

**CROCODILE  
SPECIALIST  
GROUP  
NEWSLETTER**

VOLUME 27 No. 1 • JANUARY 2008 - MARCH 2008



# CROCODILE SPECIALIST GROUP NEWSLETTER

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VOLUME 27 Number 1  
JANUARY 2008 – MARCH 2008

IUCN  
Species Survival Commission

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Printed by: Uniprint NT  
Charles Darwin University, NT 0909, Australia

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**COVER PHOTOGRAPH:** Wild Indian Gharials (*Gavialis gangeticus*) in the Chambal River, Chambal National Sanctuary, India. Photograph: Rom Whitaker.

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

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## Editorial

The recent mass mortality of *Gavialis gangeticus* in the Chambal River, India, is one of the most complex and serious crocodilian conservation problems that the CSG has ever been faced with. We are used to population declines due to excessive harvest and sometimes extreme habitat loss, but we are dealing with species that are tenacious survivors. They give us time to find ways of rectifying the problems. What has happened in the Chambal is a real case of reduced populations being vulnerable to uncertainty - the "wild card" events which cannot be predicted, but which can ultimately prove to be far more threatening than the risks we know about and try to control. Following a plea for international assistance from the Government of India, in January 2008 Fritz Huchzermeyer organised a CSG investigative team (Samuel Martin, Paolo Martelli, Brian Stacey) which was joined by Rom Whitaker, Indian veterinarians, NGOs and Government officials in the field. Over 100 adult and sub-adult gharials have died, as a result of gout-type symptoms reflecting "kidney failure due to a 'toxic insult'" (see pages 4-8). It seems that the die-off has slowed, but we are unclear why, what the caused of the problem in the first place, and whether it will start again in the future. We thank the CSG veterinarians, and everyone else at the frontline trying to both solve and understand what has happened.

The CSG-Tomistoma Task Force held their first dedicated workshop in Thailand (see pages 8-9). I wish to thank Uthen Youngprapakorn and his family for both hosting the workshop, and providing this important event with the venue and hospitality that make memorable and productive meetings. The Tomistoma Range States (Indonesia,

Malaysia, Thailand) attended, together with most CSG-TTF members and other international participants. The CSG-TTF has set a glowing example of how CSG members, united by an interest in the conservation of a single species, can achieve so much.

The first SSC Specialist Group (SG) Chairs' meeting was held in the United Arab Emirates in February 2008. The SSC Chair, Dr. Holly Dublin, deserves great credit for the vision and effort required to bring some 100 SG Chairs together to exchange experiences about life on the frontline of voluntary conservation action for the IUCN. For the new Director General of IUCN, Julia Marton-Lefevre, and many IUCN staff members, it was a chance to meet the "silent army". For the SG Chairs it was a chance to understand where the IUCN is trying to head, and the daunting array of information needs about species that they need in order to get there. A summary of this important meeting is provided on page 4.

The review of crocodile management in Vietnam has now been confirmed (27 April to 6 May 2008), and the team will comprise Dietrich Jelden (CSG Deputy Chairman), Charlie Manolis (CSG Regional Chairman, Australia and Oceania), Toshinori Tsubouchi (CSG Regional Vice Chairman, East and Southeast Asia) and Mrs. Nguyen Dao Ngoc Van (TRAFFIC Southeast Asia).

Christine Lippai visited Madagascar again in March 2008, and advanced the workplan developed and agreed with Government and industry in late 2007. Recent changes in Government, including the Minister and Director General (DGEEF), required Christine to reform links with new personnel and further consolidate the relationship with the CITES Scientific Authority (University of Antananarivo). Budgets were prepared to cover workplan activities over the next few months, including population surveys, and now funding agencies are being approached.

The 23rd meeting of the CITES Animals Committee (Geneva, Switzerland, 19-24 April 2008) has several crocodile matters on the agenda. They include a review of source code 'R' (for ranching) on CITES permits, the effectiveness of the universal tagging system, trade in small crocodilian leather goods, and a proposal to transfer the Mexican population of *Crocodylus moreletii* from CITES Appendix I to Appendix II. A number of CSG members, including myself, will attend.

On an administrative note, the CSG finances will now be administrated largely from Darwin. The University of Florida account will be maintained for now, but its long-term future will be discussed at the 19th CSG Working Meeting in Santa Cruz, Bolivia (June 2008). Working Meetings are a unique and important opportunity for CSG members to share time with like-minded colleagues, and to influence the direction the CSG goes in the future. So please make every effort to attend!

Professor Grahame Webb, *CSG Chairman*.

## **First Meeting of IUCN-SSC Specialist Group Chairs (Al Ain, UAE; 11-14 February 2008)**

Although CSG members are united in their expertise with crocodilians and their commitment to the conservation, management and sustainable use of crocodilians, it is all only possible because Specialist Groups (SGs) are constituted under the Species Survival Commission (SSC) of the IUCN. At this level, the CSG is but one of over 100 different SGs, many of which have less members than the CSG (around 350) but some of which have more. In all, the SGs consist of over 7000 specialists, all volunteering their services to the SSC, and through the SSC assisting the IUCN to meet its mission. The context of each SG is very different, and the SSC allows great flexibility in the way SGs operate to exploit that diversity. However, many of the problems they face in global conservation are similar.

The visionary Chair of SSC, Dr. Holly Dublin, who is also the long-standing Chair of the African Elephant Specialist Group, promoted the concept of a meeting of SG Chairs. It all came to fruition in Al Ain, in the United Arab Emirates, in February 2008. It was a forum allowing SG Chairs to share experiences, and learn more about the information highway, through which the knowledge generated by SG members finds its way into and through the SSC, to the IUCN through its Species Program, and beyond. The meeting was attended by the new Director General of IUCN, Julia Marton-Lefevre, and other senior staff of IUCN.

With the changing world focus of global conservation, and the IUCN becoming increasingly involved in issues such as biodiversity conservation, climate change, sustainable use and poverty alleviation, issues of possible SG restructure were discussed at length. Although the rationale for such changes was clear in the sense that new and emerging problems needed to be addressed, the SG Chairs were generally cautious about changes that may impact on their primary focus ... the species level of resolution.

There was much discussion about the Red List, its strengths and weaknesses at the species level, and the new roles it is playing in biodiversity monitoring and conservation. There were concerns expressed by some SG Chairs that conservation at the species level had to be maintained as a critical priority. It led to talk of a global conservation conference on species conservation, to consolidate the importance of that focus.

Despite the considerable contribution SGs make to providing information to the IUCN, the voluntary nature of the SSC-SG structure means that caution needs to be exercised in placing information demands on the SGs with which they are unable to comply. The will to help is there, but for many SGs the resources are not.

It was truly remarkable to learn first-hand how other SGs function. None are legal entities in their own right, and thus all have developed different and creative ways of operating, from which important lessons and opportunities were gained. It was of course a great venue for renewing old acquaintances, forging new ones, and being able to explain to others how the CSG functions. I believe all SG Chairs benefited from the meeting, and various commitments to a future meeting were discussed.

Professor Grahame Webb, *CSG Chairman*.

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## **Update on Gharial Mass Mortality in National Chambal Sanctuary**

The following summary provides the background, chronology and preliminary data on the recent mass mortality of *Gavialis gangeticus* in National Chambal Sanctuary, North India. It will hopefully clarify some of the misinformation that is currently "clogging the net".

### Early Days

8 December 2007: Rajeev Chauhan, head of Society for Conservation of Nature, an active NGO in Etawah, Uttar Pradesh State (UP), a few kilometres from the Chambal River, widely reported several gharial found dead. Prime suspects at the time were illegal fishermen in the National Chambal Sanctuary (NCS). Drowning of gharial in nets is not uncommon, and gharial are remarkably vulnerable.

12 December 2007: More gharial found dead, and alarm bells start ringing. Madras Crocodile Bank/Turtle Survival Alliance workers Shailendra Singh and Ashutosh Tripathi join the investigation. Forest Department (FD) officials of UP and Madhya Pradesh (MP) get veterinarians to undertake post-mortems under the supervision of the UP Sanctuary Warden, Mr. Dohare.

The Indian Veterinary Research Institute (IVRI) becomes involved, doing histopathology on samples from dead gharial. Samples are sent to other laboratories for virology and toxicology testing. Early toxicological findings indicate high levels of heavy metals (lead and cadmium) in tissue samples, which together with stomach ulcers and protozoan parasites reported in most necropsies, are incriminated as the cause of death. The urgency of the situation results in MP FD sending out an appeal for international assistance.

### International Involvement

The Gharial Conservation Alliance (GCA) and Worldwide Fund for Nature-India (WWF) RiverWatch initiative starts the ball rolling to get international crocodilian veterinarians to India. Crocodile Specialist Group (CSG) Chairman Grahame Webb and Executive Officer Tom Dacey discuss the issue with Dr. Fritz Huchzermeyer (Vice

Chairman CSG Veterinary Science group) who suggests a team that includes Dr. Paolo Martelli (Hong Kong) and Samuel Martin (France). Dr. Elliott Jacobson and Dr. Brian Stacy are also brought into the discussion, and Brian Stacy (with a background at the Madras Crocodile Bank) is invited to be part of the team to visit India. This is the first time that the CSG Veterinary Science group has dealt with a crisis involving wild crocodylians.

### Crisis Management Group

WWF Secretary General Ravi Singh approaches the Ministry of Environment and Forests, Government of India, who agree in principal to invite foreign crocodylian veterinarians to examine the situation first-hand. The four CSG veterinarians are requested to organise visas and get to India as soon as possible. Financial assistance for travel was provided by: the San Diego Zoological Society (BS); CSG (FH); AZA Crocodile Advisory Group and La Ferme aux Crocodiles (SM); and, Ocean Park, Hong Kong (PM). WWF India and GCA supported local hospitality and travel, and some laboratory testing.

On 7 January 2008 the Ministry of Environment and Forests convened a high level meeting in New Delhi, and formed a Crisis Management Group (CMG) chaired by Ravi Singh (WWF-India). Chief Wildlife Wardens Dr. P.B. Gangopadhy (UP) and D.N.S. Suman (MP) extend full support and cooperation to the CMG.

WWF opens a field office at Etawah, with gharial expert Dhruva Jyoti Basu as RiverWatch Coordinator for gharial and appoints an assistant, Sanjeev Yadav. WWF puts in 500,000 rupees and GCA 100,000 rupees to cover running costs.

Dr. Aniruddha Belsare (GCA Vet Consultant) travels to Etawah to participate in post-mortems by Wildlife SOS Dr. K. Jadav, and MP FD's Dr. Jatav. Aniruddha makes the initial suggestion that the "white matter" around the viscera is gout.

### International Veterinarians Arrive

On 25 January 2008, Brian Stacy arrives in Delhi for briefing, and with Rom Whitaker goes to Etawah, where he performs two post-mortems on gharials with local veterinarians (Fig. 1). BS confirms presence of visceral and articular gout, doubts the serious role of parasites in the mass mortality (based on available evidence and fact that most wild crocodylians have similar parasite loads).

Death toll is now 90, all restricted to a particular 40 km stretch of the lower Chambal River, near the confluence of one of the most heavily polluted rivers in the world, the 'holy' Yamuna River (whose religious icon "Ma Yamuna" sits on a Ganges softshell turtle). At this point Dr. Sandeep Behera, WWF Gangetic dolphin man, gets

his boat to the Chambal for logistic support, supported behind the lines by Parikshit Gautam, Director of their freshwater programs. Dr. R.K. Sharma, gharial expert with MP FD, gets two more boats on-site for patrolling and monitoring the situation.



