

**CROCODILE  
SPECIALIST  
GROUP  
NEWSLETTER**

VOLUME 26 No. 4 • OCTOBER 2007 - DECEMBER 2007



# CROCODILE

# SPECIALIST

# GROUP

# NEWSLETTER

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VOLUME 26 Number 4  
OCTOBER 2007 – DECEMBER 2007

IUCN - The World Conservation Union  
Species Survival Commission

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**COVER PHOTOGRAPH:** Indian Gharial (*Gavialis gangeticus*) hatchlings in the Girwa River, Katerniaghath Wildlife Sanctuary, India (see page 8 for full story).  
Photograph: Suresh Chaudhari, Lucknow, Uttar Pradesh State, India.

## CSG Newsletter Subscription

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

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

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## Editorial

The CSG has continued to make good progress during the last quarter of 2007. Firstly, I want to once again thank the donors who responded so positively to our annual request for contributions. For the CSG to be sustainable, and to be able to maintain activities, we must be in a secure financial position. We achieve this through the generous help of a network of supporters, both to core CSG business and to specific projects such as the CSG-Tomistoma Task Force.

The news has not all been good. The status of Indian Gharials (*Gavialis gangeticus*) in the wild has declined in recent years to such an extent that they now meet the criteria for Critically Endangered in the IUCN Red List. Adding to the difficulties, reports were received in mid-December 2007 of mass mortality of Gharials in one of the last strongholds, the National Chambal Sanctuary in

India. More than 80 Gharials, including many adults, were found dead in a 35 km stretch of the Chambal River, between Barhi (Madhya Pradesh) and Chakranagar (Uttar Pradesh). The pathology of the dead Gharials is still equivocal with regard to the cause of death, and the Government of Madhya Pradesh requested help from the CSG. The CSG Veterinary Science Group, under the guidance of Dr. Fritz Huchzermeyer, is organizing for a team of CSG veterinarians, familiar with crocodilian health and disease, to visit the area and work with the Indian veterinarians to identify and resolve the problem.

By way of contrast, good news from the Philippines. On 14 September 2007, the Ligawasan Marsh Wild Crocodile Research Program was successfully launched at the College of Agriculture, University of Southern Mindanao, Kabacan (see page 10). I congratulate Dr. Cayetano C. Pomares and all involved. Ligawasan Marsh is one of the most important natural wetland areas in the Philippines, especially for crocodiles. It contains the largest known wild population of the critically endangered Philippine crocodile (*Crocodylus mindorensis*), along with a population of Saltwater crocodiles (*C. porosus*), that are extinct throughout most of their former range in the Philippines. The research project is now underway, with a commitment to combining improved conservation with improved local livelihoods of those who coexist with the crocodiles. Two reconnaissance surveys have now been conducted in the marsh, at Cuyapon and Rajah Muda. In October, as part of the exchange program funded by CSG, there was a return visit by the Mabuyaya Foundation from Isabela Province to the University of Mindanao (see page 11). The "Philippine Crocodile Society" has now also been established to further this work.

The first regional CSG meeting ever held in Africa took place on 13-15 November 2007 in Tapoa, Niger. The meeting was a direct outcome of decisions made at the last CSG Working Meeting in France, and brought together, for the first time, the French-speaking African countries that contain crocodiles. The meeting was very successful (see report on page 4). There has already been a request to hold a second regional meeting, in Burkina Faso in 2009-2010, which the CSG is supporting fully.

Thanks to Dr. Ruth Elsey, the CSG submitted an article to the SSC "Species" Newsletter on the sustainable use of American alligators (*Alligator mississippiensis*) in Louisiana, which will be a 'feature' in "Species 48" rather than just a specialist group update. Louisiana's sustainable use program is truly one of the world's great examples of wildlife conservation and sustainable use operating hand-in-hand. Since the early 1970s it has been an important model for crocodilian conservation around the world in terms of both research and management.

The conservation, management and commercial use through farming of the Siamese crocodile (*Crocodylus siamensis*) remains problematic in that every effort must

be made to ensure the wild population remaining in Cambodia, the last stronghold, is not compromised through international trade. Following the CSG review mission in Cambodia, and discussions held at the CITES CoP14 (The Hague, Netherlands), the CSG Executive Officer met with Vietnam's Forestry Protection Department in Vietnam in late September 2007. Agreement in principle was reached on a CSG review mission to Vietnam. Draft terms of reference have been agreed and the review is scheduled to take place in April/May 2008, headed by CSG Deputy Chairman Dr. Dietrich Jelden. Serious flooding in central Vietnam during November 2007 resulted in more than 5000 crocodiles (200 breeders and thousands of hatchlings), mostly *C. siamensis*, escaping from a crocodile farm in Khanh Hoa Province.

Crocodile conservation and management in Cuba remains a priority for the CSG. In addition to the endemic population of Cuban crocodiles (*Crocodylus rhombifer*) and the new management program for American crocodiles (*C. acutus*), in which Cuba contains the most abundant remaining wild population in the region, there is apparently natural hybridisation occurring between these two species in the wild. This raises a serious of complicated conservation and scientific problems. On 20 December 2007, I wrote to Ing. Tomás Rivera Amarán, Director, Centro de Inspeccion y Control Ambiental (CITMA), proposing a CSG review mission in late 2008.

The proposed CSG Post-Graduate Grant Scheme is still being developed and I expect to be able to make some firm proposals and commitments at the next CSG working meeting (June 2008). The new CSG website should be ready to go online within the next month, thanks to the efforts of Akira Matsuda.

The CSG-Tomistoma Task Force continues to go from strength to strength and will be holding a workshop in Pattaya, Thailand, from 23-28 March 2008 and you can register online at: <http://tomistoma.org/pa> (also see page 5). Logistics and planning for the 19th CSG working meeting, to be held in Santa Cruz, Bolivia, 2-7 June 2008, are well advanced and I would urge all prospective contributors and participants to register online at: <http://www.19thworkingmeetingcsg.com>.

Professor Grahame Webb, *CSG Chairman*.

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## West African Sub-Regional Meeting

The first subregional CSG meeting ever held in Africa took place from 13 to 15 November 2007 in the magnificent tourist lodge at Tapoa in Niger. This was mainly due to the outstanding efforts by 'La Ferme aux Crocodiles' (Pierrelatte, France) and the France-based travel agency 'Point-Afrique'. The venue was situated in Parc Regional de 'W', the largest West African protected area, which stretches across Burkina Faso, Benin and Niger.

