

**CROCODILE  
SPECIALIST  
GROUP  
NEWSLETTER**

VOLUME 27 No. 2 • APRIL 2008 - JUNE 2008



# CROCODILE

# SPECIALIST

# GROUP

# NEWSLETTER

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VOLUME 27 Number 2  
APRIL 2008 – JUNE 2008

IUCN - Species Survival Commission

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COVER PHOTOGRAPH: Adult Yacare Caiman (*Caiman yacare*) at Crocoland, Santa Cruz de la Sierra, Bolivia.  
Photograph: Tom Dacey.

## CSG Newsletter Subscription

The CSG Newsletter is produced and distributed by the Crocodile Specialist Group of the Species Survival Commission of the IUCN (International Union for Conservation of Nature).

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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 Rachmat and Erik Wiradinata, Jakarta, Indonesia.  
 Yee Tai Leather Enterprise Ltd., Hong Kong.

## **19th CSG Working Meeting**

The 19th CSG Working Meeting was convened on 3-7 June in Santa Cruz, Bolivia, and was preceded by a CSG Steering Committee meeting on 2 June.

The CSG is very extremely grateful to the Beni Department Prefecture which hosted the meeting. The Organizing Committee (Karina Sauma, Alfonso Llobet, Silvia Ovando, Alvaro Velasco, Alejandro Franulic, Ana Karina Bello, Francisco Aguilera, Omar Rocha, Aleida Justiniano) and their support staff did a marvellous job in preparing and running a wonderful meeting.

None of this would have been possible without the generous financial support provided by the major sponsors; Programa Nacional de Biocomercio Sostenible (PNBS), Fundacion Amigos de Naturaleza (FAN), Prefectura del Departamento del Beni, Prefectura del Departamento de Santa Cruz, CIENSA, Curtiembre Moxos, Bolivian Leathers and Food, and Bolivian Croco. Additional financial and in-kind support was provided by the Buganvillas Hotel and ICEA.

### **Steering Committee Meeting (2 June) Minutes**

#### 1. Opening

The Chairman, Grahame Webb, opened the meeting at 0850 h. Agenda papers were available in advance online, with some spare copies and late papers for members and observers.

Steering Committee members present were: Grahame Webb, Dietrich Jelden, Alejandro Larriera, Tom Dacey, Perran Ross, Charlie Manolis, Alvaro Velasco, Carlos Piña, Sergio Medrano-Bitar, Bernardo Ortiz, Samuel Martin, Ruth Elsey, Allan Woodward, Don Ashley, Yoichi Takehara, Enrico Chiesa, Jorge Saieh, Jerome Caraguel, John Caldwell, Paolo Martelli, Kent Vliet, Val Lance, John Thorbjarnarson and Phil Wilkinson.

Apologies were received from: Richard Fergusson, Olivier Behra, Jenny Daltry, Nao Thuok, B.C. Choudhury, Asghar Mobaraki, Roberto Soberon, Ralf Sommerlad, Hank Jenkins, Yoshio Kaneko, C.H. Koh, Kevin van Jaarsveldt, James MacGregor, Fritz Huchzermeyer, Tomme Young, Harry Messel, Rom Whitaker, Rob Stuebing, Bruce Shwedick, Jiang Hongxing, Uthen Youngprapakorn, Toshinori Tsubouchi, Jon Hutton, Noel Kinler, Chris Banks, Steve Peucker and David Wilken. Some non-SC members also sent apologies; Mangal Shakya, Antoni Cadi, Antoine Joseph, Robert Godshalk, Manuel Tabet and Toby Ramos.

Observers present included: Vicki Simlesa, Merlijn van Weerd, Pablo Siroski, Gisela Poletta, Ivan Palacios, Hideki Sakamoto, Marc Gansuana, Giovanni Ulloa, Luis Bassetti, Hetty Abadie, Sally Isberg, John Caldaron, Ayan Ofance Rojano Ofanr, Hector Raigosa Villegas, Godfrid Solmu, Robert Sine, John Brueggen, Adam Britton, Craig Franklin, Jon Wiebe, Beatrice Martin, Chris Moran, Geoff McClure, Hernando Zambrano, Ari Palmo, Adriana Rivera, John Brueggen, Sonia Canto and Alfonso Llobet.

#### 1.1. Chairman's Report

The Chairman welcomed everyone to the meeting and thanked the workshop organisers, including representatives of Government, academic institutions, industry and NGOs. Particularly thanks were extended to Alfonso Llobet and Karina Sauma. He also passed on the personal best wishes from the Chair of the Species Survival Commission, Holly Dublin.

The Chairman drew attention to the activities of the CSG over the past two years, highlighting:

- CoP14 (The Hague, Netherlands, June 2007);
- Significant support provided by our donors and Wildlife Management International, which has enabled the CSG to build up its financial resources;
- Centralisation of the CSG in Darwin, Australia, including the financial arrangements;
- Proposed changes to the CSG regional structure and

Steering Committee, which will be required leading up to the IUCN Congress in Barcelona in October 2008;

- Successful West African sub-regional meeting held in Niger in 2007;
- Recent gharial mortality event in Chambal National Sanctuary, India; and,
- CSG reviews in Madagascar and Vietnam and proposed mission to Cuba in November 2008.

The meeting held one minutes' silence for two long-serving members who passed away: Dr. Tirtha Man Maskey (Nepal) and Douw "Swannie" Swanepoel (South Africa).

The Chairman drew attention to the large agenda and indicated that the agenda papers would be taken as read and opened for discussion and questions.

## 1.2. Minutes and Actions from CSG SC Meeting, Montelimar, France (19 June 2006)

Completion of actions from the previous CSG Steering Committee meeting were noted.

## 1.3. Executive Officer's Report

The EO highlighted: the composition of the Steering Committee; CSG membership (337 at May 2008); reviews (Madagascar and Vietnam and proposed mission to Cuba); CSG Newsletter (reduction to 300 hard copies under the new policy, >50% cost savings achieved); launching of new CSG website; and, the revised financial management arrangements. The report was noted.

## 1.4. Financial Report

The financial report highlighted the: current balance of around \$US320,000; transfer of the bulk of CSG funds to Darwin; resignation of Perran Ross as Treasurer; and, the strong and determined efforts to build up resources. It was reported that CSG member Rene Hedegaard (Krokodille Zoo) has advised that the temporary crocodile exhibition he helped establish at the Aquarium in Norway has turned out to be a great success. It is anticipated that it will generate a donation of around \$US25,000 to the CSG by October 2008, to be followed by a similar amount in 2009. The Chairman thanked the CSG donors, particularly the industry members, some of whom were present at the meeting. The report was noted.

## 2. Regional Reports

### 2.1.1. Africa

The report from the Regional Chairman for Africa, Rich Fergusson, was included in the agenda documents. Richard was unable to attend the

meeting. The report was noted.

### 2.1.2. West Africa Sub-Regional Meeting

Deputy Chairman, Dietrich Jelden, reported that the first West African sub-regional meeting held in Niger in November 2007, was a very important imitative that achieved the three major objectives:

1. To obtain a summary of the current and historical status of the three crocodile species distributed in countries of the West and Central African region;
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 networking 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.

Documented recommendations are included in the proceedings from the meeting and it is now proposed to hold a follow up meeting in Burkina Faso in 2009/2010 (see Letter 1, page 9)

Under the new CSG regional structure, Africa will be divided into two separate regions: West Africa (including the Francophone countries and Madagascar) and East and South Africa.

The report was noted.

### 2.1.3. Madagascar Review

The Chairman reported that crocodile conservation in Madagascar has been a very difficult management problem for both CITES and CSG for a long time. A CITES mission to Madagascar was undertaken in late 2006. In accordance with the recommendations of that mission, the CSG has commenced a follow up project to assist Madagascar implement the recommendations of the CITES Standing Committee. This review commenced in 2007, with funding support from several CSG donors. Christine Lippai has been engaged as the CSG Coordinator. Following consultation with the relevant stakeholders, the Madagascar Government has approved the work plan developed in consultation with the relevant stakeholders, a consultative Crocodile Management Committee established and field surveys are planned to commence in July-August 2008. The report was noted. [Letter 2 sent to CITES Standing Committee regarding progress with the workplan, see page 9].

#### 2.1.4. Uganda and Malawi: CITES SC Recommendations on Implementation of Resolution Conf. 11.16 (Rev. CoP14)

The report from Richard Fergusson was noted.

#### 2.2.1. East and Southeast Asia

Neither of the Regional Chairs was able to attend the meeting. The Chairman and Merlijn van Weerd provided an update on some of the activities in the Philippines with *C. mindorensis* programs, following the successful “Forum on Crocodiles in the Philippines” in February 2007.

Discussion was also held on the “intractable” problem in the whole region with *C. siamensis*. There are many captive breeding farms (>1000 in Vietnam, >900 in Cambodia, etc.), but few animals remaining in the wild. Conventional ways of dealing with the problem have met with little success, and perhaps more innovative options need to be examined (see Letter 3, page 10). It was agreed that it is a complex logistic situation and called for a roundtable discussion between the relevant countries (Thailand, Laos, Cambodia, Vietnam, China).

#### 2.2.2. China

The Regional Chairman Jiang Hongxing was unable to attend the meeting. John Thorbjarnarson provided an update on the Chinese Alligator reintroduction programs, workshop held in Shanghai in March 2008, slight but important increase in the wild population and nest production, and the establishment of a new breeding centre in Nanjing. Discussion was held on the possible use of funds held in the Chinese Alligator Fund. The CSG Executive is considering the suggestion of a public education poster and will discuss the proposal with Chinese representatives. The report was noted.

#### 2.2.3. Cambodia: Update on Implementation of Recommendations

The report from Fisheries Administration of Cambodia on the implementation of the recommendations of the 2005 CSG review was noted. Some progress had been made since the 18th CSG working meeting; some recommendations are ongoing.

#### 2.2.4. Vietnam Review

There are around 400,000 crocodiles in captive breeding facilities, which range from households with a few crocodiles to large breeding farms with over 30,000 animals. The concept of using small village holding farms is fully supported by the Government of Vietnam. The CITES-registered captive breeding facilities have working

arrangements with the small satellite farms, and the system raises many potential difficulties. It is recommended that a Regional Workshop be held to address the various illegal trade issues particularly trade with Cambodia without CITES permits.

#### 2.3.1. Latin America and the Caribbean

The report from the Regional Chairman, Alvaro Velasco, was noted.

#### 2.3.2. Colombian Farm Management

Sergio Medrano-Bitar presented the paper, explaining the proposed scute marking system being adopted in Colombia and highlighting:

- a. Marking of babilla (*Caiman crocodilus*) production - Resolution No. 923 May 2007;
- b. Marking of parental stock in Colombia - Resolution No. 221 of 2005, No. 1172 of 2004; and,
- c. Government initiatives being implemented to meet the requirements of the CITES Ranching resolution.

The Deputy Chairman, Dietrich Jelden, indicated that an analysis of the trade data, available publicly on the UNEP-WCMC website, indicates a substantial increase in Colombian exports of *Caiman crocodilus fuscus* skins, from 515,000 in 2003 to 926,000 in 2006. This raises significant questions in regard to compliance and enforcement, which needs to be addressed by Colombia and by the major importing countries, such as the European Union, Japan, USA and Singapore. The Chairman was requested to raise all concerns with Colombia and to offer such technical assistance from the CSG as the Colombian authorities may request (see Letter 4 sent to Minister, page 10).

#### 2.3.3. Brazil: Progress with *M. niger* Harvest Program

Sonia Canto from the Secretaria de Estado da Producao, Brazil, addressed the meeting, outlining the history of the *Melanoschus niger* program in Brazil and the current activities being undertaken in Mamiraua Reserve, following the successful downlisting of the species to Appendix II at CoP14. This includes experimental harvesting, and testing of the processes to ensure that the appropriate procedures are in place before a harvest program is implemented. There may be a possible extension of the management program into other areas.

#### 2.3.4. Cuba: Proposed Review of Crocodile Management

The report on the proposed CSG mission to Cuba in early November 2008 was noted.

### 2.3.5. Venezuela: *C. intermedius* Proposal

The EO advised that the following advice had only recently been received from the Venezuelan Government:

- a. The Ministry of Environment is not proceeding with a downlisting proposal for *C. intermedius* at this time. It wishes to further involve local communities into the conservation program and proposes to commence this process later in 2008 or early 2009.
- b. Government will soon create a new protected area in the Cojedes River area, which is one of the most important areas for *C. intermedius*.

The report was noted.

### 2.3.6 Ecuador: CITES Standing Committee Recommendations

There appeared to be two possible options for Ecuador:

- a. maintain the population of *Melanoschus niger* on Appendix II, which would require a submission by Ecuador to CoP15; or,
- b. return the species to Appendix I.

(See Letter 5 to Minister on page 12).

### 2.3.7. Paraguay: Latest Developments

Deputy Chairman Alejandro Larriera presented the report on the CSG mission to Asuncion, Paraguay, on 10 April 2008, regarding the self-imposed moratorium on trade. Paraguay has not formally presented a draft management plan for *Caiman yacare* to the CSG. Should it do so, it would be circulated to selected CSG members for review, and comments submitted back to the relevant Paraguayan authorities. [The management program was formally submitted to CSG and reviewed - see Letter 6 on page 12].

### 2.4. North America

The report was presented by the Joint Regional Chairs, Ruth Elsey and Allan "Woody" Woodward, clarifying the current situation with the requests to the USFWS for the reclassifications under the US Endangered Species Act in respect of *C. latirostris* by Argentina and *C. moreletii* by Mexico. The testing of bar codes on CITES skin tags by Louisiana was also mentioned. The report was noted.

#### 2.5.1. West Asia

The Regional Chairman for West Asia was unable to provide a report due to his wife being very ill. The Executive Officer briefly reported on information

that had been provided for Iran, Bangladesh and Sri Lanka.

#### 2.5.2. Indian Gharial

The Vice Chair of the Veterinary Science Group presented their report on the Gharial mortality events in the Chambal National Sanctuary, India, highlighting some of the difficulties with communication of the information. The Chairman thanked the CSG Veterinary Science Group, and particularly Fritz Huchzermeyer, for the excellent report. The report was noted.

#### 2.6. Australia and Oceania

The Regional Chairman Charlie Manolis presented the report, highlighting: the impact of cane toads on wild populations of Freshwater crocodiles in the Northern Territory; an outbreak of *Chlamydia* type disease two years ago which affected two farms in Darwin; and, the unknown status of Saltwater crocodiles in the Solomon Islands and East Timor. The report was noted.

#### 2.7. Europe

The Deputy Chairman presented the report, highlighting that John Hutton has advised that UNEP-WCMC is working with Daniela Lainez, a Masters student, to create a database of crocodile surveys in Africa. Jon is seeking support for this project by requesting CSG members to dig out all their survey reports from Africa and Madagascar and to submit them to this project. The finished product will be available for the future use of members. For further information e-mail Jon Hutton (jon.hutton@unep-wcmc.org). The report was noted.