Figure 1. Dr. Brian Stacy and local Indian veterinarians prepare to autopsy a dead gharial. Photograph: Rom Whitaker.

In late January 2008, the three other CSG veterinarians arrive (FH, PM, SM). They undertake post-mortems on newly dead gharial (Fig. 2), which now provide better samples for preparing histopathology slides. The UP and MP FDs facilitate tissue and blood samples to be sent to both private and Government laboratories for testing, as the latter generally take more time to deliver. The CMG Nodal Repository for all samples and reports is Jiwaji University, Gwalior, under the care of Dr. R.J. Rao, long-time CSG member and gharial/turtle biologist.

The Hotel Anupam was established as HQ in the 'wild west-like' frontier town of Etawah, and "Kingfisher" lager the main lubricant, along with copious orders of very spicy chicken and good veggies. This was important for the evening brainstorming which yielded logical theories [eg that the "filthy" Yamuna River was spawning 'toxic fish' that would eventually make their way up the relatively clean Chambal (human bodies, half burned in a poor man's funeral, are sometimes visible) and poison the gharial]. After all, the lower 40 km of the 428 km National Chambal Sanctuary (perhaps the longest stretch of river sanctuary in the world?) is closest to the Yamuna River, so the 'toxic fish' angle seems to make sense now.

But why are gharial between 1.6 m and 3.5 m the main ones being affected (one 4.1 m sub-adult male was an exception)? Why were juveniles, yearlings and hatchlings, as well as the largest mature males and females, being spared? Is it a fish size/species specificity that we're looking at in the size class being affected? (having studies on wild gharial feeding habits would have assisted with this). And why are the other piscivores: turtles, aquatic birds, river dolphins, predatory fish not dying off too?



Figure 2. International veterinarians Dr. Brian Stacy (back), Dr. Fritz Huchzermeyer (middle right) and Dr. Paolo Martelli (front right) assist Dr. Jadav with an autopsy. Photograph: Rom Whitaker.

#### Crisis Management Group Meeting

On 28 January a CMG meeting was convened in Etawah, attended by the Chief Wildlife Wardens of UP and MP and Pramod Krishnan (Ministry of Environment and Forests, Government of India), and chaired by Ravi Singh. Requirements for logistic support and permits were discussed and the way paved for smooth collaboration with no delays. A similar appeal was made to the IVRI representatives, to allow the foreign veterinarians to see histopathology slides from earlier post-mortems. A date was fixed in early February for a meeting to be convened in Gwalior, when the slides could be examined.

In early February 2008, Wildlife SOS received permission from the UP Chief Wildlife Warden, to capture several healthy gharial to draw blood and joint fluid to check for any evidence of gout or other abnormalities. Three gharial were captured using nets by FD staff and blood and joint fluid samples taken by CSG veterinarians. The gharials were microchipped in the left calf muscle and released at the point of capture.

Permission was granted by the MP Chief Wildlife Warden to take blood samples from gharial in the Deori captive

rearing center, Morena. PM conducted a training session with MP FD veterinarian Dr. Jatav and collected 25 samples. The chemistry values were done at a human pathology laboratory in Etawah, with results available in 24 hours. As far as could be ascertained by comparison with normal values of other crocodylians, the chemistry values of the 25 captive gharial were within normal limits. Samples of freshly preserved gharial tissue were sent to the human pathology laboratory in Pune for slide preparation and staining, with permission of the FD and under the supervision of Dr. Aniruddha Belsare. The results were received in Etawah in three days and were examined by BS and FH. The characteristic damage to the kidneys was considered to be consistent with injury caused by a toxin/s. Thus, based on available evidence, the hypothesis emerged that the dieoff was due to kidney damage (manifested as chronic visceral and/or articular gout) caused by a toxin (Fig. 3).



Figure 3. Chronic visceral gout identified from a dead gharial. Photograph: Rom Whitaker.

#### CMG Veterinary/Toxicology Meeting

On 5 February 2008 a CMG veterinary meeting was convened at Jiwaji University where results were discussed and it was concluded that deaths were due to kidney failure due to a 'toxic insult' (as succinctly stated by FH and BS). Dr. S.J.S. Flora, Joint Director, Toxicology, of the Defence Research and Development Establishment in Gwalior, attended the meeting and offered the facilities of his lab free of cost with a turnover time of one week to run toxicology tests on samples of gharial and fish tissue plus water and sediment samples from the river. In every case where samples were drawn from live animals or during necropsies, one set of samples went to the IVRI.

#### Dieoff Slows Down

By mid-February 2008 the death toll reached 100 but was slowing down. Another river dolphin was found dead, cause unknown, but no evidence that it is related to the gharial dieoff. Dolphins are vulnerable to illegal nets set by poachers in the Sanctuary. FH, PM and BS leave for South Africa, Hong Kong and France respectively.

Permission was also received from the UP FD Chief Wildlife Warden to collect blood samples from captive gharial at the Kukkrail captive rearing center. Sam Martin did the training session and 25 samples were collected, divided, and one set processed for chemistry values by the Etawah human pathology laboratory. Deaths have slowed down in recent days. On 12 February 2008 SM leaves.

On 14 February 2008 Rom Whitaker met with the MP Chief Wildlife Warden, where he outlined short- and long-term measures his Department will be taking to beef up protection, management and research in the NCS (managed by three States) which will be financially supported by a compensatory payment from the Indian Central Railway which is constructing a bridge across the Chambal River in the Sanctuary.

In March 2008 only 2 gharial deaths were recorded so far, but there is no room for complacency. The responsible toxicant/s, and likely source/s is still a mystery. Warming weather has seen a slowdown in the dieoff but it could become severe again in the coming winter. The questions of why only a certain size class of gharial, why not other piscivores and why only a specific stretch of river still need to be answered. The Ken River also flows into the polluted Yamuna River and there is no doubt that tilapia are moving up into that gharial habitat as well.

### Ecological Implications

There is an urgent need to investigate the ecological consequences of the mass mortality to date, in an effort to understand the outstanding threats to those gharial now inhabiting the affected area, and to evaluate the overall consequences to the gharial population in the NCS. Analyses of the available information associated with the dead gharial recovered to date are yet to be done, but clearly a majority of the adults and sub-adults thought to be residing in the affected areas based on previous surveys appear have been lost; most of the deaths occurred in a 35 km stretch from Sahson Ghat to Barahi. A preponderance of males is evident in the downstream section of this stretch whereas females are evident in the upstream portion.

On 11 March 2008, Dr. Jeff Lang, GCA Scientific Advisor, arrived at the field base in Etawah, and spent the next 15 days with WF-India staff participating in surveys, evaluating survey methodologies, and helping with preliminary analyses of the 18 gharial surveys carried out in the affected area during late February through 20 March. Survey results to date indicate:

1. During March there is a definite shift of adults and sub-adults downstream toward the impact area from the affected area upstream.
2. Gharials are concentrated together in breeding/nesting groups of 10-30 adults and sub-adults in at least 5 locations adjacent to known nesting banks.

3. These concentrations are dynamic, and boat and bank surveys indicate changing group composition, strongly suggesting movement between groups. In addition, static counts of gharial at two locations indicated that boat surveys are underestimating total gharial present by 25-40%.

In addition, Dr. Lang worked with WWF-India staff to develop a detailed nesting protocol to document how nesting effort (# of nests) and reproductive success (egg fertility, hatching success) may be affected by the mass mortality in the impact and affected areas. Fortunately, MCBT turtle project staff documented gharial nesting in some of these areas in 2007, and MPFD also has nesting records for these areas for 2007. Early indications from the recent repeated surveys in the impact and affected areas are that nesting will be augmented by some females that have moved downstream following the mass mortality.

Dr. Lang has suggested that a pilot telemetry study be initiated on adults and sub-adults in the affected area immediately, to monitor the health and status of the gharial residing in these areas. Hopefully, 20-40 adult and sub-adult gharial can be radio-tagged before the monsoon sets in, and then tracked to document movements, activities, and behaviours through the monsoon and post-monsoon periods. This study should provide important clues about how, when, and where gharials may be exposed to toxins-pollutants.

### Current Situation

At present WWF and GCA under the banner of RiverWatch are pushing ahead with the establishment of a field station on the Chambal, and we are seeking donations for boats, equipment, salaries, researchers and other infrastructure support. A satellite telemetry project is definitely needed to monitor gharial movement to the affected area. Other support includes inputs on research methods and collaboration with Indian and international scientists on river-based researches to be prioritised and circulated.

The excellent collaborative efforts of WWF-India, GCA, CSG, WLSOS, local NGOs and the UP and MP FDs made response to the gharial crisis rapid and relatively free of red-tape.

### Questions and Speculation

Culprit or victim? Interestingly, fishermen at different locations on the Yamuna and Chambal Rivers say that the exotic, African Tilapia (probably *Oreochromis mossambica*) appeared only about 3 years ago (it was introduced to India in the 1950s for fish farming), and is rapidly replacing other riverine fishes, presumably out-competing them for food resources since they aren't predators. They are an obvious choice for a culprit that could build up high toxin loads: they can survive where other fish would perish (eg sewage treatment ponds,

industrial effluent ponds). On the other hand, this is the main fish that gharial at the Madras Croc Bank have been fed for three decades, and they seem fine.

Parallels include toxic buildups in the flesh of Hawksbill sea turtles (*Eretmochelys imbricata*) and predatory fish like barracuda, which can be fatal to humans if eaten. The similarity to India's catastrophic dieoff of vultures from toxic loads of the veterinary drug "diclofenac" resulting in chronic gout was noticed right away, and is still being discussed (though tests in South Africa on Nile crocodiles indicate high resistance to this drug).

This leads us into the realm of whether this dieoff is a result of gharial eating toxic tilapia or perhaps the predatory fish that eat tilapia. With no data on whether the affected size class specialise in particular species/size of prey this speculation can only be clarified by studies on fish ecology, behaviour and food habits of gharial. These questions are now guiding research planning that will require FD permission to be carried out. Fortunately the climate is very positive and officials are just as keen as to find the answers to this mysterious tragedy, and determine out how to deal with it and prevent it happening again - and perhaps spreading to other species of fish-eaters (and the rest of the river!).

There's a lot at stake here (not only wildlife-wise, many people eat the same fish that are apparently killing gharial!), the unknown killer toxin(s) could at any time reach levels that start affecting the other piscivores: endangered turtles, otters, river dolphins, migratory waterfowl and native predatory fish. The deaths of two dolphins and a mugger crocodiles during the main gharial dieoff period were disturbing, but so far there is no evidence that these deaths are related. Deaths of river animals are almost monthly events with nets, turtle poaching and occasionally poisoning being common causes.

Record low winter temperatures (15°C water, 3°C air) on the Chambal this winter could be exacerbating the death toll. At the end of January the CSG veterinarian's preliminary report pointed to renal failure due to a toxicant, based on examination of histopathology slides

As the study moves forward from the realms of veterinarians and biologists, toxicologists Dr. Nancy Szabo (University of Florida) and Dr. Margaret Murphy (City University, Hong Kong) are now on the team, together with Dr. Jagdish Krishnaswamy, hydrologist with the Ashoka Trust for Research in Environment and Ecology, Bangalore.

