

CROCODILE SPECIALIST GROUP

NEWSLETTER

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IUCN–The World Conservation Union
Species Survival Commission

Prof. Harry Messel, Chairman
IUCN Crocodile Specialist Group
School of Physics
University of Sydney
Australia

EDITORIAL OFFICE:
Florida Museum of Natural History
Gainesville, Florida 32611, USA
Prof. F. Wayne King, Deputy Chairman
Dr. James Perran Ross, Executive Officer
Dr. John Thorbjarnarson
Christine Housel, Publication Assistant

COVER PHOTO. *C. cataphractus* in
Lake Divangui, southwest Gabon, Africa.
See pages 4-5 for a report on a brief population
survey of these crocodiles. B. Barr photo.

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

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Editorial

CHANGES IN STORE FOR CSG. The Crocodile Specialist Group faces a period of change in the immediate future. All CSG members were appointed by a letter from the Chairman in 2000 to serve for the period until the next IUCN World Conservation Congress. That Congress will be held in Bangkok 17-25 November 2004, at which time all Specialist Group members' terms end, and are reviewed for re-appointment. This is an opportunity for the CSG to examine member activities and introduce new blood and expertise. Over the next few months the Regional Vice Chairs will review members in their sections and make recommendations for renewal. Some time after next November, members can expect to receive notification of their re-appointment. The next few months would be a good time for members to communicate with their regional Vice Chairs and advise them of their current interests and activities.

This upcoming transition of membership will be particularly important for CSG because our Chairman, Professor Harry Messel (whose term also runs to November) has announced that he will not accept appointment for another term. Therefore CSG will have a new chairman appointed by the Chair of IUCN's Species Survival Commission in November and the new CSG chair will appoint/re-appoint members. Professor Messel will make his recommendation to SSC for his replacement and has asked the Steering Committee to advise him. The CSG Steering Committee, under the guidance of Deputy Chairman, Dietrich Jelden, has initiated an open and transparent process and discussion to solicit input and identify possible candidates. The Steering Committee will discuss this at their meeting 24 May and make a recommendation to Professor Messel, who will in turn make a recommendation to SSC. We must recall that appointment of specialist group chairs is done by the Chairman of SSC and that our input, while important, is advisory. The Steering Committee seeks to establish a broad consensus opinion on a suitable recommendation for our chairmanship and welcomes input from the membership on this important matter. Your thoughts can be transmitted to your regional vice chair or any

Steering Committee member (listed on back page). The final decision will be announced in November.

These changes pose a special challenge for the group. Change is always a little scary, but also the opportunity to refresh and renew our direction and commitment to crocodylian conservation. At this time it is particularly important that we keep our patrons and supporters fully informed and that they maintain their support of the Group's work. The CSG has been remarkably effective at addressing the interests of its diverse constituency and raising funds to support our activities. As we navigate through this challenging transition, open discussion, goodwill and trust will ensure that CSG's strengths are maintained and our members and donors confidence supported.
— The Steering Committee of CSG.

Views & Opinions

FLAWS IN THE IUCN "RED LIST" CRITERIA? The IUCN Red List of Threatened Species (<http://www.redlist.org>) is one of the best known products of the SSC (Species Survival Commission) and IUCN (International Union for the Conservation of Nature). Based on the best available scientific evidence, the Red List is a user-friendly guide to the species of wild plants and animals worldwide that the IUCN considers to be threatened with global extinction. The Red List identifies taxa that we may lose completely from the planet, unless something is done to ameliorate the threatening factors. It is thus a "call to action," and a remarkably effective one within the international political arena. Some 7,000 scientists associated with the SSC are nominally involved in making the species assessments. They do this by using such data and inferences on the status of species that may be available, and matching it to a set of Red List criteria. The process also aims to identify the degree of threat in a way that is comparable between taxa (e.g., critically endangered, endangered, vulnerable).

The CSG has long recognized problems in the Red List criteria with widely distributed crocodylian species that are abundant in some countries but extinct in others. For example, saltwater crocodiles are abundant and secure in

Australia—so this species is not threatened with extinction globally (the Red List focus of attention). Yet throughout most of its range, the saltwater crocodile is seriously depleted or extinct and in need of conservation action. So should the global population be listed in the Red List as "critically endangered" or not threatened at all?

Professor Nicholas Mrosovsky's new book on the IUCN Red List system examines this and other problems in the Red List, using sea turtles as the main example. Like crocodiles, sea turtles are long-lived and widely distributed reptiles, with highly variable status between countries. Thus many of the issues discussed with sea turtles are equally applicable to crocodylians. The book, "Predicting Extinction: Fundamental Flaws in the IUCN's Red List System, Exemplified by the Case of Sea Turtles" (ISBN 0-9734777-0-9), is readily available on the IUCN Marine Turtle Specialist Group website:

<<http://members.seaturtle.org/mrosovsky/>>.

At the heart of Mrosovsky's concern is that

the science associated with the Red List determinations should not be compromised by the desire to list species as "endangered" for advocacy reasons. The roles of science and advocacy in conservation are often polarized, so Mrosovsky's concerns deserve serious attention. There is at least one line of reasoning that questions the role of science: Science is not going to be the deciding factor, or even a major player in the debate but rather the values, opinions, and politics of the players. Scientists will increasingly find that the issues will not be argued on their merits, and that the introduction of scientific evidence will simply be ignored (Salzman, J. 1995. Scientists and advocacy. *Conservation Biology* 9(4):709-710).

The science of concern within the Red List process occurs at completely different levels of resolution. Firstly, there is the degree to which the science-based criteria for assessing species—particularly the wild population decline criteria—really apply to sea turtles. Mrosovsky argues that using three generations as a status reference point is fundamentally flawed. The CSG reached a similar conclusion when it examined this issue some years ago. When the final determination of "critically endangered" occurs with species represented by a few

individuals in one area, that are truly on the brink of extinction, but with other species in which the global population may be millions, distributed in over 100 countries, Mrosovsky argues that something is clearly wrong and that the credibility of the Red List determinations is at risk.

The second area of scientific concern is about the way the criteria (flawed or not) are applied by the 7,000+ scientists. Mrosovsky argues that there is a lack of consistency. For example, the Marine Turtle Specialist Group and the Crocodile Specialist Group have a history of approaching the problem differently, and would get different results if both groups assessed each other's species. There are also inconsistencies in the degree of concern about accuracy. When the criteria result in a species being listed as critically endangered, despite the global population being known to be under no threat of extinction, some groups make adjustments to improve accuracy. Others appear not to see their scientific role as extending to common-sense evaluations of whether the final determination bears any relationship to reality.

Mrosovsky's work is an important contribution and hopefully will be examined carefully by those charged with revising and refining the Red List system. It is important for the IUCN to initiate calls to action with endangered species, but equally important that the actions are appropriate to the problem—and use the best available science despite the temptation of using the list purely for advocacy reasons. The IUCN needs to encourage conservation action where real threats exist, and to encourage sustainable uses when a population is recovered and being used as a resource by people—nature and *natural resources* are the IUCN's mandate.

Mrosovsky believes that the problems of making a single risk determination for widely distributed species such as sea turtles could be overcome with regional listings. While this may help with some species, it is not altogether clear that within regions, the same problems created by variable status between countries would remain. The simple fact remains that conservation action is urgently needed for many species whose global populations are not threatened with extinction, and perhaps the IUCN needs to find a better way of expressing this reality within the political arena. —
Grahame Webb, *Wildlife Management*

*International Pty Ltd, P.O. Box 530,
Sanderson NT 0813, Australia
<gwebb@wmi.com.au>.*

Regional Reports



Africa

Gabon

BRIEF POPULATION SURVEY OF *C. CATAPHRACTUS* IN LAKE DIVANGUI, SOUTHWEST GABON. A biodiversity project sponsored by the Smithsonian Institution and Shell Oil/Gabon in July 2002 documented a population of slender-snouted crocodiles (*Crocodylus cataphractus*) in Lake Divangui, located in a remote area of the Ogoove-Maritime Province in southwest Gabon. With a diameter of 1 km and a depth of 80 m, Lake Divangui is the deepest lake in Gabon (Pauwels et al. 2003). Though no comprehensive croc survey was undertaken, the findings of the biodiversity project noted that, despite limited visibility from extensive vegetation along the shoreline, 24 *C. cataphractus* were seen at one time during daylight hours. In June 2003, I returned to Lake Divangui with Olivier Pauwels of the Institut Royal des Sciences Naturelles de Belgique in Brussels, Belgium, and Marius Burger of the South African Museum, Cape Town, South Africa—both members of the Smithsonian/Shell Gabon project—as well as Mei Len Sanchez of the National Aquarium in Baltimore, Maryland, USA.

Though our time at Lake Divangui was brief, we were able to perform one night survey for crocodiles. Traveling at idle speed in a small motorboat, approximately 60 m from shore, we circumnavigated the lake, looking for eyeshines with a powerful light. During the hour-long survey, a total of 56 crocodiles were seen. The animals were very approachable, possibly due to the remoteness of the lake and lack of human

interaction. Local people fish in the lake, but almost exclusively during daylight hours.

The crocodiles observed are of the following size classes, based on their total lengths (TL): > 2 m TL=6; 1-2 m TL=24; 0.5-1 m TL=13; < 0.5 m TL=9; undetermined/eyeshine only = 4.

All but three of the 56 crocodiles were seen within 60 m from the shoreline, and all looked healthy in every respect.

This brief report provides some baseline data that could complement a more comprehensive population study in the future. The limited findings of this study may indicate that Lake Divangui could be an important stronghold for *C. cataphractus*, as suitable habitat continues to be lost throughout its geographic range. A more extensive study of this population is urgently needed. — Brady Barr, *National Geographic Television*, 1145 17th St. NW, Washington, DC 20036 <Bradybarr@aol.com>.

an aspect that played an important role in defining this ecosystem. *Phragmites* and *Typha* are invading, and the waterways are silting up. A lot of money has been spent on conservation of the area in the last decade; most of it on local community participation, however, and little on



Comparison of *Osteolaemus tetraspis* and *C. cataphractus*, both caught in Lake Divangui, Gabon, Africa. B. Barr photo.

Senegal

NILE CROCODILES IN DJOUDJ NATIONAL PARK. In March, I spent a few weeks in Djoudj National Park, which is part of the Senegal River delta. During a 1½ hour boat trip, we saw 14 Nile crocodiles—the largest number of cros I have ever seen in West and Central Africa. The delta is extremely rich in aquatic resources, including the largest West African population of pelicans and approximately 30,000 flamingos. Unfortunately, human impacts are evident: two dams have been constructed, drastically modifying the hydrology in the area. Saltwater is no longer entering during the dry season—



Osteolaemus tetraspis in Shell Oil fields, with oil flare in background. Gabon, Africa. B. Barr photo.



Nile crocodiles in Djoudj National Park, Senegal. F. Deodatus photo.

ecosystem restoration. — Floris Deodatus, *Sundarban Biodiversity Conservation Project, Bangladesh* <f.deodatus@wxs.nl>.

Eastern Asia, Australia and Oceania

Australia

CROCODILE SAFARI HUNTING. A February 20 Reuters article reports from Darwin, Australia: A controversial proposal by the Parks and Wildlife Commission of the Northern Territory could allow for 25 saltwater crocodiles a year being immortalized as the trophies of professional safari hunters.

David Lawson, the Northern Territory's director of wildlife management, said that for the past five years the commission has been able to issue permits to landowners for the wild harvest of up to 600 crocodiles a year. The 25 crocodiles available for safari hunters would be from that quota. "The industry is telling us that we could expect at least A\$6,000 (US\$4,690) per animal, whereas currently if you harvest a crocodile and take the skin and meat off it, it comes out at a return of about \$600 per animal," Lawson said.

Yet the proposal, which is part of the commission's five-year review of its wildlife management plan, has raised the hackles of wildlife conservation groups and is facing an uphill battle to win approval from the Australian government. Environment Minister David Kemp is considering the safari hunting plan and has received more than 500 submissions on the issue. But a spokesman for Kemp said while a decision has not yet been made, safari hunting was currently not government policy.