The meeting, initiated at the 18th CSG meeting (Montelimar, France, June 2006), was attended by more than 25 representatives from Benin, Burkina Faso, France, Germany, Mali, Niger, Nigeria and the USA. It was specifically designed to target the needs of the West African francophone region, in which the CSG had not been very effective in extending its activities. Furthermore, the new CSG initiative was also aimed at building up a new forum through which francophone African countries can meet together and openly exchange information about crocodiles and their conservation and management in the region.

Major objectives of the meeting were:

1. To obtain a summary of the current and historical status of the three crocodile species distributed in west and central African countries;
2. To become familiar with the aims and aspirations of regional countries with regard to the conservation, management and sustainable use of crocodiles, and where appropriate, the constraints preventing those goals from being achieved; and,
3. To assess areas where the CSG may be able to offer technical assistance in the future and to foster contacts and networks that may be possible within West Africa, and between West Africa and the international community in order to increase activities with crocodiles within the region.

On the first day of the meeting, regional delegates regional and representatives of international conservation organisations presented summary reports on the current status and distribution of crocodilians in Benin, Burkina Faso, Congo, Gabon, Ghana, Ivory Coast, Mali, Niger and Nigeria.

Additional presentations were made by the CSG Regional Chairman for Africa, Dr. Richard Fergusson and Nathalie Kpera, focussing on monitoring techniques for wild populations, types of holding operations and principles to maintain and raise crocodiles in captivity, the use of crocodiles in traditional African medicine or on local conservation approaches based on the cultural significance of crocodiles such as in Benin.

On the afternoon of the second day participants split into working groups, each comprising delegates from several regional countries, to discuss coordinated strategic issues including common management plans, identifying needs to improve technical capacities or how benefits derived from crocodilians can contribute to the livelihoods of local human populations. The results of the working groups discussions were extremely positive and in many ways complementary. They included a draft resolution and many specific recommendations.

The final plenary session, held on the third day, drafted a synthesized document with short-, medium- and long-

term recommendations and strategic options from the meeting. This document can now be used independently by each participant to further the interests of crocodile conservation, management and sustainable use in the region. Furthermore, the strategy will also allow future meetings to measure progress made along the lines adopted during the congress in Tapoa. This document will be included in the proceedings of the meeting, which for the first time ever will be published in French.

A night visit to the Tapoa River inside the National Park allowed delegates to view an extremely high density of Nile crocodiles (*Crocodylus niloticus*). Collection of morphometric data, census, and different catching techniques were demonstrated by both local and expatriate crocodile experts - according to the final catching success rate the local team clearly won 5:2.

The meeting was considered a great success. Participants left with many new questions and ideas in the areas of crocodilian management and conservation in the region, which will hopefully generate much discussion and interest within the newly formed network.



Figure 1. Participants of the first West African sub-regional meeting, Tapoa, Niger.

A written invitation forwarded to the CSG Chairman by Burkina Faso, to hold a second subregional meeting either in 2009 or 2010 at the 'Ranch de Gibier' at Nazinga in Burkina Faso, was enthusiastically welcomed by all delegates.

Dr. Dietrich Jelden, CSG Deputy Chairman, <JeldenD@bfn.de>.

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## Tomistoma Conservation Workshop

At long last plans for the CSG-TTF Tomistoma Workshop have come together, and the workshop is confirmed to be held in Pattaya, Thailand, on 23-27 March 2008. *Tomistoma schlegelii* is considered to be a flagship species within its peat swamp forest habitats, which are also rapidly disappearing in Southeast Asia. Thus,

conservation of this species is highly significant for the larger picture of biodiversity conservation in Tomistoma Range States.

The CSG Tomistoma Task Force (CSG-TTF) is an international working group within the CSG, dedicated to quantifying the status of *T. schlegelii* in the wild, as this species is currently listed by the IUCN and the international conservation community as endangered. The main tasks of the CSG-TTF are identifying the threats to which the species is exposed, and to promote and implement appropriate conservation actions.

Of course, all CSG-TTF members are invited and strongly encouraged to attend this workshop. We also would like to invite those Friends of Tomistoma and others who are interested in working with us towards the conservation of this wonderful crocodilian species.

Our friend and fellow CSG-TTF member, Khun Uthen Youngprapakorn, has gone to great effort to create this opportunity for us to discuss and plan for new directions in Tomistoma conservation, from field research in the Range States to husbandry and captive breeding efforts, in which Uthen's Utairatch Farm has had dramatic success.

The workshop will include papers from the Range States on the status of Tomistoma in the wild, the potential for establishing a re-introduction program in Thailand, ongoing field projects on ecology and genetics, and captive breeding programs.

The CSG-TTF expects to develop a formal Action Plan for Tomistoma Conservation, whose implementation we hope can become a reality by mid-2008. A manual on Tomistoma husbandry, as well as plans for an Asian captive population studbook, will also be finalised at the workshop.

Participants will also enjoy a tour of the Utairatch Crocodile Farm, to witness firsthand the farm's facilities for successful captive breeding of Tomistoma on an annual basis. In addition, original prints of an outstanding natural portrait of Tomistoma in the wild, by professional wildlife artist John Agnew ([www.angelfire.com/id/wildscenes/](http://www.angelfire.com/id/wildscenes/)) will be available for purchase, with 20% of the proceeds being donated to CSG-TTF.

On behalf of the CSG-TTF, I would like to extend our invitation for you to attend this important conference.

For additional information on itinerary, accommodation, costs, etc., as well as the official Registration Form (and electronic payment facility), please visit the CSG-TTF website - [www.tomistoma.org](http://www.tomistoma.org).

In order to avoid using existing CSG-TTF funds for workshop related expenses so that they may be used to

fund field projects, we are currently seeking workshop sponsors. In addition to covering workshop expenses, we are hoping to provide partial funding support for approximately 3-4 people from Range States. For information about workshop sponsorship and for those who wish to apply for partial funding support, please contact Bruce Shwedick (bshwedick@aol.com) or Rob Stuebing (robstuebing@gmail.com).

We hope that any who are able, will consider participating in this workshop.



Figure 1. *Tomistoma schlegelii* hatchling at Utairatch Crocodile Farm. Photograph: Ralf Sommerlad.

Rob Stuebing, *Acting Chairman, CSG Tomistoma Task Force*, <robstuebing@gmail.com>.