### 3. Thematic Vice Chair Reports

#### 3.1.1. CITES

The report was briefly introduced by the Chairman, in the absence of Hank Jenkins, covering CoP14 (2007), 23rd CITES Animals Committee meeting (April 2008) and CITES Standing Committee Working Group on personal and household effects.

#### 3.1.2. Use of CITES Re-export Skin Tags

The paper was presented by the Executive Officer. Mr. Yochi Takehara explained the difficulty of implementing the re-export tag system in Japan and indicated that he would like the issue to be raised with the CITES Standing Committee when they are addressing the review of the Universal Tagging System. Dietrich Jelden, who is on the Standing Committee working group for this review, met with

industry members on 2 June to discuss solutions to this issue.

Enrico Chiesa raised an example of a recent problem experienced in the USA, where authorities were requesting individual tags on each “backstrap”. It was advised that if the USA has stricter domestic legislation, then they should advise the exporting countries accordingly. Don Ashley spoke briefly about some trade issues. The report was noted.

### 3.1.3. CoP14

The report was noted.

### 3.2.1. IUCN

The report was noted.

### 3.2.2. SSC Chairs Meeting

The Chairman, who attended this meeting, presented an outline of the structures within the IUCN, its core programs, and the SSC and how they impact upon the CSG and other Specialist Groups. The proposal to restructure each Specialist Groups into a Red List Group and a Conservation Action Group was generally opposed by the Specialist Group Chairs and the proposed restructure now seems to be “on hold”.

At the IUCN World Congress to be held in Barcelona in October 2008, it appears the current Chair of the SSC Chair Holly Dublin may be challenged. From a CSG perspective, Holly Dublin, herself a Specialist Group Chair, had demonstrated strong and sensitive leadership in a demanding position. She had always been an active source of advice and of both technical and administrative guidance to the CSG Chair when needed. Her views on the ways in which sustainable use can and is being incorporated into crocodylian conservation efforts have always been logical and sound. Under the circumstances he considered any challenge to the SSC Chair at this time was counterproductive and unwarranted, and that IUCN members attending the Barcelona Meeting should be mindful of the admirable and skilled performance of Holly Dublin with regard to the CSG if the re-election issue is contested.

It was stressed that perhaps the CSG has always been in an awkward position by not being a legal entity in its own right, which constrains CSG conservation activities in many ways. It was suggested that the way in which the Freshwater Turtle and Tortoise Specialist Group had established a foundation to support the FTTSG activities appeared to be a model that the CSG could follow. This matter is addressed further under Agenda Item 3.9 Legal Affairs.

## 3.3. Industry

Don Ashley presented the report, highlighting:

- a. Review of the Universal Tagging and small leather goods;
- b. Personal and Household Effects;
- c. Re-export tags;
- d. Current trade operations;
- e. Need for benefits to conservation and communities being integral to benefits to the commercial industry; and,
- f. Need for dedicated funding to take issues to the next level.

The report was noted.

## 3.4. Trade Monitoring

John Caldwell presented the report, highlighting:

- a. Information on the global trade in crocodylian skins is gathered by UNEP-WCMC from CITES Annual Reports and CFAZ;
- b. The latest IACTS report for 2006 is lacking information from Australia, Papua New Guinea and Japan. It demonstrates some disturbing sharp increases in trade from Colombia that do not appear to be explicable by substantial increases in farm production capacity and thus explanations from Colombia are needed.
- c. The lack of reporting from Papua New Guinea and Brazil places them in breach of CITES reporting requirements;
- d. Trade information is freely available on the WCMC website;
- e. Report on a study of the crocodile meat trade will be completed by the end of June 2008; and,
- f. The proposed “Directory” needs 20-30 farmers to trial the system.

The report was noted

## 3.5. Veterinary Science

Paolo Martelli has been appointed as the new Vice Chair of the Veterinary Science group, following the retirement of Fritz Huchzermeyer. Fritz will remain an active member of the group. Paolo presented the report, highlighting: the development of a list of veterinarians who are prepared to participate in the group and share information freely; and, development of a web-based capacity building manual to increase peoples’ capacities.

## 3.6. Red List Authority

The report was presented by John Thorbjarnarson and noted.

### 3.7. Zoos and Community Education

Kent Vliet presented the report, highlighting recent activities: funds for the Philippine Project in Luzon; funds for the Chinese Alligator project; funds for the gharial crisis in India; and, proposed website. The report was noted.

### 3.8. General Research

Val Lance presented the report, indicating that scientific research on crocodilians is increasing rapidly, which is very welcomed. There are many new crocodilian papers being published, and the number of quality students in Latin America is increasing. The report was noted.

### 3.9. Legal Affairs

There was discussion on the need to advance the proposed CSG Charter prepared by Tomme Young as a means of ensuring the proper management of the CSG and its legal status in the future. The report was noted.

## 4. Task Force/Working Group Reports

### 4.1. Tomistoma Task Force

The new CSG-TTF Chairman, Bruce Shwedick, was unavailable. Tom Dacey reported on the success of the CSG-TTF workshop held in Pattaya, Thailand, in March 2008.

### 4.2. Philippine Crocodile

In the absence of the joint Regional Chairs, Merlijn van Weerd provided an update on the CROC project in San Mariano, northern Luzon, and confirmed that funding had been secured to keep the project going for another year. Discussion was held on the matter of structural funding. The Chairman advised that projects based upon on continual donor funding are not sustainable and there is need to canvass how to get sustainable funding for projects. Tom Dacey provided a brief update on the successful nesting of *C. mindorensis* on the Mercado Farm in Mindanao. The report was noted.

### 4.3. Human-Crocodile Conflict

In the absence of Richard Fergusson, the Chairman spoke briefly on the subject of Human-Crocodile Conflict and the impacts that it can have on crocodile conservation projects. Reference was made to the recent HCC work undertaken by Nikhil Whitaker in India. It is intended to make this available on the new CSG website. The report was noted.

## 5. General Business

### 5.1. CSG Website

The new CSG website was launched on 27 May 2008 and all reports to date have been very favourable.

### 5.2. Electronic Crocodilian Journal

Very little action had been taken to progress this proposal since the last working meeting. Charlie Manolis suggested the formation a small working group to progress this matter and report back to the meeting. [The working group met on 3 June - see page 17].

### 5.3. CSG Newsletter

This matter was covered previously in the Executive Officer's report (Agenda Item 1.3, page 4).

### 5.4. Student Research Assistance Scheme

Following general discussion on the proposal, it was unanimously approved in principal and members were requested to get comments and suggestions back to the EO during the meeting. Perran Ross advised that he would donate \$AUD1000 towards the scheme. [See page 17 for details].

### 5.5. Crocodilian Management Capacity Building Manual

The Chairman advised that there was a pressing need for the CSG to make a wide range of information readily available on the new website and that it may be necessary for CSG to pay someone to coordinate the preparation of the Manual. It was agreed that this proposal should proceed.

### 5.6. Castillos Award

The Chairman advised that the Executive had considered several nominations and the successful recipient would be announced at the Bolivian Dinner on the evening of 4 June. [The Castillos Award was presented to Zilca Campos from Brazil; see page 16].

## 6. Other Business

The Chairman briefly advised members of the outcome of the matters discussed by the CSG Executive on 1 June. This included:

1. The need to restructure some of our regions and appointments of Steering Committee members, prior to the IUCN Congress (Barcelona, October 2008).



- a. It has been agreed to split Africa into two regions - "West Africa" and "East & South Africa".
- b. Proposed changes to the Latin America and Caribbean Region are under consideration.
- c. Appointment of new Regional Chairs for West Asia and East & Southeast Asia is also under consideration.

2. The Status and Conservation Action Plan is being reviewed and updated by Colin Stevenson.

3. The Philippine Crocodile and Siamese Crocodile Working Groups were disbanded.

4. A CSG Charter will be developed to guide the future operations and management of the CSG, leading to the creation of a Foundation to handle the financial affairs of the CSG.

7. Next CSG Working Meeting (2010)

Approaches are being made to find a host for the 20th Working Meeting and members will be advised when a venue has been determined.

No other business was raised and the meeting closed at 1730 h.

[Minutes of the Steering Committee meeting are available at "www.iucncsg.org/ph1/modules/Publications/reports.html"]

**Letter 1: Burkina Faso Regional Meeting**

Mr. Alain Edouard Traore 27 June 2008  
 Conseiller des Affaires Etrangeres  
 Le Secretaire General  
 Du Ministere de L'Environnement  
 Et du Cadre de Vie  
 Burkina Faso

Dear Mr. Traore,

Thank-you for your letter of 11 June 2008 regarding the proposed West African CSG sub-regional meeting at Ranch du Gibier de Nazinga in Burkina Faso, together with the names of members of the organising committee. I wish to gratefully thank the Government of Burkina Faso for undertaking to host this meeting.

We would be interested to know your preferred dates for convening this meeting. The CSG would like to suggest late 2009 (November) or early 2010 (January-February) as possible dates for your consideration.

The CSG is still holding \$US3500 that was raised through the auction at the CSG meeting in 2006, to assist your proposed meeting. Whilst we can increase this contribution to a total of \$US7000, as previously promised, it will be necessary for your organisers to seek support funding from other sources.

Recognising the importance of crocodile issues in West Africa, at the recent CSG meeting in Bolivia (2-7 June 2008) a decision was made to recognise West Africa as a CSG region. Dr. Samuel Martin was appointed as CSG Regional Chairman for West Africa. Dr Martin (s.martin@lafermeauxcrocodiles.com) and the CSG Executive Officer Tom Dacey (csg@wmi.com.au) should be considered as CSG contacts for the meeting.

Yours sincerely,  
 Dr. Grahame Webb  
 Chairman, IUCN-SSC Crocodile Specialist Group

**Letter 2: Chairman of CITES Standing Committee regarding Madagascar**

H.E. Sr. Cristián Maquieira 26 June 2008  
 Presidente del Comité Permanente de la CITES  
 Dirección de Medio Ambiente  
 Ministerio de Relaciones Exteriores  
 Santiago  
 Chile  
 E-mail: cmaquieira@minrel.gov.cl; cmaquieira@yahoo.com

Re: SC57 Doc. 22 - Ranching Operations (Madagascar)

Dear Sr. Maquieira,

The following information is provided for the 57th meeting of the CITES Steering Committee. It is intended to supplement information provided by the CITES Management Authority of Madagascar, and relates specifically to a workplan developed to comply with SC recommendations.

1. In September 2007, a CSG Mission [Christine Lippai (CSG project coordinator), Charlie Manolis (CSG Regional Chairman Australia and Oceania), Dietrich Jelden (CSG Deputy Chairman)] visited Madagascar to assist the Government of Madagascar to implement the recommendations of the SC. A draft workplan was discussed with stakeholders, and formally adopted by Government at a roundtable workshop. A copy of the workplan was provided by the Government of Madagascar to the CITES Secretariat, to document its commitment to overall improvement of the current situation and to indicate its agreement with the SC recommendations. The adopted workplan as you know has been made available by the CITES Secretariat as SC57 Doc. 22 Annex to all participants of the 57th meeting of the CITES Standing Committee.

2. A preliminary analysis of nesting data collected during the 2007 CSG mission indicates a decline in nesting effort (40-50%) between 1996 and 2003 in one of the key nesting areas in Besalampy. Counts undertaken during an opportunistic aerial survey of crocodiles in the Mahavavy River conducted during the September 2007 CSG mission also suggest similar declines since the last aerial survey was undertaken in 1997.

3. Additional information provided by industry are currently being assessed with a view to developing a more defined reporting and monitoring system for the egg harvest this year.
4. In March 2008 the CSG project coordinator, Christine Lippai visited Madagascar again. Since the previous CSG mission there had been several staff changes, including the Director General of DGEEF, and links were re-formed with new personnel. Government and Industry reaffirmed their commitment to improving the management of *C. niloticus*, and various workplan activities were planned.
5. Population monitoring surveys have been organized to be carried out between 20 July and 10 August 2008, with funding being provided by the German governments Agency for Technical Cooperation (GTZ) and industry, and involving international (CSG) and national consultants. These surveys will provide baseline data on which an annual monitoring program will be developed, and allow population size and structure to be quantified. Training will also be provided to national counterparts.
6. Assessment of crocodile ranch production and development of a monitoring system for skins and/or products will also be progressed during July-August 2008. A study to quantify and assess human-crocodile conflict in different regions of the country has also been initiated.

The information which will be collected in the next few months will definitely serve to provide a more in depth report by the Government of Madagascar to the 58th meeting of the CITES Standing Committee as decided by the Committee by postal procedure based on the recommendations contained in SC55 Doc. 13. I would therefore not object if this letter would made available to the attendants of the Steering Committee as an information document.

The major challenge currently in front of the Malagasy Government is the implementation of a management plan suited to the specific needs of this large, poor country, which could include an unconditional transfer of *C. niloticus* to Appendix II at CoP15, with establishment of a sound sustainable wild harvest and overall improvement of the ranching scheme.

Again I do hope that this additional information provided through this note might be useful for the discussions of agenda item 22 at the forthcoming 57th meeting of the CITES Standing Committee for which I would like to wish you all the best.

Yours sincerely,  
 Dr. Grahame Webb  
 Chairman, IUCN-SSC Crocodile Specialist Group

cc.: CITES Secretariat, Mr. Willem Wijnstekers

**Letter 3: Cambodia and *Crocodylus siamensis***

H.E. Dr. Nao Thuok  
 Director General, Department of Fisheries  
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 Phnom Penh  
 Cambodia  
 Email: naothuok.fia@maff.gov.kh

29 June 2008

Dear Nao,

Our recent Crocodile Specialist Group meeting in Santa Cruz was very successful and it was regrettable that neither you nor Heng Sovannara was able to attend and participate. At the CSG Steering Committee meeting discussion was also held on the "intractable" problem in the East & Southeast Asia Region with *C. siamensis*. There are many captive breeding farms (>1000 in Vietnam, >900 in Cambodia, etc.), but few animals remaining in the wild. Conventional ways of dealing with the problem have met with little success, and perhaps more innovative options need to be examined. It was agreed that it is a complex logistic situation and called for a roundtable discussion between the relevant countries (Thailand, Laos, Cambodia, Vietnam, and China).

You may remember that I emailed you in September 2007 with the idea of the CSG buying some *C. siamensis* hatchlings, mark them distinctively, and release them to the wild. It is our understanding that the price paid for hatchlings now is much reduced, and that as a consequence, it may be economically possible to buy a few thousand. The appearance of any of these animals in trade or on farms would obviously need to be a serious offence. I would like to pursue this idea with you further and would appreciate any ideas that you might have on this proposal.

