CROCODILE SPECIALIST GROUP

NEWSLETTER

VOLUME 22 No. 2 ● APRIL 2003 – JUNE 2003

IUCN - World Conservation Union ● Species Survival Commission

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Species Survival Commission

COVER PHOTO. First release of captive bred Chinese alligator back into the wild (see pages 4-5). E. Briggs photo.

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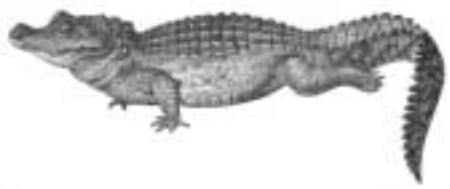

Editorial

CALIFORNIA DREAMING. For some time CSG has been concerned about California State Law, Penal Code Section 653o, which makes illegal the commercial importation of alligator and crocodile parts and products. Previous correspondence between CSG and the California Department of Fish and Game was reported in CSG Newsletter 21(1):18-19. In May I was contacted by staff of California Senator Dennis Hollingsworth and advised of his attempt to change the law to allow importation of alligator, crocodile and kangaroo products. The Steering Committee and chairman agreed that this was an important opportunity, so on 26 May I traveled to Sacramento, California and met Senator Hollingsworth, Senator Denham, and staff for breakfast on Tuesday, 27 May. Ruth Elsey of Louisiana Fish and Wildlife Dept. also joined us to testify. They briefed us on development, progress, and strategy for the hearing before the CA Senate Natural Resources and Wildlife Committee that morning.

Ruth and I attended the hearing, were introduced as witnesses in support of the bill, and gave testimony for about 30 minutes to the seven committee members present. Ruth described the Louisiana program and I gave a global overview of crocodilian conservation. We both stressed the positive connection between commercial sustainable use of crocodilians and their conservation and how removing the current prohibition on import would assist conservation. Our testimony was followed by brief testimony in support by the lobbyist for the CA Chamber of Commerce and testimony from about eight individuals representing animal rights and welfare issues (Humane Society US, PETA, the Fund for Animals, etc.), all opposing the bill. The committee chair then closed the discussion by stating she was unconvinced that the change was beneficial to conservation and that it would not benefit the people of California, and indicated her intention to vote against. A roll call vote of the committee members present resulted in three ayes, three nays, and one abstention. Failing to receive the required five supporting votes of the nine committee members, the measure failed. As a result it will not be forwarded onward in the legislative process for

consideration by the full CA senate or to the lower house for consideration.

We reviewed the activity with Senator Hollingsworth's staff and it is clear that several complex factors were responsible for the failure of the bill in committee. Partisan politics dominates California lawmaking: of a committee comprised of six Democrats (including the chair) and three Republicans, four Democrats and three Republicans (including Senator Hollingsworth) were present at the hearing. CA Democrats identify themselves as "liberal" or "progressive" on social and business issues and have a history of support for animal rights issues. The committee chairwoman is known as a strong supporter of animal welfare issues. Additionally, this issue is seen as a very minor issue on the committee's agenda compared to pollution, water resource control, etc. The vote was along party lines except that one Democrat broke ranks to abstain.

The bill originally included kangaroos and this is a *cause celebre* among animal rights activists in Australia. Despite the 30 year history of sustainable management, rigid control and careful consideration of humane aspects, Australian and other animal rights interests vehemently oppose kangaroo harvest and were successful in coordinating with their US counterparts to generate opposition to the bill. In a strategic move at the last minute, Sen. Hollingsworth withdrew "kangaroos" from his bill when he introduced it to committee on the grounds that no expert witnesses on kangaroos were available. But this was insufficient advantage for the remaining "crocodiles and alligators."

As a result of efforts by CSG and by the Louisiana Fur and Alligator Council, significant supporting comment was submitted by mail from alligator interests within the USA (CSG, State of Louisiana, alligator industry groups, etc.). This somewhat balanced the very vigorous comment in opposition orchestrated by animal rights groups. However, there appeared to be little or no support generated within California from interested constituencies (e.g., businesses, retail outlets). This lack of direct political impact on the committee, coupled with the Senator's minority party status on the committee, were serious impediments.

We discussed the next steps with the senator and his staff, who also introduced us to a couple of other lawmakers to promote the idea. The current bill can be brought up again for "re-consideration," but this cannot occur in this legislative session and will therefore be in 2004 at earliest and of little use if the present impediments are not addressed. For the immediate future, continued communication with Sen. Hollingsworth's office and promotion of the concern and possibility for change among interests in California seem to be available actions. — Perran Ross, *Executive Officer.*

Correction

CORRECTION. Our cover photo in the previous issue, Vol. 22(1), was labeled as "Fort Worth gharial" without recognition of the photographer. The editors wish to apologize and thank Andy Odum of the Department of Herpetology, Toledo Zoological Society, for submitting his photograph of the male gharial for the newsletter cover. — Perran Ross, *Editor*

Regional Reports

Africa

Tunisia

DJERBA EXPLORE: NEW CROCODILE PARK OPENS IN TUNISIA. On 21 December 2002 a new crocodile park opened within the cultural and tourist complex called "Djerba Explore," located on Djerba Island in southern Tunisia. The 6000 m^2 park, dedicated exclusively to crocodiles, is home to a group of 400 Nile crocodiles (*Crocodylus niloticus*) that are five years old and ranging from 1.5 to 2.5 m in length.

These crocodiles arrived in Tunisia in December 1998 from a farm in Madagascar. They were raised at another site in northern

Crocodile park that opened in Dec. 2002 within the cultural and tourist complex called "Djerba Explore," located on Djerba Island in southern Tunisia. M. Gansuana photo.

Tunisia until September 2002, when they were moved to Djerba, while the Tunisian staff were trained and the park was designed and constructed. This touristic and pedagogic park offers its visitors pleasant walks around and above pools ringed by natural palm trees, in a desert setting. A greenhouse with a heating system has been built to provide warmth for crocodiles during cold winter nights, and the crocodiles have been trained to return into the greenhouse when it is cold outside. Tropical vegetation has been planted inside to contrast with the outside, providing the full, unique experience of visiting North Africa.

For the benefit of visitors, informational posters are arranged along the trails and guides are available to provide explanations of the natural history of crocodiles and their life in the park. With the appropriate warm climatic conditions and large surface areas available for the crocodiles, the park could form a very interesting base for many studies. Currently, a student of the University of Tunis is preparing a statistical survey of the rearing results obtained during the last four years. Further projects were suggested by Dr. F.W. Huchzermeyer and should begin later this year.

I wish to express my warmest thanks to him as well as to Olivier Behra (Vice Chairman, CSG Africa), Ramandimbison (CSG member), and Fougeirol Luc (CSG member, la Ferme aux Crocodiles, France) for their valuable help and advice from the very beginning.

Please come to Djerba to discover this new park and to enrich us with your experiences and your suggestions. — Marc Gansuana, *Technical Manager, Djerba Explore, Zone Touristique – Ennadhour, B.P 353 Midoun 4116 Djerba, Tunisia, Africa <timsa@dcemail.com>.*

Eastern Asia

China

TRIAL REINTRODUCTION PROGRAM FOR CHINESE ALLIGATORS. The lower Yangtze River Valley in China was the first region where humans cultivated rice, establishing an agricultural tradition that spawned an ancient civilization identified with one of its most prominent cultural icons, the dragon. However, over the last 70 centuries, expanding agriculture and a growing human population have squeezed out what was once a rich fauna from the lowlands that border China's mightiest river. One of the last of the region's remaining megafauna is the Chinese alligator, a species that played an important role

in the origin of the dragon mythology. This species is on the verge of disappearing from the few ponds where it survives and is referred to locally as "Tu Long," the Earth Dragon. Since 1997, the Wildlife Conservation Society, with support from the CSG, has been working with the State Forestry Administration in Beijing and the wildlife authorities in Anhui Province to develop conservation strategies for the last groups of wild alligators.

From 19 April-2 May 2003 I was in China to assist the Anhui Forestry Bureau and the East China Normal University to carry out the first release of captive-reared Chinese alligators into the wild. The Anhui Forestry Bureau had initially selected two areas for this trial release, but both proved to be biologically unsuitable. An alterative site, Hong Xin, was selected and following a preliminary health examination by WCS Veterinarian Bonnie Raphael, three young adult alligators (1 male and 2 females) were released. We attached radio transmitters to the tails of all three animals, and a PhD student from ECNU (Ding Youzhong) will follow them over the next year to monitor how they adapt to their new environment. The entire process was documented by long-time WCS friend and photographer Eleanor Briggs. This is an experimental release designed to see how feasible it will be to use captive-reared alligators for future reintroduction programs, to learn more about the behavior and ecology of the species, and how resident alligators may adapt to the presence of new animals. As of mid-July all seemed to be going well. The radio of one of the females failed, but Ding Youzhong reports that the animal can still be seen in the pond. In August, I will return to China to assist with the radio-tracking study and to work with Prof. Wang Xiaoming and the Anhui Forestry Bureau to re-survey some of the remaining areas where small wild groups of alligators remain. — John Thorbjarnarson, *Wildlife Conservation Society, 4424 NW 13th St., A-2, Gainesville, FL 32609 USA <jthorbjarnarson@wcs.org>.*

Attachment of radio transmitter to released Chinese alligators. The device is sutured to the caudal scales and secured with super glue. E. Briggs photo.

Indonesia

SPOTLIGHT SURVEYS OF NEW GUINEA CROCODILES IN THE MEMBERANO RIVER. A crocodile survey program proposed by the Subdivision of Natural Resources Conservation, Papua Province, Irian Jaya (KSDA), was conducted 27 September - 2 October 2000, 26 November - 5 December 2001, and 13-23 December 2002. Nine lakes and four rivers, all located in the middle Memberano and Rouffaer river systems (approximately 2°-4° S latitude and 138°-139° E longitude), were surveyed at night using standard spotlight techniques. Surveys covered 29.9 km in 2000, 162.5 km in 2001, and 143 km in 2002. Some of these sites were previously surveyed by the FAO-PHPA project in 1987-1990. *Crocodylus novaeguineae* is the dominant species in these systems.

Surveys were conducted by personnel of KSDA and LIPI and results of the 2000-2001 survey were previously reported by Kurniati et al. (CSG Newsletter 20(4):75-76.). All the available spotlight survey data from this region were re-analyzed covering the

Memberano, Mati, Jaro, Baso, and Soi Rivers and lakes Sobaki, Kamika, Waropen, Kweri Satu, Kweri Dua, Apuse, Bernekam Satu, Bernekam Dua, Cabang Tiga Satu, and Cabang Tiga Dua. Data on harvest of live juvenile crocodiles and skins were also recorded from one commercial operation.

Results from the Jaro River (1989-2002) indicated a significant increase in non-hatchling density with current densities at 2.05-2.10 individuals/km. All the other areas surveyed indicated stable non-hatchling densities over the periods of the survey with current densities ranging from 1.0–3.25 crocs./km in the rivers and 3.2-40.0 crocs./km in the lakes. The more recent surveys in 2001-2002 were affected by high water levels, which are likely to have reduced the sightability of crocodiles.

