

CROCODILE SPECIALIST GROUP

NEWSLETTER

VOLUME 19 No. 2 ■ APRIL 2000 – JUNE 2000



IUCN - World Conservation Union ■ Species Survival Commission

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IUCN--The World Conservation Union
Species Survival Commission

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COVER PHOTO. Siamese crocodile
(*Crocodylus siamensis*) from the Cardamom
Mountains, SW Cambodia, a new locality for
the species. See page 7. J. Daltry photo

The CSG NEWSLETTER is produced and distributed by the Crocodile Specialist Group of the Species Survival Commission, IUCN - World Conservation Union. CSG NEWSLETTER provides information on the conservation, status, news and current events concerning crocodilians, and on the activities of the CSG. The NEWSLETTER is distributed to CSG members and, upon request, to other interested individuals and organizations. All subscribers are asked to contribute news and other materials. A voluntary contribution (suggested \$40.00 US per year) is requested from subscribers to defray expenses of producing the NEWSLETTER. All communications should be addressed to: Dr. J. P. Ross, Executive Officer CSG, Florida Museum of Natural History, Gainesville, FL 32611, USA. Fax 1 352 392 9367, E-mail prosscsg@fmnh.ufl.edu

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Editorial

DID YOU FORGET (AGAIN)?

Your last issue of the Newsletter contained a **subscription renewal** form that should be returned to keep your Newsletter coming. Last year we tried the 'hard' approach,— no response- no Newsletter. Subscriptions dropped from 978 to 692 before bouncing back to current levels of around 830. This year we will try the 'soft' approach — please return your subscription form so that we can keep your address current and your newsletter arriving regularly, and if you would like to support the newsletter with a donation, that's fine too. If you know anyone who got bounced from our list last year for not responding, or someone else you think would enjoy the CSG Newsletter— all you have to do is send a request to me here with the mailing address.

CHINESE ALLIGATOR CONSERVATION. The alarm raised at the 15th Working Meeting in January about the declining status of the Chinese alligator has prompted a flurry of activity. As reported in the last Newsletter, a draft letter was forwarded from CSG to the Director General of IUCN with a request that this be forwarded to the Forestry Administration in China expressing concern about the situation. We also arranged a meeting with the chief administrator of Forestry during the CITES Meeting in Nairobi and prepared a draft of a resolution that might be presented to the IUCN World Conservation Congress in October.

CSG Vice Chairman for East Asia, Australia and Oceania, Dr. Grahame Webb and Dr. Susan Mainka of SSC, Gland, met with Mr. Wang Zhibao of the State Forestry Administration and briefly discussed our concerns in Nairobi in April.

With the direct support of David Bracket, Chairman of SSC, and some minor editorial changes, Ms. Maritta R. von Bieberstien Koch-Weser, Director General of IUCN sent our letter to Mr. Wang Zhibao and received a most cordial and responsive reply.

In part, Mr. Wang's letter said, "In order to cease the deteriorating trend, protect and increase the wild population of Chinese alligator a Draft

10-year plan on the Conservation of the Chinese alligator is under discussion among relevant departments of the Forestry Administration and forestry departments in Anhui, Jiangsu and Zhejiang provinces. The prime tasks of this plan are to establish and protect Chinese alligator habitat, release the captive breeding population to increase the population in the wild, reintroduce the Chinese alligator to those areas where the species has been extinct, develop a long-term management plan and set up a special department to insure lasting financial support. We sincerely hope that IUCN could participate in the formulation of the Draft Plan by offering technical support and putting forward advice on conservation. We also warmly welcome IUCN to China to conduct projects on Chinese alligator conservation, wetland conservation and to seek funding alternatives and technical support jointly with this administration and the international community.”

Responding to this invitation, Professor Messel, Chairman of CSG, has immediately offered our advice and technical assistance in a letter to Mr. Wang. We are currently awaiting his response to arrange details but anticipate that John Thorbjarnarson, who will visit China again in August under the auspices of the Wildlife Conservation Society, will also communicate with Mr. Wang on our behalf. The active involvement of the CSG regional office in this project is anticipated.

In related and independent activity. The information provided by John Thorbjarnarson's report (available at <http://www.wcs.org>) has prompted a vigorous discussion and great concern on CROCLIST, the crocodylian discussion listserver managed by Adam Britton and Ragnar Lonn. This has put the issue before a completely new, and quite large audience of crocodylian aficionados, amateur croc keepers and interested researchers and students, many of whom are not directly linked with CSG. From this discussion emerged the proposal to raise a special fund source to directly support Chinese alligator conservation. CROCLIST participants and CSG contacts Billy Heinbuch, Tim Weigman, Adam Britton and John Binns at cyclura.com have run with this idea and produced web pages with information and a donation request and mechanism. They invited CSG to assist by managing this fund, and after discussion and approval by the Chairman, a new special account has been set up— The Chinese

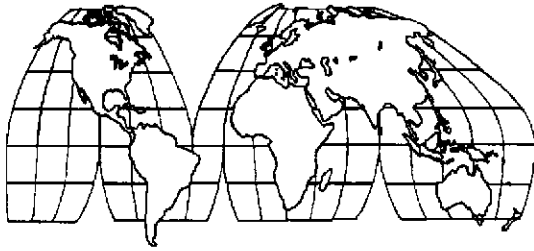
Alligator Conservation Fund— exclusively to receive these donations and apply them directly to Chinese alligator conservation. The fund has immediately attracted donations totaling \$1,050 (Thank you Kevin Wang and Irvin Smith) and we anticipate much more as this fund drive becomes more widely known. Details of this activity can be seen at <http://www.flmnh.ufl.edu/natsci/herpetology/brittoncroc/alligatorfund.html>. One initial proposal is the fund support environmental activities at the Anhui Center for Chinese Alligator Reproduction. This and other proposals will be evaluated by a small advisory committee of the CSG Chairman, Grahame Webb, Adam Britton and a representative and major donor from the CROCLIST group. Adam also successfully placed an article on this issue on the Discovery Channel TV web page at <http://animal.discovery.com/features/crocodiles/conservation.html>.

Additional contacts have been made to TRAFFIC Hong Kong, which has extensive contacts within China and to Mr. Michael Lau, member of the Chinese Reptile and Amphibian Specialist Group, who will present the issue to that forum for their support at their meeting in Chengdu, China, in July.

While one of our concerns in January was that a care must be taken not to alienate Chinese authorities with undue criticism, the very positive tone of Mr. Wang's letter and the responsible content of all the materials referred to above appear to be maintaining the right balance of concern and positive action and support that will be productive.

Elements of possible action that are not currently progressing are the resolution, which is currently under review by Chinese Forestry Administration, but may not be in time for acceptance at IUCN, and the proposed integration with GTZ (German Aid Agency) and GEF (Global Environmental Facility) efforts for wetlands conservation in China. CSG will continue to facilitate all elements of the issue while encouraging responsible and effective independent action by all the players and stakeholders. We have a vital role to play if this complex and large scale crocodylian conservation problem is to be moved forward to a positive result. Perran Ross, *Executive Officer Crocodile Specialist Group, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611, USA.*

Regional Reports



Africa

Mauritania

REMNANT CROCS IN THE SAHARA. Wolfgang Bohme of the Zoologisches Forschungsinstitut and Museum Alexander Koenig in Bonn, Germany, and his team found a population of Nile crocodiles during a reptile study of the western Sahara. Hearing of an enigmatic crocodile colony in southern Mauritania, they traveled to a large rocky plateau ruptured by crevices and cavities. There, some 5 m down, they saw water and found an underground pond about 20m wide containing four adult crocodiles. The adults were about 2 m long, compared to up to 6m for other Nile crocodiles.

Bohme described the Mauritanian crocodiles as a tropical relic that has managed to survive for thousands of years in isolation from other crocodile populations. Only 10,000 years ago most of the Sahara was a fertile savanna. As the desert expanded it cut off some groups in refuges like the underground water system that Bohme's team found.

Zoologist Steven Perry of the University of Bonn said, "Finding a new population of large animals is sensational. These animals are a rare model of a new species in the process of being formed." Nile crocodiles have been found in one other unexpected desert location, a mountain range in Chad. [See also CSG NEWSLETTER Vol. 13(1):4-5. For a prior report of Mauritanian desert crocodiles - *Eds.*]. Bohme's team hopes to continue studies, including radio tracking to examine their lifestyle and how they get along in such a confined area. - From SCIENCE, Science News, Vol. 287, 18 Feb 2000.

South Africa

KRUGER NATIONAL PARK REPORT. A five year study (1994 - 1998) in the Olifants River in the Kruger National Park (KNP) has just been completed. This study centred around the movements of large adult Nile crocodiles (*Crocodylus niloticus*) of both sexes in the lower river system, nesting habits and the possible influence of metal pollution in the river on crocodiles, and was a the first of its kind in any national park in South Africa.

The Olifants River is one of six large rivers crossing the park from west to east and is a perennial river. It flows for about 108 km through KNP before entering Mozambique in the east. There are no man-made structures obscuring the flow of the river in the park bar one weir on the extreme western boundary of the park. Outside the park, there are about 2500 dams of various capacities in the catchment area which is one of the largest of the six rivers crossing Kruger park. On the eastern side, just inside Mozambique and about 7 km from the park boundary, there is a big dam in the river. Industrial affluent is the greatest source of pollution in the river although agriculture contributes quite substantially as well. Just before the river enters KNP, some three large mines utilise the Olifants as a water source for operations. This is the one of the major sources of metal pollution in the river. Of all the six major rivers crossing KNP, the Olifants has the highest density of crocodiles, some 2500 individuals, and the total population for the park is an estimated 4600. The population in the study area varied from a low 62 to a high 697 individuals at different times of the year.