Yours sincerely  
 Dr. Grahame Webb  
 Chairman, IUCN-SSC Crocodile Specialist Group

**Letter 4: Colombian Minister of Environment**

Ministro Juan Lozano Ramirez,  
 Ministerio de Ambiente, Vivienda y  
 Desarrollo Territorial,  
 Calle 37 #8-40, Piso 4,  
 Bogota, Colombia  
 ministro@minambiente.gov.co  
 fax: 57.1.332 34 00

17 June 2008

Dear Minister,

re: Issues concerning Colombia at the 19th Working Meeting of the IUCN-SSC Crocodile Specialist Group (Santa Cruz, Bolivia 2-7 June, 2007)

At the 19th CSG Working Meeting, progress in the conservation, management and sustainable use of crocodilians in different countries was reviewed by the 220 attendees from 26 countries

involved in the meeting. With regard to Colombia, the following issues were discussed/resolved:

1. The CSG applauds the recent crocodylian conservation initiatives reported from Colombia, particularly the ranching program for *Caiman crocodilus fuscus* and the research programs with *Crocodylus acutus*, both of which involve local communities and generate benefits that help the livelihoods of rural people.
2. The CSG also welcomes the new regulations and initiatives concerning the marking of captive-bred hatchlings (“scar” identification) and inventory of adults, as part of Colombia’s commitment to ensuring international trade in Caiman skins from Colombia is legal, verifiable and sustainable.
3. As you may be aware, CITES trade statistics are analysed by the World Conservation Monitoring Centre (WCMC) in the UK, and the data are publicly available on the WCMC website. The CSG has been asked to comment on the latest WCMC assessment for world trade in crocodylians skins, which for Colombia indicates some disturbing trends with 2006 exports of Caiman skins (attached):
  - (a) In 2006 with the lifting of Colombia’s self-imposed quota, exports of whole skins increased from 560,115 in 2005 to 925,835 in 2006 (60%; 365,720 skins), flanks from 78,824 to 89,791 (14%; 10,967 flanks) and tails from 44,615 to 49,051 (10%; 4436 tails).
  - (b) This does not appear to be explicable by any major expansion in farm production capacity prior to 2006, and could indicate that a significant number of wild-harvested animals and skins entered trade in contravention of Colombian legislation.
  - (c) The numbers of flanks in trade, which come from Caiman larger than the 1.2 m maximum size limit self-imposed by Colombia, does not appear to be explicable by even a 10% recycling of adult breeding stock on farms (total stocks thought to be around 110,000 adults), nor by the raising of Caiman to this size on farms which appears uneconomic. It could again indicate significant wild harvest is involved.
  - (d) CSG members who have been involved in inspecting shipments of Caiman skins from Colombia (as part of their duties in the CITES Management Authorities of importing nations) indicate it is common for skins from large Caiman to have the tails cut off so that the skins are less than 1.2 m (rather than the animals from which they came being less than 1.2 m). The large tails, in turn, are exported separately, but also cut to ensure they are less than 60 cm long, so they appear to be from animals <1.2 m, but clearly come from much larger animals.

The CSG wants to ensure that you are aware of these potential difficulties, namely that the number of skins exported in 2006 appears well in excess of what can be produced through captive

breeding and that the size of skins exported may often exceed the size limits established by Colombia.

The CSG also discussed various actions that could improve implementation of Colombia’s Caiman breeding program and increase compliance with Colombian national legislation:

- (i) To implement stronger sanctions nationally against people who do not comply with Colombian legislation concerning the size of Caiman which can be legally exported and traded.
- (ii) To investigate mechanisms through which the skins exported are inspected with regard to ensuring compliance with the size limits imposed by Colombia.
- (iii) Until appropriate enforcement mechanisms with regard to the size of Caiman that can be legally exported from Colombia are in place, to prohibit trade in flanks, tails and skins with incomplete tails.
- (iv) To develop and test definitive enforcement tools for estimating the size of Caiman from whole skins, flanks and tails, in both raw and processed form [a morphometric study which the CSG can assist if requested to do so].
- (v) To continue with the marking of captive-bred hatchlings (“scar” identification) and implement export controls requiring the tail tip and “scar” to be included with each skin. [A research study aimed at identification of original scars (legal) versus recent scars (illegal), in raw and processed skins, is now underway in Argentina with Caiman species].
- (vi) Obtain an estimate of the number of Caiman raising stock on farms now (2008) without “scars” (that is, animals hatched prior to 2007), which should disappear from trade by 2009-2010, by which time all skins in trade from Colombia should have a “scar” identification.
- (vii) Obtain an estimate of the numbers of larger Caiman on farms (>1.2 m; mainly breeding stock) and the rate at which they are killed and/or die, so that a future quota on skins greater than 1.2 m can be developed.
- (viii) Seek assistance from the Parties to CITES with the implementation of Colombia’s 1.2 m size limit by providing them with the enforcement tools to rapidly estimate the size of animal from skins and/or pieces of skin in the export shipment [see (iv) above].

Please be assured Minister, that the CSG fully supports your Government’s efforts to conserve, manage and sustainably use Caiman, and to overcome perceived difficulties with Colombia’s management program. Within the limits of CSG capacity, we will continue to assist Colombia where possible.

As advised previously, there is no conservation barrier to Colombia legalising elements of wild harvest within their

program. Captive breeding, ranching and wild harvest are all involved in management programs for crocodilians in other countries (eg American alligators in USA, Yacare caimans in Bolivia, Saltwater crocodiles in Australia and Papua New Guinea), reducing incentives to take and trade illegally.

In summary, WCMC analyses of world trade in crocodilian skins, using public data, have highlighted potential anomalies with Colombian exports. The CSG has been asked to comment upon them. The issue was discussed openly and transparently by CSG members, and the results will form part of the minutes of the CSG Working Meeting. Accordingly, the CITES Secretariat and CITES Management Authorities of the major importers of Colombian Caiman skins (eg European Commission, Japan, Mexico, Singapore and Thailand) will be fully informed about the WCMC analysis and the CSG concerns extended to you through this letter.

We look forward to any attention/clarification you can provide, and remain,

Yours respectfully  
Dr. Grahame Webb  
Chairman, IUCN-SSC Crocodile Specialist Group

Copies: Claudia Patricia Mora Pineda (cmora@minambiente.gov.co); Maria del Pilar Pardo (mpardo@minambiente.gov.co)

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**Letter 5: Ecuador Minister**

Dra. Marcela Aguiñaga  
Ministra del Ambiente del Ecuador  
Avenidas Amazonas y Eloy Alfaro  
Edificio del Ministerio de Agricultura, Piso 8  
Quito  
Ecuador  
Email: pgaliano@ambiente.gov.ec

10 de Junio, 2008

Estimada Señora Ministra,

El Grupo de Especialistas de Cocodrilos de la Comisión de Supervivencia de Especies de la UICN le envía un cordial saludo desde la 19ava Reunión Mundial de Trabajo realizada en Santa Cruz de la Sierra, Bolivia.

El motivo de esta carta es consultarle sobre los planes del gobierno del Ecuador con relación al estatus del caimán negro *Melanosuchus niger* desde que en 1994 la 9º Conferencia de las Partes de CITES aprobó, por primera vez para la especie, el paso del Apéndice I al Apéndice II para las poblaciones del Ecuador exclusivamente, con cuota cero. Ante la desaparición de la empresa comercial sobre cuyo plan de manejo de la especie se hizo el traslado del Apéndice I al II de CITES, permanece entonces la duda en la comunidad internacional sobre la validez y la utilidad de la permanencia de las poblaciones ecuatorianas del caimán negro en el Apéndice II de CITES. Por este motivo, quisiéramos conocer los planes que tiene el gobierno ecuatoriano con el estatus especial que le

otorga el Apéndice II de CITES a las poblaciones ecuatorianas de esta valiosa especie.

La preocupación de la comunidad internacional sobre la situación del programa de caimán negro en Ecuador no es nueva, ya que vuestro país estuvo incluido en nuestra gira de revisión sobre diferentes países latinoamericanos, y en el informe con los resultados de la misma, en virtud de las entrevistas mantenidas con las autoridades se expresa sobre el programa que: "El Ministerio considera que debe ser revisado y adaptarse a las nuevas realidades el proyecto original del ranching o recolección de neonatos, basándose en la experiencia obtenida durante los años, se debe continuar con el monitoreo de las poblaciones naturales y realizar una evaluación de las potenciales áreas de reproducción de la especie en su hábitat natural, para posteriormente tomar una decisión sobre el futuro de la cría en granjas con fines comerciales del *M. niger* en el país". Una copia de este reporte fue entregada a las autoridades ecuatorianas en el año 2005, a pesar de lo cual vemos que no se ha avanzado en ninguna de las actividades, por lo que interpretamos que no existiría intención de proseguir con la actividad en el país, debiendo considerarse la posibilidad de re-clasificar la especie nuevamente en el Apéndice I de CITES.

Le reiteramos nuestra mejor voluntad de colaboración y buena predisposición, para asistir a Ecuador en la conservación y manejo de las especies de cocodrilos del país, cuando su administración así lo requiera.

Cordialmente  
Dr. Grahame Webb  
Presidente, Grupo de Especialistas de Cocodrilos de UICN

Copia Dr Manuel Bravo Subsecretario Capital Natural  
Secretariado CITES  
Comité de Fauna de CITES  
Email: cites@ambiente.gov.ec

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**Letter 6: Paraguay CITES Management Authority**

Mr Carlos C. Ovelar  
Asesor del Ministro  
Secretaria del Ambiente (SEAM)  
Presidencia de la Republica  
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Asuncion  
Paraguay  
E-mail: covelar@gmailcom; covelar@seam.gov.py

25 June 2008

Dear Senior Ovelar,

Re: National program for the management of *Caiman yacare* in Paraguay

In response to your letter of 6 June 2008, concerning the "National Program for the Management of *Caiman yacare* in Paraguay", I take pleasure in advising you that:

1. A preliminary draft of the management document was

considered at the CSG Steering Committee Meeting in Santa Cruz, Bolivia, on 2 June 2008.

2. The draft management document was then circulated to a team of CSG members for more detailed review and comments (Alfonso Llobet Querejazu, Alvaro Velasco, Carlos Piña, Charlie Manolis and Dietrich Jelden), and the response coordinated by the CSG Deputy Chairman, Alejandro Larriera.
3. The detailed comments received back from the CSG review process are attached with this letter for your information and consideration. We hope it will help you in your quest to improve the National program.
4. In overview, the current program is considered to be a significant improvement on the previous program from 2004. It is more realistic and should be easy to implement, providing that the enforcement activities are themselves properly implemented. The program should generate economic incentives for local communities, and we hope that this will ensure that they are more actively involved in conservation, not just of the species, but also of the ecosystem that it inhabits.
5. Although the reviewers' comments and minor corrections on the draft document are attached, the most important issues in the view of the reviewers are:
  - (a) The statement below, which on page 22 in the summary report of the 50th meeting of the CITES Standing Committee (<http://www.cites.org/eng/com/SC/50/E50-SumRep.pdf>), should be included in the 'Background' of the document "In relation to Paraguay, the Committee recognized the efforts undertaken by this Party to implement the actions identified in the action plan. It acknowledged that, until the Secretariat and Paraguay were jointly satisfied that sufficient remedial action had been taken, Paraguay would maintain its moratorium in place. With regard to exports of existing stocks of legally acquired reptile specimens, these would be authorized provided that the Secretariat, in cooperation with the IUCN Crocodile Specialist Group, was satisfied that the conditions mentioned by Paraguay were fully met, i.e. the implementation of management plans and the establishment of solid bases to ensure the internal control of trade".
  - (b) Consideration should be given to basing the program on the utilization of the largest size class (Class IV) only. Exploitation of Class II individuals, as well as Class IV animals, could be unsustainable on the one hand and be almost impossible to control on the other.
  - (c) Both monitoring and harvesting dates should be specified. It is also recommended that monitoring surveys only be carried out before the harvest, between 30 to 60 days prior to the hunting season,

in order to determine the quotas. Surveys after the harvest should not be required.

- (d) It is not clear why a time limit of 5 years has been placed on the harvest program, and that it be replaced by a farming/ranching program by that time. If the wild harvest program is sustainable, it should be able to continue indefinitely.
- (e) A mechanism to prevent the laundering illegal skins must be implemented. The placing of tags on skins after tanning will definitely not suffice for this purpose.. The preferred way of doing this is to implement a tagging system which begins at the time of hunting, and which continues all the way through tanning, until the time of export of the skins. Such a tagging system is now approved in Argentina and is also about to start in Bolivia.

The proposal makes no mention about the current stockpiles of *Caiman yacare* skins held in Paraguay since 2003.

The CSG agrees that the program presented by SEAM is a positive step forward, as long as the recommendations and modifications proposed in this review are taken into account. We are thus now prepared to support any agreement on the stockpile reached between the CITES Secretariat and the Paraguayan Government.

Yours sincerely,  
Dr. Grahame Webb  
Chairman, IUCN-SSC Crocodile Specialist Group

### **Working Meeting (3-6 June 2008)**

Attendance at the working meeting consisted of around 220 people from 27 countries (Australia, Argentina, Bolivia, Papua New Guinea, Japan, Thailand, USA, Mexico, Panama, Colombia, Venezuela, Paraguay, Guatemala, Uruguay, Brazil, Germany, Netherlands, Spain, Hong Kong, Italy, France, United Kingdom, Costa Rica, Ecuador, Madagascar, Guyana, Denmark). In particular, there was good representation from Latin America.

Oral presentations were organised into discrete sessions (see below), together with a poster session.

- Conservation, management and sustainable use of crocodiles in Bolivia
- Conservation, management and sustainable use of crocodiles in Latin America
- Trade and impacts on crocodiles
- Systematics, taxonomy and genetics of crocodiles
- Genetics and immunology of crocodiles
- Breeding in crocodiles
- Population status of crocodiles
- Endangered species actions
- Miscellaneous

Four workshops were organised, dealing with:

1. Sustainability criteria (environmental, social, economic) for the success of national management programs.
2. Local organisations in conservation and management of crocodilians.
3. Aspects affecting the sustainability of crocodilian trade.
4. Management plans as conservation tools in Latin America.

In addition, the CSG's Veterinary Science (Vice Chair, Paolo Martelli) and Zoos and Community Education (Vice Chair, Kent Vliet) groups met during the course of the meeting. Merlijn van Weerd took the opportunity to convene a meeting of interested people to discuss conservation and management of the Philippine crocodile.

The deliberations of each workshop and thematic group were summarised at the end of the working meeting.

No CSG meeting would be complete without the various social activities, and this meeting was no exception. Monday's welcome function featured classical "baroque" music and singing by the "Coro y Orquesta de San Javier", and the following night's dinner included rock band "Track". On Wednesday, typical Bolivian cuisine featured at "La Casa del Camba", where traditional dancers provided entertainment.

#### Auction

After participants had dined on a range of local foods (and drinks) at La Casa del Camba, auctioneers Joe Wasilewski and Carlo Piña "extracted" \$US3003 for various articles donated by people for the CSG auction. These funds will be contributed towards important research being undertaken on Indian gharial to better understand the cause of the recent mass mortality in the Chambal River.