### Use of CITES Re-Export Skin Tags

An issue was raised recently, where CITES skin tags were destroyed or become unreadable during tanning, and the tannery wished to re-export those crocodile skins. Although several major re-exporting countries (eg Singapore, Italy, France, Panama) have experienced the problem and used the relevant provision of CITES Resolution Conf. 11.12 (Universal tagging system for the identification of crocodilian skins), this recent situation highlighted the fact that other CITES Management Authorities, tanners and producers may not be fully aware of it. The paragraph in Resolution Conf. 11.12 that applies in cases of lost, destroyed or unreadable skin tags is:

“(i) that, where the original tags have been lost or removed from raw, tanned, and/or finished skins and flanks, the country of re-export should tag each such skin or flank prior to re-export, with a ‘re-export tag’ meeting all the requirements of paragraph (c) above except that the country of origin and standard species codes and years of production and/or harvest will not be required; and further, that the same information as is on these tags should be given on the re-export certificate together with details of the original permit under which

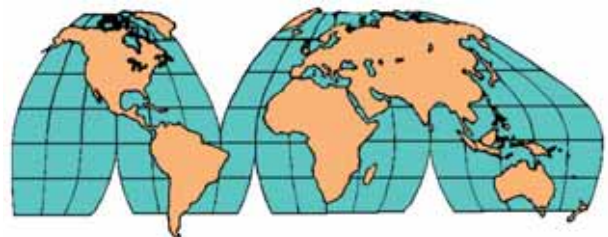
the skins were imported”.

Like the standard CITES skin tags, CITES re-export tags are supplied by the list of suppliers authorized by the CITES Secretariat (eg “Brooks”). The acquisition, distribution and management of re-export tags is the responsibility of the CITES Management Authority of the country that is re-exporting, and not individual tanners or re-exporters. The coding of the re-export tags needs to be in accordance with CITES Resolution Conf. 11.12 (see above).

The CSG proposes to raise this issue within the working group that was appointed at CoP14 to undertake the review of the implementation and effectiveness of the universal tagging system for crocodilian skins [see CSG Newsletter 26(2): 5]. The working group is scheduled to meet out of session and report back to the CITES Steering Committee (at its 58th meeting), and recommendations submitted to CoP15.

Tom Dacey, *CSG Executive Officer*, <csq@wmi.com.au>.

## Regional Reports



### Latin America & the Caribbean

#### Brazil

GEOGRAPHIC VARIATION BETWEEN PANTANAL CAIMAN (*CAIMAN CROCODILUS YACARE*) AND AMAZONIAN CAIMAN (*CAIMAN CROCODILUS CROCODILUS*): FIRST PHASE. Twenty years have passed since the first research expedition, led by Peter Brazaitis, went to the Brazilian Pantanal (swamplands of Mato Grosso and Mato Grosso do Sul), and continued on to the Paraguay, Guapore, Abunã and Madeira Rivers. Now, a new team has returned to these places to quantify the variation and define the geographical boundaries of postulated species and their variants. This is the aim of the PhD thesis of William Vasconcelos at INPA-UFAM, with Dr. Tomas Hrbek and Dr. Bill Magnusson as advisers, and Embrapa Pantanal as collaborators.

Some researchers have used references based on studies with low sample sizes, or using only leather. This is not

sufficient to draw serious conclusions about the systematic biology of these animals. Looking for scientific criteria to address old and new questions about the geographical distribution of Brazilian caimans, the team (José Augusto Dias, Denis Tilcara, Zilca Campos and William Vasconcelos) covered almost 10,000 km and caught caimans in Corumbá (MS), Porto Murtinho (MS), Coxim (MS), Cáceres (MT), Vila Bela da Santíssima Trindade (MT), Pimenteiras do Oeste (RO), Costa Marques (RO), Guajará-Mirim (RO) and Fortaleza do Abunã (RO).

A total of 116 crocodylians were collected from Pantanal to Madeira, of which 100 were assigned to *Caiman c. yacare* and its variants, 4 *C. latirostris*, 5 *Melanosuchus niger*, 5 *Paleosuchus palpebrosus* and 2 *P. trigonatus*. Morphometric measurements were taken on each animal, and scales were counted, and one or two single or double scales of the tail removed for permanent marking and for future DNA phylogenetic analysis.

William Vasconcelos (Rua Oscar Cordeiro, 66, Conj. Petros, Aleixo Manaus AM-69083-130; [williamamazon@yahoo.com.br](mailto:williamamazon@yahoo.com.br)) and Zilca Campos (Embrapa Pantanal, CP 109, Corumbá, MS 79320-900; [zilca@cpap.embrapa.br](mailto:zilca@cpap.embrapa.br)).

## Mexico

**A GIANT OF THE SUMIDERO.** On 28 June 2006, as part of the Project of Rescue, Recovery and Conservation of the American Crocodile (“Sumidero Croc”), in the “Cañón del Sumidero” National Park, Chiapas, there was an unprecedented event. A large male *C. acutus* was captured in the watershed of the Grijalva River - perhaps one of the few surviving specimens following the building of the “Ing. Manuel Moreno Torres” Dam in 1980. The *C. acutus* population in the Grijalva River is a vestige of the coastal population of Chiapas, which at the time that the central mountainous zone rose, was split. The population has clearly adapted well to a freshwater environment.

Over more than 13 years this population has been monitored to evaluate population trends, including a mark-capture study to quantify growth rates and movement. During this period, many attempts were made to capture larger individuals through direct and indirect methods (eg baited traps), but with no success, until 2004 when a 2 m animal was caught and 2005 when several individuals up to 3 m total length were caught. Attempts to capture older individuals continued, until this stroke of luck when we came across “El Viejo” (the old one). His territory is believed to include El Tapón, and he has been sighted within a radius/distance of 1.5 km up and down the river.

Several attempts had been made previously to capture El Viejo, but this time the boat (operated by Park Ranger Daniel Santos) was able to get close enough for a steel rope to be placed around the crocodile’s neck. He struggled violently, and at the first opportunity a thick

snout rope was put in place. We could then rest, knowing that the crocodile was secure.

The crocodile soon tired, and another rope was placed around the base of its tail, before we headed to Bahía Caimán, about 1.5 km away. Progress against the flowing water, with the crocodile in tow (Fig. 1), required the full power of the 80 hp engine, and water constantly entered the 15 ft (4.6 m) fibreglass boat. At Bahía Caimán the four members of the team pulled the crocodile, estimated to weigh more than 300 kg, onto the shore, where his jaws were finally secured (Fig. 2).



