu	28 May	0	0	0	0	0	9.3	0.0
P. Selirong NW coast	28 May	0	0	0	0	0	2.2	0.0
Sg. Bangau/Aloh Besar/Melimbai	11 July	0	1	0	0	2	9.9	0.30
Ma. Aloh Besar - Tj. Lumba Lumba	11 July	0	0	0	0	0	3.7	0.0
Sg. Duwau Besar	12 July	0	2	2	1	5	9.6	1.04
P. Selanjak/P. Tarap	14 July	0	0	0	0	2	8.4	0.24
Sg. Batu Apoi	15 July	0	2	1	0	4	15.3	0.46
Sg. Labu	16 July	0	0	0	1	1	20.5	0.10
<b>Totals</b>		<b>1</b>	<b>7</b>	<b>4</b>	<b>2</b>	<b>20</b>	<b>103.5</b>	<b>0.33</b>



July 2006. Technical Report for Forestry Department, Ministry of Industry and Primary Resources, Brunei Darussalam.

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[The full report is available at [www.wmi.com.au/csgarticles](http://www.wmi.com.au/csgarticles)].

## Philippines

The Forum on Crocodiles in the Philippines was convened at the National Museum of the Philippines, Manila, between 31 January and 2 February 2007, with 103 participants from 13 countries attending. Participants represented government and non-government organisations, industry, universities, independent researchers and the Crocodile Specialist Group.

The Forum was hosted by *Crocodylus Porosus* Philippines Inc. (CPPI), Veterinary Office of the City of the Philippines, Silliman University and the National Museum of the Philippines, who are congratulated for instigating this meeting. Special thanks go to Vic and “Toy” Mercado, William Belo (CPPI), Dr. Angel C. Alcala and Charles A. Ross (Silliman University), and Dr. Corazon S. Alvina (National Museum).

Over the course of the first two days, some 30 papers and a series of posters were presented, covering both species of local crocodiles, *Crocodylus mindorensis* and *C. porosus*, and a range of associated crocodylian activities within the Philippines. It is anticipated the Proceedings will be published around August/September 2007.

A central goal of the meeting was to reach consensus on a series of issues related to the conservation, management and sustainable use of crocodiles in the Philippines. This was achieved through four well-attended series of workshops, which drafted 7 resolutions, subsequently discussed and modified in a plenary session. The final resolutions were agreed by consensus with no formal objections, and together, they form an important and updated road map for crocodiles in the Philippines. The resolutions are included here (see later).

During the course of the Forum, participants also enjoyed the local Filipiniana cuisine, cultural dancing by traditional dancers from Isabela State University, and viewing of crocodylian artefacts at the National Museum.

Following the Forum, field trips were conducted to:

- northern Luzon, to inspect some of the work being undertaken by the Crocodile Rehabilitation, Observance and Conservation Project (CROC) in Isabela (see front cover);
- Davao, on the southern island of Mindanao, to inspect crocodile farms (Fig. 1) and privately-owned release sites for *C. mindorensis* (Fig. 2); and,
- Coral Farms, owned by William Belo, just outside Manila.



Figure 1. Participants of field trip to J.K.Mercado & Sons Agricultural Enterprises. The Forum on Crocodiles in the Philippines attracted international participants from Australia, USA, Papua New Guinea, Japan, France, Cambodia, Malaysia, Hong Kong, Thailand, Norway, Indonesia and the Netherlands.



Figure 2. J.K. Mercado marsh land, a potential release site for *C. mindorensis* in Mindanao. Photograph: Tom Dacey.

Many of these sites appear ideal for the release of *C. mindorensis* into the wild, and the Mercado family are to be congratulated for acquiring suitable habitat at their own expense (Fig. 2), specifically to contribute to conservation of the critically endangered, endemic crocodile.

On the final night the Mercado family hosted their guests with a wonderful banquet of whole roasted lamb, pig and forequarter of bullock, cultural dancing and a live band.



**Resolution No. 1.1** (adopted 2 February 2007)

A RESOLUTION ENCOURAGING THE LOCAL GOVERNMENTS THROUGH THEIR RESPECTIVE LOCAL SCHOOL BOARDS TO FACILITATE THE INTEGRATION OF THE CROCODILE CONSERVATION PROGRAMS IN SCHOOL CURRICULA.

1. WHEREAS there is a need to increase awareness of school children on the importance of crocodile conservation in our ecosystem and the role that they could play in the success of the conservation activities/efforts.
2. WHEREAS, the children are considered as the future caretakers and beneficiaries of a healthful and balanced ecology;
3. WHEREAS, the integration of programs on crocodile conservation and sustainable use in school curricula will serve as a means to develop positive attitudes among school children to respect and value crocodiles as an important component of the ecosystem and as a valuable renewable natural resource;
4. WHEREAS, school children should be informed that crocodiles, which are part of our cultural and natural heritage, can co-exist with humans and that they are something to be proud of;
5. WHEREAS, through the integration program, the value of crocodile conservation shall be developed and instilled in their young minds;
6. WHEREAS, the local governments, through the local chief executives, have the mandate to empower their constituents to address general welfare;

NOW THEREFORE, Be it as it is;

1. HEREBY RESOLVED, to encourage the local governments through their respective Local School Board to facilitate the integration of the crocodile conservation programs in school curricula;
  2. RESOLVED FURTHER, to forward copies of this resolution to the Local Chief Executives through their respective Local School Boards for his/her appropriate and favorable action; likewise, to furnish copies of the same to the Department of Education through channels, Department of Environment and Natural Resources through channels, the Crocodylus Porosus Philippines, Inc. etc, etc. for their support and endorsement.
- .....

**Resolution No. 1.2** (adopted 2 February 2007)

A RESOLUTION ENCOURAGING ALL SECTORS OF THE SOCIETY TO SUPPORT THE STRENGTHENING OF THE CROCODILE CONSERVATION PROGRAMS WITHIN THE PHILIPPINES.

Next presented is the need to tap the resources and solicit the efforts of the business, educational, governmental and labor sectors and the local and international non-government organizations and the media to support strengthening crocodile conservation programs in the Philippines.

