CROCODILE SPECIALIST GROUP NEWSLETTER

VOLUME 25 No. 1 • JANUARY 2006 - MARCH 2006

IUCN - World Conservation Union • Species Survival Commission

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COVER PHOTO. "Parks Australia North" rangers, traditional landowners and local residents participated in the capture of a 4.21 m long, male Saltwater Crocodile (*Crocodylus porosus*) at Moline Rockhole Creek, Mary River, Northern Territory. A satellite transmitter was attached to the crocodile before it was released, as part of a collaborative research program involving Parks Australia North, Wildlife Management International, Charles Darwin University and the Parks and Wildlife Service of the Northern Territory. Photograph: Garry Lindner.

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

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

The NEWSLETTER is available as hard copy, electronic copy, or can be downloaded from "www.flmnh.ufl.edu/natsci/herpetology/CROCS/CSGnewsletter.htm". A voluntary annual contribution is requested from subscribers to defray expenses of producing the NEWSLETTER.

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Rachmat Wiradinata, Jakarta, Java, Indonesia.

Editorial

The CSG is currently seeking funding to support surveys of *Caiman crocodilus apaporiensis* in the Rio Apaporis area of Colombia. The project is being co-ordinated by Alvaro Velasco (CSG Regional Chairman) and Giovanni Ulloa (Regional Vice Chairman). It is hoped that surveys will be undertaken in July-September 2006.

Palau recently joined CITES (July 2004), and lodged a reservation on *Crocodylus porosus* at the time that it did so. Since early 2005 it has been developing a conservation and management program for *C. porosus*, one of the goals of which is to be "a guide to the steps necessary to down-list the CITES ... classification for the Palauan *C. porosus* population if Palau decides to pursue a crocodile industry involving the trade or export of crocodile products". Following consultation with Palauan authorities, a CSG review mission was undertaken in mid-March 2006 to view the situation in Palau first-hand, discuss Palau's current management regime, and make recommendations that can help it to achieve its goals with *C. porosus*. The results of the review should be available in the next issue of the CSG Newsletter.

In February, the CSG Executive Officer travelled to Cambodia and Viet Nam in a personal capacity, but managed to devote time to meet with CSG members and industry people in both countries. In Cambodia, Tom visited one medium-sized farm, and discussed with Government progress with recommendations made by the CSG review team in 2005. The current low price for hatchlings has forced Cambodian farms to consider a change in direction, towards skin and meat production rather than the export of hatchlings. In Viet Nam, authorities confirmed reports of hatchlings being sighted in Cat Tien Park, site for the reintroduction of captive-raised *C. siamensis*. Both the Cambodian and Vietnamese Governments are looking at the registration of additional crocodile farms as CITES captive breeding facilities.

Grahame Webb, CSG Chairman.

Fuchs' Book to be Re-published

Karlheinz Fuchs' book, 'Die Krokodilhaut' (1974), is a classic and important guide to the identification of crocodilian skins, written in German, by a tanning engineer with decades of experience and a fine eye to detail. The book is out of print, but with some "encouragement' from some CSG members, Karlheinz has decided to update and re-publish the book, in English.

It is a very useful project that would help various CSG members, other people involved in the skin industry, and perhaps CITES Management Authorities. To assist in the publication of this important reference book, the CSG has pre-purchased 100 signed copies of the book, which are being offered at a discounted price (see below).

The publishers (Mr. Brahm and 'Edition Chimaira' in Frankfurt) are aiming to have the new version available for the CSG meeting in Montélimar, France (see page 26).

People ordering a pre-purchased, signed version of the book can: pick it up at the CSG meeting if they are attending; or, have it posted to them. An order form is enclosed with this Newsletter.

Normal retail price is expected to be 30 Euros, but pre-ordered copies from the CSG are available for 25 Euros ($US38 or $AUD50) (plus postage, if applicable).

Tom Dacey, *CSG Executive Officer, <csg@wmi.com.au).*

Regional Reports

North America

USA

ROCKEFELLER REFUGE AFFECTED BY HURRICANE RITA. [Many CSG members will be familiar with Rockefeller Refuge, having visited and experienced the wonderful hospitality extended over the years by Ted Joanen, Ruth Elsey and the staff there. In September 2005, the refuge was struck by Hurricane Katrina, and I sought a brief article from Ruth Elsey, knowing that many people who have visited the refuge would be keen to know how it fared. *Charlie Manolis, ed.*]

An unusually active hurricane season impacted coastal Louisiana in 2005. Hurricane Katrina hit southeast Louisiana in late August, followed by a large, strong (Category 3) Hurricane Rita which made landfall in southwest Louisiana on 24 September at Sabine Pass, about 50 miles west of Rockefeller's headquarters in Grand Chenier. Sustained winds of 110 miles/hour (176 km/h) were estimated at Lake Charles (monitoring equipment was lost), the storm surge in the Grand Chenier area was up to 15 feet (4.6 m), and numerous tornadoes developed.

CSG members who have visited Rockefeller may recall that many of the buildings at Rockefeller were elevated on pilings, after having been damaged or destroyed in Hurricane Audrey in 1957. Thankfully this limited damage to the present office. However, most other buildings sustained some damage (work shop, lumber shed, airboat sheds, dormitories, etc.). Numerous structures were entirely washed away, including the field laboratory which many CSG members have used over the years.

Sadly, over half the staff at Rockefeller lost their homes completely, and most others have significant damage which will take months to repair. The entire staff is displaced from their homes, but are all back to work (albeit with lengthy commutes from 50-60 miles away). Plans are underway to repair and rebuild with improvements and continue the work done there in marsh enhancement, and research and management of alligators, waterfowl and fisheries resources.

Close monitoring of the effects of the storm on wildlife will continue over the next several months. Fortunately, many landowners in coastal Louisiana participate in the wild egg ranching program, and thus many thousands of newly hatched alligators were protected from tidal surges in farm facilities. Thus, the ranching program limited direct mortality to alligators; although a few dead alligators were noted on aerial and ground surveys. We are concerned about long-term habitat changes due to saltwater intrusion and marsh/vegetative losses. After Hurricane Andrew in 1992, alligator nesting rebounded to pre-storm levels by the next year. However, the possible damage to Louisiana's coastal marshes (excellent alligator nesting habitat) from the combined effects of Hurricanes Katrina and Rita remains to be seen.

Photo 1. Extent of flooding around the alligator raising chambers two days after Hurricane Katrina (see next photographs). Photograph: Parke Moore.

Photo 2. Office (right) and shop (left), showing floodwaters and extensive damage. Photograph: Parke Moore.

Louisiana's wild annual harvest was delayed until 14 September, to allow trappers, buyers, processors and dealers to regain their infrastructure after Hurricane Katrina, as supplies needed (such as fuel, refrigerated trucks, ice, etc.) were diverted to the relief efforts in southeast Louisiana. Fortunately, most alligator trappers in southwest Louisiana had completed the majority of their

harvest prior to having to evacuate for Hurricane Rita. Some 32,500 wild alligators were harvested; which comprised about 90% of the tags allocated for 2005. Some trappers in the hardest hit areas affected by Hurricane Katrina were unable to hunt due to loss of their homes, boats, equipment, etc. Overall the hunt was successful and prices were strong; quotas were high this year as nesting in 2005 was the third highest year on record.

Photo 3. Laboratory and alligator raising chambers before Hurricane Katrina.

Photo 4. Laboratory and alligator raising chambers after Hurricane Katrina. Photograph: Parke Moore.

Photo 5. View of Rockefeller from the northeast, showing office and shop in the foreground, and lumber and airboat sheds in background. Photograph: Parke Moore.

Photo 6. Remains of the laboratory (bottom centre) and alligator raising chambers (bottom left). The lumber and airboat sheds are in the background (left), as are the shop and office (right). Photograph: Parke Moore.

Photo 7. Visitor accommodation. Photograph: Parke Moore.

We appreciate the many kind e-mails we have received form CSG members with words of encouragement as we rebuild from this hurricane.

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

Australia and Oceania

Australia

In October 2005, after many months of debate and discussion, the Australian Federal Government rejected the Northern Territory's plan to include safari hunting within its management program for *Crocodylus porosus.* The program allows for a wild harvest of up to 600 *C. porosus* (including problem crocodiles), and the Northern Territory

proposed that 25 of these animals could be taken by commercial trophy hunters.

The issue gained considerable attention in the media, with the Federal Government seeking submissions from the public, NGOs, etc. A well-known "crocodile identity" was strongly opposed to the Northern Territory's proposal, and may have influenced the final decision. Regardless of the positive submissions received, the overwhelming support in the Northern Territory, including traditional landowners and the general public, and the benefits that would have accrued to both traditional and non-aboriginal landowners, the Minister for the Environment and Heritage, Senator Ian Campbell, rejected the proposal.

The question was not whether any more crocodiles would be killed or not, but rather who would pull the trigger! Not one extra crocodile would have been killed with the approval of safari hunting. It was disappointing to see science, common sense and international experience disregarded. It was argued by opponents that free-range shooting would not guarantee that the crocodiles were killed in a humane fashion. Despite various safeguards included by the Northern Territory Government in their proposal, including a second shooter, it was not enough to budge the Federal Government's stand. "I do not believe that safari hunting of crocodiles is consistent with a modern day approach to animal welfare and responsible management," Senator Campbell said.

Under Northern Territory legislation, approval could be given for crocodiles to be taken by trophy hunters, but the export of the parts (eg head, skin) is not possible without Federal Government approval. It has responsibility for exports and imports and regulates activities where wildlife is exported overseas.

Charlie Manolis, *CSG Regional Chairman for Australia and Oceania, <cmanolis@wmi.com.au>*.

Papua New Guinea

Plans to introduce safari hunting in Papua New Guinea have hit red tape. Australian Mick Pitman approached the PNG Government with a plan to carry out hunting safaris for "high-paying clients to shoot man-eaters" (proven man-eaters or threats to people and livestock). Hunts were initially advertised for $US180,000, but were later reduced to $US100,000. However, PNG authorities were still considering his proposal.

There was negative feedback from the PNG crocodile industry on the proposal. Not that they disagreed with the need to control problem crocodiles. Rather they are concerned that after many years of encouraging and educating landowners to protect breeding crocodiles, the proposal could potentially lead to the loss adult animals. With the establishment of an egg harvest program in the Sepik River area, egg predation by humans has decreased significantly, but more importantly breeding females are not being killed. Nesting trends for *C. porosus* indicate an increasing adult population.

Under PNG legislation, landowners are able to kill crocodiles of any size, but skins greater than 50 cm belly width cannot be exported. This legislation was introduced so as to protect breeding adults. Safari hunting of crocodiles is carried out elsewhere in the world, and if well-managed in PNG, could provide significant benefits to landowners. However, the appropriate control and regulations would be required to ensure that the crocodile population is not detrimentally affected.

Source: *Northern Territory News, 28 January 2006.*

CROCODILE ATTACKS ON THE INCREASE. A 13-year-old girl and a 24-year-old man were killed by crocodiles in separate incidents in the Gulf Province of Papua New Guinea in January 2006. A number of other crocodile attacks were reported last year in other parts of the country.

Attacks regularly occur in Papua New Guinea, but recent media coverage on proposed safari hunting (see above) has given these recent attacks some prominence. Improved communication in remote areas means that attacks are now more likely to be reported.

Europe

PARTNERSHIP IN BREEDING TOMISTOMA. It is not unusual for US zoos to send crocodilians on breeding loan to a few proven and experienced private holdings. The famous and renowned Dvur Kralove Zoo in Czechia has now sent one of their two adult *Tomistoma schlegelii* pairs on breeding loan to the private crocodile breeder Miroslav Prochazka, who recently bred *C. rhombifer* [CSG Newsletter 24(3)] and is keeping several other crocodilian species.

