CROCODILE SPECIALIST GROUP NEWSLETTER

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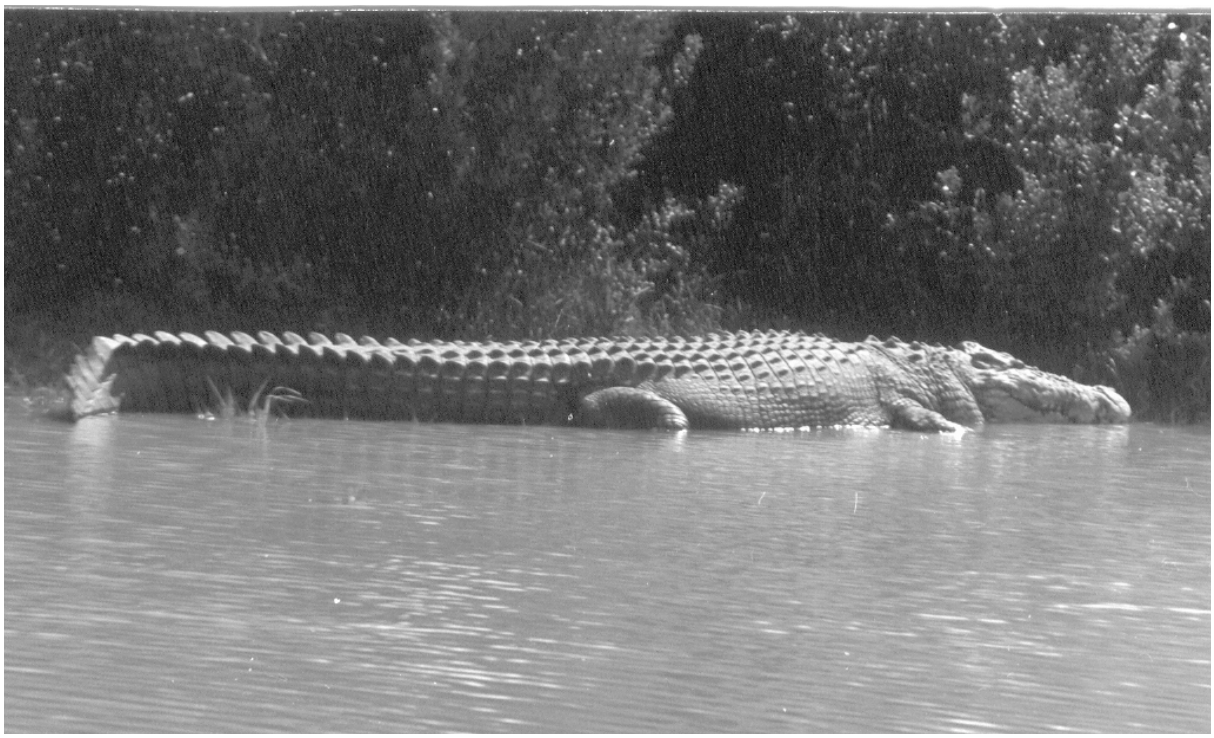

IUCN - World Conservation Union • Species Survival Commission

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CHAIRMAN:
Professor Grahame Webb
PO Box 530
Sanderson, NT 0813
Australia

EDITORIAL AND EXECUTIVE OFFICE:
PO Box 530
Sanderson, NT 0813
Australia

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COVER PHOTO. One of the few large (5.5+ m total length) Saltwater crocodiles (*Crocodylus porosus*) sighted during recent surveys in Bhitarkanika Wildlife Sanctuary, Orissa, India (see pages 9-10). Photo: Kamal Purohit.

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South Africa Crocodile Association, Lynwood Ridge, South Africa.
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Editorial

The momentum of the CSG has continued over the last quarter. Of particular significance, a review of crocodilian conservation and management in four Latin American countries (Bolivia, Ecuador, Paraguay, Peru) was undertaken by Alejandro Larriera (CSG Deputy Chairman), Alvaro Velasco (Regional Chairman, LAC) and Bernardo Ortiz (Regional Vice Chairman, LAC). A report detailing the results of the review will be available soon.

A recommendation of the recent review of crocodile conservation and management in Cambodia [see CSG Newsletter 24(1): 4-5] was to "identify training needs of the farming industry, and organise relevant courses, workshops, etc." With support from Heng Long Leather Co., the Crocodile Farming Development Association of Cambodia and the Cambodian Department of Fisheries, a National training workshop on “Crocodile Farming - Principles and Practice” was convened in Siem Reap on 5-8 July (see pages 16-17). Participants included crocodile farmers from various Provinces and Fisheries personnel from Provincial/municipal offices. Tom Dacey (CSG Executive Officer) attended the training workshop in an informal capacity, and Charlie Manolis and Adam Britton (WMI) delivered presentations on various topics. The crocodile farmers association reiterated its commitment to the conservation of the wild *Crocodylus siamensis* population in Cambodia. The Department of Fisheries updated participants on progress being made on implementation of the CSG review recommendations.

In June, Hellen Hurniati (Research Centre for Biology-LIPI; CSG Regional Vice Chair for East and Southeast Asia) led a survey to examine *C. siamensis* habitats and locations where remnant *C. siamensis* populations may still occur in the lower Makaham River, East Kalimantan (see pages 17-18). The survey, supported by crocodile industry and CSG member Mr. Rachmat Wiradinata, is a good example of Government and industry working together to address national crocodile conservation and management priorities. Mark Auliya, in consultation with Indonesian officials, and supported by funding from the CSG-Tomistoma Task Force, is about to commence a survey of *Tomistoma schlegelii* in the Tanjung Puting National Park, Kalimantan. We look forward to hearing the results of this survey in due course.

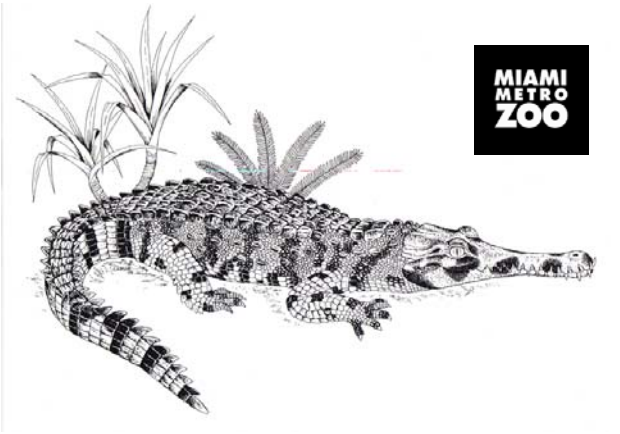
The ability of the CSG to achieve its goals relies not only on the voluntary work of its members, but also on financial support from various donors. We have made a strong and determined effort to build the financial resources of the CSG so that we can undertake a series of new initiatives. A key future priority is to upgrade the CSG website so that it becomes a more powerful tool in achieving the CSG's mission and goals. The idea of an electronic journal devoted to crocodilian conservation, management and research was strongly supported by Steering Committee members, and will be addressed when the website is revised.

Africa and West Asia are both regions where I would like to see CSG activities greatly expanded. This will be a formidable challenge, but I am confident that we can prioritise these two regions and develop much stronger programs for improved crocodilian conservation and management.

Contractual arrangements are now in place for the provision of limited Executive Office services in both Latin America (through Alvaro Velasco) and Africa (through Richard Fergusson). Under these arrangements regional issues will be better addressed by local expertise and hopefully, funding raised within the regions will help sustain and grow these services in the future.

Professor Grahame Webb, CSG Chairman

Tomistoma Task Force



TTF BENEFIT POSTPONED. The TTF benefit that was to be hosted by the Miami Metro Zoo on 5 November 2005 has been postponed, due to the recent disaster in Louisiana and adjacent States caused by Hurricane Katrina, and more recently by Hurricane Rita that struck Texas and Louisiana. Understandably, the focus of donations for many people is on the victims of these hurricanes, and there would be little to be gained by holding the benefit on the intended date.

As previously advertised, the event will be held at a later date in the Metro Zoo's magnificent, air-conditioned, indoor gallery "Dr. Wilde's World", and guests will be able to enjoy a cocktail party and buffet-style dinner, and have an opportunity to meet nationally known wildlife personalities, CSG representatives and "Pip", a captive-born Tomistoma.

As soon as new dates are confirmed, the event will again be advertised. Details will be posted on the Tomistoma Task Force website: www.tomistoma.org.

Regional Reports

Latin America & the Caribbean

French Guinea

The monitoring of the Black caiman population was initiated in late 1999. Aims of the program, funded by the Kaw Swamps Nature Reserve and the French Ministry of Ecology, were:

- to assess the status of the population, using both field surveys and molecular markers;
- to identify areas of major importance for the species;
- to gather new data on ecology and biology; and,
- to propose recommentations for a better management of habitat and species conservation.

The reserve comprises several habitats, including swamps, flooded forests, and mangroves. The Angélique area is a 80 square kilometre flooded herbaceous swamp, has remained pristine due to its inaccessibility. The Kaw River crosses the reserve, and includes a herbaceous habitat, the lower part crosses a gallery forest, and, closer to the sea, a mangrove. Caimans were extensively hunted for many decades, until the complete protection of the species by Ministerial Decree in 1986. Poaching still occurs, although at a low level. The area is exploited by unmanaged tourism, cattle ranching and fishing.

Over a 4-year period, I conducted monthly surveys on the main river channel, gathered data on growth and dispersal using capture-recapture, and developed a genetic approach with two molecular markers [nuclear microsatellite DNA and mitochondrial cytochrome b (the latter in collaboration with Izeni Farias, University of Manaus)].

Three species are present on the Kaw River; *Paleosuchus palpebrosus*, *Melanosuchus niger* and *Caiman crocodilus*. The kilometric index (KI) of both Black and Spectacled caimans are shown on Figure 1.

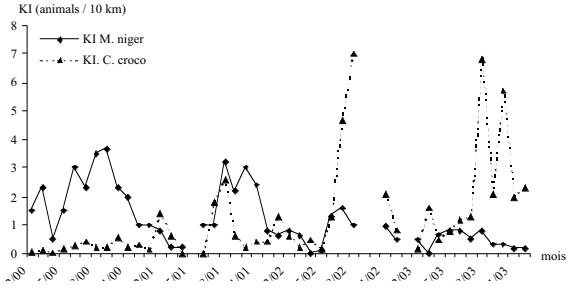


Figure 1. Monthly kilometric index (KI; individuals per 10 km) of Black caiman (*Melanosuchus niger*) and Spectacled caiman (*Caiman crocodilus*) in the Kaw River, Kaw Swamps Nature Reserve, French Guiana, 2000-2003.

The decrease in abundance of the Black caiman is significant, and the increase in the Spectacled caiman could be an ecological response to this. In addition to very low KIs, Black caimans on the river were only young animals; alternatively the size structure recorded in the Angélique swamps reflects a healthy population. Also, hatchlings and nesting activities were not recorded on the Kaw River. The Black caiman has a marked preference for forest habitats

(40% of records located in gallery forest area, 18% in mangrove area, versus 42% in savannas); the Spectacled caiman preferred the savanna area (94% of sightings).

Data on growth are very preliminary, with mean rates ranging from 1 to 3.5 cm/month, and being significantly higher in youg animals. To date, no animal marked in one of the three areas (Angélique Swamp, Kaw River, Approuague) has been recaptured in another.

Analysis of both nuclear and mitochondrial DNA suggested a high genetic diversity and a significant recovering potential (Farias *et al*. 2004; de Thoisy *et al*. 2005). Nuclear markers suggested that gene flows are important between Angélique and Kaw River. On the other hand, animals from the Approuague would be related to breeders from Pointe Béhague, another large swamp inacessible area located in the East of the river, close to the border with Brazil. Forthcoming actions will include VHF telemetry and extension of the genetic survey towards animals located outside the reserve (de Thoisy and Auffret 2003), and as far as possible with the Brazilian population of Cabo Orange.

To conclude, a large population of Black caiman is still present in French Guiana, due to the remoteness of large swamps. Although the population is severley depleted in bordering areas, a potential recovery is expected, but strict management of the area is necessary, and is not yet sufficient. Considering surveys and genetic data together, we suggest that: (i) at the population level, the high diversity and absence of significant probability of consaguinity means an overall satisfactory status, with the evidence of gene flows between pristine areas that may act as sources, and depleted areas; (ii) on the Kaw River, the continuous decrease is worrying, and may be explained by overfrequentation, inadequate behaviors of visitors and tourism operators, and maintenance of silent poaching pressure.

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Benoit de Thoisy, *Kwata NGO, Cayenne, French Guiana <thoisy@nplus.gf>*.

Honduras

AMERICAN CROCODILES IN CAJON DAM. Recently, the Government of Honduras, through the Multiphase Program of Management of Natural Resources in Priority River Basins (MARENA) and the National Electrical Energy Company (ENEE), has shown interest in establishing mechanisms for the integrated management of crocodiles in the Cajón Dam (Fig. 1). This will be through a management model and sustainable rural development that allows community participation in the medium- and long-terms [eg non-consumptive use (ecotourism), sustainable use of crocodiles]. The success of the suitable use of this resource can represent an alternative form of income for local communities in the future, and can be an important mechanism to preserve functional, healthy habitats for the population of crocodiles that resides there.

Figure 1. View of Cajón Dam.

For this purpose, on 18-24 May 2005, counts were made in the Cajón Dam with the purpose of generating information on population size and the spatial distribution of the crocodiles (*Crocodylus acutus*) in this area. In Honduras, this is considered the largest population of this species concentrated in a single place, in addition to the site being of priority for the conservation of *C. acutus* (J. Thorbjarnarson, pers. comm. 2005).

Some of the objectives of this research are: monitoring of the population to detect the variations or changes over time (compared with results from 1989, 1990 and 2001); to initiate a program of marking of individuals; increase capacity of technical personnel of the River Basins Unit of ENEE and of the Municipal Environmental Units (UMAs) of the communities in techniques for handling and conservation of crocodiles (Fig. 2); and, to formulate recommendations for the development and implementation of a management plan for the population in the dam in particular.

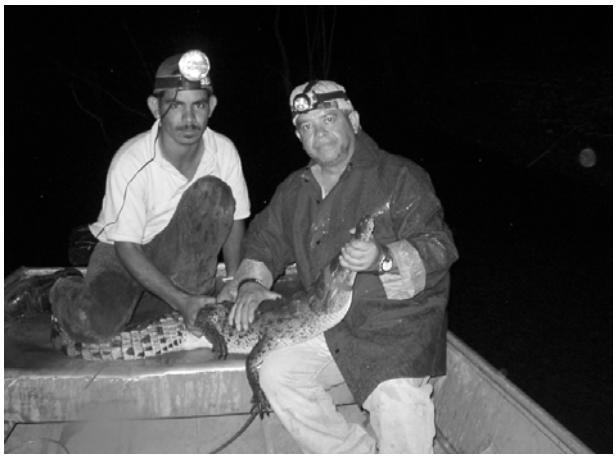

Figure 2. Enrique Noriega and Mario Espinal (Chief Investigator) with a *Crocodylus acutus* captured during night counts in May 2005.

Preliminary results show a size structure of: 536 hatchlings (49.5%), 45 <50 cm (4.2%), 84 50-90 cm (7.8%), 240 90-180 cm (22.2%), 90 >180 cm (8.3%) and 87 eyes only (8.0%) (Fig. 3). The size structure of the population, and the presence of all ages, indicates that the current population of Cajón Dam is healthy. The presence of a high number of recent hatchlings confirms the existence of reproductive adults in the population.