Figure 1. El Viejo being towed back to shore.



Figure 2. Team members Raramuri Reyes, Daniel Santos, Manuel Martínez and Jerónimo Domínguez with El Viejo.

Total length was 4.0 m (measured across the back), head length was 60 cm and maximum head width was 45 cm. There were several healed injuries from past fighting, including a fractured left hand. We also obtained blood and tissue samples for genetic analysis. Finally, the crocodile was scute-clipped (#517) and a webbing tag (#264) applied for future identification. Release back into the river took around 15 minutes.

Since his capture, he has been constantly observed in his territory without any possible effects of capture/handling. The successful capture and release of this magnificent Giant of the Grijalva River is dedicated to Luis Sigler.

## Acknowledgements

Manuel Martínez-Aeyón (photographs) and Liliana Berenice García-Reyes (translation).

Jerónimo Domínguez Laso, *Curador del Museo Cocodrilo-Instituto de Historia Natural y Ecología-Zoológico Regional Miguel Álvarez del Toro, Tuxtla Gutiérrez, Chiapas, México, <museococodrilo@yahoo.com.mx>*.

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## Africa

### Burkina Faso

During the West Africa sub-regional meeting (see page 4), Alphonse Kaboré (alphka17@yahoo.fr), from Burkina Faso, presented information on a village tourism development project dealing with “holy” crocodiles, with which the children play, swim and worship.



The project is in an arid region of the Sahel and could be developed into a major tourist attraction. The people have never killed their crocodiles, as they are deeply entrenched in the local culture. Nonetheless, non-consumptive use could provide economic benefits to the local people. The following images give a clearer view of this wonderful project in one of the poorest regions of Africa.

Dr. Dietrich Jelden, *CSG Deputy Chairman, <JeldenD@bfn.de>*.

## North America

### USA

CUBAN CROCODILE STUDBOOK FOR NORTH AMERICAN REGION. The “Cuban Crocodile Studbook” for the North American Region has been updated. An updated version (as of 9 October 2007). Compiled by Steve Conners of Miami Metrozoo, it indicates that there are currently 74 *C. rhombifer* (21.45.8) being held at 17 US and Canadian institutions (none are believed to be held in Mexico). The majority of the data is from specimens held in public institutions although a few specimens are held privately.

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## West Asia

### India

GHARIAL CONSERVATION ALLIANCE WEBSITE NOW ONLINE. The website of the Gharial Conservation Alliance is now online ([www.gharials.com/Home.asp](http://www.gharials.com/Home.asp)), although some issues still remain to be sorted out. An official launch and publicising of the website will be carried out soon.

Comments on the website are welcome, but please note that not all comments/suggestions may be addressed immediately. This is only “Phase 1” of the website, it will be continually developing, and I will be incorporating suggested changes in subsequent rounds of revisions.

Laurel Converse, *Executive Officer, Gharial Conservation Alliance, <ghariallaurel@gmail.com>*.

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GHARIAL HATCHING. The cover photo and the image below were taken in June 2007, just after the hatching of 10 or more gharial nests on one mid-river island sand bank, by Suresh Chaudhari, wildlife photographer based in Lucknow, Uttar Pradesh State, India. This nesting island is in the Girwa River, Katerniaghat Wildlife Sanctuary (up near the Nepal border), a 15 km stretch of which contains the second largest nesting concentration of gharial left in the world after the Chambal River.

This year over 20 nests were recorded there by the keenly enthusiastic Wildlife Warden, Ramesh Pandey. Noticing that monsoon currents had washed away the embankment, Mr. Pandey had the slope evened out so that the female gharial could access the nesting area. This seemed to have worked and hatching success was reportedly high, with very few spoiled or unhatched eggs seen.





Ironically (but a standard annual event), monsoonal floodwaters swept through and just days later not even one hatchling could be seen. There is a barrage on the river just below the sanctuary and the estimated 800 young gharial hatched in the Katarniaghat Sanctuary were apparently swept to their inevitable doom, as happens each monsoon. In the coming hatching season we hope to closely monitor the fate of the hatchlings and see if there is any way to improve survival odds there. It is clear that a study of the factors affecting gharial hatchling survival is long overdue, especially in the light of the relative ineffectiveness of headstarting and the release of thousands of gharial over the years.

Rom Whitaker, *Honorary CSG member*,  
<kingcobra@gmail.com>.

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**HUMAN-CROCODILE CONFLICT.** A survey of human-crocodile conflict and area action plan report for two districts in Maharashtra, Central India, is now available (at [www.wmi.com.au/csgarticles](http://www.wmi.com.au/csgarticles)).

Mugger crocodiles (*Crocodylus palustris*) in the Krishna River and its tributaries in Sangli and Kolhapur Districts, southern Maharashtra, have been implicated in fatal and non-fatal attacks on humans and livestock in recent years. This report assesses the incidence of HCC, compensation paid and use of waterbodies by local people. An area-specific action plan was also developed.

Nikhil Whitaker, *Curator, Madras Crocodile Bank Trust*,  
<nikhil.whitaker@gmail.com>.

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## Iran

**TRAPPED CROCODILES RELEASED.** Pishin Dam reservoir has been reported as the most reliable and main water resource for Mugger crocodiles (*Crocodylus palustris*) in Iran (Mobaraki 2004). After a long harsh drought the situation in the area appears to have improved, and over the past 3 years there has been considerable rain each year. However, due to the geographic characteristics of the area, severe flooding has occurred annually as a result of heavy rains.

Flooding has caused significant damage to main bridges, roads, villages and vegetation, and large amounts of mud and floating wood and timbers has entered Pishin Dam reservoir. The most significant flooding occurred in 2005, the first year after the drought. The main part of the Mugger crocodile population was distributed in this habitat, and high water flow caused some crocodiles to fall into the overflow pool (see Mobaraki 2006).

After months of waiting for water levels in the overflow pool to fall, all the crocodiles were captured by the relevant Provincial staff of the Department of the Environment (DOE) in Sistan and Baluchistan Province, from the cities of Zahedan, Chabahar and Sarbaz. Nine crocodiles were captured using nets (Fig. 1); 4 males (210, 220, 270, 274 cm TL) and 5 females (160, 180, 185, 260, 242 cm TL). It provided an opportunity to evaluate crocodiles living in the reservoir of the dam. The records have been exceptional during the past years in the country, indicating that the crocodiles had suitable habitat with good food and growth rates.