The study in the Olifants river comprised of 11 large crocodiles, all larger than 3 m total length, fitted with radio transmitters and monitored over 2 years. The whole study area of about 32 km, was annually searched for nesting sites over the five year period, and a total of 11 crocodiles were autopsied and tissue samples (muscle, kidney, liver fat and bone) analysed for metal content.

Individuals were captured at various locations in the study area, using cages, and selected randomly on sizes, only females >3 m and males > 3.5 m were fitted with transmitters. All sizes are total length. Seven males and 4 females were radio-collared, but 3 transmitters were lost in rapid succession shortly afterwards. None could

be retrieved. One female (3.1 m) remained relatively static throughout the study period of 2 years and systematically moved 4 kilometres down stream over six months before losing the transmitter. The remaining female (3.1 m) initially remained stationary, but during the rainy season moved some 9 km down stream to Mozambique and returned to the capture site three months later. The round trip was about 32 km.

Two of the seven males (both 3.9 m) remained relatively static with one moving about 3 km down stream from the capture site and the other one remained in an area of about 0.9 km around the capture site. The remaining five males varied from 3.3 to 4.3 m in length and all moved from their initial capture sites with one returning and the other four remained in Mozambique. A male of 4.1 m moved the shortest distance of 9.3 km and the longest distance of 32 km was covered by a male of 3.7 m. The latter and one female were captured at the same site and both moved to Mozambique and returned to the capture site. The round trip of 32 km took them both four months to complete and coincided with peak flow volumes. Foot counts were used simultaneously with the radio telemetry, to monitor numbers in the study area and it was found that the majority of the population moved from one season to the other. Numbers reached their peaks at the same time every year at different locations indicating that the population utilised the entire study area with larger concentrations at different locations during different times of the year.

This result led us to believe that the population moved to various locations in the river for various and different reasons. The mating season saw a segment of the population concentrated in areas with deep slow flowing pools whilst nesting resulted in the majority of crocodiles being outside the study area although an average of 64 nests per season were found. The period of high density was August with December as the low density period. May saw the largest movement when individuals seemed to return to the study area.

Nesting seemed to conform with the norm for the species. The smallest nesting female was 1.9 m and the largest 4.3 m with an average clutch size of 39 which seems to be smaller than those in Zimbabwe (54 eggs), and Umfolozi (47 eggs) and St. Lucia (45 eggs) in South Africa. There was a difference in rainfall for the 1997 and 1998

seasons and it seems as if the larger females nested during the higher rainfall season. The average distance to water was 19 m and height above water level was 6 m with a slope inclination of 20.5°

The research on the possible accumulative effect of metals (Al, Cu, Cr, Fe, Mn, Ni, Pb, and Zn) in various tissues produced mixed results. Specimens were collected from three different rivers in the park. As no data on similar studies could be found, these data were presented as baseline data and should be interpreted as such. Iron was the most prominent with concentrations of up to 16600 ppm found in liver samples. It also showed a correlation in increased values with larger sized crocodiles. The converse was found with Fe in fat tissue with smaller individuals having larger concentrations than larger ones. Unfortunately, no fat index was calculated for the individuals thus making this finding unreliable. Copper showed no difference between locations, but indicated a large variations between different tissue samples for the same individual. A number of blood values were analysed (albumin, globulin, glucose, serum protein, urea and creatinine). Our findings corresponded quite well with those for *C. porosus* and other studies.

Despite these findings, we are, however, not any closer to finding a solution to the seasonal mortalities of adults along the Olifants River. Seemingly healthy individuals simply lose condition, become very emaciated with floppy tails and eventually die within a matter of weeks. Remarkably this only happens in the period from May to end of July. Carcasses disappear very quickly and are seldom found in time before being consumed by other crocodiles.

During February 1996, the Olifants River experienced one of its largest floods, it was later calculated to be a 1:150 year flood. This impacted quite dramatically on the geomorphology of the total river and changed habitat regarding crocodiles significantly. Only 4 years later, in February 2000, another and even bigger flood again hit the Olifants River. There is now concern that the impacts of these two floods might have a negative influence on crocodiles in the Olifants River. From aerial photographs the formation of huge sandbanks and general siltation in the whole river is quite evident, and this might lead to certain areas becoming unsuitable for nesting and mating. If this is the case, then the crocodiles might leave

the protection of the park to mate and nest outside which certainly will result in their demise.

There are, however, plans to propose a large scale project to monitor the flood influence on the general ecology of Nile crocodiles in all the major rivers crossing Kruger Park. D. 'Swannie' Swanopoe, *P/Bag X40, Skukuza 1350, Republic of South Africa.* <swannie@parks-sa.co.za>

Western Asia

India

MADRAS CROCODILE BANK VOLUNTEER PROGRAM. This is to let you know that we are trying to formalize a Volunteer Program at the Croc Bank in the dual interests of getting people here to help out while providing a hands on, tropical experience for the volunteer.

We need help in the following areas but a smart volunteer will quickly identify other contributions he or she could make:

- * enclosure design, landscaping and signage
- * education, interpretation and interaction with the approximately 1.2 million visitors (of many language groups)
- * develop in-house research programs: veterinarian, behavior, breeding biology, captive husbandry
- * field surveys: crocodiles, specific endangered herps
- * develop this volunteer program to make it reciprocally useful
- * assistance with lab work, library, curating and feeding of 3000 reptiles.

International volunteers would have to find their own airfare and pay a modest sum for food and lodging at the Croc Bank (US \$ 10 per day). The volunteer period can be anything from 3 months to a year.

If you have any students or colleagues interested in working with us as a volunteer or research associate please let us have their c.v. and a letter from them stating their interests. Looking forward to fruitful collaboration! Rom Whitaker, Nikhil Whitaker & Harry Andrews, *Madras Crocodile Bank and Trus, Post Bag No. 4, Mamallaluram, TN 603 104, India* <sthiru@giasmd01.vsnl.net.in>

Nepal

CROCODILES RELEASED IN NARAYANI RIVER. Seven crocodiles were released into the Narayani River recently on the occasion of the fifth wildlife week.

The crocodiles were released under the auspices of the Royal Chitwan National Park. The released crocodiles include two males and five females of five years age, conservation officer Gopal Prasad Upadhyaya said. Crocodiles raised from wild eggs by the crocodile conservation project were released into the Narayani, Koshi, Kali Gandaki and other rivers for the first time in 1981. The crocodile conservation project was established in 1978. So far 300 crocodiles have been released in these rivers.

At the same time, planned hydro electric development on these rivers may change water levels and hydroregimes affecting wildlife including gharials. A major dam and hydropower project on the Karnali is in the planing stages by US Corporation Enron with approval and licensing from the Nepal Ministry of Finance.

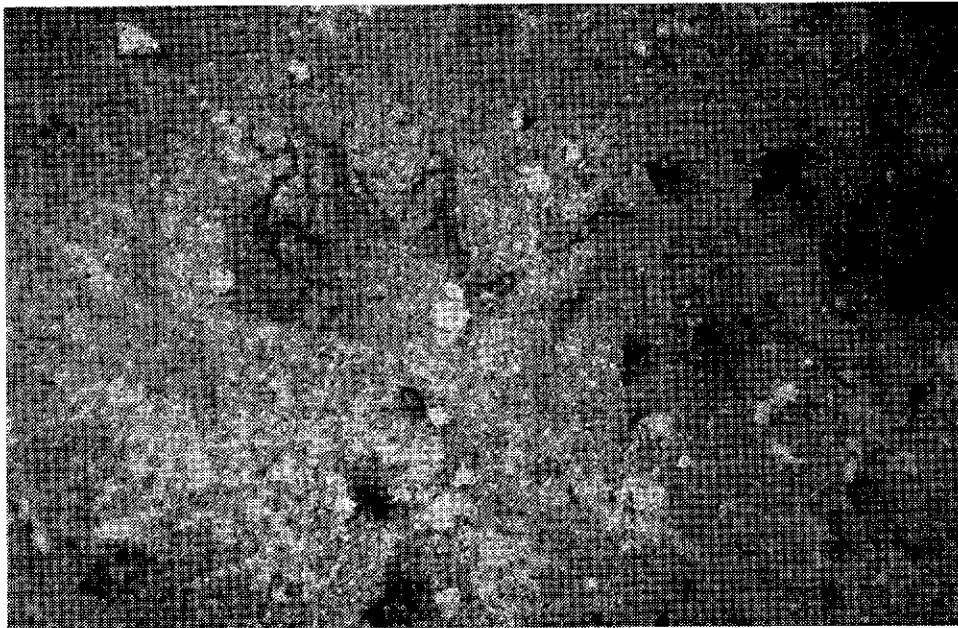
The project will produce power for export but has attracted critical comment both on its potential negative social impacts to local people and to endangered wildlife in the river and surrounding land, including the gangetic dolphin or 'sussu', freshwater turtles, elephants and Indian rhino. Other potential effects include long term effects on fisheries, downstream silt renewal and riverside access. Difficult conflicts between overall economic benefits to Nepal and immediate impacts on people and wildlife place the future management and conservation of gharial in Nepal as one small component of much larger conservation issues.