Since crocodiles were declared a protected species in 1971 when their numbers fell to about 5,000, the Northern Territory's population has exploded to around 70,000 animals in the wild with another 18,000 in six crocodiles farms.

An animal welfare group, the Royal Society for the Prevention of Cruelty to Animals (RSPCA), has condemned the proposal for the safari hunting of crocodiles and believes there is no justification for killing Australia's "icons of the outback." Australian RSPCA President Hugh Wirth said the harvesting of wild

crocodiles should remain in the hands of trained professionals, not rich tourists wanting to bag a trophy. "An amateur shooter who has paid thousands of dollars to bag a crocodile has little incentive to ensure the animals they are trying to capture and kill do not suffer in the process."

But crocodile expert Grahame Webb, who has studied the reptiles for more than three decades and operates Crocodylus Park in Darwin, dismissed the RSPCA's argument that safari hunting would amount to cruelty to crocodiles. "Crocodiles rip each others arms off. You get them going around with massive infections and holes through their snout. They are torn to pieces by each other, and nothing could be more humane or more quick than a bullet in the head," Webb said.

Australian crocodile hunter Steve Irwin declined to comment on the safari hunting plan, which would allow crocodiles longer than 12 feet to be shot. Crocodile attacks make headlines in Australia, but in the past 20 years only about a dozen people have been killed by crocodiles. The most recent was a 22-year-old man dragged to his death in December in a flooded river in the Northern Territory.

Webb and Lawson said there was no need for the reptiles to be culled because they were not a threat to public safety. "What's constraining the crocodile population is crocodiles. Crocodiles kill other crocodiles. There is not enough food to support anymore crocodiles," Webb said.

The Parks and Wildlife Commission of the Northern Territory believes landowners should be able to benefit from the wildlife on their property and that crocodile safari hunting would channel more funds into impoverished Aboriginal communities. Australia's 400,000 Aboriginals and Torres Strait islanders make up two percent of the 20 million population but remain the most disadvantaged group, dying 20 years younger than other Australians amid high rates of unemployment and alcohol abuse. "We have got something staring the government in the face that Aboriginal communities want to do," Lawson said.

The Northern Land Council, which represents traditional Aboriginal landowners, also threw its support behind the crocodile safari hunting plan, which it said would help communities build their own regional economy. "We live with these creatures daily. They are getting bigger and bolder and affecting the way

we live our lives," said Dean Yibarbuk, a senior ranger with Bawinanga Aboriginal Corporation. "Why shouldn't we be able to benefit financially from crocodiles if we share our country with them?" — Michelle Nichols, *Reuters News*, 20 Feb. 2004. Reprinted in *HerpDigest*, Vol. 4, Issue 25 (22 Feb. 2004). Submitted by Wayne King, Florida Museum of Natural History, Gainesville, FL 32611, USA. <kaiman@flmnh.ufl.edu>.

CSG responded to this issue on 28 January 2004 with the following letter to Australian Minister for the Environment, David Kemp:

Dear Mr. Kemp,

I write to express our dismay and concern about indications from your office that the application of the Northern Territory to take 25 saltwater crocodiles by trophy hunting may be rejected because of concerns raised by animal rights activists. We urge you to fully consider the whole balance of issues raised by the proposal and approve the application.

The Crocodile Specialist Group of IUCN is the global advisor to governments, wildlife agencies and conservation organizations throughout the world. We have been in close contact with the development of the NT crocodile program since its inception, are very deeply informed about its structure, function, intentions, and success, and we have provided support in the international arena such as CITES to facilitate its current and proposed activities.

We reject the contention that trophy or safari hunting of large crocodilians is inherently cruel and draw your attention to the proposed Code of Practice for crocodilian management in Australia that we recently reviewed. In that document approved humane methods to dispatch crocodilians are clearly described, including shooting, with appropriate caliber firearms to specific localities in the head that immediately shock and destroy the brain. There is no reason to suppose that the application of this technique by trophy hunters (generally skilled marksmen) would be more or less effective than by government personnel or other authorized shooters. We also draw your attention to the parallel practices regarding humane killing of kangaroos for commercial purposes that is also opposed by animal welfare interests. We propose that this opposition is not based on the

methods per se but on personal convictions opposed to killing animals in general. We respect those convictions. We would not impose our opposite conviction on those who hold such views. But we feel that it is unfair and detrimental to the conservation of crocodilians and the rights and welfare of native peoples for animal rights activists to impose their convictions on everyone else.

The value-driven conservation incentive programs that combine commercial crocodile use and conservation of habitats and natural populations have been very successful in promoting the recovery of Australian and other crocodile populations close to pristine levels. A number of practical considerations require removal of crocodiles, including removing crocodiles potentially dangerous to people, providing revenues that support conservation, supporting Aboriginal people in the pursuit of traditional activities, and generating revenue from their lands. You are aware of the number of crocodiles taken for these purposes in Australia; the proposed 25 specimens is a very small proportion of this total and it appears illogical and even perverse to impose artificial or false standards on these 25 removals compared to the rest.

We would urge you to consider the overall benefit of the proposed program. Economic returns from the necessary removal of crocodiles will be optimized and directed in part to a very needful and deserving portion of Australia's native people. No detrimental effects on crocodile populations will be generated and substantial direct and indirect conservation benefits will result. These benefits are integrated into the overall balance of protection, commercial use, and control of crocodiles that makes it possible for people and crocodiles to coexist in the north. Opposition based on allegations of cruelty are at best unsubstantiated or theoretical compared to the soundly demonstrated benefits.

Balancing the needs of people & wildlife is an increasing challenge in this increasingly occupied and urbanized world. We sincerely hope that in this case the interest of wild crocodiles & native peoples will not be set aside.

Sincerely yours,

James Perran Ross, *Executive Officer, CSG*.

South Asia

REGIONAL REPORT FROM CSG VICE CHAIRMAN FOR SOUTH ASIA, ROMULUS WHITAKER. Representing the Madras Crocodile Bank, I attended the Journal of Bombay Natural History Society's Centenary on 12 November 2003. My talk, summarized below, was an alarm call for *Gavialis gangeticus*, whose population is now probably less than 1,000 (wild and captive).

In the mid-1970s, India's Project Crocodile, aided by FAO/UNDP, started an egg collection, rearing, and release head-starting program to save the gharial—the long-snouted, fish-eating crocodylian that was down to under 250 animals in the wild. Over the years about 4,000 captive-reared and captive-bred gharial were released—most of them in the last major suitable habitat, the Chambal River in north central India. Surveys in 1995 and 1997 revealed that there were about 1,200 gharial on the Chambal (now a tri-state National Chambal Wildlife Sanctuary). But in last year's survey only 600 gharial were counted, and several reports of gharial killed in fishermen's nets were received. The following is the world status of this unique, monotypic family, genus and species: Pakistan—Extinct; Bangladesh—Extinct; Bhutan—Extinct; Nepal—fewer than 100; India—fewer than 1,000 (both captive and wild).

What can be done? Considering that the Chambal River is the last chance for the survival of the gharial in safe numbers (as well as water birds, otters, river turtles, gangetic dolphins, the mahseer, and others), the Sanctuary needs to be declared as a World Heritage Site and given the importance it deserves both for the sake of the wildlife as well as the people living on its banks. The river, its wildlife, and people are threatened by negative impacts from sand mining, water diversion, and factory and sewage effluent, to mention the main problems. After discussing these issues with experts and stakeholders, other

necessary courses of action were developed:

- Bring the river under the control of India's National River Authority in order to control pollution and begin soil conservation, tree planting, and rainwater harvesting.
- Revitalize the gharial breeding/rearing/release program which was stopped six years ago.

- Start a pilot project on sustainable use of the gharial and mugger for riverside stakeholders.
- Assist fishermen, the main players, with their problems—including fish depletion.
- Involve the various agencies interested in conservation of all the river's taxa.
- Involve local NGOs in a biodiversity and river wealth education program.
- Identify other places suitable for reintroduction of the gharial and expand the project to include these habitats.
- Find funding to put a small, competent field team to work on surveying and identifying specific problems facing the gharial and its habitat. Based on their findings, a management plan can be developed and funding sourced to assist the relevant States in taking appropriate action to ensure the survival of the gharial.

Harry Andrews and I contributed the following paper to the Journal of Bombay Natural History Society (JBNHS): "Crocodile Conservation, Western Asia Region: An Update" (JBNHS Vol. 100- No. 2 and 3 Aug-Dec 2003, pp 432-445).

With a travel grant from CSG for \$260, I attended the IUCN/SSC Asia Regional Meeting in Colombo, Sri Lanka on 9 Dec. 2003. In my talk I briefly outlined the CSG set-up in general and crocodile conservation in Asia. I then focused on two urgent issues: (1) the possibility of *Gavialis gangeticus* being Critically Endangered, and (2) efforts toward sustainable use of crocs in South Asia, with specific reference to *Crocodylus porosus* in Bangladesh.

At this meeting, my talk on *Gavialis* was basically the same one presented in the BNHS meeting (described above). It was suggested that the Chambal River be proposed as a UNESCO World Heritage Site. And, incidentally, Dr. R.J. Rao recently has communicated that the Government of Madhya Pradesh is willing to forward this recommendation to the Ministry of Environment and Forests of the Government of India. We are now communicating this suggestion to the governments of Rajasthan and Uttar Pradesh, with the hope that they will take the same action.

Regarding *Crocodylus porosus*, I presented the following information: *Crocodylus porosus*, the saltwater crocodile, was so heavily hammered by habitat loss and skin hunters that

only about a thousand survive in mangrove habitats of northeast India and Bangladesh, Andaman and Nicobar Islands, and Sri Lanka. The saltie, as it is affectionately known, has the most valuable of crocodile skins for its smaller scales and suppleness. It is the species on which the long-established Papua New Guinea and fledgling Indonesian crocodile skin industries are based. It grows to over six meters and considers humans soft and palatable. This is one reason its continued survival depends on letting local people benefit from its potential as a resource. Unfortunately, in our region, we have consistently refused to recognize what many other countries have turned to the conservation advantage to this magnificent species and other crocodilians. Ranching and farming the saltie in other parts of Asia and the Pacific is protecting habitat and insuring the survival of the species in safe numbers.

The future of the saltie in India and Sri Lanka is bleak; like most big predators with mere “paper protection,” it is unlikely to exist in twenty years. Fortunately, Bangladesh may be the saltie’s salvation. This country is the caretaker for over half of the world’s largest mangrove swamps—the 10,000 km² Sunderbans. Thanks to the Asian Development Bank, GEF, and the Netherlands Government, which funded the Sunderbans Biodiversity Conservation Project of the Government of Bangladesh (with technical inputs from Wildlife Management International, the author, and others), the saltwater crocodile resource will be surveyed and a plan for conservation, including sustainable use for the benefit of local fishermen, is under formulation. To move this forward our Specialist Group is encouraging both the government initiative as well as a push by private enterprise to start crocodile farming and perhaps ranching as a new industry for Bangladesh and the region. We continue to hope that India and Sri Lanka may soon appreciate sustainable use of carefully managed wildlife resources as a dynamic conservation strategy before it is too late for the species to recuperate.

After discussing the *Gavialis gangeticus* situation with colleagues at both meetings, it is felt that we need to raise funds toward supporting the three-year salary, travel, and living expenses of one good field person to:

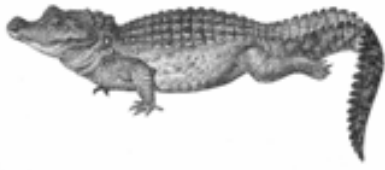
- Conduct gharial surveys in collaboration with Forest Department and other agencies.
- Network and help coordinate interdisciplinary surveys with river dolphin, bird (wetlands), turtle, and fish research groups, both government and private.
- Identify river habitats for further study and restocking of captive-reared gharial.
- Identify main problems facing the gharial and possible solutions.
- Draft a practical Gharial Survival Plan for implementation by the State Forest Departments and other appropriate agencies.

The estimated total budget is US \$15,000.00 for a three-year salary and travel and living expenses. Simultaneously the CSG will approach the Central and gharial-range state Governments to act on recommendations made in the CSG, West Asia Work Plan and in particular action for the protection and rehabilitation of the gharial. — Romulus Whitaker, *CSG Vice Chairman for South Asia, P.O. Box 21, Chengalpattu, India 603001 <draco@vsnl.com>*.