Inputs, feedback, suggestions and direct assistance are solicited from the international scientific community. Please communicate them to Dhruva Jyoti Basu (Gharial Crisis Management Group Coordinator, [dbasu@wwfindia.net](mailto:dbasu@wwfindia.net)) with copies to Ravi Singh ([ravisinh@wwf.org](mailto:ravisinh@wwf.org)) and Rom Whitaker ([kingcobra@gmail.com](mailto:kingcobra@gmail.com)).

Rom Whitaker, Chairman (*Gharial Conservation Alliance*), Dhruva Jyoti Basu (*Coordinator, Gharial Crisis Management Group, WWF India*), Dr. Fritz Huchzermeyer (*Vice Chairman, CSG Veterinary Science Group (with input from Brian Stacy, CSG Vet Group and Dr. Jeff Lang, GCA Scientific Advisor)*).

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## **CSG Tomistoma Task Force Conservation Workshop (Pattaya, Thailand, March 2008)**

The first International Workshop for the Conservation of *Tomistoma schlegelii* was held at Crocodile Adventure, Pattaya, Thailand, 24-27 March 2008. The workshop was attended by more than 30 participants, including Government officials, field researchers, representatives of zoological parks and aquariums, private foundations, and crocodile specialists from Indonesia, Malaysia, Singapore, Thailand, Australia, Germany, Czech Republic, Spain and the USA (Fig. 1). John Agnew, professional herpetofauna artist, also attended.

On the evening of 23 March, participants were treated to a sumptuous dinner of local food prepared Thai style, provided by Mr. Uthen Youngprapakorn, and honored by the attendance of his father and founder of the Samutprakarn Crocodile Farm, Khun Utai Youngprapakorn and his wife.

On the first day of the workshop there was an official release of a group of large adult Tomistoma into a special breeding pond at Crocodile Adventure. The group included two 4.5 m males from the Utairatch Crocodile Farm, several large adult females provided on breeding loan from Singapore Zoo and most noteworthy, a large female provided on breeding loan from Bangkok's Dusit Zoo. According to Dusit Zoo officials, this female is known to have been collected in southern Thailand more than 40 years ago.

The first session of the workshop was opened by CSG-TTF Chairman Ralf Sommerlad and Thai Government officials from the Department of Fisheries and the Department of Wildlife Conservation. The meeting then proceeded with the establishment of Rob Stuebing as the new Chairman and continued with reports on field studies from the Range States of Thailand, Indonesia and Malaysia. Presentations for Indonesia were made by Mark Bezuijen (Sumatra and West Kalimantan-Danau Sentarum), Mark Auliya (Tanjung Puting, Central Kalimantan) and Jack Cox Jr. (East Kalimantan report by Hellen Kurniati).

Presentations on the current status of the species in Malaysia were presented by Boyd Simpson (Peninsular Malaysia; with Shahrul Anuar Mohd. Sah) and Reza Tarmizi. Rob Stuebing (with Engkamat Lading and Abdul Hamid Ahmad) presented a report on Sarawak and Sabah.



A presentation on the history of Thailand's Tomistoma was given by Uthen Youngprapakorn.

The afternoon presentations covered captive breeding and husbandry in regional and international facilities, by Ralf Sommerlad (Crocodile Consult/CSG-TTF), Uthen Youngprapakorn (Utairatch Farm and Crocodile Adventure), Pavel Moucha (Dvur Kralove Zoo, Czech Republic), William "Chip" Harshaw (Virginia Aquarium and Marine Science Center, USA), Jesus Recuero (Fuengirola Zoo, Spain) and Bruce Shwedick (Crocodile Conservation Services/CSG-TTF). Tom Dacey (CSG Executive Officer) provided a short presentation on behalf of the CSG, including a special message from the Chairman, Professor Grahame Webb. CSG-TTF Vice-Chairman Bruce Shwedick then provided a detailed discussion of the CSG-TTF's fund-raising activities over the past 5 years, including details of a highly successful event held at the Miami Metro Zoo (Florida), which featured special guest National Geographic's Dr. Brady Barr.

The morning of the second day (25 March) began with a presentation by Martin Wiradinata on the captive husbandry of Sumatran Tomistoma at the PT. Ekanindya Karsa Crocodile Farm (Jakarta, Indonesia). Dr. Mark Auliya followed with a summary report on threats and illegal trade in wild specimens of Tomistoma. Ralf Sommerlad then provided a detailed overview of the recent Government exchange of Tomistoma between Thailand and Hong Kong, including lessons learned as a result of this complex operation.

For the afternoon session, participants formed three "breakout" discussion groups to consider one of three topics: Field research and conservation priorities; Captive management, completion of the CSG-TTF Tomistoma Husbandry Manual and development of an SEAZA studbook for Tomistoma; and, Development of regional and international partnerships for research, training and fundraising. The results of the discussion groups were

presented to all workshop participants by designated members of each group.

In the evening participants were treated to a Thai Cultural Show, followed by dinner at a seafood restaurant in Pattaya.

The final day of the workshop began with a consideration of the conclusions of the previous day's breakout groups. The results were discussed at length in an open session, and will be circulated for preparation of a final document of conclusions and recommendations from the workshop.

The workshop proposed a sincere vote of thanks to Ralf Sommerlad for his very dedicated service as Chair and to host, Khun Uthen, his family and staff for their kindness and generous hospitality. The workshop was officially closed by Ralf Sommerlad.

All participants boarded transport for an overnight visit to Uthai Thani, and a tour of the Utairatch Crocodile Farm, where the extremely successful breeding of Tomistoma has occurred over the last few years.

A more detailed report is currently being prepared for the next issue of the CSG Newsletter and the CSG-TTF website ([www.tomistoma.org](http://www.tomistoma.org)).

Robert Stuebing, *Chairman CSG Tomistoma Task Force*, <[robstuebing@gmail.com](mailto:robstuebing@gmail.com)>.

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## 19th CSG Working Meeting

This will be the last CSG Newsletter before the 19th CSG working meeting, to be held in Santa Cruz, Bolivia, 2-7 June 2008. Registration and other details on the meeting are available online, at <http://www.19thworkingmeetingcsg.com>. Potential contributors and participants are urged to register as soon as possible.



Figure 1. Participants of CSG-TTF Workshop at Crocodile Adventures, Pattaya. Photograph courtesy of Uthen Youngprapakorn.

## Books Dedicated to Late Dr. Maskey

In late February, a book launch for “Gharial Conservation in Nepal” by the late Dr. Tirtha Man Maskey, and his memoirs, “Tiger Warden”, written by his wife Laxmi B. Maskey, took place. The launch was attended by around 150 conservationists, close friends and family members of the late Dr. Maskey. The books will ensure that Dr. Maskey’s work on gharial in Nepal lives on.

**Gharial Conservation in Nepal** (ISBN 97899946-820-4-1), published by Wildlife Watch Group, Nepal, 160 pp. - 12 Euros (plus postage).

**Tiger Warden** (ISBN 97899946-820-2-7), published by Wildlife Watch Group, Nepal, 120 pp. 4.80 Euros (plus postage).

Both books were published by the Wildlife Watch Group, who have copies available now [WWG, c/o WWG House, 10-Jwagal, Kopundol, Lalitpur, GPO 8975, EPC 696. Tel: 977-1-5011139, 5524188; Fax: 977-1-5524188; e-mail <info@citesnepal.org>.

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## CITES Notification Regarding Stolen Crocodile and Leopard Skin Tags

CITES Notification No. 2008/021 was issued on 7 March 2008, informing the Parties that the CITES Management Authority of Mozambique had informed the Secretariat of the theft of 2900 crocodile and 60 leopard skin tags (for 2007) in February 2008. The tags comprised:

- 60 red tags, CTES MZ PAR 07-01 to 07-60
- 900 yellow tags, CITES MZ NIL 07-001 to 07-900
- 2000 yellow tags, CITES MZ NIL 07-0001 (AAANT) to 07-2000 (AAANT)

Skins bearing any of the above-mentioned tag numbers should be seized, and the CITES Management Authority of Mozambique and the CTES Secretariat informed.

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## VIII Latin-American Congress of Herpetology

The Cuban Zoological Society and other scientific institutions and organizations are pleased to announce that the VIII Latin-American Congress of Herpetology will take place in Topes de Collantes, Sancti Spiritus, Cuba, from 24-29 November 2008. The Congress represents a special opportunity to exchange, update and disseminate the most recent advances in herpetology in the region, and promote important regional integration among scientists and institutions.

The program will include plenary lectures, workshops,

oral presentations, poster exhibitions, and painting and photographic expositions dealing with:

- Geographic distribution and GIS
- Inventories and monitoring
- Ecology of populations and communities
- Phylogenetics and evolution
- Systematics
- Herpetological collections
- Behavior
- Bioacoustics
- Anatomy and physiology
- Animal health
- Toxicology and bio-medicine
- Environmental education
- Paleontology
- Patagonian herpetology

Six symposia and a special session will be conducted on:

- Biogeography of amphibians and reptiles
- Insular herpetofauna
- Amphibian conservation in Latin America: Challenges and priorities
- Conservation of marine turtles in the great Caribbean: “One sea, one resource”
- Crocodile biology and conservation in Latin America
- Biology and conservation of iguanas in Latin America
- Special Session: Captive breeding of amphibians and reptiles in Latin America

The symposium on crocodylians will be co-ordinated by CSG members Roberto Soberón (rsoberon@enet.cu) and Dr. John Thorbjarnarson (jthorbjarnarson@wcs.org).

Deadline for abstracts is 30 June 2008. Upon acceptance by the Scientific Committee, authors will receive confirmation before 31 August 2008. Registration and abstract forms are available at <www.fbio.uh.cu/herpetologia/index.htm> or upon request from <8voclah@fbio.uh.cu>.

Affordable tourist packages are available from Gaviota Tours S.A. (tur\_esp1@agencia.gav.tur.cu), and special discounts are being offered by Copa Airlines [www.copaair.com or Mrs. Aida Abreu (aabreu@copaair.com)].

For additional information contact Roberto Alonso Bosch, Secretario Ejecutivo VIII CLAH, Instituto de Ecología y Sistemática [Tel. (537) 6438266, 6438010; Fax. (537) 643 8090; 8voclah@fbio.uh.cu].

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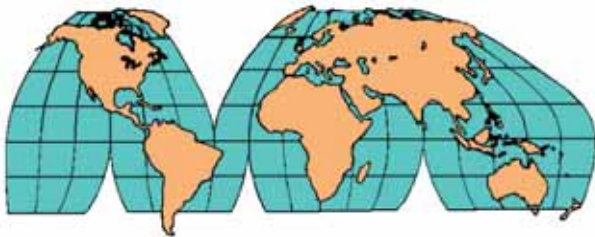
## Proceedings of “Forum on Crocodiles in the Philippines” Now Available

The “Proceedings of the Forum on Crocodiles in the Philippines” is now available. Participants will be provided with a free copy as part of their registration fee, and additional copies are available for purchase for PhP 300 or \$US25 (includes shipping and handling).

The Proceedings are published in the National Museum Papers Vol. 14(1-4) for 2007 (published February 2008) and comprise 250 pages containing 7 greetings and welcome addresses, 28 papers, Resolutions and a List of Participants.

For further information and purchasing details, please contact Careen Belo <careeen@gmail.com>.

## Regional Reports



### Latin America & the Caribbean

#### Mexico

HISTORICAL AND CURRENT DISTRIBUTION OF MORELET'S COCODILE IN MEXICO. Morelet's crocodile (*Crocodylus moreletii*) is a "marshy" species with a maximum total length of 3.5 m (Ross 1987) distributed in the Atlantic coast of Mexico and northern Central America (Ross 1998).