The continued raising and release of gharial is unlikely to be an adequate response to ensure their survival. The interests of several SSC Specialist Groups with concerns about the situation (cetaceans, turtles, elephants, rhino and crocs) appear to converge in the Nepal Terai lowlands and their rivers and continued communication between them and a combined approach would be useful. *From The Rising Nepal, Kathmandu Friday April 21, 2000* and correspondence submitted by Brian Smith <orcaella@northcoast.com> and Stephan Gorzula <sgorzula@pshdp.wlink.com.np>.

East Asia, Australia & Oceania

Cambodia

SIAMESE CROCODILES DISCOVERED IN THE CARDAMOM MOUNTAINS. The first crocodile survey in the Cardamom Mountains, SW Cambodia, has confirmed the presence of wild *Crocodylus siamensis* in several major drainage systems. These densely forested mountains span more than one million hectares and are still largely intact, but poorly known. Up until the late 1990's, the bitter civil war and lack of infrastructure prevented access to this wilderness by biologists. The present survey was conducted as part of the first biodiversity assessment of the Cardamom Mountains by Fauna & Flora International, the Wildlife Protection Office and



Siamese crocodile prints, river Kep, Cardamom Mountains, Cambodia, J. Daltry photo.

the Ministry of Environment.

The first indication that crocodiles were present came from a series of interviews with local hunters in 1999, but the species could not be identified from their descriptions alone. Between 25 February and 7 March 2000, several rivers in Koh Kong and Pursat Provinces were visited on foot. Three clear sightings of live crocodiles were made in the upper Kep and Krau rivers, confirming that the species was *C. siamensis*. There were also numerous observations of tracks, trails and dung: up to 23

crocodile scats were recorded within 2 meters of the water's edge along a 1-km river transect.

A further seven crocodiles were examined at a private collection in Koh Kong, a town on the Thailand/Cambodia border, and these again proved to be *C. siamensis* (see photograph). The crocodiles had been purchased as juveniles several years ago from fishermen in four rivers in the Central Cardamom Mountains (Kep, Tatai, Trapaeng Rung and Russei Chrum) for US\$20 each. There were further convincing reports of crocodiles in the Chaay Areng and Atay rivers from bushmeat hunters and wood collectors.

Although it is impossible to calculate total population size on the basis of these data alone, it would appear that the species is still common in many of the large freshwater drainage systems in the Central Cardamom Mountains. The human population density is still very low and much of the riparian and marshland habitat is completely

undisturbed.

Most local communities regard the crocodiles as having no value for meat, medicine or skins and believe that killing crocodiles brings bad luck, even death. Nobody questioned knew of any case in which a crocodile had attacked a human.

A number of interviewees thought that the crocodiles had become slightly less common during the late 1990's, however, at least in areas close to human settlements. Two reasons suggested for this decline were the use of explosives for fishing and the fact that newcomers to the region sometimes shoot at crocodiles 'for fun'.

More seriously, the Central Cardamom Mountains have been divided into logging concessions and much of the crocodile's habitat could be lost in the near future. The crocodiles are also becoming increasingly accessible to

illegal hunters and traders, as new logging roads open up this once-remote region.



Siamese crocodile habitat, River Kep, Cardamom Mts. Cambodia. J. Daltry photo.

There is some room for hope, however. The Cambodian Government has suspended most logging operations while it reexamines its policy towards forest exploitation, and both the Ministry of Environment and the Ministry of Forestry and Wildlife are keen to safeguard essential wildlife habitat while there is still time. To help guide this critical decision making process, further surveys are urgently needed to more accurately determine the distribution and status of Siamese crocodiles, both in the Cardamom Mountains and elsewhere in Cambodia. Dr Jennifer Daltry, *Fauna & Flora International, Great Eastern House, Tenison Road, Cambridge, CB1 2DT, UK, e-mail: <JDaltry@aol.com>*, & Mr Chheang Dany, *Wildlife Protection Office, Ministry of Forestry & Wildlife, 40 Preah Norodom Blvd, Phnom Penh, Cambodia.*

[*Editors note*, Dr. Daltry became quite severely ill with malaria following her return from Cambodia. We greatly admire her efforts in the field and kindness in submitting this report from her hospital bed, and wish her a complete and rapid recovery.]

Indonesia

RECORD OF *TOMISTOMA SCHLEGELII* IN WEST

KALIMANTAN. During a field survey on pythons (*Python curtus* and *P. reticulatus*) and the water monitor (*Varanus salvator*) in West Kalimantan in 1996/1997, the author had the opportunity to purchase a skull of an adult False Gharial in April 1996. According to villagers, the specimen was hunted up the river Sibau, beyond the village Tanjung Lasa [00°58'N, 112°57'E] at the end of 1995. The "Sungai Sibau" is located at the remote outpost Putussibau, entering the Kapuas river.

The upper jaw and skull measures 61.5cm from the tip of the premaxilla to the hind edge of the quadrate fused with the quadratojugal, and the lower jaw measures 67cm from the tip of the dentary to the hind edge of the angular meeting the retroarticular process. Referring to Wermuth's (1964) length relationships of head, snout-vent and tail of extant crocodylians, the length from the tip of the premaxilla to the margin of the postoccipital bone (squamosal) was measured, in order to determine the specimens total length. This distance was 57cm, related to an estimated total length of approximately 3.80-4.00m.

The teeth had all been removed by the hunters, as they are popular as ornaments. The skull [ZFMK 66591] is deposited in the Museum Alexander Koenig in Bonn, Germany.

Another proof of *T. schlegelii* was recorded on 9 September 1996. It was a juvenile specimen, which was to be for sale on the local market in Putussibau. It had a total length of approximately 50cm. According to the seller it was captured at 9 a.m. upstream the Sibau river, where the width did not exceed 30m. The animal was lying on a log (Schmitz, pers. comm.). These records probably provide indications of stabile

populations of *Tomistoma schlegelii* at the upper reaches of the "Sungai Sibau."

Literature Cited: Wermuth, H. (1964): Das Verhältnis zwischen Kopf-, Rumpf- und Schwanzlänge bei den rezenten Krokodilen. - Senck. biol. 45: 369-385. Mark Auliya, Zoologisches Forschungsinstitut und Museum Alexander Koenig (ZFMK), Section: Herpetology, Adenauerallee 160, 53113 Bonn, Germany, Email: <M.Auliya.ZFMK@uni-bonn.de>.

Myanmar

CROCODILE INVESTIGATIONS IN RAKHINE STATE. Historic accounts indicate estuarine crocodiles (*Crocodylus porosus*) were once common, and probably occurred throughout coastal wetlands in Rakhine State in western Myanmar. Smart (1917) stated that crocodiles were abundant in estuarine habitats near Aykab (now known as Sittwe), and according to Tydd (1912), although uncommon, crocodiles occurred in river deltas and mangroves in the vicinity of Sandoway. Maxwell (1911) mentions crocodile predation of loggerhead turtles (*Caretta caretta*) along the Arakan coast. Salter (1983b) noted that *C. porosus* remained common during the 1960's in mangrove swamps separating Ramree Island from the mainland, and nesting was recorded from several rivers. However, by the early 1980's commercial skin hunting and collection of juveniles for sale to crocodile farms resulted in drastic population declines throughout coastal Rakhine (Salter 1983b). Salter (1983b) was unable to locate evidence of recent nesting or observe crocodiles, noted illegal hunting continued, and concluded only scattered individuals remained in the area.

We conducted crocodile surveys in the vicinity of Pyin Won Village from 6 to 8 February. A combination of diurnal surveys and nocturnal spotlight counts were used to census crocodiles. We surveyed 33.5 km during the day, and 55.4 km during spotlight counts, but observed no crocodiles or crocodile sign.

Nonetheless, it is probable that the area harbors a remnant population of *C. porosus*. According to villagers, two juveniles (TL ca. 60 and 120 cm) were killed and three adult crocodiles were sighted during 1999; a large adult readily distinguished by a missing eye and

two smaller individuals. We also examined a captive crocodile (TL = 107 cm) hatched from an egg collected in 1997, and visited two crocodile nest sites in a nearby mangrove swamp. Hunters found one nest along Hnan Chaung in 1997 (19° 22.948' N; 94° 07.083' E). We located the remains of a nest mound about 20 m from the creek in a dense thicket of *Acrostichum aureum* and *Acanthus ilicifolius* with no overhead tree canopy. The mound was constructed of mud and *A. aureum* fronds and positioned about 1.5 m from a wallow where hunters found the female. The hunters chased the female from the nest and collected 32 eggs. Hunters found a second nest in 1998 along a tributary creek of the Hnan Chaung (19° 22.581' N; 94° 07.629' E), about 0.5 km from the 1997 nest site. We were unable to locate the old nest mound, but the site was in a dense thicket of *A. aureum*. This nest also contained 32 eggs according to the hunters. Given the close proximity of the two sites, and the reported identical clutch sizes, it is probable the nests represent the reproductive efforts of a single female.

A professional crocodile hunter was interviewed on Ramree Island. This individual began commercial hunting about 1970 and ceased in 1990 when crocodiles became too scarce to justify his efforts. He killed approximately 300 crocodiles during this 20-year period. The largest crocodile the hunter killed was 18 feet (5.4 m) long, although he was uncertain if he actually measured the specimen. Hunters also collected and ate crocodile eggs. Crocodile meat was sold for local consumption and traders purchased skins and hunters received the equivalent of US\$60 to \$75. Crocodiles were last seen on Ramree Island in 1990, and the hunter attributed the decline to chronic over-harvesting. A summary table of recent records of crocodiles in the region is given in the full report.