The auction is proving to be a popular event, and is set to become a permanent feature of future CSG working meetings.



Figure 1. From left; Yoichi Takehara, Hideki Sakamoto and Dietrich Jelden.



Figure 2. A large Argentinian contingent participated in the meeting, including: from left, Guillermo Principe, Noelia Nuñez (behind), Gisela Poletta, Virginia Parachu and Josefina Iungman. The girls also assisted CSG auctioneers Joe Wasilewski and Carlo Piña during the auction at La Casa del Camba.

#### Field Trip

Crocoland S.R.L., the first crocodilian farm established in Bolivia, was visited during the field trip on 7 June. About 29 km out of Santa Cruz, Crocoland has been in operation since September 2006, starting with 1600 female and 400 male adult *C. yacare* extracted from the Bolivian Pantanal (Fig. 3). Breeding stock are held in 8 lagoons at the farm. Farm stocks are derived from captive breeding and ranching of eggs (Fig. 4).

Hosted by owners Jorge Baldivieso V., Jorge Baldivieso O., Carlos Ormachea and Alejandro Franulicto, the farm visit was preceded by a magnificent barbeque at the adjacent San Juanito, giving participants a chance to "wind-down" and enjoy more Bolivian hospitality (Figs. 5-11).



Figure 3. Adult *Caiman yacare* in one of the breeding enclosures at Crocoland prepare to be fed.



Figure 4. Hatchling *Caiman yacare* at Crocoland are derived from captive-laid and ranched eggs.



Figure 7. Carlos Piña (left) and “Woody” Woodward (right) enjoy a moment together.



Figure 5. Alvaro Velasco (left) with Crocoland owner Jorge Baldivieso and his daughter, Daniella de Franulic.



Figure 8. From left; Vicki Simlesa, Sally Isberg and Mitch Eaton.



Figure 6. From left; Tom Dacey, Val Lance and Paolo Martelli.



Figure 9. From left; Antonio Castro, Rafael Antelo and Gustavo Villaroel.



Figure 10. Alfonso Llobet (with 10-month-old son Matías) finally gets to relax after months of preparing and organising of a very successful CSG meeting.



Figure 11. From left; Adam Britton, Rene Hedegaard and Kent Vliet. Rene's efforts in fund-raising have resulted in a significant donation to the CSG over the next two years (see page 4).

#### Castillos Award

Zilca Campos from Brazil became the latest recipient of the Castillos Award for her significant contribution to crocodylian biology, management and conservation (Fig. 7). Zilca's dedication and significant contribution are summarised by long-time colleague Alejandro Larriera:

“When one sees Zilca Campos at some international meeting, it is easy to make the mistake her as simply another enthusiast and young researcher who attends workshops and conferences trying to learn something, and to know about the “great” researchers of the CSG. Even if you speak with her, she will ask more about your work and research and be more interested in your results and successes, rather than being proud of her own successes, of which there have been many.

For over 20 years Zilca has worked enthusiastically, as much in the field as in the office, for the conservation of South American caimans. At times she has studied species of

economic importance such as *Caiman yacare*, with results being applied to programs of use and management. More recently she has concentrated on species with no commercial value, such as *Paleosuchus*.

Whatever her line of work, the common denominator always has been her professionalism, stability, capacity to learn, and ability to work in a team - and luckily for all of us, also her ability to teach. And in this regard, it is worth clarifying that Zilca not only teaches us what she knows, but much more importantly she serves as example not only for young people starting in these activities, but also for ourselves. I hope there is still time to follow her lead.”



Figure 12. Zilca Campos receiving the Castillos Award from CSG Chairman Grahame Webb (left) and Deputy Chairman Alejandro Larriera (right).

### **Harold Nugent Receives Conservation Steward Award**

The Alachua Conservation Trust has selected CSG member Harold Nugent (USA) for its annual Conservation Steward award for 2008. The award is given to people considered to be “role models in the field of land conservation, historic conservation, and environmental education”. Harold has helped thousands of students understand the role of alligators in the ecosystem, taking live alligators and crocodiles into “classrooms” throughout the region. Congratulations Harold.



## New CSG Journal calls for Papers

The development of a journal devoted to crocodylians was first discussed at the 18th CSG working meeting (France, June 2006). However, little progress was made until the 19th CSG meeting (Bolivia, 2008; see page 9), when a small working group discussed the issue further and initiated a series of actions.

Guidelines for an online CSG journal, named *Crocodylia*, have now been developed, and together with other information will soon be available on the CSG website ([www.iucncsg.org](http://www.iucncsg.org)). In the interim, details can be obtained from Charlie Manolis ([cmanolis@wmi.com.au](mailto:cmanolis@wmi.com.au)).

The goal of *Crocodylia* is to provide an international forum for the publication of articles on crocodylian research. The journal is intended to have a broad focus, ranging from pure biology and ecology to management and conservation issues.

*Crocodylia* invites contributions of original research, reviews on current management and conservation issues, methods or techniques papers and editorials. Recognising the extent of important “grey” literature that remains unpublished and unavailable to crocodylian researchers, *Crocodylia* will consider such articles for publication. All papers will be peer-reviewed.

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## CSG Launches “Student Research Assistance Scheme”

The CSG’s Student Research Assistance Scheme (SRAS) has been developed with the specific goal of encouraging and assisting undergraduate and post-graduate students to undertake formal research on crocodylians, particularly field research. The CSG recognizes that crocodile research often involves a greater commitment of resources and time by students, relative to many other subjects, and believes that this justifies efforts to assist. This is the type of research that gives students the skills needed to assist crocodile conservation and to become active CSG members in the future.

The SRAS will provide up to \$US1000 per year to a limited number of projects that meet the criteria for assistance. The grant is not designed to fully fund projects, nor to sustain them over years, but rather to provide some direct financial assistance to students during their study. Students are encouraged to use the CSG funds and “CSG-Approved Project” status to try and lever more funds from other sources.

Proposed projects must be part of a formal undergraduate or post-graduate student degree course leading to higher qualification. The applicant must have appropriate academic supervision, and ideally some involvement by the student or their project with an existing CSG member is desirable.

Full details of eligibility criteria and SRAS application forms are available from the CSG website ([www.iucncsg.org](http://www.iucncsg.org)).

## CITES Animals Meeting Committee (Geneva; 11-14 April 2008)

The 23rd meeting of the CITES Animals Committee (AC) was held in Geneva (19-24 April 2008). In an effort to identify common management elements, the AC initiated a process to review the literature on different management regimes in use that are being used broadly described as ranching. Using data compiled by UNEP-WCMC on all reported exports using the source code ‘R’, the AC is also required to survey countries applying this source code to species other than crocodylians transferred from Appendix I to Appendix II subject to ranching, and obtain information on the management program for the species to which this source code is applied. The results of these reviews will be reported to the 2009 meeting of the Animals and Plants Committees.

AC23 agreed to appoint Dietrich Jelden as its representative to serve on the working group of the Standing Committee. The 57th meeting of the Standing Committee is scheduled to be held in Geneva on 14-18 July 2008. The successful implementation of the universal tagging system is due to the pragmatic and consultative approach to its formulation in which the private sector derived a sense of ‘ownership’ in the product. Given his role in its development and his connection with the CSG, the appointment of Dietrich Jelden to the working group was an excellent outcome.

Management and export of *Crocodylus niloticus* in Madagascar was considered peripherally by AC23 in the context of the country-based review of significant trade in Appendix-II species. The CSG Chairman advised that some problems remained with respect to the management and use of the species in Madagascar, and the Malagasy authorities in collaboration with the CSG was addressing these. The AC noted the situation in Madagascar. Management of *C. niloticus* in Madagascar, together with the recent CSG mission are included on the agenda for the upcoming 57th meeting of the Standing Committee.

The manner in which the Standing Committee working group on personal and household effects deals with the instructions it has received from the Conference of the Parties has the potential to impact on international trade in crocodylian products that are purchased as tourist souvenirs. As a consequence, it will be important for the CSG to monitor and (ideally) contribute to the deliberations of the working group.

AC23 also considered a draft proposal being prepared by Mexico to transfer its population of *Crocodylus moreletti* from Appendix I to Appendix II. The AC Chair advised that discussion on this matter should be restricted to the technical content of the proposal without indicating support or opposition to the proposed amendment. Mexico advised that the proposed amendment, if adopted, would not result in any wild-harvested skins entering trade. The AC noted that skins of this species derived from captive breeding operations were being exported and questioned what controls were in place to

avoid illegal skins from the wild entering trade disguised as captive-bred specimens. Furthermore, Mexico was requested to clarify, in the supporting statement, the views of other range States (Belize and Guatemala) for the species. Mexico undertook to address these concerns and refine its proposal in consultation with the CSG.

Hank Jenkins, *CSG Vice Chair for CITES*.

## CSG Tomistoma Task Force Report

**Membership:** Mark Bezuijen recently stepped down as Indonesia Regional Chair and Robert Stuebing has stepped down as Chair of the CSG-TTF due to work commitments. Both have agreed to remain active TTF members, and Bruce Shwedick has been appointed CSG-TTF Chair (as of 2 June 2008). Uthen Youngprapakorn has also been appointed as a Vice-chair. Dr. Shahrul Anuar Mohd Sah has accepted an invitation to become a TTF member, and additional members and other volunteers are being recruited from within the range states to support the mission of this task force.

**Upcoming Activities:** A temporary Tomistoma exhibit at the Cape May Zoo in New Jersey will focus on Tomistoma conservation. This exhibit will also generate daily donations for the CSFG-TF from the general public between July and November 2008. The Cape May Zoo has agreed to provide funds to match the public donations.

A new banner for future US events will be produced in the near future. T-shirts with Tomistoma artwork by Marty Capron are once again being sponsored by Croc's 19th Street Bistro in Virginia Beach. These have proved to be a very popular item and very useful for fund raising. Bruce Shwedick will take these items with him during a 9-month lecture tour of schools across the US which will begin in September 2008.

Colin Stevenson will be speaking to the public about Tomistoma conservation at the Natural History Museum in London in July 2008. He will also speak at many other events in the UK throughout the coming months.

**CSG-TTF Conservation Workshop:** The workshop resulted in a number of important financial contributions. Most notably were:

- REA Kaltim Plantations in Indonesia donated \$US5000 towards the TTF Research Fund.
- All workshop registration fees were offered to Uthen Youngprapakorn to help cover his many expenses associated with hosting this meeting. However, Uthen preferred to donate all of the fees, over \$US3600 to the CSG-TTF.
- Singapore Zoo provided a donation of \$US1000 to support workshop participation and for future field projects. Virginia Aquarium and Marine Science Center also provided funding to support workshop participation.
- New CSG-TTF T-shirts produced for the workshop were also donated by Uthen Youngprapakorn. These were provided to workshop participants and leftover shirts are

being used for fundraising.

- Wildlife artist John Agnew donated a portion of the proceeds of his art sales during the workshop.

The CSG-TTF expresses great appreciation for the hard work and financial contributions of Uthen Youngprapakorn and his family. This support not only made the workshop possible but also contributed greatly to the success of this important meeting.

The CSG-TTF's full color banner which has been displayed in many parts of the USA over the last 5 years was left with Uthen during the workshop in order to advance our public awareness campaign in Asia.

**Conclusions and Recommendations of the First International CSG-TTF Workshop** (Post-Workshop document prepared by Robert Stuebing):

Group 1: Priorities for field research and conservation in range states

Date: 25 March 2008

Attendance: Oswald Braken Tisen (Snr. Manager Biodiversity Conservation, Sarawak Forestry Corporation), Mark Auliya (Scientific Officer, TRAFFIC Southeast Asia), Imanul Huda (Director PRCF West Kalimantan), Tom Dacey (CSG Executive Officer), Dr. Reza Tarmizi (Assistant Reptile Curator, Zoo Negara Malaysia), Mark Bezuijen (WWF Greater Mekong Programme), Michael Cota (Associate Researcher Thailand Natural History Museum), Boyd Simpson (FFI Cambodia), Dr. Abdul Hamid Ahmad (Deputy Director, Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah), Jack H. Cox (independent expert).

Facilitator: Jack Cox

Minutes: Mark Bezuijen

Presenter: Abdul Hamid Ahmad

Focus: Research and community management. Areas of focus for maximum attention. Rationale for choice, priority ranking; What do we need to focus on for the science? Where are we weak, & where are we already strong? Methodologies?

TS = *Tomistoma schlegelii*; CP = *Crocodylus porosus*

### Brunei

Jack: In last several years, TS confirmed to occur. Few surveys, little known of status, distribution. Positive country support and interest for status surveys conveyed; there are opportunities for conservation. Government informally requested a proposal. One key Brunei contact is Professor Joseph Charles.

Tom: What are possibilities for national funding? Should be a key option.

Abdul Hamid: Current research links between Sabah and University of Brunei Darusalaam for freshwater fish, may be possible to extend to crocodylian research. Possibly also extend linkages with Sarawak agencies - a cooperative project between the 3 states. Could include training of Brunei counterparts.

Tom: Sultan of Brunei apparently interested in conservation - may be a good opportunity.

Jack: Positive opportunities for conservation, mobilizing existing interest. Should include Government, university, Brunei Museum.

Key follow-up action points:

1. Abdul Hamid to contact Brunei counterparts and discuss possibilities to consolidate available information and if possible, plan a baseline survey.
2. Abdul Hamid to prepare a brief summary email to TTF.

#### Sarawak

Braken: Scattered records; currently low awareness and priority of TS within state. More awareness and previous surveys on CP. Raising awareness among decision-making agencies, NGOs etc will be critical to enabling conservation and research. Need to raise the national priority of TS conservation. Economic valuation is one avenue for justification of management/protection of some habitats. A key point: as per national law, 10% of the state land area is already allocated to protection status, and this is very difficult to revise or expand. Therefore we need to look at other ways to conserve TS outside protected areas.

Abdul Hamid: Given that CP is a state priority, try to build on top of existing CP work to extend TS knowledge e.g. extend surveys further upstream – will also strengthen CP management.

Braken: Request international assistance to provide a survey specialist and their financing, and the state would cover the logistical expenses.

Key follow-up action points:

3. Conduct a crocodile survey to review status of CP and TS in focal areas and, update status in sites with existing baseline data which were surveyed previously. Surveys should not be confined only to protected areas.
4. Braken to submit a formal letter of request to CSG for international assistance to provide a survey specialist and their financing. The state would cover the logistical expenses for the survey.
5. Braken to prepare a brief summary email to TTF.

#### Sabah

Abdul Hamid: Local community reports of TS but are unconfirmed. Current status unclear. There is currently a university grant for some short-term surveys to be completed in September 2008. Potential survey sites for TS include Kinabatangan River and headwaters.

Key follow-up action points:

6. Complete current surveys and reporting. Abdul Hamid will distribute final report to TTF after internal national review and distribution.

#### Peninsular Malaysia

Previous status reviews but new data available since the 1990s; requires collation and review. Breeding reports of TS from Setiu wetlands in Terangganu State and current project in this site for a threatened turtle: potential to extend to crocodile surveys to assess TS status.