It took long time to capture all of the crocodiles, which appears to have caused considerable stress. Unfortunately, three crocodiles died (270, 225 and 185 cm TL) before they could be released into the Pishin Dam. Injuries were evident on the bodies of all crocodiles, indicating that they had attacked each other during their time in the pool which was decreasing in size and food availability daily.



Figure 1. Mugger crocodiles captured in the overflow pool of Pishin Dam. Photograph: E. Abtin.

As the size of the dam is extremely vast, it is quite difficult to monitor the entire area and crocodiles within it - it is even very difficult to see and find some crocodiles. But the ponds after the dam provide suitable habitats in which crocodiles can be found throughout the year. We are currently seeking support for any tracking equipment to monitor crocodile movements in the area (Mobaraki and Abtin 2007). Boats and other equipment are also supposed to be required by DOE to undertake monitoring.

Personnel at the dam kindly cooperate with DOE offices and inform them of any crocodile-related events. We greatly appreciate the efforts and assistance of our colleagues, local people and dam personnel in this work.

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## East and Southeast Asia

### Philippines

LIGAWASAN MARSH WILD CROCODILE RESEARCH PROGRAM LAUNCHED AT USM. The Ligawasan Marsh Wild Crocodile Research Program was successfully launched on 14 September 2007 at the College of Agriculture Annex AVR, which is headed by Dr. Cayetano C. Pomares (Project Leader). The launch started with a motorcade which included Kabacan LGU, officials of Barangays around Ligawasan Marsh, USM constituents with Kabacan PNP, and USM security force as marshals. The program will involve collaboration between The University of Southern Mindanao (USM) the Mabuwaya Foundation of Isabela Province, Northern Luzon [see CSG Newsletter 26(1): 13-14; 26(2): 13-14].

Vice President for Research, Development and Extension (RDE), Dr. Eugenio A. Alcalá delivered the welcome address, Dr. Conrado C. Evangelista (Dean, College of Agriculture-USM) the opening remarks, and Dr. C. Pomares (Fig. 1) presented an overview of the project. He reported that Ligawasan Marsh covers about 288,000 ha, of which 43,900 ha was declared a Game Refuge and Bird Sanctuary under the Forestry Administrative Order No. 19 of December 26, 1940 (effective January 1, 1941). The Ligawasan Marsh Development Master Plan (1999-2025), prepared by the Region XII Office of the National Economic and Development Authority (NEDA) in November 1998, recommended designation of the marsh as a protected area under the National Integrated Protected Area System (NIPAS) Act (Republic ACT No. 7586 of 1992).

The Honorable Jabib Guiabar, (member SB, Kabacan) and Datu Dima M. Ambel (Al Haj and Chairman of MNLF-ATMR-SKSRC) gave short inspirational messages. Prof. Charles A. Ross, crocodile specialist, spoke on crocodile conservation research in the Philippines. He emphasized the importance of the USM as the lead institution on crocodile research in the Ligawasan Marsh.



Figure 1. Project Leader Dr. Cayetano C. Pomares, giving the overview of the Ligawasan Marsh Wild Crocodile Research Project.

In all, 113 participants attended the project launch, comprising: 23 Local Government Units from Cuyapon (14), Omonay (2) and Kabacan (7); 58 students (Biology Club, Rodeo Club, etc.); 5 farmers; 15 USM faculty; and, 12 participants from support agencies (Crocodylus Porosus Philippines Inc., CSG).



Figure 2. A poster-making contest was undertaken during the CA day Anniversary in August. Raymund Corejado won first prize (2000 pesos) for his poster for crocodile conservation.

Part of the program was the poster-making award. Raymund M. Corejado, 3BSA Plant Pathology major student, won the first prize of P2000 (Fig. 2), and second place was awarded to Robert B. Pajate, 1BSIT, with 600 pesos. Apart from the major prizes, a special award for T-shirt printing on conservation by Leo Eroy of 2BSA

and other entries received 100 pesos each as consolation prizes. All entries centered on the theme of nurturing crocodiles as ecological animals with important roles to play in nature.

Dr. Cayetano C. Pomares, *Project Leader*,  
<cayetonop@yahoo.com>.

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**CROSS-VISIT TO LIGUASAN MARSH.** In May 2007 the University of Southern Mindanao (USM) Wild Crocodile Research Team visited the Municipality of San Mariano in Isabela Province [see CSG Newsletter 26(2): 13-14]. The CROC project in San Mariano is currently the only *in-situ* conservation effort for the critically endangered Philippine crocodile and can serve as a model for other areas in the Philippines.

In return, CROC project staff visited the Liguasan Marsh in North Cotabato Province in south-central Mindanao in October 2007. The Liguasan Marsh is one of the largest wetlands in the Philippines, covering approximately 280,000 ha. *Crocodylus mindorensis* and *C. porosus* are both recorded in the river channels, swamps and ponds that form the marsh. However, very little is known about the status of the crocodile populations here. Civil insurgency has made access to the marsh virtually impossible for outsiders for the past 40 years. As a public institution based in the province, USM is able to work in the marsh.

The delegation from Isabela Province consisted of Dominic Rodriguez, Jessie Guerrero, Marites Balbas, Bernard Tarun and Samuel Telan of the Mabuwaya Foundation and Dr. Myrna Cureg of Isabela State University. On 22 October 2007, the team visited the Davao Crocodile Park and the Balderama Crocodile Farm in Davao. In the afternoon of the same day, a meeting was held with Dr. Cayetano and his colleagues at the USM campus in Kabacan.

The following day the team visited the northern tributaries of Liguasan Marsh by motorized boat. A 2.5 m adult Philippine crocodile was observed basking along the bank of Moleta River at around 2 pm. Near Omonay village the team saw a Philippine crocodile nest of which 10 eggs had hatched the previous week (15 October 2007)(Fig. 1), suggesting differences in breeding ecology between the Luzon and Mindanao Philippine crocodile populations. In Luzon, *C. mindorensis* nests hatch in July. Six hatchlings from this nest are currently kept in captivity at USM, and the remaining four hatchlings are in the Moleta River. At night, a spotlight survey was conducted to practise survey techniques with the USM team; one adult *C. mindorensis* was observed, possibly the same individual that was seen during the day.