Harvest by one company between 2000 – 2002 has been 762-1804 juveniles/year live crocodiles for crocodile farms and between 2440 and 3400/year wild skins. Trends in live crocodile and skin harvests appear to be driven by market forces, the moratorium on crocodile skin exports in the early 1990s, and a current skin harvest quota of 2440 imposed by the Ministry of Forestry, rather than by any limitations of the crocodile resource. In general, the population of *C. novaeguineae* in the mid-zone Memberano River has been relatively stable despite extensive harvesting. The assistance of CV Bintang Mas, Indonesian Crocodile Farmers Association and KSDA staff is gratefully acknowledged. — *Extracted from Survey Report, Spotlight Surveys of New Guinea Freshwater Crocodiles in the Mid-Zone Memberano River (Memberano and Rouffaer River systems), Paua Province, Indonesia.* H. Kurniati and C. Manolis. *Indonesian Institute of Sciences (LIPI), Cibinong, April 2003.*

OCCURRENCE OF THE NEW GUINEA FRESHWATER CROCODILE *CROCODYLUS NOVAEGUINEAE* OFF THE ISLAND OF NEW GUINEA. While filming the television documentary "Papua: Surviving Extremes," an excursion to the remote islands of Kimaam and Komolom off the southeastern coast of Papua (formerly Irian Jaya) province in Indonesia yielded new information on the distribution and ecology of the New Guinea freshwater crocodile (also referred to as "freshie").

Figure 1. Alber Kaise, of Desa Komolom, New Guinea, with a 0.8 m long "freshie" (*C. novaeguineae*) he captured at the edge of Kowonep Swamp in the interior of Pulau Komolom. J. Cox photo.

Juveniles of this species have been noted in crocodile rearing pens at the district center of Desa Kimaam village and elsewhere on the island, and were said by local residents to have originated from Kimaam (Frazier 1989a, 1990b), but its occurrence in the wild there was unconfirmed. Pulau Kimaam (= P. Dolok and P. Yos Sudarso) is a large, low lying island with extensive coastal mangrove forests, turbid saline tributaries and extensive interior herbaceous swamps. The tidal habitats evidently represent a major stronghold of the Estuarine Crocodile *C. porosus* ("saltie") in Indonesia. The interior wetlands, however, are very poorly known. The southwest half of Pulau Kimaam is gazetted as Pulau Kimaam Wildlife Reserve (689,000 ha) and is the largest wetland reserve in Papua.

The authors observed juvenile freshies in pens at Desa Kimaam village (7° 58.002' S 138° 52.998' E) on 6 February 2003 and at Desa Komolom (8° 22.237′ S 138° 50.404′ E) on 7 February 2003. The following day the film crew

traveled to Sebilam (8° 20.576′ S 138.43.584′ E), a hunting and fishing camp at the edge of Kowonep swamp in the interior of Pulau Komolom. That night Alber Kaise of Desa Komolom spotlighted and captured a 0.8 m long freshwater crocodile (Figure 1) <100 m from Sebilam. Mr. Kaise's find confirmed the presence of *C. novaeguineae* in the wild on Pulau Komolom (which in turn suggests a wild population), and provided the first record of the species extralimital to mainland New Guinea. The crocodile exhibited a post-occipital scale pattern of two rows of three enlarged scutes (Figure 2), a character that is much more common in southern form *C. novaeguineae* than in northern form (JC, pers. obs.).

Kowonep is a shallow, semi-saline, non-tidal marsh. Patches of open water were present on this wet season visit, but the surface was mainly a mosaic of sparse to dense emergent bulrushes and grasses, and scattered thickets of the bole fern, *Acrostichum aurum*. An extensive variety of submergent vegetation was present. Local hunters asserted that both *C. novaeguineae* and *C. porosus* inhabited Kowonep, and that the marsh was largely reduced to mudflats in the dry season. "Buaya bob," the local name for *C. novaeguineae*, was known to inhabit the area from oral histories extending at least 70 years into the past, well before the live crocodile trade began in the region.

Figure 2. Post-occipital scute pattern of two rows of three enlarged scutes, a character that is much more common in southern form *C. novaeguineae* than in northern form (J. Cox, pers. obs.). J. Cox photo.

Kimaam and Komolom are separated from the Papuan coast by Selat Muli (formerly Princess Marianne Strait), and a distance of only 3 km at the nearest point. Freshies ostensibly drifted or swam from mainland New Guinea tributaries to colonize the islands, but it is intriguing to find this crocodilian established in a semi-saline wetland.

A subsequent excursion to the stilted village of Kampung (= village) Yobi (= Jeobi) amidst sago, *Metroxylon sagu,* swamp in the interior of Pulau Kimaam did not turn up any crocodiles. The nearest were said to be about 12 km away. An aerial survey on 19 February 2003 showed very little open water in the vicinity of Kampung Yobi. Most vegetation beyond the periphery of the village was seen to be dense herbaceous associations.

The extensive and largely intact crocodile habitat of Kimaam and Komolom merits thorough investigation. A FAO-PHPA crocodile project (1987-1992) conducted multiple surveys of representative examples of *C. porosus* habitat on Kimaam from 1988-1991 (Frazier 1989a,b,c; Frazier 1990a,b; Saroy 1991; Saroy 1992). Results indicated a moderate population decline with subsequent rapid recovery during and immediately following a period of very high skin prices (Frazier 1990a,b; Cox 1992).

Since 1991, skin prices have declined substantially. Unfortunately, no additional surveys have been conducted. It was the authors' impression that "salties" on Kimaam and Komolom are now fairly plentiful. This is based on sightings of seven non-hatchling *C. porosus* on tidal mud banks during daylight travel along a *c*. 4 km section of the lower Sungai Dab (a relatively accessible tributary), and from informal interviews with a variety of local residents participating in the crocodile trade. Additional replicate surveys are needed to confirm the further recovery of *C. porosus* in this remote stronghold. Results of such surveys would likely enhance Indonesia's ability to manage its crocodile resource, and improve

reporting of population monitoring efforts for this CITES Appendix 2 crocodilian.

Priority is similarly merited for research and monitoring of *C. novaeguineae* on Kimaam and Komolom. Considerable trade in live juveniles and skins is evidently taking place. Moreover, the interior of Pulau Kimaam in particular is *terra incognita* as regards our knowledge of its wetland habitats and the distribution, status and conservation needs of its resident crocodilians.

The authors are grateful to Scott Frazier and Phil Hall for reviewing drafts of this note and providing a variety of useful comments and information. — Jack Cox, *2919 Colony Road, Charlotte, NC 28211 USA <jackcoxjr@yahoo.com>;* Nick Middleton, *Keo Films Presenter & Lecturer in Physical Geography, St Anne's College, Oxford University, UK <nicholas.middleton@geog.ox.ac.uk>;* & Marco Wattimena, *Wetland Specialist, WWF Indonesia Bioregion Sahul Project, Merauke, Papua, Indonesia c/o <wwfwasur@jayapura.wasantara.net.id>*.

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Papua New Guinea

2003 CROCODILE NEST SURVEYS. As part of Papua New Guinea's long-term crocodile population monitoring program, nest count surveys of *C. porosus* were conducted 9-14 March 2003, in the Middle-Upper Sepik River region. Surveys were conducted annually since inception of the program in 1982 (except between 1999 and 2002, due of lack of funding). The survey area comprises primary nesting habitat of crocodiles and are considered representative of nesting trends in the country. Over 40% of crocodile skins and live animals harvested and exported from the country originate from the Sepik River region.

The survey involved a Bell Jet Ranger 206 Helicopter systematically surveying sites over a four-day period. Active nests were noted and their status—whether harvested, flooded, raided, false, etc.—was recorded. The GPS locations of individual nests also were noted. For the sake of consistency, individual sites continue to be traversed in similar fashion as in previous surveys. The use of twin spotting allowed surveys to be conducted in a more cost effective manner.

From a total 58 survey sites, only 41 sites surveyed annually since 1982 were revisited this year. The remaining 17 sites are considered to be "scattered" data and were recommended for inclusion in future surveys. The nesting data collected were categorized into three groups, N=12, N=15, and N=29 sites based on the consistency a particular site was surveyed since 1982.

Based on previous nesting data, the reduced nesting activity observed in the 1998 *C. porosus* survey appeared to be a result of environmental factors, particularly following the severe dry season in 1997. This was considered an aberrant year. As a result, regressions were conducted both including and excluding the 1998 data.

The raw nest counts collected indicate an initial increase in nesting effort followed by a period (1985-1988) when nest counts remained stable, then from 1988 onwards, a steep increase in numbers of nests. In 1994, a decline in nesting effort was observed which at that time was considered an aberrant year and thought to be associated with the severe dry season. The raw data in 1998 clearly portray an aberrant year, as there was over 52% reduction in nesting effort compared to the 1997 data. In 2003, raw nest counts clearly indicate a significant increase in nesting effort with over 50% increase in nest numbers observed for all three indices (i.e., N=12, N=15, and N=29).

The nesting data was regressed for N=12, N=15, and N=29 sites consistently surveyed between 1982 and 2003 both including and excluding the 1998. For N=12 sites surveyed consistently from 1982 to 2003 excluding the 1998 data, an increasing trend is depicted. The relationship was considered highly significant. Similarly, for N=15 and N=29 sites surveyed consistently between 1983 and 1989 to 2003 respectively, both relationships also indicated highly significant relationships without the 1998 data. The inclusion of the 1998 data rendered the two relationships, N=12 and N=15, significant (Figure 1). The inclusion of the 1998 data for N=29 sites surveyed consistently between 1988 and 2003 was not significant. Regardless of which data set is used, results indicate increasing rather than decreasing or stable trends.

As observed during this survey, the significant increase in nesting effort may have being attributed to the reduced burning regimes

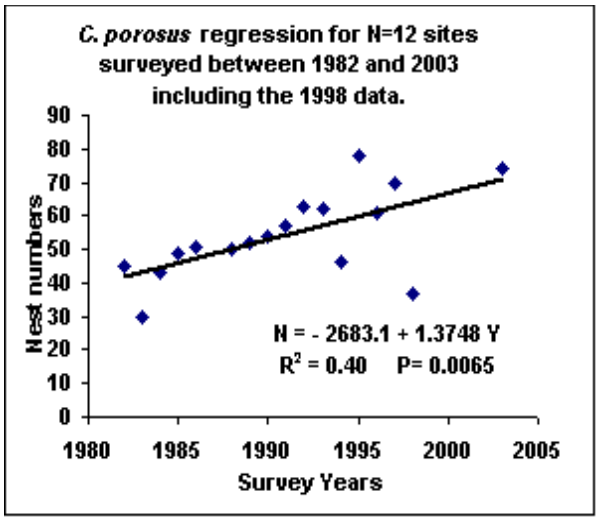

Figure 1. Regression for N=12 sites surveyed between 1982 and 2003, including the 1998 data. The relationship indicates a significant increase in nest number over years surveyed.

that commonly occur within the crocodile survey areas. The Sepik Wetlands Initiative, a recently established NGO based in Ambunti which concentrates its efforts on conservation of crocodile nesting habitat is commended for its efforts. The Department of Environment and Conservation conveys its appreciation to the government of Papua New Guinea and continued support provided by the Crocodile Industry in ensuring the availability of funds to conduct the survey. A similar survey will also be conducted for the *C. novaeguineae* in October later this year.

A series of recommendations for future surveys was made:

- Ensure that the PNG government provides funding to the DEC though a special line item to facilitate the continued operation of the monitoring program. Support is also required from the provincial governments in the major wetland areas.
- Prepare a development budget after the October survey, which will supplement the current funding allocation in that the monitoring program can be implemented for a longer period (i.e., 5–10 years) development budget in that annual request is eliminated.
- Adequately address the increasing loss of primary nesting habitats for the *C. porosus* in the Middle Sepik. In consultations with DEC, local

NGOs and communities formulate and implement a community-driven habitat conservation program.

- The DEC should consider formulating a wetlands policy to assist in the protection of various habitats and ecosystems of significance that will assist in the regulation of protection and the use of resources on a sustainable basis.
- The DEC should consider developing a GIS database management strategy to interpret the site configurations and degradation over time. This would clarify some of the management assumptions in the wild population trends relating to environmental variables.
- Expand the sites to include the scattered data, include them in the next *C. porosus* survey in 2004 (as recommended by Mr. Manolis), and survey them biannually in subsequent years.
- The DEC should concentrate on assimilating other forms of monitoring data collected over the years, particularly the harvest data. An analysis of the data according to regions and size structures should be conducted. It also would be useful if the DEC highlighted crucial areas where management strategies can be concentrated.
- The DEC should identify capable staff within the Conservation Division to participate in conducting the surveys, as backup to the current staff, to ensure that sustainability and the long-term implementation of this highly technical aspect of the crocodile surveys is maintained.