Key follow-up action points:

7. Conduct status surveys in Setiu wetlands and Sungai Tengi. Malaysia's Federal Department of Wildlife and Parks (PERHILITAN) may coordinate this work.

#### Thailand

No confirmed sightings since 1970s; unconfirmed local reports in the last few years in provinces in southern Thailand. Scattered records (historic and current) but not collated and/or published.

Key follow-up action points:

8. Michael Cota to collate published records and local reports on historic and recent sightings. If possible, conduct a rapid assessment in key sites in southern Thailand.

#### Indonesia

Note: For "follow-up actions" for Sumatra and Kalimantan, see also the 2003 TTF review on Tomistoma conservation priorities.

Sumatra - Background – see presentation by M. Bezuijen (data up to 2002). No surveys since 2002.

Key follow-up action points:

9. In at least two sites, Merang River and Berbak NP, initiate activities for a longer-term programme of work to secure remaining TS populations and their habitats.
10. Identify potential program partners, including government, academic institutions, local NGOs.
11. Identify the key communities and their priorities.
12. Identify potential funding sources.

West Kalimantan - see presentation by M. Bezuijen (data until 2004). Update since 2004 by Mr. Budi and Mr. Imanul Huda: new and positive opportunities for TS conservation in Danau Sentarum National Park. These include:

- PHKA supports conservation of TS and wishes to develop further activities (Mr. Tonny Soehartono, Director-General PHKA, is also on the board of directors for PRCF, and two PHKA representatives were at the TTF Meeting);
- Danau Sentarum National Park management board wishes to initiate further activities for TS conservation and has already undertaken two independent surveys since the 2004 surveys (Mr. Budi, Head Subsection for the park, attended the TTF meeting);
- PRCF is supportive of TS conservation, has a permanent presence in the province and wishes to assist in the implementation of the 2004 report recommendations. PRCF also distributes a provincial bulletin on its project activities: this is one potential venue for awareness raising for Tomistoma conservation.

Key follow-up action points:

13. DSNP and PRCF to develop a concept note for new and collaborative conservation activities in the park, including: community awareness campaign (radio, bulletin, field activities center); strengthening park management for TS conservation; the development of a TS research centre; use of NTFPs to contribute to community livelihoods.

PRCF may have some funds to contribute to a brief site visit by a TTF specialist to assist in the development of this concept note.

14. Conduct follow-up status surveys in the southern swamp forests of the province, especially: a new status survey in Muara Kendawangan Nature Reserve (previously unsurveyed); and, follow-up surveys in Gunung Palung National Park (after 2004 surveys).

Central Kalimantan- One student (Rene Bonke, Germany) conducting ecology of TS in Tanjung Puting NP (coordinated by M. Auliya). This research is conducted in association with the provincial university and a provincial student counterpart.

Key follow-up action points:

15. Conduct a follow-up, relatively detailed status assessment of TS in Barito River.

South Kalimantan - Key follow-up action points:

16. Revisit crocodile farm at Banjar Baru to assess current crocodile stock.

East Kalimantan - Key follow-up action points:

17. Conduct systematic status surveys in Mahakam River.
18. Revisit crocodile farms with TS and conduct inventory of crocodiles (all species). (Tom Dacey plans to visit these farms in April 2008).
19. Initiate contacts with potential conservation partners e.g. Mulwarman University (Samarinda), provincial government offices.

Java - see previous reports by M. Auliya. In Ujung Kulon National Park, verbal reports from "pawang" (shaman) to M. Auliya that a century ago, the Dutch released TS in Java.

Key follow-up action points:

20. Update current status and strengthen habitat management in this national park. Low global priority but if/when funds available, initiate activities.

Note: For additional information please refer to Conservation Priorities for Action by Bezuijen *et al.* 2003.

Group 2: Captive Husbandry

Research , studbook, Where do we stand now? What are the current problems? Implications of our current knowledge? Should any proposals be made for CITES, ESA, etc.?

Attendance: Ralf Sommerland (CSG-TTF), Melanie Litton (Audubon Zoo), Steve Conners (Miami Metrozoo), Fabian Schmidt (Leipzig Zoo), Pavel Moucha (ZOO Dvur Kralove), Mira Prochazka (Nadace Tomistoma), Jan Prochazka(Nadace Tomistoma), Evi Haerlina (Directorate of Biodiversity Conservation, Indonesia), Henry-Martinus Wiradinata (PT. Ekanindya Karsa), Uthen Youngprapakorn, Mrs. Yuee (Royal CITES Authority, Thailand), Jesus Recuero (Fuengirola Zoo)

Facilitator: Ralf Sommerland (CSG-TTF)

Minutes: Melanie Litton

Presenter: Jesus Recuero

Tomistoma Husbandry Manual - The group members agreed with the following points: This manual should be our first priority, and will be finished by the end of this year (31 December 2008). It will be international scope The draft manuscript will be provided by Ralf to all working group members for revision.

A survey questionnaire (now being prepared by Steve Conners and a graduate student at the Dvur Kralove Zoo) to all Tomistoma holders. Information will be collected on:

- Nutrition
- Enclosure size and design
- Social grouping
- Behavioural management
- Enrichment
- Health
- Reproduction

Studbook - Currently there is a PMP in the AZA and an ESB in Europe. There is also a list of international collections keeping Tomistoma on the TTF web site. It needs updating, especially in the South East Asian Region. Uthen will provide the institution names and contact details. The establishment of an Asian Regional studbook is recommended by the members. Ask for CBSG support to include non-SEAZA institution in any captive management program.

Key follow-up action points: Ralf Sommerland and Bruce Shwedick will oversee publication of the Tomistoma Husbandry Manual..

Group 3: Regional and International Support. Not just funding for research, but integration of all conservation related interests, including government bodies, NGOs, national and private zoos & aquaria, private plantation companies, etc.

Attendance: Bruce Shwedick (Crocodile Conservation Services, USA), Chip Harshaw (Virginia Aquarium and Marine Science Center), Rob Stuebing (Conservation, REA Kaltim Plantations), Budi Suriasyah (Danau Sentarum National Park), Bernard Nathan (Singapore Zoological Gardens), Trio Santoso (National Biodiversity Directorate, Indonesia)

Facilitator: Bruce Shwedick

Minutes: Chip Harshaw

Presenter: Bernard Nathan

Discussion: Institutional, regional and international partnerships: Partnerships should not be limited to funding for research, but the integration of all conservation interests, including Government bodies, a wide variety of local, regional and international conservation and community NGO's, private companies, public and private zoos, aquariums, wildlife farms and ranches, and local communities.

The key partners or parties concerned for Tomistoma conservation include:

1. Government departments and agencies
2. Conservation and often community NGOs
3. Private companies who occupy or develop/exploit resources in TS habitats
4. Public and private zoos, aquaria, as well as local farming or ranching entities, local villages and communities who reside within or adjacent to key Tomistoma habitats.

In Indonesia, the principal Government body is the Ministry of Forestry, Directorate of Biodiversity Conservation.

International NGOs with potential direct interest in Tomistoma (in Kalimantan and/or Sumatra) are the Nature Conservancy Indonesia (NCI), Worldwide Fund For Nature (WWFI), Conservation International, the Wildlife Conservation Society (WCS), Flora and Fauna International (FFI),

In Malaysia, there are three Government agencies with direct jurisdiction over Tomistoma protection and its habitats, including the Federal Department of Wildlife and National Parks in Peninsular Malaysia; the Forest Department Sarawak and the Sarawak Forestry Corporation's Section for Protected Areas and Biodiversity Conservation (PABC); and in Sabah, the Sabah Wildlife Department and the Sabah Parks.

Malaysian NGOs who have a direct interest in Tomistoma are the Malaysian Nature Society (with branches in almost all the States of Malaysia), Worldwide Fund For Nature (WWFI), and the Wildlife Conservation Society (WCS).

Thailand

- Utairatch Crocodile Farm
- Samutprakarn Crocodile Farm
- Crocodile Adventure - Pattaya and other crocodile farms
- Government of Thailand
- Department of Fisheries

Potential Partners -Special interest Groups, mining, plantation companies, zoos aquariums, private breeders, farms, local villages and communities, which includes countries like Singapore.

Challenges of obtaining support

- Value of animal and its environment

Incentives for companies support

- Animals
- Environment
- Needs of local community
- Positive public relations and corporate image

Such objectives can be accomplished by:

- Use of media, celebrities, radio, TV, newspaper
- Making Tomistoma Flagship species
- Completing film of Peat Swamp documentaries
- Creating a logo or branding
- Grass roots education through schools, communities, villages
- Cooperation of industries

Key follow-up action points:

Bruce Shwedick to work on media aspects in USA, and coordinate with Rob Stuebing to follow up contacts with government, private sector and NGOs in Malaysia and Indonesia.

Incentives for companies

- Tax benefits
- Publicity / Corporate Social responsibilities

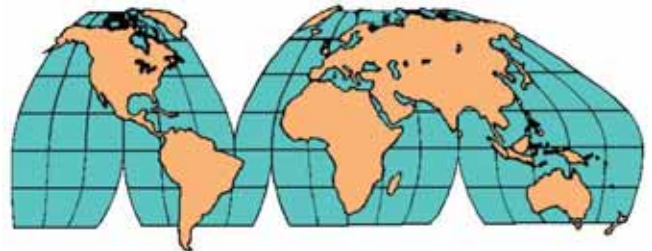
Key follow-up action points:

Rob Stuebing to liaise with plantation companies located in TS habitats in Malaysia/Indonesia for awareness and support of TS conservation. See "Conclusions and Recommendations sections.

Additional remarks provided by Jack Cox: "Considering Tomistoma's widespread but low density distribution in many surveyed river systems, and the lack of an intrinsic economic incentive (no commercial value, negligible benefits from ecotourism), perhaps the best hope for an in situ conservation is combining conservation awareness campaigns with efforts to improve a component that actively seeks such ideas from local communities."

A post workshop press release prepared by Mark Auliya and additional photos from the workshop have been posted at [www.tomistoma.org](http://www.tomistoma.org).

## Regional Reports



### Latin America & the Caribbean

#### **Brazil**

CAIMAN MEAT CONFISCATED. In early April 2008 the Institute for Environmental Protection in Amazonas (IPAAM) confiscated 7.8 ton of caiman meat obtained illegally from within the Piagaçu-Purus Sustainable Use Reserve (PP-SDR), located west of Manaus. The meat was derived from about 740 individuals, both *Melanosuchus niger* and *Caiman crocodilus*, and was destined to be illegally traded in Para State. There is no management program for commercial use of crocodilians in the 1 million ha PP-SDR.

Pieces of meat up to 3 m long were found, and illegal timber was also seized. Four people were fined about \$US100,000 by the State Public Ministry. IPAAM asked health authorities whether the meat could be used for human consumption, in

which case it will be donated to local institutions.

Source: Karin Blikstad, *FolhaOnline*, 8 April 2008 <[www1.folha.uol.com.br/folha/ambiente/ult10007u388124.shtml](http://www1.folha.uol.com.br/folha/ambiente/ult10007u388124.shtml)>; Translated by Carlos Piña.

## Mexico

RECORD OF *ALLIGATOR MISSISSIPPIENSIS* IN BRAVO RIVER, NUEVO LAREDO, TAMAULIPAS, MEXICO. On 7 October 2006, members of the fire department of Nuevo Laredo, Tamaulipas, captured an American alligator (*Alligator mississippiensis*) in the Bravo River, near the Cooperative “El Bayito”. The 2.2 m long specimen was accidentally captured using a baited fishing line. The animal was given to Mrs. Gina Ferrara de León of the Society for the Protection of Animals, who initially named it “Cokis” and later “Fortunato”. It was later relocated to the Regional Zoo of Nuevo Laredo (ZRNL), in Tamaulipas.

Sixteen months after capture of the alligator, it was suggested to have a workshop on management of crocodilians, which was delivered by the Crocodile Museum of the Regional Zoo “Miguel Alvarez del Toro” in Tuxtla Gutierrez, Chiapas, and with the assistance of Jerónimo Domínguez Laso and Guadalupe Ruiz Vidal. Over a 3-day period 7 members of the ZRNL received intensive training on general topics such as diets, handling, care, etc.



Figure 1. Jerónimo Domínguez-Laso and José Luís Rodríguez with “Queen Lupita”.

Physical examination of the alligator indicated that sex had been incorrectly assigned previously - it is a female - and she re-named “Queen Lupita” (Fig. 1). Now measuring 2.26 m and weighing 71 kg, the alligator was microchipped (AVID-106-797-121) and webb-tagged (No. 274). She is estimated to be 8-10 years of age.

As part of the workshop, we took the opportunity to visit the location where Queen Lupita was originally captured

(between 27° 34' 3.84"N, 99° 30' 47.32"W and 27° 11' 48.6"N, 99° 25' 52.7"). Local people reported that they have seen other alligators in parts of the river, but we were unable to survey other areas and no crocodilians were sighted.

Acknowledgments

Gina Ferrara de León and DVM Luís Fernando Carmona from the Regional Zoo of Nuevo Laredo; Liliana Berenice García-Reyes (translation).

Jerónimo Domínguez-Laso, *Curator of Crocodile Museum -Instituto de Historia Natural y Ecología-Regional Zoo “Miguel Álvarez del Toro”, Tuxtla Gutiérrez, Chiapas, México* <[museococodrilo@yahoo.com.mx](mailto:museococodrilo@yahoo.com.mx)>.

FIRST WORKSHOP ON HANDLING OF MEXICAN CROCODILIANS. Various courses on the biology, conservation and handling of crocodilians have been carried out in Mexico since 1987 (eg in Los Tuxtlas, Veracruz and San Cristóbal de las Casas, Chiapas). With crocodilians occurring in 17 of the 32 States of the Mexican Republic (including DF), there is a need for applied training for researchers, students and handlers in many parts of the country. For this reason the Crocodile Museum of the Regional Zoo “Miguel Alvarez del Toro” (ZooMAT) organized the First Specialized Workshop on Handling of Mexican Crocodiles.



Figure 1. Instructors of the Specialized Workshop on Mexican Crocodilians; Helios Hernández Hurtado (back), Jerónimo Domínguez Laso (middle) and Edgar Sarmiento Marina (front), with *C. acutus*, *C. moreletii* and *C. crocodilus* respectively.

The workshop took place in Tuxtla Gutierrez City and the coast of Chiapas, from 14-20 April 2008, involving 60 hours of activity, and 20 participants and support team, coming from the states of Aguascalientes, Chiapas, Estado de México, Distrito Federal, Jalisco, Oaxaca, Querétaro and Veracruz. Instructors were Jerónimo Domínguez-Laso, Edgar Sarmiento Marina (Crocodile Museum-ZooMAT) and Helios Hernández Hurtado (Environmental Handling Unit, Cipactli Reptilary of the University of Guadalajara CUC) (Fig. 1).