Bangladesh

CROC FARMING ARRIVES IN BANGLADESH. Thanks to support from the government of Bangladesh, the Dhaka-based company, "Reptiles Farm Limited," has brought the practice of crocodile farming to the country for the first time. On 29 March 2004, the government of Bangladesh granted formal permission for the project to proceed. A total of 75 adult crocodiles are expected to arrive around the third week of April, completing the first stage of the project. For more information, visit the web-site at: www.reptilesfarm.com

The staff of Reptiles Farm Limited thanks the Government of the People's Republic of Bangladesh—particularly the Ministry of Environment and Forest—for its cooperation and support. The company also appreciates the many well-wishers who encouraged its venture into the world of crocodile farming. — Mushtaq Ahmed, *Managing Director and CEO, Reptiles Farm, Limited, 2-B, 1/8 Block-D, Lalmatia, Dhaka 1207, Bangladesh <mushtaq@reptilesfarm.com>*.



CROCS RELEASED IN RAPTI RIVER. On 2 February, Royal Chitwan National Park released 10 gharial crocodiles into the Rapti River to commemorate World Wetlands Day. Six females and four males were released at a place called Dudhaura within the park. According to Shivaraj Bhatta, chief conservation officer of the park, 495 crocodiles have been released in the Koshi, Narayani, Rapti, Babahi, Karnali, and Kaligandaki Rivers. — Rastriya Samachar Samiti, *The Himalayan Times*, 3 February 2004. Submitted by Steve Gorzula, *International Resources Group, Washington, DC, USA* <sgorzula@wlink.com.np>.

Shortly after this good news appeared in the press, however, this bad news was published:

FUNDING CRUNCH THREATENS PROGRAMS TO PROTECT ENDANGERED GHARIAL. Because the government has been unable to provide an adequate budget this year to run the crocodile breeding center in central Nepal, the most endangered of the species—gharial or *Gavialis gangeticus*—could face the heat this season. The Kasara Gharial Breeding Center (KGBC)—which has been raising gharial in captivity and releasing them to natural waterways—has only received around half of the amount it requires to operate the center this season.

According to warden Shiva Raj Bhatta of the Royal Chitwan National Park (RCNP), which houses the KGBC, if the center does not get adequate funding within next two months, it will be unable to buy enough fish to feed the crocodiles and to maintain the ponds. Although the center requires annual budget of around US\$15,278 to feed the crocodile hatchlings, care for eggs, and maintain the ponds, together with providing employee salaries, this year the Department for National Parks and Wildlife Conservation (DNPWC) could only release around US\$8,333. "The government is facing budget constraints, and there are not enough

funds available," said Mohan Wagley, spokesperson at the Ministry of Forest and Soil Conservation (MFSC), which oversees the department. The government has been operating the breeding center on its own at present. In the past it had received technical and other kinds of support from WWF and IUCN as well.

This funding crunch is predicted to have a direct effect on the gharial. At present, there are 353 gharial hatchlings and 57 mugger crocodiles in the Center's 11 artificial ponds. "In April and May, the crocodiles need more food, which means more money to buy fishes from the market," said Bhatta, the warden at Royal Chitwan NP. The lack of adequate funds also could undo the small successes achieved by the center, which was established in 1977 to halt the rapidly disappearing trend of gharial crocodiles. "Gharial is the oldest and most primitive reptile among the crocodylian family and the largest crocodile in running freshwater ecosystem. It is the most endangered crocodylian species in the world and endemic to few major river systems of India and Nepal," Nilambar Mishra, an expert, writes in his paper, "Status and Distribution of Gharial in Nepal."

Gharial are fascinating creatures with characteristic elongated, narrow snout. The bulbous growth on the tip of the adult male's snout is called a "ghara," meaning "pot." It has several functions: as a vocal resonator (which produces a loud buzzing noise during vocalization), a visual stimulus to females, and the production of bubbles associated with sexual behavior. The elongated jaws lined with many interlocking, razor-sharp teeth are its major attraction. It is also one of the largest of all crocodylian species—males reach at least 5 meters in length. Although it has poor terrestrial locomotion, it is agile in water due to extensive foot webbing.

Gharial are adapted to an aquatic lifestyle in the calmer areas of deep, fast-moving rivers. They usually only leave the water to bask and nest, usually on sandbanks. Classified as "protected species" by the DNPWC, currently there are 96 to 103 gharial in the wild in different river systems of Nepal. Likewise, there are around 1,322 gharial in different river systems of northern India. Although they were found in river systems across the Indian subcontinent from Pakistan to Burma in the past, they are now concentrated only in few rivers in Nepal and northern India.

"Increasing human population pressure, development activities like construction of dam, barrage, hydroelectricity, and irrigation canals has altered their habitat day by day, resulting in declining populations. Also, rising temperatures and heavy flood are some of the reasons for their decline," writes Mishra. In Nepal, gharial are found in the Narayani, Karnali, Babai, Rapti, Kosi, and Kaligandaki Rivers. "They are critically endangered due to many factors: a lack of awareness in the local community of their importance, the practice of stealing their eggs, which are considered to be delicacy, killing them for their skins, and a superstition that keeping the ghara of the gharial will protect their houses against evil spirits and so on," said Laxmi Prasad Manandhar, conservation education officer at the DNPWC. He acknowledged that the department had been unable to provide adequate budget to run the breeding center.

The significance of the breeding center is highlighted by the fact that before its establishment in 1977, the gharial were almost extinct, with only around 56 of them in Nepal. "Its extensive efforts to catch the eggs from the wild and rear gharial in captivity, later releasing them in the wild, paid off," said Subas Dhakal, a wildlife researcher. "Earlier, the eggs of the crocodiles could not be protected in the wild as people used to steal them for various purposes."

The KGBC employs close to a dozen local fishermen to collect the eggs of both gharial and mugger crocodiles (*Crocodylus palustris*). The department classifies gharial as a protected species, but not the mugger. The eggs have to be handled delicately and hatched under the supervision of the experts. The center normally collects the eggs in March/April and regulates their temperature. The eggs usually hatch around July and the hatchlings are kept in an artificial pond. Usually they are released after three years.

The tricky part is that the survival rate of the eggs as well as hatchlings is quite low. Between 1981 and 2003, a total of 539 gharial crocodiles had been released to natural river systems—and only 96-103 of them (approx. 1/5) survived. A field-based study by Dr. Tirtha Man Maskey, a well-known crocodile expert of Nepal, showed that around 24 percent of gharial survive after they are released from the breeding center to the rivers. The study, conducted in 1998, found that

the low survival rate was partly due to local peoples' belief in various mystical power of the "ghara" of males found in their snouts. "In Nepal, local tribes believe that a ghara of gharial placed under the pillow of expectant women relieves pain and speed labor. Similarly, incense made from the ghara is believed to act as repellent for insects and other pests from agriculture fields," Mishra states.

The survival rate is even lower if left to natural forces alone. "It is said that survival of gharial under natural conditions is less than one percent due to natural predators of eggs and hatchlings like jackals, otter, pigs, large fishes, turtles, birds of prey and large wading birds," writes Mishra. The situation has worsened with population pressure and stealing of eggs by humans. "Although there are also fears of poaching of crocodiles for their skins, it has not been a big problem—but authorities do need to keep their eyes open," said Dhakal. He added that though there has been no study to find out about the situation of poaching crocodile for commercial purposes, it cannot be discounted at all as a threat to the gharial.

Gharial crocodiles are key components of running freshwater ecosystems. They help to maintain the fish population, as well as help distribute nutrients from the bottom of the river bed to the water's surface. Crocodiles are important predatory species of the wetlands, eating fish and other smaller aquatic and amphibian animals and helping to maintain the balance of wetland ecosystems. Increasingly, the Royal Chitwan National Park (RCNP)—which is renowned worldwide for its flagship one-horned rhino and Royal Bengal Tiger—is also becoming known for gharial and mugger crocodiles. Recently, the government introduced the policy of allowing domestic farming of wild animals to include gharial, which it believes could help in their conservation.

"The government recognizes their importance. The funding crunch is not deliberate and is not aimed at harming crocodile population. It is just that the government has been unable to generate more resources," said Mohan Wagley, spokesperson at the MFSC. At present, as per budget estimates of fiscal year 2003-2004, the forest sector commands around 1.5 percent of the government's total development expenditure. Budget figures for the past two fiscal years indicate that in the last three years, the budget for this sector has remained

stagnant. As the lion's share of the government's budget has to be set aside for the rising cost of security for insurgency control issues, the environment sector is getting hit by the funding crunch. According to officials, the Nepalese government has made the environment a second-priority sector. — Sanjaya Dhakal, *Spotlight Vol. 23, No. 35, 19-25 March 2004 (Chaitra 6, 2060)*. Submitted by Steve Gorzula, International Resources Group, Washington, DC, USA <sgorzula@wlink.com.np>.

Sri Lanka

SALTIES OR MUGGERS? Over the years a number of authors have reported the presence of the saltwater crocodile (*Crocodylus porosus*) in Block I of the Yala National Park (Santiapillai et al. 2000). Having recently spent several months there filming the mugger or marsh crocodile (*Crocodylus palustris*), I think that presently there are no resident saltwater crocodiles in Block I of Yala. "Salties" have a different specific set of habitat requisites compared to the ubiquitous mugger who can make do with a mud hole or a drainage ditch if it has to. The typical habitats of the salty are the rivers and backwaters once lined with extensive mangroves in Sri Lanka's southwestern coast from Negombo down to Galle. There are very few salties left now in Sri Lanka, perhaps the only breeding population is in the Muthurajawela swamp near Negombo (Devapriya 2001) with sporadic breeding at places like the Bentota River. It would be great to hear of more salty sightings from Sri Lankan naturalists.

It is reported that salties are sometimes seen on the East Coast (Kumana, Trincomalee, etc.), but a survey is necessary to confirm this. *Crocodylus porosus* can certainly travel far; one male 3 m long was caught by fishermen off the coast of Pondicherry in India in 1985 and given to the Madras Crocodile Bank. We surmised that it had swum from southwestern Sri Lanka.

So there is a chance that an occasional salty may swim into a Yala lagoon, but it probably wouldn't stay for long.

It is easy to confuse the two species because of color variation, and we noticed that some of the smaller (< 1.5 m) muggers of Yala do have



Adult male saltwater crocodile (*Crocodylus porosus*). Note the overall regular scale rows on the back and very small neck scales just behind the head. R. Whitaker photo.



Adult mugger or marsh crocodile (*Crocodylus palustris*), Panama Wewa. Note the irregular scale rows on the back and four large post-occipital scutes just behind the head. R. Whitaker photo.

the more streamlined shape typical of a salty. Young salties generally have a yellowish skin color compared to the duller gray of the mugger. Also, while muggers often (but not always) have a rougher, irregular scale pattern, salties always have a more streamlined symmetrical scale arrangement which is obvious in the photos above. But the clincher is to get a good look at the back of the neck. Just behind the flat head of the mugger are four large raised scales called the post-occipital scutes. The neck region just behind the head of a salty is smooth with small

scales. Unless the croc is basking, you won't be able to easily see the neck. You can also observe their habits (salties bask much less and aren't generally sociable like muggers which will crowd a pond or line up like logs on a sunny bank) and habitats (mentioned above).

The status of Sri Lanka's two crocodiles needs to be assessed quickly. The last survey was done in 1977 (Whitaker & Whitaker). If you have any information about crocodiles, please write to the Wildlife Heritage Trust or to me. Romulus Whitaker, *CSG Vice Chairman for South Asia, P.O. Box 21, Chengalpattu, India 603001 <draco@vsnl.com>*.

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NEW SIGHTINGS OF CROCODILES FROM NORTHERN SRI LANKA. Between 1983 and 2001, Sri Lanka experienced one of the bloodiest armed conflicts between government forces and Tamil guerrillas in which over 60,000 people perished. The armed conflict affected not only the people but also the environment and wildlife. However, the impact of war on wildlife and the environment in Sri Lanka is poorly documented (Santiapillai & Wijeyamohan 2003). Today, with the enforcement of a ceasefire, the island enjoys an illusion of peace. But even after the hostilities have ended, the impacts of war continue to be felt. Both man and wildlife lose lives and limbs from land mines. War has also increased the number of people dependent on forests for firewood for fuel and bushmeat for protein (Mylvaganam et al. 2004).