— *From* Kula Veari V. & Godfrid C. Solmu, *2003:* C. porosus *population monitoring survey in middle-upper Sepik River region of Papua New Guinea, March 2003. Department of Environment and Conservation, PO Box 6601 Boroko, NCD 111 Papua New Guinea, Indonesia. Submitted by* Dr. Navu Kwapena, *First Assistant Secretary, Conservation Division.*

Tomistoma Task Force

TOMISTOMA TASK FORCE PROGRESS REPORT. At the 16th Working Meeting of the IUCN-SSC Crocodile Specialist Group in Gainesville (Florida, 7-10 October 2003), an informal group of interested people met to discuss how best to further the conservation interests of the false gharial, *Tomistoma schlegelii*.

It was agreed that people outside the range states needed to play a much more active role in cooperating with and assisting range states to conserve *Tomistoma*—assistance with surveys, training, education, research, conservation action and both financial and human resources. The conclusion was that we may be able to approach this with a CSG *Tomistoma* Task Force (TTF), and a foundation group of members was established.

This year there has been considerable discussion about how a CSG-TTF could operate. We kept in mind that if the "Task Force" approach was successful, it could form a model that can be applied to some other species of crocodilians with special conservation needs.

This brief report summarizes the progress to date, and calls attention to some issues (a suggested "resolution") where action by the CSG Steering Committee is recommended.

Suggested resolution: There is a series of different aspects of *Tomistoma* that we consider to merit the establishment of a Task Force. We believe that these should be encapsulated in a formal statement—not just for our own benefit, but for the benefit of others who will interact with the TTF.

Our suggestion is that these aspects could be summarized within a CSG-SSC Resolution, directing the Vice Chairman for the region to establish a TTF on a "trial basis." A draft resolution for the CSG *Tomistoma* Task Force follows:

1. RECOGNIZING that the false gharial, *Tomistoma schlegelii,* is a large (5-6 m long), taxonomically distinct species of crocodilian in Southeast Asia, which shares many features with the families Crocodylidae and Gavialidae, but is distinct from both, and has an independent fossil record.
2. AWARE that the wild population has been adversely affected by the loss of habitat, particularly loss of peat swamp forest through logging and conversion to agriculture, and by a long history of human-induced mortality through deliberate and incidental catch, and that these threatening processes are ongoing.
3. NOTING that the species is listed on Appendix I of CITES and that the global population is considered "endangered" by the IUCN, although status remains poorly known in parts of its range: it may well meet the IUCN criteria for "critically endangered."
4. ALSO NOTING that the species has limited commercial value: international trade does not appear to be a major factor impacting on its

status, and conservation resources from the commercial crocodilian sector may be limited.

5. ACCEPTING that the species is likely to be extinct in the wild in Thailand, is represented by a small remnant in both Peninsula Malaysia and Java (perhaps a few individuals), and occurs in low densities in scattered locations in Sarawak, Sumatra and Kalimantan.

6. UNABLE to interpret at this time the extent of historical distribution outside this range, but noting remains found in China and the possibility that the historical or present distribution may include Sabah and Brunei.

7. WELCOMING the new information on the status of *Tomistoma* in the wild that has been gained over the last decade through various survey programs and research efforts, particularly by CSG members and their host organizations.

8. NOTING that the species is widely held in zoological collections, but that it is one of the few crocodilians in which successful captive breeding is rare.

9. CONVINCED that conservation action at the national level, by relevant authorities, can and should be the primary goal for achieving sustainable conservation of *Tomistoma*.

10. CONCERNED that the ability to quantify status of the remaining wild population, and to assist national authorities to implement conservation programs, is constrained by lack of resources.

11. ACCEPTING that increased international cooperation between individuals and institutions with a particular interest in *Tomistoma* may help achieve increased conservation action.

12. AWARE that at the 16th Working Meeting of the IUCN/SSC Crocodile Specialist Group, a group of CSG members decided to investigate the possibility of a CSG Task Force dedicated to *Tomistoma*.

Juvenile *Tomistoma*, Samutprakan, Thailand. Feb. 2003. J. Thorbjarnarson photo.

The Steering Committee of the IUCN-SSC Crocodile Specialist Group, resolved in February 2003:

1. To direct the Vice-Chairman for Eastern Asia, Oceania and Australasia to establish a CSG *Tomistoma* Task Force (TTF), with a mandate to operate until the next CSG Working Meeting.
2. To direct the CSG executive officer to be a member of the Task Force and to assist as appropriate.
3. To review progress made with the TTF at the next CSG Working Meeting and to decide whether the initiative should be continued until the following CSG Working Meeting.

Mission statement: what will the TTF do, and how? Although our efforts on this are all voluntary, and we do not want the TTF to become overly bureaucratic, or unreasonably demanding, it is important that we get a clear idea of what we *will* be doing and what we *will not* be doing.

This is best addressed through a mission statement, with some clearly defined objectives, and general spheres of action to achieve those objectives that can be built on as needed. The suggested "mission statement."

The *Tomistoma* Task Force, within the IUCN/SSC Crocodile Specialist Group, is dedicated to quantifying the status of false gharials (*Tomistoma schlegelii*) in the wild, identifying the threats to which they are exposed, and to promoting such actions in cooperation with range states and others as may be deemed appropriate for achieving sustainable conservation benefits for the species.

Objectives & actions:

Objective 1: To facilitate information exchange on *Tomistoma* with TTF members, students, researchers, managers, institutions, organizations and the public in general, thereby improving the ease with which objective and reliable information on *Tomistoma* can be gained by anyone with a serious interest in them.

Action 1.1: Set up and run a TTF website (completed! See: www.tomistoma.org/pa/).

Action 1.2: Develop protocols for membership.

Action 1.3: Facilitate information exchange between members.

Action 1.4: Establish a "priority circulation list" for new information and progress.

Action 1.5: Actively engage in public education.

Action 1.6: Conduct affairs in an open, transparent and professional manner.

Objective 2: To identify conservation problems with *Tomistoma* and pursue solutions to them.

Action 2.1: Establish problems as they are currently known from the literature and the experience of members and colleagues, on a regional basis.

Action 2.2: Develop potential solutions to those problems.

Action 2.3: Engage in or promote such new activities as may be necessary to further quantify problems and threats, and develop solutions.

Objective 3: To assist in the acquisition of financial and other resources to pursue the *Tomistoma* conservation.

Action 3.1: To establish under the auspices of the CSG a TTF Trust Fund (TTFTF).

Action 3.2: To appoint two TTF members as fund-raising coordinators and encourage all members to participate.

Action 3.3: To establish with the CSG executive officer a committee to oversee any expenditure from the TTFTF.

Action 3.4: To assist and support TTF members and others seeking funds for work on *Tomistoma* considered consistent with the TTF mission.

Action 3.5: To encourage national and international government and non-government organizations to undertake projects likely to advance the TTF mission.

Action 3.6: To examine all possibilities for collaboration and partnerships in projects likely to advance the mission of the TTF.

Objective 4: Encourage research into the social, cultural, economic and biological variables that ultimately interact to determine whether conservation in the wild can be successful and sustainable

Action 4.1: To examine all possibilities for collaboration and partnerships in projects likely to advance the mission of the TTF.

Office and coordination: Subject to any direction from the CSG Chair or SC, the TTF will be directed and coordinated by the regional Vice-Chair (Grahame Webb), through WMI offices in Darwin. In the absence of Grahame Webb, Adam Britton (WMI) and Charlie Manolis (WMI) will assist with day-to-day correspondence.

Current members: Membership has been expanded to include more people active with *Tomistoma*. At present, members are:

Mark Auliya	Germany
John Behler	USA
Mark Bezuijen	Australia
Adam Britton	UK–res. in Australia
Jong Joon Soon	Sarawak
Akira Matsuda	Japan
Charlie Manolis	Australia
Parntep Ratanakorn	Thailand
Perran Ross	CSG Exec. Office
Scott Pfaff	USA
Bruce Shwedick	USA
Robert Stuebing	USA
Ralf Sommerlad	Germany
Colin Stevenson	Australia
John Thorbjarnarson	USA
Grahame Webb	Australia
Uthen Youngprapakorn	Thailand

Website: www.tomistoma.org/pa/
Website subcommittee: Akira Matsuda and Adam Britton

Address:

Tomistoma Task Force
c/o Dr. Grahame Webb
Wildlife Management International Pty Limited
P.O.Box 530, Sanderson NT 0813, Australia
Telephone: 61 8 8922 4500
Facsimile: 61 8 8947 0678

Tomistoma Task Force Trust Fund (TTFTF): This will be established under the CSG through the University of Florida in the first instance, when fund raising activities begin.

Fundraising subcommittee: Bruce Shwedick and Colin Stevenson

Authorization committee: Perran Ross and Grahame Webb

Various activities may be undertaken to raise funds, and Adam Britton is formulating a short report on the Chinese alligator fundraising effort

to provide some guidance on "cost-effectiveness."

When attempting to raise funds the TTF needs to be mindful about approaching funding sources which already provide base funding for the CSG itself. The CSG may be asked to provide some funding ($US1000 - to be repaid) to establish the web site and pay for fundraising materials etc.

The CSG may itself decide that some initiatives of the TTF deserve funding through the CSG, if resources are available.

Regional coordinators: In the first instance, activities within different regions will be coordinated by the following people, who may coopt other members as they feel necessary:

Australia - Colin Stevenson
Europe - Ralf Sommerlad
Indonesia - Mark Bezuijen
Remaining Southeast Asia - Rob Stuebing
USA - Bruce Shwedick

The issue of range state representation is at this stage considered secondary to establishing a working mechanism for getting outside support for *Tomistoma*. It is clearly an issue that the TTF will need to address once it is more operational.

Logo: A logo is being developed, possibly including *Tomistoma* and *Ramin*, a tree representative of peat swamp forest. Logo subcommittee: Ralf Sommerlad, Bruce Shwedick, Robert Stuebing

Some operating principles: With any such effort involving volunteers, TTF members need to be mindful about obligating themselves to do more than they can reasonably be expected to do with limited resources. We believe we can achieve a lot through the TTF, both through combined initiatives and through the TTF members actively supporting each other when they attempt to get various projects on *Tomistoma* underway, in their own right. In a general sense, projects and activities will probably fall within one of three classes:

1. Things the TTF and its members can do, for the TTF and its mission;
2. Things that TTF members can do in their own right which advance TTF goals, and as such may need to call on the TTF or its members for assistance; and
3. Things that are beyond the TTF or its individual members, but which the TTF considers would advance our mission, in which case the TTF can play a role in trying to solicit countries and/or other NGOs to undertake the projects.

— Grahame Webb, *Director of Wildlife Management International, P.O. Box 521, Sanderson, NT 0812, Australia 0678 <gwebb@wmi.com.au>.*

Western Asia

Bangladesh

THE MARSH CROCODILE RECOVERY PLAN FOR KHAN JAHAN ALI MAZAR. Rom Whitaker, a crocodile and snake expert based in India, was called to visit Bangladesh to review the current status of the marsh crocodiles (muggers) living in the pond at the Saint Khan Jahan Ali Mazar (KJAM) and to suggest strategies to conserve this critically endangered species. The mugger crocodile ranges all the way from Iran, through Pakistan, India, Sri Lanka, and Bangladesh, but nowhere is its existence safe. Unrestrained slaughter has extirpated the species throughout Bangladesh and the last surviving members are protected by religious sanction at the KJAM. Mr. Whitaker arrived in Bangladesh on 22 May 2003 and visited the holy shrine of the KJAM in Bagerhat on 24 and 25 May.