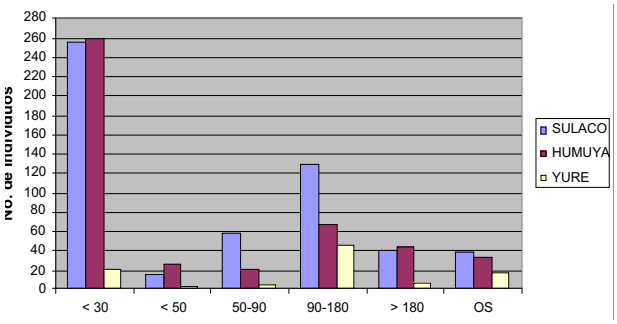

Figure 3. Size structure (cm TL) of *Crocodylus acutus* observed in the Cajón Dam, May 2005. OS= eyes only.

Other work will be undertaken during June in order to draft a technical document on the "Study on the Abundance and Distribution of the American Lizard *Crocodylus acutus*" and the relation with its surroundings in Cajón Dam, accompanied by a georeferenced map under a platform of Arc View with its respective data base.

Mario Espinal, *Residencia Cerro Grande, Zona 2, Bloque 48, Casa No 2409, Comayaguela, Honduras, <mknorops@hotmail.com>*.

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Ecuador

AMERICAN CROCODILES STLL REMAIN IN MANGROVES OF THE GUAYAQUIL GULF, ECUADOR. The American crocodile (*Crocodylus acutus*) is a critically endangered reptile in Ecuador. In the past it was hunted extensively for the leather trade, with about 200,000 individuals slaughtered from 1930 to 1950 (Fiallos *et al*. 1980). Furthermore, loss of habitat (mangrove forests) due to anthropogenic activities such as urban sprawl, agriculture and shrimp farming have reduced the population and compromised the survival of this species.

The conservation status of the species is poorly understood and there is a lack of scientific information on its natural history, hampering management strategies to enhance its survival in Ecuador. Moreover, it has been unknown whether this species still existed in coastal habitats such as mangroves and estuarine areas. In addition to a survey on captive American crocodiles in different farms and ranches of the coastal zone of Ecuador, between 2001 and 2002 (Alava *et al*. 2003) a preliminary population study on the American crocodile was conducted in the Reserva de Producción de Fauna Manglares El Salado (The El Salado Fauna Production and Mangrove Reserve), Gulf of Guayaquil, by Fundación Natura Guayaquil Chapter. The study was developed along 15 km of mangrove channels and tidal creeks, using nocturnal spotlight boat surveys (Chabreck 1966) during the dry season, from September to November 2004. The estimation of size class and age were based on Gaby *et al*. (1985), Thorbjarnarson (1989) and Platt and Thorbjarnarson (2000) (hatchlings <30 cm, juveniles <0.9 m, sub-adults 0.9-1.8 m, adults >1.8 m). This study also included a survey of the human population (510 persons) living close or within this Reserve, in order to know the level of perception and degree of awareness that people had on this species.

Surprisingly, about four crocodiles, with a mean relative abundance of 0.45 ind./km (range 0.27-0.63), were detected in the study area. The population composition was represented only by adults (Fig. 1) and juveniles, 50% each; subadults and hatchlings were not observed. The crocodiles were aggregated in the final extreme of a tidal creek (Estero Plano Seco), where the release of thermal effluent (>32°C) from electric power plants and run-off with low salinity water (range: 10-28 ppm) from urbanized centers have been evident. The abundance found in this ongoing study suggests one of the lowest population densities for American crocodiles in Latin America.

The last survey was conducted in 1978-1979, when a total number of about 9 individuals were sighted at four sites in the Manglares Churutes Ecologic Reserve, and a population density of 0.9 ind./km was reported for 12 km of the El Estero Bajen, some distance from the Reserve (Fiallos *et al*. 1980). This implies that more ecological and population studies are needed in order to elucidate some

gaps and the environmental factors (eg anthropogenic activities) that are influencing on the species conservation, as well as the establishment of management strategies to ensure its survival.

Figure 1. Adult individual (~2 m) sighted at night in a zone of thermal effluent adjacent to electric power plant in 2004. Photograph: Johanna Panchana.

The results from the local survey showed that in general people from human communities are not aware about the existence of the American crocodile, and there were some negative perceptions on this species (eg people are afraid of crocodiles). Thus, environmental education with local human communities was one of the actions recommended in the final document of this initial phase to transform the negative perception on this species and opportunities focused on ecotourism (eg crocodile-watching) as meanings of community-based conservation (CBC).

The outstanding results produced during the first phase of this field study has motivated the current sponsoring institution, EcoCiencia (Fundación Ecuatoriana de Estudios Ecológicos), to continue supporting Fundación Natura in a second phase during the 2005 rainy season after 25 years since the last field study was deployed (Fiallos *et al*. 1980).

More information is available from the final Technical Report [in Spanish: Carvajal, R. and Saavedra, M. (2005). Estimación Poblacional del Cocodrilo de la Costa (*Crocodylus acutus*) en la "Reserva de Producción de Fauna Manglares El Salado" durante la época seca del 2004, Golfo de Guayaquil, Ecuador. EcoCiencia Programa de Becas de Investigación para la Conservación, Conservación Internacional Ecuador, Embajada Real de los Países Bajos, Gordon and Betty Moore Foundation y Fundación Natura Capítulo Guayaquil: Guayaquil. 41 pp. (Unpublished)] available from the authors.

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Raul Carvajal[1] and Juan Jose Alava1[2]: *[1]Fundación Natura Capítulo Guayaquil, Av. Carlos Julio Arosemena Km. 2.5; P.O. Box 09-01-11327, Guayaquil, Ecuador, <raul_carvajal8@hotpop.com>; [2]School of the Environment, University of South Carolina, 901 Sumter Street, 702G Byrnes Building, Columbia, SC 29208, USA, <jalva@environ.sc.edu>*.

[Nota: Una version en Español de el reporte completo esta disponible en: www.wmi.com.au/csgarticles]

Venezuela

CURRENT STATUS OF THE AMERICAN CROCODILE IN VENEZUELA.The American crocodile (*Crocodylus acutus*) is one of the five species found in Venezuela, and the species is considered to be Endangered by Venezuelan law, CITES and the IUCN.

Between November 2003 and July 2004 we undertook spotlight count surveys at 9 locations: Neverí and Unare Rivers (Anzoátegui State); Turiamo Bay (Aragua State); Cuare Wildlife Refuge, Tocuyo River, Tucurere Wildlife Reservation and Hueque Mouth (Falcon State); and, Santa Rosa and Santa Ana Rivers (Zulia State). Daytime surveys were undertaken to characterise habitats, including

classification of water bodies, identification of surrounding vegetation, presence of good nesting areas, presence of human establishments and level of "interference". The species was encountered at all locations, with less in Hueque Mouth and Santa Ana River. A total of 310 crocodiles was observed, classified in 5 size classes: Class I (135), Class II (110), Class III (42), Class IV (16) and Class V (7).

We compiled information for 21 locations in seven coastal states from 14 bibliographical references, besides the information for 477 crocs liberated in four coastal states (7 locations). It is considered that the largest American crocodile population is in the coastal rivers (Yaracuy, Aroa and Tocuyo Rivers). Areas of mangrove, particularly those with little freshwater input, like Cuare Wildlife Refuge, Morrocoy National Park, Turiamo Bay and Hueque Mouth, appeared to be marginal habitats for *C. acutus*.

We confirmed that certain anthropogenic factors, like direct hunting and use of fishing nets, in almost all the places visited has a negative impact on the recovery of the wild populations. We established that favorable conditions for the American crocodile populations are; presence of mangrove and adjacent forest vegetation, nesting beaches, influx of fresh water and the protection of the habitats through legal means.

Alfredo Lander and Sergio Bermudez, *Museo Estación Biológica de Rancho Grande, Oficina Nacional de Diversidad Biológica, Venezuela, <museoebrg@cantv.net>*.

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Mexico

PHENOTYPIC CHARACTERISTICS OF *CROCODYLUS ACUTUS* AND *C. MORELETII* IN SOUTH QUINTANA ROO. The social relationships between species of crocodiles are of recent interest, since there has been hybridization detected in some parts of the country. This has given rise to several questions on the classification of apparently hybrid species. For this reason, between February and August 2002, a study was undertaken on populations of crocodiles in the south of the State of Quintana Roo, where both American crocodiles (*Crocodylus acutus*) and Morelet's crocodiles (*C. moreletii*) are present. Areas in the Bay of Chetumal and the Hondo River were sampled, as were some crocodiles located in a zoo (“Crococun”) - a total of 234 individuals.

In the Bay of Chetumal were some atypical *C. moreletii* (3.1%; 1 of 32), and atypical *C. acutus* (25.0%; 4 of 16), which were captured in the zone of sympatry. The number of atypical *C. moreletii* in the Hondo River was low (8.5%; 11 of 129). The number of atypical *C. acutus* at Crococun was relatively high (38.8%; 7 of 18) compared with *C.*

Table 1. Results of ANOVA and Multiple Rank Analysis for different cranial measures in *C. moreletii* and *C. acutus*. A= wild *C. moreletii*, B= captive *C. moreletii*, C= wild *C. acutus*, D= captive *C. acutus*. ACRMD= maximum head width; ACRMX= snout width at 10th maxillary teeth; ACRN= snout width at nasal disc; LHO= snout length from tip of snout to eyes; LCR= head length; LIO= interocular width; LHN= distance from anterior edge of nasal disc to tip of snout.

Parameter	Level of Significance	Test for Homogeneity of Variance	Multiple Ranking Analysis
LHO	0.0003	Cochran C.: 0.503748 Bartlett: B=1.66788; Hartley: 27.7877	A=B, A≠C, A=D, B≠C, B=D, C≠D
LI	0.0079	Cochran C.: 0.58872 Bartlett: B=1.75189; Hartley: 27.7877	A=B, A≠C, A=D, B≠C, B=D, C≠D
LCR	0.0001	Cochran C.: 0.543251 Bartlett: B=1.44856; Hartley: 52.7837	A=B, A≠C, A=D, B≠C, B=D, C≠D
ACR	0.4756	Cochran C.: 0.845107 Bartlett: B=2.49127; Hartley: 156.79	A=B, A=C, A=D, B=C, B=D, C=D
ACRMXA	0.0351	Cochran C.: 0.529996 Bartlett: B=1.5822; Hartley: 59.0921	A=B, A≠C, A=D, B=C, B=D, C≠D
ACRNA	0.0054	Cochran C.: 0.584027 Bartlett: B=1.53472; Hartley: 43.7032	A=B, A≠C, A=D, B≠C, B=D, C≠D
LHDN	0.0000	Cochran C.: 0.55674 Bartlett: B=1.61042; Hartley: 25.2465	A=B, A≠C, A=D, B≠C, B=D, C≠D

moreletii (12.8%; 5 of 39). For *C. moreletii* the most common pattern of post-occipitals and cervical osteoderms corresponded to a formula of 4.4.2, although some displayed 6.4.2. This does not appear to be a good indicator to argue whether one is possibly a hybrid, since the cervical scale pattern of the same species can vary. Another reason is that in the Hondo River are *C. moreletii* with this same pattern of cervical osteoderms.

More variation is apparent in the post-occipitals and cervical osteoderms of *C. acutus*. In this study, *C. acutus* had between 2-4 post-occipitals and 2-8 cervical osteoderms. Two *C. acutus* in the zone of sympatry of the Bay had a "normal" pattern as described by Ross and Ross (1974), who mention that there can be 1-3 irregularities in the tail. Those irregularities are restricted to the lateral surface of the tail, whereas in *C. moreletii* presents variable lateral irregularities with two or more fusions, and the ventrals are generally twice the number of laterals.

There were several *C. acutus* in Crococun with a totally atypical pattern as far as their fused scales. It is possible that these individuals are hybrids, as personnel in charge of maintenance of the animals commented that *C. acutus* sometimes get to mate with *C. moreletii*, because they are in the same breeding enclosure. Some individuals at Crococun showed several peculiarities and it was difficult to identify them to species; for example, short size in relation to muscule tone development, some cranial deformities in adults, and atypical scalation in each species.

ANOVA analysis indicated significant differences in length of the snout to the nasal disc (LHN; p= 0.0000) and head length (LCR; p= 0.0001), indicating that these are fundamental difference between the species. Through review of variances using Cochran, Bartlett and Hartley tests, and by applying Multiple Rank Analysis, wild and captive *C. moreletii* were not different, but wild and captive *C. acutus* were different (Table 1).

It is probable that hybrids will tend to look morphologically like a *C. moreletii*, based on observations at Crococun of the few *C. acutus* there. Conditions at the zoo were not adequate for good growth, and some individuals (well developed except for size) showed hunched backs and also a widening of the snout (at the 10th maxillary tooth) as occurs in old individuals (Sigler, pers. comm.), in addition to the presence of fused scales in the lateral and ventral surfaces of the tail. It is assumed that the result of crosses between species (hybrids), at least in captivity, will generally look like *C. moreletii*.

Alejandro Villegas, *El Colegio de la Frontera Sur, Av. Centenario Km. 5.5, Chetumal, Quintana Roo, México, C.P. 77900, <avillegas@universo.com>*.

[Nota:Una versión en Español de este artículo esta disponible en: www.wmi.com.au/csgarticles].

West Asia

India

CROCODILES SWEPT INTO CITY. Recent monsoonal flooding in the State of Gujarat left at least 132 people dead and more than 400,000 homeless. As rains eased, new dangers were caused by crocodiles and snakes swept into the city of Baroda by the floods. Seven crocodiles up to 1.7 m long were caught in the city centre, including a university campus. At least 65 snakes were washed into the city centre, many of them highly venomous. Two people were injured trying to catch a crocodile.

Source: Justin Huggler, *The Independent, 5 July 2005.*

The May 2005 issue of "Reptiles" magazine (Vol.13, No. 5) reports that following the recent Asian tsunami, Saltwater crocodiles (*Crocodylus porosus*) on Little Andaman Island were able to make their way up irrigation canals to the town. People returning to their homes to collect belongings observed crocodiles feeding on the dead. The crocodiles also posed a threat to tsunami survivors as they were being evacuated onto ships.

Source: *www.timesonline.co.uk, January 2005*

ANNUAL CENSUS OF SALTWATER CROCODILES IN BHITARKANIKA WILDLIFE SANCTUARY IN ORISSA, INDIA. The annual census of Saltwater crocodiles (*Crocodylus porosus*) was conducted in the river systems of Bhitarkanika Wildlife Sanctuary from 12 to 18 January 2005, to asses their population number and trends, recruitment, migration, survival, etc.

A total of 1454 crocodiles were counted, consisting of 1429 in the Bhitarkanika Wildlife Sanctuary and 25 from outside the sanctuary. The number counted is 7.0% higher than that recorded in the January 2004 census.

The estimated crocodile population in the Sanctuary during the winter 1976-77 census, prior to the crocodile 'rear and release' program, was only 95 crocodiles, made up of 61 hatchlings/juveniles, 6 sub-adults and 28 adults. In various phases since 1977, over 2200 young captive-reared crocodiles (approximately 1 m total length) from the Dangmal Crocodile Research Centre have been released into the river systems of Bhitarkanika Wildlife Sanctuary. Besides these, there has been natural annual recruitment into the wild population. The change in density of crocodiles (number per km length of river/creek) has increased from 0.87 (1976-77) to 13.0 (2004-05).

Table 1. Numbers of crocodiles counted in each size category during surveys of rivers/creeks in Bhitarkanika Wildlife Sanctuary, January 2005.

Hatchlings (<50 cm)	Yearlings (50-90 cm)	Juveniles (90-120 cm)	Sub-adult (120-180 cm)	Adult (108 cm+)	Total
681 (46.8%)	290 (20.0%)	169 (11.6%)	107 (7.4%)	207 (14.2%)	1454 (100%)

The census results reflect:

i. Successful implementation of the Government of India, FAO/UNDP assisted crocodiles 'rear and rehabilitation' program in Bhitarkanika Sanctuary/National Park since 1975; and,
ii. Breeding and nesting by crocodiles released into the wild (over 55 crocodiles nests were located in different forest blocks of the sanctuary during the 2004 nesting season).