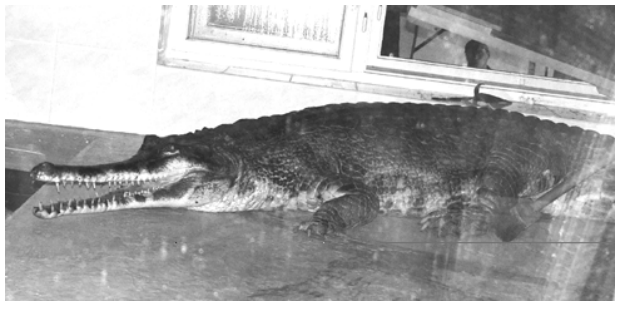

Figure 1. Female *Tomistoma schlegelii* (2.8 m TL, 110 kg) on breeding loan to Miroslav Prochazka.

This form of partnership between zoos and private holdings

is still unsual in Europe, but it opens a new opportunity in the *ex-situ* conservation of these endangered crocodilians. Dvur Kralove Zoo is now hoping to get their remaining male to breed without the presence of the other male. Separating these two pairs may improve their chances for successful reproduction.

Ralf Sommerlad, *Chairman, CSG Tomistoma Task Force, Rödelheimer Landstr. 42, D-60487 Frankfurt, Germany, <crocodilians@web.de>*.

REPTILE CRAZE. In February 2006, an animal welfare charity recovered 10 hatchling crocodiles and a variety of poisonous reptiles from a car which had been stopped by police outside of Newry, Northern Ireland. More reptiles were later recovered from a house near Omagh during the investigation into the illegal trading of wild animals. According to the charity, the diminishing demand for big cats was being replaced by a craze for dangerous reptiles, and legislation was required to stop illegal trade by unlicensed dealers.

Source: *BBC News (news.bbc.co.uk/2/hi/uk_news/northern_ireland/4745976.stm)*

Latin America & the Caribbean

Ecuador

BLACK CAIMAN POPULATION AND ECOLOGICAL RESEARCH IN ECUADORIAN AMAZONIA. In 2002, after a Black caiman (*Melanosuchus niger*) research training course organized by the Wildlife Conservation Society in Ecuador and conducted by John Thorbjarnarson (see Thorbjarnarson 2003), crocodilian research priorities in Ecuador were determined. Due to a lack of detailed information about the nesting biology of the Black caiman and its population status in Ecuador, WCS funds were secured to start a pilot research project in the Ecuadorian Amazonia.

The project was carried out during the dry season (October 2002 to March 2003) at Limoncocha (at the Limoncocha Biological Reserve) and Añangu Lagoons (in the Yasuní National Park´s north-western region). These two water bodies are influenced by black water systems (Igapo), but Limoncocha is also influenced by the Napo River white water system.

Seven Black caiman nests were found (Limoncocha 4, Añangu 3) and a continuous follow-up of all of them was carried out during the incubation period. A total of 199 observation hours was completed at one of the nests at Limoncocha. In another nest, camera trap photographs of the nesting female opening it were obtained (Fig. 1). Hatching rate was 39.7%, and flooding was identified as the main cause of egg mortality (29% of all eggs).

Figure 1. *Melanosuchus niger* nesting female (~2.9 m TL) removing nest material when the eggs hatched.

Black caiman populations at Limoncocha and Añangu showed encounter rates of up to 8.27 and 4.09 ind/km of shoreline, respectively. Previous surveys in Añangu, reported up to 14 ind/km (Villamarín-Jurado *et al.* 2002; Thorbjarnarson 2003). A high abundance of juveniles and adults was observed (Fig. 2) and a high proportion of reproductively active adult females was detected, suggesting that these populations appear to be healthy (Ross 1997, 1999).

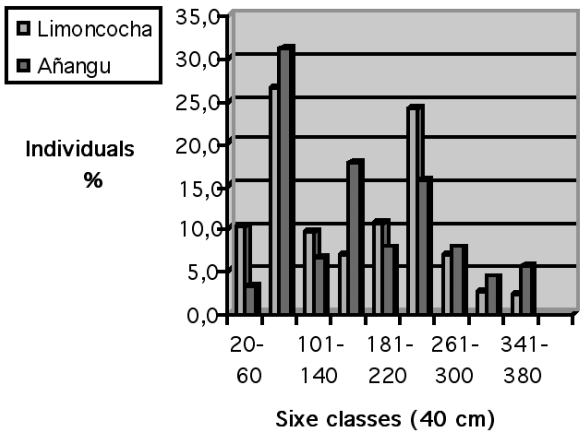

Figure 2. Size structure of the *Melanosuchus niger* populations at Limoncocha and Añangu.

Although this favorable panorama for *M. niger* was found, the Limoncocha population of *Caiman crocodilus* seems to have been dramatically reduced over the last 20 years, possibly due to hunting pressure for human consumption.

Habitat use analysis suggest that the microhabitat called "Mandial", composed of emergent vegetation where *Montrichardia linifera* (Araceae), Poaceae and Cyperaceae grassland predominate, is the one preferred by hatchlings

and adults, because this is where nesting occurs. Once the eggs have hatched, hatchlings and nesting females remain in these habitats.

These results have demonstrated the importance of biological research for creating a scientific basis to plan management programs for Black caiman and other species in Ecuador. These studies have also motivated further population and ecological research in other locations, particularly in the Cuyabeno Reserve in the Ecuadorian Amazonia central region.

Acknowledgements

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[This report is part of the author´s BSc thesis: Villamarín-Jurado, F. (2006). Anidación y patrones de uso de hábitat del Caimán Negro, *Melanosuchus niger* (Crocodylia: Alligatoridae), en dos localidades de la Amazonía ecuatoriana. Pontificia Universidad Católica del Ecuador. It is available from the author.]

Francisco Villamarín-Jurado, <*franciscovillamarin@yahoo.com.ar*>, and Luis de Beethoven, *Quito, Ecuador*.

Bolivia

APPLYING GIS FOR RE-DESIGNING THE BOLIVIAN YACARE CAIMAN HARVESTING PROGRAM. Since 2002, the Bolivian caiman conservation and sustainable harvesting program has allowed for the export of about 45,000 *C. yacare* skins per year. The program has benefitted local communities, but has also shown weak governmental coordination and control (Larriera 2002; Llobet *et al*. 2004).

In 2004, the Bolivian Biodiversity Office (DGB) initiated efforts to strengthen the program by calling a national expert advisory group to discuss and implement new legislation, technical changes, and administrative improvements. As a result of this process, the Noel Kempff Mercado Museum (NKMM) in Santa Cruz, in partnership with Wildlife Conservation Society (WCS), took the lead in designing a new harvest monitoring scheme and a method to establish and distribute the annual harvest quota among the hundreds of potential requests for harvesting in the Beni and Santa Cruz areas of Bolivia.

For these changes to be put into effect, two Ministerial decrees were passed in 2005; one modifying the previous caiman program statute, and another naming the NKMM as a CITES Scientific Authority for wildlife issues in the Bolivian lowlands. The Museum is currently responsible for surveys and reviewing local management plans to ensure that harvesting is not detrimental for the wild populations. Preliminary results (Rumiz and Llobet 2005) were presented in April 2005 at the CSG regional meeting in Santa Fe, Argentina, and the lessons learned during this initial step are being included in the new general wildlife statute under revision. Here, we describe the methods designed to catalogue the licensed users, to distribute the harvest quota among them, and to start monitoring population abundance and harvest.

Defining and cataloging requests for harvesting

Requests for harvesting are submitted to Beni and Santa Cruz Natural Resource offices on the basis of land ownership for individuals or community groups. Three main land ownership categories are accepted: privately owned cattle ranches, communal land and indigenous territories (TCOs). The petition includes a certified copy of the original land titles and a map of the property. If the property map is not available in digital form, the original map is digitized by the NKMM, with the following attributes assigned: case number, property name, province, property area, and land ownership category.

Once requests are processed and digital maps are available for all requests, a GIS spatial analysis is conducted to verify any discrepancies between reported information and property location and area. Property maps are compared to other GIS map layers to verify: location (department,

province, municipality, or if it is within a protected area), identify the caiman eco-region the property is located in, and other information that we may want to analyze later (watershed, sub-watershed). Furthermore, the digitized property maps are compared to each other to verify if there are any overlaps between claimed properties. Superposition over forestry concessions, municipal reserves, and other protected areas are also verified. Conflicting properties are dealt with on a case by case basis by the appropriate administrative authorities.

Some TCO or communal territories claim extensive areas which have not yet been granted and the areas of these claims have to be reduced accordingly. Other claims are located in areas that are completely inaccessible, which makes their claim to potential harvesting of caimans dubious. Some requests have even been made for regions where there are no wetlands or rivers implying that there are no caiman habitats. It is clear that some of these requests are submitted for the sole purpose of obtaining a caiman harvesting quota that can be sold or traded. We found that GIS is the ideal tool to identify these discrepancies and facilitate the appropriate decisions.

Some of the technical difficulties, however, have come as a result of a significant growth in the number of claims. For example, 626 claims were received in 2005 for the Beni region (see Fig. 1), which was twice as many as the were presented in 2004. The digitization of these requests presented a series of problems such as illegible maps, lack of geographical projections, and a series of problems related to overlapping of properties and protected areas due to inaccurate surveying of properties or other mishaps. As mentioned before, these issues were dealt with on a case by case basis.

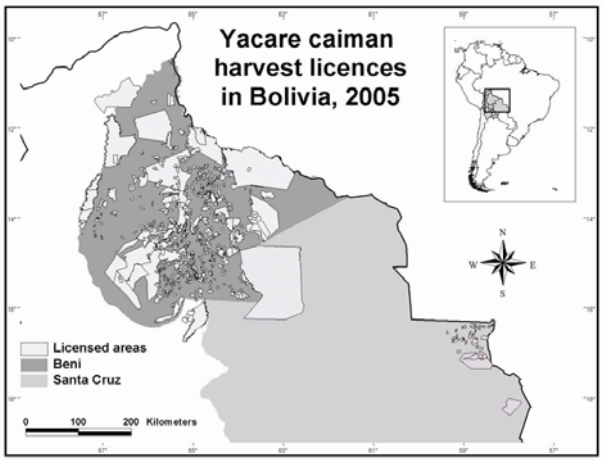

Figure 1. Private properties and indigenous territories requested for harvesting, and mapped in GIS.

Procedure for determining harvest quotas

Once all problems related to the digitization and cataloguing of requests where resolved, we proceeded to assign harvest quotas for each property. Spatial information from available GIS coverage were used as well as field surveys conducted through the monitoring program.

The monitoring program involved collecting field data from various key locations in the Santa Cruz and Beni regions. Several teams recorded caiman population numbers and habitat characteristics. Of particular interest was quantifying the number of caimans per linear kilometre of water body (river, stream, lagoon, lake, etc.) in key locations. A database linked geographically by GPS measurements was kept, which included the following surveys:

- 40 key locations surveyed in 2005 in the Beni region covering a variety of natural habitats and water bodies.
- Two years of caiman monitoring data from the Isiboro Secure indigenous area and national parks which was part of their management plan (FAUNAGUA *et al*. 2004).
- Caiman population data collected in the San Matias region of the department of Santa Cruz.

Caiman populations were divided into size (age) classes, and only the larger (Class IV) individuals were considered appropriate for harvesting. These data were further analyzed to calculate an average number of harvestable caimans per linear kilometre of rivers and lakes margins as related to the GIS coverages presented below. The number of caimans per hectare of wetlands was also determined and used in conjunction with the wetland coverage below.

Bolivian hydrological map at a scale of 1:1.000.000 (UOT-BID 2002) with the following categories:

1. Lakes (lagoons, lakes, meanders)
2. Permanent wide rivers (Wide enough to identify both margins)
3. Permanent rivers
4. Secondary rivers (only a few were identified)

Wetlands map of Bolivia at a scale of 1:1.000.000 (UOT-BID 2002) with the following 5 inundation classes:

1. Alluvial plains of occasional flooding (1-30 days/year)
2. Occasional flood plains (1-30 days/year)
3. Seasonal to occasional flood plains (31-90 days/year)
4. Seasonal to permanent flood plains (91-180 days/year)
5. Permanent flood plains (greater than 180 days/year)

A hydrological map of Santa Cruz (1:100,000 scale) which was prepared by the NKMM and complemented by the digitization of lagoons in the San Matías region. This map has a better resolution than previous maps, but the distinctions between rivers and lakes is not adequate.