Mr. Whitaker previously visited the KJAM in 1982 as part of an FAO consultancy on crocodile conservation and management in Bangladesh. He learned from the *kadem* then that in 1970 there were eight adults and about 30 babies. At the time of his visit in 1982, there were five adults and no babies. On his more recent visit, he confirmed the presence of only two adult marsh crocodiles—one male and one female. Although the *kadem* said there was another female, it is suspected that this female died last year. All of this indicates a drastic decline.

Interestingly, as he followed up on reports of a smaller crocodile in the lake, Mr. Whitaker confirmed the presence of a subadult (juvenile) saltwater crocodile, a species usually restricted to the mangrove swamps of the Sunderbans. This is not conducive to the long-term survival of the marsh crocodile.

Following discussions with the *kadem*, facilitated by Rafiqul Islam, director of Rupantar (a Khulna-based NGO), and accompanied by

Nirmol Kumar Halder, Assistant Conservator of Forests of the Bangladesh Forest Department, Mr. Whitaker was permitted to open the nest and examine the eggs. Again with the help of the *kadem*, he candled the 20 eggs and found them all to be infertile. Since baby crocodiles haven't been seen in the lake since 1988, this indicates a serious problem. It was noticed that the crocodiles were very obese from overfeeding by pilgrims. Also observed was that the female, blind in one eye, was of an advanced age, which may account for infertility.

The following actions were discussed in a preliminary manner with the *kadem*, as options to ascertain the reasons for the infertility and to enhance the population of marsh crocodiles:

1. Capturing and testing of fertility of the female and spermatogenicity of the male.
2. Bringing adult crocodiles and/or eggs of the same species from surplus stock being reared at the Madras Crocodile Bank, India (founded by Mr. Whitaker).
3. Returning the one crocodile, originally from the lake and now at Khulna Zoo, back to the shrine.
4. Conducting follow-up awareness programs with the *kadem* and other people at Bagerhat.

As part of this assignment, Mr. Whitaker made a keynote presentation in a technical discussion held on 26 May 2003. The discussion session, "Conservation of Bangladesh Marsh Crocodiles," was jointly organized by Rupantar and Winrock's "Farmer-to-Farmer" Program and was attended by a large number of development professionals, university teachers, and media representatives. Also in attendance were many individuals from the private sector, including Mushtaq Ahmed, an entrepreneur who has developed a proposal for commercial crocodile farming in Bangladesh. Mr. Whitaker outlined strategies for a recovery program for crocodiles in Bangladesh, then explained the benefits of commercial crocodile farming to stakeholders at various levels.

Mr. Whitaker also visited the recently established crocodile breeding and rearing center of the Bangladesh Forest Department at Karamjal in the Sunderbans. There he met with Osman Goni, Uttam Kumar Saha (Tourism Division), and Tariqul Islam (Sunderban East Forest Division) to discuss the future development of the crocodile rearing center.

He also visited the Dhaka Zoo and discussed their plans for establishing breeding groups of the three crocodile species found in Bangladesh. The zoo has a healthy large adult male gharial and four females—a perfect breeding group. They also have an adult pair of saltwater crocodiles, but no marsh crocodiles. They recently constructed two huge crocodile breeding enclosures capable of housing dozens of adult crocodiles. — Rom Whitaker, *P.O. Box 21, Chengalpattu, India 603001 <draco@vsnl.com>.*

India

CROCODILE SURVEY IN AND AROUND THE BARADA WILDLIFE SANCTUARY, GUJARAT, INDIA. During the year 2000, a mugger crocodile (*Crocodylus palustris)* survey was conducted in the Barada Wildlife Sanctuary (BWS), Gujarat State, western India. The BWS is located in the Porbandar District, in the western part of Saurashtra Peninsula (between 21° 42' – 21° 54' N latitude and 69° 39' – 69° 49' E longitude). Originally called "Shikar Reserve," the sanctuary formerly was a game hunting reserve of ex-rulers Maharaja of Nawa Nagar and Porbandar States after the independents. In 1979, the entire 19,231.44 sq. km area was decreed as a protected area by the Gujarat Forest Department. The sanctuary is comprised of a dry deciduous forest classified as "northern tropical thorn forest." Situated on hilly, rocky terrain, at an altitude ranging from 79.2 m to 617.8 m (Venu Hill) above mean sea level, the area receives only scanty and erratic rainfall and experiences a drought every three to five years.

The crocodile survey was divided into two separate counts, with the first count occurring during the winter (the second week of October 2000) and the second in the summer (the third week of December 2000). The survey methods used were direct visual day counts and rapid habitat assessment, including the gathering of information on animal conflict in the area. A total of 15 important water bodies in the sanctuary—of which 11 had small mugger populations—were surveyed. According to reports by local people, 44 to 56 crocodiles inhabit these waters. During the survey, a total of 34 mugger crocodiles—one juvenile, three

subadults, and 30 adults—were counted in the entire sanctuary (Table 1). A large number of muggers have been recorded in Fodala Ness Dam, Gulab Sagar and Gothatad Dam, with all three water bodies holding 64.7% of the crocodile population of the area. Attacks on livestock are common in some of the water bodies, while human conflicts rarely are observed.

All eleven water bodies are on river drainage systems of the Kileshwari and Bileshwari Rivers, which empty into the Fodala Ness Dam. During unfavorable conditions—especially during the drought and food scarcity—the entire crocodile population migrates from one water body to other and ultimately ends up in the Fodala Ness Dam. The following is a detailed account of the survey and other information observed in the water bodies where muggers were recorded:

Dhola Ghuna: A small water body in the interior part of the sanctuary, Dhola Ghuna is the origin of Kileshwar River. It also is used by local Mal-dharis for drinking and bathing. Two large crocodiles were recorded there during the study.

Kileshwar Check Dam: This is a small body of water on the Kileshwar River, near Kileshwar Temple. During the study, two subadult crocodiles (approx. 1 m long) were observed. Animals here appear to be quite tame and do not seem to be disturbed by the presence of local people. Part of the pool is used as a swimming hole by locals and temple visitors. Previous observations in this area in 1984 showed that even when the local people were using this pool, crocodiles came out and basked on its shore.

Causeway: This is a small check dam on the Kileshwar River, five kilometers from the Kileshwar Temple. Local people use the water for bathing and washing of buffalo. During the first visit a subadult crocodile (approx. 1 m. long) was observed, but on the second visit the pool was dry and the animal had migrated 2 km to Kala Ghuna, towards Fodala Ness Dam.

Gulab Sagar: According to a local watchman, approximately eight crocodiles are inhabiting this large body of water at the edge of the sanctuary. Few of them are laying eggs regularly. Also, he reports that it is common for crocodiles to attack livestock of Mal-dhari, especially goats and sheep. During the survey, only six crocodiles were observed basking on an island—one juvenile, one subadult, and four adults (approx. 2 m long).

Table 1. Mugger crocodiles (*Crocodylus palustris*) recorded in different water bodies in and around Barada Wildlife Sanctuary, Gujarat, India.

No.	Name of water body	Size of water body (approx.)	Crocodiles					
			B	J	S	A	Total no.	Reported
1	Dhola Ghuno	Small	-	-	-	2	2	2-3
2	Kileshwar Check Dam	Small				2	2	2
3	Parashiya Talaw	Small	-			0	0	0
4	Causeway	Small	-			1	1	2
5	Gulab Sagar	Large	B	1	1	4	6	8
6	Sat Sagar	Medium	-			0	0	0
7	Bari Talaw	Medium	-			1	1	2-5
8	Fodala Ness Dam	Large	B		1	10	11	12-15
9	Khambhala Dam	Large	-			2	2	5-8
10	Gothatad Dam	Large	B			5	5	8-10
11	Aabhapara Water Bodies (cluster of three)	Small	-			0	0	0
12	Sonkansari Talaw	Small	-			0	0	0
13	Sankaroja Talaw	Medium	-	-	-	1	1	1
14	Ranasar	Medium	-	-	1	1	2	2
15	Chek Dam (down to Gothatad Dam)	Small	-	-	-	1	1	0
Total numbers of muggers:				1	3	30	34	44 - 56

Small = <50 acres; Medium = <100 acres; Large > 100 acres; B = Breeding; J = Juvenile; S = Subadult; A = Adult

Bari nu Talaw: This is a medium-sized body of water surrounded by three Mal-dhari Ness. According to local people, five crocodiles inhabited the Talaw, but only one adult mugger was recorded during the survey.

Fodala Ness Dam: The largest body of water in the area, Fodala Ness Dam is under the jurisdiction of the State Irrigation Department. The crocodile population of the reservoir is one of the oldest stock in the state, as is the Gir crocodile population of Kamaleshwar or Hiran Dam. Even when crocodile population was depleted throughout India during the 1970s, this reservoir had a large number of muggers. The dam water is reserved for supply to Porbandar City. According to a report, approximately fifteen crocodiles inhabit the dam, of which two or three are observed nesting regularly. During the visit, I counted only four large (over 2.5 m long) and one subadult crocodile, but the actual number might be higher. Illegal fishing by four local fishermen was observed there during the visit. In addition, the water was being used by local people for their livestock.

Khambhala Dam: This is another large water reservoir in the area that is under jurisdiction of the State Irrigation Department. Only a very small area of water was observed during the first survey, due to scanty rains the previous year. In December 2000, almost the entire reservoir had dried up, leaving only a few small pools and wells in the dam area. Two large crocodiles were seen in one of those wells.

Gothatad Dam: According to the head-man of the Gothatad Ness, eight crocodiles inhabit this dam, a large body of water in the interior part of the sanctuary. Five crocodiles were recorded during the survey, all over 2 m in length. Crocodile attacks on livestock were a frequent occurrence in this dam. The water also is used by local people for bathing and washing buffalos.

Sankharoja nu Talaw: This is a medium-sized water body located in the interior parts of the forest. During the survey, a crocodile over 2 m in length was observed basking on the banks of this pool.

Ranasar: This medium-sized body of water on the edge of the sanctuary supplies drinking water to the town of Bhanvad. During the survey, two muggers (one subadult and one adult) were sighted here.

Check Dam (near Gothatat): This is a small check dam located approximately 8 km downstream from Gothatad Dam. During the study a large mugger crocodile (over 3 m long) was seen in the river, in a small pool surrounded by large boulders.

Crocodile conflicts: Rapid development and urbanization leads to encroachment on forest land, putting tremendous pressure on areas reserved for the protection of natural resources. This results in animal vs. human conflicts—an increasingly common phenomenon.

Over the past few years it has become evident that crocodile and livestock/human conflicts are increasing in the Barada Wildlife Sanctuary, especially at a few of the larger bodies of water inhabited by larger crocodiles. Crocodiles killing the livestock of the local Mal-dhari is a common phenomenon during the droughts that occur in the area every three to five years.

The information on human-crocodile conflicts was gathered during the study by interviewing local people, victims, and forest personnel. The conflicts were recorded at Gothatad Dam, Gulab Sagar, and Fodala Ness Dam:

Gothatad Dam: This reservoir is used by local people for bathing, washing clothes, and bathing of cattle. In 1999, a Gothatad crocodile attacked victim Bavo Gigan Rabari, who lost four fingers during the incident. In early October 2000, a crocodile was seen killing a goat—a common sight at this dam, as attacks on livestock happen frequently.

Gulab Sagar: The Mal-dharis, who live in nearby Ness, use the water at Gulab Sagar for their daily activities. It is common there to see crocodiles kill livestock, especially goats and sheep. According to resident Naranhbhai Rabari, in late September 2000, a cow lost its hump and tail in a crocodile attack at this pool.