Ramree Island was the scene of an alleged massacre of Japanese soldiers by *Crocodylus porosus* during World War II although there is some doubt, based on historical accounts, that this event actually occurred. We interviewed a number of older Ramree Island residents and they unanimously discounted any suggestion that large numbers of soldiers fell prey to crocodiles. One informant who conducts regular tours for visiting Japanese veterans stated his clients often recount their experiences, but have never mentioned crocodile attacks. From. Platt, S. G. 2000. *An expedition into central Rakhine State*,

Philippines

PHILIPPINE CROCODILE RECOVERY TEAM FORMED. The Philippine Crocodile, *Crocodylus mindorensis*, is recognized by the Crocodile Specialist Group as arguably the most threatened species of crocodile in the world, with the general consensus being that there are fewer than 100 adults remaining in the wild. Hence, following extensive discussion with many stakeholders, the Secretary of the Department of Environment & Natural Resources (DENR). Mr. Antonio H. Cerilles, signed DENR Special Order No. 2000-231 on 3 March 2000, officially creating the Philippine Crocodile Recovery Team. The Special Order notes that the Team has been created to address the continuing decline of the Philippine Crocodile and to strengthen international co-operation and partnerships in the conservation of the species. The Team is comprised of:

DENR Undersecretary for Policy & Technical Services – Chairperson.

Director of the Protected Areas & Wildlife Bureau (PAWB) – Vice Chairperson.

Project Director of the Crocodile Farming Institute (CFI) – National Co-ordinator.

Chris Banks, Melbourne Zoo – International Co-ordinator.

Assistant Director, PAWB – Member.

Dr Angel Alcala, Silliman University – Member.

Collete Adams, Gladys Porter Zoo – Member.

Representative from the relevant DENR Regional Office & Protected Area Management Board – Member.

The Team is supported by a four person Secretariat from the PAWB and CFI, and has the following responsibilities:

Develop a "National Recovery Plan for the Philippine Crocodile (*Crocodylus mindorensis*) that will serve as the basic framework in addressing the causal factors in the population decline of the species. The Plan shall include strategic objectives, research and management priorities, detailed activities, and budgetary requirements to possibly carry out the identified priority actions.

Oversee/lead in the implementation of the Recovery Plan, in collaboration with all concerned parties.

Endeavor to access financial support and other resources for the implementation of the Plan, and provide recommendations on their effective use.

Foster community awareness, promote exchange of information and provide technical advice and advocacy on *C. mindorensis* and its conservation as required.

Develop mechanisms to integrate *C. mindorensis* research and management with wider wetland conservation efforts and organizations in the Philippines.

Through the National and International Co-ordinators, co-ordinate the implementation of the Plan and all conservation activities for *C. mindorensis* with concerned and/or relevant parties, both locally and internationally.

Conduct annual reviews of the implementation status of the Plan and other activities under the DENR Special Order 2000-231.

Perform other relevant duties as may be necessary and legally possible; and

Submit annual progress reports to the Secretary, DENR.

The Recovery Plan is now in its final draft stage and has been circulated among the members of the Team for any last-minute comments. Chris Banks, *Melbourne Zoo, Australia*.

NEW BREEDING SITES FOR THE PHILIPPINE CROCODILE. The Philippine crocodile, *Crocodylus mindorensis* Schmidt, is one of the most endangered species of crocodilian in the world. There may be no more than 100 non-hatchlings remaining in the wild. The CSG - IUCN gave it the second highest priority for conservation action among all crocodilians. Little is known about the biology of these animals in the wild. This project aims to update the survey data for extant wild populations of the species and to use current techniques for maintaining genetic diversity in the overall population in anticipation of eventual reintroduction from captive stocks. We are also looking for suitable areas for the establishment of protected areas for the species.

Our goals were:

1) Conduct field surveys to verify the occurrence and determine the abundance of the Philippine crocodile in the following areas: i) Agusan Marsh, Mindanao Island; ii) rivers in Busuanga Island; iii) Lake Mainit, Mindanao Island; iv) marshes and waterways surrounding Lake Naujan, Mindoro Island; v) Liguasan Marsh, Mindanao Island; and vi) rivers in Northern Sierra Madre Natural Park, Palanan, Isabela;

2) Collect blood and muscle tissue samples from wild and captive Philippine crocodiles for molecular genetic analyses;

We conducted field surveys from June to September 1999 in five sites in the Philippines. From June to September 1999, my team, consisting of local people and personnel of the Crocodile Farming Institute in Palawan, Philippines, and I conducted field surveys in the following areas: Agusan Marsh, Mindanao Island; Diwakden Creek and adjacent areas at the western foothills of the Sierra Madre mountain range, Isabela Province, Luzon Island; rivers at the eastern side of the Sierra Madre mountain range, Isabela Province, Luzon Island; Busuanga and Dipuyai Rivers, Busuanga Island, Palawan Province; and Pulangui River, Bukidnon Province, Mindanao Island. I added San Mariano, Isabela, Luzon Island and Pulangui River, Bukidnon, Mindanao Island to our study sites due to reports of captive wild crocodiles from the two areas.

We surveyed the Agusan Marsh Wildlife Sanctuary, Mindanao Island, for almost one month from June to July 1999. Our spotlight observations, size estimates from crocodile tracks, and a photograph of a crocodile taken in October 1998 indicate the presence of a small population (<10 adults) of saltwater crocodiles inside the approximately 19,000-ha wildlife sanctuary. Since there has been no documented case of Philippine crocodiles coexisting with the saltwater crocodiles in the same place, it is highly unlikely that Philippine crocodiles exist in the freshwater marshes, rivers, and lakes in the area. However, species inventories for the sanctuary include the Philippine crocodile. Authors of these inventories probably made the presumption that Philippine crocodiles dwell in the site because it is a freshwater area.

The highlight of our field season is the discovery of two extant populations of the Philippine crocodile, one in San Mariano, Isabela, Luzon Island, and another in Pulangui

River, Bukidnon, Mindanao Island. There is at least one breeding pair of Philippine crocodiles in each of these areas. Additional surveys are needed in order to obtain reliable estimates of the population size and to trap crocodiles for sampling and tagging.

The discovery of the new populations of the Philippine crocodile is highly significant due to the status of the species in the wild. One of the main objectives of the project is to find suitable sites for the establishment of protected areas for the Philippine crocodile. We determined the San Mariano, Isabela area as a possible site for the establishment of a Philippine crocodile sanctuary. In addition to Diwakden Creek, there are other creeks in the area that could possibly harbor Philippine crocodiles. It remains to be seen whether its location, being right beside the borders of the Northern Sierra Madre Natural Park, will facilitate the establishment of a Philippine crocodile sanctuary. The local government seems to be supportive and recently voted to protect the crocodiles. A Dutch-funded non-governmental organization, PLAN International, has expressed interest in working together with the Crocodile Farming Institute for sanctuary establishment.

Our results underscore the critical status of the animals in the wild. We are coordinating with PLAN International, in pushing for the establishment of a crocodile sanctuary in the site. PLAN International, incorporating our survey results, has prepared a fast-track Philippine crocodile conservation program for 2000 and this will be discussed with local communities and the Department of Environment and Natural Resources.

The local government of San Mariano had recently voted to protect the Philippine crocodiles. We will be formulating a long-term management plan for a crocodile sanctuary in the area.

Our survey results have been incorporated into the Philippine crocodile conservation plan. We plan to conduct another series of field surveys between May 2000 to June 2001.

The molecular population genetics and phylogeography aspect of the research is currently on going. We collected blood and muscle tissue samples from a number of captive Philippine crocodiles. — U. Frederick A. Pontillas, *Louisiana State University Museum of Natural Science, 119 Foster Hall, Baton Rouge, LA 70803 and Department of Biological*

Latin America

Argentina

CAIMAN LATIROSTRIS AND *C. YACARE* CONSERVATION THROUGH PRIVATE INITIATIVE IN ARGENTINA. In 1996 we began a new ranching experience — *Caiman yacare* and *Caiman latirostris* — in northern Argentina, involving a private landowner (Dr. Eduardo Boló Bolaño, Estancia El Cachapé), an NGO (Fundación Vida Silvestre Argentina), and the provincial authorities (Ministerio de la Producción, Dirección de Fauna, Parques y Ecología – Chaco Province). The final aim of this project is to reach a sustainable economic alternative for this region of Argentina, in which wetlands are now endangered by traditional activities (drainage for cropping and farming). The use of native wild species through a sustainable method, would confer economic value to conservation of these environments. In this sense, caimans are one of the most important resources.

The experience began with the first population studies, developed by Lic. Walter Prado, under the direction of Mr. Tomás Waller and Dr. Rubén Quintana (Buenos Aires University). Information on population parameters and habitat were obtained through aerial nest census, night counts, and satellite image analysis.

We began our experimental stage of the project by harvesting the nests of caimans deposited in the dryer upland surroundings of the wetlands. First on January 1998, second December 1998-January 1999, and third December 1999-January 2000, clutches of 330, 658 and 1,510 eggs were collected from 16, 28 and 43 nests respectively. At the moment, 544 caimans were reintroduced to nest collection sites, after sanitary evaluations performed by Dr. Guillermo Stamatti (Nordeste National University). During last January, sanitary evaluations were improved under the direction of Dr. Marcela Uhart (WCS), who began a research project with the objective of comparing wild and captive caimans.