Using the above coverages, together with field data of potential caiman harvesting, it was possible to calculate a harvest quota for a specific property. A simplified version of the equation used is:

Quota = [(lakesKM x potCAI1) + (riverKM x potCAI2) +(wetAREA x potCAIarea)] x FS

Where,
Quota = caiman harvesting quota per property;
lakesKM = linear km of lake margins in property;
riverKM = linear km of rivers in property;
wetAREA = area (ha) of wetland in property;
potCAI1 = potential number of caimans to be harvested per km of lake margin (and type) for that region;
potCAI2 = potential number of caimans to be harvested per km of river (and type) for that region;
potCAIarea = potential number of caimans to be harvested per area of wetland (and type) for that region; and,
FS = factor of safety.

By overlaying all digitized property coverages on the hydrological map, we were able to extract the total lengths of rivers (permanent, wide, and secondary) and length of lake margins for each property. By overlaying the digitized property coverage on the wetland map we were able to extract the area (ha) of each wetland type for each property. We could then use the number of caimans per km of river or lake and number of caimans per area of wetland type obtained from the field surveys to calculate the potential number of caimans in a specific property and thus assign a harvesting quota. By analysing all digitized properties together we were able to limit the total harvesting quota for Bolivia using a factor of safety (FS) to maintain the harvest within the self imposed limit of 45,000. We foresee that as the Caiman monitoring program progresses, additional data will become available to better identify the geographical distribution and harvest potential of caimans for different eco-systems, thus improving the designation of harvesting quotas. Subsequently it will also lead to establishing improved national limits for the harvesting of caiman.

Recent advances

In August 2005, a CSG review team visited Bolivia to assess the caiman program [see CSG Newsletter 24(4) for details]. Late last year, the NKMM participated in a bi-national meeting about wildlife management between Brazil and Bolivia, and organized with WCS a training course on caiman management for Bolivian biologists. Currently, and with the support of the National Program for Sustainable Biotrade, the NKMM is focused on improving the caiman geographic database and estimating population abundance and distribution country-wide to adjust the national harvesting quota. Since Bolivia is currently going through significant political changes, one of the main challenges facing the program will be to continue and reinforce coordinated monitoring actions with new government authorities.

Acknowledgements

We thank the national and departmental authorities in La Paz, Beni and Santa Cruz, the Biotrade Program, the Bolivian caiman specialists group, and fellow biologists at the NKMM who took part in this effort.

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NEW WEBSITE FOR YACARE PROGRAM. The Bolivian Ministry of Sustainable Development (Vice-Ministry of Natural Resources and Environment) has developed a website on the Program for Conservation and Sustainable Use of the Yacare Caiman in Bolivia (www.mds.gov.bo/DGB/Lagarto/PagPrincipal.html). It is an excellent website, providing information on the program, legal framework, biology of the species, publications, upcoming events, news, contacts, etc.

EARLY OBSERVATION OF A MOTHER/YOUNG RELATIONSHIP IN THE BROAD-SNOUTED CAIMAN FROM BOLIVIA. Natural history data on the broad-snouted caiman (*Caiman latirostris*) are generally scarce (Yanosky 1990). Data about maternal care in this species were not published before the 1980s (Widholzer and Melo 1983; Gruss and Waller 1986). However, more than 50 years earlier, an interesting mother/young relationship was observed in Bolivia by the German mammalogist Prof. Martin Eisentraut (1902-1994) during his expedition to the Bolivian Chaco in 1930. Eisentraut was based at Villa Montes, Tarija Province, and carried out surveys of the mammal and bird fauna. In a popular little book (Eisentraut 1983) he described an incident with caimans that took place in early September 1930 in a small lagoon east of Villa Montes, close to the Pilcomayo River. From the book it appears that the caimans involved might have been Jacarés (*C. crocodilus yacare*). Fortunately Eisentraut had reported this incident personally to me, with more detail than in his booklet. Moreover, his observation referred to a voucher specimen still in his possession (Fig. 1).

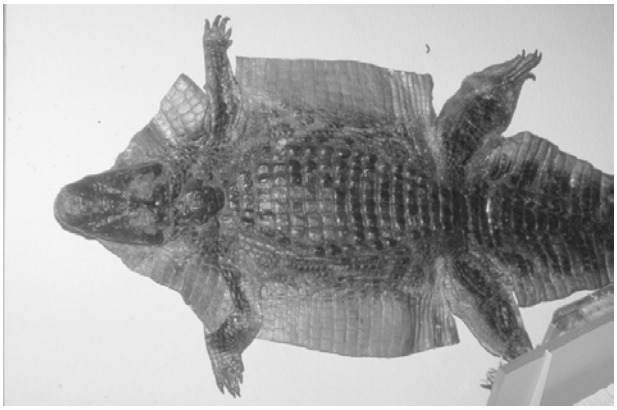

Figure 1. Voucher speciman of adult, female *C. latirostris.*

When sitting at a small, pond-like lagoon the bank of which were already beginning to dry out, Eisentraut saw the head of an adult caiman in the middle of the water, which he shot. The hit animal turned around belly upside, so that it was necessary to use a lasso to pull it out of the water. It turned out to be a female. To his great surprise, several hatchling caimans followed with loud squeaks their dead mother out of the water, and two of them were also collected.

When starting his Chaco expedition, Eisentraut was employed at the Zoologisches Museum, Humboldt University, Berlin (ZMB), where he deposited the two juvenile voucher specimens. They are still in the collection (Catalogue Numbers ZMB 35332 and 36586). The adult female was prepared as a hornback skin with the skull included. Many years later when he was the director of the Zoologisches Forschungsmuseum A. Koenig (ZFMK) in Bonn, he donated the specimen to this museum (ZFMK 76389).

Eisentraut's historical locality record of *Caiman latirostris* in Bolivia was situated in an area which is currently the last documented place in this country where this species still existed in the 1980s (King and Videz Roca 1989; Ergueta and Pacheco 1990), and where it might still be today. The area, fitting well with the only extant Bolivian locality on the map of King and Videz Roca (1989), might be separated from the Paraguayan populations, as the whole northern and northwestern Chaco of Paraguay seems to be free of *C. latirostris* (Scott *et al*. 1990).

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Brazil

STUDIES OF *MELANOSUCHUS NIGER* AND *CAIMAN CROCODILUS* POPULATIONS IN THE JAVAES RIVER, ARAGUAIA NATIONAL PARK, TOCANTINS, BRAZIL. Three of the six species of crocodilian in Brazil occur in the State of Tocantins [*Melanosuchus niger* (Black

caiman), *Caiman crocodilus* (Common caiman) and *Paleosuchus palpebrosus* (Cuvier's Dwarf caiman)]. *Melanosuchus nige*r and *C. crocodilus* occur in the Javaés River that surrounds the eastern side of the Araguaia National Park, Bananl Island. Bananal Island is the largest fluvial island in the world and the Araguaia National Park is considered a RAMSAR site.

Population studies are being carried out in the Javaés River (12°50' W, 9°40' S) and the resulting data can contribute to updating the status of these species, especially for *M. niger*, which may warrant downlisting from CITES Appendix I to Appendix II. Distribution patterns in different environments along the river (eg beaches, ravines, fringing vegetation and river basin), density and population structure (size and sex) of *M. niger* and *C. crocodilus* are being assessed.

Data collection was carried out during the dry season (May-October) and the wet (flood) season (November-April) (Table 1).

Table 1. Density and proportion of *Caiman crocodilus* sighted during surveys. *onset of dry season.

Date	Season	No.	Density	% *C. c.*
October 2004	Dry	893	17.9	69.6
March 2005	Wet		0.28	30.0
June 2005	Dry *		2.28	82.4
August 2005	Dry	577	10.5	72.5

Overall density and the proportion of *C. crocodilus* sighted in the dry season were higher in the dry season than in the wet season (Table 1). Almost 70% of sightings in August 2004 and August 2005 were eyeshines.

Based on the August 2005 survey, the size structure of *C. crocodilus* consisted of: 10.2% Class I (<50 cm), 37.2% Class II (50-140 cm), 37.9% Class III (140-180 cm) and 14.6% Class IV (>180 cm). For *M. niger* it was 0% Class I, 21.5% Class II (50-190 cm), 34.6% Class III (190-210 cm) and 43% Class IV (>210 cm). No small (<50 cm) *M. niger* were sighted.

Most (65.6%) of *M. niger* were sighted in fringing vegetation, compared with 83.7% for *C. crocodilus*. With respect to size class, Classes III and IV were observed in ravines, beaches and the river basin. Classes I and II appeared to prefer fringing vegetation environments.

In general, both species are concentrated in larger numbers along the river during the dry season, when water levels are low. At this time, the number of *M. niger* was higher. It was observed that as an individual's size increased, so did its territory. This study is in its initial phase and we will continue with population studies, and we intend to include observations on thermoregulatory behavior and nesting (incubation temperature, sex ratio and hatching success, parental behaviour) of both species.

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Africa

Gabon

CROCODILES AND NATIONAL PARKS IN GABON. The well-preserved natural environment in Gabon is home to all three species of African crocodiles. These species were protected by a Gabonese Decree in 1966, with provision for a hunting period. The commercial hunting for skins ceased in 1975, when the wild stocks were too depleted (especially for *Crocodylus niloticus*), and the decree was therefore no longer published. Since then, crocodile hunting for meat has continued throughout the country, although crocodiles presently benefit from partial (but mostly unapplied) protection according to current Gabonese laws. After our interviews with old hunters and fishermen, the scarce available literature data and our field observations, the original distribution and population densities of crocodiles within the country were much affected by hunting, especially in the Ogooué River (type locality of *Osteolaemus t. tetraspis*) and adjacent lakes and swamps, and the Gabon Estuary. Depletion of Nile crocodile populations appeared so severe that some authors (Dupuy *et al*. 1998) thought it was probably extinct in Gabon.

Pending field surveys dedicated to the evaluation of the impacts of hunting and environmental changes on population status at a national level, an important step is to record the current respective representations of crocodile species in the recently (2002) established network of 13 national parks and in the other protected areas. Our field work and literature searches (see Pauwels *et al*. 2004, 2006b,c) led to the record of the current presence of *Crocodylus cataphractus* in three national parks (Ivindo, Loango and Moukalaba-Doudou), *C. niloticus* in two (Loango and Moukalaba-Doudou), and *Osteolaemus t. tetraspis* in six (Akanda, Loango, Lopé, Minkébé, Moukalaba-Doudou and Pongara) (see Fig. 1).

Little herpetological fieldwork has been done to date in Gabon's national parks, and it is obvious that more of the 13 parks have crocodiles. Due to its ecological requirements, it is however possible that the Nile crocodile won't be recorded from more parks, except perhaps Mayumba, along the coast near Congo. It is still common in Loango N.P., but in Moukalaba-Doudou N.P. it is always

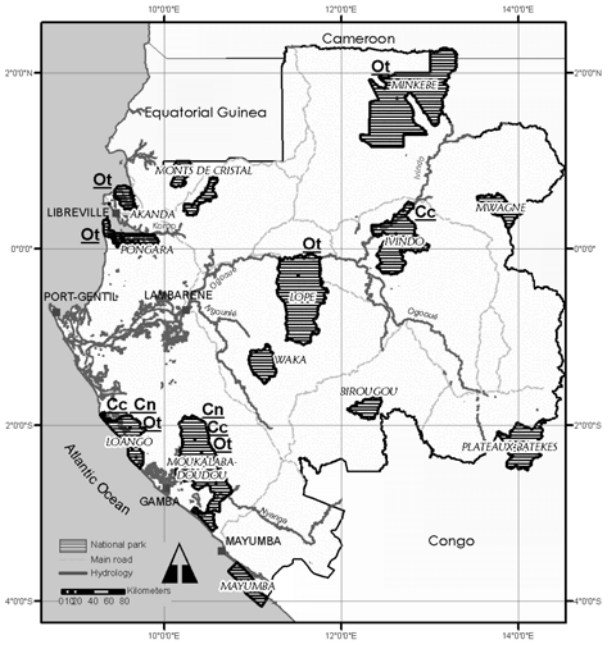

Figure 1. Map of Gabon, showing the 13 national parks. Known occurrences of crocodile species in the parks are indicated (Cc= *C. cataphractus*; Cn = *C. niloticus*; Ot = *O. t. tetraspis*).

observed in very small numbers (personal obs., 2005). It is still hunted in the Nyanga River along Moukalaba-Doudou, and frequently seen, along with *C. cataphractus*, in the nearby Mayonami market (pers. obs., 2004-2005). It was probably once present in the mangroves and rivers of Akanda and Pongara National Parks near the capital of Libreville, but seems to have been extirpated from there because of hunting (see Vande Weghe 2005).