Fodala Ness Dam: One of the largest water bodies in the area, Fodala Ness is home to a large number of crocodiles. Attacks on local livestock—especially goats and sheep—are common. In 1996, a crocodile killed one of Natharam Rabari's children. Two other incidents of attacks on humans at the dam were recorded during 1995 and 1996, but the victims survived.

Fishing activities (illegal?) were observed in Fodala Ness Dam and Gulab Sagar during the study. Every year the State Irrigation Department invites offers for fishing, and the Fisheries Department introduces fish fingerlings and crustacean seeds into these waters. These fishing culture practices have negative impacts

not only on the crocodile population, but also on native freshwater fauna. This is also in violation of the Wildlife Protection Act of 1972, which states that the introduction of any living organism in an official protected area is an illegal offense.

I am thankful to H.S. Singh, ex-director of the Gujarat Ecological Education and Research Foundation, Gandhinagar for financial support and to Parbataji Odedara, ex- superintendent of the Barada Wildlife Sanctuary, for facilities and permission for the study. — Dr. Raju Vyas, *Sayaji Baug Zoo, Vadodara – 390018, Gujarat, India* <*razoovyas@hotmail.com*>.

Nepal

PRINCE PARAS RELEASES NEWLY-BRED CROCODILE. Chitwan, March 31: Crown Prince Paras Bir Bikram Shah Dev and Chairman of the King Mahendra Trust for Nature Conservation (KMTNC) today released newly-bred gharial crocodiles into the Narayani River, at Amaltari.

The Crown Prince also inspected the rhinos that were to be translocated from Royal Chitwan National Park to Royal Bardiya National Park, the latter being the newly created habitat of the highly endangered mammals. Accompanied by Princess Himani and their daughter Purnima, he also interacted with representatives of the foreign partner organizations of KMTNC.

The Trust also released a book on Crown Prince Paras' year-long involvement in the conservation of biological diversity. In a speech given during the event, Arup Rajouriya, member-secretary of the Trust, highlighted the conservation and development programs being conducted in coordination with the local community. "The government, partner organizations, and local community have contributed significantly in this process," Rajouriya said.

Michael E. Malinowsky, US Ambassador to Nepal, also spoke during the program, hailing the contributions of the royal family in nature conservation. He also expressed satisfaction for the involvement of locals in the preservation of the nature.

The Trust has a plan to release, into the Narayani River, 35 gharials bred in the Gharial Breeding Center inside Royal Chitwan National Park. Once they reach one or two meters in length, the baby crocodiles are usually released in river, which is their natural habitat.

The Chitwan National Park initiated the Gharial Conservation Project in 1978, with assistance from the Frankfurt Zoological Society. According to officials, the park has already released about 500 crocodiles into the Narayani, Babai, Mahakali, Koshi, and Gandaki Rivers.
The two species of crocodile, which are already extinct in Bangladesh, Bhutan, and Burma, now are found only in Nepal and India. — Manish Gautam & Prabhakar Ghimire, *Kathmandu Post. Submitted by* Dr. Phil Hall, *FL-ARNG,* <*phil.hall@fl.ngb.army.mil*>.

Latin America & Caribbean

Belize

A RECENT SURVEY OF THE AMERICAN CROCODILE IN TURNEFFE ATOLL, BELIZE. A countrywide survey of the American crocodile (*Crocodylus acutus*) in Belize was conducted from July 1996 to October 1997 (Platt and Thorbjarnarson, 1997, 2000a and b). Fewer than 1500 non-hatchling *C. acutus* are currently believed to occur in Belize. Turneffe Atoll harbors the largest population and highest concentration of nesting activity anywhere in Belize (Platt and Thorbjarnarson 2000a). An estimated 200-300 non-hatchling *C. acutus* inhabit the atoll, including 15-25 breeding females, and this population is thought to play a vital role in regional metapopulation dynamics. However, the conservation status of the Turneffe Atoll population is considered tenuous because reproduction is dependent on beach ridge habitats that are increasingly threatened by development (Platt and Thorbjarnarson 1997, 2000a,b). During June-July 2002, I worked with Oceanic Society volunteers to assess the current status of *C. acutus* in the Turneffe Atoll and make recommendations for a long-term conservation and monitoring program. Significantly, this is the first such investigation conducted in the atoll since the survey of 1996-97.

Crocodile nesting: We searched known crocodile nesting areas on Northern, Blackbird, and Deadmans Cays for recently hatched nests. The site on Northern Cay (17° 29.76′ N; 87° 47.02′ W) is the most important nesting beach in the entire coastal zone of Belize. It consists of a high sand ridge adjacent to a shallow lagoon that provides excellent nursery habitat for hatchlings and undoubtedly enhances neonate survival (Platt and Thorbjarnarson 2000b). Seven to 10 clutches were deposited annually on this beach from 1994 to 1997 (Table 1). In July 2002 we found six recently hatched nests on Northern Cay that had been excavated by female crocodiles. The nesting area was greatly modified by Hurricane Keith in 2000; considerable beach erosion was evident and much of the tree canopy was damaged, resulting in a profusion of understory vegetation that may limit sites available for crocodile nesting. However, tidal overwash also deposited a large amount of sand at the eastern end of the lagoon, which is now being used for nesting.

Table 1. Number of American crocodile nests found at nesting beaches in the Turneffe Atoll. Data from 1994-1997 in Platt & Thorbjarnarson (1997). Note that 1995 data are incomplete (NS = not searched).

Location	1994	1995	1996	1997	2002
Blackbird Cay (east)	0	NS	5	3	1
Blackbird Cay (west)	2	1	1	2	0
Deadmans Cay	1	1	0	0	0
Northern Cay	8	NS	7	10	6
Calabash Cay	0	NS	0	0	1
Total	**11**	**2**	**13**	**15**	**8**

Two nesting sites were previously identified on the eastern shore of Blackbird Cay (Platt and Thorbjarnarson 1997). The first site is a partially cleared beach ridge approximately 100 m north of Blackbird Resort. We found a well-used crocodile trail traversing the beach and an old nest (2001?) containing several eggshells, but no evidence of recent nesting activity, although the site remains suitable nesting habitat. A second and more significant nesting area is located approximately 3 km north of Blackbird Resort. This site consists of an elevated beach ridge extending about 1.5 km along the shoreline. Much of the vegetation on the beach ridge was cleared in 1995, creating excellent nesting habitat. We found most of the ridge is now overgrown with dense vegetation that probably discourages crocodile nesting. Although some suitable nest sites remain, we found only a single nest at the extreme northern end of the ridge (17° 20.602′ N; 87° 47.917′ W).

In addition to known nesting sites, we also searched beaches along the eastern shore of southern Calabash Cay. These beaches are excellent habitat, but no evidence of nesting was found here in previous surveys. During the current survey we encountered a pod of 12 to 15 neonates while conducting a spotlight survey of Bull Bay, and found a freshly excavated nest and an old nest, probably from 2001, the following day (17°15.703′ N; 87° 50.185′ W).

In summary, we found eight recent (2002) nests during the current survey, considerably fewer than noted in our previous investigation (Table 1). The reason for this apparent decline in nesting activity is unclear. It is doubtful that nests were overlooked in 2002 as the location of nesting beaches are well known, these sites were thoroughly searched, and nests are conspicuous after being excavated by the female. The decline in nesting activity may indicate a population decline, but given the lack of data from 1998-2001, speculating on population trends is somewhat premature, although the need for additional monitoring is clearly obvious. The fate of *C. acutus* in the Turneffe Atoll is closely linked to the fate of the few remaining nesting beaches and these sites should be stringently protected from any form of development.

Spotlight surveys: We conducted spotlight surveys along the eastern and western shores of Blackbird Cay, the western shore of northern Calabash Cay, and the eastern and western shores of southern Calabash Cay. Survey routes are described in Platt and Thorbjarnarson (1997) and Platt (2002). A total of 49 crocodiles were encountered along 40.1 km of survey route (encounter rate = 1.2/km) (Table 2). This encounter rate is somewhat higher than the previously reported rate of 0.9/km (Platt and Thorbjarnarson, 1997), but results of the 2002 survey were undoubtedly skewed by conducting spotlight counts in areas known to harbor crocodiles. Encounter rates along individual routes were similar to previous surveys. Because of the variability inherent in spotlight counts, long-term monitoring will be required to detect population changes.

Table 2. Results of spotlight surveys conducted in the Turneffe Atoll (June-July 2002). Data from Calabash Cay/Bull Bay does not include pod of hatchlings encountered during the survey.

Location	Date	Crocodiles observed	Kilometers surveyed	Encounter rate (crocodiles/km)
Blackbird Cay (Soldier Bight)	30 June	4	4.7	0.8
Blackbird Cay (eastern)	1 July	11	4.1	2.6
Calabash Cay (northern)	2 July	2	2.1	0.9
Blackbird Cay (western)	3 July	7	11.5	0.6
Blackbird Cay (eastern)	5 July	15	4.1	3.6
Blackbird Cay (Soldier Bight)	8 July	2	4.7	0.4
Calabash Cay/Bull Bay	12 July	8	8.9	0.8
Total		**49**	**40.1**	

Crocodiles observed during spotlight surveys were classified as juveniles (total length [TL] = 30-90 cm), subadults (TL = 90-180 cm), adults (TL > 180 cm), or "eyeshine only" (EO). Of the 49 crocodiles observed (excluding hatchlings), 1 (2.0%) was classified as a juvenile, 17 (34.6 %) as subadults, 15 (30.6%) as adults, and 16 (32.6%) as EO. The high percentage of subadults and adults encountered is probably due in part to sampling bias; juveniles remain concealed in mangroves and therefore escape detection during spotlight surveys (Platt and Thorbjarnarson 2000a).

We captured and tagged 12 crocodiles ranging in size from 50.1 to 212.0 cm TL during the 2002 survey. A subadult crocodile captured on 1 July 2002 along the eastern shore of Blackbird Cay was originally captured in the same area on 26 November 1996. This individual measured 97.5 cm when first captured and 130.0 cm when recaptured, having grown only 32.5 cm in approximately 5.5 years. While conclusions based on the growth rate of a single animal are tentative, low growth rates could have important demographic consequences for *C. acutus* in the Turneffe Atoll. Because juvenile crocodiles are most vulnerable to predation and osmotic stress, rapid growth early in life is vital to minimize the time spent in the smaller size classes. If growth rates are excessively slow, juveniles will remain vulnerable for much longer periods and a concomitant decrease in survival can be expected.

Recommendations:

1. Establish permanent transects for spotlight surveys. These should preferably follow previous survey routes to allow direct comparison of encounter rates and detect population changes.
2. Monitor nesting beaches to determine annual nesting effort in the Turneffe Atoll. Annual nesting effort is an extremely sensitive indicator of population trends. Additionally, suitable nesting habitat on other cays should be searched each year. Searches are best conducted shortly after hatchling emergence in early July when freshly excavated nests are most obvious.
3. Clear vegetation from nesting beaches on Blackbird and Northern Cays to provide open microsites for nest construction. This work should be conducted outside of the reproductive period (mid-February through early July) to avoid possible disturbance of nesting females.
4. Continue capture and tagging of crocodiles. The crocodiles marked in June-July 2002 complement the ninety crocodiles tagged during our earlier survey (Platt and Thorbjarnarson 1997). Recaptures will generate important data on long-term growth, survival, and population size.
5. Monitor *C. acutus* nesting on Northern Cay, Lighthouse Atoll. A small reproducing population of American crocodiles occurs on the cay (Platt et al. 1999), and nest sites are readily accessible and warrant monitoring.

— Steven G. Platt, *Oglala Lakota College, PO Box 490, Kyle, SD 57752-0490, USA <splatt@gwtc.net>*.