1. WHEREAS, crocodiles play an important role in the ecosystem;
2. WHEREAS, contrary to popular beliefs and concepts, crocodiles, other animals and humans can live harmoniously together to maintain a balanced ecosystem;
3. WHEREAS, the Philippines should protect its crocodiles, the endemic Philippine crocodile *Crocodylus mindorensis* and the Indo-pacific (saltwater) crocodile *Crocodylus porosus*;
4. WHEREAS, people from all sectors of society can help in the effort to save these endangered crocodilian species;
5. WHEREAS, the media and other agencies and organizations can play an important role to save these species from extinction in the Philippines;
6. WHEREAS, the government agencies should support conservation activities and efforts by streamlining processes related to crocodile conservation;

NOW THEREFORE, Be it as it is;

1. HEREBY RESOLVED, to encourage all sectors of the society to support the strengthening of crocodile conservation programs within the Philippines;
  2. RESOLVED FURTHER, to forward copies of this resolution to all national and local government agencies, the business sectors, local and international non-government organizations focused on wildlife conservation, the academe, the mass media and other cause-oriented private groups for their information, support and active participation.
- .....

**Resolution No. 1.3** (adopted 2 February 2007)

A RESOLUTION PROPOSING FOR A SYSTEMATIC COOPERATION REGARDING THE CONSERVATION OF THE CROCODILE AND ITS NATURAL HABITAT IN LIGUASAN MARSH.

1. WHEREAS there is limited information on wild crocodilian species in Mindanao, particularly in Liguasan Marsh.
2. WHEREAS, the Liguasan Marsh in Mindanao has been identified as an important area where both the *C. porosus* and *C. mindorensis* are known to occur;

3. WHEREAS, the University of Southern Mindanao is located Northeast of Liguasan Marsh and is interested in developing a research and conservation project for the two crocodilian species in their natural habitats;
4. WHEREAS, there is considerable experience with crocodile research and conservation in Northeastern Luzon by a consortium of organizations coordinated by the Mabuwaya Foundation, Inc.;

NOW THEREFORE, Be it as it is;

1. HEREBY RESOLVED, to appoint Dr. Cayetano Pomares (USM) and Dr. Andres Masipiquena (Mabuwaya Foundation) to establish systematic cooperation regarding the conservation of the crocodiles and their natural habitats in Liguasan Marsh in coordination with DENR;
2. RESOLVED FURTHER, to request relevant government organizations, funding agencies, conservation organizations and business operators to support the important crocodile research and conservation project in Liguasan Marsh in terms of permits, support and funding;
3. RESOLVED FURTHER, to forward copies of this resolution to the Crocodile Specialist Group, University of Southern Mindanao, the local government units located within Liguasan Marsh for their information, support and active participation; likewise, to furnish copies of the same to the local government of San Mariano, Isabela and the Mabuwaya Foundation, Inc. for their information and support; and to furnish copies of the same to the DENR, the Philippine Crocodile National Recovery Team, other relevant government organizations, conservation organizations and possible donors for their information, support and action;

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**Resolution No. 1.4** (adopted 2 February 2007)

A RESOLUTION EARNESTLY REQUESTING HON. ANGELO M. REYES, DENR SECRETARY, THROUGH DIRECTOR MUNDITA S. LIM, PROTECTED AREAS AND WILDLIFE BUREAU TO ISSUE A GRATUITOUS PERMIT FOR THE HEAD-START PROGRAM OF THE MABUWAYA FOUNDATION, INC. IN COOPERATION WITH THE LOCAL GOVERNMENT OF SAN MARIANO, ISABELA AND OTHER STAKEHOLDERS.

1. WHEREAS, the Philippine crocodile population in the municipality of San Mariano, Isabela is still critically small;
2. WHEREAS, to ensure the rapid recovery of the species, the local government has adopted a head-start program of the Mabuwaya Foundation, Inc. (Attached is Resolution No. \_\_\_ and copy of the proposal forming part of this resolution);

3. WHEREAS, there is a need to seek the assistance of the DENR through the PAWB to expedite the head-start program by the immediate granting of the necessary permits;

NOW THEREFORE, Be it as it is;

1. HEREBY RESOLVED, to earnestly request Sec. Angelo M. Reyes, DENR Secretary, through Director Mundita S. Lim, PAWB, to issue a gratuitous permit for the head-start program of the Mabuwaya Foundation, Inc in cooperation with the LGU of San Mariano, Isabela and other stakeholders;
2. RESOLVED FURTHER, to forward copies of this resolution to the Hon. Secretary Angelo M. Reyes, DENR and Director Mundita S. Lim, PAWB for their information, support and favorable action; likewise, to furnish copies of the same to the local government of San Mariano, Isabela and the Mabuwaya Foundation, Inc. for their information and appropriate action;

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**Resolution No. 1.5** (adopted 2 February 2007)

A RESOLUTION TO REINTRODUCE CAPTIVE-BRED *CRODODYLUS MINDORENSIS* TO LAKE DICATIAN IN DIVILACAN, ISABELA IN COOPERATION WITH PAWB, NSMNP - DFI, MABUWAYA FOUNDATION, PWRCC, AND LOCAL GOVERNMENT UNITS IN 2007.

1. WHEREAS *C. mindorensis* has been extirpated or occurs in extremely small numbers threatening its ability to reproduce in most areas in the country it used to occupy;
2. WHEREAS there is available supply of captive-bred crocodiles for release into the wild;
3. WHEREAS there is an urgent need to prevent extinction of *C. mindorensis* throughout the Philippines
4. WHEREAS, this trial release provides a unique opportunity to gather the necessary scientific information that will be essential for an effective reintroduction program of *C. mindorensis* throughout the Philippines;
5. WHEREAS, Lake Dicitian in Divilacan, Isabela has been identified as a suitable release site for *C. mindorensis*;

NOW THEREFORE, Be it as it is;

1. HEREBY RESOLVED, to request Dr. Mundita Lim (Protected Areas and Wildlife Bureau), Dr. Restituta Antolin (Wildlife Division Chief, PAWS-Region 2), Dr. Andres Masipiquena (President, Mabuwaya Foundation), Mrs. Erlinda Domingo (Chairman of the Northern Sierra Madre Natural Park Development