Although such armed conflict is often detrimental to wildlife, there are also instances where it has enhanced the survival of wildlife by reducing pressure on habitats, slowing down or stopping resource exploitation and loss of biodiversity (McNeely 2000). Forests are also invaluable for guerilla warfare, which is another

reason they are preserved in areas under the control of the guerrillas (in the army-controlled areas, however, forests are often clear-cut up to depths of 500 m on each side of a road, for security purposes). Fear of land mines may also prevent poachers moving into conservation areas. War seems to benefit wildlife and environment if and when it keeps large numbers of people out of large areas. The exodus of refugees from conflict areas reduces pressure on the land and promotes the return of wildlife, as has happened in the case of the crocodiles that have made a come back to the Jaffna peninsula in Sri Lanka, after decades (Santiapillai & Wijeyamohan 2004—see next article).

With the cessation of war and opening up the north and east of the island, it is now possible to visit areas where access was formerly denied and conduct wildlife observations. During a few recent visits to the north, we were able to examine a number of man-made reservoirs (or tanks) and interview people living nearby about the presence or absence of crocodiles. In the process we came across a few new locations where freshwater crocodiles (*Crocodylus palustris*) still survive. These locations can complement those listed by Whitaker & Whitaker (1977, 1979) during their pioneering survey of crocodiles in Sri Lanka.

Paradoxically, Sri Lanka has no natural lakes, but rather almost 10,000 man-made reservoirs or tanks. Northern Sri Lanka in general and the Vanni region (comprising the Administrative Districts of Mannar, Vavuniya, Kilinochchi, and Mullaitivu) in particular have thousands of these tanks dotted across the landscape. These were constructed in the ancient times to catch rainwater for irrigation. As Lewis (1895) points out, "every river rises at some trifling hillock, and is blocked by a tank as soon as it is more than a rivulet." Many of the tanks are seasonal and therefore are completely dry during the drought, but teem with fish and waterfowl during the rainy season. Thus, they help promote the spread and survival of crocodiles across the Dry Zone. Unfortunately, crocodiles are also dangerous predators. They attack livestock and sometimes even people.

In the Kilinochchi District, we found evidence of freshwater crocodiles in reservoirs such as Vannarikulam, Akkaryankulam, Thevankulam, Pandivettikulam, and Kariyalai Nagapaduwanakulam ("Kulam" in Tamil means a

pond) (Figure 1). Of these, the Vannarikulam appears the best for crocodiles; there, at least a dozen crocodiles have been reported basking on the bank of the pond. Characteristic crocodile feces also were found on the banks.

Vannarikulam is also very rich in bird life: we were able to observe egrets, herons, storks, darters, cormorants, coots, pelicans, whistling teals, and terns in mid- January 2004. In the Mullaitivu District, crocodiles are present in one of the oldest irrigation reservoirs known as Vavunikulam, situated in the Thunukkai Division, and built across the Pali aru, a stream which flows into the sea close to Poonakeri or Pooneryn. Vavunikulam is situated about 13 km southwest of Mankulam. It may have been built as far back as the 3rd century B.C (Arumugam 1957). In the Vavuniya District, Pavatkulam and Pampaimadu are two new crocodile localities. Pavatkulam is pre-Christian in construction and is one of those tanks that have no corresponding Sinhala names, thereby attesting to the fact that Tamils from remote antiquity have been the permanent inhabitants of this district

(Navaratnam 2003). It is located along a minor road that links Highways A14 and A30. A freshwater crocodile was observed basking on a rocky outcrop in Pavatkulam. Pampaimadu, close to Vavuniya, also is home to several freshwater crocodiles and can be reached via Highway A30.

The survey has revealed the presence of freshwater or mugger crocodile from a number of hitherto unlisted localities in the north. A more thorough survey (planned for the future) would no doubt give a better understanding of the range of the crocodiles in the northern and eastern parts of the island. The crocs have managed to survive largely because of the reduction in human population, following armed conflict, and the availability of food in the form of fish and waterfowl. But with the return of the refugees to their original areas, crocodiles may come into conflict with man. As Fergusson (2002) so aptly points out, “the predator occupies a habitat that is essential to the prey.” Herein lies the recipe for human-crocodile conflict (HCC). At present, HCC is rare. But it is bound to increase with the resettlement of these areas by refugees. More

people are killed on the road by motor vehicles than by crocodiles. But a crocodile attack is big news. Given the poor image crocs have in Sri Lanka, their conservation needs the support of the local communities. The fact that the freshwater crocodile is widely distributed, although in low numbers, across much of the low country dry zone in the north points to its ability to survive and bounce back when conditions in the habitat improve. But its continued survival in the north in viable numbers, outside protected areas, would require the adoption of measures that would alleviate conflict with man. — Charles Santiapillai, *Dept. of Zoology, Univ. of Peradeniya, Sri Lanka* <csanti@slt.lk> & S. Wijeyamohan, *Dept. of Biological Sciences, Univ. of Jaffna, Vavuniya Campus, Sri Lanka* <abhirhamy@hotmail.com>.

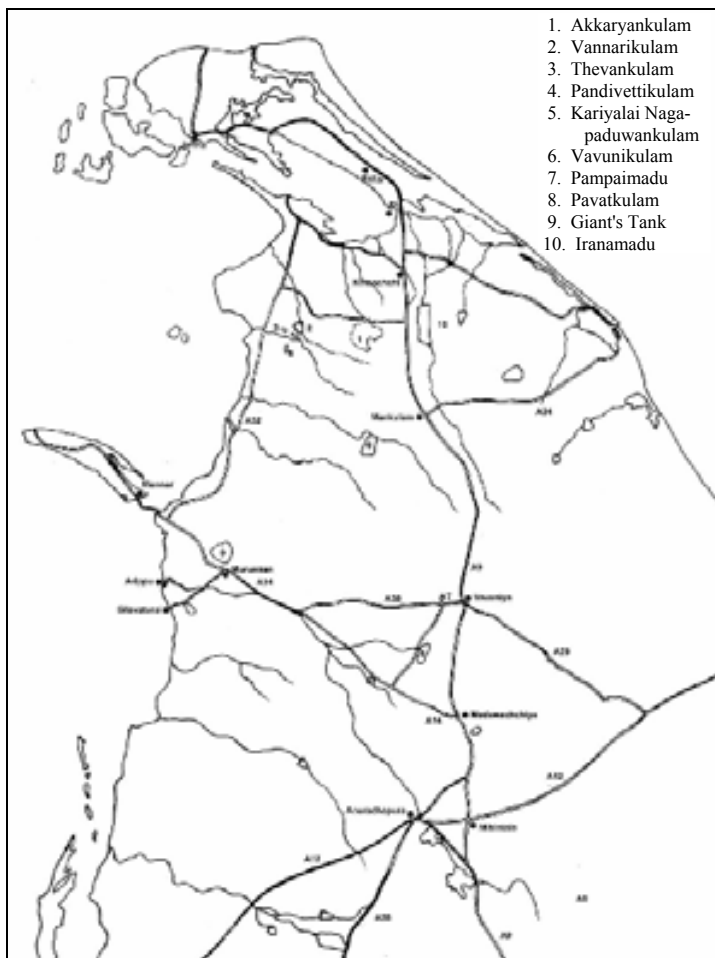


Figure 1. Map of northern Sri Lanka showing the new localities from where crocodiles have been recorded recently (2004).

** See Literature Cited on page 16 (combined with that of the following article by Santiapillai & Wijeyamohan).

REDISCOVERY OF CROCODILES IN THE JAFFNA PENINSULA, SRI LANKA. The family Crocodylidae is represented in Sri Lanka by two species, namely the "freshy" or marsh or freshwater crocodile (*Crocodylus palustris*) and the "salty" or estuarine crocodile (*C. porosus*). Both are listed on Appendix I of CITES. In Sri Lanka, the two species would meet the IUCN criteria for being "endangered" and "critically endangered," respectively. Crocodiles have been poorly studied in Sri Lanka, following Deraniyagala's (1953) pioneering work. The first comprehensive survey of the two species of crocodiles in Sri Lanka was carried out by Whitaker & Whitaker (1977, 1979), which was later followed by those of Santiapillai et al. (2000) and Santiapillai & de Silva (2001). According to Whitaker & Whitaker (1979), "crocodiles seem to have become extinct" in the Jaffna Lagoon "since several decades." But they also mention the Chundikulam Sanctuary as having "occasional crocodiles, probably *C. palustris* from the tanks." Crocodiles did occur in the distant past in the Jaffna peninsula. According to Baldaeus (1672), there were many crocodiles in the fens, ponds, and lakes of the Jaffna peninsula, while Ferguson (1877) observed the freshwater crocodile to be very

common. Tennent (1859) referred to the still waters and tanks of the northern provinces literally teeming with crocodiles. Since then, it was generally believed that crocodiles had become locally extinct in the Jaffna Peninsula.

Since the survey of crocodiles by Whittaker & Whitaker (1977, 1979), it was not possible to determine the status of the crocodiles in the Jaffna peninsula for almost 20 years because of the armed conflict in the island. However, with the declaration of a cease-fire, it is now possible to travel to the north and conduct surveys. We were able to survey the Thondamanaru lagoon in the peninsula between 16-20 January 2004 for evidence of crocodiles. This preliminary survey has confirmed the presence of crocodiles in the peninsula. Both freshwater and saltwater crocodiles are present, and locals refer to them by their vernacular names "Chaanakan" and "Semmoogan," respectively. Both species were recorded from the northern extension of the Chundikulam Sanctuary, while freshwater crocodile was known to be present in Pallai. At Naharkoil, two crocodiles (species not known) were killed in early January. Crocodiles were also recorded in places such as Varani, Ampan, Maruthankerni, Maanviluntha kooru, and Mulliyyan (Figure 2) and from the extensive mangroves that are found along the Thondamanaru lagoon.

That the crocodiles have managed to survive in the Jaffna peninsula points to their tenacity and ability to bounce back if and when conditions in their environment improve. The 20-year civil war may have been a blessing in disguise to the crocodiles, since most of the people were moved from the peninsula and resettled in the Vanni region. This reduction of human pressure enabled the return and recolonization of the Thondamanaru lagoon by crocodiles. It also reduced the hunting pressure on crocodiles. Today, the Thondamanaru lagoon and its mangroves represent the last

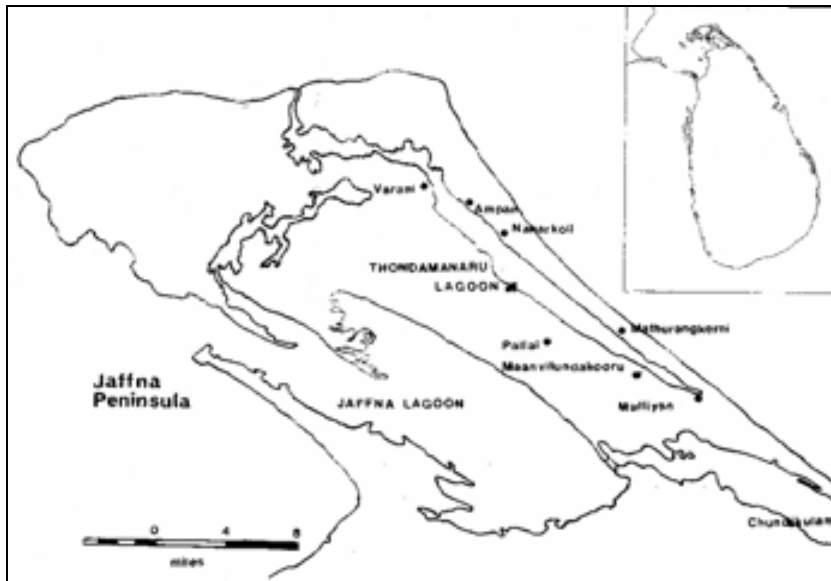


Figure 2. Map of the Jaffna peninsula, northern Sri Lanka. Localities marked are where crocodiles have been reported. Inset: map of Sri Lanka.

stronghold of the crocodiles in the Jaffna peninsula. More intensive surveys are needed to identify clearly the range and number of the two species of crocodiles in the Jaffna peninsula if they are to be conserved. One difficulty in surveying wildlife in general and the crocs and birds in particular is that the use of binoculars is prohibited by the military. This greatly restricts our ability to identify animals at a distance. At a time when ordinary fishermen are using GPS to catch fish in the sea, it is not clear why the military continues to insist on banning the use of binoculars in the peninsula.