Figure 1. Philippine crocodile nest. The USM Wild Crocodile Research Team had placed a net around the nest to protect it from predators.

Local residents regularly see crocodiles in the marsh. Estuarine crocodiles are reported to occur in the marsh, but we have no reliable up-to-date information on the status of the *C. porosus* population. Several Philippine crocodiles are kept in captivity (eg at several resorts in the province) and hatchlings are occasionally captured for the local pet trade. This suggests the presence of a relatively substantial and reproducing *C. mindorensis* population, but also indicates several threats to wild crocodiles. Local people in the Liguasan Marsh generally tolerate crocodiles, which forms a solid basis for *in-situ* conservation action.

The USM team aims to raise the awareness of local people in the marsh, particularly on environmental legislation. A poster-making contest at USM has been a promising start (see previous article). In Isabela, community meetings have been effective in mobilizing local support for crocodile conservation, generate information on crocodile localities and build trust between local people and conservationists. In our view, an interactive communication strategy in combination with a comprehensive survey of crocodile populations in Liguasan Marsh is an important priority for Philippine crocodile conservation. USM is in a unique position to initiate and implement such an *in-situ* conservation program.

We would like to thank *Crocodylus Porosus Philippines Inc.* and the CSG for facilitating the cross-visit. We are looking forward to continuing our cooperation with the USM Wild Crocodile Research Team in the near future.

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## Science



### Recent Publications

Matthew K. Vickaryous and Brian K. Hall (2007). Development of the dermal skeleton in *Alligator mississippiensis* (Archosauria, Crocodylia) with comments on the homology of osteoderms. J. Morphology (in press).

**Abstract:** The dermal skeleton (5 exoskeleton) has long been recognized as a major determinant of vertebrate morphology. Until recently however, details of tissue development and diversity, particularly among amniotes, have been lacking. This investigation explores the development of the dermatocranium, gastralia, and osteoderms in the American alligator, *Alligator mississippiensis*. With the exception of osteoderms, elements of the dermal skeleton develop early during skeletogenesis, with most initiating ossification prior to mineralization of the endoskeleton. Characteristically, circumoral elements of the dermatocranium, including the pterygoid and dentigerous elements, are among the first to form. Unlike other axially arranged bones, gastralia develop in a caudolateral to craniomedial sequence. Osteoderms demonstrate a delayed onset of development compared with the rest of the skeleton, not appearing until well after hatching. Osteoderm development is asynchronous across the body, first forming dorsally adjacent to the cervical vertebrae; the majority of successive elements appear in caudal and lateral positions. Exclusive of osteoderms, the dermal skeleton initiates osteogenesis via intramembranous ossification. Following the establishment of skeletal condensations, some preossified spicules become engorged with many closely packed clusters of chondrocyte-like cells in a bone-like matrix. This combination of features is characteristic of chondroid bone, a tissue otherwise unreported among nonavian reptiles. No secondary cartilage was identified in any of the specimens examined. With continued growth, dermal bone (including chondroid bone) and osteoid are resorbed by multinucleated osteoclasts. However, there is no evidence that these cells contribute to the rugose pattern of bony ornamentation characteristic of the crocodylian dermatocranium. Instead, ornamentation develops as a result of localized concentrations of bone deposited by osteoblasts. Osteoderms develop in the absence of osteoblastic cells, osteoid, and periosteum; bone develops via the direct transformation of the preexisting dense irregular connective tissue. This mode of bone formation is identified as metaplasia. Importantly, it is also demonstrated that osteoderms are not histologically uniform but involve a range of tissues including calcified

and uncalcified dense irregular connective tissue. Between taxa, not all osteoderms develop by homologous processes. However, it is concluded that all osteoderms may share a deep homology, connected by the structural and skeletogenic properties of the dermis.

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Russello, M.A., Brazaitis, P., Gratten, J., Watkins-Colwell, G.J. and Caccone, A. (2007). Molecular assessment of the genetic integrity, distinctiveness and phylogeographic context of the Saltwater crocodile (*Crocodylus porosus*) on Palau. Conservation Genetics 8: 777-787.

**Abstract:** The saltwater crocodile (*Crocodylus porosus*) is the largest and most broadly distributed crocodylian species, and thus is of special conservation and economic interest. Similar to other parts of its range throughout the Indo-Pacific, *C. porosus* distributed in the Republic of Palau have experienced a severe population decline over the past century primarily due to commercial hunting and eradication campaigns. In addition, several thousand crocodiles of undocumented species and origin were imported into Palau during the 1930s for commercial farming purposes, potentially polluting the gene pool of the endemic saltwater crocodiles. Analysis of 39 individuals collected throughout the Republic of Palau revealed a single mitochondrial DNA control region haplotype shared by populations sampled in Sulawesi, Borneo and Australia. The mtDNA results, in combination with microsatellite genotypic data at six loci, detected no evidence for inter-specific hybridization between endemic Palauan *C. porosus* and potentially introduced *Crocodylus* species. There was no evidence for a genetic bottleneck in the Palauan population, however an excess of rare alleles was identified, indirectly suggesting a recent history of admixture potentially linked to introductions of non-native *C. porosus*. Following from these findings, Palauan *C. porosus* should be included in the single ESU previously established for all saltwater crocodiles given the recovery of a fixed, but geographically widespread haplotype. Although Palauan *C. porosus* exhibited significant genetic differentiation relative to all other sampled populations, its delineation as a distinct management unit is precluded at the present time by evidence that the genetic integrity of the population may have been compromised by the introduction of non-native saltwater crocodiles.

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L.A.K. Singh and S.K. Kar (2006). Status of the saltwater crocodile in Orissa: an overview. Journal of the Bombay Natural History Society 103(2-3): 274-285.

**Abstract:** Information on the historic occurrence of mangrove habitat and *Crocodylus porosus* in Orissa, have been discussed in three zones - the northern habitat, the Bhitarkanika habitat and the southern habitat. Presently, south of the Sundarbans in southern West Bengal, only Bhitarkanika holds *C. porosus* on the Indian mainland.