In Mexico, Morelet's crocodile is known as "Lagarto" or "Swamp crocodile" (Alvarez del Toro and Sigler 2001) and is distributed in the lowlands of the Gulf of Mexico slope in the States of Tamaulipas, San Luis Potosi, Veracruz, Tabasco, Campeche, Yucatan, Quintana Roo, Oaxaca and Chiapas (Alvarez del Toro 1974; Campbell 1998; Casas 2002; Casas and Guzman 1970; Guzman 1973; Ross 1987; Lazcano *et al.* 1988; Alvarez del Toro and Sigler 2001).

Casas and Guzman (1970) indicated Soto la Marina in Tamaulipas as the most northern locality but recently Oscar Hinojosa cited San Fernando Municipality in Tamaulipas as the northernmost locality (Sigler *et al.* 2007). Aguirre (1999) reported the presence of the species in the Lacantun and Chajulillo Rivers in Chiapas, the southern distribution in Mexico. Cedeño (2002) proved the Yucatan Peninsula's southern limit of the species distribution to be the Hondo River, the natural border line between Belize and Mexico. The species was thought to be distributed from sea level to approximately 500 m asl (Guzman 1973), but in 2003 a breeding population was found at 890 asl in Chiapas (Sigler and Sarmiento 2004).

Ross (1998) cited little available information about the

populations along the Gulf of Mexico, and the CSG placed a high priority on the gathering of information on the status and distribution of the species in Mexico.

Here, we compare known historical localities for Morelet's crocodile in Mexico to recent data.

#### Methods

In 2002, Mexico started the "COPAN" project, with the goal of obtaining information about the current status of the wild populations of *C. moreletii* in the country. One of the immediate goals was the analysis of information contained in 187 published documents and a list of 122 cited localities in Mexico (Sigler and Gallegos 2002).

Documents by Casas (2002) and Sigler and Gallegos (2002) were considered as the reference point for the historical distribution, as they were the most recent and cited the greatest number of localities. Firstly, a single list of localities was prepared from both documents. Secondly, field observations were performed from 2002 to 2004 in different localities of Mexico (Sigler *et al.* 2002; Dominguez *et al.* 2004). Two workshops were organized by CONABIO, the Mexican CITES Scientific Authority, in 2004 and 2006, to gather specialists and new information, and produce some maps and predictions.

#### Results

In 2002, 128 "historical" localities were identified. Of the 63 localities visited between 2002 and 2004 during the "COPAN" project (Fig. 1), 23 were historical localities and 40 were new records that increased the species known distribution. The current list of 168 localities in 10 Mexican States included the new record of Santa Maria River in Queretaro State.

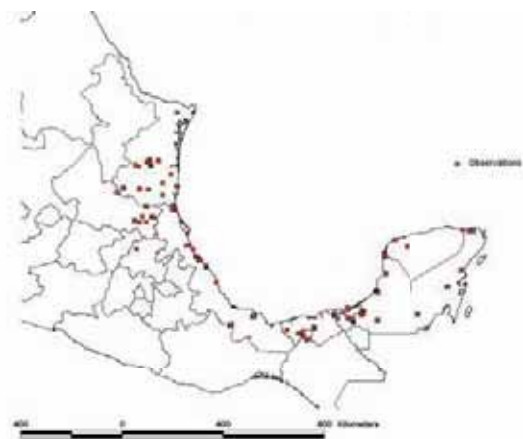


Figure 1. Recently surveyed localities in Mexico where *C. moreletii* were observed. From CONABIO (2005).

In Mexico, *C. moreletii* occupies an area estimated by the GARP algorithm and based on historical and current localities, of 396,455 km<sup>2</sup> (Fig. 2) The historical

distribution of the species in the three Range States (Mexico, Belize, Guatemala) has been estimated as 450,000 km<sup>2</sup> - Mexico thus represents 88% of the total distribution of the species (CONABIO 2005).

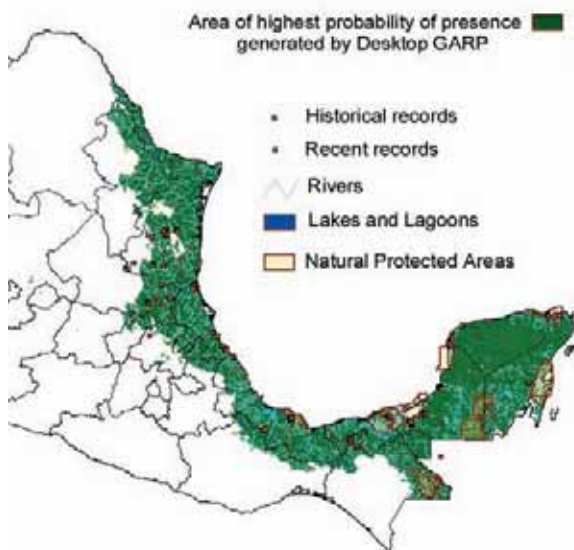


Figure 2. Potential distribution of *C. moreletii* in Mexico. From CONABIO (2005).

### Conclusions

Knowledge about the distribution of the species has increased by 572%, from 25 localities in 1970 (Casas and Guzman 1970) to 168 now. This is due to more time being invested in the field. It is highly likely that the number of localities can be doubled if more time and economic resources were available. We consider the information here adequately addresses the priority relating to compilation on data on the distribution of *C. moreletii* in Mexico.

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Luis Sigler <cocodriloblanco@yahoo.com> and Jerónimo Domínguez Laso <museococodrilo@yahoo.com.mx>.

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## Venezuela

MINISTRY OF ENVIRONMENT BEGINS REARING OF ORINOCO CROCODILES. Starting in 2007, the Ministry of the Popular Power for the Environment of Venezuela, with the resolute support of Vice Minister Miguel Rodríguez, started the captive rearing of Orinoco crocodiles (*Crocodylus intermedius*) by restoring and adapting facilities at the Rancho Grande Biological Station located at Maracay, in Aragua State.

The rearing facilities consist of 10 pools (each 12 x 5.5 m), corresponding to 60% land and 40% water areas. Each pool has a covered roof section, electricity and infrared light bulbs, to compensate for the low temperatures that occur between November and January.

Feed consists of a mixture of cattle organs and fish meat supplemented with vitamins and minerals. Weekly rations equivalent to 30% of live weight are provided every two days. At a density of 1.5 animals/m<sup>2</sup>, 100 young *C. intermedius* can be reared per pool.



Figure 1. Young Orinoco crocodiles at the Ministry of Environment's rearing facility at the Rancho Grande Biological Station. Photograph: Ricardo Babarro.

During this initial stage (2007-2008), 4 pools were used for the raising of 415 hatchlings collected from the

Cojedes (N= 316) and Capanaparo (N= 99) River areas, thus establishing the facility as the largest in Venezuela. Together with the facilities of Hato Masaguaral, Fudeci-Amazonas, Universidad de los Llanos "Ezequiel Zamora", Biological Station El Frío and Puerto Miranda, around 800 young Orinoco crocodiles will be released into natural areas by mid-2008 (Fig. 1).

A quarantine area is also being readied, to receive 57 one- and two-year-old *C. intermedius* hatched at the Dallas World Aquarium in Texas. These animals are due to arrive in late 2008, and are being repatriated to Venezuela to be released into natural habitats.

For the 2008-2009 season, the Ministry has set the goal of raising 800 crocodiles in its facilities, so that together with the other facilities in the country, the number of young crocodiles that could be released in 2009 could be as high as 1200. Field trips are already planned to May 2008, to collect hatchlings that will be reared during 2008-2009.

Ricardo Babarro, *Ministry of the Popular Power of Environment, National Office of Biological Diversity*, <rbabarro@minam.gob.ve>.

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## West Asia

### Iran

CROCODILE LADY OF IRAN. In the southeastern Sistan and Baluchistan Provinces of Iran, is the country's first and only woman working on Mugger crocodiles (*Crocodylus palustris*). Miss Elham Abtin (Fig. 1) is senior expert for the Natural Environment Section of the Department of Environment (DOE), with responsibility for Sistan and Baluchistan Provinces. She has held this position for 5 years. All wildlife-related issues are under the control and management of DOE provincial offices.



Figure 1. Miss Elham Abtin with a captured Mugger crocodile from Pishin Dam. Photograph: A.A. Hosseini.

The Mugger, or “Ghandou” as it is known to local people, requires special consideration, and Miss Abtin has focused her work on this species. This has required annual field trips to crocodile habitats in different seasons, either alone or with a team, and she has become familiar with the main issues (eg population status, threats, biology, behaviour, human-crocodile conflict) involving crocodiles in Iran. She is also graduating with a Master degree in “Habitats and Biodiversity”.

Miss Abtin reflects the diverse range of people involved with the CSG, and we look forward to hearing from her about the status of crocodiles in Iran.

Asghar Mobaraki, *CSG Regional Vice Chairman for West Asia*, <amobaraki@yahoo.com>.

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## Bangladesh

SECOND BANGLADESHI MUGGER CROCODILE FOUND IN NOAKHALI! A Mugger crocodile (*Crocodylus palustris*), descended from the famous “Kala Pahar” and “Dhola Pahar” of Bagerhat Shrine, was recently discovered in the remote Charhajari village, in Noakhali District. The existence of the crocodile came to light during my recent visit to Basurhat.

The female crocodile is 2.4-2.7 m long, and appears to be overfed, thus suffering from obesity (Fig. 1). It is confined to a 6 x 9 m pond with a high protective boundary wall (1.5 m high on two sides and 2.4 m high on the other two sides), and little land area is available.

Villagers reported that someone brought two baby crocodiles to the village about 15-20 years ago, but only this one remains now. Named “Rupa”, the female lays eggs every year during March. Unfortunately the crocodile’s owner died recently, and there does not appear to be anyone to look after the animal.



Figure 1. Adult, female *C. palustris* discovered in Noakhali District, Bangladesh.

Three captive Muggers were previously known to exist

in Bangladesh: “Kala Pahar” and “Dhola Pahar”, both of which died within the last two years; and, one female in the Gilatola Zoo (Khulna). With *C. palustris* considered to be extinct in the wild in Bangladesh, consideration should be given for “Rupa”, one of the two remaining Bangladeshi Muggers to be returned to Bagerhat Shrine where it was born, and placed with Mugger crocodiles that were imported from India in 2005 (see Andrews 2005). Discussions are now underway between various CSG members in the region to develop a suitable strategy to deal with this situation.

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Mushtaq Ahmed, *Reptiles Farm Ltd.*, <mushtaq@reptilesfarm.biz>.

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## India

WHY MUGGERS (*CROCODYLUS PALUSTRIS*) ARE FOUND AT SOME OF WATER-BODIES OF GUJARAT STATE? The Marsh or Mugger Crocodile (*Crocodylus palustris*) is one of the threatened reptilian species in India and is a legally protected Schedule I species under the Indian Wildlife (Protection) Act. It is listed as Vulnerable on the IUCN Red List (Molur and Walker 1998). Through the conservation efforts of various State Government Forest Departments and NGOs, the species has recovered from the brink of extinction in India. Now mugger populations are increasing in many States of India, and credit for this success lies with the ex-situ conservation program - “Indian Crocodile Conservation Project” (Singh 1999).