Special emphasis was placed on using specimens of all sizes for handling (49 *Caiman crocodilus fuscus* <2 m TL; 29 *Crocodylus moreletii*: <2.7 m TL); 52 *Crocodylus acutus* <2.3 m TL), including specimens from the Crocodile Museum and Turtle Camp of Puerto Arista.

Handling wild crocodylians was restricted to one pond (Boca del Cielo-Ponte Duro, on the coast of Chiapas), involving one 3.2 m long female *C. acutus*. She had old injuries to the right side of her head caused by a shotgun.

Population monitoring using spotlight count surveys were undertaken in three areas: Estero Boca del Cielo-Ponte Duro, Tonalá Chiapas, RD= 1.0/km (8 km); Estero Zapotalito, Agua Tendida, Pijijiapan, Chiapas, 5.5/km (2 km); and, Estero Las Pocitas, Agua Tendida, Pijijiapan, Chiapas 37.5/km (0.4 km).

During a daytime survey in Estero el Zapotalito participants recorded 10 traces of crocodiles. Of the 6 snare traps set, two were activated but did not result in captures, and various individuals were observed, including various sized (< 4.5 m) *C. acutus*. Few *C. c. fuscus* were observed as salinities in these zones exceed the normal tolerance limits of this species.

Participants (Fig. 2) were evaluated daily on attitude, skill and ability, initiative and interest, team work and security, creativity, spontaneity and adaptability, and a theoretical test was applied at the end of the workshop. All participants were ranked as “good” to “very good”.



Figure 2. Participants of the First Specialized Workshop on Mexican Crocodylians.

Delivery of “hands-on” courses such as this one will strengthen conservation, research and management efforts for Mexican crocodylians.

#### Acknowledgments

Liliana Berenice García-Reyes (translation).

Jerónimo Domínguez-Laso, *Curator of Crocodile Museum - Instituto de Historia Natural y Ecología-Regional Zoo “Miguel Álvarez del Toro”*, México <museococodrilo@yahoo.com.mx>, and Helios Hernández-Hurtado, *Technical Responsible of the UMA Reptilary CIPACTLI, Centro Universitario de La Costa, Jalisco, México* <helios@pv.udg.mx>.

## East and Southeast Asia

### Indonesia

RAPID SURVEY OF SIAMESE CROCODILE AND TOMISTOMA IN EAST KALIMANTAN. At the invitation of Mr. Tarto Sugiarto, owner of S.V. Surya Raya (Balikpapan Crocodile Farm), I visited East Kalimantan in 7-14 April 2008 for the purpose of obtaining first-hand information of the practical and logistic difficulties involved in surveying/finding wild *Tomistoma schlegelii* and *Crocodylus siamensis*, in rivers northwest of Samarinda (Fig. 1).

Accompanied by Tarto Sugiarto and his driver/guide, Aidil, we drove from Balikpapan to Samarinda and Sebulu and then northwest through woodchip and oil palm plantations, seeking access to the Kedang Rantau River. At the village of Batu Balai (called SDC), near Muara Bengkal, we hired two small long-boats and undertook a night survey (7 hours) along the Kedangkepala River and into the Kedang Rantau River between the fishing villages of Ngayau-Senambah. No crocodiles were sighted.

The next day we drove west, past Mesangat Lake to Muara Dun on the Kelinjau River and crossed by boat to the village of Gemar Baru (District of Kecamatan Muara Angalong). Here we were met by Mr. Arsat and taken to his house, where we inspected a dry *C. siamensis* skin mounted on the wall of his house. The crocodile had been caught in Mesangat Lake and kept in the yard by Mr. Arsat for a year. The animal became a “problem” and was slaughtered for meat (50 kg) in December 2007. The skin measured 58 cm (width) by 1.5 m (length) (excluding the head and a large part of the tail) (Fig. 2).

That afternoon we went by boat upstream on the Kelinjau River, to the village of Rantau Sentosa. In 1996 some 23 *Tomistoma* eggs, that were close to hatching, were collected about 70 km from Muara Dun, and shared amongst the fishermen (crocodiles typically kept as pets).

The nest was in a remote area, on a hillside, near a tree, some 200 m from a small pond, approximately 100 m<sup>2</sup> in area. The nest was approximately 2 m in diameter and 1 m high. Mr. Gardon from Rantau Sentosa took and hatched 8 of the eggs. All but one animal escaped, and the one remaining animal has been kept in a wooden crate in the house as a family pet since that time (Fig. 3).



Figure 1. Location of “survey” areas in East Kalimantan, Indonesia. 1= Section of Kedang Rantau River (between fishing villages of Ngayau and Senambah) that was spotlight surveyed; 2= Gemar Baru village where *C. siamensis* skin seen in house (see Fig. 2); 3= Rantau Sentosa village where *Tomistoma* kept in a wooden crate (see Fig. 3); 4= Batu Ampar village - wild *Tomistoma* sighted near here; 5= Menamang Kiri village and adjoining Lake Mau.





Figure 2. Crocodile skin, from animal caught in Mesangat Lake in late 2006.



Figure 3. Captive 16-year-old Tomistoma.

Later that day we returned by boat to our vehicle at Muara Dun and drove to the company village of Batu Ampar by the bank of the Wahau River. The next morning we went downstream on the Wahau River for approximately 30-40 minutes, to Bintang Baru Logpond, an area known by villagers for regular sightings of *T. schlegelii*. Over the next hour we sighted 3 different adult-sized Tomistoma; one was basking (full animal), one was at the waters' edge (head only), and one was swimming upstream against the current. We were unable to get close enough to take photographs before the animals submerged.

We returned to Bintang Baru and drove to the small fishing village of Menamang Kiri, on an offshoot of the Kedang Rantau River, near Lake Mau. After negotiating the hire of a long boat with the village head man, we commenced a night survey. However, the survey had to be abandoned due to a severe thunderstorm and we had to take shelter in a house at a small fishing village of Sedulang. The family provided us with a meal and bedding for the night.



Figure 4. Channel cut through thick vegetation to access lake area for fishing.

The next morning we returned by boat to Menamang Kiri and continued on to the adjoining Lake Mau, where village fishermen report encountering Tomistoma on a regular basis. They usually catch them in their fishing traps and release them. The lake was very dense with vegetation and the locals have opened up a channel (Fig. 4) into the lake area to allow them to set fishing traps. The water in the lake entry and the lake itself was crystal clear and very fast flowing in parts. No crocodiles were sighted.

Later that afternoon we drove back to Balikpapan, where we inspected *C. siamensis* hatchlings that had hatched on the farm two months earlier. Two other clutches were still in the incubator.

Mr. Sugiarto indicated that he would welcome a CSG-organised survey for *C. siamensis*, and would be prepared to provide necessary logistical support.

I wish to thank Tarto Sugiarto for his hospitality and for introducing me to the habitats in which these species live. He made my visit a very pleasant event, for which I am grateful. I also thank his driver/guide, Aidil, for his expert knowledge and ability in helping me to find wild *Tomistoma schlegelii*.

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

## Philippines

A 7-year-old boy was attacked and killed by a crocodile in Palawan on 30 April 2008. The victim's 12-year-old brother

saw his brother being attacked by a crocodile while they were swimming in the Sumorom River, at around 1330 h.

Within an hour after the incident, residents caught and killed a 4.5 m long crocodile. Examination of its stomach contents revealed no trace of the victim, whose body was located at 1030 h the following morning about 10 m from the place where he had been attacked. Examination of the recovered body revealed 19 bite wounds on different parts of the body.

The attack resulted in calls for curtailing trade in mangrove bark on Palawan Island, which has been blamed for the “increased incidence of crocodile attacks on humans”. In November 2006 a 9-year-old girl was killed by a crocodile in the Panalingaan River [CSGN 25(4): 12], in the same town as this attack. The crocodile responsible for the 2006 attack was never caught.

Sources: *Ferdie Castro, Manila Bulletin, 3 May 2008; Redempto Anda, Philippine Daily Inquirer, 5 May 2008.*

## Africa

### South Africa

RECENT CROCODILE DEATHS IN THE OLIPHANTS RIVER. On 27 May, Olifants trails ranger Nichol Coetzee reported 3 crocodile carcasses downstream of the trails camp. Dr. Dewald Keet, State Veterinarian based at Phalaborwa, went out to investigate the following day.

On 29 May he informed the author that the one crocodile he examined was very decomposed, but he saw that the fat in the tail was yellow-orange in colour and hardened. This sounded frighteningly similar to the condition observed in dead crocodiles in Loskop Dam, in the Olifants River near Middelburg, over the past 2 years.

A decision was made to fly the whole Olifants River and try to determine the extent of the mortalities. Helicopter pilot, Charles Thompson, agreed at very short notice to do the survey, and Dr. Roy Bengis made available two of his technicians (At Dekker and Johan Oosthuizen), as all the veterinarians were unavailable due to other commitments.

The survey began at the western border and extended eastwards along the Olifants River. The first dead crocodile was found about 14 km upstream from the high-water bridge over the river (Fig. 1, site 1). It was a 4.3 m crocodile in a state of advanced decomposition, with the same yellow-orange hardened fat in the tail. Tissue and water samples were collected.

Approximately 1.5 km below the Olifants trails camp, a very large crocodile was seen swimming with a 2 m long crocodile in his jaws (Fig. 1, site 2). We managed to recover the dead crocodile with some difficulty, and noted that all the fat in the

body cavity was orange in colour and as hard as rubber (Fig. 2). The animal was taken back to Skukuza for a full post-mortem by a veterinarian, and to save survey time.



Figure 2. Hard, orange-coloured fat around body organs.

In the Olifants gorge at the Bangu mouth (Fig. 1, site 3) a large number of vultures were noticed on the northern bank. A pool off the main river channel contained about 10 dead crocodiles in varying states of decomposition (Fig. 3). There were also a few that were clearly dying - they barely reacted even when prodded with a stick. It appears as if the smaller 2-3 m crocodiles had moved into these shallower areas either because they are unable to swim well anymore, or to escape from the larger crocodiles. Hardened orange fat could also be seen in the decomposed crocodile carcasses.



Figure 3. Dead Nile crocodile at Olifants Gorge.

Further down the Olifants gorge, towards the Mozambican border, more dead crocodiles and a few crocodile skeletons were observed. We also saw some gill-netting taking place just on the Mozambican side of the border.

Dead crocodiles were also seen in the Letaba River, about 2 km upstream from the confluence with the Olifants (Fig. 1, site 4). Just below Engelhard Dam one very large dead crocodile was observed being eaten by about 20 other crocodiles (Fig. 1 site 5). This crocodile carcass was unfortunately in deep water and no samples could be taken to establish the cause of death.

The results of the post-mortem done by Dr. Bengis on 29 May indicated that all the body fat, even around the organs and



Figure 1. Localities of crocodile deaths on the Oliphant and Letaba Rivers; 1= first dead crocodile found on aerial survey; 2= 2 m crocodile recovered from large crocodile; 3= Oliphants Gorge; 4= Letaba River; 5= just below Engelhard Dam.

intestines, was orange in colour and completely hardened (Fig. 2). An incision through the tail also showed hardening and discoloration of the fat stored there. This is a condition known as pansteatitis and is usually associated with the consumption of rotten/rancid fish. Mr. Hannes Botha of Mpumalanga Conservation informed us that all the crocodiles over 2 m in Loskop Dam have died as a result of this condition, due to pollution causing major fish die-offs in this dam over the past few years. It is thought that the crocodiles subsequently consumed the rotten fish which caused saponification of the body fat, turning it orange in colour and hard (Fig. 2).

We have not detected any significant fish die-offs in the Oliphants since last winter (June 2007) when a barbel kill was noticed. The link between fish kills and the crocodile deaths here is less clear. Perhaps this is a cumulative condition and the onset of winter was the final straw that precipitated this event. Except for two carcasses, all deaths occurred in or close to the Olifants River gorge. In February this year the Massingir Dam in Mozambique back-filled into the Olifants River gorge causing water levels to rise and the river to stop flowing, creating a dam-like condition in the gorge. This resulted in sediment that used to be carried through the gorge with higher flow velocities being deposited in the gorge. In certain sites we also observed a red coloured liquid oozing from the deposited sediments. With the increased mining activity in the Olifants River catchment it is tempting to

draw a link between heavy metal accumulation in the gorge sediments and the crocodile deaths, but at this stage it would only be speculation. We are waiting for laboratory results which may shed some light on this.

Complete organ, fat and tissue samples as well as water samples were collected for analysis by the State Veterinary office, and contact was made with Dr. Jan Myburgh and Prof. Fritz Huchzermeyer, both crocodile experts at Onderstepoort. Dr. Myburgh has analysed crocodile blood throughout the Olifants and Blyde Rivers and he reported that the Vitamin E levels of two samples collected in Loskop Dam and the Olifants River gorge in Kruger NP to be the lowest in the entire catchment.

Inadequate Vitamin E levels have been associated with pansteatitis in a number of species. Low levels of Vitamin E result in decreased antioxidant capacity with subsequent free radical peroxidation of lipids. Clinically this causes inflamed body fat and the inflammation results in the fat turning orange in colour and hardening (Fig. 2) - it is very painful. The hardened fat causes the crocodiles to become stiff, and results in reduction in mobility and the ability to swim. Affected animals may die of starvation and even drowning, and also become reluctant to enter the water and move away as normal when approached.

All the dead crocodiles that were cut open had empty stomachs, indicating they have not been feeding for some time. The saponified body fat would not be available to the crocodiles as an energy source during winter, with the real possibility that even partially affected ones may starve during winter.



Figure 4. Large live Nile crocodile that appeared bloated, stiff and lethargic.

In total, about 30 dead or dying crocodiles between 2 and 4.3 m in length were observed in the Olifants River gorge area. Many other large crocodiles appeared very lethargic and reluctant to move into the water and may also be affected. Some of these crocodiles also appeared swollen and stiff which could indicate that their fat layers have already saponified (Fig. 4). This event has the potential to become an environmental catastrophe, with the very real possibility that we might lose this unique population of large crocodiles in the Olifants River – one of only two such spectacular places in Africa.

In order to monitor the situation, we plan to fly the Olifants River every Wednesday using the Bantam aircraft and ranger Steven Whitfield as pilot. This will provide us with regular updated data on the situation. The trails rangers conducting walking trails along the Olifants River have also been notified to keep their eyes open for any crocodile or fish deaths. We are also planning to hold an emergency workshop on 2 May to discuss additional measures and monitoring protocols. Actions to be considered will include an urgent survey of the crocodile and fish populations in the Olifants and Letaba Rivers, to ascertain the proportion of the crocodile population that is affected, to obtain physiological parameters of infected and uninfected crocodiles, and complete water and sediment analysis.

**[Additional information provided by Prof. Fritz Huchzermeyer:** There also was some degree of muscle degeneration and one of the 4 crocodiles examined had generalized coccidiosis similar to the gharial cases in the Chambal River (India), but obviously secondary and not link to the mortality. Fish pathologist Dr. David Huchzermeyer, has done histopathology on one catfish caught alive in the

Olifants River. He did not find anything that could be linked to the crocodile deaths.