In the future, the mangrove habitat may survive or reappear in Orissa outside Bhitarkanika Sanctuary and National Park, but they hold no future for the saltwater crocodile nor can they ever regenerate the biodiversity associated with Bhitarkanika. In 1975, the State and Central Governments launched a crocodile research and conservation project at Bhitarkanika, with assistance from UNDP and FAO. The trends of population of crocodiles in captivity at Dangamal, and the population and nesting efforts in the wild in Bhitarkanika Sanctuary and National Park have been discussed. The subject of main-crocodile conflict has been mentioned from four angles: (i) human kills due to crocodiles, (ii) cattle kills due to crocodiles, (iii) people robbing wildlife-kills made by crocodiles and (iv) threat from humans against the nest-guarding trait of large crocodiles. The conservation programme could ensure the survival of crocodiles in Bhitarkanika since 1975, but for another fresh lease of life, the possibilities lie in managing the area as a Biosphere Reserve with sound programmes for ecodevelopment. Recommendations and management options have been given for captive crocodiles, wild mangrove habitat and anthropogenic pressure.

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Platt, S.G., Tasirin, J.S., Hunowu, I., Siwu, S. and Rainwater, T.R. (2007). Recent distribution records of Estuarine crocodiles (*Crocodylus porosus*) in northern Sulawesi, Indonesia. *Herpetological Bulletin* 100: 13-17.

**Abstract:** Little is known regarding the distribution and biology of crocodiles inhabiting the island of Sulawesi. As many as four species may inhabit Sulawesi, but the Estuarine crocodile (*Crocodylus porosus*) is the only species yet confirmed on the island. Although historic accounts suggest Estuarine crocodiles were once widespread and abundant, decades of unrestricted skin hunting, collecting to stock crocodile farms, and habitat degradation have reduced populations to scattered remnants. Comprehensive field surveys are lacking and there is a notable paucity of information regarding the current distribution of *C. porosus* on the island. We documented the occurrence of Estuarine crocodiles at three localities in northern Sulawesi during July 2006. These include two coastal sites (Cape Panjang and Kombat Village) and an inland river (Dumoga River). Crocodiles at coastal sites inhabit mangrove or grass swamps. The presence of small juveniles at one coastal site suggests that local population recruitment is occurring. We also visited a nest site along the Dumoga River where a clutch of 52 eggs was found by villagers. The nest was constructed in a bamboo thicket on a low ridge approximately 30 m from the river. All of the crocodiles that we examined lacked post-occipital scutellation, a character consistent with *C. porosus*. This is significant because others have described crocodiles in Sulawesi that exhibited prominent post-occipital scutellation, suggesting that at least one additional species of *Crocodylus* occurs on the island. Our observations and interviews with local villagers

collectively indicate that Estuarine crocodiles persist at scattered localities in northern Sulawesi, although the long-term viability of these populations is questionable.

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Mark Merchant, Stephanie Williams, Phillip L. Trosclair III, Ruth M. Elsey and Kaili Mills (2007). Febrile response to infection in the American alligator (*Alligator mississippiensis*). *Comparative Biochemistry and Physiology Part A* 148: 921–925.

Temperature probes were inserted into the stomachs of juvenile American alligators (*Alligator mississippiensis*) maintained outdoors at ambient fluctuating temperatures. Internal body temperatures (Tb) were measured every 15 min for two days, and then the alligators were injected with bacterial lipopolysaccharide (LPS), pyrogen-free saline, or left untreated. Alligators injected intraperitoneally with LPS exhibited maximum Tbs  $2.6 \pm 1.1^\circ\text{C}$  and  $3.5 \pm 1.2^\circ\text{C}$  higher than untreated control animals on days one and two after treatment, respectively. Tbs for these animals fell to within control ranges by day three postinjection. Similarly, mean preferred body temperatures (MPBTs) were significantly higher for LPS-injected alligators on days one ( $4.2 \pm 1.8^\circ\text{C}$ ) and two ( $3.5 \pm 1.6^\circ\text{C}$ ) after treatment. Intraperitoneal injection of heat-killed *Aeromonas hydrophila*, a gram-negative bacterium known to infect crocodilians, resulted in a fever while injection of *Staphylococcus aureus* (gram positive) did not elicit a febrile response. Injection of LPS in alligators maintained indoors in a constant temperature environment resulted in no increase in internal Tb. These results indicate that alligators did not exhibit a febrile response in the absence of a thermal gradient, and suggest that febrile responses observed are probably behavioral in nature.

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### Submitted Articles

DIFFERENTIATION OF CROCODILIAN SPECIES OF MEXICO USING AMPLIFIED FRAGMENT LENGTH POLYMORPHISM (AFLP). The 23 species of crocodilian are taxonomically divided into three families; Alligatoridae (8 species), Crocodylidae (14 species) and Gavialidae (1 species). Two crocodylids (*Crocodylus acutus*, *C. moreletii*) and one alligatorid (*Caiman crocodilus*) are represented in Mexico. The consanguinity and inter-breeding between the different species (eg *C. moreletii* x *C. acutus*) makes identification of hybrids difficult. The amplified fragment length polymorphism (AFLP) technique allows differentiation of the DNA of the three species by polymerase chain reaction (PCR) using restriction enzymes Taq I Eco IR. The main objective of this study was to differentiate the three species of crocodilian in Mexico, which are considered threatened due to various human and natural factors.

**Methodology:** In February 2000 we obtained samples from within the natural distribution of crocodilians in

Mexico, and extracted DNA blood and scutes from 5 of each of the three species (Sambrook *et al.* 1994). The AFLP technique was developed (Vos *et al.* 1995), and analysis undertaken on the polymorphic fragments in 8% polyacrylamide.

**Results and Discussion:** With the E33 and T33 combination, 32 different fragments were obtained: 5 were specific to particular species, (2 *C. acutus*, 2 *C. crocodilus*, 1 *C. moreletii*), 19 fragments were shared by two species (ie *C. moreletii/C. acutus*, *C. crocodilus/C. moreletii*, *C. acutus/C. crocodilus*) and 8 were common to the three species (Fig. 1).



Figure 1. Polyacrylamide gel (8%): Lanes 1 and 14 indicate a marker with molecular weight of 100 base pairs; Lanes 2 to 5 *C. acutus*; Lanes 6 to 9 *C. crocodilus*; and, Lanes 10 to 13 *C. moreletii*.

With the combination between T38 and E33, 38 fragments were obtained: 11 were specific to particular species (2 *C. moreletii*, 1 *C. crocodilus*, 8 *C. acutus*), 19 were shared by two species, and 8 were shared by the three species (Fig. 2).