The areas having higher concentration of crocodiles have:

a. Good mangrove cover / fringing mangrove vegetation;
b. Less human disturbance (little and no illegal fishing activities); and,
c. A network of creeks and creeklets.

Dr. Sudhakar Kar, *Senior Research Officer, c/o Principal CCF (WL) & CWLW, Orissa, 5th Floor, Prakruti Bhawan, Nayapalli, Bhuubaneswar-751012, Orissa, India. Tel: 0674-2565019, Fax: 0674-2565062, <kar_sudhakar2005@yahoo.com>.*

Bangladesh

MARSH CROCODILES SENT TO BANGLADESH. On 25 June, 40 *Crocodylus palustris* from the Madras Crocodile Bank were sent to Dhaka, Bangladesh. The `mugger' or 'marsh' crocodile appears to be extinct in Bangladesh. The last female mugger in Bangladesh, at the Saint Jahan Ali Mazar, Baberhat pond, died in January 2005, after being injured in a fight with the last remaining male. She had been laying only infertile eggs since 1988.

Planning for the shipment has been underway for a year, after a formal request was made by Bangladesh to India. Clearances were obtained from the Zoo Authority of India and the Union Ministry of Environment and Forests, and the crocodiles were shipped by air.

Ten crocodiles (2M, 8F) went to Dhaka Zoo and 30 (6M, 24F) to Chittagong Safari Park (Fig. 1). All of these animals were adults that have been breeding over the last 10-15 years. Some of the males were either wild-caught or hatched from wild eggs.

Figure 1. One of the 30 *C. palustris* from Madras Crocodile Bank, at Chittagong Safari Park. Photo: Shahidul Islam.

It has been recognised that a regional meeting is required to review the status of crocodiles in west Asia. As a step towards this goal, a roundtable discussion will be held during the MCBT/TSA/UP Forestry Department's "Freshwater turtle and Tortoise Workshop" at Lucknow, Uttar Pradesh, 17-20 October 2005. It is important that India take a lead role in the region, and help cross border conservation efforts. India's biggest conservation success story is the Indian Crocodile project that started in 1974, when there were less than 100 gharials. There are now over 1000 in the wild and several hundreds in captivity.

Harry Andrews, *Madras Crocodile Bank, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India, <mcbtindia@vsnl.net>.*

East and Southeast Asia

Philippines

In May-June I made a brief visit to the Philippines, where the Wildlife Conservation Society (WCS) had previously supported the work of Frederick Pontillas. I first visited the CROC project team in Isabela Province, which has recently consolidated their crocodile conservation work in the newly established Mabuwaya Foundation. The morning after my arrival I gave a lecture to students and faculty at at Isabela State University (in the town of

Cabagan) on WCS and crocodile conservation efforts worldwide. With CROC team members [Merlijn van Weerd, Jan van der Ploeg (Netherlands), Jessie Guerrero, Sammy Telan, Dominic Rodriguez and Bernard Tarun (graduates of ISU College of Forestry and Environmental Management) we then traveled by car to the municipality of San Mariano, which has provided considerable support for the crocodile project, to meet with Jerome Miranda, a principal member of the municipal board who has spearheaded much of the work. We transferred to an old logging truck for a week long sojourn through the western foothills of the Sierra Madre, an area that has been extensively deforested and settled by migrant farmers since the late 1960s. We visited three main sites that are the focus of the CROC project, the first one located just within the boundary of the Northern Sierra Madre Natural Park, the largest remaining patch of undisturbed rain forest in the Philippines. The second site was the Disulap River, a small stream that flows through a limestone canyon that provides the area with a degree of isolation. This area has been declared a municipal crocodile sanctuary and contains a very small group of crocodiles. The last site, further south along the Pinacanauan de Ilagan River, was Dinang Creek.

The CROC project has been attempting to initiate a radio-telemetry study of crocodiles and I assisted by showing them how to make and set traps. At the Dunoy site we captured an adult female *C. mindorensis*. I demonstrated to the team how to attach a radio transmitter to the dorsal tail surface and the crocodile was subsequently released to form the basis of a research project on habitat use and movement patterns.

I was extremely impressed by their work, and what they have managed to accomplish in collaboration with the municipality of San Mariano, under very difficult circumstances. They have focused to a large degree on grass-roots community awareness and local Government involvement in crocodile conservation. They have also been quite diligent in carrying out quarterly monitoring at each of three main sites within the municipality of San Mariano. The CROC team deserves strong support from the CSG as the one group with a site-based field project on *C. mindorensis*, and for the strong level of community involvement that is so necessary for conservation of these small remnant groups of critically endangered and habitat limited crocodiles.

My impression from this brief visit is that there are many parallels between the *C. mindorensis* situation and that of both *C. siamensis* and the Chinese alligator - especially in terms of the natural and cultural factors that have contributed to defining where the last groups of crocodiles are found. Two of the sites I visited have been settled primarily by indigenous groups who have cultural taboos on killing crocodiles. Two of the sites were also fairly fast-moving, clear water streams that seem to offer, at best, marginal habitat. The number of crocodiles at these sites is extremely small, probably no more than one adult female and factors that have allowed successful nesting over the last decade have also been important in determining their survival in these areas (at Disulap, where crocodiles are confined largely to a stream within a limestone canyon, there seems also to be some indication that this mound-nesting species is "experimenting" with hole nests in sand).

After visiting Luzon I made a brief trip to Palawan, to visit the Government-run Palawan Wildlife Rescue and Conservation Center (PWRCC) located just outside Puerto Princesa City. The surveys by Ross (1981) had alarmed the Philippine Government and prompted them to take notice of the conservation status of this high-profile endemic species. The PWRCC was formerly known as the Crocodile Farming Institute (CFI) and was established in 1989, in conjunction with the Philippine Government, as a Japanese foreign aid project to assist in rural development and as a crocodile conservation project. Since its inception, the CFI focused on captive breeding of both species of crocodiles found in the Philippines, with an emphasis on *C. porosus* for eventual commercial skin production and *C. mindorensis* as a captive reserve for future conservation efforts (eg reintroduction). In the late 1990s, Japan withdrew from the project and it was taken over entirely by the Philippine Government (with a greatly reduced budget). It was initially run under the Protected Areas and Wildlife Bureau (PAWB) within the Department of Environment and Natural Resources (DENR). However, with plans to enter commercial operation, in 2002 administration of CFI was switched to the Natural Resources Development Corporation (NRDC), a "for-profit arm" of the DENR. This allowed the proceeds from the sale of crocodiles to be re-invested in the farming operations (under PAWB they would have disappeared into the national treasury).

At the PWRCC, I talked with Glen Rebong and Ranier Manalo. The farm is clearly suffering from a lack of budget but the animals appear OK and nesting is reportedly continuing at high levels. Under the NRDC, the goal is to become economically self-sustaining. They have some income from visitors and over the past few years have sold about 2000 *C. porosus* to 6 other commercial farms being established on Luzon and Mindanao. However, these farms are apparently no longer buying as their animals are now breeding. Future income at PWRCC will depend to a large extent on sale of skins, something in which the staff there does not have any experience. Given the limited resources and need to focus on commercial production, since 2001 the farm has stopped new reproduction of *C. mindorensis* by: a) separating animals that were housed in pairs; and, b) collecting and killing the eggs of animals in group pens. The total stock of *C. mindorensis* is 1131 individuals, of which 161 were the founder stock.

To the extent that their time and budget allows, PWRCC staff have remained active in terms of surveying areas for

wild populations. In Luzon they work closely with the CROC team. They are also setting up an agreement with a local NGO- the Katala Foundation- to receive outside funds that would support *C. mindorensis* work (without having it go through NRDC). They are interested in focusing work in Mindanao, where the Katala Foundation has strong links and ideas for carrying out joint surveys with the CROC project team on islands other than Luzon.

Another reason for PWRCC to focus on Mindanao is that is where virtually all the initial *C. mindorensis* at the farm originated. The issue of genetic differences between island populations is problematic and unclear. The genetic work to determine this is now finally underway with the samples at the Henry Doorly Zoo in Omaha. Although little is known about genetic variation within *C. mindorensis*, the question of releasing potential inter-island hybrids has been a concern and is one of the many issues holding back plans for reintroductions. However, this problem can be avoided (or minimized) by using PWRCC animals for releases in Mindanao. Initially, there were a few animals from other locations (Negros, Mindoro) but it appears that the Negros animals may be *C. porosus* x *C. mindorensis* hybrids and the one animal from Mindoro has subsequently died. Because most of these animals were purchased from private collectors, there is a possibility that animals reported from Mindanao came from other islands but Ranier Manalo thinks this unlikely as the collectors were from Mindanao and indicated that all the animals were collected locally.

The PWRCC is also developing a MOU with the Subic Bay Metropolitan Authority (SBMA), a mini state within a state running the area around the old US naval base. The SBMA is apparently very pro-environmental protection and will be using some of the old ammunition bunkers to house walk-in habitat displays, one of which will include Philippine crocodiles. The Subic Bay land is fairy large and well protected, and quite possibly contains habitats suitable for *C. mindorensis*. Glen Rebong was very positive that the Subic Bay people would be interested in the idea of trial reintroductions. There are indigenous Aeta people living in the area and would have to be consulted but Glen thinks they would also be supportive. The issue of using animals from PWRCC (of Mindanao stock) or perhaps a portion of the hatchling production of animals from wild groups in other parts of Luzon will have to be addressed. One of the major black-holes in terms of *C. mindorensis* is what is happening on Mindanao. The peace and order situation there has limited field work opportunities, particularly in the Liguasan Marsh area. However, information based on interview surveys could be collected if it were done by a local person, and one of the ways the CROC team has proposed to do this is through their base at the Isabela State University and a link they are developing with the Central Mindanao State University. Students from CMSU who live in the Liguasan region could travel to ISU for training and develop projects to initiate interview surveys for Mindanao crocodiles. The CROC team is also interested in following up recent reports of wild crocodiles in other areas, including Mindoro.

John Thorbjarnarson, *Wildlife Conservation Society, P.O. Box 357625, Gainesville, FL 32635-7625, USA.*

CONTINUED PHILIPPINE CROCODILE CONSERVATION ACTION IN NORTHEAST LUZON. Last June 2005, the Philippine Crocodile Rehabilitation, Observance and Conservation (CROC) Project won the British Petroleum Conservation Programme (BPCP) Consolidation Award of $US75,000. The BPCP has been supporting Philippine crocodile conservation in the wild since 2002. With the current grant the CROC Project is able to sustain its basic activities for another 2.5 years. We warmly thank the BPCP for their continued support!

As reported in earlier newsletters [Vol. 22(1); Vol. 19(4)], the CROC Project aims to conserve the critically endangered, endemic, Philippine crocodile *Crocodylus mindorensis* in the wild in Northeast Luzon. The project is being carried out by five local team members and two team leaders. A foundation has been established to implement the CROC Project and other Philippine crocodile conservation activities. The Mabuwaya Foundation (a contraction of the Philippine words “Mabuhay” = Welcome, Long live and “Buwaya” = Crocodile) is a registered Philippine NGO and will soon celebrate its second birthday.

Philippine crocodile distribution, population size and ongoing research activities

We now have identified seven permanently inhabited Philippine crocodile localities in Northeast Luzon: five in the municipality of San Mariano in the Cagayan Valley and two along the Pacific coast in the municipalities of Palanan and Divilacan (crocodiles observed at close range, no confusion with *C. porosus*). The Estuarine crocodile also still survives along the coast of the Sierra Madre mountains: three different individuals were documented on video in 2004. Philippine crocodile breeding has occurred in four localities in the past six years, the latest successfully hatched nest was located at Dunoy Lake in September 2004 (3 hatchlings). The total minimum non-hatchling population in northeast Luzon at last count in May 2005 stands at 7 adults and 8 sub-adults/juveniles. A new exciting discovery is the presence of a small Philippine crocodile population on Dalupiri Island, off the coast of northern Luzon (see report by Carl Oliveros *et al.* on page 14).

In San Mariano, we monitor the crocodile population, habitat and possible threats on a quarterly basis. The monitoring scheme includes crocodile surveys, habitat change surveys using fixed point photography, fish stock assessments, water quality measurements and focus group

discussions with local communities. One of the goals is to show that crocodile and wetland conservation leads to benefits to local communities in the form of reliable water supplies, cleaner water and increased fish stocks. In addition, we are conducting a long term study on the behavior and ecology of the Philippine crocodile from an observation tower in Dunoy Lake. Since May 2005 we also study the movements of radio-tagged crocodiles within San Mariano. John Thorbjarnarson provided technical support for the catching and tagging of crocodiles.

Conservation action

At least three *C. mindorensis* were killed during the last year in northeast Luzon: two were unintentionally caught in fishing nets and drowned, and one was purposely shot. Unfortunately they were all adults and the two animals examined by us were both females. Killing is by far the largest threat to the survival of the Philippine crocodile (although a very strong typhoon which hit San Mariano in 2003 has probably taken its toll on the crocodiles as well). We are trying hard to stop the killing of crocodiles, with mixed success.

In San Mariano, local legislation is in place to protect the crocodiles and their habitat. A local protection group was established to enforce the municipal ordinances regarding crocodiles, wetlands and fisheries. This group, the Bantay Sanktuwaryo, is receiving a modest salary from the municipal government and was trained in law enforcement and crocodile monitoring. The Small Wetlands Program of the Netherlands Committee for IUCN financed a pilot project to develop a wetland conservation strategy for the Disulap River municipal crocodile sanctuary. Representatives from the villages along the river were trained in Philippine environmental legislation, local law enforcement and action planning. As a result, local village councils have adopted local rules and regulations to protect wetlands, wetland resources and crocodiles and have identified low-cost wetland conservation actions that can be locally implemented. The key to success lies in enforcement of these rules and regulations. The lack of law enforcement in the Philippines, especially regarding the environment, is a big national issue. Local laws are seen as more legitimate by local people, are better disseminated and are perhaps easier to enforce (as they carry much lower penalties compared to national laws). Three farmers were penalized in February 2005 for burning down part of the buffer zone of the municipal crocodile sanctuary, an important precedent in Philippine crocodile conservation.

Upcoming activities

The BPCP consolidation award secures the salaries of the local team members, the basic field costs and the costs of a continuing information campaign for the coming 2.5 years. In addition, we have received a small planning grant from the Critical Ecosystem Partnership Fund (CEPF) which has been used to organize a workshop in which a regional (covering the Sierra Madre biodiversity corridor) Philippine crocodile conservation action plan has been developed. This plan will serve as the guideline for all regional partners in crocodile conservation for the coming years. Funding has also been received from WWF Philippines to conduct crocodile surveys along the Pacific coast of the Northern Sierra Madre Natural Park which led to the identification of new Philippine and Estuarine crocodile localities. Unfortunately, the WWF Philippines funding can not be extended. A small grant from the Chicago Zoological Society has been used to conduct ground work for the declaration of the second Philippine crocodile sanctuary of Dinang Creek in San Mariano. In June 2005, the local community voted in favor of establishing a crocodile sanctuary, committing themselves to maintain a 10 m buffer zone and limit fishing activities in the creek. Finally, Terry Cullen was able to raise $US6000 for the Philippine crocodile conservation program. This will be used to carry out new Philippine crocodile surveys on Mindanao, Mindoro and in the Cordillera Mountains of Luzon.