Foundation), and Dr. Glenn Rebong (Project Director, Palawan Wildlife Rescue and Conservation Center) to arrange a systematic cooperative scheme for the re-introduction of captive-bred *C. mindorensis* to Dicitian Lake in Divilacan, Isabela;

2. RESOLVED FURTHER, to request relevant government organizations, funding agencies, conservation organizations and private sector to support the re-introduction of crocodiles in Dicitian Lake in Divilacan, Isabela;
3. RESOLVED FURTHER, to forward copies of this resolution to the Crocodile Specialist Group, the municipal government of Divilacan for their information, support and active participation; likewise, to furnish copies of the same to the Mabuwaya Foundation, Inc. for their information and support; and to furnish copies of the same to the DENR, the Philippine Crocodile National Recovery Team, other relevant government organizations, conservation organizations and possible donors for their information, support and action;

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**Resolution No. 1.6** (adopted 2 February 2007)

A RESOLUTION TO REINTRODUCE CAPTIVE-BRED *CROCODYLUS MINDORENSIS* TO SELECTED AREAS WHERE THEY WERE FOUND BEFORE PARTICULARLY IN LAKE PINAMALOY IN BUKIDNON, PAGATBAN RIVER IN NEGROS ORIENTAL AND PAG-ASA FARMS IN FEEDER ROAD 8 IN NEW KATIPUNAN, STO. TOMAS, DAVAO DEL NORTE.

1. WHEREAS *C. mindorensis* has been extirpated or occurs in extremely small numbers threatening its ability to reproduce in most areas in the country it used to occupy;
2. WHEREAS, there is available supply of captive-bred crocodiles for release into the wild;
3. WHEREAS, there is an urgent need to prevent extinction of *C. mindorensis* throughout the Philippines
4. WHEREAS, the general public needs, including students at all educational levels, to be educated on crocodile conservation, management and sustainable use of wildlife;
5. WHEREAS, the areas mentioned have no more crocodiles based on current knowledge but have been judged to be suitable release areas for *C. mindorensis*;

NOW THEREFORE, Be it as it is;

1. HEREBY RESOLVED, to request Dr. Mundita Lim (Protected Areas and Wildlife Bureau) and Dr. Glenn Rebong (Project Director, Palawan Wildlife Rescue

and Conservation Center) to arrange a systematic cooperative scheme for the re-introduction of captive-bred *C. mindorensis* to Lake Pinamaloy, Bukidnon, Pagatban River in Negros Oriental and Pag-asa Farms, Feeder Road 8 in New Katipunan, Sto. Tomas, Davao Del Norte.

2. RESOLVED FURTHER, to request relevant government organizations, funding agencies, conservation organizations and private sector to support the re-introduction of crocodiles in Lake Pinamaloy, Bukidnon, Pagatban River in Negros Oriental and Pag-asa Farms, Feeder Road 8 in New Katipunan, Sto. Tomas, Davao Del Norte.
3. RESOLVED FURTHER, to forward copies of this resolution to the Crocodile Specialist Group, for their information and support; and to furnish copies of the same to the DENR, the Philippine Crocodile National Recovery Team, other relevant government organizations, conservation organizations and possible donors for their information, support and action;

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**Resolution No. 1.7** (adopted 2 February 2007)

A RESOLUTION AIMED AT IMPROVING LEGAL AND ADMINISTRATIVE ISSUES ASSOCIATED WITH CROCODILE CONSERVATION, MANAGEMENT AND SUSTAINABLE USE IN THE PHILIPPINES

1. WHEREAS, crocodiles in the Philippines (*Crocodylus porosus* and *Crocodylus mindorensis*) are critically endangered. Crocodiles are protected by law (R.A. 9147). In practice, however, indiscriminate hunting, unsustainable fishing methods, destructive land use practices and illegal logging continue to threaten crocodiles in the wild and destroy the resource base of poor rural communities. There is an urgent need to strengthen law enforcement, particularly in remote areas where crocodiles survive in the wild.
2. WHEREAS, Local Government Units (LGUs) are pivotal in effective environmental conservation at the local level. The devolution of authority over natural resources to the provincial and municipal government can strengthen *in-situ* crocodile conservation.
3. WHEREAS, the world has increasingly recognized that research, development and innovation are major drivers of economic growth. Delays in permitting procedures for bureaucratic rather than conservation purposes is a serious constraint on Philippine researchers to compete and lead internationally.
4. WHEREAS, bureaucratic procedures and permitting requirements constrain effective *in-situ* crocodile conservation.
5. WHEREAS, commercial crocodile farming has been

encouraged by the government over the past years. This has resulted in the incorporation of Crocodylus Porosus Philippines Inc. (CPPI) which currently has six cooperators and is considered as industry pioneers with the sole purpose of farming *C. porosus* for commercial purposes.

6. WHEREAS, commercial crocodile farming can strengthen *in-situ* crocodile conservation efforts through educating people about crocodiles, mobilizing public support and generating revenues for conservation action. CPPI considers the *in-situ* conservation of *C. mindorensis* and *C. porosus* as one of its main responsibilities.
7. WHEREAS the export of live *C. porosus* for commercial purposes may threaten the competitiveness of the pioneering Philippine crocodile industry.
8. WHEREAS the National Resource and Development Corporation (NRDC) currently competes with the private crocodile industry by exporting live *C. porosus*, a violation of its legal mandate.