The future record of *C. cataphractus* from several additional parks, in particular Lopé, Minkébé and Mwagna (= Mwagne), is very probable. Blanc and Frétey (2000) recorded *C. cataphractus* from a locality just outside Lopé N.P. It is urgent to make sure that viable populations inhabit some parks, because this species is heavily threatened by hunting wherever it occurs in the country. Thanks to its ubiquity and ecological plasticity, it is expected that *Osteolaemus* will eventually be recorded from all parks. It is much hunted in Gabon for its meat, but still widely distributed and common. Possibly only Loango and Moukalaba-Doudou National Parks, both situated in the Gamba Complex of Protected Areas, host the three species. The Gamba Complex is thus important in terms of crocodile conservation, and it moreover includes Lake Divangui, right between both parks, which would be an adequate sanctuary for *C. cataphractus* (Pauwels 2004; Pauwels *et al*. 2003), and which is also home to *Osteolaemus* (Barr 2004). In December 2005 we examined the skulls of 7 recently-killed adult and subadult *C. cataphractus* in a village along Lake Mandjé (also called Cachimba) in the southeastern part of the Gamba Complex, and the villagers report the species to be locally common.

Priority conservation actions for Gabonese crocodiles include: better control of the meat trade (especially for *C. cataphractus* and *C. niloticus*) and the parallel development of alternative protein resources; species inventories in national parks and other protected areas, contributing in the same time to increase their ecotouristic value; and, definition of important, still unprotected localities, to be proposed as biodiversity sanctuaries. Touristic boat circuits to observe crocodiles are already operational in Loango National Park. Tourist guides, park ecoguards and students from the Forestry School (Ecole Nationale des Eaux et Forêts, Cap Estérias) should be involved as much as possible in crocodile monitoring and conservation programs.

Acknowledgements

Our research is supported by the Smithsonian Institution/ Monitoring and Assessment of Biodiversity Program and grants from Shell Foundation and Shell Gabon. This publication is contribution 56 of the Gabon Biodiversity Program (contribution 55 was made by Pauwels *et al*. 2006a). We thank Annabelle Honorez (SI/MAB, Gamba) for the map and Ekki Waitkuwait (PSVAP, Libreville) for constructive comments.

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West Asia

Iran

NEW SITUATION FOR MUGGER POPULATION IN IRAN. After the long years of harsh drought in Mugger crocodile habitats in Iran, there were heavy rains in the area. The resulting flooding caused destruction and damage to many small villages. Bridges and most parts of the roads were destroyed. On the other hand, most of the ponds, and especially Pishin Dam filled completely, and for some weeks it exceeded its maximum capacity (175 million cubic metres) and overflowed. Later rain kept it full, guaranteeing a water supply for crocodile ponds.

Water runoff from the reservoir keeps Sarbaz (Bahukalat) River flowing, and enough water reaches the next smaller Dam (Kahir Borz). The Department of Environment (DOE) has no responsibility for the amount of runoff, and the local staff of the Ministry of Power are authorized to apply any management. On the contrary, the situation along Kaju River is still not suitable, and only a few ponds over a long distance contain some water; a dam is under construction on this river.

The main part of the Mugger population was aggregated in the reservoir during the water shortage, and the amount of water and intensity of flow during the flooding caused some of the crocodiles to fall through the overflow into the overflow pool (Fig. 1), which holds water because of blockages to its drainage pipe. The trapped crocodiles have no way to escape from this pool. During the first flooding, 9 crocodiles which had fallen were captured and released back to the reservoir by local DOE staff from the cities of Chabahar and Rask. The second time, three crocodiles were caught and released. These incidents are likely to be repeated in any later flooding, and we have yet to find a solution.

Figure 1. Mugger Crcodiles in the overflow pool.

In order to make legal support and protection more effective, the Environment High Council approved an article in May 2005, doubling fines for killing crocodiles from 16,000,000 Rilas to 32,000,000 Rilas ($US350).

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Nepal

A recent publication from the International Institute for Sustainable Development examined the impact of Maoist rebel activity in Nepal on the environment and on the ability of conservation organizations to work in conflict-affected regions (Murphy *et al*. 2005).

The study was carried out between August 2004 and January 2005, a period that coincided with a marked increase in Maoist activity in Kathmandu. The conflict has resulted in over 12,000 people being killed, more than 200,000 people being internally displaced, and hundreds of thousands fleeing to neighbouring India.Dwindling government control in rural regions has interrupted or halted effective development efforts for many NGOs, international organizations and donors.

Gharial crocodiles were one of the species examined in the study. The Kasara Gharial Breeding Center has been successfully raising gharials in captivity since 1977, and

Nepal's wild gharial population currently stands at about 100 individuals. The KGBC currently has over 350 gharial hatchlings, but its activities are threatened by budget cuts. Since the government declared the state of emergency in November 2001, the environment sector has been increasingly under-funded. Last year's environment budget was reduced by 14%, and the budget reduction in 2005 translated into a 50% cut in funds for the gharial center. This could seriously impact a crucial link in the gharial's survival in Nepal.

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Southeast and East Asia

Malaysia

The Segama River is a major river system to the south of the Kinabatangan River in eastern Sabah, with an altitude of 0-30 m above sea level (Fig. 1). Riverine habitat varies from mangrove and nipah swamps of the delta, to lowland dipterocarp forest and freshwater swamp forest with freshwater oxbow lakes and swamps. The river and swamps are fresh in the middle reaches and brackish in their lower reaches. About 80% of the wetland is permanently inundated. Lowland riverine forest dominated by *Octomeles sumatrana* (commercial timber) in the lower reaches with transition to mangrove, *Rhizophora apiculata* and nipah, *Nipa fructicans* (Fig. 2).

In all, 45 spotlight surveys were carried out between June 2004 and July 2005. Crocodiles sighted were categorised on the basis of estimated length, as hatchlings (<0.5 m), juveniles (0.5-1.0 m), subadults (1-2 m), adults (>2 m) and "eyes only". Numbers of crocodiles sighted varied with time of year, with maximum numbers being recorded in the dry season (April-June). Most sightings were recorded between km40 and km65, where the water is fresh.

Depending mainly on time of year non-hatchling *C. porosus* density was 0.33-2.67 ind/km for the upstream 45.1 km section of the Segama River, and 0.31-1.83 ind/km for the downstream section (Kaur *et al.* 2005). Non-hatchling density in June 2005 was 1.42 ind/km, which represents a significant increase on densities reported by Whitaker (1984) in 1981 (11 crocodiles in 285 km; density of 0.04 ind/km). In addition, the size structure of the population in 2005 is heavily biased towards juveniles (92% of animals sized were <2 m TL), which together with the confirmed sightings of hatchlings (February-April) indicates that recruitment from nesting is taking place.

We also examined the attitudes of local people towards crocodiles. Generally, they were fearful of crocodiles, but had a healthy respect for them. They were aware that *C. porosus* is a protected species, and although they "are uncomfortable and afraid with the presence of crocodiles in the river, they feel that it would be wrong to remove them completely from the river".

Ranching may be a future option that can benefit local people, and create positive incentives for the conservation of *C. porosus* in the Segama River. Additional research on this population is planned, on movement, diet and habitat.

Figure 1. Overview of Segama River, Sabah, Malaysia.

Figure 2. Nipah palm (*Nipa fructicans*) habitat along the lower reaches of the Segama River.

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Science

Recent Publications

Merchant, M.E., Mills, K., Leger, N., Jerkins, E., Vliet, K. and McDaniel, N. (2006). Comparisons of innate immune activity of all known living crocodylian species. Comp. Biochem. Physiol. Part B 143: 133-137.

Abstract: Serum samples from all twenty-three known living members of the Crocodylia were tested for antibacterial activity against eight bacterial species. These data were used to generate an immune profile for each crocodylian species. Statistical analyses revealed that the three living lineages of crocodylians, Alligatoroidea, Crocodyloidea, and Gavialoidea, were distinguishable by their immunological activities. For instance, species within the Alligatoroidea and Crocodyloidea exhibited remarkable immune activity similarities to others in their own lineages. Comparisons of the members of the different lineages, however, revealed substantial differences in immune profiles. Furthermore, species that are in the same genus were shown to exhibit more immune similarities to each other than to members of other genera within the same family. Finally, our immunological analyses reveal that *Tomistoma schlegelii* aligns more closely with the Gavialoidea than the Crocodyloidea.

Isberg, S.R., Thomson, P.C., Nicholas, F.W., Barker, S.G. and Moran, C. (2005). Quantitative analysis of production traits in saltwater crocodiles (*Crocodylus porosus*): I. reproduction traits. J. Anim. Breed. Genet. 122: 361-369.

Abstract: Repeatability and phenotypic correlations were estimated for saltwater crocodile reproductive traits. No pedigree information was available to estimate heritability or genetic correlations, because the majority of breeder animals on farms were wild-caught. Moreover, as the age of the female breeders could not be accounted for, egg-size measurements were used as proxies. The reproductive traits investigated were clutch size (total number of eggs laid), number of viable eggs, number of eggs that produced a live, healthy hatchling, hatchability, average snout-vent length of the hatchlings and time of nesting. A second data set was also created comprising binary data of whether or not the female nested. Repeatability estimates ranged from 0.24 to 0.68 for the measurable traits, with phenotypic correlations ranging from -0.15 to 0.86. Repeatability for whether a female nested or not was 0.58 on the underlying scale. Correlations could not be estimated between the measurement and binary traits because of confounding. These estimates are the first published for crocodilian reproduction traits.

Isberg, S.R., Thomson, P.C., Nicholas, F.W., Barker, S.G. and Moran, C. (2005). Quantitative analysis of production traits in saltwater crocodiles (*Crocodylus porosus*): II. age at slaughter. J. Anim. Breed. Genet. 122: 370-377.

Abstract: Crocodile morphometric (head, snout-vent and total length) measurements were recorded at three stages during the production chain: hatching, inventory [average age (±SE) is 265.1 ± 0.4 days] and slaughter (average age is 1037.8 ± 0.4 days). Crocodile skins are used for the manufacture of exclusive leather products, with the most common-sized skin sold having 35-45 cm in belly width. One of the breeding objectives for inclusion into a multitrait genetic improvement programme for saltwater crocodiles is the time taken for a juvenile to reach this size or age at slaughter. A multivariate restricted maximum likelihood analysis provided (co)variance components for estimating the first published genetic parameter estimates for these traits. Heritability (±SE) estimates for the traits hatchling snout-vent length, inventory head length and age at slaughter were 0.60 (0.15), 0.59 (0.12) and 0.40 (0.10) respectively. There were strong negative genetic (-0.81 ± 0.08) and phenotypic (-0.82 ± 0.02) correlations between age at slaughter and inventory head length.

Isberg, S.R., Thomson, P.C., Nicholas, F.W., Barker, S.G. and Moran, C. (2006). Quantitative analysis of production traits in saltwater crocodiles (*Crocodylus porosus*): III. juvenile survival. J. Anim. Breed. Genet. 123: 44-47.