The mangroves are extensive and support a variety of birds, providing nesting and breeding areas for storks, cormorants, egrets, and herons. They provide support for the marine food web, nurseries for valuable fish and crustaceans, and habitat for plants and animals (Maltby 1986). They represent vital breeding and nursery grounds for shrimp and fish. Many mangrove areas in Sri Lanka have been lost irretrievably, and the rest are under threat from conversion to prawn farms. As “keystone species,” crocodiles are important for the maintenance of ecosystem structure and function. They should also be regarded as “flagship species” for the conservation of the mangroves in the Jaffna peninsula. — Charles Santiapillai, *Dept. of Zoology, University of Peradeniya, Sri Lanka* <csanti@slt.lk> & S. Wijeyamohan, *Dept. of Biological Sciences, University of Jaffna, Vavuniya Campus, Sri Lanka* <abhirhamy@hotmail.com>.

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Latin America & Caribbean

Colombia

CSG MISSION TO COLOMBIA: 1-6 MARCH 2004. The mission was undertaken by Dr. Alejandro Larriera, CSG Vice Chairman for Latin American and the Caribbean; Dr. Grahame Webb, CSG Vice Chairman for Eastern Asia, Oceania, and Australasia; Dr. Miguel Rodríguez, CSG Steering Committee Member; Lic. Bernado Ortiz, CSG Steering Committee; and Lic. Alvaro Velasco, CSG Deputy Vice-Chairman for Latin American and the Caribbean.

The first day we had meetings in Bogotá at the Ministry of the Environment, Housing, and Land Development, with Vice Minister Dr. Juan Pablo Bonilla, Ecosystem Director Dr. Gonzalo Andrade, and their staff (Adriana Rivera,

Francisco Gutierrez, Antonio Gómez, Milena Gómez, and Claudia Rodriguez). They made various background presentations including:

- Structure of the National Environmental System (SINA), by Francisco de P. Gutiérrez B. (Ecosystem Direction).
- CITES Administrative and Scientific Authorities, by Adriana Rivera B. (Ecosystem Directorate).
- Wildlife law in Colombia, by Dr. Rodrigo Negrete (Legal Office of the Ministry of Environment, Housing, and Land Development).
- CITES general procedures: harvest quotas, export quotas, customs procedures, etc., by Adriana Rivera (Ecosystem Direction).
- Strategy for control and the prevention of illegal trade by Milena Gómez (Ecosystem Direction).
- Criteria and indicators system for assessing captive breeding, by Dr. Fernando Gast H., Director of the Alexander von Humboldt Institute of Biological Research (Colombian CITES Scientific Authority).

The second day we met in Cartagena with the Autonomous Regional Corporations (Corporaciones Regionales Autónomas), producers associations, independent producers, technical officers and biologists, and a tag production company. The presentations were:

- Captive breeding evaluation and monitoring system of the Colombia Canal del Dique Autonomous Regional Corporations (CARDIQUE) representing all the Corporations.
- Criteria and indicators system for captive breeding, by Dr. Fernando Gast H., Director of the Alexander von Humboldt Institute of Biological Research (Colombian CITES Scientific Authority).
- Sustainable use programs as a conservation tool, by Alejandro Larriera (CSG).
- Crocodile conservation and sustainable use, by Alvaro Velasco B. (CSG).
- Harvesting and trade in CITES-listed wildlife species: the role of wildlife management principles/practices, by Grahame Webb (CSG).
- New tag system proposal, by ALPHEX enterprise.
- Crocodiles sustainable workshop, by reporter Sergio Medrano.

The third day was a field trip involving:

- Flight over mangrove areas of Canal del Dique area and Cispatá Bay.

- Visit to Cispatá Bay, *Crocodilus acutus* conservation program.
- Visit Caicsa farm (*Crocodilus acutus* and *Caiman crocodilus fuscus*).
- Visit Los Caimanes farm (*Caiman crocodilus fuscus*).

The fourth day also consisted of field trips:

- Visit Zobem farm (*Crocodilus acutus* and *Caiman crocodilus fuscus*).
- Visit Caribbean farm (*Caiman crocodilus fuscus*).
- Visit Canal del Dique project, *Caiman crocodilus fuscus* conservation program
- Visit Zoofarm farm (*Crocodilus acutus* and *Caiman crocodilus fuscus*).

The final day involved an open meeting in Bogotá City, at the National University of Colombia. There were some additional presentations:

- General status of crocodiles in Colombia, by Dra. Olga Castaño, National University of Colombia (CITES Scientific Authority).
- *Crocodylus intermedius* conservation program, by Dra. María Cristina Ardila. National University of Colombia, Natural Sciences Institute (CITES Scientific Authority).
- *Melanosuchus niger* conservation program, by Claudia Sánchez, Amazonian Research Institute (SINCHI; a CITES Scientific Authority).
- *Crocodilus acutus* conservation program, by Adriana Rivera (Ecosystem Direction).

The remainder of the meeting was devoted to the CSG presenting its observations, general findings, and draft recommendations. A full report of discussions and recommendations is in preparation by the team.

We want to express our acknowledgments to all institutions and individuals involved in the mission: first and foremost to the Ministry of the Environment, Housing, and Land Development, and specifically to the Ecosystems Directorate—their Director Dr. Gonzalo Andrade and personnel: Francisco Gutiérrez, Adriana Rivera, Antonio Gómez, and Claudia Rodríguez. We also thank the Colombia CITES Scientific Authority, the producers associations in Colombia, Azoocol and Biodiversa—especially Dr. Juan Carlos Ucos—and the professionals, technicians, and researchers that work within the crocodile farms and the biologists forging new

ground linking crocodilian sustainable use to rural communities: Sergio Medrano (Canal del Dique Project) and Giovani Ulloa (Cispatá Bay Swamps Project). Finally, we extend our thanks to these farms: Caicsa (Martínez Family), Los Caimanes (Héctor Reigosa and family), Zobem (Jorge Saieh and family), and Zoofarm (Carlos Camacho and family). — Alvaro Velasco, *Apdo. Aéreo 66597, Caracas 1010 Venezuela* <velascoalvaro@tutopia.com>; Alejandro Larriera, *CSG Vice Chairman for Latin America & the Caribbean, Pje. Pvd. 4455, Centeno 950, Santa Fe, Argentina* <yacare@arnet.com.ar>; Grahame Webb, *Wildlife Management International, PO Box 521, Sanderson, NT 0812, Australia 0678* <gwebb@wmi.com.au>; Miguel Rodríguez, *Pizano SA, Colombia*; & Bernardo Ortíz, *TRAFFIC-South America*.

CONSERVATION OF *C. ACUTUS* IN CISPATÁ BAY, DEPT. OF CORDOBA. The purpose of this project is to formulate a pilot conservation strategy for *C. acutus* in Cispatá Bay—the old mouth of the Sinú River, in the Department of Córdoba-Caribe, Colombia. We believe that a combination of early-stage research, follow-up, and monitoring activities and the formulation of a management plan will aid both local and national entities in their attempts to conserve the species.

After the initial research, the project goal will be based on the sustainable management of *C. acutus* by local community members, within the framework of the activities that CVS (Autonomous Regional Organization of the Sinú and San Jorge Valleys) and CONIF-OIMT (Ministry of the Environment's Mangroves Program) are developing in the implementation of the Integrated Management Plan for the mangroves of Cispatá Bay. The idea is to integrate conservation components and the ideas of crocodile specialists in the governmental process of developing land-use and land tenure plans for the region. It is suggested that the following components be carefully considered and included in the Integrated Management Plan: (1) population censuses; (2) population recovery programs; (3) monitoring; (4) biological studies; (5) precautionary mechanisms; (6) benefits for local people; (7) agreements; (8) traffic control; (9) overall economic benefits.

From early 2000 to mid-2001, the Ministry of Environment's Mangroves Program (CONIF—OIMT), with the support of CVS, Agrosoledad, Fundación Natura, and UAESPNN, developed the first stage of the project. This stage consisted of library research, the acquisition of field permits, and analysis of the information to be used in laying the groundwork for the management plan. The result was the final report (for Phase 1) entitled "Characteristics and status of *Crocodylus acutus* populations and their natural habitat" (Ulloa-Delgado & Sierra-Díaz 2002). This report provided a description of the study area, to be facilitate the management of the natural habitat of *C. acutus*, and an assessment of the distribution, characteristics, and status of wild populations of *Crocodylus acutus* in Cispatá Bay. This report also established medium- and long-term goals, namely: (1) to develop conservation strategies with the participation of the community, and (2) to implement a management plan, in conjunction with local communities and environmental authorities, that would allow for the conservation of crocodilian populations in the region.

A preliminary activity included an estimation of the population size and structure of *C. acutus* (judging by individuals observed) and their spatial distribution (judging by their presence in bogs or sewers). Management guidelines for each of the populations identified were suggested, with the idea that these preliminary suggestions would be incorporated in the latter phases of the planning process.

In 2003, CVS—with the support of the Mangroves Program—conducted a study of wild populations of *Caiman crocodilus* and their natural habitat. The result was a preliminary report (Ulloa-Delgado & Cavanzo Ulloa 2003) discussing the identification and characteristics of "babilla" (*Caiman crocodilus*) populations and their natural habitat in Cispatá Bay.

Along with these activities in 2003, in an attempt to optimize resources, the Mangroves Program teamed up with CVS and Conservation International/Colombia to continue monitoring the *C. acutus* population and analyzing the data obtained. Also, with the support of a private company, Agrosoledad, the team collected *C. acutus* eggs, incubated them, and raised the young in a controlled environment, to test the viability of a community-assisted repopulation program. Currently there are approximately 150

young crocodiles, 60 - 90 cm long, which will be released and monitored this year.

In late 2003, an agreement between CVS and the Mangroves Program brought some much-needed infrastructure for the management of crocodilians in the region, with an emphasis on the conservation of *Crocodylus acutus*. A research station was constructed—an "experimental, community-based station for research and management of *Crocodylus acutus* and other important fauna in the the region."

At present (2004), the Ministry's Mangroves Program (CONIF—OIMT) and CVS are still collaborating in the management of the research station. Since mid-February, they have had the active participation of seven members of the fishing and mangrove community. These individuals have collected approximately 30 nests (800 eggs), which are now being incubated in a carefully-controlled environment.

Additionally, with the support of the Alexander Von Humboldt Institute and private company C.I. Zobem S.A., the CVS / CONIF—OIMT team is implementing an important training program. The main objective of the program, "Community training for the conservation of wild crocodilians in the Cispatá Bay/Dept. of Córdoba zone," is to set in motion the mechanisms of conservation through community participation, within the framework of activities that are being conducted in the region. Specific objectives of this project are to teach 10 members of the local community the methodology of monitoring wild crocodile populations, as well as how to care for incubating eggs and young crocodiles born in captivity, for later release. These training activities currently are being conducted at the special research station established last year in the region.

— Giovanni Andrés Ulloa Delgado, "Sustainable Management and Mangrove Restoration by Local Communities of the Colombian Caribbean" Project, Minambiente-CONIF-OIMT & CVS (Corporación Autónoma Regional de los Valles del Sinú y San Jorge), Dept. of Córdoba, Colombia.