We are looking forward to initiate in the following years a commercial stage of the project, when all environmental and legal

requirements are obtained. We think that this model (private landowner as an investor and direct beneficiary, the provincial authorities providing controls and certifications, and an NGO supervising the project and giving technical advice) is one of the most important ways to reach conservation and sustainable use of caimans in northern Argentina. For more information and technical reports, please contact: Lic. Diego Moreno, *Fundación Vida Silvestre Argentina*, <refugios@vidasilvestre.org.ar>

Colombia

RECENT RESEARCH RESULTS. A very active crocodylian research group at the Institute of Natural Sciences, National University of Colombia, Bogotá, is operating under the direction of Associate Professora Maria Cristina Ardila-Robayo and consists mostly of women. This group has been actively researching the status of crocodylians in the wild (See CSG Newsletter Vol 18 (3):11), and also studying the captive group of *Crocodylus intermedius* held at the 'Roberto Franco' Tropical Research Station in Villavicencio in conjunction with Professora Dr. Myrian Lugo.

The group has recently published a series of valuable research reports in *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* (Rev. Acad. Col.). Special Supplement Volume XXIII. 1999. These are briefly abstracted here:

Barahona-B, Sandra Liliana & Olga Patricia Bonilla-C. 1999. Pp. 448-451 Evaluación del Poblacional del caimán llanero (*Crocodylus intermedius*) en el subareal de distribución en el Departamento de Arauca. In 1994 and 1995 an investigation of the status of a remaining population of *C. intermedius* was conducted in Colombia in the rivers Cravo Norte, Ele, Lipa, Casanare and Caño Matepalma. The surveys were carried out during the dry season. Twenty nine crocodiles were found but it is estimated that there are 51. Most of them are breeding adults. The interaction with inhabitants of the region is affecting them. A program for the recovery of this population is recommended. The paper includes detailed maps, survey routes and distances and photographs of *C. intermedius* in the field.

Ardila-R, M.C., Sandra L. Barahona-B, Olga P. Bonilla-C & Diana R. Cardenas-R. 1999. Pp.

417 - 424. Aportes al conocimiento de la reproducción embriología y manejo de *Crocodylus intermedius* en la Estación de Biología Tropical 'Roberto Franco' de Villavicencio. The Tropical Biological Station Roberto Franco has captive reptiles which are subject to observations and analysis that will permit development of guidelines in management, conservation and repopulation. Incidental to the program for conservation of *C. intermedius*, we made observations on a nest of one of the captive pairs which allow us to provide some information on mating behavior, nesting, management of embryos and neonates and embryonic development. The paper includes color photographs of courting and mating, nests, embryos of three stages and detailed data on nest temperature, egg dimensions and a sonogram of hatchling vocalisations.

Ardila-R, M.C., Sandra L. Barahona-B, Olga P. Bonilla-C & Diana R. Cardenas-R. 1999. Pp. 425-435. Evaluación del crecimiento en *C. intermedius* nacido en la Estación de Biología Tropical 'Roberto Franco' de Villavicencio. A series of observations were made on a nest of *C. intermedius* maintained in the Tropical Biological Station 'Roberto Franco'. These observations allow us to establish growth models for the first year of life and to try and understand the physiological characteristics, behavior and sexual maturity. These are important parameters to know before repopulation efforts are undertaken.

Ardila-R, M.C., Sandra L. Barahona-B, Olga P. Bonilla-C & Diana R. Cardenas-R. 1999. Pp. 437-444. Análisis morfométrico craneal asociado con la edad en los *Crocodylus intermedius* nacidos en la Estación de Biología Tropical 'Roberto Franco' de Villavicencio. The Tropical Biological Station Roberto Franco has a series of skulls of *C. intermedius* hatched in captivity. From these skulls we have obtained information on sizes for a range of ages of the cranial morphometrics related to total length and body weight. Data from 48 skulls ranging from 6 to 64 months age are presented with trends in growth and correlations among 16 skull measurements and body dimensions.

Gloria Romero de Perez, Martha P. Ramirez & Martha Lucia Calderon. 1999. Pp. 453-464. Estudio preliminar de la ultraestructura de la pared del ovario y de folículos previtelogénicos y vitelogénicos tempranos de *Caiman crocodilus fuscus*. The ultrastructure of the ovarian

epithelium, follicles of different developmental states and other stromal elements is described. Ovarian tissue was obtained from adult individuals of *Caiman crocodilus fuscus* and processed by conventional methods for transmission electron microscopy (TEM). The general morphology of the ovary and follicular structure is similar to that of other reptiles and shows a chordolacunar bird-like system with large lymphatic vessels. A single layer of follicle cells forms the granulosa of the follicles. Ultrastructural characteristics of follicular cells and oocytes, and their relationship, suggest that the substances pass into the ovocell by both intra and extracellular pathways during follicle development. However, the precise mechanism used for the transport of nutrients and yolk precursors during vitellogenesis cannot be clarified from these observations. Neither the follicle cells nor the theca cells in growing follicles have the characteristics of steroidogenic cells as in other reptiles and birds. Two interesting findings are reported: the presence of electron dense and heterogeneous granules, similar to lysosomes, in the endothelium of the lymphatic vessels, and neurosecretory cells in the ovarian interstices. The function of these structures was not studied.

Reprints can be obtained from the senior authors – Maria Cristina Ardila-Robayo & Sandra Lilibiana Barahona Buitrago, *Laboratorio Anfíbios, Instituto Ciencias Naturales, Facultad de Ciencias, Universidad Nacional de Colombia, Bogotá Apartado Aéreo 7495 Santa Fe de Bogotá, Colombia*
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French Guiana

BLACK CAIMAN POPULATION IN KAW SWAMPS. Between 14 and 17 December 1999, a small expedition took place to the Angélique Creek in the western part of the swamps of Kaw. It was organized by the Association Kwata, a local NGO on nature conservation research. They invited Paul Ouboter, a crocodile specialist located in Suriname, to join the team.

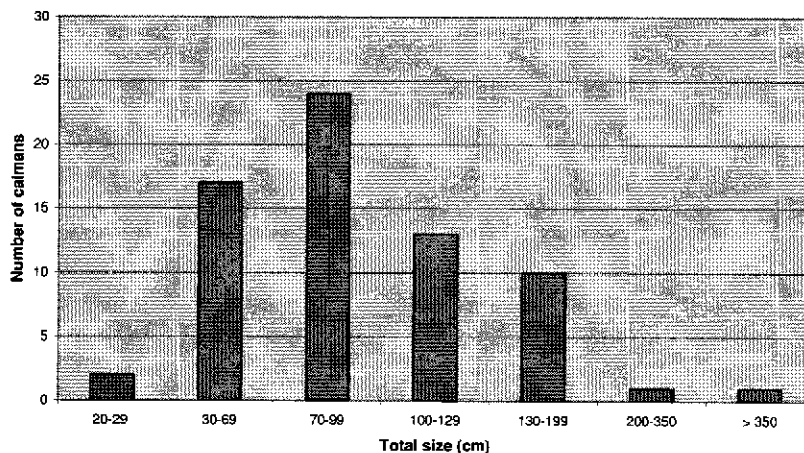
In 1979, Plotkin, Mittermeier and Constable visited the Kaw River and reported the existence of a substantial population of the black caiman (*Melanosuchus niger*) in the area, although they

saw mostly juveniles (Plotkin et al., 1983). The necessity to protect the area was stressed by them, and before by Condamin (1975). The Kaw Swamps were declared a nature reserve (Réserve Naturelle de Kaw-Roura) on March 13, 1998, mainly based on the population of black caimans and hoatzins (*Opisthocomus hoazin*). However, it soon became clear that the black caiman population in the accessible parts of the swamp was still decreasing and it consisted mainly of juveniles. It was hoped that a larger number, including reproducing adults, would be present in the hardly accessible parts of the Kaw swamps, especially in the area west of the Kaw River, the Savanna Angelique. In order to investigate this, a preliminary survey was organized.

An area suitable for the survey was selected by airplane on May 20th, and in more detail by helicopter on December 10th. On December 14th, a helicopter dropped the team of five people near the Angelique Creek, together with two boats and equipment. It was the end of the dry season, so the swamps were almost dry and the caimans should be concentrated in the creeks. During three days and nights the team covered about 5 km of creek. Along most of the creek the going was really tough because of overgrowing bushes of *Chrysobalanus icaco* and trunks of *Mauritia* and *Euterpe* palms. Between these overgrown creek parts were wider areas with water lilies (*Nymphaea*) and other aquatic vegetation (*Cabomba* and *Utricularia*). Black caimans were most abundant in the wider parts. In the narrow channels only few were seen, together with juveniles of *Paleosuchus palpebrosus*, that stayed in very shallow water, near the shore. Black caimans were both seen during the day and

night. The total distance covered during the night surveys was 3 km, on which we counted 130 caimans. Seventy six (76) could be identified as *M. niger*, 16 as *P. palpebrosus* and 38 dived before identification was possible. These were probably *M. niger* as well, since *P. palpebrosus* are easy to approach. So the minimum density of the black caiman population in the area was about 25/km, but a more reliable estimate is 38/km. The highest density recently recorded for a black caiman population is >30/km in parts of an area of rivers, streams and lakes near the Mamirauá Ecological Station, Brazil. All other high figures are between 23 and 28/km, and are for lakes in Ecuador and Peru (Ross 1998), not for a small creek. Therefore it can be concluded that the Angelique Creek contains a dense population of *M. niger*. In addition to counting and identifying caimans, size estimates were made. The accuracy of these estimates was checked by measuring some individuals. Unfortunately, only few large specimens could be estimated to size. Only two were above 2 m total length and could be reproductive adults according to available information (Ross, 1998). Only one was really large, and was surely a male. We were able to approach this individual very close. A comparison with the size of the boat led to an estimated size of 4.0-4.5 m. Several of the individuals that dived before a size estimate was possible, both during day and night surveys, were quite large. We estimate the adult breeding population on this 3 km stretch of creek to consist of 2-3 large males and about the same number of females. *M. niger* is supposed to nest in the dry season (see i.e. Ouboter & Nanhoé 1987). We found only two hatchlings. It is likely

Size estimates of *Melanosuchus niger* in 3 km of the Angelique Creek



that hatching had just started.