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Costa Rica

ENVIRONMENTAL EDUCATION PROJECT: HOW TO LIVE WITH CROCODILES? In Costa Rica, the American crocodile (*Crocodylus acutus*) is in danger of extinction due to habitat destruction, hunting, and the illegal trade of its meat and skin. In response to this situation and as part of a plan for the conservation of crocodilians, the Association of Crocodile Specialists-Costa Rica (AEC-CR) has developed a project to evaluate the status of crocodiles in the country and design strategies for the management of wild populations. One of the most important goals of this project is to teach Costa Rican youth about crocodiles and the integral role they play in the environment.

AEC-CR's educational efforts are concentrated in rural communities, where children share their environment with crocodiles and tend to develop the beliefs commonly held by adults: that crocodiles are bad and that it would be best for them to just disappear, for example. By teaching primary-school children basic concepts in biology, ecology, sustainable resource management, and environmental legislation, and by placing them in direct contact with crocodiles, the project teaches youth to respect and understand their importance in the ecosystem. They are taught that it is possible to share their environment with crocodiles without compromising their security. It is hoped that these educational efforts will instill in children a positive attitude about crocodiles and their conservation, such that they will serve as good examples to others in their communities. In the long term, the desired outcome is an increased probability of maintaining a healthy population *C. acutus* in areas where it is already in decline.

Children in their fifth year of primary school are the chosen participants in the project. In the classroom, the students are given lectures on basic biology, ecology, environmental legislation, the administrative structure of MINAE (the Costa Rican Ministry for Energy and the Environment), and the management of both wild and captive crocodiles and caimans. For greater comprehension, these lectures are combined with group discussions and videos that illustrate the natural habitat, behavior, reproduction, and other basic facts about American crocodiles.

In March, the students embark upon several field trips to collect crocodile eggs. The eggs, which are artificially incubated, are cared for by the children (under the supervision of the project

Costa Rican children with *C. acutus* hatchlings they are raising and will later release. L. Porras Murillo photo.

directors). When they hatch, the baby crocodiles are cared for, along with other babies collected in local rivers, for at least three months. At that time the children release them into rivers in which declining populations of *C. acutus* have been detected.

The collection of crocodile eggs and babies is very important to the conservation of the species. At least 50% of the nests are lost to predation and flooding, and of the eggs that do hatch, only 5% of the young survive. Extracting and caring for crocodile eggs and babies in a safe, controlled environment and releasing the young back into their natural habitat provides a valuable boost to the viability of the species.

The end of the project is marked by the release of the young crocodiles by the children who raised them. At this time the children are awarded certificates of participation, which serve as an incentive for their continued interest and participation in the conservation of crocodiles in their country. — Laura Patricia Porras Murillo, *Asociación de Expertos en Crocodílidos de Costa Rica (AEC-CR) <lauporras@costarricense.cr>*.

North America

Mexico

AMERICAN CROCODILE IN PUERTO VALLARTA, MEXICO. The city of Puerto Vallarta is situated within the distribution area of the American crocodile (*Crocodylus acutus*) on the continental coast of the Gulf of California, Mexico. Crocodile habitat in this area includes coastal rivers, wetlands and even urban areas. However, the pressure of unplanned human development is threatening the species due to the loss of its natural habitats and the conflicts that arise when man and animal confront each other.

To counteract the crocodiles' disadvantaged situation, a special farm was established to house animals confiscated from fauna traffickers. This facility provides for the care of injured and diseased crocodiles and those who are vulnerable to attacks from poachers or frightened townsfolk.

Based in Puerto Vallarta, at the Coastal University Center of the University of Guadalajara, the farm has been in operation since January 2000. This 5,000 m^2 property includes seven tanks of various sizes: two smaller tanks (7.50 m^2) and five others ranging in size from 9.32 to 1,300 m^2. In 2002, the farm housed 28 crocodiles: seven adults, 21 juveniles, and one newborn. All animals are being observed closely in order to study their growth, feeding habits, and behavior under veterinary care.

This work is complemented by population studies in the field around Puerto Vallarta, particularly in the estuaries of Boca de Tomates (138 ha), Boca Negra (14.18 ha), El Salado (2 km channel), and El Quelele-El Chino (100 ha). In late June 2002, researchers made some promising discoveries in the Boca de Tomates area. They found a nest with 26 newborn crocodiles (total average length of 32.13 mm); three nests containing the eggshell remains of 29 hatchlings (including five unhatched eggs); one nest with 19 eggshells; and another nest with 19 eggshells (including one unhatched egg). Another important observation was the migration of crocodiles from this area to the golf course on the outskirts of Marina Vallarta. In July 2002, two adults (2.5–4.0 m), two subadults (1.2–2.0 m), and two juveniles (1.0 m) were observed in transit along this route.

Studies of crocodile abundance in Boca Negra, El Quelele-El Chino and Boca de Tomates estuaries were conducted from May to November 2002. The maximum abundance (66.05 ± 10.50) of crocodiles was recorded in Boca Negra and the lowest (17.64 ± 9.68) in El Quelele-El Chino. The population was 29.23 ± 6.20 in Boca de Tomates. Unfortunately, this population is decreasing on a daily basis, due to the construction of housing and public infrastructure that continues to serve as obstacles in the already threatened lives of the river crocodiles.

Of additional concern is the impact of the floods caused by Hurricane Kenna on 24 October, 2002. According to the authorities responsible for the protection of wildlife in the neighboring Mexican state of Nayarit, the floods allowed the crocodiles to colonize places beyond their natural distribution borders. With the arrival of the dry season, water levels usually drop, which will pose a problem for the reptiles and is cause for concern among residents. Being far from the usual areas they use for feeding and reproduction, these crocodiles could die or become dangerous to humans.

Fortunately for the crocodiles living in the Puerto Vallarta area, the mangrove surrounding

their natural habitat provides excellent shelter that acts as barrier against the wind and waves of hurricanes. Nevertheless, the occurrence of this meteorological phenomenon prior to the hatching of the eggs (in June) would have caused floods and irreparable loss of the nests that the female crocodiles build near the beaches. Fabio G. Cupul-Magaña, Armando Rubio-Delgado & Abraham Reyes-Juárez, *Coastal University Center, University of Guadalajara, Av. Universidad de Guadalajara, No. 203, Delegación Ixtapa, C.P. 48280, Puerto Vallarta, Jalisco, México <fcupul@pv.udg.mx> & <fcupul@hotmail.com>.*

TOWARDS THE SUSTAINABLE USE OF MORELET'S CROCODILE IN MEXICO. An extraordinary meeting of the Mexican Crocodile Specialist Group was held in Mexico City, 14-15 March 2003. Scientists and others interested in the research, management, sustainable use, and conservation of the different crocodilian species that occur in Mexico convened to discuss a variety of topics pertinent to these species.

Of particular interest is the topic of downlisting and eventually taking the Morelet's crocodile off the Endangered Species Act list of the US. This would allow sustainable trade of wild harvested specimens in the future, as well as of those products originating in established farms with verified and verifiable control mechanisms into the US.

Last October, during the 16th Working Meeting of the Crocodile Specialist Group in Gainesville, Florida, a presentation authored by several Mexican crocodile experts gave an update of current research and information on *Crocodylus moreletii* in Mexico aimed at establishing the current status of the species in the country. This new information still should be considered preliminary, given that it only shows the results of the first of a two-year planned survey. However, it is generally agreed that in past decades the Morelet's crocodile was depleted from certain regions, but that recent observations in the field by Mexican and foreign researchers seem to indicate a very tangible recuperation of the species. This field research has shown the highest registered population densities for the species in Mexico of up to 18.5 crocodiles/km. Based on surveys that have been completed thus far, these researchers believe that sustainable use of certain crocodile populations through ranching techniques would not pose a threat to the species in the wild, and would create a conservation incentive among locals interested in the legal and sustainable use of this resource.

For more information, contact Luis Sigler at <crocosigler@prodigy.net.mx>. — Adrian Reuter, *World Wildlife Fund-Mexico, Mexico City, Mexico <areuterwwfmex@mexis.com>. Submitted by* Manuel I. Muñiz Canales, *President of COMACROM, Apdo. Postal 41601, Lomas de Chapultepec, Mexico DF CP 11000, Mexico <moreletii@psi.net.mx>.*

ABUNDANCE, HABITAT USE, AND CONSERVATION OF THE AMERICAN CROCODILE IN SINALOA. By means of monthly night surveys, the habitat use and abundance of the American crocodile (*Crocodylus acutus*) in the southern half of the El Verde estuary, Sinaloa, Mexico, was determined. The study area is approximately 3.1 km wide and is located between 23º 25' 30" N, 106º 33' 30" W and 23º 24' 29" N, 106º 32' 14" W. The individuals observed were divided into adults, juveniles, and young. The distribution of each size-class within the different vegetation, salinity and depth classes of the study area was analyzed. A total of 11 adults and 15 juveniles was estimated, with a density, without young, of 8.4 individuals/km. This number occupies a mid-high level among the ones reported for other localities within the continent. The proportion of adults is 15.38%, less than those of other populations reported, suggesting that El Verde's population is increasing and recovering after illegal hunting incidents that took place several years ago. However, nest density (0.97 nests/km) is smaller than others. The young were found to have a preference for shallow, less saline water with lots of food. Juveniles were marginalized into areas less favored by the adults. Adults are found throughout the study area, but in higher numbers in those areas with an abundance of non-navigable canals that offer them protection and bigger prey. The distribution of juveniles and adults did not show a well-defined pattern regarding salinity, but seem to have a tendency to occupy areas with lower salinity levels.

People of El Verde who have economic, research, or recreative interests in the area, as well as residents of a nearby estuary with few or

no crocodiles, La Escopama, were interviewed. Answers showed a greater lack of information about the crocodiles in La Escopama, whereas the level of ecological awareness in El Verde was noticeably greater. This could be the result of more than two decades of close contact by nearby communities with biologists who study the nesting sea turtles at the local research station. The main economic activity at El Verde—extensive shrimp farming in seasonally flooded adjacent areas—has prevented a more destructive use of the natural resources there while also providing additional habitat (*ca*. 300 ha.), different prey species, and a lessening of territorial competition. Although small, El Verde remains one of the last crocodile refuges in the vicinity of Mazatlán city, and it is one that should be conserved. — Thesis abstract: Navarro-Serment, C.J. 2002. Abundance, Habitat Use, and Conservation of the American Crocodile, *Crocodylus acutus* Cuvier, 1807 (Reptilia: Crocodylia) in the El Verde Estuary, Sinaloa, Mexico. Master's Thesis in Sciences, with Specialization in Environmental Management. Center for Food and Development Research (CIAD), Mazatlán, Sinaloa, Mexico. 70 P. Carlos J. Navarro, *Crepusculo #18, Fracc. Alborada, M13 SM44 Cancun, Quintana Roo 77506, Mexico <navarrosc@hotmail.com>*.

Veterinary Science

WEST NILE VIRUS IN AMERICAN ALLIGATORS. West Nile Virus (WNV) is a mosquito-borne virus endemic to Africa but distributed throughout Europe, the Middle East, Western Asia and, most recently, into North America. WNV first was reported in the New World in 1999 and since has spread rapidly to 44 US states and into the Caribbean and Mexico. The virus is related to Murray Valley Encephalitis in Australia and St. Louis Encephalitis in the USA. Birds are the primary hosts for WNV and it can be spread both by mosquitoes and possibly by ingestion of infected tissue. The virus is rarely fatal in its native Africa, where most species seem to have adapted immunity. But in the USA it has caused widespread mortality among birds, particularly corvids and raptors, and also is reported widely in horses and a variety of domestic and wild mammals, including humans. The virus can cause fatal encephalitis in humans. Several thousand human cases have been reported and over 200 deaths, primarily among the elderly and other immune-compromised people. The virus is thought to affect mostly endotherms (warm-blooded animals) but now has been reported in farmed alligators.