The Olifants River is heavily polluted with much agricultural run-off as well. We would need a survey of all the possible pollutants. First thought of investigators was to look for heavy metals. Recently we had cases of suspected manganese poisoning in farmed crocodiles, where an employee maliciously mixed  $\text{KMnO}_4$  into the ration of some groups of crocodiles causing outbreaks of “mysterious” disease with nervous symptoms and fits, causing many of the affected animals to drown. This may be the first cases of clinically manifest heavy metal poisoning in crocodiles - but no fat necrosis.

So far no other agent except rancid fish oil has been found involved in outbreaks of fat necrosis in crocodiles. Most of the recorded cases were in farmed crocodiles. As the pathology is so clear and the diagnosis is so easy to establish, there has been hardly any follow-up research on this condition, which is why our knowledge of fat necrosis still is so limited.

There is one further link to the gharial cases. The gharials became unable to move because of the arthritic gout. In cases of fat necrosis the fat hardens, becomes saponified, and this immobilizes the tail in particular. The affected animals cannot swim but still are able to move on land.

“Pansteatitis” is a misnomer - it should be “pansteatosis”, the inflammatory reaction is to the necrotic fat tissue which the body rejects as foreign body. Fat necrosis is a very fitting term.]

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## West Asia

### India

CONTROVERSIAL DAM SITE NOW MUGGER CONFLICT SITE. The Narmada Dam has long been in the national news but recent attention was on a different issue. Local newspapers and media broadcast stories about poor tribal people losing their lives to a population of “man-eating” mugger crocodiles (*Crocodylus palustris*) in the Narmada Reservoir, especially in the vicinity of its Dyke No. 3 (Fig. 1).

Official records indicate that muggers killed 2 people in November 2004, one in September 2006 and one in August 2007. It is estimated over a dozen other attacks may have gone unreported, and some of the crocodiles involved have were killed by local people. Such incidents are however restricted to very remote areas inhabited by tribal communities on the borders of Gujarat State and its neighbours.



Figure 1. Map showing location of Narmada Dam, associated dykes, sites of fatal attack by *C. palustris* on humans, and survey route (see text).

The Narmada Dam have created a platform for various media, tribal welfare groups, activists and politicians to pressure authorities such as the State Forest Department (SFD) to “eliminate all muggers from the water body and rehabilitate them away from human settlements.

The Narmada Dam project has been intensely debated due to its huge size (large areas of agricultural, scrub and forestlands have been submerged, uprooting thousands of families from their traditional lands and depriving them of their livelihoods). The final status of the environment after completion of this mega-project is unknown, but clues are emerging to enable us to make predictions about human-crocodile conflict.

Previous census data indicated that mugger populations were gradually rising in many areas (Vijayakumar *et. al.* 1999). These increasing crocodile populations have now become problematic for local authorities at many places in Gujarat State (Vyas 2007). Conflicts sometimes arise when mugger migrate to waterbodies near human settlements, which are used for daily activities such as washing clothes and utensils, bathing of livestock and traditional fishing.

Muggers occur in many parts of the Narmada River (Fig. 2), and they have naturally colonized habitats created by the system of dyke and lakes for over a decade. In November 2006 we visited Laxman Kund (Fig. 1), a backwater pool of the river from which muggers may have colonized the dyke lakes a few kilometres away. We learned that the SFD had also sporadically rescued muggers from settlements and relocated them into the lake system (Vyas 1994). An estimated 10-15 muggers may have been moved into the dyke-lakes over the last 2 years.

According to local forestry officers there are over 200 muggers in Dyke 3, some of which are 3-4 m long. A rapid survey (day and night counts) was carried out by the authors after the third fatal attack in November 2006. The combined results of these surveys revealed 37 muggers in all four dyke systems

(25 km) (see Figure 1 for survey route). The population at this time was estimated to be in the order of 50 individuals, and at best no more than 75 individuals (if a higher proportion of the population was not sighted). During the daytime search, we recorded over a dozen adult crocodiles as well as a few burrows two old nests with dried eggshells (confirming that breeding is taking place).



Figure 2. Narmada River at Kevadia Colony, is the only large river, which is flows from east to west in India. Photograph: Raju Vyas.

Enquiries revealed that staff of Rajpipala Division, SFD, had acquired the necessary skills to catch 7 muggers (0.75 to 3.5 m TL) between December 2005 and November 2006 from the dyke-lakes in the vicinity of human settlements and relocate them to the Hafeshwar area of Narmada Dam.

It is difficult to say what the size of the mugger population will be in a few years time, particularly in light of the large new network of canals and waterbodies created by the Narmada Dam project. The Narmada canals and all connected water bodies may become one of the best habitats of muggers in the country.

Some forest officials and naturalists are concerned by future projections of density and distribution of mugger s in the State. Encounters with muggers, leopards and lions are gradually increasing, and many farmers are suffering from crop raiding by wild herbivores such as blue bull antelope, black buck and pigs.

Two state authorities, including the SFD, and Sardar Sarovar Narmada Nigam Limited (SSNN) are planning to remove the muggers from the dyke-lakes and move them some distance away, as a huge water sports complex to increase tourism activities at this site is under consideration (Basu 2006). Recently the Principal Chief Conservator of Forest and Chief Wildlife Warden of Gujarat contacted Madras Crocodile Bank Trust, the Forest Department of Uttar Pradesh and the CSG Regional Chairman for West Asia to find out a workable solution for this problem.

From 1994 to 2007, over 14 notable incidents of human-mugger conflict have been recorded, including 9 that were fatal, in South Gujarat and Saurashtra (Vyas 2005; Vyas,

unpublished). In all these incidents the victims belonged to the lower middleclass who depend completely on nearby waterbodies for drinking water, washing clothes, fishing, etc. Two of these incidents involved small children playing close to the shore.

The increasing numbers of attacks and loss of human life suggest that it is time to review and the rigid conservation policy and management plans for the species in the state. This applies especially to those crocodile populations that inhabit non-protected areas and lie close to human habitations. These unfortunate episodes not only have negative impact on crocodile conservation programs but also impact on conservation efforts for other species that are directly or indirectly involved in conflict with human life and property.



Figure 3. Statue of the river goddess “Namami Devi Narmade” at Kevadia Colony, Narmada Dam. The goddess rides a mugger. Photograph: Raju Vyas.

#### Acknowledgements

We thank Pradeep Khanna PCCF & Chief Wildlife Warden of SFD, Gujarat, for logistic support and help in various aspects of study and surveys. Thanks to R.G. Prajapati, Assistant Conservator of Forest, Rajpipla, for help in ground level problems in the field. Also, we especially thank B.P. Matroja, Forest Beat Officer, Kartik Upadhayay, Manjoj Thakar, Rajesh Boatman and Rajesh Bhavsar of Vadodara for providing photographs for the article and accompanying us during fieldwork.

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## Science



#### Recent Publications

Fred W. Allendorf, Phillip R. England, Gordon Luikart, Peter A. Ritchie and Nils Ryman (2008). Genetic effects of harvest on wild animal populations. Trends in Ecology and Evolution 23(6): 327-337.

**Abstract:** Human harvest of animals in the wild occurs in terrestrial and aquatic habitats throughout the world and is often intense. Harvest has the potential to cause three types of genetic change: alteration of population subdivision, loss of genetic variation, and selective genetic changes. To sustain the productivity of harvested populations, it is crucial to incorporate genetic considerations into management. Nevertheless, it is not necessary to disentangle genetic and environmental causes of phenotypic changes to develop management plans for individual species. We recommend recognizing that some genetic change due to harvest is inevitable. Management plans should be developed by applying basic genetic principles combined with molecular genetic monitoring to minimize harmful genetic change.

Thomas R. Rainwater, Kyle W. Selcer, Lisa M. Nespoli, Adam G. Finger, David. A. Ray, Steven G. Platt, Philip N. Smith, Llewellyn D. Densmore, Todd A. Anderson, and

Scott T. McMurry (2008). Plasma vitellogenin in Morelet's crocodiles from contaminated habitats in northern Belize. *Environmental Pollution* 153: 101-109.

**Abstract:** Vitellogenin induction has been widely used as a biomarker of endocrine disruption in wildlife, but few studies have investigated its use in wild reptiles living in contaminated habitats. This study examined vitellogenin induction in Morelet's crocodiles (*Crocodylus moreletii*) from wetlands in northern Belize contaminated with organochlorine (OC) pesticides. Vitellogenin was measured in 381 crocodile plasma samples using a vitellogenin ELISA previously developed for this species. Vitellogenin was detected in nine samples, all from adult females sampled during the breeding season. Males and juvenile females did not contain detectable levels of vitellogenin; however, many of these animals contained OC pesticides in their caudal scutes, confirming contaminant exposure. The lack of a vitellogenic response in these animals may be attributable to several factors related to the timing and magnitude of exposure to endocrine-disrupting chemicals and should not be interpreted as an absence of other contaminant-induced biological responses.

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José Luis Tellería, Hamoud El Mamy Ghaillani, José María Fernández-Palacios, Juan Bartolomé and Emilio Montiano (2008). Crocodiles *Crocodylus niloticus* as a focal species for conserving water resources in Mauritanian Sahara. *Oryx* 42(2): 292-295.

**Abstract:** A survey on the Tagant Plateau, Mauritania, to design a reserve for the crocodile *Crocodylus niloticus* revealed that the area is occupied by a crocodile population larger than expected. Crocodiles occur in the lakes and pools along seasonal rivers that form an inner hydrological network. Reported movements of individuals during the summer floods suggested that it is necessary to protect the whole 700 km-long hydrological network to preserve interpool connectivity. However, the basin is occupied by 40,000 people that are completely dependent on water from the hydrological network. Thus it is important to propose a reserve network that would reconcile both the protection of biodiversity and human use of water resources. Considering the symbolic role of crocodiles for many Mauritians, the acceptance of their presence by the people of Tagant, and the increasing use by tourism agencies of some pools for crocodile-watching, the species may be a good focal species for promoting the conservation of the whole hydrological network of the Tagant Plateau.

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Matthew L. Brien, Mark A. Read, Hamish I. McCallum and Gordon C. Grigg (2008). Home range and movements of radio-tracked estuarine crocodiles (*Crocodylus porosus*) within a non-tidal waterhole. *Wildlife Research* 35: 140-149.

**Abstract:** We radio-tracked five male and eight female estuarine crocodiles (*Crocodylus porosus*) in a non-tidal waterhole in Lakefield National Park in northern Queensland during the late dry/mid-wet season (2003-04)

and the following dry season (2004). Individual crocodiles occupied larger home ranges (River Channel Areas (RCA)) during the late dry/mid-wet season ( $10.64 \pm 2.86$  ha) than in the dry season ( $3.20 \pm 1.02$  ha), and males occupied larger home ranges ( $23.89 \pm 2.36$  ha) than females ( $5.94 \pm 1.34$  ha) during the late dry/mid-wet season. There were no obvious differences in home range between sexes during the dry season. During the late dry/mid-wet season, adult males often travelled long distances along the waterhole while females moved less. During the dry season, movement patterns were quite variable, with no clear difference between sexes. All crocodiles were most active from late afternoon (1500-1800 hours) until midnight. Individual home ranges (RCA) overlapped considerably during the late dry/mid-wet season. The extent of home-range overlap between three adult males and the number of times they either passed each other or were located near each other was particularly striking. Previous research has come to conflicting conclusions about the extent of territoriality in wild estuarine crocodiles, although it has been widely believed that males are highly territorial. The findings imply that large adult male estuarine crocodiles are not highly territorial in non-tidal freshwater systems that are geographically confined.

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Hamish A. Campbell, Mariana A. Micheli and Augusto Abe (2008). A seasonally dependent change in the distribution and physiological condition of Caiman crocodilus yacare in the Paraguay River Basin. *Wildlife Research* 35(2) 150-157.

**Abstract:** The distribution and physiological condition of 116 *Caiman crocodilus yacare* was assessed over one year in the Southern Pantanal. Body mass and intermediary plasma metabolites were measured at three different time periods, representing large differences in the abundance of surface water. During the wet season the study site was completely submerged under water and *C. c. yacare* were distributed evenly throughout. High levels of [glucose] and [triglyceride] in the plasma indicated regular feeding. As the dry season progressed *C. c. yacare* became increasingly crowded around the remaining ponds. They showed a reduction in plasma [glucose] and [triglyceride], and an increase in plasma [ $\beta$ -hydroxy-butyrate], signifying that they were feeding less and utilising fat reserves. At this sampling period, ~40% of the male *C. c. yacare* that were >10 years old inhabited dry grassland and did not have access to water. These animals were significantly lighter than males of a similar length that had immediate water access, and plasma [uric acid] indicated that they had not fed for a long time and were metabolising tissue proteins. Essentially, the adult male *C. c. yacare* that inhabited dry grassland were in a state of energy deficiency. This was so severe in some animals that recovery seemed unlikely. The study suggests that fluctuations in the abundance of surface ground water may influence the size and structure of the *C. c. yacare* population in the Pantanal.

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Farmer, C.G., Uriona, T.J., Olsen, D.B., Steenblik, M. and Sanders, K. (2008). The right-to-left shunt of crocodilians serves digestion. *Physiol. Biochem. Zool.* 81(2): 125-137.

**Abstract:** All amniotes except birds and mammals have the ability to shunt blood past the lungs, but the physiological function of this ability is poorly understood. We studied the role of the shunt in digestion in juvenile American alligators in the following ways. First, we characterized the shunt in fasting and postprandial animals and found that blood was shunted past the lungs during digestion. Second, we disabled the shunt by surgically sealing the left aortic orifice in one group of animals, and we performed a sham surgery in another. We then compared postprandial rates of gastric acid secretion at body temperatures of 19°C and 27°C and rates of digestion of bone at 27°C. Twelve hours after eating, maximal rates of gastric acid secretion when measured at 19°C and 27°C were significantly less in the disabled group than in sham-operated animals. Twenty-four hours postprandial, a significant decrease was found at 27°C but not at 19°C. For the first half of digestion, dissolution of cortical bone was significantly slower in the disabled animals. These data suggest the right-to-left shunt serves to retain carbon dioxide in the body so that it can be used by the gastrointestinal system. We hypothesize that the foramen of Panizza functions to enrich with oxygen blood that is destined for the gastrointestinal system to power proton pumps and other energy-demanding processes of digestion and that the right-to-left shunt serves to provide carbon dioxide to gastrointestinal organs besides the stomach, such as the pancreas, spleen, upper small intestine, and liver.

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Rebecca L. Cramp, Edward A. Meyer, Nicole Sparks and Craig E. Franklin (2008). Functional and morphological plasticity of crocodile (*Crocodylus porosus*) salt glands. *J. Exp. Biol.* 211: 1482-1489.