Abstract: Mortality records of 1302 juvenile crocodiles were available for analysis. Crocodiles that were slaughtered during this study were treated as censored (n = 2151). Additionally, records from animals that had neither died nor been slaughtered, i.e. were still alive in the production system (n = 1582), were censored at the last date of data collection. There were a total of 3733 censored records. The data were all full-sib records from 29 parental pairs from Janamba Croc Farm (Northern Territory, Australia), collected over nine consecutive years. Data were analysed using an extension of Cox's proportional hazards model to include frailty (random) terms to account for genetic effects. Heritability of log survival time for juvenile crocodile survival was 0.15 (SE 0.04). The probability of a juvenile crocodile surviving to day 400 was estimated to be only 51%. These results are the first to quantify juvenile survival in a captive breeding situation. Also, this is the first heritability estimate of crocodile survival and is a fundamental element in the development of a genetic improvement programme.

Isberg, S.R., Thomson, P.C., Nicholas, F.W., Webb, G.J.W., Manolis, S.C., Barker, S.G. and Moran, C. (2006). Quantitative analysis of production traits in saltwater crocodiles (*Crocodylus porosus*): IV. number of scale rows. J. Anim. Breed. Genet. 123: 48-55.

Abstract: A total of 3156 scale row records, comprising 1739 full-sibling records from 30 families from Janamba Croc Farm (NT, Australia) and 1417 parent-offspring records from 19 families from Wildlife Management International, Pty Ltd (NT, Australia), collected at each facility using a different method, were analysed using ASReml. The full-sibling heritability estimate for the Janamba data was 0.37 (SE 0.03). The animal model estimate of heritability for the Wildlife Management International (WMI) data, also based predominantly on full-sibling data, was 0.42 (SE 0.04). The counts from three counting methods were evaluated by regression analysis on 100 individuals and were found to be highly correlated. Using the regression relationship, the WMI data were transformed and pooled with the Janamba data to give an animal model heritability estimate of 0.42 (SE 0.04). A multitrait analysis revealed negligible correlations (both phenotypical and genetical) between hatchling size traits and the number of scale rows. There is ample genetic variation to incorporate this trait into a genetic improvement programme for farmed saltwater crocodiles.

Platt, S.G., Sovannara, H., Kheng, L., Stuart, B.L. and Walston, J. (2006). *Crocodylus siamensis* along the Sre Ambel River, southern Cambodia: habitat, nesting, and conservation. Herpetological Natural History 9(2): 183-187.

Abstract: We investigated the conservation status of the endangered Siamese crocodile (*Crocodylus siamensis*) along the Sre Ambel River in southern Cambodia from 2000-2002. The Sre Ambel River drains much of southwestern Cambodia before flowing into Kampong Saom Bay. Extensive, heavily vegetated wetlands and oxbow lakes characterize the floodplain. A combination of daylight surveys and nocturnal spotlight surveys were used to assess the distribution and status of crocodile populations in this region. We verified the occurrence of *C. siamensis* at six sites based on observations of crocodiles, the presence of tracks and scat, evidence of nesting, and a fresh skeleton obtained in a village. Crocodiles are uncommon in the main river channel, and seem to prefer oxbow lakes with floating mats of vegetation and permanent freshwater marshes. Observations of nesting activity suggest that most clutches are deposited during the late dry season (March-April) in nest mounds composed of soil and vegetation, and hatchlings emerge at the beginning of the wet season (June-July). The long-term viability of the *C. siamensis* population along the Sre Ambel River is doubtful owing to the widespread collection of living crocodiles to stock breeding farms; other crocodiles are taken incidental to fishing activities.

Steubing, R.B., Bezuijen, M., Auliya, M. and Voris, H.K. (2006). The current and historic distribution of *Tomistoma schlegelii* (the False Gharial) (Müller, 1838) (Crocodylia, Reptilia). The Raffles Bulletin of Zoology 54(1): 181-197.

Abstract: *Tomistoma schlegelii* the "False Gharial" (Müller, 1838) is one of the largest yet least-known of the world's 23 crocodilian species, restricted to Indonesia and Malaysia. We compiled and mapped 210 records and overlaid these against geological river systems and current vegetation, in order to assess historic and current distribution, relationship to key habitats and potential centres of current abundance. The current distribution of *T. schlegelii* extends over lowland regions of eastern Sumatra, Kalimantan and western Java (Indonesia), Sarawak and Peninsular Malaysia, Vietnam and Thailand, within 5 degree north and south of the equator. Additional records from Sabah (Borneo) and Thailand are unconfirmed, and early records from Thailand may have originated from regions currently within Peninsular Malaysia. The Pliocene to early Pleistocene distribution of *T. schlegelii* was apparently much broader than its historical range, and extended over lowland river systems of Indonesia, Malaysia and into southern China. Since the discovery of the species in 1838, a significant decline in the density of populations throughout range states has occurred, more markedly since the 1940s. Ironically, the broad outline of the original distribution seem to have remained. A large portion of the records appear to be associated with peat swamp forest, a highly threatened category of tropical forest, suggesting that a decline in abundance is related to habitat loss. Current areas in which the species appears to still maintain reasonable levels of abundance are in southern Sumatra, west Kalimantan and south-central Kalimantan, although some smaller protected populations occur in central Sarawak. Current *T. schlegelii* breeding habitats are under threat throughout range states as a result of the progressive draining, logging, burning and clearing of swamp forests.

Verdade, L.M., Piña, C.I. and Araujo, J.L.O. (2006). Diurnal use of space by captive adult broad-snouted caiman (*Caiman latirostris*): Implications for pen design. Aquaculture 251(2-4): 333-339.

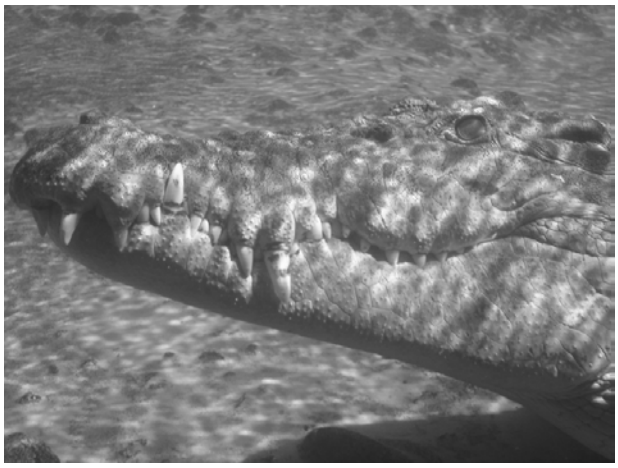
Abstract: Crocodilians generally present low reproductive success in captivity. The reasons for this are still unclear, but the faulty design of reproductive facilities can be a cause of stress, injuries and social disruption. This study explored the use of space by captive adult broad-snouted caiman in order to improve pen design for farming species. Caimans showed a predominant use of the pool and its margin during daytime. Even in our small (9 x 10 m) pens, caimans used pools and their margins significantly more than areas farther removed from pools. This pattern suggests that caiman farmers should maximize pool area and perimeter in pen design.

Submitted Articles

CROCODILIAN TOOTH REPLACEMENT. It is well known that crocodilians replace their teeth on a regular

basis and in a very specific pattern (Edmund 1960, 1962). Maximo, our 15' 3" (4.65 m) long Saltwater crocodile (*Crocodylus porosus*) had orange teeth, stained by the tannins in the water were he lived in Australia. Since arriving at St. Augustine Alligator Farm Zoological Park in October 2003 [see CSGN 23(1)], every time Maximo lost a tooth it was very obvious, as the old orange-stained teeth were replaced with bright, white new teeth.

It is worth noting the last orange-stained tooth was lost exactly one year after Maximo arrived at our facility. He managed to loose and replace every tooth in his smile over a 12-month period. Photographs of Maximo and some video of him feeding are available at: www.alligatorfarm.com.



Literature

Edmund, A.G. (1960). Tooth replacement phenomena in the lower vertebrates. Roy. Ontario Mus. Life Sci. Div. Contr. 52: 1-190.

Edmund, A.G. (1962). Sequence and rate of tooth replacement in the Crocodilia. Roy. Ontario Mus. Life Sci. Div. Contr. 56: 1-42.

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

EXTREMELY OLD NAMES CAN BE DANGEROUS. In his revision of the living Crocodilia in 1807, Georges Cuvier said that *Crocodylus africanus* Laurenti was based on faulty pictures, and he purposefully rejected it from zoology. Later, John Edward Gray was so afraid of *C. africanus* Laurenti that he never mentioned it in any of his papers about crocodilians. Further, George Albert Boulenger and almost all modern authors who have tentatively listed *africanus* in the synonymy of *C. niloticus* have placed a prominent question mark before it, clearly indicating their considerable uncertainty about assigning the old name as a synonym.

The reason that the IUCN now recognizes the subspecies *C. niloticus africanus Laurenti*, with its type locality newly restricted to Tanzania, is that Karlheinz Fuchs said it was so in 1974, and he somehow convinced the German museum community to go along with him. They then included the remarkable taxon in the prestigious and much respected Das Tierreich magazine issue (Wermuth and Mertens 1977), and then in the IUCN-approved CITES manual in 1983. This recent literature consists of lists and repeats of the original data, and in total it amounts to the single original action in 1974.

Thus, so long as the IUCN recognizes *C. niloticus africanus* Laurenti as being the Tanzanian subspecies of the Nile crocodile, the CITES list is contradicting history up until 1974, because essentially nobody but Laurenti has ever before dared to recognized both *niloticus* and *africanus* simultaneously. Someone should figure out if Fuchs, when he resurrected *africanus* Laurenti, had a destabilizing effect on *C. niloticus* Laurenti and *C. acutus* Cuvier, and on the genus *Crocodylus* Laurenti as well. Note that Laurenti's *africanus* was based on three pictures in Seba, and one of those animals is spotted and has no postoccipital scutes, which makes it *C. porosus* according to the 1995 CITES guide and all other sources, assuming that it is a crocodile at all.

While I have no negative prejudice against subspecies in *C. niloticus* or any other living crocodilian species, my advice to the IUCN is to drop *africanus* Laurenti. Get it off the list immediately, without even testing the hypothesis that Tanzanian belly skins can be identified. If it is necessary to discuss subspecies of Nile crocodiles in eastern Africa, the name *C. niloticus pauciscutatus* from Kenya is already in use, and it has a type description based on real animals. For the sake of hypothesis testing, please classify your samples as *C. n. niloticus* from Egypt and Sudan, *C. n. pauciscutatus* from Kenya and Tanzania, *C. n. cowieii* from Zimbabwe and South Africa, *C. niloticus binuensis* from the Congo and Niger drainages along the Atlantic to Mauritania. The boundary between *C. n. binuensis* in the west, and *C. n. niloticus* in the east, is the essentially north-south running Dharfur divide in easternmost Chad. The other subspecies borders are anyone's guess, except for *C. n. madagascariensis* which is an island.

SPECIAL CROCS DO NOT KEY TO THEIR NAME. Because *Crocodylus niloticus pauciscutatus* Deraniyagala (1948) is recognized as valid today in the CITES identification documents for living crocodilians, the ventral scale count range alleged by the IUCN to identify the subspecies needs serious attention. The type series of the name, and also several additional photographed specimens from the type locality, do not key out correctly, because Deraniyagala (1948) included ventral scale count data that significantly disagrees with the current CITES numbers and further, photos of bellies of topotypes of *pauciscutatus*

Deraniyagala published by Graham and Beard (1973) appear to agree with the Deraniyagala data in the type description.

Also note that *pauciscutatus* was originally distinguished from the nominate subspecies, *C. n. niloticus* Laurenti, by dorsal armor characters, and Deraniyagala found no significant difference between the bellies of Faiyum, Egypt crocodiles compared with Lake Rudolf (= Lake Turkana) crocodiles in Kenya. The suggestion that Deraniyagala's ventral scale counts were wrong, and that the belly scales really do separate *pauciscutatus* from nominate *niloticus* originated in 1974 in Germany, and deserves rigorous testing before being reprinted in another IUCN-advised CITES document.