NOW THEREFORE, Be it as it is;

That Participants:

1. URGE the Department of Environment and Natural Resources (DENR) at the national (PAWB), regional (PAWS) and local level (CENRO) to effectively implement existing environmental legislation conserving crocodiles and their habitat;
2. REQUEST the PAWB to review the policies with a view to delegate the issuance of necessary domestic permits for effective crocodile conservation action from the national office to the regional offices of DENR as stipulated in DAO 55-2004;
3. SUGGEST simplifying and streamlining existing bureaucratic procedures for the issuance of permits for academic research strengthening *in-situ* conservation of crocodiles in the Philippines;
4. URGE the DENR to streamline the bureaucratic process with regards to the issuance of permits to the Philippine crocodile industry, and significantly simplify legal requirements for compliance and shorten the processing time;
5. ESTABLISH a taskforce for a period of 3 months consisting of representatives of the Department of Agriculture (DA), the DENR, and the private sector to work out specific details on (1) the simplification of processes of issuing permits to the crocodile farming industry and (2) the sharing of jurisdiction over crocodile farms between DENR and DA, and (3) the preparation of a manual on regulations pertaining to crocodiles;

6. DEMAND an immediate halt to the export of live *C. porosus* for commercial purposes deemed to compete with the crocodile industry in the Philippines;
7. RE-EVALUATE NRDC's supervision of commercial use and export of farmed *C. porosus* with a view to rationalizing their role or possibly transferring commercial crocodile farms under the jurisdiction of DA.

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PHILIPPINE CROCODILE CHRONICLES. The following excerpt was provided by Corazon Alvina. It is taken from "The Philippine Chronicles of Fray San Anonio", and is a translation from the Spanish by D. Pedro Picornell of Book I of "Cronicas de la Provincia de San Gregorio Magno" by Fray Juan Fransisco de San Antonio. Printed in Casalinda and Historical Conservation Society, Manila (1977). It provides some interesting observations and information on crocodiles in the Philippines in the 1700s.

*"152. The swordfishes ..... It is a particular enemy of the crocodiles and he usually take the best part of his battles with them. The experienced Indians (who have given great attention to thee battles) say that God has given these fishes the same instinct that (according to the authors) the dolphin has to fight the crocodiles (which are similar to ours) in directing their swords to the only spot on them known to be vulnerable. Much .....*

*153. The natives call the crocodile "boaya" and I believe it to be the most horrible, voracious and formidable among the beast. It is amphibious and can live in water as well as on land, and the damage it does on animals and men is the same in both of these elements. Some authors believe that this is the crocodile described by Pliny, and even if this is so, the ones we have here are more varied because we have them longer than twenty elbows which is the limit given by Pliny. It looks like a big lizard with a tail which is wider than round, which differentiates it from the land lizard. It has short arms and legs with hands and large claws. It has a varied size of head, a long pointed snout, and when it opens its mouth (in some of them), a man can stand in it. It has ferocious teeth, all of them incisors and those of the upper jaw fit into those of the lower jaw. The top of its whole body is armored with very tough and strong scales. It has only two eyes in the place common to animals, and although it has been said that it has two more eyes towards the gills, this is not so. There you can see small black bones with eyebrows as if these were painted on, which look like real eyes, but these are neither eyes as some would have there to be, nor nostrils as others infer; as there are neither apertures nor the parts required for eyes at these spots. These small black bones (especially the left ones) are carefully removed by the Indians because they smell like good quality musk. Musk is not found in any other place and the belief that*



the musk pockets are found in the armpits or gills can be discarded. I have gotten this information from someone who has lived all his life in the swamps among crocodiles and has seen very much of their anatomy in many smaller ones he has captured alive and other larger ones which he has killed with the help of his companions.

154. It is definite that crocodiles do not have a tongue. However, I am told that a crocodile who had swallowed a man whole and was later followed and killed, the man being found complete in its stomach, had a large black tongue. It is not known whether this is because it was of a special type, or because it was the strangest one seen by my informant during his whole life. This happened in 1736 in the Macabebe River in Pampanga. The man who was thus swallowed was Captain Culango who owned a tavern in the village called Manlauay, well known by the natives.

155. As to whether both the male and the female come out onto dry land with equal frequency, I can say that it is the female that comes out most. It runs with an incredible ease, considering its great bulk, but it has difficulty in turning or going sideways. The male also comes out but only at night - to cohabit. It cannot go too far because its scrotum impedes its movement. Because of its size, and because the crocodile's arms and legs are so short, it is dragged along the ground and it hurts the beast. This has been observed by more than one of the natives.

156. The ability of these animals to breed is unbelievable. Their fertility is such that they lay eggs frequently, hatching fifty or sixty small crocodiles at a time. At this rate, all the rivers in these islands would become impassable, were it not for Divine Mercy which has acted to prevent this evident harm. The voracity of the mother is such that, when the small ones can fend for themselves (this being on land where the egg hatch), the mother places herself on the path they have to take to get to the water, and, with an open mouth, swallows them one by one as they instinctively walk to the water. Only the ones who have casually deviated from this path are saved and thus, very few survive so that man can live without so many dangers.

157. Another thing that the Providence of God has provided against their voracity is that these animals do not have the natural organs for the elimination of waste found in animals living on land. This lengthens the time needed for digestion and it is not hungry enough to force him to attack man frequently. If he gets anything in his stomach that bothers him, he vomits it easily, but the usual thing is for him to digest even bones. The only thing he does not digest is human hair, and by counting the balls of hair found in his stomach, one knows the number of men who have died between his teeth. He is a very timid beast in spite of his voracity and he runs away at sounds made by or at shouts of men. Unless caught unaware, the

Indians are not afraid of it, but some pay with their lives for being continuously careless or because of not being afraid of them. Some very brave Indians have fought these animals hand to hand, killing them and rescuing their victims from their claws or teeth. It is common to trap them with a noose, using little live dogs, which they like very much, as bait. Many are caught in this manner, but many more abound in the rivers and along the shores, and man and animals are not safe wherever they happen to live."

Copy of article provided by Dr. Corazon Alvina, National Museum, Manila, Philippines.

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## Thailand

PILOT REINTRODUCTION OF SIAMESE CROCODILES. A priority of crocodile management in Thailand is the reintroduction of pure Siamese crocodiles (*Crocodylus siamensis*) from captive breeding facilities within the country. The first reintroduction took place following habitat surveys in the historical range of the species, public hearings and education, training of park rangers, selection and preparation of pure and healthy animals, and acclimatization before their release. Monitoring released crocodiles was an important element of the program.