The accessible part of the area, the Kaw River, was surveyed on 18 and 19 December 1999. According to the inhabitants of the Kaw village, black caimans were once so abundant that boatmen had to hit the water with a paddle to chase them away in order to make passage for the boats possible. Plotkin et al. (1983) observed mainly small individuals in the Kaw River in 1979. Also we found mainly juveniles. On a river length of about 47 km, 68 caimans were seen. Seventeen (17) dived before identification was possible, 22 were *M. niger*, 19 *P. palpebrosus* and 10 *Caiman crocodilus*. As in the Angelique Creek, newly born *P. palpebrosus*

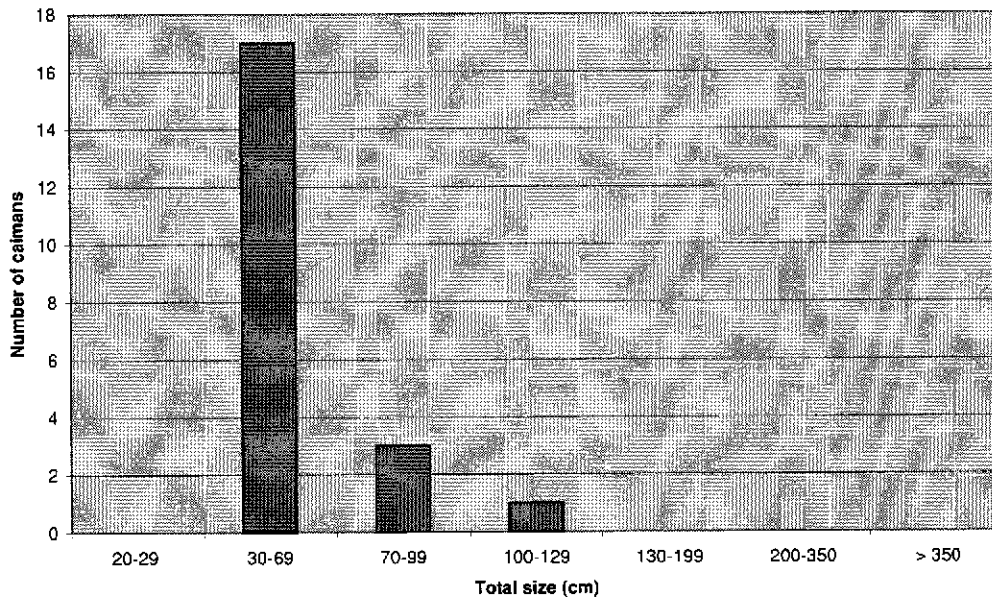
the swamp may prove to be suited for ecological studies because of the presence of a black caiman population in an almost pristine stage.

We like to acknowledge the help of Sylvia Lochon of the Direction Regionale de l'Environnement and Armelle Joly, manager of the Reserve Naturelle de Kaw-Roura. The survey was funded by the Association Aratai.

References: Condamin, M., 1975. Projets de Réserves Naturelles sur le littoral guyanais. ORSTROM, Cayenne, 95 p.

Ouboter, P.E. & L.M.R. Nanhoe, 1987. Notes on nesting and parental care in *Caiman crocodilus crocodilus* in northern Suriname and an analysis of crocodylian nesting habitats

Size estimates of *Melanosuchus niger* in 47 km of the Kaw River



were present, but here also many subadult and adult dwarf caimans were seen. *C. crocodilus* was most abundant near the village. It seems that the Kaw River at present only contains some juvenile and subadult black caimans, probably individuals that wandered away from the breeding population in the swamps.

These preliminary surveys showed that the Kaw Swamps are likely to have a good black caiman population, as many other hardly accessible areas with suitable habitat exist in the swamps. However, the exact status of the population needs further investigation. Especially surveys in other parts of the swamps are needed. The part of the population in the Kaw River needs to be monitored regularly. Some areas of

[SIC]. Amphibia-Reptilia 8: 331-348.

Plotkin, M., R. Mittermeier & I. Constable, 1983. The Black Caimans of Kaw. Wildlife, October 1983: 374-377.

Ross, J.P. (ed.), 1998. Crocodiles. Status Survey and Conservation Action Plan. 2nd ed. IUCN/SSC Crocodile Specialist Group, 96 pp.

— Paul E. Ouboter, University of Suriname, Paramaribo, Suriname, P.O. Box 9212, e-mail nzcs@cq-link.sr or p.ouboter@cq-link.sr, Jean-Christophe Vie, Thierry Montford, Michel Blanc, Association Kwata, BP 672-97335 Cayenne Cedex, French Guiana, e-mail kwata@nplus.gf & Jean-Marie PrevotEAU Réserve Naturelle de Kaw-Roura.

Uruguay

PROYECTO ZOOLOGICO, THE FIRST YACARE CAPTIVE BREEDING OPERATION IN URUGUAY. The primary objective of this project is to establish captive breeding of *Caiman latirostris* (called 'yacare') in conjunction with similar activities on other native animals. The central focus will be the study of yacare from the egg to adults in a facility open to the public, and of particular interest to schoolchildren and university students. At the same time we will maintain examples of other native species for observation and eventual reproduction, in order to present a place with a variety of fauna that will be more attractive to the public.

We require a minimum of 15 hectares of land with good access, where we will begin with construction of a structure of 220 square meters and some lagoon of different depths and form. These will be divided among the main salon, and incubation area, a hatchling area and the main lagoons. In these lagoons we intend to place yacares of different sizes according to their future destinies. The smallest animals will be placed in the smallest and most shallow ponds where they can be fed according to the requirements of their size. In this way progressively larger individuals will be moved to ponds of greater depth, up to 2 m, that will be used for reproduction.

Around the perimeter we will put large rocks at different levels to form a small cascade or water fall. To achieve this effect we will use pumps to recirculate water from the pools to the head of the waterfall. These stones can also be used by the animals for protection and shelter from the cold. We will plant several species of native trees and bushes around the water. However, we intend to prevent the establishment of aquatic weeds and may have to treat them with an herbicide to control them and algal growth. In this way it will be possible to observe the animals in the water. We have been testing the herbicide Simazine in a tank containing fish and yacares for one year and shown that this treatment is completely harmless to the animals. We will introduce fish from local rivers and also freshwater turtles so that the final effect will be the appearance of a natural opening in the lagoon.

This lagoon complex will be crossed by a small wooden bridge that will allow observation of the animals. We will also construct an area

for rest and photography in the center of the lagoon. In the remainder of the large pools we are thinking of installing examples of the larger specimens and in one of them adults that we hope will use it for reproduction. This central area will include an arena of 8m diameter with a sand floor and a small wall in which we will demonstrate specimens of the caimans, showing their anatomy, structure, teeth, jaws, etc.

In the first large building we intend to put a small exhibit or archeological materials from the past inhabitants of the area. The museum will be at the entry to the yacare display and will deliver an explanation of the exhibit to everyone entering. We will also construct standard facilities for the public, bathrooms, etc. The development of the project is envisioned in two stages, first the acquisition of suitable land and then the construction of the necessary infrastructure. I am interested in communicating with others who have experience with this kind of development. — Alvaro J. Fernandez, *Rubens 4497-CP 11400, Montevideo, Uruguay* <afcr@adinet.com.uy>.

Venezuela

LIBERACIÓN DE CAIMANES DEL ORINOCO (*CROCODYLUS INTERMEDIUS*) EN EL REFUGIO DE FAUNA SILVESTRE CAÑO GUARITICO, ESTADO APURE, VENEZUELA. El pasado 8 de abril fueron liberados 233 caimanes del Orinoco (*Crocodylus intermedius*) en el Refugio de Fauna Silvestre Caño Guaritico, dentro del Programa de Conservación de la especie que viene implementando la Dirección General de Fauna, del Ministerio del Ambiente y de los Recursos Naturales, desde 1990. Los ejemplares fueron mantenidos en cautiverio por un año, en los zocriaderos Finca Agropecuaria Masaguara y Agropecuaria Puerto Miranda. La longitud total promedio fue de 134.84 cm y peso promedio de 1.380,28 gr. Los ejemplares fueron marcados con placas metálica interdígital y cortes de escamas, para su posterior seguimiento. — Alvaro Velasco. *Wildlife General Direction. Email:* <avelasco@marnr.gov.ve>.

LIBERATION OF ORINOCO CAIMAN (*CROCODYLUS INTERMEDIUS*) IN THE WILDLIFE REFUGE CAÑO GUARITICO, APURE STATE, VENEZUELA. The past 8 of April 233 Orinoco caiman (*Crocodylus intermedius*) were liberated in the Wildlife

Refuge Caño Guaritico, inside the Conservation Program of the species that has been implemented by the Wildlife General Direction, of the Ministry of the Environmental and of the Natural Resources, from 1990. The caimans were maintained in captivity by one year, in Finca Agropecuaria Masaguaral and Agropecuaria Puerto Miranda. The average Total Length was of 134.84 cm and average weight 1,380.28 gr. The caimans were marked with metallic interdigital tags and caudal scute cuts, for their later monitoring. — Alvaro Velasco. *Wildlife General Direction.* Email: <avelasco@marnr.gov.ve>.