Such significant conservation actions are making many mugger habitats safe and healthy, including good breeding grounds, as in Gujarat State. In recent years there have been scattered sightings of muggers from various parts of the State. Some of these animals were rescued from human habitation (eg Vyas 2005; Vyas and Bhatt 2004), but the question remains as to how these animals came to be in these various water bodies in the first place.

Here, I present data from 2006 and 2007 on mugger conflict-related information, such as rescues, attacks and sightings, etc. This information was gathered from various sources, including the State Forest Department (SFD), NGOs and personal observations.

### Central Gujarat

Ahmedabad District: June 2006 - >2 m mugger rescued by SFD from a pond of Trasad Village, Dholala tehsil, and released at Pariyaj Water Tank, Anand District. According to villagers, there were no muggers in the pond prior to this - its origin is unknown.

Anand District: September 2007 - 1.5 m mugger sighted at pond in Bhadran, and is still there. None had been sighted previously - its origin is unknown.

### Saurashtra

Surendranagar District: September 2006 - sub-adult mugger sighted at village pond of Googalia, Than tehsil. After two weeks it disappeared from the area.

Porbandar District: October 2006 - mugger killed a number of livestock, including goats and sheep, at small village pond of Pavsim, near Ranavav. After one month the animal disappeared from the pond.

Junagadh District: There are small (100 m<sup>2</sup>) to medium (1000 m<sup>2</sup>) sized water bodies and watercourses found around Girnar mountains, which were not inhabited by mugger historically, except the Willington Dams. But recently SFD recorded >65 muggers at some water bodies (Hanapur, Khodiyar, Bordevi, Sonrakh, Ram-nath and Sarkhdiya) during the 2006 census. After the rainy season of 2006, a non-fatal crocodile attack was recorded at a rivulet of Ozat, Nr. Visavader. Some crocodiles may have migrated from the nearby population in the Gir forest to occupy the new habitat.

Bhavnagar District: Sub-adult mugger rescued from a small puddle of Hadanagar, Bhavnagar City, released at Shentrunji Dam, Palitana. Previously, no muggers had been recorded within a 50 km radius of the city - the nearest mugger population was located at Shentrunji Dam, about 70 km from the city.

### South Gujarat

Vadodara District: 2006 to October 2007 - 49 muggers of various sizes were rescued and released in Ajawa Sarover (Fig. 1). Four attacks were recorded at Vishwamitri River, Vadodara City, including three fatal ones.



Figure 1. Mugger crocodiles rescued from the Vishwamitri River, Vadodara City, by volunteers of the Gujarat Society for the Prevention of Cruelty to Animals (GSPCA) . Photograph: Rajesh Bhavsar.

Bharuch District: 22 June 2007 - GSPCA volunteers rescued a 2.3 m mugger from gam-talaw of Jambusar and released it in Ajawa Sarovar of Vadodara.

Narmada District: 2006 to 2007 - 7 muggers rescued (5 from Dhar Khadi village and 2 from Kevadiya town) by SFD. All released into Narmada Dam. Two fatal mugger attacks recorded at Dyke 3, Narmada Dam.

Surat District: July 2006, 1 m long mugger rescued from the hub of Surat City and released in the upstream of Tapti River. Also, on 9 September 2007, a 2 m mugger was rescued from water treatment tank of Kribhco Co., Hajira, by Surat Nature Club volunteers and released in Tapti River near Ukai Dam. The latter may have come with floods (during 2006 the Tapti River was flooded and the entire city was submerged under 2-5 m of floodwaters).

Presence of mugger in these various water bodies, Trasad village (Ahmedabad District), Bhadran Gam Talaw (Anand District), Googalia Talaw (Surendranagar District), small puddle of Hadanagar (Bhavnagar District), gam-talaw of Jambusar (Bharuch District) and water treatment tank of Kribhco Co., Hajira (Surat District), are notable records. The species was absent or had not been recorded over the last two to three decades, except in the Vishwamitri River and Narmada.

The appearance of muggers in these water bodies is probably a result of some well developing mugger populations of the State, which saturate their habitats, which reach carrying capacity. New recruits and subordinate animals may be forced to leave their resident water bodies by dominant animals, and seek safer habitats, generally nearer to human settlements or that are used by villagers.

Most of the water bodies of Gir National Park (Gir Wildlife Sanctuary) and Barda Wildlife Sanctuary contain good populations of muggers (Vijayakumar *et al.* 1999; Vyas 2001, 2003). It has also been observed that animals from these areas migrate downstream during flooding (Vyas 2005) or drought conditions. The records of mugger at Visavader (Junagadh) and Pavsim Village near Ranavav (Porbander), and four districts in South Gujarat (Vadodara City, Jambusar, Dhar Khadi Village, Kevadiya Town and Surat City) may be the result of this sort of migration. Another possibility is that movement may be “assisted” by newly constructed irrigation canal networks.

Most of the rescued or problem crocodiles are released without being tagged or marked (except at Vadodara City), under the direction of the SFDF. Tagging may provide some information on movement of the species and might be helpful for management.

Of interest, two cases were recently filed by SFD regarding unauthorized possession of muggers. In first case, officials investigated 5 muggers in Ahmedabad

City, along with a few other reptiles (*Geochelone elegans*, *Panshura tectum*, *Varanus bengalensis*), held illegally. In the second raid, the department found two young muggers in Vadodara City. SFD also confiscated 7 muggers (0.3 to 0.9 m) destined for delivery to the pet market. These minor incidents are a warning for the authorities and conservationists that there are networks of pet dealers and poachers active in the State.

#### Acknowledgements

I am thankful to staff of Sayaji Baug Zoo, fire brigade (Vadodara) and Gujarat State Forest Department (Gandhinagar), Gujarat Society for the Prevention of Cruelty to Animals (GSPCA) and Crocodile Group (Vadodara) for providing information on rescued animals. I am especially thankful to Mrs. Snehal Patel, Rajesh Bhavsar, Chiku Vora and Goldy Gandhi for photographs and accompanying me in fieldwork. Thanks to Mr. Bharat Pathak (CF, Junagadh), Mr. H.V. Patel (RFO, Kevadiya) for information and support.

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## Nepal

NEW GHARIAL NURSERY IN KASARA BREEDING CENTRE. The Gharial (*Gavialis gangeticus*) is on Appendix I of CITES and was recently listed as Critically Endangered in the IUCN Red List. Nearly extinct in the 1970s, gharial populations were restored to approximately 1500 individuals thanks to the creation of protected wetland areas associated with a reintroduction program of captive-reared individuals initiated in India (1975) and Nepal (Andrews and MacEachern 1994; Whitaker and Andrews 2003).

The Gharial Conservation Project in Chitwan National Park (CNP, Nepal) was launched in 1978, and between 1981 and 1994 432 young gharials were introduced into Nepalese rivers (mostly the Narayani and Rapti Rivers) to reinforce the wild populations. Only 58 wild and 75 reintroduced individuals were subsequently observed in 1994 (Maskey and Percival 1994). The release program has been maintained, with around 23 juveniles being released each year, but without any clear effect on the wild populations. Thus, despite conservation efforts, gharial populations remain fragile, and increased conservation efforts are needed. This note summarises the main results of a survey initiated in 2002 and provides information on the new nursery at the Kasara Breeding Centre in CNP.

The joint French-Nepalese collaboration was initiated in 2001 at La Ferme aux Crocodiles in Pierrelatte (France). One of the aims of the project was to examine the effectiveness of the reintroduction program and to identify the main complications. Gharials reintroduced in CNP were monitored continuously, both visually and by radio-tracking, over a 2-year period (2003- 2004), except during the 4 months monsoon season. by two successive teams of French students (Cadi *et al.* 2002). Recommendations on potentially favourable sites and time period to release crocodiles were consequently proposed (Priol *et al.* 2003; Ballouard *et al.* 2004).

#### 1. Survey of the Gharial Population

A total of 358 captive-reared gharials have been reintroduced into CNP from 1981 to 2003. In 2003, an initial survey counted 40 wild gharials. Twenty-six gharials were reintroduced in 2004, and the subsequent count was 50 individuals, including 16 crocodiles that were recently released. In 2005, 30 individuals were released, and the total population was estimated to be 49 gharials (including 9 from the last release). In January 2006, the estimated number of adults was 21 females and to 4 males. Since 1981, all the adult females have been monitored before the laying season, and eggs removed and artificially incubated. Hatchlings were raised in captivity for 4-7 years until they attained a body size of 1.5 m before release. Individuals have only been marked since 2001, but it still enables us to examine the impact of the release program on the wild population.



As successful natural incubation of eggs is unlikely, due to the intensive collection of all detected clutches and the negative impact of a dam (river banks are submerged during the whole monsoon), the maintenance of the population depends on the release program. However, despite a long-term high input of captive-raised juveniles, the size of the population has been maintained at around 40-50 crocodiles in the rivers of the CNP. This result suggests a high rate of emigration and/or very low survival rates for released animals. The survival rate of released animals was estimated to be approximately 0.5 the first year and 0.2 the second year (Ballouard *et al.* 2004). The recruitment of released animals (>1.5 m TL) into the adult population appears to be very low.

Overall, although the program has probably played an essential role in maintaining the species, but long-term it is difficult to see the release program compensating for mortality of adult gharials. Indeed, the population suffers from various threats; high disturbance, entanglement of young gharials in fishing nets, low water quality, and perturbations provoked by a downstream dam (Ballouard *et al.* 2004; Cadi *et al.* 2004).

## 2. Importance of Captive Stock: a Priority for Gharial Conservation

The maintenance of captive-raised gharials is important for two main reasons. Firstly, because survival of wild populations is compromised, captivity offers an alternative to avoid the extinction of the species. Secondly, artificial incubation of eggs taken from the field and obtained from reproduction in captivity provide individuals necessary for the release program. Therefore, the capacity of the Kasara captive stock to supply individuals for release programs should be increased. Unfortunately, the current stock of gharials at the Kasara Breeding Centre, as well as the functioning of the centre, do not fulfil entirely the prerequisites to play such a role. For instance, although the survival of hatching crocodiles is higher in the farm compared to the natural environment (25% versus 5% respectively), mortality rates remain very high. Nearly 75% of the individuals do not survive the December-February in their first year, likely due to a lack of heat and appropriate basking sites in the centre.

This situation is worsened by stress induced by night lighting of the nursery to maintain a minimum temperature at night. Many young crocodiles are weak and consequently subject to parasites and various fungal or bacterial infections. Several simple techniques (eg covering ponds at night to avoid the loss of heat during the cold season) have greatly improved the survival rate of gharials hatched in 2004 and 2005. In 2005, the breeding centre produced a record number of 154 one-year-olds and 196 hatchlings. This encouraging result

justified an increase in the carrying capacity of the centre, through the construction of the new nursery.

## 3. New Nursery in Kasara Breeding Centre

Funded through the “SOS Crocodiles” Project supported by WWF-Nepal, the construction of a new nursery began in January 2006 (Figs. 1 and 2). The system was designed to meet the physiological and ecological needs of young crocodiles. Following exchanges with various specialists (particularly Dr. Fritz Huchzermeyer, CSG Vice Chairman for Veterinary Science), and in collaboration with the Department of National Parks and Wildlife Conservation, new facilities were set up to optimise breeding and hatchling success.



Figure 1. External view of new gharial nursery at the Kasara Breeding Centre, showing information board explaining the role of the new facility for improving the survival of hatchling gharial. Photograph: Jean-Marie Ballouard.