A new paradigm for crocodilian conservation in SE Asia

Apart from the first successful attempt to establish an in situ conservation project for *Crocodylus mindorensis*, an additional result of the Philippine crocodile conservation program has perhaps been the development of an alternative approach to top down crocodile conservation which has been so successful in Australia, the USA, South America and partly in Africa (captive breeding, sustainable harvesting or total protection in well established and well visited national parks). Although we certainly do not dismiss these top down approaches as good practice we conclude that they have not been effective in the Philippines. High human population densities, increasing pressure on wetlands and water, negative cultural perceptions towards the animals (in the Philippines crocodiles are generally regarded as dangerous pests or as a delicious snack) and a technocratic approach to crocodile conservation in which it is widely believed that crocodiles are best protected in zoos and farms (or people from them) coupled with weak environmental protection ask for localized approaches in which it is tried to advocate and negotiate *in-situ* crocodile conservation directly with local people who have to accept co-habitation with crocodiles. Looking for benefits from crocodile conservation is still key; but with critically endangered species surviving in remote areas sustainable harvesting and eco-tourism are, for a long time to come, non-viable options. Instead, a clear link has to be established between crocodile and wetland conservation and benefits derived from well-protected wetlands such as the year round availability of clean water for irrigation, drinking and washing, and increased fish stocks. Crocodiles can also serve as flagship species, as they do in the municipality of San Mariano, thereby

focusing on immaterial benefits such as pride, interest and enjoyment, which prove to be strong motivational factors even for poor rural communities to protect wildlife.

We think that under current conditions only conservation programs which aim to develop community-based ecosystem approaches in which wetlands are being locally protected and managed for the benefit of people and crocodiles could offer a future for the Philippine crocodile (and perhaps also the other threatened crocodilians of Southeast Asia) in the wild.

Merlijn van Weerd and Jan van der Ploeg, *CROC team leaders, CROC Project Mabuwaya Foundation, EIC Building, ISU Campus Garita, Cabagan, Isabela, Philippines, <vanweerd@cml.leidenuniv.nl, vanderploegjan@pacific.net.ph>.*

PHILIPPINE CROCODILE RECORDED ON DALUPIRI ISLAND. A small population of the critically endangered Philippine crocodile *Crocodylus mindorensis* has been found on Dalupiri Island, in the extreme north of the Philippines. A team composed of researchers from Isla Biodiversity Conservation, the Palawan Wildlife Rescue and Conservation Center (PWRCC) and the Crocodile Rehabilitation, Observance and Conservation (CROC) Project found the species while conducting surveys on 14-21 May 2005 on the islands of Dalupiri and Fuga of the Babuyan group of islands.

An adult female (2.17 m total length) was captured at Caucauayan Creek, a 300 m long freshwater creek flowing over limestone. The presence of six post-occipital scutes and 25 transverse ventral scale rows identifies the animal as *C. mindorensis* (Figs. 1 and 2). The crocodile was immediately released after staff of the PWRCC cut tail scutes (corresponding to an identification number of 12/3/3) and collected tissue samples. Analysis of the tissue collected will provide more information on the relationship of the Babuyan Philippine crocodile sub-population with conspecifics from other island.

The confirmed presence of *C. mindorensis* on this small northern island is remarkable, as it shows that this species was once widely distributed throughout the archipelago from south to the extreme north. *C. mindorensis* is currently known to occur only in small populations on Luzon, Mindanao, and perhaps Negros (Van Weerd and van der Ploeg 2003) and has not been previously recorded north of Luzon. Crocodiles have been sighted on Dalupiri Island in the Manolong River (Ross calls it "Manulong") as early as 1990 but they were not identified to species (Ross 2005). In 2004, a team co-led by CO sighted a crocodile on the island in Caucauayan Creek but its identity was not ascertained (Oliveros *et al*. 2004). This year's survey was conducted in order to verify the identity of the crocodiles on Dalupiri, and to verify the reported presence of crocodiles on Fuga Island. In addition, the abundance and distribution of crocodilian populations on both islands were investigated.

Figure 1. Row of 6 enlarged post-occipital scutes. Photograph: Rainier Manalo.

Figure 2. Crocodile, showing 25 ventral scale rows. Photograph: Carlos Oliveros.

There appears to be a breeding population of the species on Dalupiri. Tracks of two smaller individuals, which we believe were made by a juvenile and a hatchling, were found along Caucauayan Creek. The captured female was carrying eggs and was approximately one to two weeks from parturition, which shows that she could still be capable of breeding. No tracks or eyeshines were observed along the Manolong River and Nipa Creek, which were briefly surveyed. On the island of Fuga, crocodiles disappeared more than a decade ago, mainly due to hunting and habitat loss, according to residents. Other islands of the Babuyan group were visited for biodiversity surveys in 2004 and there are no indications that crocodiles might still occur on these islands.

Dalupiri Island, situated 40 km north of Luzon, occupies an area of 50 square km. Most of this privately-owned island is covered by grassland and scrub, and is used as a

cattle ranch. Forest grows along gulleys, streams and in the north-western region of the island. A small community of 555 inhabitants resides on the island**.**

Local residents claim that crocodiles previously occurred in higher numbers on the island, until they were hunted in the 1970s and 1980s by skin merchants from Luzon. Anecdotal reports mention that 3-10 animals were taken from Manolong River while another two were caught in Nipa Creek. Caucauayan Creek was reportedly not visited by hunters. Crocodile sightings were made at Bumaro Creek around 1975, and at Cabitangaan Creek as late as six years ago. It seems crocodiles were once widely distributed on the island.

We examined a tooth collected by a resident from a dead crocodile at Makmak-ruoy at the northern tip of the island around 1989, although it is possible that this tooth was from an Estuarine crocodile *C. porosus* because it was found near the coast. Crocodiles that residents say used to be washed along the seashore during strong typhoons were also possibly *C. porosus*. There are no indications, however, that *C. porosus* is (still) present in the island or the entire island group.

We showed a television documentary on crocodile conservation and conducted a brief community consultation at the main community center of Dalupiri. We also distributed posters advocating Philippine crocodile and wetland conservation to members of the community and local officials. Local leaders expressed support for the conservation of the Philippine crocodile on the island. Members of the community who were interviewed were mostly supportive but some showed indifference or fear of crocodiles.

Dalupiri Island could be an important site for *in-situ* conservation of the Philippine crocodile. Further studies are being planned to determine any appropriate intervention required to help the crocodile population recover on the island. Consultations with stakeholders, especially with the local community and the island's owners, together with awareness-raising activities are recommended to strengthen their support and develop ownership in the conservation effort.

It also supports the idea that *C. mindorensis* is able to move considerable distances through sea and thus colonize small isolated islands, as it did the islands of Busuanga and Jolo.

The crocodile survey in May was made possible by a grant from Melbourne Zoo, through the support of Chris Banks.

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Carl Oliveros[1], Rainier Manalo[2], Ernesto Coñate Sr.[2], Bernard Tarun[3], Samuel Telan[3] and Merlijn van Weerd[3]; *[1]Isla Biodiversity Conservation, 9 Bougainvillea St., Manuela Subdivision, Las Piñas City, Philippines 1741, <carl_oliveros@yahoo.com>; [2]Palawan Wildlife Rescue and Conservation Center, Irawan, Puerto Princesa City, Palawan, <rimanaloecology@yahoo.com>; [3]CROC Project, EIC Building, ISU Campus, Garita, Cabagan, Isabela, Philippines, <vanweerd@cml.leidenuniv.nl>.*

REVISED PHILIPPINE CROCODILE RECOVERY PLAN PUBLISHED. The second edition of the "National Recovery Plan for the Philippine Crocodile, *Crocodylus mindorensis*, 2005-2008", was published in April 2005 by the Philippines Department of Environment and Natural Resources - Protected Areas and Wildlife Bureau, and Zoos Victoria.

This Plan follows the format of the first version published in 2000, but reflects the significant developments that have occurred since, particularly: confirmation of the species in the Northern Sierra Madre region of north-east Luzon Island and the subsequent *in-situ* conservation program; the increase in US institutions contributing to the captive population; operational and management changes at the Palawan Wildlife Rescue and Conservation Centre (previously the Crocodile Farming Institute and holder of the largest single captive group of crocodiles); and, the importance of clarifying the population genetics of the species.

Zoos Victoria continues to be a major supporter of the conservation program in the Philippines, including funding of field surveys on the Babuyan Islands and upgrading of an educational display near San Mariano, and participation in the second regional conservation workshop at Isabela State University in 2004.

The Plan was written by Chris Banks, as International Co-ordinator on the Philippine Crocodile National Recovery Team, and all printing costs were covered by ZV. A very limited number of hard copies of the Plan are available (from Chris Banks, address below), but a pdf version of the plan can be downloaded from the Zoos Victoria website (www.zoo.org.au).

Chris Banks, *Zoos Victoria, PO Box 74, Parkville, Victoria 3052, Australia.*

Vietnam

CROCODILES FOUND NEAR HYDROPOWER STATION. Siamese crocodiles, thought to be extinct in the wild in Vietnam, were recently recorded in a lakebed near the Song Hinh Hydropower Station in Phu Yen Province.

Surveys were instigated in December 2004, following reports of wild freshwater crocodiles from local villagers and fishermen. A 10-day field survey was undertaken to confirm and assess the status of the crocodile population, including including daytime searches for sightings of crocodiles and their signs (eg dung, tracks, slides, burrows, nests, etc.), night-time spotlighting and interviews with the local people. One fresh track of a large individual was found on a steep swamp bank during a daytime search, while a direct observation of an adult individual was made during a spotlight survey.

These findings reveal there is a small group of wild crocodiles, but their survival is threatened by illegal hunting, habitat destruction and over-fishing. Urgent efforts are needed to save the last wild crocodiles in Vietnam. A conservation action plan is being developd, and awareness raising activities about the global significance of the crocodiles and the need for their conservation will be implemented.

The surveys also identified other potential sites for further crocodile surveys in Viet Nam. The surveys are a joint collaboration of the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP), the Institute of Tropical Biology (ITB), Fauna and Flora International (FFI) Cambodia, and local Government authorities. The Siamese Crocodile is also one of the four designated flagship species of the MWBP's species conservation work in the Lower Mekong Region.

Source*: "Back from the Brink - Wild Siamese Crocodiles Spotted in Viet Nam" (www.mekongwetlands.org/News/index.htm).*

HO CHI MINH CITY AIMS TO BE TOP CROCODILE EXPORTER. HCMC will issue policies to encourage crocodile farming and processing for export, said a leader of Vietnam's southern hub at a seminar held by the municipal Agriculture and Rural Development Department on 12 July. The crocodile industry was urged to accelerate the construction of a crocodile farming village and a tanning factory in a bid to become a high-tech center for processing crocodile products to sell abroad, said Vice Chairman of HCMC People's Committee, Nguyen Thien Nhan. Also, the city will seek to boost local crocodile meat consumption by running food programs at restaurants and hotels.

HCMC has set a target of 150 breeding farms for a crocodile population of 100,000 by the year 2010. Participants indicated that because of backward technology the city's crocodile industry faces difficulties due to unstable markets and high prices of crocodile-related products. The city's agriculture sector should complete a plan to develop crocodile rearing while ensuring income for crocodile breeders.

HCMC currently has nearly 50,000 crocodiles, which are bred on 34 farms. The city has 4 of the 5 CITES-registered crocodile breeding farms in Vietnam.

Cambodia

UPDATE ON CONSERVATION AND MANAGEMENT OF WILD AND CAPTIVE CROCODILES IN CAMBODIA. The purpose of this summary is to provide an update on past and on-going conservation and management activities with wild and captive *Crocodylus siamensis* that have been implemented through cooperation and interaction between the Department of Fisheries (DoF; within the Ministry of Agriculture, Forestry and Fisheries of the Kingdom of Cambodia), the Cambodian Crocodile Development Association (CCDA), crocodile farmers and other stakeholders, and NGOs who have provided financial and technical assistance.

In order to address some concerns and share information among stakeholders, DoF in association with CCDA and the Wildlife Conservation Society (WCS) conducted a workshop on Crocodile Farming and Conservation in 2003, in Siem Reap Province. Many issues were raised at this workshop, including farming technology, markets and lack of effective cooperation and management between farmers and other agencies and institutions. It was suggested that such events should be conducted one or two times per year, to discuss and identify appropriate approaches to improve collection of data and baseline information in order to develop an adequate national conservation and management action plan on both wild and farmed crocodiles in Cambodia. Improved liaison with all stakeholders was also a key goal.

Through its Provincial-municipal fisheries offices, crocodile farms are listed, and have been provided with record-keeping books for data and information relating to farming operations. Furthermore, DoF in collaboration with WCS has been working on: quantifying the distribution of wild crocodiles; demarcating their habitats for setting up of protected areas or crocodile sanctuaries, to assist in the recovery of the wild population; and, research activities. These studies have identified good habitats with wild populations at two sites (Phrasat Domrey, Sangkom Tmey village, Preah Vihear Province; Sre Ambel, Koh Kong Province). For proper continuation of its

program on the conservation and management of wild and farmed crocodiles, DoF needs closer association and cooperation with other Government agencies, NGOs, the private sector and all stakeholders, to encourage more surveys and activities in other targeted areas in order to identify crocodile distribution patterns in the whole country, and effective conservation and management mechanisms.

In February-March 2005, the CSG undertook a review mission on crocodile conservation and management in Cambodia. One of the objectives of this review was to provide recommendations for Cambodia to improve its crocodile management. In order to disseminate the results of the CSG review to stakeholders, including the CCDA, a second workshop was conducted on 5-8 July 2005 in Siem Reap. This important event was held through good organization and collaboration of DoF and relevant agencies, and with funding from the CCDA and Heng Long Leather Company. The importance of this workshop was exemplified by attendance by H.E. Uk Sokhonn (Under Secretary of State of MAFF and Chairman of CITES Management Authority), H.E. Nao Thuok (Director General of DoF and CITES Scientific Authority), Provincial-municipal fisheries officers and crocodile farmers, CCDA, Mr. Koh (Director, Heng Long Leather Co.), Tom Dacey (CSG Executive Officer), Charlie Manolis and Adam Britton (Wildlife Management International) also participated in the workshop.

H.E. Nao Thuok gave a detailed presentation in Khmer on the CSG's findings and recommendations, pointing out what Cambodia has been doing and what needs to be fulfilled. Presentations were delivered on farming technology (eg CITES, IUCN, disease and parasites, egg incubation, hatchling care, nutrition, husbandry, captive breeding, skin quality, marketing), as a first step towards participants improving their capacity and shifting away from outdated farming methods. The workshop provided basic guidelines and principles for farmers to improve activities in the future, and to allow them to better compete on the international market. Participants understood the importance of working to accomplish their goals.

In overview, the results of the workshop, together with the findings and recommendations of the CSG review, have been very useful to DoF and crocodile farmers for the development of a strategy for adequate conservation, management and farming of crocodiles in Cambodia, and identification of constraints to this goal.

1. Constraints

   Crocodile farming is undertaken at different levels, from small, floating village farms to large, land-based operations. Recently, profitability has decreased markedly. Improvement is constrained by:
   - Lack of data and information on crocodile farms.
   - Poor farming technology leading to low skin quality.
   - Illegal ways become a way of life when law enforcement is relaxed.
   - There is no clear plan for future crocodile trade.
   - Increasing costs of feed and limited food supplies.
   - CCDA is not running properly because of internal conflict between its members and unregistered farmers.
   - Poor cooperation between CCDA, farmers, Government agencies and the private sector.
   - Farms have no ability to sustainably invest in crocodiles.

   Suggestions from CCDA and DoF participants:
   - Urgent need to stop illegal trade.
   - Trader and middlemen should trade through CCDA so that records for DoF are more easily collected.
   - DoF to communicate with international markets to identify potential markets for Cambodian crocodiles.