Siamese crocodiles were previously reported as being extinct from the wild in Thailand, but no serious surveys had been carried out. I reported several remnant populations scattered in protected areas (CSG Regional Meeting, China, 2001), and habitat surveys in 2004 updated the number of wild crocodiles to around 100 individuals in 5 surveyed habitats (see below). These populations were able to survive in these protected areas, which had limited carrying capacity. Siamese crocodiles prefer open water such as lakes or reservoirs over a watershed or small creek/canal in the deep forest, but high human population in Thailand has resulted in less than 10% of land being protected. All low lying areas are used for agriculture, logging and human habitation.

The five surveyed habitats were Kaeng Krachan National Park, Tarutao National Park, Khao Ang Lue Nai Wildlife Sanctuary, Phu Kieow Wildlife Sanctuary and Pang Sida National Park. Kaeng Krachan NP in western Thailand is the most suitable habitat with the largest crocodile population. Tarutao NP in southern Thailand is the third largest island in the Andaman Sea. The survey reported only a remnant population of Saltwater crocodiles (*C. porosus*) around the mangrove forest, but no *C. siamensis* in the freshwater habitat on the island. Khao Ang Lue Nai Wildlife Sanctuary in southeast Thailand is the largest lowland forest in the country. The survey found only one adult Siamese crocodile in a small pool during the dry season [CSG Newsletter 20(4): 78]. The habitat is highly

unsuitable for a crocodile population and there is a plan to relocate this individual. Phu Kieow Wildlife Sanctuary is situated in central Thailand and surveys found a remnant population up in the water shed. There is still a question as to whether the record of *C. siamensis* at high altitude (750 m above sea level) in Khao Yai NP involves a released animal or a new population.



Figure 1. Project sign in restricted area of Pang Sida National Park.

Pang Sida NP in eastern Thailand was chosen as the study area for the pilot re-introduction project because there is no human activity and there is sufficient suitable habitat for a crocodile population. The park was designated as World Heritage by UNESCO in 2005. The habitat survey indicated suitable habitat for a small population of up to 100 crocodiles.

Following the initial release of 10 captive-raised juvenile crocodiles in early 2005, park rangers often spotted two crocodiles within 1 km of the release sites, indicating a 20% MKA survival index. The other 8 crocodiles were never sighted after release. This indicated that either more effort was needed for monitoring or the area was not suitable. Villagers downstream did not report any crocodile sightings.

The local village is a partner in the project. Public hearings and education were carried out in early 2004 to ensure that crocodiles that escaped out of the protected area were not captured. They promised to capture and hand in any escaped crocodiles to the rangers. The villagers have seen the increase in numbers eco-tourists since the crocodiles were brought back to these areas.

On 21 October 2006, a second group of 10 captive-raised juvenile crocodiles was released in the same area (Wang Mon Pool). All crocodiles were microchipped for identification. A monitoring program was established by a graduate student at Kasetsart University, using camera traps along the pool and creek. It was considered that

radio-telemetry may affect survival of the crocodiles, so we did not use this technique.

The training for wildlife rangers was completed in mid-2004, and included natural history of crocodiles, importance of crocodiles in the ecosystem, safe handling techniques for all-sized crocodiles, survey techniques and field data collection.



Figure 2. Temporary enclosure in the study area for acclimatization of crocodiles prior to release.

To avoid release of hybrid animals, crocodiles selected for release were DNA tested (microsatellite technique) by Kasetsart University in 2004. Dr. Parntep Ratanakorn checked the health of the crocodiles to guarantee that they were disease-free. Acclimatization of the two groups of crocodiles for three months before their release in February 2005 and October 2006 respectively (Fig. 2), showed excellent survival skills such as finding and capturing prey, seeking shelter and avoiding natural predators, including humans.

Notwithstanding the low survival rate for the first re-introduction, public acceptance and continuation of the project for annual release will ensure the re-establishment of a crocodile population from a re-introduction program in the long-term. Once this project is allowed by Government to release crocodiles in public lakes such as Bung Borapet in Nakornsawan Province, the Thai Siamese crocodile population will never be depleted again.

Yosapong Temsiripong, *CSG Regional Vice Chairman, Crocodile Management Association of Thailand*, Tel.: +6681-9853832, <yosapong@srirachamoda.com>.

## Indonesia

The report “A Short-term Assessment of the Conservation Status of *Tomistoma schlegelii* (Crocodylia: Crocodylidae) in Tanjung Puting National Park (Central Kalimantan),

Indonesia)" (Auliya *et al.* 2006) is now available at the CSG Tomistoma Task Force website ([http://tomistoma.org/pa\\_contents/2005surveys.html](http://tomistoma.org/pa_contents/2005surveys.html)).

Undertaken in September-October 2005, the survey confirmed previously (2002) documented high densities of Tomistoma in the Tanjung Puting National Park, and identified potential threats to the population.

Auliya, M., Schwedick, B., Sommerlad, R., Brend, S. and Samedi (2006). A Short-term Assessment of the Conservation Status of *Tomistoma schlegelii* (Crocodylia: Crocodylidae) in Tanjung Puting National Park (Central Kalimantan, Indonesia). A cooperative survey by the Orangutan Foundation (UK) and the Tomistoma Task Force of the IUCN/SSC Crocodile Specialist Group. 36 pp.

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## **Australia and Oceania**

### **Australia**

CROCODILE ASSISTS POLICE! Northern Territory police had some unexpected help as they searched for a man who was evading arrest. Police had visited the man's house, at the small community of Naiyu, 360 km south of Darwin, several times on 2 February, but each time they approached the house the man ran away and hid in vegetation along the banks of the Daly River. When he tried to swim across the river that evening (around 2000 h), a crocodile bit him on the head and hand, inflicting several puncture wounds and cuts.

The attack only lasted seconds, and the man estimated the crocodile to be 3-4 m long. It is not clear whether a Saltwater crocodile (*Crocodylus porosus*) or Australian Freshwater Crocodile (*C. johnstoni*) was responsible for the attack - both species occur in that section of the Daly River - but based on size it was more than likely that it was a Saltwater crocodile.

[Note: Rich Fergusson (CSG Regional Chairman for Africa) has a report of an escaped convict in Mombasa, Kenya, who chose a river as his escape route, but who not as fortunate as the Australian man.]

Source: *The Northern Territory News*, 3 February 2007.