Figure 2. Internal view of new gharial nursery at the Kasara Breeding Centre, showing two ponds per enclosure; one covered and used as a resting area and the other as a feeding area. Photograph: Jean-Marie Ballouard.

Six enclosures (4.1 m x 6 m) fitted with two ponds (5 m<sup>2</sup> and 3 m<sup>2</sup> respectively) and a greenhouse (Figs.

1 and 2). One pond is used as a feeding area, and the second pond, which is covered by the greenhouse, is used as a resting place. Importantly, there are ample opportunities for individuals to thermoregulate freely in the enclosure.

The water of each pond is replaced every 2 weeks and after each feeding episode. The greenhouse presents two major advantages: it retains heat and humidity and decreases the stress caused by disturbances of visitors or maintenance. The carrying capacity of each enclosure is of 30-50 young gharials depending on body size. The construction of these facilities required 3 months, with work being undertaken by local workers. Overall, 300 hatching gharials can be accommodated in the centre.

The new nursery effectively improved the conditions in captivity. Survival rate of hatchlings increased to approximately 50% in the first year. The success of this practical action not only represents an element to avoid the extinction of the gharial, but also provides strong basis for the development of additional centres (another breeding centre has been planned for Bardia National Park).

#### 4. Further Prospects

A Memorandum of Understanding between WWF-Nepal, WWG and Noë Conservation International (French association succeeding SOS Crocodiles) should be signed in early 2008. The coordination of the actions of the main partners involved in the protection of the gharials is indeed essential to optimise the programs. This partnership added the gharial to the list of iconic species for Nepalese biodiversity, like tigers or rhinoceroses. The agreement validated by the Department of National Parks and Wildlife Conservation is essential to ensure the future of the gharial in Nepal. At the same time, concrete conservation measures such as habitat restoration are necessary. The project also includes education actions to include the main actors (local communities, politicians, industry, tourism, etc.). In a broader perspective, collaboration between India and Nepal is essential for gharial conservation.

The proposal submitted in 2007 contains 6 main components.

- Increase the level of scientific knowledge on the habitat of the gharial that is currently insufficient to organise field actions;
- Improve the protection status of areas known to be essential for the crocodiles (eg sandbanks) accompanied by effective surveys in national parks (Chitwan NP, Bardia NP, Koshi Tappu WR, etc.);
- Develop the capacity of breeding centres (Chitwan and Bardia) and the efficiency of the breeding and raising practices;

- Promote education, notably to improve the population awareness about the necessity to protect wild populations of gharials; and,
- Obtain funds to set up an operative structure to coordinate the project.

The current situation of the gharial is disastrous. The species is again listed as critically endangered on the IUCN Red List, and the mass mortality of over 100 gharials in Chambal National Sanctuary is of great concern (see page 4) (GCA 2008). For these reasons the long-term project must be launched rapidly.

#### Acknowledgments

We warmly thank Rex Cambag for significant improvements of this article. We wish to express our sincere thanks to Dr. Tirtha Man Maskey for his encouragement to carry out this program. We also thank equally the Rangers of the Gharial Conservation Project and the Tiger Tops naturalist's team.

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## North America

### USA

MOVEMENT OF ALLIGATORS IN MISSISSIPPI. Tagging of 134 different-sized alligators (*Alligator mississippiensis*) (0.6 to 4.1 m TL) was undertaken between 30 March and 15 September 2007. To assist with later identification and observation, without the need to recapture the animal, numbered, plastic tags were placed on the vertical tail scutes of alligators greater than 1.0 m TL (Fig. 1). Since tagging, few alligators have been recovered, and there have been a number of observations of other tagged animals.

- Figure 1 shows a 2.78 m long male alligator, marked and released on 30 March 2007, and later recaptured 0.3 km from the capture site. He was later observed 0.5 km from the capture site on 20 March 2008, almost one year after being tagged.
- A 2.5 m female was roadkilled 1.1 km from the relocation site 51 days later.
- A 1.60 m long female relocated 7.2 km away, was recaptured 1.6 km from her capture site. She had traveled across one major highway and was in a metropolitan area in a road ditch when recaptured. It appeared that she had been traveling in a straight line towards her capture site.



Figure 1. Tagged alligator (No. 72).

We do not know how long these types of tags (Fig. 1) will be retained on the alligators. The few recaptures that we have were within 7 and 62 days after being tagged, and the condition of the tag and the scute where the tag was placed were in almost original condition. Researchers in Louisiana have used the same type of tag on captive

alligators, attaching them on the nuchal scales (Ruth Elsey, pers. comm.) - these lasted 1-2 years. They have also been used on other crocodylian species for short-term mark-recapture studies (Charlie Manolis, pers. comm.).

The male alligator observed 355 days after capture (see above) looked to be in good condition, as did the plastic tag (Fig. 1). The mark-recapture program will continue this year, and attempts may be made to radio-track one of the tagged alligators for more detailed movement data.

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## Science



### Recent Publications

Seebacher, F. and Franklin, C.E. (2007). Redistribution of blood within the body is important for thermoregulation in an ectothermic vertebrate (*Crocodylus porosus*). *Journal of Comparative Physiology B* 177: 841-848.

Abstract: Changes in blood flow are a principal mechanism of thermoregulation in vertebrates. Changes in heart rate will alter blood flow, although multiple demands for limited cardiac output may compromise effective thermoregulation. We tested the hypothesis that regional differences in blood flow during heating and cooling can occur independently from changes in heart rate. We measured heart rate and blood pressure concurrently with blood flow in the crocodile, *Crocodylus porosus*. We measured changes in blood flow by laser Doppler flowmetry, and by injecting coloured microspheres. All measurements were made under different heat loads, with and without blocking cholinergic and  $\beta$ -adrenergic receptors (autonomic blockade). Heart rates were significantly faster during heating than cooling in the control animals, but not when autonomic receptors were blocked. There were no significant differences in blood flow distribution between the control and autonomic blockade treatments. In both treatments, blood flow was directed to the dorsal skin and muscle and away from the tail and duodenum during heating. When the heat source was switched off, there was a redistribution of blood from the dorsal surface to the duodenum. Blood flow to the leg skin and muscle, and to the liver did not change significantly with thermal state. Blood pressure was significantly higher during the autonomic blockade than during the control. Thermal time constants of heating and cooling were unaffected by the blockade of autonomic receptors. We concluded that animals partially

compensated for a lack of differential heart rates during heating and cooling by redistributing blood within the body, and by increasing blood pressure to increase flow. Hence, measures of heart rate alone are insufficient to assess physiological thermoregulation in reptiles.

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Oliver S.G. Pauwels, Brady Barr, Mei Lin Sanchez and Marius Burger (2007). Diet records for the dwarf crocodile, *Osteolaemus tetraspis tetraspis* in Rabi oil fields and Loango National Park, southwestern Gabon. *Hamadryad* 31(2): 258-264.

Abstract: The objective of this study was to investigate the diets of *Osteolaemus tetraspis tetraspis* from two biotypes in south-western Gabon: inland lowland rainforest (14 samples) and mangrove forest (eight samples). Stomach contents included vegetation (including leaves, fruits, etc.) and animal matter (Gasteropoda, Arachnida, Diplopoda, Insecta, Crustacea, Osteichthyes, Amphibia, Reptilia, Mammalia), and confirm a varied, partly terrestrial diet. Gastroliths numbered from 0 to 42, and their wet mass did not exceed 0.33% of the crocodile mass, and seem too low to serve a hydrostatic function. Maximal total length observed was 1.8 m.

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Rachel M. McNew, Ruth M. Elsey, Thomas R. Rainwater, Eric J. Marsland and Steven M. Presley (2007). Survey for West Nile virus infection in free-ranging American alligators in Louisiana. *Southeastern Naturalist* 6(4):737-742.

Abstract: West Nile virus (WNV) is an endemic arboviral pathogen that occurs throughout most of the United States and is typically maintained through a bird-mosquito-bird transmission cycle. The ecological significance of the virus is high due to its ability to infect and cause disease in humans, livestock, and wildlife. West Nile virus infection of many vertebrate species causes signs of viral illness, including encephalitis that may result in mortality. Infection by WNV has recently been detected in captive *Alligator mississippiensis* (American Alligators) in Georgia and Louisiana, and in both captive and free-ranging alligators in Florida. However, additional surveys for WNV in populations of free-ranging alligators within the southeastern USA have not been conducted. The purpose of this study was to survey free ranging alligators in south Louisiana for active WNV infection. Blood samples were collected from 93 alligators captured at Rockefeller Wildlife Refuge in Cameron Parish, LA, during May 2006 and were screened for WNV using reverse transcriptase polymerase chain reaction (RT-PCR). All samples (100%) tested negative for WNV, indicating a lack of detectable active infection in these animals. Additional surveys of the occurrence of WNV in alligators throughout the southeastern USA are needed to determine the susceptibility of these reptiles to the virus, effects on the health of infected populations, and the potential role of alligators in the maintenance and transmission of the virus.

Steven G. Platt and Thomas R. Rainwater (2007). Notes on the consumption of *Bufo marinus* (Anura: Bufonidae) by *Crocodylus moreletii* (Crocodylia: Crocodylidae) in northern Belize. *Brenesia* 67: 79-81.

Summary: In summary, our observations suggest that *C. moreletii* in northern Belize are capable of consuming *B. marinus* without suffering obvious effects from bufogenin. However, consumption of *B. marinus* appears rare among wild *C. moreletii* because toads and crocodiles rarely occur in the same habitats, toads are generally less abundant than other prey, and for behavioral reasons, toads are likely to escape notice of foraging crocodiles. In addition, *B. marinus* could be under-represented in our analyses of *C. moreletii* stomach contents owing to the rapid digestion of soft-bodied anurans that typically occurs in the highly acidic crocodilian stomach.

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J. Sean Doody, Rachel A. Sims and Mike Letnic (2007). Environmental manipulation to avoid a unique predator drinking hole excavation in the Agile Wallaby, *Macropus agilis*. *Ethology* 113(2): 128-136.

Abstract: The simplest way of avoiding an ambush predator is to entirely avoid the habitat in which it hunts. However, this strategy requires that the prey species find alternative, risk-free sources of essential resources. Herein we describe a novel strategy used by agile wallabies (*Macropus agilis*) to avoid saltwater crocodile (*Crocodylus porosus*) predation: the creation of risk-free sites to obtain water. We studied the anti-predator behaviour of agile wallabies for 3 yr during the dry season along the Daly River, Northern Territory, Australia. Wallabies excavated holes in the sand 0.5-18.0 m from the water's edge, and preferred to drink from these holes over drinking from the river. We determined a hierarchy of preferred drinking-site options for the wallabies: non-river sites: springs, puddles, excavated holes; and river sites: sites with cover, shallow water sites and deep water sites. Drinking holes were twice as far from the water's edge in a river stretch with high crocodile density (2/km) than those in a stretch with low crocodile density (0.08/km). However, site differences could also be explained by river bank morphology. Collectively, our findings indicate that agile wallabies excavate drinking holes to avoid crocodile predation. We contend that this behaviour represents environmental manipulation specifically to alter the risk associated with obtaining a key resource.

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Ismar de Souza Carvalho, Felipe Mesquita de Vasconcellos and Sandra Aparecida Simionato Tavares (2007). *Montealtosuchus arrudacamposi*, a new peirosaurid crocodile (Mesoeucrocodylia) from the Late Cretaceous Adamantina Formation of Brazil. *Zootaxa* 1607: 35-46.