2. Strategies
   - All farmers should be members of CCDA and support activities to promote markets and find partners for investment in sustainable crocodile industries and conservation.
   - Improving crocodile association support from DoF.
   - All crocodile farmers must be registered with DoF for a farming license, and additional farms registered with CITES.
   - All farm should look at improving farming methods to produce high quality skins sought by the international market.
   - Non-Association members that are satellites of member farms should report numbers of crocodiles, etc. to the Association.
   - Work strongly to stop illegal trade.
   - Trader and middlemen should be licensed by DoF and should buy crocodiles through the CCDA.
   - DoF to create a new office on Crocodile Conservation, Management and Farming.

Heng Sovannara, *Department of Fisheries/WCS, Cambodia, <sovannara_2000@yahoo.com>*.

Indonesia

In Indonesia, the Siamese crocodile (*Crocodylus siamensis*) is only found in its natural habitats in the lower Mahakam River system, East Kalimantan (Ross *et al*. 1998). Surveys in 1995 and 1996 (Ross *et al*. 1998) concluded that the population was highly disjunct, and estimated that the population at that time consisted of "several hundred individuals" (Cox 2004). The current status of the *C. siamensis* population is unknown (SCWG 2004), but it is thought to be very small or extinct (Simpson and Han 2004).

A meeting between CSG Chairman, Professor Grahame Webb and Government and industry CSG members in Jakarta in April 2005 (CSGN 2005) agreed that it was important for Indonesian scientists to become more involved with *C. siamensis* (and *T. schlegelii*) conservation efforts in Indonesia, in partnership with the local crocodile industry. As a result of this meeting, a survey was planned and undertaken (9-21 June 2005) as a first step towards the development of a systematic survey program and conservation and management plan.

The specific goals of the survey were to: visit crocodile farms and ascertain the origin/source of *C. siamensis* held; interview local people about the historical and current distribution of crocodiles, types of crocodile present, and daily activities around crocodile habitats; assess potential crocodile habitats; and, identify potential threats on crocodile populations and their habitats.

Results of the survey can be summarised as:

- Siamese crocodiles are still present in the upper Makaham River, and breeding still occurs. More detailed systematic surveys over a wider area are required to assess the current status of the wild *C. siamensis* population.

- Although *C. siamensis* is protected under Indonesian Law and all activities related to the commerce of this species are prohibited, this was not clear to local people and some local crocodile industry members. Wild Siamese crocodiles obtained in 1985, 1995 and 10 days before this survey was undertaken were being held by villagers.

- Numerous waterways in crocodile habitats are fished intensively with fishing nets, hooks and fish traps, which also catch hatchling and juvenile crocodiles. The use of electro-fishing equipment may also have a detrimental effect on the crocodile population.

- Captive breeding has been successful at one of the two farms visited. Adult *C. siamensis* and *C. porosus* previously housed in a common enclosure have produced hybrid offspring. The *C. siamensis* on the crocodile farms represent a significant source of adult stock that could be used to produce crocodiles for restocking, should that prove to be a strategy to adopt in the future. DNA testing would be required to ensure that only pure *C. siamensis* are used for this purpose.

- Wild habitats visited have changed greatly since 1995-1996 (Ross *et al*. 1998), with weeds (eg *Hanguana malayana*, *Eichornia crassipes*) and sedimentation being identified as impacting negatively on the habitats now.

- Pressure on the existing *C. siamensis* habitats is high, and it may not be easy to minimise the threats caused by activities of local people. Community-based conservation is a possible conservation strategy that may be suitable for the local community in the Mahakam River area.

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

Hellen Kurniati, *Research Center for Biology-LIPI, Widyasatwaloka Building, Jalan Raya Cibinong Km 46, Cibinong 16911, West Java, Indonesia, <hkurniati@yahoo.com>*.

Africa

Republic of Congo

From 27 March to 4 April, 2005 we conducted a joint Wildlife Conservation Society (WCS) and National Geographic Television (NGT) expedition to Lac Tele in the northern Republic of Congo. The purpose of the trip was to search for nesting African rock pythons (*Python sebae*), but also to evaluate hunting pressure and the status of crocodile populations in the area of the lake. The expedition also included the Government Conservateur of the Lac Tele Community Reserve (LTCR) and the WCS LTCR Director. Lac Tele is located in the north-west region

of the LTCR, swamp forest/wetland reserve (Congo's only Ramsar Site) allowing sustainable use of wildlife resources by the 26 villages located in or adjacent to the protected area. Lac Tele has been the subject of several previous expeditions seeking to document an extant dinosaur or to confirm reports of a large population of pythons. We presumed the lake to also be an important site for crocodiles, given its location in the vast Likouala Swamp forest and its remoteness from villages. To our knowledge, no crocodile surveys had been performed in the lake or its surroundings. Neither author had previously visited the lake, but ME has an on-going research program in the LTCR on the ecology and conservation of the dwarf crocodile (*Osteolaemus tetraspis*).

Lac Tele lies approximately 65 km (trail distance) from the nearest village on the Likouala aux Herbs River (a tributary of the Sangha and Congo Rivers). The lake forms a near perfect oval, 6 km in diameter along its north-south axis and 4.65 km on the east-west axis (Fig. 1). The lake is very shallow, with an average depth of approximately 4.5 m and a maximum depth of 6 m, which results in extremely warm water temperatures (~37°C). The lake is surrounded by dense swamp forest and appears to either fluctuate seasonally or be slowly increasing in size, as we encountered submerged tree stumps just off shore.

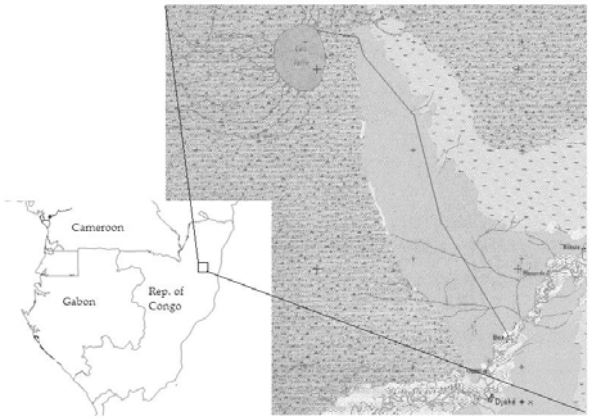

Figure 1. Lac Tele, northern Republic of Congo. Line indicates hiking route from Boha village.

During the 3-day hike to the lake a gaboon viper (*Bitis gabonica*) was captured and filmed. We then spent four days searching the perimeter of Lac Tele from collapsible canoes, covering approximately 11.5 km of the estimated 18.6 km circumference of the lake (62%). We surveyed several of the same areas repeatedly, limiting our surveys to the northern 2/3 of the lake. One python (4 m) was captured and 2 others of undetermined length were observed. Our local guides informed us that python nesting season was earlier - from mid-February to early March - and that we may have arrived too late to find many pythons at the lake's edge.

We surveyed for crocodiles during 3 of the 4 nights at the lake, covering approximately 7 km of the shore and 1.3 km of tributary streams. We also surveyed approximately 10 km of the lake's interior. During lake-shore surveys, we sighted 23 Slender-snouted crocodiles (*Crocodylus cataphractus*, 3.3/km), one Dwarf crocodile (0.14/km) and 16 EO (2.3/km). Based on eye spacing, a few EOs were believed to be medium-sized Slender-snouted crocodiles, but none larger than 1 m were positively identified (Table 1).

Table 1. Size class frequency of Dwarf and Slender-snouted crocodiles in lake (shore) and stream habitats at Lac Tele.

Species	Area	Total Length (m)			Total
		0-0.5	0.5-1.0	1.0-1.5	
O. tetraspis	Shore	0	1	0	1
	Stream	13	6	2	21
C. cataphractus	Shore	16	7	0	23
	Stream	3	5	0	8

Crocodiles spotted on the shoreline were very wary and none were captured. No crocodiles were seen further than 10 m off shore. One Dwarf crocodile was seen in the lake, which was unexpected given the high water temperatures. Dwarf crocodiles may be able to venture briefly in to the lake, but water temperatures may be too high to spend long periods of time. We surveyed 4 river inlets and tributaries on the north and west sides of the lake, sighting 8 slender-snouted crocodiles (6.2/km), 21 dwarf crocodiles (16.2/km) and 16 EO (12.3/km). Two dwarf crocodiles (123 and 143 cm TL) and three slender-snouted hatchlings (50, 55 and 57 cm TL) were captured, all in streams. No Nile crocodiles were observed in the lake or associated streams, and villagers confirmed that none are found in the area.

The porters and guides, all hired from Boha village which maintains traditional fishing rights at Lac Tele, were permitted to fish while at the lake in order to minimise the amount of food carried in for the team. During our 4-day stay, 2 adult, female Slender-snouted crocodiles were killed in fishing nets. One (210 cm TL) was found drowned in a net within 200 m of camp. The skull, a tissue sample and stomach contents were collected. The stomach was relatively empty, with a few catfish spines, fish scales and palm nuts. The palm nuts may be used by the crocodiles as gastroliths, as no stones are available anywhere in the surrounding area. The second animal (231 cm TL) was brought to camp by two youths who had found it, still alive, in their net across the lake. The youths were among a group of porters sent back to Boha after reaching the lake; they decided to remain in the distant camp to fish. The crocodile had been killed with a machete. It is illegal to kill Slender-snouted crocodiles in Congo, and the Reserve Conservateur

ordered the skin removed to submit to wildlife officials in the provincial capital, Impfondo (Fig. 2). The skull was too badly damaged to collect and the stomach was empty, but a tissue sample was taken. Both crocodiles appeared very healthy. In addition to the crocodiles, two wading birds were also drowned in fishing nets set by our team of porters.

Figure 2. Adult female slender-snouted crocodile (*Crocodylus cataphractus*) drowned in a fishing net.

It is very apparent that heavy fishing (and possibly hunting) pressure has significantly reduced the Slender-snouted crocodile population at Lac Tele. Crocodiles may not be targeted directly, due to the difficulty of transporting large quantities of meat back to the village, but appear to be routinely killed in fishing nets. Nets are often placed at the mouths of tributaries to catch fish swimming between the lake and streams, which may also increase crocodile mortality if the cool-water streams are used for nesting or nurseries. Estimated from our short visit to the lake, the net bycatch mortality rate is 0.5 crocodiles/day. It is difficult to assess the impact of hunting/fishing on the size structure of crocodile populations in the lake, based on our nightime surveys. While no slender-snouted crocodiles over 1 m were identified, adult animals may be wary of humans and avoided our spotlight. Fishing nets likely do not discriminate in the size-classes captured, with only the smallest hatchlings able to swim through. Direct hunting of crocodiles however, tends to target sub-adult and adult animals (M. Eaton, unpubl. data). The dwarf crocodile population appears to be relatively healthy in Lac Tele's adjacent swamp forest and numerous tributaries. The lake is too warm for dwarf crocodiles, and most of the human activity seems to be focused at the lake itself.

Although logistical difficulties limit the ability to establish a long-term crocodile research project at Lac Tele, we plan to return in early 2006 to conduct more extensive herpetological surveys in and around the lake.

Mitch Eaton[1] and Brady Barr[2]; *[1]Ecology and Evolutionary Biology, Ramaley N122, Campus Box 334, University of Colorado, Boulder, CO 80309-0334, USA, <eaton@colorado.edu>; [2]National Geographic Society, Washington, D.C., USA.*

North America

United States of America

17TH FATAL ALLIGATOR ATTACK IN FLORIDA. Kevin Murray, 41, became Florida's 17th fatal American alligator attack victim. Described as "a big guy who loved country music, drinking beer with his buddies and working outdoors", Murray never thought twice about jumping into Charlotte County canals for an evening swim. But his end-of-the-workday habit cost him his life on the night of 15 July, when an alligator attacked and killed him.

Murray, a Quality Lawn Service employee, jumped into the canal near the Myakka River after mowing Richard and Laura Bernhard's lawn. Richard Bernhard saw the alligator grab Murray's arm and pull him under shortly after 7 pm. He surfaced once before the animal dragged him down again. A neighbor witnessed the attack from about 200 or 300 yards away, but didn't realize what he had seen until the next morning when he heard the news.

Florida Fish and Wildlife Conservation Commission officers found Murray's body at about 8 pm on Friday, and by 9 pm had caught and killed the 3.71 m long alligator.

Source: Kristen Kridel, *Sarasota Herald Tribune, 17 July 2005*.

COUPLE ARRESTED FOR FEEDING ALLIGATORS. On 22 July, Florida Fish and Wildlife Conservation Commission (FFWCC) officers arrested a Charlotte County couple for deliberately feeding an alligator. James Jones and Jackie O'Neil were charged with feeding alligators, a second degree misdemeanor punishable by up to $US500 and/or 60 days in jail.

This is an offense that the agency's alligator experts say is often associated with fatal attacks against humans. "When fed, alligators quickly lose their natural fear of people and

begin to associate human presence with a feeding opportunity. This altered behavior creates a significant danger that jeopardizes the safety of anyone who may come into contact with that animal," said Harry Dutton, head of FFWCC's alligator management section.

FFWCC trappers were immediately dispatched and removed two alligators (2.67 and 1.80 m TL) from the area. The arrest comes in the wake of an unrelated fatal alligator attack that occurred in nearby Port Charlotte a week earlier (see previous article).

The couple pleaded no contest to the charge, and were placed on 6 months probation and ordered to pay court costs ($US220) and a fine of ($US220). A condition of their probation forbids them from doing any fishing on the Peace River, where the offence took place.

Sources: Gary Morse*, 27 July 200*5; The Led*ger, 8 August 20*05.

Europe

The handbag has become the hottest itemin the £10 billion global, style business. The rise of the "must-have" bag is the fashion phenomenon of the past five years and signals a shift in global business.

Decreasing clothing sales have left major clothing labels struggling, and some of fashion's biggest names are only making ends meet by selling high-margin accessories. For example, for some major labels in Milan and Paris, accessories now account for more than half of sales and are growing at twice the rate of clothes. Recently, Italy's Gucci and Britain's Mulberry revealed that leather goods make up more than 80% of sales.

Recent sales figures confirm that since 1998 total UK spending on women's accessories has increased by almost 40%, while spending on designer clothes has plateaued. It is estimated that women now buy on average three handbags per year, compared to 0.5 as recently as 2000.

Fashion experts point to changes that may explain the "handbag phenomenom". In recent years once-dowdy chains have begun producing their own versions of catwalk styles within weeks of the big-name fashion shows. Consumers have begun buying their clothes in the likes of "Zara", "Top Shop" or bargain-basement "Primark" and using the money they have saved to 'top off' their look with an expensive branded accessory.

The fashion houses are fighting back to protect their lucrative new territory. Chloe, a luxury French label, is taking legal action against Kookai, the high-street chain, over a bag which it claims has been copied and sold at a snip of the price. It claims that Kookai's 'Whip Stitch Pocket Bag', costing £35, is a lookalike version of Chloe's snakeskin Silverado bag which sells for £1086.

Gucci is pinning its hopes on a new crocodile-skin bag which costs more than the average family car (£10,020).

Paraphrased from 'Bags, Ladies' by John Arlidge, The Observer (UK), 24 July 2005; http://observer.guardian.co.uk/focus/story/0,6903,1535037,00.html.

CUBAN CROCODILES HATCHED IN CZECH REPUBLIC. Two *Crocodylus rhombifer* hatched on 22 July 2005 after an incubation period of 81 days, in the private holding of Mr. Miroslav Prochazka of the Czech Republic.

Mr. Prochazka, who is keeping a couple of different crocodilian species, incubated the clutch in a custom-made incubator in vermiculite. The incubation temperature was constant 31.5ºC and the relative humidity was 95%.

The Cuban crocodiles kept by Mr. Prochazka are considered to be pure. If this is not the first successful breeding of pure Cuban crocodiles in Europe (which seems to stil be unclear) it is in any case a great effort for this species in European captivity.

Photograph: Miroslav Prochazka, <porosus@atlas.cz>.