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### **Science**



### **Recent Publications**

Thomas R. Rainwater, Ted H. Wu, Adam G. Finger, Jaclyn E. Cañas, Lu Yu, Kevin D. Reynolds, Gopal Coimbatore, Brady Barr, Steven G. Platt, George P. Cobb, Todd A. Anderson and Scott T. McMurry (2006). Metals and organochlorine pesticides in caudal scutes of crocodiles from Belize and Costa Rica. *Science of the Total Environment* 373: 146-156.

**Abstract:** Despite high animal diversity in the Neotropics and the largely unregulated use and disposal of pesticides and industrial chemicals in Central America, few data exist regarding accumulation of environmental contaminants in Central American wildlife. In this study we examined accumulation of metals and organochlorine (OC) pesticides in caudal scutes of crocodiles from Belize and Costa Rica. Scutes from Morelet's crocodiles (*Crocodylus moreletii*) from two sites in northern Belize were analyzed for metals, and scutes from American crocodiles (*C. acutus*) from one site in Costa Rica were analyzed for metals and OC pesticides. All scutes (n = 25; one scute from each of 25 individuals) contained multiple contaminants. Mercury was the predominant metal detected, occurring in all scutes examined from both species. Other metals detected include cadmium, copper, lead, and zinc. American crocodile scutes from Costa Rica contained multiple OC pesticides, including endrin, methoxychlor, *p,p*-DDE, and *p,p*-DDT, all of which occurred in 100% of scutes analyzed (n = 6). Mean metal and OC concentrations varied in relation to those previously reported in crocodylian scutes from other localities in North, Central, and South America. OC concentrations in American crocodile scutes were generally higher than those previously reported for other Costa Rican wildlife. Currently, caudal scutes may serve as general, non-lethal indicators of contaminant accumulation in crocodylians and their areas of occurrence. However, a better understanding of the relationships between pollutant concentrations in scutes, internal tissues, and environmental matrices at sample collection sites are needed to improve the utility of scutes in future ecotoxicological investigations.

[A PDF of this paper is available from Thomas Rainwater at [trrainwater@gmail.com](mailto:trrainwater@gmail.com)].

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Anton D. Tucker, Colin J. Limpus, Keith R. McDonald and Hamish I. McCallum (2006). Growth dynamics of freshwater crocodiles (*Crocodylus johnstoni*) in the Lynd River, Queensland. *Australian Journal of Zoology* 54: 409-415.

**Abstract.** We analysed growth models for a population of Australian freshwater crocodiles (*Crocodylus johnstoni*). Competing growth models were tested with two data sets: individuals of known-age, and growth interval data from

capture-recapture records. A von Bertalanffy function provided the best empirical fit of several growth models. The estimated asymptotic lengths (snout-vent length of males = 125.3 cm; females = 97.4 cm) agreed well with average lengths of the ten largest males and females in the population. Sexual size dimorphism in this species resulted from a combination of smaller mean length at maturity for females and a subsequent decline in female growth rate. Size dimorphism may result from individual trade-offs in age v. length at maturity as a consequence of sexual selection.

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Nicole M. Scott, Mark F. Haussmann, Ruth M. Elsey, Phillip L. Trosclair III and Carol M. Vleck (2006). Telomere length shortens with body length in *Alligator mississippiensis*. Southeastern Naturalist 5(4): 685-692.

**Abstract:** In *Alligator mississippiensis* (American Alligator), body length increases with age, but body length can be used as an accurate estimator of age only up to about 6-7 years, when growth rates slow considerably. Telomeres are repetitive DNA sequences that cap the ends of each chromosome. Telomeres shorten with age in most animals, but telomere shortening has not been examined in reptiles. We measured telomere length in erythrocytes of *A. mississippiensis* varying between = 5 and 240 cm in body length and found a negative relationship between telomere length and body length ( $P < 0.01$ ). Assuming that erythrocyte telomeres continue to shorten with time, even after growth rate declines, those individuals with the shortest telomeres should be the oldest members of the population. This method of estimating age, even in animals of similar body size, should allow questions about age structure and senescence to be addressed.

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Steven G. Platt, Thomas R. Rainwater, Adam G. Finger, John B. Thorjarnarson, Todd A. Anderson and Scott T. McMurray (2006). Food habits, ontogenetic dietary partitioning and observations of foraging behaviour of Morelet's crocodile (*Crocodylus moreletii*) in northern Belize. Herpetological Journal 16: 281-290.

We studied the food habits and size-related dietary patterns of Morelet's crocodile (*Crocodylus moreletii*) in freshwater wetlands of northern Belize (1992-2000). Crocodiles ( $n = 420$ ) were classified as hatchlings, small juveniles, large juveniles, subadults or adults based on total length. Stomach contents were obtained primarily by stomach flushing. Prey items included aquatic and terrestrial insects, arachnids, aquatic gastropods, crustaceans, fish, amphibians, reptiles, birds, and mammals. Based on the percent occurrence of recovered prey items, we concluded that the smallest size classes feed largely on insects and arachnids. Large juveniles broadened their diet to include aquatic gastropods, crustaceans, fish and non-fish vertebrates. Insect and arachnid consumption declined

sharply among subadults, and increasing amounts of aquatic gastropods and fish were recovered from this size class. The adult diet consisted mainly of aquatic gastropods, fish and crustaceans. Dietary diversity was greatest among large juveniles and subadults. Conversely, hatchlings and small juveniles had the most specialized (least diverse) diet owing to a reliance on insects and arachnids. Dietary overlap was greatest between adjacent size classes, and lowest between the smallest and largest size classes. We also provide field observations of prey-specific foraging behaviours.

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Frank Seebacher and Shauna A. Murray (2007). Transient receptor potential ion channels control thermoregulatory behaviour in reptiles. PLoS ONE 2(3): e281.