Deraniyagala, P.E.P. (1948). Some scientific results of two visits to Africa. Spolia Zeylanica 25 (2): 1-42.

SUBSTITUTE NAME LEADS TO NAME SUBSTITUTIONS. It is impossible that *Crocodylus niloticus chamses* Bory should have its type locality restricted to the Congo River, because it is an unnecessary substitute name for the older name *C. vulgaris* Cuvier, and even if it was needed, *chamses* must retain the original type locality of the name it replaces. Note that the type locality of *C. vulgaris* has recently been restricted to Egypt, and it accomplished Bory de St. Vincent's stated aim, because his choice of *chamses* was based on the ancient Egyptian god Chamses, to put the Nile back into the Nile crocodile. The available Nile crocodile group name based ecologically closest to the Congo River is from the eastern branch of the Niger River drainage, at the Binué River, and it was originally and correctly described as *Crocodylus binuensis* Baikie (1857).

It is counter-intuitive that a Nile crocodile population that is sympatric with the African Slender-snouted crocodile should be more slender-headed than Nile crocodiles from Egypt and South Africa, but that is what Baikie claimed that his measurements showed, when compared with published data from John Edward Gray. My explanation of the discrepancy is that Dr. Baikie probably measured the length of the head differently than Gray did. Because Baikie measured cleaned skulls from the front of the snout to back of the ball of the occipital condyle where the cranium articulates with the vertebral column, the head appeared to be longer than when Gray measured it on the dorsal midline to the posterior edge of the cranial table.

Since *C. binuensis* Baikie (1857) is unquestionably in the Nile crocodile group, the name *Crocodylus niloticus binuensis* Baikie (1857) is available to replace both "*Crocodylus niloticus suchus* Geoffroy" (sic) and "*Crocodylus niloticus chamses* Bory" (sic), as they have appeared in the recent literature since 1974. This would be the Nile crocodiles in the Niger and Congo drainages, based on the Atlantic side near "Old Calabar" and "Fernando Po" of colonial days, and extending inland to Chad, and westward under the Sahara to Gambia and Senegal.

Authors who wish to discuss the hypothesis that eastern and western Nile crocodiles are different should keep the argument at the subspecies level, and *C. n. binuensis* Baikie can be compared with *C. n. niloticus* Laurenti, and the northern subspecies can be compared with *cowieii* and *madagascariensis* if it suits you. If a purely extreme East African name is needed, avoid *africanus* Laurenti, and substitute *pauciscutatus* Deraniyagala from Kenya.

Baikie, B. (1857). On the species of Crocodilus inhabiting the rivers Kwóra and Bínuë (Niger and Tsadda) in central Africa. Proc. Zool. Soc. London 25: 48-50.

AFRICAN DWARF-CROC QUANDARY PERSISTS. In its "index B" list of recognized names, the 1995 CITES guide included two subspecies of *Osteolaemus tetraspis* Cope, the African Dwarf crocodile. However, the guide did not offer any details about how to distinguish *O. t. tetraspis* from *O. t. osborni* (Schmidt). This case of not saying anything defending or defining the subspecies of the reptile was likely the result of the quandary at hand, where authors are apparently undecided about African Dwarf crocodile systematics, and also about the nomenclaturally significant physical characters involved.

Earlier, superficially appearing to contradict the above, King and Burke (1989) had decided not to recognize any subspecies in *O. tetraspis* Cope. However, King and Burke (1989) also mentioned that the US Endangered Species Act at that time recognized two subspecies, and also mentioned that Groombridge (1982) had considered the *osborni* Schmidt subspecies "indeterminate" and not clearly understood.

After King and Burke (1989) initially established that they followed Groombridge (1982), they then wandered into the quandary, suggesting that their readers should "see Wermuth and Fuchs (1983)" which had fully recognized two subspecies of African Dwarf crocodiles, based on a study by Karlheinz Fuchs. Groombridge (1982) never mentioned the belly of *Osteolaemus* Cope, and was concerned with cranial and dorsal armor characters. On the other hand, Wermuth and Fuchs (1983) did not mention any of this secretive animal's cranial or dorsal armor characters.

It was thus misleading for King and Burke (1989) to send readers to Wermuth and Fuchs (1983) without any warning about the change from Schmidt characters such as the bony nasal septum, to ventral scales as counted by Karlheinz Fuchs on commercial belly leather. How we get out of the taxonomic quandary is simple. First, test the Brazaitis (1973) hypothesis that the belly scales down the midline from collar to vent are diagnostic for distinguishing two

named kinds of these dark colored forest dwellers, as also indicated by Fuchs *et al*. (1974), Fuchs (1974) and Wermuth and Fuchs (1983).

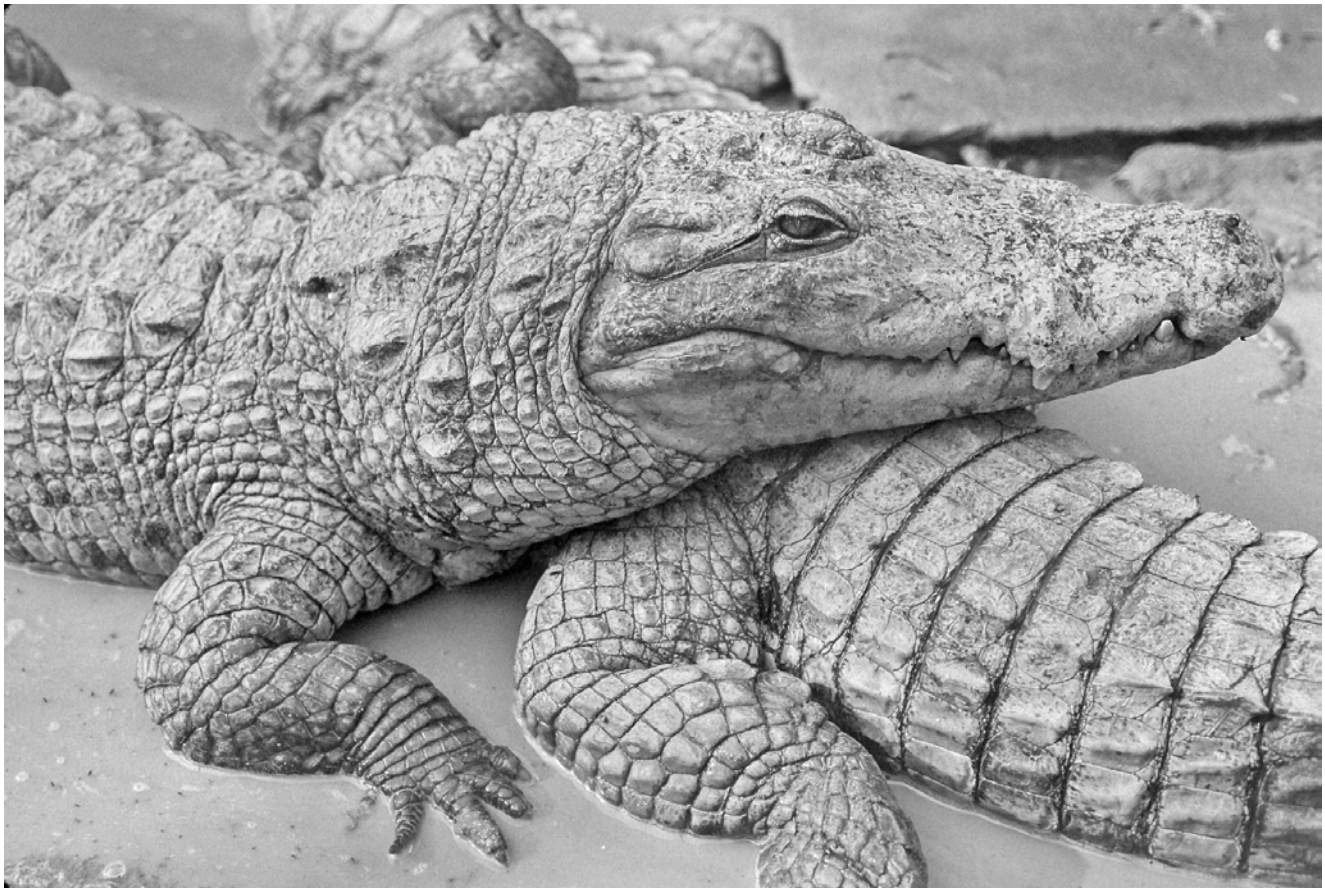
Second, go back to Inger (1948) about the bony nasal septum character and other cranial and dorsal armor characters from Schmidt. It appears that the *Osteoblepharon osborni* Schmidt skull illustrated in the type description, which happens to be the holotype skull of a skin and skull specimen, is almost an "atypicotype" (below), being the extreme of known variation in the ordinarily diagnostic nasal septum character. Inger (1948) found intermediate conditions of internarial division, including a paratype of *osborni* Schmidt, where the nasal bones protrude anteriorly across the external narial opening, but stop short of contacting the premaxillary bones at the tip of the snout, and rather, cartilage fills the gap in the incompletely bony internarial septum, uniting the nasal bone and premaxaillary bone projections along the dorsal midline.

The geographic distribution of variation in the percentages and sources of the bony and cartilage contributions of the nasal septum in African Dwarf crocodiles needs attention, as does the belly scales variation. Additional cranial and dorsal armor characters from the type description of *osborni* Schmidt are discussed and generally discredited by Inger (1948), including citations to relevant literature. However, Schmidt's double crest caudals character still needs further testing with counts based on the pelvis as the starting point for vertebral correspondences.

It is clear to me that the genus *Osteoblepharon* Schmidt is not necessary, and I am likewise quite sure that *osborni* Schmidt is not a species, but the available data does not falsify the King and Brazaitis (1971) hypothesis that the African Dwarf crocodile's ventral scales are a cline, nor does the Inger (1948) data falsify the hypothesis that the *Osteolaemus* nose is a cline including the holotype skull of *osborni* Schmidt as an extreme. The AMNH 10082 skull really is impressively lacking the bony nasal septum, to the point of resembling some *Crocodylus* in having mostly cartilage, and with no contribution from the anterior end where in normal *Osteolaemus* Cope, and even some *Crocodylus* species, the premaxillary bones contribute an anterior part of the nasal septum.

Cope's genus *Osteolaemus* is real, and my only remaining nomenclatural question about *tetraspis* is whether Cope was referring to four postoccipital scales or four nuchal scales on the neck, since "*tetraspis*" means 4-scaled in Greek (Strauch 1866).

The safest listing for CITES is *Osteolaemus tetraspis* Cope without subspecies, but sinking *osborni* Schmidt before understanding it is unsatisfactory. There is work to be done.



Crocodylus niloticus at the National Zoo of Abidjan in Cote d'Ivoire (January 1990). Photograph: Ralph Schwedick.

Note that an "atypicotype" is a vertebrate paleontology joke, defined as type material said by the describer to be not characteristic of its newly named taxon. In the case of *Osteolaemus osborni* (Schmidt), the actual specimen, AMNH 10082 (type), is said by Inger (1948) to be less representative of its population than one of Schmidt's paratypes, AMNH 10083, with regard to the development of the bony and cartilage nasal septum. Test my atypicotype hypothesis, utilizing large samples from various regions.

Brazaitis, P. (1973). The identification of living crocodilians. Zoologica 58: 59-101.

Fuchs, K. (1974). Die Krokodilhaut: ein wichtiger merkmalträger bei der Identifizierung von Krokodil-Arten. Eduard Roether: Darmstadt, Germany, 183 pp.

Fuchs, K., Mertens, R. and Wermuth, H. (1974). Zum Status von *Crocodylus cataphractus* und *Osteolaemus tetraspis*. Stuttgarter Beiträge zur Naturkunde, Ser. A: Biologie (266): 1-8.

Groombridge, B. (1982). IUCN Amphibia-Reptilia Red Data Book: Testudines, Crocodylia, Rhynchocephalia. IUCN: Gland, Switzerland.