Mr. Prochazka is a very experienced keeper of different crocodilian species, who is still keeping the largest group of *Tomistoma schlegelii* (11 individuals) and the only group of *C. mindorensis* in Europe! He still co-operates with CSG-TTF for genetic research on Tomistoma, and also agreed to co-operate with Chris Banks, who is responsible for the Philippine Crocodile Management Program.

Ralf Sommerlad, *CSG Regional Vice Chairman (Europe), Roedelheimer Landstr. 32, Frankfurt, Germany 60487, <crocodilians@web.de>.*

Science

PREHISTORIC CROCODILE FOSSILS FOUND IN BRAZIL. Scientists in Brazil have unveiled 11 skeletons of prehistoric crocodiles and suggest that an ancient land bridge once linked South America to Indo-Pakistan. The skeletons of *Baurusuchus salgadoensis* appear to be closely related to another ancient crocodile species, *Pabwehshi pakistanesis,* from Pakistan.

Baurusuchus salgadoensis lived around 90 million years ago in an area of southeastern Brazil known as the Bauru Basin. With adults about 3 m long and weighing around 400 kg, this is the largest crocodile species ever discovered in South America. Unlike modern crocodilians, *Baurusuchus* had long legs and spent much of its time walking.

In January 2005, the same team of scientists unveiled a replica of another prehistoric crocodile, *Uberabasuchus terrificus*, which lived along the Sao Paulo coast some 70 million years ago. In December 2004, a replica of *Unaysaurus tolentinoi*, an ancestor of the Brontosaurus that lived 230 million years ago in what is now southern Brazil, was also unveiled.

Source: The Associated Press, *9 June 2005*.

CROCODILIANS DRINKING. In a previous Newsletter [Vol. 22(1), 2003] I discussed that fact that crocodilians have the ability to swallow underwater. While they often come to the surface to swallow prey, they don't have to. They can expel the extra water by squeezing it back out of their stomachs. Of course we all assume that alligators purposely drink water, but it is rarely witnessed. In September 2004 I witnessed an adult female American alligator (*Alligator mississippiensis*) drinking water. She had been out of the water most of the night, and when I noticed her she was still lying on land. She moved her head over the pond and let her lower jaw settle into the water. She tilted her head down toward the water at almost a 45º angle. From the side I could see that she was lowering her tongue, creating a pouch that filled with water. At the same time she was opening her palatal valve. She used her palatal valve and her tongue to push the water to the back of her throat. Her intake of water went on for almost five minutes. I was able to capture a short segment on video, which can be seen at our website: www.alligatorfarm.com. In this video her mouth is closed, but you can see her swallow and see excess water squeeze out from the back of her jaws.

John Brueggen, *Director, St. Augustine Alligator Farm Zoological Park, St. Augustine, Florida, USA, <Jbrueggen1@aol.com>.*

COMMERCIAL CAIMAN PAPER IN CONTEXT: A CASE OF STUDY BOOKS (SCHMIDT IS CRUCIAL), AND THEN NATURE. In the December 2001 issue of the CSG Newsletter, the "Views and Opinions" section consisted of items by Bill Magnusson (20: 72-73) and Stephen Busack (20: 73-75), both of which should be read to better understand why the paper by Busack and Pandya (2001) is still an open question. In the discussion below, scientific names appear as they are spelled in their original sources, unless noted otherwise. It is very confusing because *crocodilus* is a species and *Crocodilus* is a genus (today's *Crocodylus*); and, *caiman* is the same thing *as caïman* as a species, but not the same as the genus *Caiman*, and then Schmidt sometimes uses "caiman" and "Caiman" not in italics.

My immediate criticism of the Busack and Pandya (2001) paper was that they didn't cite the Ross and Mayer (1983) scale counts of Latin American caymans or the technique for obtaining better (more defined and repeatable) results in the dorsal armor than the Busack and Pandya method. Even more serious though, is that Karl Patterson Schmidt (1928) was not cited by Magnusson or by Busack in the Newsletter, nor by Busack and Pandya (2001), though the latter peer-reviewed paper did cite Daudin's 1802 type description of *Crocodilus yacare*.

Before discussing Daudin's 1802 paper, I think K.P. Schmidt deserves his say about the caymans (and the sympatric true crocodiles with whom they share the Neotropics). Schmidt (1928) put the combination *Crocodilus caiman* Daudin in his synonymy of the species *Caiman sclerops* (Schneider); and below it Schmidt said that he "tentatively proposed to restrict the name *sclerops* to the small Spectacled Caiman in northern South America, especially of the lower Amazon, the Guianas and Venezuela. The caiman of northwestern South America and Central America is certainly distinguishable from

sclerops... The identity of the Guiana caiman with the one from the lower Amazon deserves to be investigated... A detailed comparison with the Amazonian *sclerops* remains to be made, but there is little doubt that the small caiman described by Spix, Natterer and Hagmann will be found to be essentially in agreement with the form of the Guianas... According to Hagmann, this species occurs in peaceful association with the much larger *Caiman niger*... The caimans in the Magdalena basin appear to belong with the Panamanian and Central American form, whose range in eastern Colombia is probably coextensive with that of *Crocodilus acutus*... The range of *Crocodilus intermedius* is probably exclusive of and adjoining that *of acutus*, but it occurs with *Caiman sclerops* in Venezuela."

Thus, Schmidt (1928) said that the common cayman of Surinam should be called *Caiman sclerops* (Schneider, from *Crocodilus sclerops*). Today, what Schmidt called *sclerops* as a species is *Caiman crocodilus crocodilus*, according to King and Burke's (1989) ASSC list. This is not the time to discuss the species-group name *crocodilus* Linnaeus, as compared with *sclerops* Schneider; nor to discuss the generic spelling as *Crocodilus* or *Crocodylus*. The matter I wish to pursue is Daudin*'s Crocodilus caïman* of 1802, which is a junior synonym of the species-group name *sclerops* Schneider; and it is also a synonym of the older and thus today senior name *crocodilus* Linnaeus. In this case it doesn't matter if we use *sclerops* or *crocodilus* as a species or subspecies, because Daudin's *caïman* is today always in both, as a junior synonym.

Back in 1802, when Daudin created the taxon *Crocodilus yacare* from the Paraguay region, he consciously distinguished it from *Crocodilus caïman* as a species. It is clear that Daudin's concept of *Crocodilus caïman* was based on a specimen from Surinam. The type description *of caïman* mentioned North America and the Antilles as places that have caymans (spelled "caïmans" in old French) of some sort, and also the Guianas; but, the creature described in detail was a single individual received from a medical doctor named Marin de Baize, who obtained it originally as a native animal, in Surinam. Later in the same paper, Daudin named *Crocodilus yacare* as new; and, he distinguished it from the common cayman of Surinam, before also comparing his *Crocodilus latirostris* with the common cayman of Surinam. He found *latirostris* and *caïman* different as species in skull proportions and dentition, but remarkably similar in dorsal armor. Daudin in 1802 did not know the distribution of today's species *Caiman latirostris*.

Another part of Daudin's problem was that he did not have details about the dorsal scalation of *yacare*, and had to rely on Azara's description of the head and teeth, and coloration. There is no doubt that Daudin based his new taxon *yacare* on Felix d'Azara's travels in the Paraguay region; but, although Azara collected specimens and shipped them back to Europe, they were purposely destroyed by the Spanish authorities. Thus, there was no physical animal or illustration to count scales on; and, there is no type locality for *yacare* other than Azara's itinerary (ie the various places he went while exploring the region). For information about Felix d'Azara, see Beddall (1975, 1983) and Glick and Quinlan (1975).

When, in 1802 Daudin distinguished the common cayman of Surinam from the common cayman of Paraguay and Brazil, he did not have a detailed knowledge of Brazil at the time; because, Spix wasn't published until 1825, and Wagler in 1830, Natterer in 1840, and Hagmann's date is 1906. When Daudin lumped Brazil with *yacare* in 1802, it was technically true, since Schmidt's 1928 paper reports *Caiman yacare* from Brazil, south of the Amazon drainage. Brazil is a big place, though; and the common caymans from the lower part of the Amazon River, near its mouth at the Atlantic, Schmidt (1928) put in his common cayman of Surinam, *Caiman sclerops* (Schneider), with *Crocodilus caïman* Daudin in synonymy. Thus, today southern Brazil h*as yac*are, and northern Brazil has the same species or subspecies as that of Surinam.

Busack and Pandya (2001) agreed with Schmidt's 1928 distribution of *yacare* ranging north from Paraguay into southern Brazil; and, the common cayman of Surinam ranging southward to include the Amazon River part of Brazil. Back in 1928, Schmidt didn't know that *Melanosuchus niger* occurs not only in Brazil, but in Surinam also. Thus, by Schmidt's model, the common cayman of Surinam and the Amazon is avoiding competition with *Melanosuchus* (the big cayman with bold black spots on its jaws); but, south of *Melanosuchus* it becomes possible in theory that *yacare* is avoiding competition with *latirostris*, except that Schmidt found that the distributions of *latirostris* and *yacare* were "mutually exclusive" for the most part. This suggests that *latirostris* and *yacare* are avoiding each other in a geographic sense (allopatry or parapatry), much like big black *yacare* avoids competing with big black *niger*. The new subspecies *Caiman latirostris chacoensis* Freiberg and Carvalho (1965) is apparently truly sympatric with *yacare* west of the Paraguay River (but as relicts only, needs work). For additional newer distribution data for the caymans of southern South America, see Medem's two volume set of 1983 and 1981, Freiberg (1977), Freiberg and Carvalho (1965). Especially useful with keys to whole animals as well as cleaned skulls is Carvalho (1955), which is another important work absent from the bibliography of Busack and Pandya (2001).

It makes me wonder if the common cayman of Colombia and Panama is different from the cayman that coexists with *Crocodylus moreletii* in Chiapas, where the boldness of the common cayman's jaw spotting also reappears in the absence of sympatric *Melanosuchus*. My advice is to take K.P. Schmidt very seriously when dealing with caymans. He used special measurements of the skull that Busack and Pandya didn't use. Be warned that ratios of snout-width to skull-length, for example, can not be compared between

Schmidt and the Busack and Pandya paper. Thus, they didn't test Schmidt's hypothesis about recognizable races of common Latin American caymans, since cranial characters should, in theory, still count. If there is anything "political" going on today, it is throwing the old dorsal armor and cranial characters away, and substituting commercial leather as the real crocodilian. To the best of my knowledge, the classical data ignored the belly as being not understood and difficult to count. The only scholar who claimed to understand the belly skin of the common cayman was Thomas Henry Huxley, and I think it was one of his very few mistakes. When it comes to comparing many different crocodilian genera with each other, what looks like analogy on the belly may possibly not be analogy. Yes, there is a checkerboard pattern with perpendicular series of rows; but, the grid is free-floating and I've found that ventral and lateral scalation characters on the body are a waste of time, at least in the New World *Crocodylus*, when compared with the dorsal armor (including all the way around the tail in Ross and Ross (1974), and the skull. Schmidt never claimed that ventrals and dorsals (counted the way that Busack and Pandya did it) would show significant differences; but, Schmidt did claim that Busack and Pandya are wrong about Cope's *fuscus*, etc.

I think it is time that somebody utilise Schmidt's characters and test his conclusions with bigger samples. I'm convinced that Busack and Pandya, no matter how many people reviewed and commented on their statistics, missed the boat. Schmidt's dental and cranial characters might just be real. I'm not sure who first proposed the use of *yacare* as a subspecies, but Wermuth and Mertens (1961) suggested that Werner (1933) and later Müller and Hellmich (1936) did it (see below), taking the middle ground between Boulenger as a lumper in 1889, and Schmidt as a splitter in 1928 (above). I think we're still there. The only thing I'm sure about in the *yacare* as a species or subspecies controversy is that the dorsal armor data in Busack and Pandya's geographic variation paper is so flawed and poorly defined that no matter how powerful a tool Discriminant Function Analysis is, the basic raw numbers have to be correct, meaning reporting and comparing true analogies.

With regard to Magnusson's 2001 Newsletter item, Schmidt (1928) is quite clear at "The abundant species of the Paraguay River" is not a synonym of the common cayman of Surinam and the Guianas. Further, Schmidt argues that Boulenger's lumping of *yacare* with *sclerops* (today's *Caiman crocodilus*) was not necessary; and, using the word "Formenkreis" discusses the problem that *Caiman latirostris* and *Melanosuchus niger* are remarkably similar to each other for animals in separate genera. However, it is more than just the exposed vomer bone on the palate of niger that distinguishes it from *latirostris*, because the dorsal armor of *Melanosuchus* distinguishes it from all Caiman, especially the missing scale rows at the base of the neck of the living *latirostris*, detailed with vertebral correspondences by Ross and Mayer (1983).

Although it contains some errors discussed by Schmidt, he recommends Natterer as "the only author who has recognized the species of the Paraguay basin as distinct from the Amazonian forms, and his synonymy is already confusing in 1840." In his discussion of *Caiman yacare* (Daudin), Schmidt was convinced that "the caiman abundant throughout the course of the Paraguay above its confluence with the Paraná, or perhaps above the Pilcomayo, represents a distinct species, distinguished from the Amazoni*an sclero*ps by its large size and black coloration, as well as by more technical characters; and that Daudin's name *yacare*, founded exclusively on Azara's account of the Paraguayan Caiman, must be applied to it." Remember that Busack and Pandya used almost none of Schmidt's "technical characters" to refute him. Here the "political" factor enters the equation, since the important parts of Schmidt's data are not available from a sample of commercial belly skins.

In his summary, Schmidt (1928) said that "The forms lumped with *Caiman sclerops* by Boulenger and subsequent authors constitute a 'Formenkreis' in which three geographic forms may be distinguished." (meaning *fuscus, sclerops* and *yacare*). "There is no good evidence of integradation between these three forms, which are consequently ranked as species in the present paper." Later, Schmidt (1933) still considered the "Central American caiman" a species, *Caiman fuscus* (Cope), as distinct from the "Amazonian *Caiman sclerops*" and also distinguishable from the "Paraguayan *Caiman yacare*" using characters only available on cleaned skulls; and, thus also not part of Busack and Pandya's data.

With regard to a question raised as a negative assertion in Busack and Pandya's paper, and also in Busack's Newsletter item, Werner (1933) recognized the subspecies *Jacaretinga crocodilus crocodilus* (Linnaeus), with the published combinations *Crocodilus sclerops* Schneider, and also *Crocodilus caiman* Daudin as junior synonyms. Further, Werner (1933) recognized the subspecies *Jacaretinga crocodilus jacare* (Daudin), *Jacaretinga crocodilus fuscus* (Cope), and also the species *Jacaretinga latirostris* (Daudin) and *Melanosuchus niger* (Spix).

Though I have not seen the Müller and Hellmich authored Gran Chaco Expedition paper of 1936, I have seen where Hellmich (1939) applied *Caiman crocodilus fuscus* to the common cayman of Colombia. The 1936 German use of subspecies in *Caiman* basically followed the 1933 German use of subspecies in *Jacaretinga*, just changing the genus. So, in summary, Werner (1933) revised Boulenger (1889) by agreeing with Schmidt (1928) that the Paraguay common cayman is distinguishable from the Amazonian and Surinam common cayman; but, if Werner had said that he agreed with Schmidt, it would not have been as exciting. Thus, Werner said he agreed with all of Schmidt's ways of

identifying them (Werner's characters are Schmidt translated); but, rather than the three kinds being recognizable species, the common caymans of Schmidt (*sclerops, fuscus* and *yacare*) are just subspecies. Werner thus became a revision, without doing any new work; and, Werner in a sense sided with Boulenger (1889) by returning *fuscus* and *yacare* to the same species as *sclerops*.