Costa Rica

DATA ON MASS OF LARGE WILD *C. ACUTUS*. Mass data on large wild crocodilians is sorely lacking in the scientific literature, for obvious reasons. It is clearly problematic to weigh a large, uncooperative crocodile in the field, as well as overcome the constraints of equipment, manpower, muscle, and supportive structure to handle the mass of an animal that may well approach a weight of one ton. In March 2003, the translocation of a large *C. acutus* for a long-term radio-tracking project provided an opportunity to obtain valuable mass data on a large adult. The crocodile had a total length of 3.95 meters, and was visibly healthy in all respects. During transit to the relocation site a highway weigh station truck scale provided a gross weight of truck and croc. Following the release of the crocodile, the truck was again weighed without the mass of the animal, and then subtracted from the gross weight. The crocodile's mass was determined to be 500 kg. Utilizing highway weigh station truck scales can be an effective way to obtain mass data on animals too large to weigh in the field.

— Dr. Brady Barr, *National Geographic Television*, 1145 17th St. NW, Washington DC 20036, USA <Bradybarr@aol.com>.

Venezuela

CAPTURE OF A LARGE *C. INTERMEDIUS*. The Orinoco crocodile, *Crocodylus intermedius*, is one of the largest crocodilian species in the world, but sadly also one of the most threatened. Most of the giant crocodiles of years past have been extirpated throughout most of their range, and today animals longer than four meters are exceedingly rare. In April 2003 a crocodile survey/mark-recapture study was conducted in the Cojedes River drainage basin in northern Venezuela. This project was led by Andrés Seijas, CSG member and professor at the National Experimental University of Llanos Occidentales "Ezequiel Zamora" in Guanare, Portuguesa. The objective of the study was to estimate populations of Orinoco crocodiles (*C. acutus*) as well as the spectacled caiman (*C. crocodilus*).

During this project a very large *C. intermedius* was captured from a man-made flood control device. The concrete structure was designed to transfer water from the river into the

surrounding agricultural fields. The large male crocodile was fishing in the rapid water being expelled from the spillway, a foraging technique described in other crocodile species. The crocodile measured a total of 4.0 m, but was missing the terminal portion of its tail. The tail had only 12 single crest caudal scutes, whereas adult *C. intermedius* normally have 19-20 single crest caudal whorls. The last seven single caudal scutes that the croc possessed measured 46 cm in length, assuming that the terminal seven scutes would be of comparable size, the total length of the animal can be extrapolated. Adding the missing 46 cm of the tail to the measured length of the animal results in a total length of 4.5 m--a giant crocodile! Andrés commented that it was one of the largest he had ever seen in Venezuela. Even with the missing tail, it was one of the largest Orinoco crocs captured in the wild in the last 25 years. Ten minutes after capturing it and collecting this data, the crocodile was released, unharmed. — Dr. Brady Barr, *National Geographic Television*, 1145 17th St. NW, Washington DC 20036, USA <Bradybarr@aol.com>.

North America

Mexico

CROCODYLUS ACUTUS IN BANCO CHINCHORRO BIOSPHERE RESERVE, QUINTANA ROO. From June to August 2003, we conducted three spotlight survey counts and a capture-and-mark program in order to evaluate the conservation status of the American crocodile (*Crocodylus acutus*) in the Banco Chinchorro Biosphere Reserve, Quintana Roo, Mexico. Banco Chinchorro is an atoll located 30.8 km east of the village of Mahahual (the nearest continental point). Of its three cays, only the largest one, Cayo Centro, is inhabited by crocodiles.

We established 10 survey routes along interior lagoons, as well as in a section of the outlying cay. Aboard a 4.25 m aluminum boat with a 15 HP outboard motor, we estimated encounter rates (# crocodiles/km) and determined population structure by class size and sex ratio. For each individual sighting we recorded the habitat and vegetation types, depth, water temperature, and salinity. We observed a

total of 133 crocodiles, and determined that the average encounter rate was 6.8 crocodiles/km. However, important differences were detected between the three habitat types surveyed (open water in the outlying cay, shallow lagoons, and deep interior lagoons). Grouping the survey routes by habitat type, we found 13.9 indiv/km in the shallow Chandés lagoon, 1.3 indiv/km in the outlying cay, and 1.1 indiv/km in the remaining deeper lagoons, which in turn were occupied only by subadults and adults. The population structure is composed mainly of subadults (27.4%) and juveniles (26.5%), followed by adults (20.4%), yearlings (13.3%), and hatchlings (12.4%). All size classes were present only in Chandés Lagoon. The population showed a strongly male-biased sex ratio in all age classes ($n = 39$) except for yearlings, and its origin is probably in the clutch (Thorbjarnarson 1997). Our results indicate that the current population of *C. acutus* in Banco Chinchorro seems to be in good shape, especially when compared with the closest inland populations of Mexico (Cedeño-Vázquez 2002; Domínguez-Laso 2002) and Belize (Platt and Thorbjarnarson 2000). Additionally, crocodiles of all sizes in Banco Chinchorro are capable of tolerating the high salinity values we recorded (mean 52.9 ppt; min. 30 ppt; max. 61 ppt). These results indicate that a population monitoring program is one of the management actions necessary to follow its evolution and conservation. — Pierre Charruau, *Institut d'Ecologie Appliquée*, 44 rue Rabelais, B. P. 808, 49008 Angers Cedex 01, France <charruau_pierre@yahoo.fr>; J. Rogelio Cedeño-Vázquez and Roberto Rojo, *El Colegio de la Frontera Sur*, Av. Centenario Km 5.5, 77900 Chetumal, Q. Roo, México <rogeliocv@mexico.com> (J. Rogelio) and <chibebo@yahoo.com> (Roberto).

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- Domínguez-Laso, J. 2002. Análisis poblacional de *Crocodylus acutus* (Cuvier, 1807) y *Crocodylus moreletii* (Duméril, 1851) en el sistema lagunar norte de la Reserva de la Biosfera Sian Ka'an, Quintana Roo, México. Tesis de licenciatura,

Universidad Autónoma Metropolitana, Unidad Xochimilco, México, 104 p.

Platt, S.G. & J.B. Thorbjarnarson. 2000. Status and conservation of the American Crocodile, *Crocodylus acutus*, in Belize. *Biological Conservation* 96:13-20.

Thorbjarnarson, J.B. 1997. Are crocodylian sex ratios female-biased? The data are equivocal. *Copeia* 2:451-455.

REPORT ON THE CURRENT STATUS OF CROCODYLIANS IN MEXICO. Despite decades of research related to crocodylians in Mexico, disseminating this information outside of the country still remains a challenge. The purpose of this summary therefore is to provide an update on the status of crocodylians in Mexico and activities related to their conservation.

Mexico is home to three of the 23 species of crocodylians: the caiman, *Caiman crocodilus chiapasius* (not yet confirmed as subspecies); American crocodile, *Crocodylus acutus*; and Morelet's crocodile, *Crocodylus moreletii*. In 16 of the 32 states of the Mexican Republic, crocodylians can be found: from Sinaloa to Chiapas along the Pacific coast; Tamaulipas and San Luis Potosí all the way to the Peninsula of Yucatan; and inland in the center of the State of Chiapas.

Crocodylians in Mexico face threats similar to those endangering other crocodylians worldwide: habitat destruction, transformation, contamination, and invasion, as well as the pressures of hunting and illegal trade. Fortunately, because of their ecological value and role as keystone species in their habitat, Mexican crocodylians are considered to be high-priority species for protection. Many combined efforts involving communities, cooperatives, researchers, private investors, NGOs, government entities, and universities are helping to reverse and minimize these threats. However, much work remains to be done in order to ensure the recovery of Mexico's three crocodylian species.

The following is a brief description of the three species and an update on the status of each on the national and international lists, laws and conventions that affect and control Mexican crocodylians:

(1) *Caiman sclerops chiapasius*, known as

Caiman crocodilus fuscus: Described by Bocourt, this species is now known as *Caiman*

crocodilus fuscus because too few studies have been done on the species to officially confirm it as a subspecies. We do know that del Toro & Sigler (2001) mentioned and described the subspecies, and Medem (1962) classified and described the subspecies of caimans *Caiman sclerops chiapasius*. Some DNA studies suggest that *Caiman crocodilus fuscus* and *Caiman crocodilus chiapasius* are in the same natural group. However, some morphological differences have been seen between the Mexican caiman, *Caiman sclerops chiapasius* or *Caiman crocodilus chiapasius*, and *Caiman crocodilus crocodilus* and *Caiman crocodilus fuscus*.

The maximum size registered for an adult of this species is 2.5 m. Hatchlings are an average size of 22.5 cm. Females lay an average of 30 eggs.

This snout of this caiman is short, with round tip, and measuring 1.2-1.5 times as long as broad at the front corners of the eyes. A transverse bony ridge connects the anterior points of the orbits. The upper eyelid has a high point or tubercle. The lower jaw has at least two blotches. The belly skin of caimans has osteoderms and lacks integumentary sensory organs. Post-occipital scutes: one or two transversal rows of 6-8 irregularly-arranged scales. Nuchal scutes: four or five transverse rows of 2-4 scales, continuous with the dorsal scales. Collar scutes: has one single row of enlarged scales.

Distribution: *Caiman crocodilus* is found from the southern Pacific coast of Mexico all the way to northern Argentina. Subspecies *Caiman sclerops chiapasius*, as described by Medem, is registered in the Tonalá region, on the northwest coast of Chiapas, so we believed that this subspecies could be found in southern Oaxaca throughout the Pacific coast of Chiapas, as high as 50 m above sea level. It is not known whether this subspecies is found throughout Central America, although some authors mention seeing it in Panama.

Conservation status: NOM-059-ECOL-2001

(official norm that identifies flora and fauna in Mexico that are at risk): Special Protection. CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora): Appendix II. IUCN (International Union for the Conservation of Nature, Red List) 1996: Not

listed. ESA (Endangered Species Acts, U.S. law): Not listed. CSG (Crocodile Specialist Group, Species Survival Commission, IUCN) 1998: Availability of survey data – Adequate; Need for wild population recovery – Low; Potential for sustainable management – Highest.

Threats: Habitat loss and illegal hunting.

(2) *Crocodylus acutus*: This is the largest of the

three Mexican species. The maximum size registered for an adult *C. acutus* is 7.0 m, but nowadays it is rare to find specimens larger than 5.0 m. Hatchlings are an average size of 28 cm. Females lay an average of 34 eggs.

The skull and snout of this crocodile are slender and elongate—1.8 to 2.5 times as long as broad at the level of the front corners of the eyes. Adults develop a hump on the snout anterior to the orbit. The iris is greenish and the eyelid is wrinkled.

The scute pattern is highly irregular and variable among individuals. Dorsal scales are large and significantly raised. Post-occipitals: a single transversal row of 1 to 6 enlarged scales medially divided by soft skin. Nuchals: the nuchal rosette has four enlarged scales in a quadrant and two scales flanked by the sides.

Distribution: Worldwide, *C. acutus* can be found from south Florida, United States, and Mexico's north Pacific coast, all the way to Venezuela and northern Peru. It is also found in Cuba, Jamaica, Dominican Republic, Antilles, and in most small islands and cays in the Caribbean Ocean.

In Mexico, *C. acutus* can be found along the north Pacific coast, from La Bojonea, north of the El Fuerte River, all the way to the Suchiate River at the border of Guatemala and Mexico. It inhabits all major coastal mangroves, marshes, swamps, rivers, lagoons, and larger ponds, and also has been reported on the coast and in the cays and small islands of the state of Quintana Roo in the Yucatan Peninsula. Its presence in the Gulf of Mexico, specifically in the states of Tabasco and Campeche, has not been confirmed. In the center of Chiapas State, there is an isolated population of *C. acutus* living in the Grijalva River, between large hydroelectric dams and the Sierra Madre Mountains.

Conservation status: NOM-059-ECOL-2001:

Special Protection. CITES: Appendix I. IUCN 1996: Listed; Vulnerable; Criteria A.1.a.c. inferred decline >20% in three generations, inferred from reduction in extent of occurrence. ESA: Listed. CSG 1998: Availability of survey data – Poor; Need for wild population recovery – High; Potential for sustainable management – Moderate. Threats: Habitat loss and illegal hunting.

(3) *Crocodylus moreletii*: The maximum size

registered for an adult *C. moreletii* is 3.5 m. Hatchlings are an average size of 26.2 cm. Females lay an average of 35 eggs.