Inger, R.F. (1948). The systematic status of the crocodile *Osteoblepharon osborni*. Copeia 1948(1): 15-19.

King, F.W. and Brazaitis, P. (1971). Species identification of commercial crocodilian skins. Zoologica 56 (2): 15-70.

King, F.W. and Burke, R.L. (1989). Crocodilian, tuatara, and turtle species of the world. Association of Systematics Collections: Washington D.C.

Wermuth, H. and Fuchs, K. (1983). CITES Identification Manual, Vol. 5: Parts and Derivatives 2. *In* P. Dollinger *et al.* (eds.) series. IUCN: Gland, Switzerland.

OSTEOLAEMUS SYNTYPE HEADCOUNT REQUESTED. The type description of *Osteolaemus tetraspis* Cope, the black colored and short snouted African Dwarf crocodile, was written by the Secretary of the Academy of Natural Sciences of Philadelphia, Pennsylvania, shortly after the actual meeting where Professor Cope gave his verbal and physically supplemented presentation of what appears to be two separate specimens called *Osteolaemus tetraspis* Cope, gen. & sp. nov. One was an adult skin, and the other was a cleaned skull of a smaller individual. The cleaned skull was described in detail, but only the dorsal and ventral armor of the skin was mentioned, and it is unclear if the hornback hide had its head present or not. If the skin was lacking its head, then I wonder how Cope knew that the skin and the skull were from the same species.

All of the cranial characters of *O. tetraspis* Cope appear to be based on the cleaned skull, which was lacking locality data. The current type locality of *O. tetraspis* Cope is the Ogowe River in Gabon, originally called the Ogobai River. It is important to note that the type locality is derived from the skin, and not from the more famously diagnostic skull. Crocodile specialists are encouraged to search the University of Pennsylvania, and the ANSP, for the two cotypes of *O. tetraspis* Cope, and if they are found, redescribe and figure them in detail. Note that Barboza du Bocage (1895) said that Du Chaillu discovered the species at the Ogouvé River, possibly referring to one or both of the syntypes. It would be a real surprise if anything is found to be seriously wrong, but I am embarrassed to admit that I do not know how many heads were in Cope's sample, and I would be reassured if there were two. For the IUCN's purposes, consider *Osteolaemus* safe, and the type locality valid, until proven otherwise.

Topotypes of *tetraspis* Cope still survive in the Ogooué River region near Port Gentil, Gabon, and the African Slender-snouted crocodile, and also the Nile crocodile are found there too (Thorbjarnarson and Eaton 2004). An ontogenetic series of cleaned or possibly cleared and stained Dwarf crocodile topotype skulls from Gabon should be compared with the original *O. tetraspis* skull, if it can be located. If the original syntype skin has a head, it could be x-rayed to determine the ossification of the nasal septum, but it should not be cleaned, because it is irreplaceable evidence susceptible to damage during preparation, and possibly including some cartilage of special interest.

Barboza du Bocage, J.V. (1895). Herpétologie d'Angola et du Congo. Imprimerie Nationale: Lisbon, Portugal.

Thorbjarnarson, J. and Eaton, M. (2004). Preliminary examination of crocodile bushmeat issues in the Republic of Congo and Gabon. Pp. 236-247 *in* Crocodiles: Proceedings of the 17th Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland, Switzerland.

AFRICAN DWARF DATES AND PICTURES. Everyone agrees that the African Dwarf crocodile genus, *Osteolaemus* Cope, and its type species combination, *Osteolaemus tetraspis* Cope, appeared in print for the first time, properly noted as new genus and new species, in the December 1860 issue of the Proceedings of the Academy of Natural Sciences of Philadelphia, [1860(12): 549-550].

Strauch (1866) did not directly give a year of availability for *Osteolaemus* Cope and *O. tetraspis* Cope, but did refer to Cope's names, as a combination, as being two years earlier than a Murray (1862) name, when Strauch discussed how Cope's combination clearly had priority over *Crocodilus frontatus* Murray, in a chronological sense. However, Strauch (1866) then proceeded to argue that the

species group name *tetraspis* Cope is from the Greek, as opposed to the Latin, so Strauch rejected *tetraspis* Cope and its genus with it, and Strauch (1866) recognized *C. frontatus* Murray as the oldest available name for the generally black colored and short snouted African Dwarf crocodile.

Gray (1867, 1872) did not give an availability date for Cope's names, but he did not give availability dates for other junior synonyms, either. Incidentally Gray's (1867) misspelling "*tetraspes*" (sic), was corrected to *tetraspis* Cope in Gray's (1872) later paper. More significantly, Gray (1867, 1872) did not follow Strauch about *tetraspis* Cope being an empty name. Rather, Gray considered the Cope combination from the 12th issue of the 1860 Proceedings of the ANSP to be a junior synonym of much older names going back all the way through Georges Cuvier, to Michel Adanson's voyage to Senegal in the mid 1700s.

Boulenger (1889) appears to be the first to clearly state that *Osteolaemus* Cope and *O. tetraspis* Cope became available to zoological nomenclature in 1861. It is unclear whether Werner (1933) independently established the 1861 date, or if Werner copied the information from Boulenger's catalogue. Similarly, it is unclear if Wermuth and Mertens (1961) actually knew that the December 1860 issue was mailed from Philadelphia, Pennsylvania, in 1861, or if they copied the information from earlier sources, namely Werner (1933) and Boulenger (1889). The same is true of King and Burke (1989).

I am content to accept Boulenger (1889) as correct about *O. tetraspis* Cope becoming available in 1861. However, I object to Wermuth and Fuchs' (1983) listing "*Osteolaemus tetraspis* Cope 1861" as a CITES regulated animal, because it tells only part of the story. As a bibliographic citation, "Cope 1861" (sic) is misleading, because the paper is Cope (1860). To punctuate this phenomenon, Cope 1860 (1861) is recommended. Note that Strauch's objection to *tetraspis* Cope did not impress later authors, and *C. frontatus* Murray is today considered a junior synonym of *Osteolaemus tetraspis* Cope.

One of Cope's two syntypes, the dorsal and ventral skin, was from Gabon. The figured and complete animal holotype of *C. frontatus* Murray is from Nigeria. The head and neck figured by Strauch is without locality data. The skull with the completely ossified nasal septum illustrated by Gray (1867) is from the type locality of *O. frontatus* (Murray). The types of *O. tetraspis* Cope 1860 (1861) have never been figured, and King and Burke (1989) said that they are currently unlocated.

The Strauch (1866) pictures are reprinted in Wermuth and Mertens (1961), and Gray's (1867) *Halcrosia frontata* plate pictures were reprinted in redrawn form by a different artist in 1919, in the type description of *Osteoblepharon osborni* K.P. Schmidt, and also in their redrawn form in Werner (1933) which also includes the original 1919 pictures of *osborni* Schmidt. The text figures of *H. nigra* in Gray (1872) are reprinted from the type description of *C. frontatus* Murray (1862). Note that the combination *H. frontata* appears on Gray's (1867) plate only, and was illustrating *H. nigra* in the 1867 text as the formally recognized name of the mild mannered and remarkably inoffensive African Black Crocodile, today's *Osteolaemus tetraspis* Cope 1860 (distributed and available to nomenclature in 1861).

Boulenger, G.A. (1889). Catalogue of the Chelonians, Rhynchocephalians, and Crocodiles in the British Museum (Natural History). Trustees of the British Museum: London.

Cope, E.D. 1860 (mailed in 1861). List of the recent species of Emydosaurian Reptiles in the museum of the Academy of Natural Sciences. Proceedings of the Acad. Nat. Sci. Philadelphia 1860: 549-550.

Gray, J.E. (1867). Synopsis of the species of recent Crocodilians or Emydosaurians, chiefly founded on the specimens in the British Museum and the Royal College of Surgeons. Transactions Zool. Soc. London 6: 125-169.

Gray, J.E. (1872). Catalogue of the Shield Reptiles in the collection of the British Museum, Part 2: Emydosaurians, Rhynchocephalia, and Amphisbaenians. Trustees of the B.M.: London.

King, F.W. and Burke, R.L. (1989). Crocodilian, Tuatara, and Turtle Species of the World. Association of Systematics Collections: Washington, D.C.

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GAMBIA DWARF-CROC DOT NEEDED.Correct information about the Gambia River drainage record for the African Dwarf crocodile, *Osteolaemus tetraspis* Cope, was available in Groombridge (1982), but the CITES maps of 1983 and 1995 both ignored it.

The range map for *O. tetraspis* in the CITES guide is remarkably similar to Johanna Wermuth's earlier map illustrating the Heinz Wermuth and Karlheinz Fuchs authored part of the 1983 CITES manuals. Both correctly show Guinea and Guinea-Bissau as having the species, but at least the southernmost part of Senegal and a national park in the Gambia River drainage of southern Senegal should be indicated as being in the distribution (Villiers 1956, 1958).

Villiers (1958) said about the black colored Dwarf crocodile that "La distribution de cette espèce est très mal connue. On l'a citée du Sénégal, de la Haute et Basse Guinée, de la Sierra Leone, de Côte d'Ivoire, de Gold Coast, de Nigeria, du Cameroun, du Gabon et du Congo Belge. C'est un animal caractéristique des forêts guinéennes mais peut se recontrer dans les galeries forestières du Sud de la zone soudanienne (Niokolo-Koba, au Sud de Sénégal; Kérouané en Haute Guinée, etc.)."

In his 1956 paper, Villiers gave locality details for these *Osteolaemus* including "la région du Parc National du Niokolo Koba, au Sud de Tambacounda (13 degrees lat., 13 degrees long. environ)" and "le Ouolou, affluent de la Gambie" and he included a photograph captioned "Exemplaire sénégalais d'*Osteolaemus tetraspis*."

The rediscovery of African Dwarf crocodiles surviving in the Senegal and Gambia region confirms the very early written report of Adanson's Black Crocodile at the same place. The Senegal and Gambia *Osteolaemus* are the earliest discovered, and therefore the longest known and now documented population of their species. The next IUCN authorized map should acknowledge the very good news from Dakar, that Adanson's Crocodile Noire still survives.

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EAST AFRICA RANGE MAP UPGRADE. Groombridge (1982) said that the African Slender-snouted crocodile, *Crocodylus cataphractus* Cuvier, inhabits "extreme eastern Tanzania" (sic) really meaning extreme western Tanzania, and the 1982 Red Data Book also said that the species reaches Zambia. However, the 1983 and 1995 distribution maps in the CITES crocodilian identification documents are identical to each other in showing the whole southeastern corner of the Zaire (now Democratic Republic of Congo, previously Belgian Congo) as lacking *C. cataphractus*. The northern end of Lake Tanganyika and the whole of the Katanga district of Zaire should be stippled. The part of Zambia closest to Katanga and Lake Tanganyika should also be marked to indicate that *C. cataphractus* is present.

Loveridge (1940) said that " (*Crocodylus cataphractus*) of the Gambia reaches its eastern limits at Ujiji, Lake Tanganyika." While Ujiji is on the eastern side of Lake Tanganyika, the species was also recorded from the Zaire side of the lake, at Albertville settlement, in 1952 (de Witte 1952). The Katanga data for *C. cataphractus* is from several localities including Lake Mweru (=Lac Moero and Lac Moïro), which is half in Zaire and half in neighboring Zambia, all of which is detailed in de Witte (1953).

Expanding the *cataphractus* range map to include the southeastern corner of the distribution of the African Slender-snouted crocodile is clearly warranted, because even if they are very rarely encountered there today, *C. cataphractus* is a member of the East African fauna.

Groombridge, B. (1982). The IUCN Amphibia-Reptilia Red Data Book, part 1:Testudines, Crocodylia, Rhynchocephalia. IUCN: Gland, Switzerland.