Biological functions are governed by thermodynamics, and animals regulate their body temperature to optimise cellular performance and to avoid harmful extremes. The capacity to sense environmental and internal temperatures is a prerequisite for the evolution of thermoregulation. However, the mechanisms that enable ectothermic vertebrates to sense heat remain unknown. The recently discovered thermal characteristics of transient receptor potential ion channels (TRP) render these proteins suitable to act as temperature sensors. Here we test the hypothesis that TRPs are present in reptiles and function to control thermoregulatory behaviour. We show that the hot-sensing TRPV1 is expressed in a crocodile (*Crocodylus porosus*), an agamid (*Amphibolurus muricatus*) and a scincid (*Pseudemoia entrecasteauxii*) lizard, as well as in the quail and zebrafinch (*Coturnix chinensis* and *Poephila guttata*). The TRPV1 genes from all reptiles form a unique clade that is delineated from the mammalian and the ancestral *Xenopus* sequences by an insertion of two amino acids. TRPV1 and the cool-sensing TRPM8 are expressed in liver, muscle (transversospinalis complex), and heart tissues of the crocodile, and have the potential to act as internal thermometer and as external temperatures sensors. Inhibition of TRPV1 and TRPM8 in *C. porosus* abolishes the typically reptilian shuttling behaviour between cooling and heating environments, and leads to significantly altered body temperature patterns. Our results provide the proximate mechanism of thermal selection in terrestrial ectotherms, which heralds a fundamental change in interpretation, because TRPs provide the mechanism for a tissue-specific input into the animals' thermoregulatory response.

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Clara Lucía Sierra Díaz, Hovaimar Morelo Gutiérrez, Yuraini López Solano and Antonio Luis Díaz González (2007). Conserving Columbian mangroves and crocodiles. The Sandwatcher 2(1): 5.

Started in the Caribbean in 1999, "Sandwatch" began as an initiative of the United Nations Educational, Scientific



and Cultural Organization (UNESCO), through the platform for Environment and Development in Coastal Regions and Small Islands and the Associated Schools Project Network. Sandwatch ([www.sandwatch.ca/index.htm](http://www.sandwatch.ca/index.htm)) is now a global activity involving islands as far away as Cook Islands in the Pacific, Seychelles in the Indian Ocean, and the Bahamas in the Caribbean. It seeks to modify the lifestyle and habits of children, youth and adults on a community-wide basis, and to develop awareness of the fragile nature of the marine and coastal environment and the need to use it wisely.



Figure 1. Clara Lucía Sierra Díaz and Colombian students at the Sandwatch Symposium in Trinidad and Tobago. Photograph: Sandwatch.

Colombian researchers and students (Fig. 1) participated in the Regional Sandwatch Youth Symposium held in Trinidad and Tobago, 4-6 December 2006. A summary of the pilot *Crocodylus acutus* conservation program run by Giovanni Ulloa and Clara Sierra (Fig. 1) in Cispatá Bay, Colombia, is outlined in the latest Sandwatcher newsletter.

Raymond Hoser (2006). A case of "death by fur-ball" in a young freshwater crocodile (*Crocodylus johnstoni*). *Herpetofauna* 36(2): 122.

Reports the case of a 27 cm long pet freshwater crocodile that died as a result of impaction in the stomach by a 3 x 1.8 cm fur-ball. The animal had been fed on the legs (fur on) of dead mice for about 80 days.

## Re-Organisation of CSG-Tomistoma Task Force

Due to various changes, the CSG Tomistoma Task Force has decided to re-organise itself. The current structure now comprises:

Chair: Ralf Sommerlad ([crocodilians@web.de](mailto:crocodilians@web.de))  
 Vice Chair: Akira Matsuda ([akira@crocodilian.net](mailto:akira@crocodilian.net))  
 Regional Chairs:

Australia: Charlie Manolis ([cmanolis@wmi.com.au](mailto:cmanolis@wmi.com.au))  
 Europe: Colin Stevenson ([coleosuchus@hotmail.com](mailto:coleosuchus@hotmail.com))  
 Indonesia: Mark Bezuijen ([bezuijen@dodo.com.au](mailto:bezuijen@dodo.com.au))  
 Malaysia: Robert Stuebing ([rs888@aol.com](mailto:rs888@aol.com))  
 Remaining Southeast Asia: Uthen Youngprapakorn ([thutroc@ksc.th.com](mailto:thutroc@ksc.th.com))  
 USA: Bruce Shwedick ([shwedick@aol.com](mailto:shwedick@aol.com))  
 Treasurer: J. Perran Ross ([pross@wec.ufl.edu](mailto:pross@wec.ufl.edu))  
 Officer for Illegal Trade Monitoring: Mark Auliya ([mark\\_auliya@myjaring.net](mailto:mark_auliya@myjaring.net))

Contributing Members:

Hellen Kurniati, Indonesia ([hkurniati@yahoo.com](mailto:hkurniati@yahoo.com))  
 Joon Soon Jong, Malaysia ([jongss@hotmail.com](mailto:jongss@hotmail.com))  
 Scott Pfaff, USA ([spfaff@riverbanks.org](mailto:spfaff@riverbanks.org))  
 Boyd Simpson, Cambodia ([boyd1@ekit.com](mailto:boyd1@ekit.com))  
 Joe Wasilewski, USA ([jawnatsel@bellsouth.net](mailto:jawnatsel@bellsouth.net))  
 Grahame Webb, Australia ([gwebb@wmi.com.au](mailto:gwebb@wmi.com.au))

The CSG-TTF is seeking more CSG members from the Tomistoma range states as contributing TTF members.

Ralf Sommerlad, *Rödelheimer Landstr. 42, 60487 Frankfurt, Germany*, [<crocodilians@web.de>](mailto:crocodilians@web.de).

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## Tomistoma Workshop

A Tomistoma Workshop is proposed to be held in Thailand, on 20-22 September 2007. Details will be posted in the CSG Newsletter as they are confirmed.

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## Third International Workshop on Crocodylian Genetics and Genomics

The Crocodile Specialist Group (CSG), Texas Tech University (TTU), the Savannah River Ecology Lab (SREL), La Autoridad Nacional del Ambiente de Panamá (ANAM) and the Smithsonian Tropical Research Institute (STRI) are pleased to announce and invite you to participate in the Third International Workshop on Crocodylian Genetics and Genomics, to be held at the Smithsonian Tropical Research Institute in Panama City, Republic of Panamá, 13-15 April 2007 (<http://striweb.si.edu/crocodile/index.html>).