The snout of this crocodile is short, massive, and wide, and not more than 1.5 times as long as broad at the level of the front corners of the eyes. Post-occipital scutes: a single transversal row of 4-6 scales divided by smooth skin. Nuchals: presents a nuchal rosette with one row of four scales and another row with two scales. The belly skin of the Morelet's crocodile is highly prized because it has few osteoderms.

Distribution: Outside of Mexico, *C. moreletii* is found in Belize and Guatemala. Within Mexico, it occurs on the Atlantic side in the Gulf of Mexico region from as high as Laguna Madre in northern Tamaulipas State. Its distribution continues south through Veracruz, San Luis Potosí, Oaxaca, and Tabasco to Campeche, Yucatan, and Quintana Roo, in the Yucatan Peninsula. It is found inland as far as Huasteca Potosina, in San Luis Potosí State in the north; in the south, it occurs in the northwest and northeast regions of Chiapas State, El Caracol Lagoon, El Aguacate Lagoon, the Lacanja and Lacantún Rivers in the Montes Azules Biosphere Reserve, and the Usumacinta River (Guatemala – Mexico border), up to 800 m above sea level.

Conservation status: NOM-059-ECOL-2001: Special Protection. CITES: Appendix I and Special Permits for three farms (num. 501, 502 and 503). IUCN 1996: Listed. ESA: Listed. CSG 1998: Availability of survey data – Poor; Need for wild population recovery – Moderate; Potential for sustainable management – Moderate. Threats: Habitat loss and illegal hunting.

Imports and exports: commercialization of crocodilian hides: Mexico has become more of an importer than a producer of crocodilian hides. Over the past four years, Mexico has imported more than 250,000 caiman and other crocodilian hides, which are then transformed and re-exported to the rest of the world as finished products and sub-products. By contrast, Mexico's commercial farms are legally producing a mere 8,000 – 10,000 skins each year (from the *Caiman* species and *Crocodylus moreletii*). This is a big difference with unfortunate consequences: unlike domestically-produced hides, imports do not provide an incentive for the conservation of the country's three crocodilian species.

Most of the imported hides come from Venezuela and Colombia, while others come from the United States, Argentina, Brazil, Zimbabwe, and Australia. Once they reach Mexico, the hides are processed in tanneries located largely in the states of Guanajuato, Chihuahua, Sonora, Jalisco, and Chiapas, and in Mexico City. They are transformed into cowboy boots, belts, bags, wallets, and other small items. 60 - 75% of these finished products are then re-exported—mostly to the United States, but also (in smaller quantities) to Spain, Italy, Japan, and southeast Asia.

Farms authorized by CITES for exportation of hides: The following three farms are authorized, by CITES, to commercialize Morelet's crocodile hides, products, and sub-products:

- *Cocodrilos Mexicanos SA de CV, Cocomex, Mexico:* Estimated production of 12,000 eggs per year. Commercializing 6,500 - 4,800 hides per year. Principal markets are Mexico, Japan, and Spain.
- *Industrias Moreletii SA de CV:* Estimated production of 3,000 - 4,000 eggs per year. Commercializing around 1,500 hides per year. Principal markets are Mexico, Spain, and Italy.
- *Cocodrilos de Chiapas SA de CV:* Not working at present; no data obtained.

Another farm, Caimanes y Cocodrilos de Chiapas, is commercializing *Caiman crocodilus* and does not need a CITES permit to export. Estimated production of 1,000 eggs per year.

No other farms had applied for registration, though there are a few others that plan to apply in a few years.

Current crocodilian research projects and farms in Mexico, by region:

North Pacific Coast -- Sinaloa, Nayarit, Jalisco, Colima, and Michoacán states (characterized by a long dry season and low jungle [Caducifolian forest] with a thin line of mangrove coast and short rivers; *Crocodylus acutus* is only species found there):

- Genetic evaluation of the reproducing herd of Mexican crocodilians and establishment of a genetic selection program. (Abreu, A. et al.)
- Chirricahueto Lagoon, Culiacán city, Sinaloa. (León, F. et al.)
- Population dynamics of *C. acutus* in Jalisco. (Huerta, S. et al.)
- Human-crocodile interactions on the coast of Jalisco. (Huerta, S. et al.)
- Relationship between physical aspects of habitat and reproductive events of *C. acutus*. (Ponce, P. et al.)
- Distribution and current status of *C. acutus* populations in Jalisco. (Ponce, P. et al.)
- Ecology and conservation of the river crocodile, *C. acutus*, in Banderas Bay, Jalisco-Nayarit. (Curul, F. et al.)
- Ecology and conservation of *C. acutus* in the Chamela-Cuixmala Biosphere Reserve, Jalisco. (Valtierra, M.)
- Determination of the population status of *C. acutus* in the extreme north of Sinaloa and southern Sonora. (Navarro, C.)
- Cocodrilos Mexicanos, in Culiacán, Sinaloa. Largest farm in Mexico, with more than 25,000 crocodiles. For reproduction of *C. moreletii*.
- Reptilario Cipactli, in Puerto Vallarta, Jalisco. Houses approx. 20 crocodiles at the University of Puerto Vallarta. For exhibition, research, conservation, and reproduction of *C. acutus*.
- Cocodrilos del Pacífico, Lagunas de Monte Negro, in Coquimatlán, Colima. Houses more than 250 *C. acutus*. For research, reproduction, and promotion of sustainable use.

South Pacific Coast--Guerrero, Oaxaca, and Chiapas states:

- Cañón del Sumidero Project, at ZooMAT in Chiapas. (Sigler, L. et al.)
- Designing a management strategy for *C. acutus* in the La Ventanilla estuary, Oaxaca. (García, J.)
- Current status of the *Caiman crocodilus chiapasius* population in the “Castaño” Zone of

the La Encrucijada Biosphere Reserve, Chiapas coast. (Giselle, C. et al.)

- Current status and diet of the *Caiman crocodilus chiapasius* population in the Laguna de Chantuto Zone of the La Encrucijada Biosphere Reserve, Chiapas coast. (López, A. et al.)
- Recuperation of the population of *C. acutus* in the La Encrucijada Biosphere Reserve, Chiapas. (Gordillo, O. et al.)
- SSS Guardians of the Forest, Pico de Oro, Chiapas. (Martínez, I. et al.)
- Caimanes and Cocodrilos of Chiapas—CAICROCHIS—in Tapachula City, Chiapas. Breeds *Caiman crocodilus*, *C. acutus*, and *C. moreletii*. Houses over 1,000 crocodilians, as well as South American species and an African tortoise.

Yucatan Peninsula-Campeche, Yucatan, and Quintana Roo states:

- Research, management, and conservation of crocodile populations in the Lagunar Nichupte System, Cancún, Quintana Roo. (Carballar, J. et al.)
- Crocodile monitoring in the Banco Chinchorro Biosphere Reserve. (Carballar, J. et al.)
- CETMAR Crocodile Project, Campeche. (Romero, M. et al.) — *Information from various authors, compiled by Manuel I. Muñiz, Sociedad para el Estudio y Conservación de los Cocodrilos en México AC (SECOCOM AC), Apdo. Postal 41 – 601, Lomas de Chapultepec, CP 11000 México DF, México <moreletii@mx.inter.net >.*

USA

IMPORTING *CROCODYLUS POROSUS*. Since the death of Gomek, a 17' 9½" long saltwater crocodile, the St. Augustine Alligator Farm Zoological Park has been looking for just the right animal to act as his replacement. Gomek was the star attraction at the St. Augustine Alligator Farm from 1989 to 1997 and can never truly be replaced.



Two male *Caiman crocodilus* during the courtship season, at the Caicrochis Farm in Tapachula, Chiapas, Mexico. M. Muñiz photo.

However, people want to see giant crocodiles. We have had many offers, and have seen many crocodiles that might have made suitable display animals, but we wanted just the right one. It was important to find a young crocodile that had already reached an impressive size, as we did not want to buy a crocodile that was enormous but also at the end of his life span. Of course, we also wanted a crocodile that was fairly attractive. Our staff has seen many massive animals, but most were not the perfect specimen we had in our minds.

We narrowed the species we were looking for to the saltwater crocodile, *Crocodylus porosus*. This species has the largest range of any of the crocodilians and boasts the largest size as well. We started looking seriously at places that had large saltwater crocodiles in captivity. There are several large farms in Papua New Guinea, as well as quite a few farms throughout Australia. Gomek was captured in New Guinea in 1968 by our friend, George Craig. George took Gomek to Australia and put



Female *Caiman crocodilus* hiding in the leaves during a drought at the Caicrochis Farm in Tapachula, Chiapas, Mexico. M. Muñiz photo.

him on display on Green Island for a number of years before he was brought to the United States. It was our assumption that exporting crocodiles from New Guinea would be easier than exporting from Australia. Australia has had a long history of being very protective of its wildlife, and export permits do not come easily. However, while talking to George, he said that he felt that things in Australia were changing and that with a little patience we might be able to obtain the proper permits. With the help of George and his grandson, Toody, we made the appropriate contacts and started investigating large captive crocodiles that were for sale in Australia, as well as the possibility of obtaining the appropriate permits.

In September 2003, David Drysdale and I went to Cairns, Australia, to see some crocodiles at the Cairns Crocodile Farm that George thought we might be interested in. There, we first laid eyes on Maximo. Maximo has been in a captive situation his entire life. His egg was collected by aborigines in Australia and hatched by them. Maximo was then sold as a youngster to the Cairns Crocodile Farm where he grew up to be one of their breeders. He is just over 30 years old and more than 15 feet long. He was living with two breeding females, and while he bred with both females every year, he really spent time with only one of them. Her name is Sydney, and we managed to bring her to Florida as well. Both Maximo and Sydney are beautiful animals with gorgeous black and yellow patterns. They are colored more like a Cuban crocodile than most saltwater crocodiles.

The permitting turned out to be fairly straightforward. It helped considerably that these animals were captive-born in Australia and were therefore CITES II animals instead of CITES I. I had to provide many pages of information about our facility and our experience with crocodiles. However, as I was filling out the paperwork, I

realized that if they didn't issue the permit to us, they probably were not going to issue a permit to anyone. They wanted to know how long we have been in business. Answer: 110 years. They asked if we had experience working with this species. Answer: Yes, as well as every other crocodilian species on the planet. They asked if we had ever worked with crocodiles this size. Answer: Yes, Gomek. They asked about our credentials. Answer: We are accredited with the American Zoo and Aquarium Association, the Florida Attractions Association, and listed in the National Register of Historic Places.

In the end, we found that looking for our crocodiles in Australia was a wise decision. We have since attempted to help National Geographic Television export a couple of large *C. porosus* from New Guinea and then, most recently, attempted to export two Nile crocodiles, *Crocodylus niloticus*, from Uganda. Both attempts ended in failure. It would seem that New Guinea has no desire to issue any such permits, and while we were issued CITES permits from Uganda, the paperwork was not filled out correctly by the CITES officer. In addition, the Solicitor General of Uganda decided he needed to be involved in the process, and put a hold on things. It is not that Australia is opening a floodgate of animals for export out of their country—just that we happened to have the right connections and background to make this work. In fact, we were told that there have only been four saltwater crocodiles exported out of Australia alive. Those include Gomek and his girlfriend, Annabel, and now Maximo and Sydney. I have no way of knowing if this is actually true, but it is clear that it doesn't happen often.

In October 2003, David Kledzik, our Curator of Reptiles, went to Australia to help crate and transport Maximo and Sydney. Our two new crocodiles were shipped in wooden crates inside the belly of



John Brueggen with Maximo, a 1,249-lb. *C. porosus* from Australia, now residing at the St. Augustine Alligator Farm, Florida. J. Brueggen photo.

a Qantas passenger plane from Cairns to Sydney and then from Sydney, Australia to Los Angeles. They had to clear customs in L.A. and were then transferred to a cargo carrier, Kitty Hawk. On 24 October, I met a tired David Kledzik and two crocodiles in Orlando, Florida, with a rented Ryder truck and drove them back to the St. Augustine Alligator Farm Zoological Park.