Abstract: We describe a new species of Peirosauridae (Crocodyliformes, Mesoeucrocodylia), *Montealtosuchus arrudacamposi* gen. nov. et sp. nov., from the Late

Cretaceous (Turonian-Santonian) strata of the Bauru Basin, Brazil. *Montealtosuchus* was found at the outskirts of Monte Alto County in reddish sandstones of the Adamantina Formation. This specimen is exquisitely preserved with skull, mandible, postcranial and exoskeletal elements in articulation that provides critical information of the anatomy of this group. The occurrence of Peirosauridae in the Adamantina Formation (Turonian-Santonian) widens the chronostratigraphic range of this Mesoeucrocodylia taxon in Brazil. Recent analysis suggests that the Peirosauridae is restricted to the Late Cretaceous deposits of South America.

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Nevalainen, T.J., Kanchanapangka, S., Youngprapakorn, P., Webb, G.J.W., Manolis, S.C. and Scott, K.F. (2007). Phospholipase A2 activity of crocodile serum. Reptilia and Amphibia (in press).

**Abstract:** The catalytic activity of phospholipase A2 (PLA2) was measured in serum samples from 32 crocodiles in Thailand and Australia by a method using <sup>14</sup>C-oleic acid-labelled autoclaved *Escherichia coli* membranes as a substrate. The highest mean (SD) PLA2 activity was measured in the serum of *Crocodylus siamensis* (n=9), 13.3 (3.1) U/l followed by hybrid *C. siamensis* x *C. porosus*, (n=6) 10.4 (8.7) U/l and *Crocodylus porosus* (n=17), 4.3 (3.0) U/l. The difference between *C. siamensis* and *C. porosus* was highly significant (p<0.001). The gender of the animals and the geographical location of the crocodile farms were not significant variables affecting serum PLA2 levels. It was concluded that PLA2 is present in crocodilian serum and may have an antimicrobial role.

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## SUBMITTED ARTICLES

Ruth Elsey, Chris Tracy, Valentine Lance and Charlie Manolis (2008). Collecting blood from crocodilians. Crocodile Specialist Group Newsletter 27(1): 21-22.

Many researchers and wildlife managers often need to collect blood from crocodilians for a variety of studies. In general this is relatively simple compared to collecting blood from other species such as birds or mammals. We have had some experience with collecting blood from American alligators (*Alligator mississippiensis*) and Saltwater crocodiles (*Crocodylus porosus*) from several anatomical locations, and briefly share some photos and notes on our results. Some of these methods have been described in detail (Lloyd and Mitchell 1999; Pothiwong *et al.* 2000; Zippel *et al.* 2003).

A. Spinal vein [post-occipital (supravertebral) venous sinus; Richardson *et al.* 2002]: This is the method with which we have had the most experience, and which we find is the easiest. We have used this on all sized animals, from hatchlings to large adults (Fig. 1).



Figure 1. Blood collection from the spinal vein of hatchling (top), juvenile (middle) and adult (bottom) *A. mississippiensis*.

A major advantage is the animal does not need to be turned over onto its back to access the blood sinus. One disadvantage is that it is possible to obtain a clear fluid (spinal or lymphatic fluid) instead of blood or to hit the spinal cord and cause injury. The second disadvantage is the risk of causing spinal injury is greater in smaller crocodiles/alligators, and increases with repeated sampling. We initially had difficulty obtaining blood from young (<1 month old; 26-30 cm TL) *C. porosus* hatchlings without damaging the spine, but with care and use of appropriately sized needles the method works fine for repeated sampling of small animals, even over a relatively short period of time, though scar tissue does eventually build up.

In very large alligators we have had trouble reaching the vessel with a 1.5” long needle.

In two groups of juvenile Saltwater crocodiles and alligators (<800 mm TL) bled repeatedly over the same period of time, the vein appeared to be easier to find in crocodiles than alligators, perhaps because of the relatively thicker skin of the latter.

Using a variation of the spinal vein method, it is possible to obtain blood from the lateral side of the neck, and our colleagues Dr. Javier Nevarez and Dr. Ray Wilhite plan to publish their results with the use of this methodology soon.

- B. Cardiac puncture: This method is not difficult, and avoids possible damage to the spinal cord. We have collected blood from alligator hatchlings (Fig. 2) by this method but prefer the spinal vein for hatchlings.



Figure 2. Cardiac puncture on hatchling (left) and juvenile (right) *A. mississippiensis*.

Juveniles are easily bled by this method, and if the tail is curled, and held with the same hand holding the animal's head, bleeding can be done by a single person. Larger crocodilians need to be turned over on their back and thus 2-3 people may be needed to conduct cardiac puncture on adults. It might be possible to have a pericardial effusion after cardiac puncture, but to my knowledge we have not experienced this complication.

- C. Caudal vein: This method is safer than the spinal vein because there is no risk of hitting the spinal cord. However, the animal must be turned over onto its back to access the blood vessel, so two people are usually required to hold even small animals steady during sampling (Fig. 3). However, Dr. Roland Coulson used to bleed small (<1.5 m) alligators from the caudal vein by placing the tail inside a piece of PVC piping screwed to the wall in a vertical plane - so that one person was able to collect blood. This is the method with which we've had the least experience but with more practice might find it a good alternative.



Figure 3. Blood collection from the caudal vein of a 2 m long *C. porosus*. Photograph: Akira Matsuda.

We recommend that the smallest gauge needle and syringe as is possible/practical is used. Vacutainers have also been used successfully on juveniles. We prefer to use heparin coated syringes.

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“ATYPICAL” CROCODILES OF SUMIDERO CANYON. In 2003, as Luis Sigler was undertaking population studies as part of the “Conservation of the American Crocodile in the Cañón del Sumidero” project (now called “SUMIDERO CROC”), he found an individual *Crocodylus acutus* with atypical skin and eye colouration.

In 2004, I located another specimen with the same characteristics as that found in 2003, but in this case it was very emaciated and had injuries caused by another crocodile; it later died as a result of its injuries. We obtained biological material from this animal, which was processed in a superficial manner and although the results suggested a genetic distance relative to other crocodiles in the same population, they were not conclusive (García-Cruz *et al.* 2006).

In 2006 during the rescue of nests and hatchlings (eg Dominguez-Laso 2006) we found 4 “atypical” hatchlings similar to those identified in previous years. They were all within a single, newly hatched creche, and were likely from the same nearby nest.

In May 2007, as we reviewed nesting in the National Park, we identified 4 “blue” crocodiles (3 hatched live, 1 dead in egg) from a nest that had just begun to hatch (Fig. 1). This nest was at the same location as the nest that produced the creche in 2006. We noted that the eggs of these atypical hatchlings were essentially the same in size, shape and colouration as eggs producing normal hatchlings.

All of the “blue” hatchlings have been taken to the Crocodile Museum, and are now being raised off-display in such a way as to reduce stress that may compromise their health. Diet consists of red meat, fish, chicken, viscera, vitamins and calcium. The first specimen (2003) is now around 5 years old and measures approximately 90 cm. The 4 animals hatched in 2006 are around 2 years old and 33-40 cm long, and the 3 hatchlings from 2007 will be one year old in May 2008. Growth rates are similar to those of “normal” hatchlings raised under the same conditions. The main physical difference between blue and normal hatchlings is the colour of the skin (blue grey) and the eyes (dark) (Table 1; Fig. 1). They also appear to be calmer than typical hatchlings. There are no apparent differences in the scale patterns of the skin.



Figure 1. “Blue” (background) and normal (foreground) *C. acutus* hatchlings. Photograph: Jerónimo Domínguez-Laso.

The specimens have been subject to observation and particular handling to assess their behaviour and development. Genetic analysis will be undertaken in the future to better understand their origin and/or identify potential risks to wildlife in the National Park “Cañón del Sumidero”.

That the “blue” hatchlings located in 2006 and 2007 are likely to have come from nests produced by the same female suggests that she may be carrying a genetic trait associated with skin colour, that is passed onto some of her young. It is not unusual for crocodilian hatchlings with atypical colouration to be produced [eg Palacios (2006) describes “grey” *Caiman crocodilus fuscus* hatchlings produced from captive breeding in Colombia], but for such “morphs” to be consistently produced by the same female have rarely been reported. The consistent production of albino *Alligator mississippiensis* (Ruth Else, pers. comm.) and leucistic *Crocodylus porosus* (Francis Mauriks, pers. comm.) hatchlings from particular females is known.

#### Acknowledgments

Liliana Berenice García-Reyes (translation).

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Jerónimo Domínguez-Laso, *Curador del Museo Cocodrilo-Instituto de Historia Natural y Ecología-Zoológico Regional Miguel Álvarez del Toro, Tuxtla*

Table 1. Features of “blue” and “normal” *Crocodylus acutus* hatchlings.

Characteristics	“Normal” Hatchlings	“Blue” Hatchlings
Tongue colour	Yellow	Blue grey
Eye colour	Iris is yellow or greenish yellow	Dark coloured iris
Skin colour	Tones of yellow on back and sides of the body, similar to the yellowish coloration on part of the belly	Tones of blue or grey on back and sides of the body, as well as on belly
Behaviour	Bit aggressive, but typically defensive	Calm, not defensive

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**IDENTIFICATION OF CAIMAN BONES IN JAGUAR FAECES.** As relatively large predators, crocodylians are situated at the top of the food chain. Hatchlings are typically preyed upon by a variety of predators (eg fish, birds, reptiles, mammals), but predation rates of subadults and adults usually low. It has been reported that large felids hunt and feed crocodylians. In Mexico, the distribution of the Jaguar (*Panthera onca*) overlaps that of three species of crocodylian (*C. acutus*, *C. moreletii*, *Caiman crocodylus fuscus*), and there is thus potential for interaction between these two “top” predators.

Activities within the Project “Mamíferos Chiapanecos en Peligro” (“Chiapan Mammals in Danger”) include the collection of samples. On 12 June of 2007, adult Jaguar faeces considered to be at least two weeks old, were located at Isla Rancho Viejo, in the Reserve of the Biosphere “La Encrucijada” (REBIEN), in Chiapas State. The 25.9 g sample was located at 0 m asl, in mangrove habitat (Collect #524, IHNE/Moguel A., 2007), and taken to the Laboratory of Restoration and Conservation of Biodiversity of the ZooMAT for content analysis.

Raccoon (*Procyon lotor*) hair was identified in the sample, as were 124 crocodylian bone fragments. Detailed examination revealed that these bones comprised: 45 osteoderms (3 nuchal, 18 dorsal, 9 lumbar, 2 sacral, 13 unidentified); 26 vertebral (19 vertebrae, 6 transverse processes, 1 neural arch); 12 limb/digit (7 phalanges, 2 ulna/radius, 2 femur/fibula, 1 unidentified); 8 ribs; 1 procoracoids; and, 32 unidentifiable fragments.

At the Crocodile Museum at the Regional Zoo “Miguel Álvarez del Toro”, Instituto de Historia Natural y Ecología (IHNE), we were able to examine the fragments in more detail and compare them to other skeletal material. Based largely on the size and structure of the osteoderms, we were able to establish that the fragments were from a single, approximately 80 cm long, caiman (*C. c. fuscus*) (Fig. 1). The species is known to occur in the area in which the faeces were located.



Figure 1. Osteoderm fragments laid over an outline of a caiman.

## Acknowledgements

Liliana Berenice García-Reyes (Traslation). Carlos Chávez Hernández, Jorge A. Moguel Acuña, Personal del Proyecto Mamíferos Chiapanecos en Peligro, del IHNE, ZOOMAT.