MONITOREO DE LAS POBLACIONES DE BABA (*CAIMAN CROCODYLUS*) EN LA REGIÓN ECOLÓGICA HOYA DE ARISMENDI, VENEZUELA. Entre 02 de abril al 11 de mayo se realizó el monitoreo de la Región Ecológica Hoya de Arismendi, cubriendo una superficie aproximada de 131.322 ha, equivalentes al 21,34% del área total de la región. El estudio fue realizado conjuntamente entre la Coordinación de Extensión de la Facultad de Ciencias, Universidad Central de Venezuela y la Dirección General de Fauna, Ministerio del Ambiente y de los Recursos Naturales. Esta es la tercera vez que se evalúa esta región, la primera en 1992 y la segunda en 1996. La densidad de babas encontrada fue de 0,11 ind/ha. La estructura de tamaños fue de 19,08% de clase II, 59,34% de clase III y 20,14% de clase IV. Estos resultados son similares a los obtenidos durante el estudio de 1996. Esto demuestra que el Programa de Aprovechamiento Comercial de la especie Baba (*Caiman crocodylus*) en los llanos inundables de Venezuela, no afecta las poblaciones naturales de esta especie. — Alvaro Velasco & Roldan De Sola. *Dirección General de Fauna.* Email: <avelasco@marnr.gov.ve>.

MONITORING BABAS POPULATIONS (*CAIMAN CROCODYLUS*) IN THE HOYA DE ARISMENDI ECOLOGICAL REGION, VENEZUELA. Monitoring of Babas populations was carried out between April 02 at May 11 at Hoya de Arismendi Region Ecological, covering an approximate surface of 131,322 has, equivalent to 21.34% of the total area of the region. The study was carried out jointly between the Coordination of Extension of the Facultad de Ciencias, Central University of Venezuela and the Wildlife General Direction,

Ministry of the Environmental and of the Natural Resources. This is the third time that we evaluated this region, the first time in 1992 and the second in 1996. The babas density was of 0.11 ind/ha. The sizes class was of 19.08% of class II, 59.34% of class III and 20.14% of class IV. These results are similar to those obtained during the study of 1996. This demonstrates that the Program of Commercial Use of the baba specie (*Caiman crocodylus*) in the flooded llanos of Venezuela, it doesn't affect the natural populations of this species. — Alvaro Velasco & Roldan De Sola. *Wildlife General Direction.* Email: <avelasco@marnr.gov.ve>.

North America

Mexico

AMERICAN CROCODILE ATTACK IN CHIAPAS. Jorge L. Lorenzana Cruz, 20 years old was attacked on February 2000 at "El Esteron" stream at "El Manguito" town in Tonalá, Chiapas, by an American crocodile (*C. acutus*) while he was snorkeling and capturing fish with a harpoon. At the moment of the attack, his father was in a canoe with all the fish Jorge had collected 20 meters from him.

The attack occurred at four p.m. and after probably one minute of severe injuries, Jorge's father was able to dissuade the crocodile and assist his son. Jorge was transported in the canoe to the town and after that driven to Tonalá, where he received medical attention in intensive care for two weeks. The wounds (more than 30) were left open for continue examination and all of them healed. The most serious damage was in the armpit, presumably the biggest upper teeth affected the area, and George has lost sensitivity of some areas from his left arm. With the other arm, George tried to protect his body, and his elbow suffered a dislocation. "I was seeing the edge of the water when I felt a presence behind me, when I turned around, the crocodile open his jaws and hit me on my mouth and bit me on my left arm. Fortunately, my father heard my screams and he assisted me," George said.

After this accident, all the people in town began an intensive persecution of the crocodiles in "El Esteron" stream and in other places nearby. A week after, a big male (probably four meters long) was killed after taking him out of

his cave under mangrove roots. Some other juvenile and adult crocodiles were killed. In past years, the people of the town were worried about the abundance of crocodiles so they destroyed all the nests, hatchlings and juveniles they found. It is sad to observe the absence of concern about natural resources, specially crocodiles, in the place, but we think that this is due to the lack of assistance of wildlife managers with those people.

When we visited the place, we tried to stimulate the community with the idea of establishing a tourist attraction with crocodiles in an abandoned shrimp pond. With this they can take out all the dangerous big crocodiles, put them in captivity and obtain money with tourism. Also we talked about ranching of eggs and hatchlings, but they are mainly interested in shrimp collection and they do not believe in crocodiles as an important economic resource. Our job now is to make them change their mind and promote the sustainable use of crocodiles. — Louis Sigler, *Museo de Historia Natural, Zoológico Miguel Alvarez del Toro, AP-6, Tuxtla Gutierrez, Chiapas, 29000, Mexico.*

STUDENT SURVIVES REPTILE ATTACK IN MEXICO. A Clearfield man returned home Tuesday night after his spring-break vacation in Cancun was marred by a vicious attack from a reptile similar to an alligator. Weber State University student Spencer VanWeerd, 19, required 126 stitches in his wrists, hands, neck, head and back. VanWeerd said the attack occurred in the afternoon while he was swimming in a peaceful lagoon at the Mexican beachfront resort. As he swam on his back, he hit what he assumed was a rock. Suddenly sharp, powerful teeth tore into the back of his head and neck. He said the 6-foot reptile clamped onto his head and shoulders, but he managed to work free. After struggling to shore and collapsing on a beachfront sidewalk, VanWeerd's bad luck continued. He was taken to a hospital where doctors refused to treat him until they verified his ability to pay.

Police in Cancun say VanWeerd was being chased by police after witnesses reported seeing beer being stolen from a store and that is when he jumped into the lagoon. — Kevin Cantera, *The SALT LAKE TRIBUNE, USA, Wednesday, March 22, 2000.*

AMERICAN CROCODILES ON THE JALISCO COAST. Between 24 June and 1 July, I spent a vacation visiting Sara Huerta and Paulino Ponce and their American crocodile research program in Jalisco, Mexico. Sara and Paulino operate a conservation NGO, 'Bosque Tropical', and are graduate students at the University of Guadalajara, and Val Lance and I serve as external advisors on their Ph.D. Projects. Paulino is looking at genetics, proteins and hormones associated with reproduction under Val's guidance and Sara is studying population dynamics with my help. After spending a day at the University of Guadalajara, and giving presentations on crocodilian conservation and reptilian egg function, I accompanied Sara and Paulino to their research sites. With all our gear packed into Bosque Tropical's 4 door Nissan pickup (affectionately called 'la mixadora,' the food blender, referring to its tiny 4-cylinder engine), and with their new 14-foot jon boat strapped on top, we set off on a 6 day, 300 km field trip.

The coast of Jalisco is backed by a series of mountain ranges rising to several thousand m and drops quite steeply to the Pacific ocean with dramatic scenery, steep slopes covered in dry deciduous forest, and beautiful sand beaches. Many small rivers, and one large one, the Rio Ameca, flow to the coast where they commonly form small mangrove estuaries running parallel to the beach dunes, before breaking through to the sea. The three research sites are typical examples of these small estuaries. Boca Negra is a small part of the larger delta complex of the Rio Almeca at Puerto Vallarta. The delta covers about 20 sq. km but most of this is heavily impacted by development, agriculture, an airport, a marine harbor complex and condominiums. A central saline mangrove estuary called El Salado remains in natural condition and is the site of proposed conservation protection promoted by a local conservation society, Grupo Ecologico de Puerto Vallarta. Boca Negra is a short (850m) channel of El Salado that our two night surveys and Sara's previous surveys indicate supports two or three pairs of adult *C. acutus*. One or two nests per year have been recorded and 15 – 20 juveniles up to about 1.5 m remain resident. [Precise survey data will form part of Sara's thesis and I only report general numbers here—JPR]. We also found 25 new hatchlings and located their recently excavated nest nearby.

Majahuas estuary is part of the delta of the Rio Tomatlan. About 10 km of narrow mangrove creeks and lagoons lie parallel to the beach dunes. Crocodiles of all sizes are present but extremely shy, apparently as a result of recent illegal hunting. We recorded about 25 'eyes only' records in a night survey.

Manzanilla estuary in the south of Jalisco is a brackish estuary of about 2.2 km that flows to the sea at the small village of Manzanilla near the resort town of Barra de Navidad. Here, local fishermen attempt to protect the crocodiles, erecting signs and fencing to keep crocodiles and people apart and prohibiting the use of motors on the estuary. Their hope is to develop a small industry displaying crocodiles and other wildlife to tourists. We saw about 30 large and medium sized crocodiles each night of our two night survey.

We also stopped in to visit Marciano Valtierra and his wife Lorena who run the Chamela-Cuixmala Biosphere Reserve. The Reserve includes an upland deciduous forest reserve supporting six species of felids and the site of radio tracking studies of jaguar and puma. In the lowland coastal section the typical coastal wetlands of the Cuixmala river estuary have been extensively modified to form several km of artificial, shallow lagoons. Crocodiles occur both in the natural river and estuary and in the lagoons, where there is remarkable population of large adults. We saw more than 40 individuals, with several in the 12-14 foot length range, during a brief late afternoon examination. The large crocodiles apparently prosper from the protection afforded by the reserve and security associated with a nearby private estate, and from the rich fish population of the lagoons. However, juveniles are rare in this system except immediately following nesting.