We kept the two animals separate for the first few days. We didn't want Maximo taking out any aggression on Sydney. After all, he outweighs her by more than 1,000 pounds. After five days we opened the shift door and allowed Sydney to enter Maximo's exhibit. Within five minutes she was soliciting him by rubbing her chin up and down his back. They bred immediately and have spent most of their time in the exhibit side by side. They are on display in a large exhibit that affords our visitors both above ground viewing and underwater viewing. We are very pleased with our new saltwater crocodiles. We refuse to exaggerate our animals' credentials for the sake of advertising. Maximo is exactly 15' 3" long and weighs 1,249 pounds. There are parks that are advertising hybrid crocodiles as saltwater crocodiles, advertising 14-foot animals as "nearly 20-foot long," and calling their animals the largest captive crocodile in the world. All are blatant exaggerations. We feel that the truth is just as impressive, and we are sure our visitors appreciate it. We hope that Maximo grows to be the largest saltwater crocodile in captivity some day, but for now we are extremely happy with him just the way he is. — John Brueggen, *Deputy Director/General Curator, St. Augustine Alligator Farm, St. Augustine, FL, USA* <JBrueggen1@aol.com>.

Science

MOLECULAR EVIDENCE FOR SPECIES LEVEL DIVERGENCE IN AFRICAN NILE CROCODILES (*C. NILOTICUS*). **Abstract:** Relationships of the newly discovered dwarf crocodiles from Mauritania were inferred from mitochondrial 12S sequences. Specimens from 13 different *Crocodylus niloticus* populations (from East Africa, West Africa, and Madagascar) were compared. Additional representatives of the genus *Crocodylus* (one from Africa and one from Australia), the African genus *Osteolaemus*,

and the South American alligatorid *Paleosuchus palpebrosus* (as outgroup) were included in the analysis. Maximum-likelihood and Bayesian analyses yielded relationships that were strikingly different from currently prevailing phylogenetic hypotheses. Both analyses consistently revealed two groups, one consisting of the monophyletic west and central African populations and the other of a paraphyletic group containing the east Africa and Madagascan populations. High genetic divergence between those groups indicates separation on the species level. Furthermore, "*C. cataphractus*" is clearly shown not to be a member of the genus *Crocodylus*. The resulting nomenclatural changes are discussed. — Andreas Schmitz, *Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, 53113 Bonn, Germany* <a.schmitz.zfmk@t-online.de>; Patrick Mansfeld, *same affiliation as first author*; Evon Hekkala, *American Museum of Natural History, Division of Invertebrate Zoology, 79th St. Central Park West, New York, NY 10024, USA*; Tara Shine, *42 Meadow Way, Kilkenny, Ireland*; Hemmo Nickel, *same affiliation as first author*; George Amato, *Wildlife Conservation Society, 2300 Southern Blvd., Bronx, NY 10460, USA*; and Wolfgang Böhme, *same affiliation as first author*. *Abstract of journal article published in C.R. Palevol* 2 (2003):703-712.

COMPARISON OF STRESS INDUCED BY MANUAL RESTRAINT AND IMMOBILIZATION IN *C. POROSUS*. This study compared the stress induced in captive estuarine crocodiles, *Crocodylus porosus*, by two different handling methods: manual restraint (noosing with ropes) and immobilization by electro-stunning. To stun, a short charge (approx. 6 s) at 110 V was delivered to the back of the necks of *C. porosus* using a custom-built device, which immobilized the animals for 5-10 min. Immobilized and restrained animals were measured and sexed, and the condition of the skin assessed. Blood samples were taken from some animals immediately after restraint or immobilization. Other animals were returned to their pens to recover for periods of 30 min, 1, 4, 12, 24 or 48 hours, after which they were stunned and blood samples taken. Individual animals (mean body length 1.96 m, N=99) were bled only once.

Haematocrit and haemoglobin concentrations were measured and plasma samples were analysed for corticosterone, glucose and lactate levels. Following restraint, there were significant increases in haematocrit, haemoglobin, glucose, lactate and corticosterone concentrations in *C. porosus*. For restrained animals, recovery to baseline levels occurred after approximately 8 hours. The stress response of stunned animals was significantly reduced compared to manually captured and restrained crocodiles. Both groups showed a significant increase in haematocrit, haemoglobin concentration and lactate levels; however, the magnitude of change was significantly reduced, and recovery was faster in stunned animals. No increase in either glucose or corticosterone levels occurred with immobilization. The results imply that immobilization by electro-stunning is much less stressful. — Franklin, C.E., B.M. Davis, S.K. Peucker, H. Stephenson, R. Mayer, J. Whittier, J. Lever, G.C. Grigg. 2003 (Aug. 1). *Journal of Exp. Zoology Part A Comp. Exp. Biol.* 298(2):86-92. Contact C.E. Franklin, School of Life Sciences, University of Queensland, St. Lucia Qld 4072, Australia <cfranklin@zen.uq.edu.au>. Reprinted in *HerpDigest*, Vol. 4, No. 26 (<http://www.herpdigest.org/>) & Crocodile Capers newsletter (<http://www.dpi.qld.gov.au/croc/>).

Reviews



FUCHS, K. & M. FUCHS. 2003. DIE REPTILHAUT / THE REPTILE SKIN: A KEY FEATURE IN THE IDENTIFICATION OF LIZARDS AND SNAKES.

EDITION CHIMAIRA, FRANKFURT AM MAIN. ISBN 3-930612-36-4. Karlheinz Fuchs and his son Manuel have produced a unique and very useful handbook for identifying reptile skins commonly encountered in trade. The book represents the lifetime experience of the senior author in trade, tanning, and scientific investigation of reptile skins. It will be a valuable reference and resource to scientific investigators and those involved in identifying skins and products. The book is presented with text in both German and English in adjacent

columns, preserving the authors' original nuance but expanding the accessibility to a global audience. The foreword by Dr. Dietrich Jelden places the work into the context of present international regulations for trade in wildlife products and the assistance to conservation that such regulated trade provides. Correct identification of skins and skin products is an integral component of that regulation and the present volume will be a valuable aid to that process.

The introductory section lays out the authors' main objectives: to provide practical illustrated keys to identify reptile skins, and to demonstrate the reliability of skin features for taxonomic application. This is followed by a detailed methods section where the many features and landmarks by which snake and lizard skins can be measured and identified are described and illustrated. A feature of the book throughout is the extremely clear, useful, and well-labeled photographic illustrations that greatly aid comprehension and application by the reader. Two following sections detail the histology of the reptile skin and a discussion of the location and stability of natural pigments that clarify and correct several previous descriptions. Together, these features of scale counts and arrangement, scale structure and pigmentation form the basis

of the descriptions that follow.

The main body of the book is comprised of species accounts for 78 species of lizards and snakes commonly encountered in the international reptile skin trade. Summary tables present the key features for 28 taxa of lizards in the genera *Iguana*, *Tupinambis*, *Dracaena* and *Varanus* and 50 taxa of snakes including *Boa*, *Python*, *Eunectes*, *Bothrops*, *Elaphe*, *Acrochordis*, and 27 others encountered in trade. The species are tabulated in order of increasing count of the midbody scales, rather than taxonomically, which is initially confusing, but provides prompt access to the non-specialist user with one simple character. The book's limited taxonomic scope will frustrate the research reader, because all the numerous species not found in trade receive no mention. However, the general principles and methods for identifying species in trade from their skins will have general application and could be the foundation of much future work. Each species account gives scientific and common names, protective status (CITES and EU), range, size information,

diagnostic scale features and counts, and photographs of the skin surface at a standard 4x magnification and additional higher resolution, as needed. Central sections of color plates show whole animal and whole skin with generally excellent color reproduction. The taxonomy is current, based on the EMBL-Reptile on-line database and an appendix provides synonyms. Additional appendices provide trade names, a useful bibliography, and indices for scientific and common names and general topics.

The book is stoutly bound and on excellent glossy paper that shows the illustrations to good advantage. The English translations are occasionally stilted but nowhere detract from the technical meaning. On a minor technical point, while the stated objective is to provide identification keys, in fact there are no dichotomous keys, but rather a series of detailed diagnostic descriptions, but these serve very well to identify the species. Although the work does not specifically say so, it appears that the skin of each of the species covered is completely unique and diagnostic. The implication is that all snakes and lizards could be similarly characterized and it would be useful for the authors to clarify the point. For practical application in identifying items in trade, new species are occasionally introduced. If the characters proposed by Fuchs and Fuchs are of general application, then comparison of materials with reference collections (e.g., in museums) will allow extension of the suite of diagnostic descriptions of skins and scales. So the book's contribution meets the authors' twin goals: being both an immediate guide to the identification of 78 species commonly in trade and providing the foundation for future identification and taxonomic description. This is a very solid, excellently researched and presented contribution that will meet the needs of customs officers, herpetologists, and reptile leather experts. — Perran Ross, *Editor*.

Publications



CROCODILE CAPERS Newsletter!



Crocodile Capers is a newsletter covering industry news & research findings for crocodile producers, researchers, & manufacturers.

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Personals

GOODBYE & THANKS FROM LUIS SIGLER; LEAVING ZOOMAT AFTER 13 YEARS. Dear colleagues and friends: With cordial greetings I bring you the news that as of April 1 of this year, I will no longer be working in the Miguel Álvarez del Toro Zoo—the beloved place to which I have given the last 13 years of my professional career. This wonderful institution gave me the opportunity to work with all three species of crocodilians here in Mexico—especially my favorite, the "river crocodile." It has been a great honor to work with Dr. Álvarez del Toro at his zoo.

As I have told some of you, my decision to leave ZooMAT is based on my desire to move forward in my career and, above all, to share my knowledge. I felt a bit "frozen" by some of the zoo's directives, and although I endured the hypothermia, to remain any longer would be pathological (obvious that I was a veterinarian, no?). Although I am not sure where I will ultimately settle, my intention is to move to the United States, to California, and work there for awhile....and then return to Mexico to develop my personal "life project," which luckily for all of us (and not surprisingly) will include the conservation of our crocodilians. As such, we all will stay in close contact, working together on this issue.

I wish to express my appreciation to all of you, for your friendship and the good times we have shared: the beers we've enjoyed together, the nights spent chatting and trying to figure out the "Crocosphere," and all the trips filled with memorable moments—mud-caked field clothes, aches and pains, sleepless nights, arguments and agreements....but most of all, my appreciation for all that we've learned and created together.

My position at the Crocodile Museum of ZooMAT will be taken over by my good friend, Jerónimo Domínguez, whom I trust will take advantage of the solid base I have left him, delving into the projects at hand and taking them to higher levels, moving them farther along. Based on my discussions with Jerónimo, I feel confident that he will do a great job.

I'll keep in touch with you and will look forward to seeing many of you at the Vasharta meeting, which I hope to be able to attend.

Sincerely,

Luis Sigler
Tuxtla Gutiérrez
Chiapas, Mexico
22 de marzo de 2004

P.S. I am enclosing this drawing (at right) because it reflects very well my life as a "crocodile apprentice":



PROFESSOR MESSEL HONORED BY PHYSICS FOUNDATION. The photograph (at right) of a remarkably youthful and slender Harry Messel was included in the commemorative program for the 50th Anniversary of the University of Sydney Physics Foundation that was established by Prof. Messel in 1954. The foundation was the first of its kind in Australia, a voluntary philanthropic association dedicated to the pursuit of excellence in science education and research. Over a half century of activity the foundation has raised tens of millions of dollars, supported major research developments in astrophysics, solar energy, and radio telemetry (which initially led Harry into crocodile research!). The foundation also pioneered improved science text books, student scholarships and the annual International Science School for high school



students. Professor Messel was honored at the anniversary dinner, 5 March 2004, on the occasion of his 82nd birthday and delivered a very short address announcing that he had just solicited a donation of one million dollars from his dinner companion, and posed that as challenge to current Foundation members! — Perran Ross, *Editor*.

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Deputy Chairmen: (New World) Prof. F. Wayne King, Florida Museum of Natural History, Gainesville, FL 32611, USA. Tel: (1) 352 392 1721 Fax: (1) 352 392 9367. E-mail <kaiman@flmnh.ufl.edu> **(Old World) Dr. Dietrich Jelden**, Bundesamt für Naturschutz, Konstantin Str. 110, D-53179 Bonn, Federal Republic of Germany. Tel: (49) 228 849 1453 E-mail <JeldenD@bfn.de>.

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