Considering that Werner's evidence in 1933 for *yacare* as a subspecies is a translation of the evidence for *yacare* as a species in Schmidt five years earlier, it was Schmidt (1928) who resurrected Daudin's *yacare* as a currently recognized taxon. For a review of the revisions of caymans in South America, including Surinam but not Colombia and Central America, see Carvalho (1955) about 1889 Boulenger, and 1905 Siebenrock, and 1923-24 Lorenz Müller, and 1926 Leuderwaldt, and 1928 Schmidt, and 1933 Werner, and 1933 Kälin, and 1936 L. Müller and Hellmich, and lastly 1940 Mook and Mook.

About the 1936 paper, Carvalho (1955) said "L. Müller e Hellmich (1936) tratando do material coligido pela Deutschen Gran Chaco Expedition, acha que *C. sclerops* e *C. yacare* de Schmidt, sao apenas ravas geograficas de *C. crocodilus* (L.) tendo quando muito, valor de subespecies. *C. crocodilus crocodilus* (L., 1758). bacia do Amazonas. *C. crocodilus yacare* (Daudin 1802). bacia do Paraguai." (sic).

The least understood part of the puzzle is the subspecies *Caiman latirostris chacoensis* and its ecological relations with the common cayman of Paraguay. Freiberg (1977) presented a key using head proportions and dorsal cervical-shield scales to separate *yacare* from *latirostris*; and, then the pterygoid bones and the palatal fenestrae to divide latirostris into the subspecies *latirostris latirostris* as distinct from *latirostris chacoensis*. The type description of *chacoensis* Freiberg and Carvalho (1965) includes dorsal and ventral scale counts of sorts, and coloration. Although Freiberg and Carvalho (1965) used *Caiman crocodilus yacare* (Daudin) as a subspecies; the Argentine paleontologist Chiappe (1988), while creating a new species-group name *(Caiman tremembensis*), recognized both *Caiman yacare* and *Caiman sclerops* as species, in a sense agreeing with Busack and Pandya.

Two 1924 papers by L. Müller, "Zur Nomenklatur der sudamerikanischen Kaiman-Arten" and "Beitrage zur Osteologie der rezenten Krokodilier" are mostly concerned with questions about the correct genus for creatures like *punctulatus* Spix from the Amazon. A 1940 paper by Müller and Hellmich about "Mitteilungen Uber kolumbianische Panzerechsen" recognized *"Caiman crocodilus crocodilus* (Linne)" and also *"Caiman crocodilus fuscus* (Cope)" from Colombia. In their 1940 text, Müller and Hellmich used *"C. cr. crocodilus*" amongst other abbreviations.

While researching this Newsletter update, I found it odd that neither Boulenger (1889) nor Schmidt (1928) mentioned a type locality for *sclerops* Schneider; so, I looked it up. *"Sclerops*" is written in Latin. I don't see a locality on pages 162-164, but the words "Niloticum crocodilum" are there, about something relating probably to Linnaeus. Earlier in Schneider's "Historiae Amphibiorum" Volume 2, on page 139, he discussed Bonnaterre, and names like *"Crocodilum Cayman*" and page 138, *"Crocodilus Cayman*" appear. In the end, it seems that Daudin's *Crocodilus caïman* of 1802 was the first of the common caymans to be named with a type specimen and known locality. It is fitting and proper that he distinguished his other two closely related taxa, *latirostris* (without locality) and *yacare* (without a specimen), from the Surinam animal.

Part of the reason that *sclerops* Schneider was used in preference to *caïman* Daudin is that Cuvier liked the name *"sclerops*" because the curved transverse ridge that gives the "Spectacled Caiman" (of most people's writing) its name is very useful for separating today's genus *Caiman* from *Alligator* and *Paleosuchus*. In 1807, Cuvier didn't know about *Melanosuchus*.

There is a picture in Seba (recently reprinted and now much more available) that Schneider cited, and Cuvier recognized *sclerops* on the basis of it, adding that the Museum in Paris has quite a few more now, known to have come from the Guianas, as "1'espece la plus commune a Cayenne, celle qu'on envoie le plus frequemment de la Guyane" and the word "Surinam" is used before speculation about "M. d'Azzara" in Cuvier's spelling. Though *yacare* Daudin had already been named, there appears to be no mention of it in Cuvier's major revision of 1807 (nor of *Crocodilus caïman* Daudin). Rather, Cuvier's concept of *Crocodilus sclerops* Schneider was general enough that he noted the nesting behavior of the common caymans of Surinam as being different from those of Paraguay, all under *sclerops* without subspecies.

Cuvier's lumping of Daudin's *Crocodilus caïman* and *Crocodilus yacare* into the single tax*on sclerops* makes Daudin's opinion (that the Surinam common cayman is a different taxon than Azara's common cayman) more important than ever. In the "caïmans" (Cuvier's spelling), Daudin was more scientific than Cuvier, since *Crocodilus caïman* was based on a specimen, while Seba's picture was an animal that Cuvier said was supposed by Seba to have come from Ceylon. The same Seba picture is likely the basis of the *Caiman crocodilus* Linnaeus that we use today; but, I have not researched it (Schmidt warned us that Natterer is confusing; and, I'm happy to say that Seba is not part of the Busack and Pandya problem, since they were following the current convention of *Caiman crocodilus* for Surinam, sometimes as *Caiman crocodilus crocodilus*).

My contribution to today's problem is showing that Daudin

made Surinam and Paraguay two species, and Cuvier in essence made Paraguay a subspecies of Surinam, and Boulenger followed Cuvier; but, Schmidt went back to Daudin's view of two named taxa of common caymans in the eastern half of South America. Schmidt went further, though, and recognized *fuscus* from the Magdalena River in Colombia. Busack and Pandya claim that Schmidt was wrong about *fuscus*; and, also that *chiapasius* and *appaporiensis* are not real.

Schmidt created the suite of characters that the Germans used to make three subspecies of common caymans. Schmidt was the first to construct a key that separated Surinam from Paraguay (unless Natterer earlier found the same characters). Lacking specimens of the Paraguay animal, Cuvier passed-up the chance to recognize Daudin's *yac*are. Daudin named three kinds of caymans, two common and one broad-snouted. Two of Daudin's names of 1802, *latirostris* and *yacare*, are still in use today, unless Magnusson (2001) has his way.

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Franklin Ross, *Department of Vertebrates, Naturalis Museum, P.O. Box 9517, Leiden 2399-RA, the Netherlands. The Nationaal Natuurhistorisch Museum, formerly the RMNH.*

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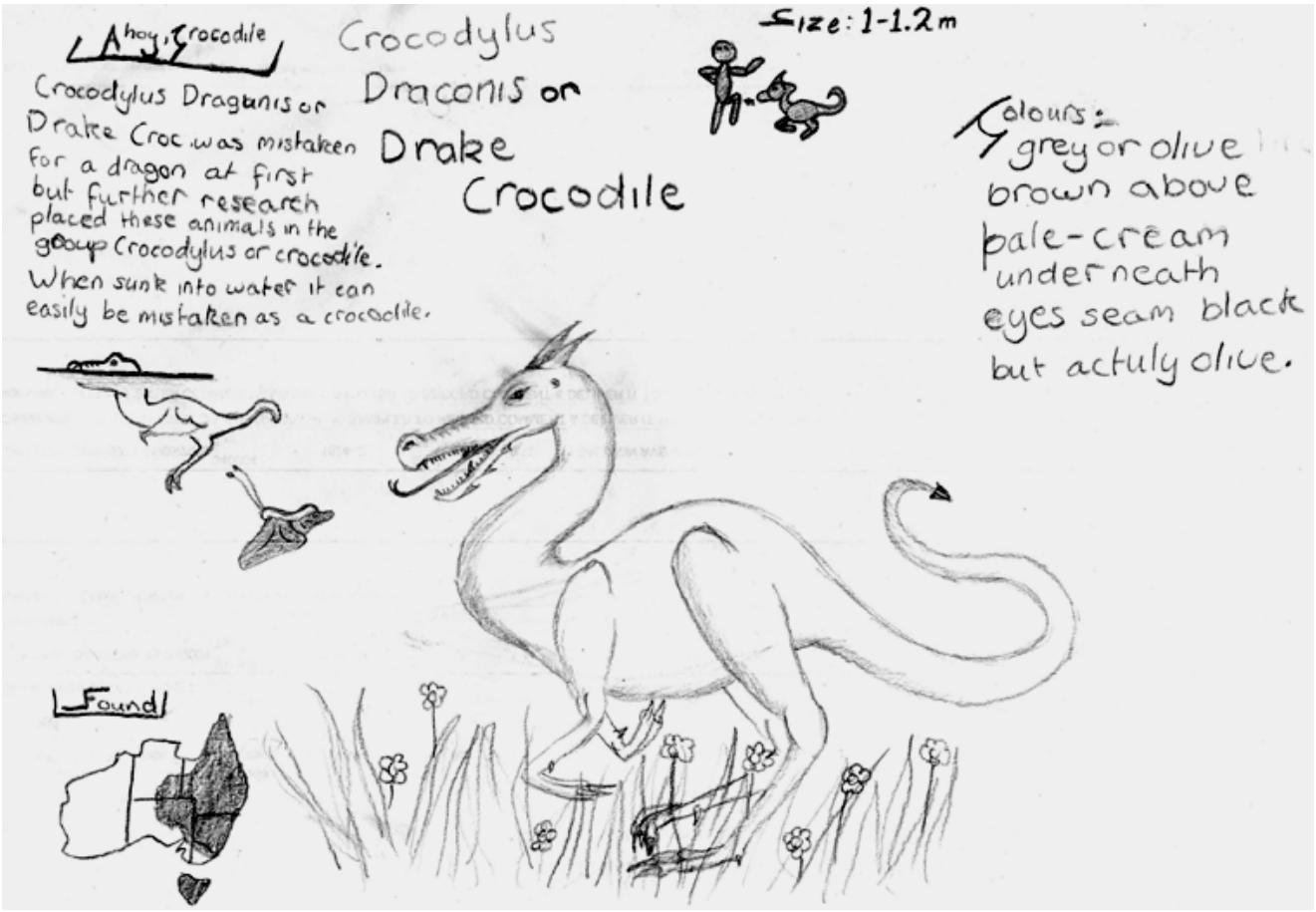

Just when you thought we had enough species! (Jessica K. Riese, aged 9 years).

Zilca Campos, Marcos Coutinho and William E. Magnusson (2005). Field body temperatures of caimans in the Pantanal, Brazil. Herpetological Journal 15: 97-106.

Abstract: Body temperatures of 51 caimans in the Pantanal were monitored by radio telemetry in cool (dry season) and warm (dry and wet seasons) seasons in an area with isolated lakes and an area with intermittent rivers. Cloacal temperatures of 739 caimans of different sizes captured between1830 hrs and 2200 hrs were measured with a digital thermometer between August 1996 and September 1999 in the same area. The masses of caimans monitored ranged from 3 to 42 kg, and caiman size affected the amplitude of body temperatures. Small caimans generally had lower mean body temperatures than larger caimans only at the beginning of the night in the cool season before body temperatures equilibrated with water temperatures. Mean body temperature was 25.7ºC in the cool season and 30.1ºC in the warm season, with a minimum of 16.9ºC and a maximum of 37.9ºC. In the warm season, caimans spent more time in shady areas, on land or in the water, than exposed directly to sunlight, and body temperatures only slightly exceeded water temperatures. In the cool season, caimans basked in the sun, both on land and in water, and caimans on land achieved body temperatures up to 15ºC above water temperatures, but body temperatures of caimans on land rarely exceeded air temperatures during daylight hours. Gravid females did not have higher temperatures than females that were not gravid. The caimans appeared to vary from near thermoconformity in the warm season to active thermoregulation when water temperatures were less than about 28ºC. However, caimans often appeared to give low priority to thermoregulation, and much shuttling behavior may occur for reasons unrelated to thermoregulation.

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Mark Merchant, Damon Thibodeaux, Kara Loubser and Ruth M. Elsey (2004). Amoebacidal effects of serum from the American alligator (*Alligator mississippiensis*). J. Parasitol. 90(6): 1480-1483.

Abstract: Treatment of axenic *Naegleria gruberi* cultures with alligator serum resulted in time-dependent amoebacidal activity, with measurable activity at 5 min and maximal activity occurring at 20 min. The amoebacidal activity was concentration dependent, with measurable activity at 25% serum, whereas treatment of amoebas with undiluted serum resulted in only 16% survival. The efficacy was dependent on the concentration of amoebas, with higher survival rates at high amoeba densities and lower

survival rates at low amoeba densities. The amoeba-killing effects of alligator serum were broad in spectrum because the serum was effective against 3 strains *of Naegler*ia species tested and 4 *Acanthamoeba* species, which have been reported to be resistant to human serum complement-mediated lysis. The amoebacidal effects of alligator serum were temperature dependent, with optimal activity at 15-30°C and a decrease in activity below 15°C and above 30°C. The amoebacidal activity of alligator serum was heat labile and protease sensitive, indicating the proteinaceous nature of the activity, and was also inhibited by ethylenediaminetetraacetic acid, which indicated a requirement for divalent metal ions. These characteristics strongly suggest that the amoebacidal properties of alligator serum are because of complement activity.

[Note: A PDF file of this publication is available at: www.wmi.com.au/csgarticles]

Mark E. Merchant, Brannon Verret and Ruth M. Elsey (2005). Role of divalent metal ions in serum complement activity of the American alligator (*Alligator mississippiensis*). Comparative Biochemistry and Physiology, Part B 141: 289-293.

Abstract: Treatment of alligator serum with different concentrations of EDTA resulted in a concentration-dependent inhibition of serum-mediated sheep red blood cell (SRBC) hemolysis. This inhibition of serum-dependent hemolysis was observed for other chelators of divalent metal ions, such as phosphate and citrate. Treatment of alligator serum with 5 mM EDTA completely inhibited SRBC hemolysis, which could be totally restored by the addition of 5 mM Ca2+ or Mg2+, but not Cu2+ or Ba2+. These data indicate a specific need for Ca2+ and/or Mg2+ in the serum-mediated hemolysis of SRBCs. Kinetic analyses revealed that the addition of 30 mM EDTA 1 min after incubation of SRBCs with serum resulted in only 30% inhibition of hemolytic activity. However, addition of EDTA as early as 3 min post-incubation resulted in complete SRBC hemolysis. Pretreatment of serum with EDTA inhibited the hemolytic activity, but the activity could be restored in a time-dependent manner by the addition of Ca2+ or Mg2+. These data indicate that, as in human serum, the need for divalent metal ions occurs early in the alligator serum complement cascade.

[Note: A PDF file of this publication is available at: www.wmi.com.au/csgarticles]

Mark E. Merchant, Cherie M. Roche, Damon Thibodeaux and Ruth M. Elsey (2005). Identification of alternative pathway serum complement activity in the blood of the American alligator (*Alligator mississippiensis*). Comparative Biochemistry and Physiology, Part B 141: 281-288.

Abstract: Incubation of different dilutions of alligator serum with sheep red blood cells (SRBCs) that had not been sensitized with antibodies resulted in concentration-dependent hemolytic activity. This hemolytic activity was not affected by the presence of ammonium hydroxide and methylamine, known inactivators of the classical complement cascade. However, the hemolytic activities were inhibited by EDTA and salicylaldoxime, indicating that the alternate pathway is primarily responsible for these activities. Immunofixation of electrophoreticallyresolved alligator serum proteins with antihuman C3 polyclonal antibodies resulted in detection of a protein antigenically similar to human C3 in alligator serum. SDS-PAGE, followed by Western blot analysis, revealed the presence of two alligator serum proteins with nearly identical molecular weights as human C3α and C3β. SRBC hemolysis and antibacterial activity by alligator serum was significantly reduced in the presence of antihuman C3 antibodies. The hemolytic effect of alligator serum was shown to occur rapidly, with significant activity within 5 min and maximal activity occurring at 15 min. SRBC hemolysis was also temperature-dependent, with reduced activity below 15°C and above 30°C. These data suggest that the antibiotic properties of alligator serum are partially due to the presence of a complement facilitated humoral immune response analogous to that described in mammalian systems.