These locations are typical of numerous similar estuaries along the Jalisco coast. Sara and Paulino have recorded crocodile presence in more than 50 locations. Most of these are isolated habitat remnants, heavily impacted by people (tourism, fishermen and upstream agriculture) and each supporting quite small numbers of crocodiles. If each of these is an isolated location then they are probably all doomed to eventual extinction. However, if crocodiles can move between these locations then this fragmented habitat may function effectively as a meta-population, with source areas of successful reproduction generating

migrant subadults that move to other estuaries. Some areas are probably population 'sinks' where mortality from people and fishing nets continually removes crocodiles. Understanding the structure and relationships of these fragmented populations is a basic step to generating an effective management strategy for these discontinuous habitats. The research that Sara and Paulino are currently undertaking should provide this information. I am grateful to Sara and Paulino for sharing their research and their excellent companionship in the field. I am very appreciative of the hospitality of Mrs. Sara Ortega and Mr. Jesus Huerta who welcomed me in their home and Marciano and Lorena Valtierra for their fine tour of Chamela-Cuixmala. — Perran Ross, *Florida Museum of Natural History, University of Florida, Gainesville FL 32611, USA*

CSG On-Line

ONE MILLION PLUS! The CSG web page at www.flmnh.ufl.edu/natsci/herpetology/crocs.htm received more than one million 'hits' in February 2000 and reached 1,254,355 hits in May. This represents between approximately 55,000 and 70,000 individual user sessions that averaged 10 minutes each. This means more than 50,000 people a month are making significant use of our web site. Most of these are probably not CSG members. The website has become our major outreach vehicle on crocodylian conservation to the general public and scientific community, far surpassing our Newsletter, Proceedings, general correspondence or any other method.

This is reflected in inquiries made to CSG. During June, I received 58 new unsolicited contacts from the public of which 31 (53%) explicitly said they had discovered CSG on the web. Presumably a few of the others did also but failed to mention it. While many of these inquiries are trivial (and time consuming!), e.g., "Please send me information on....." or "May I use an image from your page?" Others include substantive questions from CITES Management Authorities, businesses, researchers, film makers and conservation organizations seeking CSG's input into their activities. Our web site is the place where many of these 'clients' learn of our existence and interests. Put 'crocodile' into any web search device (Yahoo, Lycos, etc.) and the

CSG site turns up quickly in the first few entries found.

The web site also generates modest revenues, about \$300 in the last quarter, with the potential for much more (see Chinese Alligator Conservation Fund editorial pages 2-3).

However, having congratulated ourselves on this major initiative, we must also inform you that the major entry site for the CSG activity is Adam Britton's "Crocodilian Conservation" pages hosted on the CSG site. We must also shamefully reveal that our site is just not keeping up with the rapid rate of change that the electronic medium requires. Posting the last two newsletter issues on the web was delayed, the Spanish version is sadly behind, the Cuba meeting information is out of date and the general text and layout have not been updated for several months. We just lack the time (in competition with other urgent demands) and the readily available technical expertise to keep our pages updated and active. The web world is fiercely competitive and if we wish to maintain our current prominence, we need to improve our web page.

We are considering attracting the assistance of a part time web organizer to keep our pages in order. This will have financial and practical implications but follows very directly on our stated policy of decentralization of CSG's functions. We believe the CSG web site to be a very important part of our activities and outreach to the world conservation community and public. — Eds.

Veterinary Science.

FATAL OVARIAN HEMORRHAGE IN A MUGGER. On 22 February 2000, a young captive female mugger (*C. palustris*), code #629, 19 years old and 212 cm total length was found dead at the Madras Crocodile bank. The animal was in good nutritional state and did not show any signs of external injury. On postmortem examination the internal organs were found to be pale. The abdominal cavity was filled with a yellowish fluid and at the base of the right ovary there was a large blood clot. Twenty one eggs had descended the two oviducts and had reached the shell gland portion, but only a thin layer of shell had been deposited. There was no significant

size or weight difference between eggs in the left oviduct (n=10) and the right oviduct (n=11).

We were not able to determine the actual point of origin of the hemorrhage, but we presume that it occurred during ovulation and that the hemorrhage was slow and death finally occurred before deposition of the shells had been completed. In the absence of signs of external injury we consider it unlikely that the hemorrhage occurred as the result of fighting. Does anybody know of any other such cases? — N. Whitaker, *Madras Crocodile Bank, Center for Herpetology, Mamallapuram, P.O. Box #4, TN 603104, India* & F. W. Huchzermayer, *P.O. Box 12499, 0110 Onderstepoort, South Africa.*

EXCESSIVE STOMACH STONES IN AN INDIAN MUGGER. On 3 February 2000, a captive mugger female, code #91, 15 years old, total body length 210 cm, weighing 38.5 kg was found dead and was presented for necropsy. Upon incision of the stomach, 13 large granite stones were found, two of them obstructing the pyloric sphincter. The total weight of the stones was 1,600 g or 4.15% of the animals weight.

Cott (1960, *Trans. Zool. Soc. Lond.* 28(4).) describes the relation of stomach stones and body weight of *C. niloticus*. He reported the mean percent of body weight represented by stones as 0.85% in a sample of 39 female *C. niloticus* with a range of body lengths from 200–250 cm and mean body weight of 40.92 kg.

I do not know of any information published on the cause for the abnormally large quantity of stomach stones we found. Has anyone else experienced similar large loads of stomach stones in other species? Has there been any research to evaluate the cause of this behavior? — Nikhil Whitaker, *Asst. Curator Madras Crocodile Bank, Center for Herpetology, Mamallapuram, P.O. Box #4, TN 603104, India*

STOMACH STONES. After reading Chris Whittles' CSG Newsletter Vol. 14(3):22 item on X-ray observations of digestion in alligator I am convinced that stomach stones in crocodilians are not for the purpose of grinding up food. I have previously commented that the violent churning reported by the X-ray study was probably a reaction to the radioactive marker (Newsletter 13(4):23-24 and 14(2):19). There is a big difference between strictly carnivorous crocodiles with their powerful digestive juices

and chiefly herbivorous chickens that need 'grit' in their diet.

Are stomach stones for ballast? A fairly good answer appeared in CSG NEWSLETTER, January 1974, Vol. 1 (9):1, quoting another hard-to-find reference that is worth quoting again here. DIVING WORLD Vol. 1 (5) :228, official magazine of the National Association of Underwater Instructors stated: 'Crocodiles swallow stones. 680 crocodiles studied by British zoologist Dr. Hugh Cott in Uganda and Northern Rhodesia were found to have stones in their stomachs. Dr. Cott used X-ray to learn that the stones in the lower part of the stomach serve as a counterweight for the lungs, located higher up. The weight of the stones was found to be one percent of the crocodile's weight.' CSG Newsletter editor at the time, James

Powell, commented, "It's encouraging to see the work of CSG members attracting attention outside the immediate field of crocodilian studies."

These old but valuable observations do not address why some crocodiles have stones and some do not or why wild alligators swallow hard pieces of wood. There are still numerous questions about use of stones and other hard materials that could be usefully studied in captive animals. Do crocodilians with stones grow better than those without? Does the acquisition and retention of stones vary with temperature? diet? food availability? Do crocodiles ever defecate pebbles? There is still a need for experimental data about hard objects in stomachs of living crocodiles. — Franklin Ross, *Boekelstatt 14, Hoofddorp, 2131 WT Netherlands*. [Franklin Ross submitted these comments some time ago but it seemed an appropriate moment to present them. *Eds.*].

Zoos



FIRST EUROPEAN BREEDING OF MORELET'S CROCODILE. Nuremberg Zoo, Germany, successfully bred *Crocodylus moreletii* in December 1999. The parents were on loan from

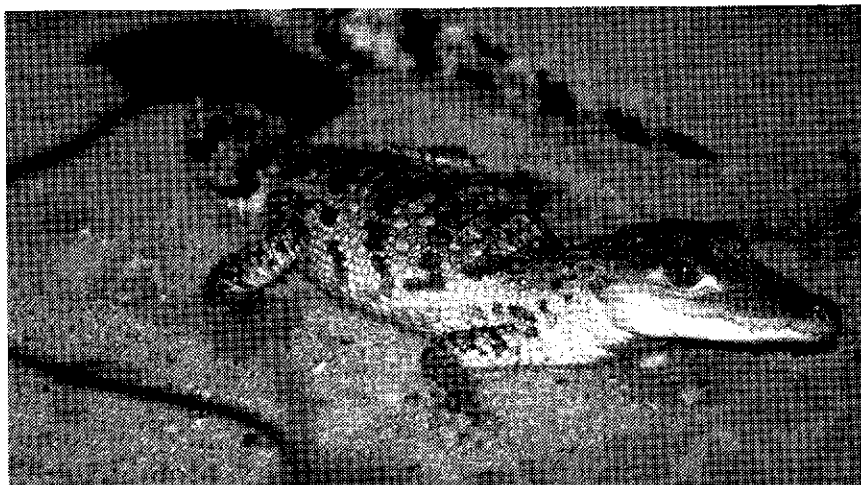


Photo. One of the *C. moreletii* born in Nuremberg Zoo in December 1999. Ralf Sommerlad,

Vienna Zoo while their enclosure there was under construction. Eleven eggs were laid 27 September 1999, and were removed to an incubator where three of them hatched just before Christmas. — from European Association of Zoos and Aquaria (EAZA) news 30-2000 submitted by Rene Honegger, Mythenstrasse 6, CH-8802 Kilchberg, Switzerland.

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