In Florida, an alligator farm experienced a mass die-off of juveniles in late 2002 in a grow-out house. Subsequent testing showed that some of the affected alligators had very high titres of WNV viral particles (Jacobson et al 2003). In another recently published report (Miller et al. 2003), epizootics and mass mortality of captive juvenile alligators was reported in autumn 2001 and 2002 from a commercial farm in Georgia. On both occasions several hundred animals showed very rapid onset of neurological symptoms and on necropsy were shown to have numerous infected foci in all tissues and high levels of WNV. In the Georgia case, the infection is thought to be transmitted via infected horsemeat fed to the alligators. The vector in the Florida case remains unknown. Both cases are under intense study. Adult captive alligators on both farms were not affected. Preliminary findings on a limited sample of 13 wild alligators sampled in 2002 at a location within 50 km of the Florida farm outbreak were all negative for WNV, but a widespread effort to sample and test wild alligators for WNV is underway in Florida.

The very high levels of virus found in farmed alligators have prompted concern that alligators may function as a reservoir and amplification host for further infection. It has been proposed that WNV in farmed alligators may be a consequence of the high ambient temperature maintained in grow-out facilities so that the alligators maintain a high mammal/bird-like body temperature. Direct transmission in crowded and often unhygienic conditions also may promote high virus levels and seasonal stress may increase susceptibility. However, all these remain speculations at this time.

A large proportion of wild crows in the USA are now infected and they are very susceptible to the virus. In contrast to crows, people get sick only in approx. 1 in 140 infections, with a fatality rate of about 10%. The true mortality rate for humans therefore is less than 1%. Symptoms include flu-like fever, nausea, and headache. WNV is being treated as a serious human and wildlife health issue in USA. While information from CSG veterinarians in southern Africa

indicate that WNV is considered a ubiquitous and trivial pathogen there, the south African form is genetically distinct and less virulent. While it seems likely that exposed populations in North America will quickly develop immunity, significant wildlife mortality may occur during the initial exposure of naïve populations. Researchers who believe that crocodilians they come in contact with may have WNV should adopt appropriate biohazard protocols and precautions. Exposure of personnel to crocodilian tissue or fluids should be avoided, particularly in droplet or aerosol forms that are easily inhaled or spread to open wounds and mucus membranes. — Perran Ross, *Editor*, *compiled from* McLean R.G. 2002. *Trans. 67th North American Wildlife and Nat. Resources Conf. 62-74.* Marra et al. 2003. *<http://www.cdc.gov/ncidod/eid/vol9no7/03-0277.htm>;* Miller D., M. Mauel, C. Baldwin, G. Burtle, D. Ingram, M. Hines, & K. Frazier. 2003. *Emerging InfectiousDiseases, CDC <www.cdc.gov/ncidod/EID Vol9no7/03-0085.htm>;* Jacobson E., J. Troutman, P. Ginn, J. Hernandez, L. Stark, R. Stephens, K.Klenk, N. Komar, & M. Bunning. 2003. *Outbreak of West Nile Virus in farmed alligators in Florida. Smithsonian WNV &Wildlife Health Workshop <http://www.serc.si.edu/migratorybirds/WNV_wkshp_abstracts.htm> and personal communications with* Nick Komar & Michael Bunning, *Centers for Disease Control*, C. Foggin, F. Huchzermeyer, D. Carbonneau, Elliot Jacobson, & L. Conti, *Fla. Dept. of Health,* & Barbara Fox-Nellis*, Biological Safety Officer, University of Florida.*

SKIN LESIONS IN CAPTIVE INDIAN CROCODILIANS: SUGGESTIONS FOR EARLY DETECTION AND TREATMENT. Fungal infection is a regular problem with captive reptiles, particularly for the aquatic species or those housed in moist areas. Requests for the sharing of experiences are very common. I came across a 1989 announcement in which the Columbus Zoo's Reptile Department staff was looking for solutions to fungal infections in infantile turtles, especially species such as *Elseya latisternum* and *Emydura subglabosa*. They had tried 2% saltwater and 2% prepodyne solutions, with minimal results. Since every bit of experience in captive husbandry can serve as a valuable guideline for people at various levels, I present here my experience with crocodilian skin lesions, suspected to be caused by fungal or viral infection.

The winter and monsoon seasons (particularly the latter) are difficult times in crocodile husbandry. This is the time when many hatchlings die, the older ones refuse food and, though they may not die, will exhibit several health-related complications. Among the non-fatal complications are skin diseases, which include (1) growth of algae on the skin of crocodiles which are usually debilitated, (2) mouth canker involving primarily the jaws but also extending all over the surface of the mouth, eyelids, and head, and (3) acute skin lesions that can affect the scutes on the tail and the osteodermal scutes on the back to the extent that they fall off or leave a permanent scar on the body. Crocodile farmers have reason to worry about these diseases, as they affect the quality of the hides they produce.

In my experience, keeping the basking areas of the rearing pens dry, even if there is no sunshine for basking, helps control skin problems due to algae. Mouth cankers seem to respond to cleaning with 1:1000 Acriflavin or potassium permanganate solution.

During my 28-year experience with crocodile husbandry, skin lesions—though rarely seen—have baffled me at least twice. The first puzzling case was related to lesions on *Gavialis gangeticus* at Gharial Research and Conservation Unit at Tikarapada, Orissa, and the other problematic case involved lesions on mugger crocodiles at the Mugger Research and Conservation Unit, Ramatirtha (under the Similipal Tiger Reserve).

At Tikarapada, in August 1985, three 10 year-old gharials developed a peculiar type of skin disease. The initial symptom was the development of white patches on the back and tail, which subsequently developed into deep wounds. The wounds gradually became gangrenous and deep until they exposed the bone in the tail region. Some scutes in the severely affected areas were totally lost.

These gharials first were treated by the local veterinary doctor, then by an Orissa Veterinary College Health Committee consisting of medicine and pathology professors, and finally by a committee from the Indian Veterinary Research Institute. Tests carried out at the

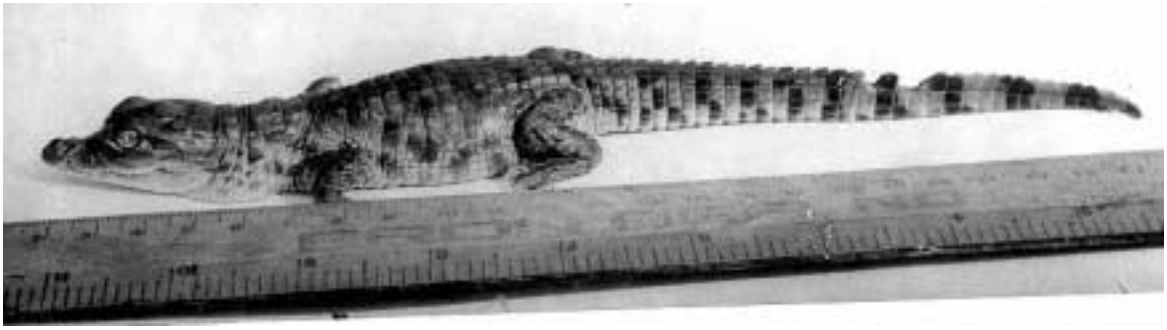


Figure 1. *C. palustris* hatchling with permanent scars from tail scute lesions. Mugger Research and Conservation Unit, Ramatirtha, India. L.A.K. Singh photo.

Orissa Veterinary College indicated a gram-negative bacilli type of bacteria, identified as *Klabsilla* species of the order Enterobacteria. This bacteria then was reported to be resistant to almost all kinds of antibacterial drugs except gentamycine, to which it also was moderately resistant.

The course of treatment between the first appearance of symptoms in June 1985 till 19 September 1985 was as follows: (1) antibiotic treatment with tetracycline, which later was changed to gentamycine, (2) antihistamine treatment with pheneramine maleate, and (3) treatment for vitamin deficiencies, particularly B and C. The 3.5-month treatment resulted in the control of the spread of the lesions due to the *Klabsilla* bacteria, but because full recovery of the crocodiles took much longer, we suspected that a viral skin disease had been present.

At the Mugger Research and Conservation Unit, Ramatirtha, two hatchling muggers (approx. two months old) from a 1990 batch were seen with tail scute lesions. At first, the lesions appeared to be injuries inflicted by another hatchling due to accidental seizure—injuries that normally dry up automatically if basking is allowed (or quickly heal after an application of potassium permanganate). In this case, however, basking was not adequate due to rain and overcast skies, and potassium permanganate did not help. Inconsistent or rare access to electricity in this remote area prevented the use of an electrically-controlled drying mechanism. Thus the "lesions" appeared to be spreading, and within a week of their appearance, covered three scutes of the crocodiles. The appearance of the affected scutes reminded me of the gharial lesions seen at Tikarapada in 1985.

The hatchlings were removed from the water, kept dry in a bucket, and treated twice daily for three days with Candiderma cream (Glenmark Pharmaceutical Pvt. Ltd., Bombay), which normally is used to treat fungal skin infections in humans. The lesions on the muggers disappeared after application of the medicine and the hatchlings were released back in water. Although the infections were cured, damage to the skin already had occurred, leaving permanent scars on the tails of both hatchlings (Figure 1). The Candiderma preparation contains the following ingredients: Clotrimazole IP 1% w/w, beclomethasone dipropionate IP 0.025% w/w, and neomycin sulphate IP 0.5% w/w in a cream base, with preservatives methylparaben IP 0.15% w/w and propylparaben IP 0.08% w/w.

I am grateful to the Chief Wildlife Warden of Orissa, Prof. S.B. Tripathy of the Orissa Veterinary College, Prof. B.M. Arora of the Indian Veterinary Research Institute, the Crocodile Research Center of the Wildlife Institute of India (my former organization), the Divisional Forest Officer of Satkoshia Gorge Sanctuary, and the Conservator of Forests and Field Director of the Similipal Tiger Reserve, who facilitated observations and discussions at various stages. I am also grateful to the staff at GRACU (Gharial Research and Conservation Unit), Tikarapada and MRACU (Mugger Research and Conservation Unit), Ramatirtha for their assistance. — Lala A.K. Singh, *Similipal Biosphere/Tiger Reserve, Baripada 757002, Orissa, India <bid_lashvini@sancharnet.in>*.

Science & Research

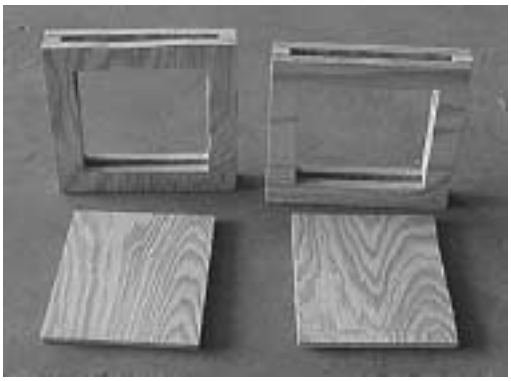
NEW HYDROCARBONS FROM ALLIGATORIDAE. The contents of the paracloacal gland secretions of alligatorids *Alligator mississipiensis*, *A. sinensis*, *Paleosuchus palpebrosus,* and *P. trigonatus* were investigated. The paracloacal glands of crocodilians, a putative source of pheromones, produce a variety of lipids, including compounds rare or unique among the vertebrates. Glandular secretions obtained from captive-reared specimens from the St. Augustine Alligator Farm, Bronx Zoo, and the National Aquarium at Baltimore were analyzed by gas chromatograph and mass spectrometry.