[Note: A PDF file of this publication is available at: www.wmi.com.au/csgarticles]

Mark E. Merchant, Melanie Pallansch, Robin L. Paulman, Jay B. Wells, Aysegul Nalca and Roger Ptak (2005). Antiviral activity of serum from the American alligator (*Alligator mississippiensis*). Antiviral Research 66: 35-38.

Abstract: Serum from wild alligators was collected and tested for antibiotic activity against three enveloped viruses using cell-based assays. Alligator serum demonstrated antiviral activities against human immunodeficiency virus type 1 (HIV-1; IC50 = 0.9%), West Nile virus (WNV; IC50 = 4.3%), and Herpes simplex virus type 1 (HSV-1; IC50 = 3.4%). The inhibitory concentration (IC50) is defined as the concentration of serum that inhibits 50% of viral activity. The antiviral effects of the alligator serum were difficult to evaluate at high concentrations due to the inherent toxicity to the mammalian cells used to assay viral activities. The TC50 (serum concentration that reduces cell viability to 50%) values for the serum in the HIV-1, WNV, and HSV-1 assays were 32.8, 36.3 and 39.1%, respectively. Heat-treated serum (56°C, 30 min) displayed IC50 values of >50, 9.8 and 14.9% for HIV-1, WNV and HSV-1 viruses, respectively. In addition, the TC50 values using heat-treated serum were substantially elevated for all three assays, relative to untreated serum (47.3 to >50%). Alligator serum complement activity has been shown to be heat labile under these conditions. HIV-1 antiviral action

was heat-sensitive, and thus possibly due to the action of serum complement, while the anti-WNV and anti-HSV-1 activities were not heat labile and thus probably not complement mediated.

[Note: A PDF file of this publication is available at: www.wmi.com.au/csgarticles]

Christopher P. Kofron (2004). The trial intensive management area for crocodiles: a crocodile removal zone in Queensland, Australia. Coastal Management 32: 319-330.

Abstract: The Estuarine Crocodile (*Crocodylus porosus*) is the world's largest living crocodile, and in Queensland it inhabits tropical coastal wetlands and waterways. From 1990 to 2001, there have been nine substantiated crocodile attacks on people in Queensland, resulting in one death and eight serious injuries. Several crocodile attacks occurred in the Cairns area during these years, and Cairns's popular swimming beaches have been closed on a number of occasions because of crocodiles. Human safety from crocodile attack is an issue of great public and political concern in Queensland. From May 1998 to June 2001, the Queensland Parks and Wildlife Service operated a trial crocodile removal program in the Cairns area, with a removal zone that extended 70 km along the coast. The program was named the Trial Intensive Management Area for Crocodiles (TIMAC), and its primary purpose was to protect the Cairns's popular swimming beaches from crocodiles. The program was expanded to provide a problem crocodile response service throughout north Queensland and to train additional rangers in crocodile management skills. During the three years of the TIMAC program, 80 crocodiles were captured in north Queensland: 46 crocodiles from within the removal zone, and 34 from outside the removal zone. There were no crocodile attacks in the removal zone during the three-year trial program. At the request of local governments, the program became permanent in July 2001. In effect, Cairns is the only tropical city whose popular swimming beaches are protected by a combination of a lifeguard service, a shark control program, netted enclosures (seasonal) for protection from dangerous Box Jellyfish (*Chironex fleckeri*), and a crocodile removal program.

[Note: A PDF file of this publication is available at: www.wmi.com.au/csgarticles]

Requests

My name is Jonathan Wagner, and I am a PhD student in the Department of Geological Sciences at the University of Texas at Austin, studying under Dr. Tim Rowe. My dissertation project is on the phylogenetic relationships of the jacarean caimans (*Caiman* and *Melanosuchus*), including both broader relationships among the species, and investigation of the relationships among the populations and subspecies of *Caiman crocodilus*.

I will be using molecular markers (from both mitochondrial and nuclear genes) and morphological characters to reconstruct caiman phylogeny. My immediate goals are:

1. to examine the relationship between molecular and morphological divergence among these animals, to assist in understanding patterns of diversity in the fossil record;
2. to understand the relationships among caimans, and the status of subspecies within the group, as an aid to conservation efforts; and,
3. to develop an understanding of the pattern of caiman evolution relative to the geologic history of South America by incorporating fossils into my analysis.

Because a project of this nature requires large numbers of tissue samples from all over Central America, I am seeking assistance from CSG members. So far the response has been overwhelming. To date I have received offers of samples, referrals to possible sample sources, advice, or other support from many CSG members, including Laurent Abadie, Lucy Aquino, Yeda Bataus, Adam Britton, Chris Brochu, Steve Busack, Fernández Buzó, Adrian Reuter Cortes, Marcos Coutinho, Zulma Gasparini, John Gatsey, Evon Hekkala, Wann Langston, Alejandro Larriera, Alfonso Llobet, María de la Paz López, William Magnusson, Martha Motte, Manuel Muñiz, Devon Pearse, Paulino Ponce-Campos, Walter Prado, Norman Scott, Andres Seijas, Luis Sigler, Pablo Siroski, Jack Sites, Benoit de Thoissy, Alvaro Velasco, Luciano Verdade, Kent Vliet, Grahame Watkins and Grahame Webb. David Kledzik and John Brueggen have already provided samples, Lew Densmore has provided a number of samples and is serving on my dissertation committee, and George Amato has offered to provide samples collected from across South America as part of a previous study.

After a brief delay in my research caused by the birth of my son, I am now beginning the process of collecting and processing samples, and ensuring that the Texas Memorial Museum has the appropriate permits to legally import blood samples from other countries. I have not yet managed to secure offers of samples from all of the locations I need, and I would appreciate any further help CSG members could provide. Particularly important will be samples of *Caiman latirostris* from outside Argentina, *Melanosuchus* from the southern and eastern parts of its range, and *Caiman crocodilus* spp. from the Colombian llanos, but samples from almost anywhere would be helpful.

I am very interested in collaborating with other workers, either through coauthorship or trading of samples (or both), and I welcome comments on any and all topics related to

my project. A copy of my dissertation proposal is available on request; copies will be mailed soon to those who have already requested them.

Jonathan R. Wagner, *2625B Alcott Lane, Austin, TX 78748, USA, <jonathan.r.wagner@mail.utexas.edu>*.

FROM SICKNESS TO SANCTUARY

A couple of sick American crocodiles, have spurred Cherie and Vince Rose in Belize into action. Having bought property on the Rio Grande, they were excited to see that a 9-foot female *Crocodylus acutus* (Fig. 1) lived in a nearby canal. In June this year, 14 hatchlings were seen in the canal, and Cherie, a marine biologist, has been observing the behaviour of the crocodiles.

Figure 1. Adult, female *C. acutus* living near Cherie and Vince Rose's property in Belize.

Figure 2. One of the two sick *C. acutus* hatchlings that subsequently died.

When two of the hatchlings appeared ill (Fig. 2), Cherie found it difficult to find assistance within Belize, and began asking for help from any crocodile experts she could find. Many CSG members responded (thanks to Frank Mazzotti, Perran Ross, Grahame Webb and Fritz Huchzermeyer especially), and although advice was given, these two hatchlings died. The cause of these deaths remains unknown, and all other hatchlings and mother are OK - as are turtles and other aquatic creatures within the canal.

Due to the lack of local knowledge about crocodiles in general (a vet suggested feeding the sick hatchlings fruit and vegetables …!!!), Cherie wishes to establish a non-profit sanctuary (American Crocodile Endangered Sanctuary - ACES) to: provide care for sick and injured wildlife; collect scientific data on American crocodiles with a conservation focus; and, establish a long-term management plan for these crocodiles.

Cherie and Vince would like any assistance CSG members could offer on establishing a sanctuary, as well as field work techniques such as tagging, GPS, surveying, etc. For more information or photographs of these crocodiles, or advice for Cherie, please respond via e-mail to Cherie and Vince Rose <ppinpg@direcway.com>.

Compiled by Colin Stevenson <coleosuchus@hotmail.com> from information provided by Cherie Rose.

18th CSG Working Meeting

Location: Hotel du Monard, 5km out of Montélimar, France

Hosted by: La Ferme aux Crocodiles at Pierrelatte

Dates: 19 June - CSG Steering Committee meeting
20-23 June - Working meeting
24 June - field trip (optional)

Registration: Online at <www.lafermeauxcrocodiles.com/meeting>.

Papers: Submit through <www.lafermeauxcrocodiles.com/meeting>.

Accommodation: All accommodation is being handled through the Montélimar tourist office <congres@montelimar-tourisme.com>. Details on hotels will be posted on the website soon.

Additional information available from: Samuel Martin (info@lafermeauxcrocodiles.com; Tel: 33 4 75 960931; Facs: 33 4 75 963907).

West Asia Region Meeting

A round table meeting of West Asia region CSG Vice Chairs and several proposed CSG members from the region (India, Nepal, Sri Lanka) is planned for 18-19 October 2005 in Lucknow, during a meeting being hosted by the Madras Crocodile Bank (see also"Bangladesh", page 10).

B.C. Choudhury, CSG Regional Chairman for West Asia.

Steering Committee of the Crocodile Specialist Group

Chairman: Professor Grahame Webb, P.O. Box 530, Sanderson, NT 0813, Australia
For further information on the CSG and its programs, on crocodile conservation, biology, management, farming, ranching, or trade, contact the Executive Office (csg@wmi.com.au) or Regional Chairmen

Deputy Chairmen: Dr. Dietrich Jelden, Bundesamt für Naturschutz, Konstantin Str. 110, D-53179 Bonn, Federal Republic of Germany, Tel: (49) 228 849 1453, <JeldenD@bfn.de>. Alejandro Larriera, Pje. Pvdo. 4455, Centeno 950, Santa Fe, Argentina, Tel: (543) 42 4531539, Fax: (543) 42 558955, <yacare@arnet.com.ar>.

Executive Officer: Tom Dacey, P.O. Box 98, Clifton Beach, QLD 4871, Australia, Tel/Fax: (61) 7 40553060, Cell: (61) 419704073, <csg@wmi.com.au>.

Treasurer: Dr. Perran Ross, Department of Wildlife Ecology and Conservation, P.O. Box 110430, University of Florida, Gainesville, FL 32611, USA, Tel: (1) 352 392 7137, <rossp@wec.ufl.edu>.

Regional Chairman, Africa: Dr. Richard Fergusson, 8 Maiden Dr., Highlands, Harare, Zimbabwe, Tel/Fax: (263) 47 76203, Cell: (263) 91 285103, <zeahtco@zol.co.zw>. **Regional Vice Chairmen:** Madagascar, Olivier Behra <OlivierBehra@MATE.mg>; West Africa, Ekkehard Waitkuwait <Wwaitkuwait@aol.com>.

Regional Chairmen, East and Southeast Asia: Dr. Jenny Daltry, FFI Cambodia Programme, P.O. Box 1380, Phnom Penh, Cambodia BKK 1, Tel: (855) 23 294934, Fax: (855) 23 211142, <jenny.daltry@fauna-flora.org>; Jiang Hongxing, State Forestry Administration of China, <hxjiang@forestry.ac.cn>. **Regional Vice Chairmen:** Dr. Choo Hoo Giam <giamch@pacific.net.sg>; Dr. Nao Thuok <naothuok@mobitel.com.kh>; Uthen Youngprapakorn <thutcroc@ksc15.th.com>; Yosapong Temsiripong <yosapong@srirachamoda.com>; Toshinori Tsubouchi <ttubouti@fd5.so-net.ne.jp>; Hellen Kurniati <hkurniati@yahoo.com>; Julie Thomson <julie@traffic.netnam.vn>.

Regional Chairman, Australia and Oceania: Charlie Manolis, P.O. Box 530, Sanderson, NT 0813, Australia, Tel: (61) 8 89224500, Fax: (61) 8 89470678, <cmanolis@wmi.com.au>. **Regional Vice Chairmen:** David Wilken <crocfarm@mainland.com.pg>; Steve Peucker <steve.peucker@dpi.qld.gov.au>.

Regional Chairman, West Asia: B.C. Choudhury, P.O. Box 18 Chandrabani, Dehra Dun, Uttaranchal, India, <bcc@wii.gov.in>. **Regional Vice Chairmen:** Harry Andrews <mcbtindia@vsnl.net>; Dr. Tirtha Man Maskey <maskey@gausala.wlink.com.np>; Jayantha Jayawardane <romalijj@eureka.lk>; Abdul Aleem Choudhury <mhaleemi@isb.iucnp.org>; Ashgar Mobaraki <amobaraki@hotmail.com>; Dr.S.M.A. Rashid <carinam95@yahoo.com>.

Regional Chairman, Latin America and the Caribbean: Alvaro Velasco, Apartado Postal 66597, Caracas, Venezuela, Tel: (58) 414 254 6054, <velascoalvaro@tutopia.com>. **Regional Vice Chairmen:** Central America, Manuel Muñiz <moreletii@prodigy.net.mx>; Caribbean, Roberto Soberón <soberon@ffauna.sih.cu>; northern South America, Giovanni Ulloa <croco_mangle@hotmail.com>; southern South America, Luciano Verdade <lmv@esalq.usp.br>; Regional Trade, Bernado Ortiz <bernardo.ortiz@traffic.sur.iucn.org>.

Regional Chairman, Europe: Dr. Jon Hutton, Fauna & Flora International, Africa Programme, Great Eastern House, Tenison Rd., Cambridge CB1 2DT, UK, Tel: (44) 1223 571000, Fax: (44) 1223 461481, <jon.hutton@fauna-flora.org>. **Regional Vice Chairman:** Ralf Sommerlad, Roedelheimer Landstr. 42, Frankfurt Hessen, Germany 60487, <crocodilians@web.de>.

Regional Chairmen, North America: Dr. Ruth Elsey, Louisiana Wildlife and Fisheries Department, 5476 Grand Chenier Way, Grand Chenier, LA 70643, USA, Tel: (1) 337 5382165, Fax: (1) 337 4912595, <relsey@wlf.louisiana.gov>; Allan Woodward, Florida Fish and Wildlife Conservation Commission, 4005 S. Main Street, Gainesville, FL 32601, USA, Tel: (1) 352 9552230, Fax: (1) 352 3765359, <allan.woodward@myfwc.com>. **Regional Vice Chairmen:** Noel Kinler <kinler_n@>wlf.state.la.us>; Harry Dutton <harry.dutton@myfwc.com>.

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Vice Chairman, Zoos and Education: Kent Vliet, University of Florida, Gainesville, FL 32611, USA, Tel: (1) 352 3928130, Fax: (1) 352 3924738, <kent.vliet@zoo.ufl.edu>.

Vice Chairman, General Research: Dr. Valentine Lance. Graduate School of Public Health, San Diego University, San Diego, CA, USA, <lvalenti@sunstroke.sdsu.edu>.

CSG Red List Authority: Dr. John Thorbjarnarson, Wildlife Conservation Society, P.O. Box 357625, Gainesville, FL 32635-7625, USA, Tel: (1) 352 2647775, <jthorbjarnarson@wcs.org>.

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Task Force/Working Group Chairmen: Indian Gharial, Nikhil Whitaker <kachuga21@hotmail.com>; **Chinese Alligator**, Jiang Hongxing <hxjiang@forestry.ac.cn>; **Tomistoma**, Ralf Sommerlad <crocodilians@web.de>; **Philippine Crocodile,** Chris Banks; **Commercial Live Exports**, Dr. Perran Ross <rossp@wec.ufl.edu>.

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