The success of the previous two workshops, which included contributors representing science, industry and even business and the subsequent research projects that they have spawned has expanded the range of topics that we will be discussing for the Third International Workshop. These will include molecular or biochemical aspects regarding the:

1. Systematics and evolution of the Crocodylia;
2. Use of nuclear genes vs. mitochondrial genes in crocodylian studies;
3. Population genetic analyses of crocodylians;
4. Genomic studies;
5. Gene expression studies and immunity systems of crocodylians;
6. Crocodylian conservation biology and management efforts; and,
7. The skin industry.

There will be several invited talks, but we would very much like interested participants to present their research in a regular 30 minute per talk session. There will also be a poster session, which may be more appropriate for some of the students who attend the meeting and would also like to present their results.

Although the physical location of the meeting in Panamá will facilitate participation by researchers from the Caribbean (including Cuba), as well as South, Central and North America, we anticipate workshop attendees to come from around the world.

**Cost for Registration:** Registration will be \$US100 for all professional crocodylian researchers, conservation managers or industry workers, with graduate or undergraduate students being allowed to attend for \$US25, with the accompanying signatures of their major professors or departmental chairs.

**Location:** Talks and workshop sessions will be held at the STRI Conference Center, located in Ancón, Panama City.

**Accommodation:** Hotel rooms for workshop participants have been reserved at the Amador Country Inn Hotel. Participants will be given a special meeting rate of \$US65 +10% for 1 or 2 people, including breakfast. To get this rate, reservations need to be made before 15 March 2007. To make your reservations, please contact Ms. Vielka Gutierrez [Tel: (507) 6677-4359; Fax: (507) 302-5426; vielkag@unesa.com] and mention code cocodrilos-STRI.

**Transportation:** COPA, the official Panamanian airline, is offering a discount of 20% on plane tickets to workshop participants. To get this discount, tickets need to be purchased through a COPA travel office. Discounts will not apply on tickets purchased through internet. Tickets can be purchased at any time after 30 January 2007 - please mention the code "cocodrilos-STRI".

We understand that this announcement is much later than most people expect for an international workshop and it is also later than we had hoped it would be. The opportunity to hold this meeting at STRI arose last fall, but the logistics of having this meeting in Panamá resulted in the details

of the workshop not being finalized until recently. Thus, we are trying to recruit participants for the workshop as quickly as possible to take advantage of the chance to hold such a meeting at STRI.

We look forward to your attendance and participation in the Third International Workshop on Crocodylian Genetics and Genomics and eagerly await your acceptance of this invitation to attend.

We really need you to let us know if you plan to attend by Friday, 9 February 2007. Please respond to Miryam Venegas [dracocodrilo@hotmail.com, venegasm@si.edu; Fax: (507) 212-8790; Tel: (507) 212-8830]. Or feel free to contact either Travis Glenn or Lou Densmore at the phone numbers and/or e-mails listed below. Additional meeting information will be provided soon after 12 February 2007, when an initial tally of attendees is completed, including a list of speakers and topics.

If there is not a strong enough response because of the lateness of this notification, the meeting will be postponed until the Fall of 2007.

Co-organizers of the Third International Workshop on Crocodylian Genetics and Genomics, Dr. Llewellyn D. Densmore (*Lou.Densmore@ttu.edu*; Tel. 1 806 742-2728), Dr. Travis C. Glenn (*glennt@biol.sc.edu*; Tel. 1 803 725-5746), Aleida Salazar (*a.salazar@anam.gob.pa*; Tel. (507) 742-2728) and Dr. Eldredge Bermingham (*bermingham@si.edu*; Tel. (507) 212-8086).

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CROCODILE POO AND ANCIENT MEDICAL PRACTICES. As I was doing some research for a paper on ancient medical practices, I came across some interesting uses for crocodile excrement, including:

1. Birth control: Medical papyri suggest two ways to eliminate an unwanted pregnancy. One method was to place crocodile excrement in the vagina. It is likely that this prescription refers to a hardened plug of dried dung inserted at the mouth of the uterus to block the entrance of sperm, but the papyrus is not clear (Thompson 2005). The Kuhun Papyrus, discovered in 1860, mentions various contraceptive methods used in ancient Egypt, among which is the use of tampons made with a paste of crocodile excrement, honey and salt (Margolis 2004).
2. Anti-wrinkle Cream: The Greek physician Galen invented the first skin moisturiser when he blended olive oil with beeswax and added rose water. The cream had a cooling effect on the skin and was a lot more appealing than earlier anti-wrinkle recipes that were based on crocodile excrement (Woodhead 2006). In Egypt, crocodile excrement was also used in mud baths (Price 2001).

3. Eye Ailments: Nunn (1996) noted that reptilian fluids such as blood, excrement and fat were used extensively in ancient Egyptian medicine. However, he found it difficult to discern the pharmacological basis for the practice of using crocodile excrement for treating eye ailments.
4. Hysteria: In ancient Egypt the inhalation of the fumes of charred crocodile faeces was a treatment for female hysteria (Laporte 2000).

#### Literature

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## Terrestrial Mating?

In January 2007, Vladimir Dinets spent one week observing Mugger crocodiles (*Crocodylus palustris*) in Sasan Gir National Park, Gujarat, India. He was able to position himself quite close to the pool (which was about 1 m deep in places) without disturbing the crocodiles, and took a photograph of two *C. palustris* attempting to mate on land (Fig. 1).

This reminded me of an observation I had made in February 2005, of two captive Siamese crocodiles (*C. siamensis*) at a farm in Siem Reap, Cambodia, which were also attempting to mate on land (Fig. 2). The farmer had observed such attempts on other occasions.

Charlie Manolis, *CSG Regional Chairman for Australia and Oceania*, <[cmanolis@wmi.com.au](mailto:cmanolis@wmi.com.au)>.



Figure 1. Two wild Mugger crocodiles attempting to mate on land. Photograph: Vladimir Dinets (Coral Gables, FL, USA).



Figure 2. Two captive Siamese crocodiles attempting to mate on land. Photograph: Charlie Manolis.

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