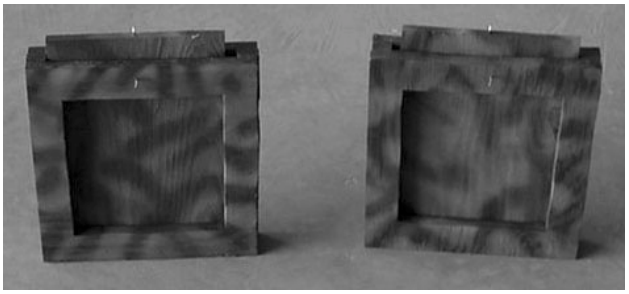
Novel acyclic hydrocarbon terpenes with rare a tri substituted 2,4-diene system were identified in the secretions of *A. sinenis*, *P. palpebrosus,* and *P. trigonatus*. The structures of the monoturpene (2E,4E)-3,7-dimethyl-2,4-octadiene and the sesquiterpene (2e,4E,7S)-3,7,11-trimethyl-2, 4 dodecadiene were proven by synthesis and gas chromatography. Several other new terpenes related to these components were present in the secretions as well as known compounds myrcene, (E)-β-farnesene, (E)-β-springene, squalene, cembrene and 11,12-dihydrocembren-10-one. Differences in lipid composition of paracloacal gland secretions were observed among species and among specimens of the same species but different sex and age. This is the first report to suggest differences in crocodilian skin gland products at different facilities. Variations in glandular chemistry may be due to differences in diet, holding facilities or other aspects of their captive environment. These results provide a broader picture of the distribution of hydrocarbon terpenoids within alligatoridae and they extend the known distribution of some compounds among the sexes and age classes of these taxa. The article also featured a photograph of *Paleosuchus* on the journal cover. — *Abstracted and adapted from* Schulz, S.K. Kruckert & P. Weldon. *2003. New terpene hydrocarbons from the Alligatoridae (Crocodylia, Reptilia). J. Nat. Products. 66:34-38. Submitted by* Paul Weldon *<pweldon@osfl.gmu.edu>*.

TRUE AND FALSE GHARIALS: A NUCLEAR GENE PHYLOGENY OF CROCODYLIA. The phylogeny of Crocodylia offers an unusual twist on the usual molecules versus morphology story. The true gharial (*Gavialis gangeticus*) and the false gharial (*Tomistoma schlegelii*), as their common names imply, have appeared in all cladistic morphological analyses as distantly related species, convergent upon a similar morphology. In contrast, all previous molecular studies have shown them to be sister taxa. We present the first phylogenetic study of Crocodylia using a nuclear gene. We cloned and sequenced the c-myc proto-oncogene from *Alligator mississippiensis* to facilitate primer design and then sequenced an 1,100-base pair fragment that includes both coding and noncoding regions and informative indels for one species in each extant crocodylian genus and six avian outgroups. Phylogenetic analyses using parsimony, maximum likelihood, and Bayesian inference all strongly agreed on the same tree, which is identical to the tree found in previous molecular analyses: *Gavialis* and *Tomistoma* are sister taxa and together are the sister group of Crocodylidae. Kishino-Hasegawa tests rejected the morphological tree in favor of the molecular tree. We excluded long-branch attraction and variation in base composition among taxa as explanations for this topology. To explore the causes of discrepancy between molecular and morphological estimates of crocodylian phylogeny, we examined puzzling features of the morphological data using a priori partitions of the data based on anatomical regions and investigated the effects of different coding schemes for two obvious morphological similarities of the two gharials. — *Abstract of* Harshman, J.; C.J. Huddleston; J.P. Bollback, T.J. Parsons, & M.J. Braun. *2003 (June). True and false gharials: a nuclear gene phylogeny of Crocodylia. Syst. Biol. 52(3):386-402. Department of Systematic Biology, National Museum of Natural History, Smithsonian Institution, Suitland, MD 20746, USA <braun@lab.si.edu>. Submitted by* Colin Stevenson, *434 Avoca Drive, Green Point NSW 2251, Australia <coleosuchus@hotmail.com>*.

A NEW TRAP DESIGN FOR SMALLER CROCODILIANS. Harold Weatherman at the St. John's River Water Management District was faced with removing a number of small alligators from enclosed fish ponds in central Florida. He has designed and tested the following effective trap.

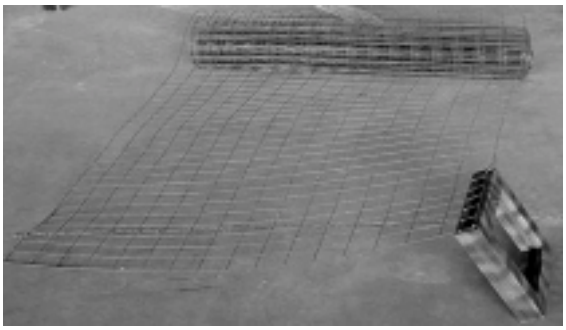
Supporting frames with integrated drop door for each end of the trap are cut from plywood.

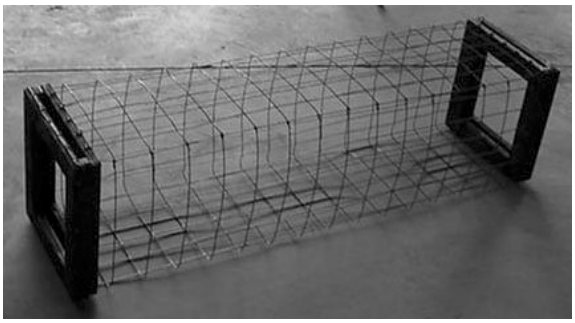




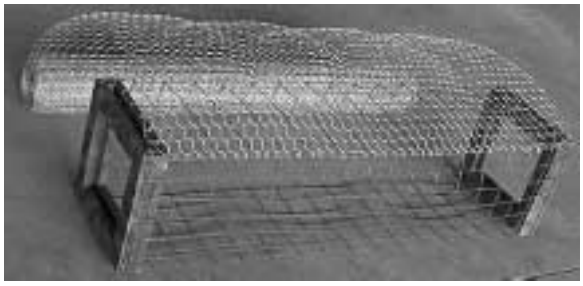
Spraypaint is added, for a camoflage effect.

The frames are wrapped first with steel mesh.....

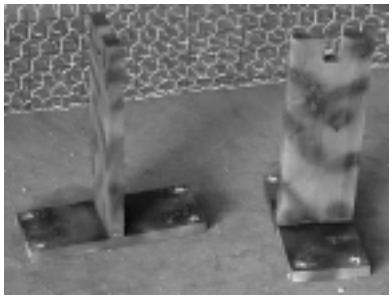


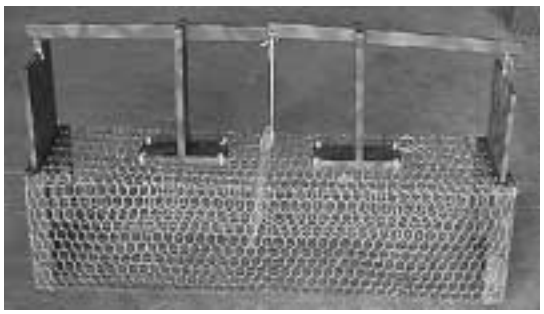


....then with galvanized chicken wire.



A simple trigger mechanism is supported on plywood supports.





Bait is attached to the central trigger rod that has a notch that hooks over the wire. When the bait and rod are displaced, gravity drops both doors, and "Voila!" it works. — *Photos submitted by* Harold Weatherman, *St. John's River Watershed Management District, Florida, USA <hweather@sjrwmd.com>.*

Meetings

17th CSG Working Meeting

23-28 May 2004

Darwin, Australia

See insert this issue for more information & registration form or visit www.wmi.com.au/csg17/dinfo.html

ICZ 2004: 19th International Congress of Zoology

23-27 August 2004

Beijing, China

The International Congress of Zoology (ICZ) announces its 19th conference, to be held 23-27 August 2004 in Beijing, China. ICZ 2004 is organized by the China Zoological Society, Institute of Zoology, Chinese Academy of Sciences, China Wildlife Conservation Association, and the China International Conference Center for Science and Technology. The program will include an opening ceremony, plenary session, symposium sessions, contributed paper sessions, and poster sessions.

A special symposium, "Conservation Biology of Crocodilians" (Special Symposium S5.5), is being convened by Dr. Wu Xiao-Bing (China) <wuxb@mail.ahnu.edu.cn> and Perran Ross (CSG) <prosscsg@flmnh.ufl.edu>.

This represents the first call for participants in this symposium. The focus of the symposium is on critically endangered crocodilians in Asia and elsewhere and general principles for crocodilian conservation. Persons expecting to attend the meeting and wishing to participate in this symposium should contact both of the convenors by e-mail indicating their interest and a potential topic.

For detailed and updated information about ICZ 2004, please visit the ICZ 2004 website at: http://www.icz.ioz.ac.cn.

To register on-line, visit: http://www.congress.com.cn/icz/register.htm

Trade

NEW EU TRADE WEBSITE. The European Commission Environment Directorate General and TRAFFIC Europe have combined forces to provide a rich and informative website covering all aspects of wildlife trade into the EU: http://www.eu-wildlifetrade.org/index.htm. The page is available in all the languages of the EU and provides entry to PDF files in which an extensive array of information for the traveler, trader, or simply curious can be found. Topics cover international regulations, national regulations for the 15 EU member states and specific and technical information on permits, welfare, marking, personal effects and souvenirs and definitions and regulations for captive bred and artificially propagated materials. A very extensive links section provides links to hundreds of sites covering national, hobbyist, zoo, conservation organization and many more useful sites. — James MacGregor, *Resource Economist, 95 Leahurst Road, London SE13 5HY, UK.*

HORIUCHI TRADING TURNS 50. Yoichi Takehara's company celebrated its 50th anniversary recently, inviting more than 150 people. Mr. Tad Tanabe acted as master of ceremonies. Takehara-san made a welcome speech followed by the remark of His Excellency Michael Maue, ambassador from Papua New Guinea. The ambassador stressed an important role played by Horiuchi Trading in terms of economy and conservation in his country.

After the ambassador's speech, Takehara-san donated funding to him for conservation purposes, and this was welcomed by all the participants. Among others, many from the reptile industry sector were present, including Saikyo, Inoue, Tomobe, Ogiso, and Kataoka. Mr. Takehara's company was established by his uncle, Mr. Horiuchi, on 1 May 1953. Mr. Van Zylk and Mr. Vermaak, both from KKI, came from South Africa via Kuala Lumpur. No one from Singapore and Hong Kong attended due to SARS problems. — Yoshio Kaneko, *Global Guardian Trust, Tokyo, Japan.*

Costa Rican schoolchildren collect and care for *C. acutus* eggs as part of an environmental education project designed to teach them about crocodiles and the integral role they play in the environment (see pages 20-21). L. Porras Murillo photo.

CLUB PLANS CROC-FILLED MOAT TO CONTROL HOOLIGANS. A Romanian football club is planning to control its rowdy fans by installing a crocodile-filled moat around the pitch.

Fourth division Steaua Nicolae Balcescu has been threatened with expulsion from the league after repeated pitch invasions and violent outbreaks. Worried bosses think a moat, stocked with fully-grown hungry crocodiles, would be the only way to keep their fans off the pitch.

Club chairman Alexandra Cringus said: "This is not a joke. We can get crocodiles easy enough and feed them on meat from the local abattoir. The ditch is planned to be wide enough that no one could manage to jump over it. Anyone who attempted to do so would have to deal with the crocs. I think that the problem of fans running onto the pitch will be solved once and for all."

The moat would have electric pipes installed to heat the water during cold weather. And it would be far enough from the pitch to prevent players from chasing the ball right into it.

The proposal is being considered by local authorities. — From Ananova web-site, <http://www.ananova.com/news/story/sm_735648.html?menu=news.quirkies.sportingquirkies>.

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