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**MONKEY AND THE CROCODILE.** The featured postage stamp, issued by the Postal Department of Government of India, relates to a story about a monkey and a crocodile, one of the many stories within the Hindu Panchatantra (a collection of animal fables in verse and prose). A full version of the monkey/crocodile fable can be found at <www.indiaparenting.com/stories/panchatantra/panch001.shtml>.



Submitted by Rajendra V. Vyas, 505, *Krishnadeep Apartments, Mission Road, Fatehgunj, Vadodara 390002, Gujarat, India*, <razoovyas@hotmail.com>.

**POSSIBLE MISSING LINK BETWEEN PREHISTORIC AND MODERN CROCODYLIANS GOES ON DISPLAY.** The fossilised remains of a terrestrial reptile believed to be a link between prehistoric and modern crocodylians recently went on display in Brazil (Fig. 1). *Montealtosuchus arrudacamposi* was located in 2004, near Monte Alto, about 350 km northwest of Sao Paulo (Carvalho *et al.* 2007; see page 20).



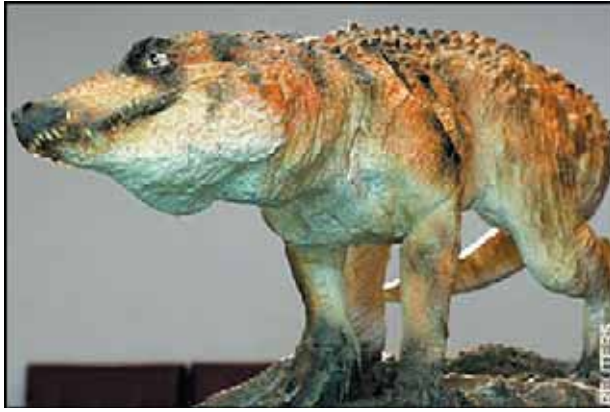


Figure 1. Model of *Montealtosuchus arrudacamposi*.  
Photograph: Reuters.

The species measures 1.5-1.7 m in length, and lived around 80 million years ago. The species' stocky build and long snout are similar to the features of a large dog. With so little evidence of terrestrial crocodilians to date, the find is considered of scientific importance.

Source: *Weekend Australian*, 2-3 February 2008.

**LION VERSUS CROCODILE.** Wildlife photographer Bhushan Pandya took this rather unique image of an Asian lion (*Panthera leo persica*) carrying a freshly-killed Mugger crocodile (*Crocodylus palustris*) in the Gir Forest.



Submitted by Rajendra V. Vyas, 505, Krishnadeep Apartments, Mission Road, Fatehgunj, Vadodara 390002, Gujarat, India, <razoovyas@hotmail.com>.

**JUST WHEN YOU THOUGHT IT WAS SAFE TO GO BACK INTO THE WATER!** Johnnie is a 12-year-old female Australian Freshwater Crocodile (*Crocodylus johnstoni*) living with Vicki Lowing and her family in Rockbank, a little township on the outskirts of Melbourne,

southern Australia.



Johnnie's lack of teeth was due to living in water affected by blue-green algae (see Lowing 2004), but her health improved greatly after she was moved away from that area. Teeth or no teeth, Johnnie normally has a clear run of the house, and recently featured in a TV series called "Animal Hospital".

Literature

Lowing, V. (2004). Observations on the effects of toxic blue green algae on crocodiles. Pp. 487-490 in Crocodiles. Proceedings of the 17th Working Meeting of IUCN-SSC Crocodile Specialist Group. IUCN: Gland.

## Wanted! Images/Video of Crocodilian Reproductive Behaviour

I am a graduate student with the Paleobiology Research Group at the University of Portsmouth, currently studying for an MSc equivalent degree investigating reproduction in extinct archosaurs, which will in part both review and attempt to reconstruct behaviour of certain dinosaurs using a combination of extant phylogenetic bracketing and comparisons to specific types of living animals.

In that respect I have been seeking explicit visual records detailing crocodilian sexual behaviour to be used for comparative purposes and possible reconstructive models. I am in particular interested in any and all examples of behaviour (preferably videofilmed) that explicitly details the mechanics of crocodilian copulation, by which I mean the entire act (mounting, insertion and penetration, intromission, dismount) which might be used as a comparison as to whether such positioning and movement would have been feasible in similar large-sized extinct taxa. I am also interested in any visual records

that unequivocally demonstrate terrestrial mating in these animals.

I am seeking duplicates of any graphic videofilm that depicts mating in these animals? Any information provided would be for strictly comparative and research purposes only and would not be distributed or duplicated in any form without the consent of the copyright owner(s).

I have also been searching for any photographic or visual records that depict male-male sociosexual behaviour among crocodiles or alligators. If any of you have such documentation, or have witnessed such behaviours, please do let me know. I am aware of records of a German herpetologist at Cologne Zoo, Sven Olbort, but unfortunately I have not been able to contact him. Any assistance in this regard would be greatly appreciated.

Tim E. Isles, BSc (Hons), *School of Earth & Environmental Sciences, Burnaby Building, Burnaby Road, University of Portsmouth, Portsmouth PO1 3QL, United Kingdom, <ethologist@gmail.com>, Tel. 07840 294109.*

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## **Texas Fundraiser to Benefit CSG Tomistoma Task Force**

A fundraiser was held in support of the CSG Tomistoma Task Force (CSG-TTF) at the National Association of Reptile Breeder's Conference (NARBC), at the Arlington Convention Center in Arlington, Texas, 23-24 February 2008. Volunteers and other parties assisted in making this a warm success.

CSG-TTF Vice Chairman, Bruce Shwedick, met with me in advance to provide the TTF banner and many donated items for the table, including T-shirts, hats, children's coin purses, postcards and posters. Bruce also helped recruit volunteers for this effort in the weeks leading up to the event and arranged for several gift baskets donated by the San Antonio Zoo and left over from the "Night for the Crocs" Benefit in Miami (February 2007), to be brought to the event and used as raffle items. Bill Horneck of ReptilesTV was also very supportive of this effort in both transporting the goods to Texas and in promoting CSG-TTF during the ReptilesTV television webcast.

Christopher Dieter of Crocodile Encounter in Angleton, Texas, attended with two friends, herpetoculture enthusiasts Joe Griffin and Adam Horsch. Chris brought two live juvenile Nile Crocodiles, a large Crocodile Encounter banner, Crocodile Encounter T-shirts, and many copies of his book, *The Ultimate Guide to Crocodylians in Captivity*. Chris placed several books from the table with buyers, and donated the majority of the proceeds to CSG-TTF. The banner was very dramatic and eye-catching (see photos below), and made the booth easily identifiable to

guests in what was a very visually cluttered event, so it served the effort well.

Bekky Muscher (San Antonio Zoo) and Judith Bryja (Houston Zoo) also traveled to the event to participate. Bekky brought a sizable collection of stuffed crocodile toys, tote bags, T-shirts, beverage coasters and coffee mugs for placement. These items were provided in support of this event by the San Antonio Zoo. As a kind gesture of support to the volunteers, Bekky offered some of the remaining goods as gifts to the volunteers. Luis Sigler of the Dallas World Aquarium (DWA) arrived on Sunday, and brought a bag of goods provided by DWA, which included postcards, hats, and sea turtle T-shirts.

The photo opportunities provided to guests by Chris Dieter with his juvenile crocodiles were very popular, and a large portion of the funds collected were a result of this feature. The donation requested for a photo with the crocodiles was \$US5.

It was also helpful on Sunday to request permission to use the public address system. When an announcement was made of photo opportunity with live crocodiles and of registration for the raffle of the gift baskets, there was an immediate surge of interest at the table. Another announcement was made about three hours later, announcing the winners of the raffle and for the photo opportunity. Again, there was another surge in attendance at the booth.

Enormous gratitude must go to Brian Potter and Bob Ashley of the NARBC. They were extremely gracious and warm to this effort. Even though other non-profit groups were present, they were happy to offer a booth at no charge to our effort. The whole atmosphere of this event was warm and friendly. Bob's and Brian's (and their staff's) cooperative spirit cannot be overemphasized.

Thanks also go to ReptilesTV's Bill Horneck, for allowing me to promote CSG-TTF on-air during the live TV webcast. Chris Dieter (and his crocs!) was a great guest on air, and the two plugged crocodile conservation in general, and talked about CSG-TTF and the effort to support the organization. The CSG-TTF website (including the URL) was directly promoted. A short plug was made about 45 minutes into the webcast. Portions of the webcast, including one of the two interviews with Chris Dieter, may be viewed on the Internet, at <http://www.youtube.com>, keyphrase, "ReptilesTV NARBC." The second webcast featured a more detailed discussion of Tomistoma. Popular TV personality Nigel Marven was a guest shortly after this, so it was hoped that many were watching at this time.

It is hoped that this effort will have residual benefits for crocodile conservation, as many guests in attendance were previously unaware of CSG-TTF. In addition, volunteers

were able to meet members of other groups, such as the IRCF, and exchange goodwill. Near the end of the event, Izzy brought a few of the remaining items from San Antonio Zoo to the IRCF table as a gesture of support. IRCF has been instrumental in supporting *Gavialis* conservation. The IRCF members, Desiree Wong among them, seemed very pleased.



Figure 1. Kneeling, left to right: Adam Horsch, Israel Dupont. Standing, left to right: Christopher Dieter, Bekky Muscher, Judith Bryja, Joe Griffin.

The socializing with other participants of the NARBC event was also beneficial, for publicising the CSG-TTF and crocodilian conservation. The resulting funds, totalling \$US403, have been transferred to the CSG Treasurer, Perran Ross.

It is hoped that with this positive experience, the proprietors of NARBC will accept other conservation booth initiatives at their other NARBC expos in the US (California, Virginia and Illinois). The volunteers also appreciated the support of Rob Stuebing and Ralf Sommerlad in the organizing of this effort. This event was a good model of sustainable development in support of conservation initiatives - commercial entities and a commercial event benefitting conservation financially. All in all, it was certainly a success.

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## Recent Publication Provides Food (or Drink?) for Thought

Although not directly related to crocodilians, a recent publication from the Czech Republic describes an interesting relationship between alcohol consumption and scientific productivity (Grim 2008). The abstract is included here:

“Publication output is the standard by which scientific productivity is evaluated. Despite a plethora of papers on the issue of publication and citation biases, no study has so far considered a possible effect of social activities on publication output. One of the most frequent social activities in the world is drinking alcohol. In Europe, most alcohol is consumed as beer and, based on well known negative effects of alcohol consumption on cognitive performance, I predicted negative correlations between beer consumption and several measures of scientific performance. Using a survey from the Czech Republic, that has the highest per capita beer consumption rate in the world. I show that increasing per capita beer consumption is associated with lower numbers of papers, total citations, and citations per paper (a surrogate measure of paper quality). In addition I found the same predicted trends in comparison of two separate geographic areas within the Czech Republic that are also known to differ in beer consumption rates. These correlations are consistent with the possibility that leisure time social activities might influence the quality and quantity of scientific work and may be potential sources of publication and citation biases.”

Grim, Tomas (2008). A possible role of social activity to explain differences in publication output among ecologists. *Oikos* doi:10.1111/j.2008.0030-1299.16551.x.



Adult (>5 m TL), male *Tomistoma schlegelii* at Utairatch Crocodile Farm, Thailand. Photograph: Tom Dacey.

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