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WESTERN AFRICAN RANGE MAP OMISSIONS. The CITES distribution maps of 1983 and 1995 for *C. cataphractus* Cuvier, are slightly misleading about the northern and southern extremes of the range of the species. In the Senegal region, both of the range maps include the Gambia River as occupied, but they show the range of the species as stopping at Dakar, as opposed to including the more northerly located Senegal River. In the absence of the Senegal River being indicated as occupied by the species, both of the CITES maps disagree with and directly contradict a statement by Villiers (1958), that the species is found in savanna habitat along the Senegal River, and that it possibly extends into southern Mauritania. Villiers (1958) also reported that the species often inhabits brackish lagoons in the Senegal region, at the northern extreme limit of its Atlantic Ocean coastal distribution.

Interestingly, at the southern extreme of its Atlantic drainage, Gulf of Guinea coastal distribution, *C. cataphractus* has also been observed to inhabit brackish water in mangrove habitat at the mouth of the Congo River (reported by H. Lang in K.P. Schmidt's famous paper about the American Museum of Natural History expedition specimens including some from the Congo River mouth, which were actually collected on the north bank in Democratic Republic of Congo (previously Zaire), as

opposed to the Angolan south bank of the estuary.

There is also a Museum of Comparative Zoology specimen from the former "Portuguese Congo" political entity, which is located just a short distance north of the mouth of the Congo River, along the Atlantic coastline, at the place called "Cabinda" today. The tiny Cabinda enclave is now part of Angola, but is disjunct from, and north of, the rest of its political nation, and thus the isolated Cabinda part of Angola is slightly more equatorial in location than any other Angolan records of Slender-snouted crocodiles.

The Cabinda enclave and also the Congo River mouth region of the *C. cataphractus* distribution maps in both of the two CITES documents is portrayed accurately enough for most purposes. However, it is important to note that neither map shows the Angolan interior Dundo region population in some of the southernmost Kasai River tributaries of the Congo River drainage, far inland and isolated from the Atlantic coast. According to Laurent (1964), the district of Dundo, Angola, *C. cataphractus* population has been known to science since the 1930s. It really should be added to the CITES map as protected.

By coincidence, the Senegal River population of African Slender-snouted crocodiles is restricted to northern gallery forest along waterways extending far inland into predominantly savanna and desert environment, and the Dundo population in Angola is also in rivers extending well beyond the limit of continuous equatorial rainforest, but this time on the southern side.

Laurent, R. (1964). Reptiles et Amphibiens de l'Angola. Publicacoes Culturais Companhia de Diamantes de Angola 67: 11-165. Lisbon, Portugal.

Villiers, A. (1958). Tortues et crocodiles de l'Afrique noire francaise. Institute Fran. Afr. Noire, Initiations africaines 15: 354. Dakar: Senegal.

MALAGASY FOSSIL IS NOT VULGAR CROC. Back around 1983 when *Crocodylus niloticus madagascariensis* appeared on the list of living crocodilians regulated by CITES, it was not the original French 1872 meaning of *madagascariensis* that the IUCN adopted, but rather the more modern German interpretation of the name, which erroneously included some fossil material and also some misidentified modern specimens. Unfortunately, the extinct *C. robustus* reported in error to survive on Madagascar in 1883, and also the incorrectly identified and nomenclaturally misleading pictures published in 1910 of the supposed living representatives of "*Croc. robustus*" (sic), have confused many people, because the specimens that were alleged to represent two different Madagascan species were really just ontogenetic and individual variation in a single endemic subspecies. Thus, some *C. niloticus madagascariensis* have been incorrectly identified in the prominent literature as being *C. robustus* when they really were Nile crocodiles, *C. niloticus* Laurenti.

There is a *C. robustus* skull in the MCZ at Harvard University that is definitely not the living Malagasy crocodile. The Harvard specimen was collected at the type locality, and is from the type horizon, and it is more complete than the skull fragments of several individuals in the original collection of disarticulated material that is the type of *C. robustus* A. Grandidier & Vaillant. Thus, I recommend that Barbour (1918) be cited as an example of the real *C. robustus* that is not regulated by CITES, and that plate 1 in Barbour (1918) should replace the 1910 pictures of adult Nile crocodiles that in error were called "*Crocodilus robustus* Grand. et Vaill." Anyone constructing synonymies is warned that many authors have included both the fossil and the modern animals in *C. robustus* by mistake, so the usage is partly one fossil species, and partly a different and living other species. Similarly, one must examine each usage of *madagascariensis* to see if it has any fossil robustus included in it, because I am certain that the true *C. robustus* from the type description, and also from Barbour (1918), is not *C. niloticus madagascariensis* Grandidier.

Barbour, T. (1918). Vertebrata from Madagascar: Amphibia and Reptilia. Bulletin of the Museum of Comparative Zoology 61(14): 479-489.

Franklin D. Ross, *Dept. Vertebrates, National Natural History Museum, PO Box 9517, Leiden 2300-RA, the Netherlands.*

BIG BITE FROM A BIG, WILD MALE NILE CROCODILE. In October 2004, in South Africa, I had the opportunity to measure the bite force of a very large wild-caught *C. niloticus*. While assisting Dr. Hannes Botha in a long-term population study of crocodiles in the reservoir of Flag Boshielo Dam, we captured a large 4.7 m long male. The animal was captured from a boat at night by using a pole snare and light, and after a brief struggle was brought ashore where it was secured. The crocodile's bite force was then measured using a dynamometer, as described by Erickson *et al*. (2004).

We recorded a maximum bite force of 2700 lb (1227 kg), making it one of the highest bite force measurements ever recorded from a crocodilian, and only a few hundred pounds shy of the highest bite force recorded for any living animal (Erickson *et al*. 2004). These results are astounding, considering that the crocodile was exhausted after struggling on the capture rope for some time, being pulled ashore, and then physically restrained by several men. I am confident that the bite force of a large (>4.5 m TL), rested, unrestrained, wild crocodile would be considerably more than we documented here, and possibly the highest bite force ever recorded.

Literature

Erickson, G.M., Lappin, A.K., Parker, T. and Vliet, K. (2004). Comparison of bite-force performance between long-term captive and wild American alligators (*Alligator mississippiensis*). J. Zool. (Lond.) 262: 21-28.

Brady Barr, *National Geographic Channel, 1145 17th St. NW Washington DC 20036, USA*; and, Hannes Botha, *Assistant Director, Mpumalanga Parks Board, Private Bag X8689, Suite 43, Groblersdal 0470, South Africa.*

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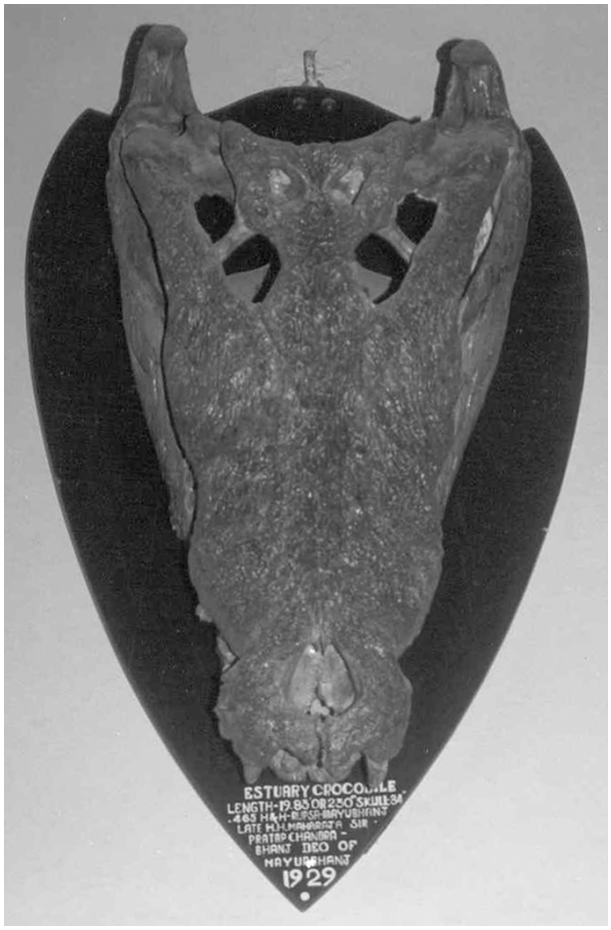
6 METRE LONG SALTIE! The following photograph is of the skull of Estuarine crocodile (*Crocodylus porosus*) shot by the late Shri Pratap Chandra Bhanja Deo, King of Mayurbhanj, in 1929, in Subarnarekha estuary of Orissa. The mangrove habitat in the area has since been totally lost, and no crocodiles can be seen there!

According to the plaque, the crocodile was reportedly 19' 8" (6.0 m) long, and the skull is 34" (86 cm) long. After adjusting skull length for loss of tissue (4%), based on the reported head length alone the total length of this animal would be estimated to be 6.5 m (Webb and Messel 1978). The skull length of a 6 m long *C. porosus* would be expected to be around 31" (79-80 cm).

A more precise estimate of total length of large *C. porosus* can be obtained using multiple regression analysis, with head length, maximum head width, snout-eye length, cranial platform midpoint width and cranial platform point-point width as independent variables (Webb and Messel 1978). Measuring these attrubutes on this skull would clarify the size of the skull, and allow reported total length to be confirmed.

Literature

Webb, G.J.W. and Messel, H. (1978). Morphometric Analysis of *Crocodylus porosus* from the north coast of Arnhem Land, northern Australia. Aust. J. Zool. 26: 1-27.



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Obituary

We were deeply saddened to learn that John L. Behler, the curator of the Herpetology Department at the Bronx Zoo, died on 31 January 2006 as a result of congestive heart

failure. John Luther Behler was born in Allentown, Pennsylvania in 1943. He received his undergraduate degree from the University of Miami and his Master's degree in biological sciences from East Stroudsburg University. After briefly teaching biology at Hobart and William Smith Colleges, he joined the Wildlife Conservation Society, which operates the Bronx Zoo, in 1970, working as an intern with then curator F. Wayne King. John became curator in 1976 and assumed a leadership role among his peers in groundbreaking captive breeding programs for endangered crocodilians, tortoises, and freshwater turtles and also focused on the ecology and behavior of reptiles. John was a well-rounded herpetologist and with Wayne King, wrote a field guide that remains in wide use, the National Audubon Society Field Guide to North American Reptiles and Amphibians (1979).

John's straight-forward manner, quick wit, charm and dedication allowed him to share his life's work with many. John had a long history of involvement on crocodilian conservation issues. In the 1970s he conducted an evaluation of the developing crocodile management program in Papua New Guinea, and a feasibility study for a captive breeding program for American crocodiles in Florida. However, concerning crocodilians, John will best be remembered for his involvement with the Chinese Alligator. In the early 1980s he was one of the first western scientists to visit China to learn for himself about the conservation status of the species. In the USA, he coordinated the captive breeding program for the species, including the establishment of the program at the Rockefeller Refuge in Louisiana that led to the first known captive breeding of the species in 1977. Likewise, John played an active role in WCS international work to conserve this species in China.

While John played an important role in a number of crocodilian conservation efforts, his real passion was for turtles. For many years John was the Chairman of the IUCN-SSC Tortoise and Freshwater Turtle Specialist Group, where he promoted turtle conservation efforts around the world. In the early 1990s, he warned about an increasing trade of wild Asian turtles in China, where they are prized as food and in preparing traditional medicines. At the time, China had been importing turtles from Thailand, Indonesia and the United States. Behler, while chairman of the turtle specialist group, argued against the practice and pushed for the opening of turtle farms in China to supply the growing commercial market. John's knowledge and love of wildlife included working on projects in many parts of the world. His recent turtle research and conservation focus had been in Madagascar, and in the metropolitan New York region. Along with Peter Pritchard and Anders Rhodin, John was one of the driving forces behind the publication of Chelonian Conservation and Biology, the journal of the Tortoise and Freshwater Turtle Specialist Group.

John authored more than 40 popular and scientific articles, and five books on reptilians and amphibians, including a number with Debbie, his wife of 28 years. He had many fiends around the world and they all will miss him greatly.

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: Visit <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).

Interesting Sign!

This photo has been taken by Nicole Wörner at the Crocodile Farm and Snake Park, St. Lucia , South Africa, It was provided with Nicole's permission by Klaus Berlig.

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