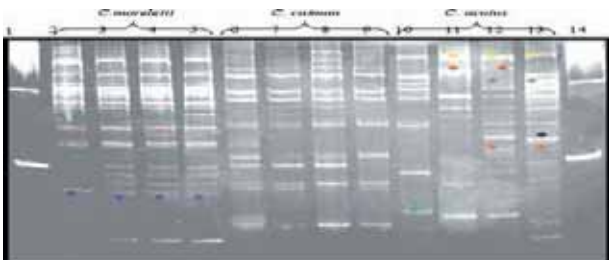


Figure 2. Polyacrylamide gel (8%) stained with ethidium bromide: Lanes 1 and 14 indicates marker with molecular weight of 100 base pairs; Lanes 2 to 13 product of selective PCR, combination of E33 to T38; Lanes 2 to 5 *C. moreletii*; Lanes 6 to 9 *C. crocodilus*; and Lanes 10 to 13 *C. acutus*.

Recent studies of genetic variability have been focused on separating these two families. For example, Ray *et al.* (2004) analyzed the low levels of nucleotide diversity in *C. moreletii* and evidence of hybridization in *C. acutus*. A question mark exists with species of hybrid appearance, as detected in captivity with atypical specimens of *C. acutus* (25%) and *C. moreletii* (3.1%) in Quintana Roo [see Villegas (2005)]. These results are very helpful to complementing the polymorphism analysis that has now demonstrated phenotypic and genetic differences and

hybridization. It is supposed that in this way, the fragments that are not common to the three species are specific markers for them.

**Conclusions and Perspectives:** The AFLP technique is able to reliably identify and differentiate the three Mexican species, as well as the different populations of each. The difference between fragments is specific for each species. The existence of hybrids and consanguinity in both captive and wild populations must be determined. It is proposed to select and sequence specific and common fragments of species to derive concrete and reliable reference markers, and compare band standards of typical and atypical individuals.

**Acknowledgements:** COR. M.C. SUBDIR. INVEST. Ramón Arturo Valdés Espinosa, M.C. Virginia Sánchez Monroy, García-Reyes, L.B. (translation).

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SEEKING CROCODILIAN OSTEODERMS AND TURTLE SHELL I am a Master's student working under Dr. Phil Currie at the University of Alberta (Alberta, Canada). My research interests include variation in dermal armor. This includes looking at the osteoderms of

crocodilians, turtles and ankylosaurs (a group of derived dinosaurs). I am currently looking at pathologies in these three groups and, as such, am searching for osteoderm specimens for thin sectioning. This, unfortunately, is a destructive process, albeit very informative with regards to inferring the biology of extinct organisms from bone. In addition to the focus on dinosaurs, my project will also add to the paucity of published literature on dermal pathology in turtles and crocodiles.

If anyone is able to aid me in acquiring crocodile osteoderm or turtle shell specimens for thin sectioning, I would be most appreciative. Of course, proper acknowledgment would be given to donators in any publication that arises from the study of their specimens and the thin sections would be returned to the lending institution. I have been able to acquire some crocodile material and, thus, am in more urgent need of turtle shell (fragments are welcome). If anyone is able and interested, please feel free to contact me.

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## OBITUARY

Douw "Swannie" Swanepoel  
(30 June 1958 - 11 September 2007)

Douw Swanepoel, better known as "Swannie" to most of us, joined the Kruger National Park (KNP) in 1982, and became a Wilderness Trails Ranger in early 1983. In December of the same year he was promoted to Section Ranger. During 1994 he was transferred to Olifants Camp where his career ended in 2001 due to staff restructuring in KNP. After leaving KNP, he spent a brief period of time with the Peace Parks Foundation before starting his own environmental consultancy company. Swannie was a keen athlete and was one of the first KNP Rangers ever to run the Comrades Marathon, and he also completed the Skukuza half-marathon five times.

During his career in KNP, he successfully completed the National Diploma in Nature Conservation (1986) and the National Higher Diploma in Nature Conservation (1995). This was followed by an MSc degree from the University of Natal (1999). His thesis "Movements, Nesting and the Effects of Pollution on the Nile Crocodile *Crocodylus niloticus* in the Olifants River, Kruger National Park" generated a couple of publications.

Because of his research and in-depth knowledge of crocodiles, Swannie invited to join the IUCN-SSC Crocodile Specialist, and presented some of his work at a meeting of the group in Singapore. He also appeared in four television documentaries based on the Nile crocodile.

During 2000 Swannie was commissioned by the South African Department of Water Affairs and Forestry to determine the impact of the raising of the Flag Boshielo Dam on the resident Nile crocodile population. His assessment led to a full-time baseline study being initiated to document the impact of the change in habitat on the crocodile population. He was also involved in the assessment of the impact resulting from the rehabilitation of the Massingire Dam in Mozambique on the crocodile population of the Olifants River in KNP and played a leading role in the planning of aerial surveys to determine the number and distribution of Nile crocodiles in the entire Olifants River system in the Mpumalanga and Limpopo provinces of South Africa. One of the last projects in which Swannie was involved was the creation of artificial basking sites above the full supply level of the Flag Boshielo Dam in an attempt to replace lost habitat. Unfortunately this project could not be finished in time.

Swannie was extremely knowledgeable in the use of computers. He recognised the value of mobile computers and the Cyber Tracker software way ahead of anybody else in KNP at the time. His efforts put and kept KNP way ahead of any similar organisation worldwide.

In mid-October 2005, Swannie was diagnosed with cancer of the esophagus and stomach. Towards the end of 2005, a week after receiving the Phalaborwa Chamber of Commerce's Newsmaker of the Year Award, he was admitted to hospital for major surgery. During surgery it was discovered that the cancer has spread more aggressively than expected and the difficult decision was made to remove his entire stomach and esophagus. A slow recovery period followed, involving the reconstruction of his esophagus and stomach, and chemotherapy. Swannie initially reacted well to the treatment but earlier this year the cancer returned and he passed away on 11 September 2007 at his home in Phalaborwa, South Africa.

Swannie was loved by a multitude of people, from all walks of life, and will remain in the hearts of those whose lives he touched forever. Swannie leaves behind his wife Louisa and two children, Jireh-Marì and Wessel.

Hannes Botha, *Olifants River Nile Crocodile Survey, Centre for Wildlife Management, University of Pretoria, South Africa, <nilecrocs@mweb.co.za>*.

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## Steering Committee of the Crocodile Specialist Group

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