**Abstract:** The estuarine crocodile, *Crocodylus porosus*, inhabits both freshwater and hypersaline waterways and maintains ionic homeostasis by excreting excess sodium and chloride ions via lingual salt glands. In the present study, we sought to investigate the phenotypic plasticity, both morphological and functional, in the lingual salt glands of the estuarine crocodile associated with chronic exposure to freshwater (FW) and saltwater (SW) environments. Examination of haematological parameters indicated that there were no long-term disruptions to ionic homeostasis with prolonged exposure to SW. Maximal secretory rates from the salt glands of SW-acclimated animals ( $100.8 \pm 14.7 \mu\text{mol } 100 \text{ g}^{-0.7} \text{ body mass h}^{-1}$ ) were almost three times greater than those of FW-acclimated animals ( $31.6 \pm 6.2 \mu\text{mol } 100 \text{ g}^{-0.7} \text{ body mass h}^{-1}$ ). There were no differences in the mass-specific metabolic rate of salt gland tissue slices from FW- and SW-acclimated animals ( $558.9 \pm 49.6$  and  $527.3 \pm 142.8 \mu\text{l O}_2 \text{ g}^{-1} \text{ h}^{-1}$ , respectively). Stimulation of the tissue slices from SW-acclimated animals by methacholine resulted in a 33% increase in oxygen consumption rate. There was no significant increase in the metabolic rate of tissues from FW-acclimated animals in response to methacholine. Morphologically, the secretory cells from the salt glands of SW-acclimated animals were larger than those of FW-acclimated animals. In addition, there were significantly more mitochondria per unit volume in secretory tissue from SW-acclimated animals.

The results from this study demonstrate that the salt glands of *C. porosus* are phenotypically plastic, both morphologically and functionally and acclimate to changes in environmental salinity.

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Todd, N.P. (2007). Estimated source intensity and active space of the American alligator (*Alligator mississippiensis*) vocal display. *J. Acoust. Soc. Am.* 122(5): 2906-2915.

In this article the results are reported of a study to measure the intensity of the vocal displays of a population of American alligators (*Alligator mississippiensis*). It was found that the dominant frequencies in air range between 20 and 250 Hz with a source sound pressure level (SPL) of 91-94 dB at 1 m. The active space for the air-borne component is defined by the background and was estimated to be in a range up to 159 m in the 125-200 Hz band. For the water-borne component the dominant frequency range was 20-100 Hz with a source SPL of 121-125 dB at 1 m. The active space in water is defined by hearing thresholds and was estimated to range up to 1.5 km in the 63-100 Hz band. In the lowest frequency bands, i.e., 16-50 Hz, the estimated active space for otolith detection of near-field particle motion in water ranged to 80 m, which compared significantly with far-field detection for these frequencies. It is suggested that alligator vocal communication may involve two distinct sensory mechanisms which may subservise the functions of scene analysis and reproduction, respectively.

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Poletta, G.L., Larriera, A., Kleinsorge, E. and Mudry, M.D. (2007). *Caiman latirostris* (broad-snouted caiman) as a sentinel organism for genotoxic monitoring: Basal values determination of micronucleus and comet assay. *Mutat. Res.* 650(2): 202-209.

**Abstract:** *Caiman latirostris* is one of the two crocodilian species that inhabit Argentina. In this country, as a consequence of agricultural frontiers expansion during the last years, many areas of the geographic distribution of the broad snouted caiman overlap with regions of intensive agricultural activity. Contaminants released to the environment may induce genetic alterations in wildlife, which could lead to mutations and/or carcinogenesis. Up to the moment, no studies had been made concerning the possibility to apply biomarkers of genotoxic evaluation in *C. latirostris*. The aim of this study was to adapt two widely used genotoxic techniques, the comet assay and the micronucleus test, for their application in *C. latirostris* and to determine the baseline values in this species, in order to establish its suitability as a sentinel organism for future genotoxic monitoring of environmental pollutants. A total of 41 juvenile caimans of 4 months old (FMO) and 10 months old (TMO) were used. Genotoxic techniques were applied on peripheral blood erythrocytes introducing the necessary modifications required by the material, which are presented here. Our results show that baseline values of DNA damage are quite stable among juvenile caimans (MN: FMO animals  $0.87 \pm 0.74$  and TMO animals  $1.04 \pm 0.92$ ; DI: FMO animals  $103.40 \pm 3.36$  and TMO animals  $120.08 \pm 11.33$ ), being independent of the nest of origin, sex and size of the animals



and confirm the potential value of both short term tests as accurate screening tools for the evaluation of genotoxic agents in *C. latirostris*. This is the first reference to the application of genotoxic techniques on *C. latirostris* and the second in crocodylians. Data provided here will be useful for future studies involving the biomonitoring of natural regions where *C. latirostris* occurs, employing this species as a sentinel organism for genotoxic assessment of environmental pollutants.

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Lovely, C.J., Pittman, J.M. and Leslie, A.J. (2007). Normal haematology and blood biochemistry of wild Nile crocodiles (*Crocodylus niloticus*) in the Okavango Delta, Botswana. J. S. Afr. Vet. Assoc. 78(3): 137-144.

Abstract: Wild Nile crocodiles (*Crocodylus niloticus*) of various size classes were captured in the Okavango Delta, Botswana. Blood was collected from the post occipital sinus and used for the determination of a wide range of haematological and biochemical parameters. These values were compared between the sexes and between 3 size classes. The values were also compared with the limited data available from farmed Nile crocodiles, as well as from other wild Nile crocodiles. The Okavango crocodiles were comparatively anaemic, and had comparatively low total protein and blood glucose levels. There was a high prevalence of *Hepatozoon pettiti* infection, however, there was no significant difference in haematological values between the infected and uninfected crocodiles. The values reported here will be useful in diagnostic investigations in both zoo and farmed Nile crocodiles.

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Uriona, T.J. and Farmer, C.G. (2008). Recruitment of the diaphragmaticus, ischiopubis and other respiratory muscles to control pitch and roll in the American alligator (*Alligator mississippiensis*). J. Exp. Biol. 211(7): 1141-1147.

Abstract: We used electromyography on juvenile American alligators to test the hypothesis that the following muscles, which are known to play a role in respiration, are recruited for aquatic locomotion: M. diaphragmaticus, M. ischiopubis, M. rectus abdominis, M. intercostalis internus, and the M. transversus abdominis. We found no activity with locomotion in the transversus. The diaphragmaticus, ischiopubis, rectus abdominis and internal intercostals were active when the animals executed a head-down dive from a horizontal posture. Weights attached to the base of the tail resulted in greater electrical activity of diaphragmaticus, ischiopubis and rectus muscles than when weights were attached to the head, supporting a role of this musculature in locomotion. The diaphragmaticus and rectus abdominis were active unilaterally with rolling maneuvers. Although the function of these muscles in locomotion has previously been unrecognized, these data raise the possibility that the locomotor function arose when Crocodylomorpha assumed a semi-aquatic existence and that the musculoskeletal complex was secondarily recruited to supplement ventilation.

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Dzoma, B.M., Sejoe, S. and Segwagwe, B.V. (2008). Commercial crocodile farming in Botswana. Trop. Anim. Health Prod. 40(5): 377-381.

Abstract: A survey-based study was carried out to assess the state of crocodile farming in Botswana. A prepared, structured questionnaire was dispatched to crocodile farmers based on a directory provided by the Fisheries section of the Department of Wildlife and National Parks in the Ministry of Environment, Wildlife and National Parks. The oldest farm was established in 1986. An average of three farms have been in operation since then, all of which obtained their stock from the Okavango and Thamalakane rivers in Botswana. The current stock averages 5,419 animals as follows: breeders 4%, hatchlings 56%, and growers 40%. The average clutch size and average hatchability were 47 eggs/clutch and 67% respectively. Mortality among hatchlings and growers averaged 8.3% up to 12 weeks of age. Only one farm encountered some problems with *Salmonella* and fungal infections of the belly. Raw skins are sold to South Africa as a result of the absence of a tannery. Crocodile farming should be encouraged in Botswana since a good market for crocodile products already exists.

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Kate Jackson and Daniel Brooks (2007). Do crocodiles co-opt their sense of “touch” to “taste”? A possible new type of vertebrate sensory organ. Amphibia-Reptilia 28(2): 277-285.

Abstract: We recount here two experiments carried out which suggest the existence of the first described integumentary osmoreceptor of its kind in a vertebrate. Domed pressure receptors, present on the cranial scales of alligators have previously been demonstrated to convey the sensation of “touch” when flattened by pressure. Here we find that morphologically similar domed sensory organs present on the post-cranial scales of crocodylid but not alligatorid crocodylians flatten when exposed to increased osmotic pressure, such as that experienced when swimming in sea water hyper-osmotic to the body fluids. When contact between the integument and the surrounding sea water solution is blocked, crocodiles are found to lose their ability to discriminate salinities. We propose that the flattening of the sensory organ in hyper-osmotic sea water is sensed by the animal as “touch”, but interpreted as chemical information about its surroundings.

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Ronis Da Silveira, William E. Magnusson and John B. Thorbjarnarson (2008). Factors affecting the number of caimans seen during spotlight surveys in the Mamiraua Reserve, Brazilian Amazonia. Copeia 2008(2): 425-430.

Abstract: Between 1995 and 1998 we studied the effects of water level, moon phase, and site on the number of caimans observed in spotlight surveys in the Mamiraua Sustainable Development Reserve, Brazilian Amazonia. Multiple linear regression analyses including water level of the Amazon River and the moon phase explained 91 and 73% of the variance in number of *Melanosuchus niger* seen in spotlight surveys in

Lago Mamiraua and Cano Mamiraua, respectively, and 60 and 76%, respectively, of the variance in the number of *Caiman crocodilus* seen. Water level had a statistically significant and negative effect on the number of *M. niger* and *C. crocodilus* seen. Moon phase had no significant effect on the number of *C. crocodilus* seen, but more *M. niger* were detected in Lago Mamiraua on nights with more moon light. The regression equations derived for Lago Mamiraua and Cano Mamiraua did not adequately predict the variation in numbers seen in 18 other water bodies in the Mamiraua Reserve. Analysis of covariance showed an interaction between water level and site on the numbers of *M. niger* and *C. crocodilus* observed in the spotlight surveys in these water bodies, indicating that the effect of water level depends on the site. In these analyses, moon phase did not have a significant effect on either species, and there was no interaction between moon phase and site. To monitor natural tendencies, or impacts (e.g., controlled commercial hunting), on caiman populations of Mamiraua Reserve, it will be necessary to undertake regular spotlight surveys in many water bodies of all types at a narrow range of water level to have confidence in the results.

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S.G. Platt, T.R. Rainwater, J.B. Thorbjarnarson and S.T. McMurry (2008). Reproductive dynamics of a tropical freshwater crocodylian: Morelet's crocodile in northern Belize. *J. Zool.* 275: 177-189.

**Abstract:** Morelet's crocodile *Crocodylus moreletii* has not been well-studied and many aspects of its life history are unknown. In particular there is a notable paucity of information on nesting and reproductive ecology. We studied the nesting ecology of Morelet's crocodile in northern Belize from 1992 through 1995. Nesting occurs at the onset of the wet season in mid-June and continues through mid-July (mean oviposition date = 1 July 10 days). Eggs hatch from mid-August through mid to late September. Nesting effort at our primary study site remained relatively constant during 1992, 1993 and 1995, but nearly doubled in 1994; this appeared to reflect a regional trend. Natural and man-made islands are heavily used as nesting sites. Nesting success in 1993 and 1994 was consistently higher on natural islands when compared with man-made islands or shoreline sites. Nest losses were primarily due to flooding and raccoon *Procyon lotor* predation. Losses from predation were greatest in 1994 when unseasonably low water levels facilitated predator access to nests. Females probably reach sexual maturity in 7-8 years after attaining a total length of 150 cm. Mean clutch size (25.0  $\pm$  7.6; range=9-42; n=73) did not differ among years. Mean clutch size, egg width (EW), egg length, egg mass (EM) and clutch mass were positively correlated with female snout-vent length (SVL). Mean EW was the best predictor of female SVL. A partial correlation analysis of egg and clutch attributes found that independent of female SVL, EM increases with increasing clutch size.

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Marta E. Garcia, Pilar Lanzarot, Eduardo Costas, Victoria Lopez Rodas, Mercedes Marín, Jose L. Blanco. (2008). Isolation of *Serratia fonticola* from skin lesions in a

Nile Crocodile (*Crocodylus niloticus*) with an associated septicaemia. *Vet. J.* 176(2): 254-256.

**Abstract:** This paper describes the first isolation of *Serratia fonticola* in a Nile Crocodile (*Crocodylus niloticus*). This organism was initially isolated from skin lesions and blood and subsequently from a variety of organs during necropsy. *S. fonticola* was confirmed as the pathogen causing the infection.

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Kevin M. Wallace and Alison J. Leslie (2008). Diet of the Nile crocodile (*Crocodylus niloticus*) in the Okavango Delta, Botswana. *J. Herp.* 42(2): 361-368.

**Abstract:** The analysis of stomach contents can shed light on patterns of prey availability and foraging habits of a predator; however, recent studies have shown the potential bias in dietary studies resulting from differential digestion rates of various prey items. The stomachs of 286 Nile Crocodiles (17-166 cm snout-vent length) were lavaged over a two-year period. Taking prey residence times into account, the contents were examined for prey eaten within 24 h. *Crocodylus niloticus* has a similar ontogenetic shift in diet to that of other crocodylians. Yearlings consumed primarily aquatic insecta and arachnida. As crocodile size increased (juveniles), the diet became more diverse including crustacea, amphibia, and fish. The largest size class (subadults) consumed primarily fish. Yearlings fed consistently throughout the year; however a higher proportion of empty stomachs occurred within the juvenile and subadult size classes during the winter months. Seven species of nematodes were found within the stomachs, four of which represent new geographic records.

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Moore B.C., Uribe-Aranzábal, M.C., Boggs, A.S. and Guillette, L.J. Jr. (2008). Developmental morphology of the neonatal alligator (*Alligator mississippiensis*) ovary. *J. Morphol.* 269(3): 302-312.

**Abstract:** American alligator (*Alligator mississippiensis*) ovary development is incomplete at hatching. During the months following hatching, the cortical processes of oogenesis started in ovo continues and folliculogenesis is initiated. Additionally, the medullary region of the gonad undergoes dramatic restructuring. We describe alligator ovarian histology at hatching, 1 week, 1 month, and 3 months of age in order to characterize the timing of morphological development and compare these findings to chicken ovary development. At hatching, the ovarian cortex presents a germinal epithelium containing oogonia and a few primary oocytes irregularly scattered between somatic epithelial cells. The hatchling medulla shows fragmentation indicative of the formation of lacunae. By 1 week of age, oocytes form growing nests and show increased interactions with somatic cells, indicative of the initiation of folliculogenesis. Medullary lacunae increase in diameter and contain secretory material in their lumen. At 1 month, nest sizes and lacunar diameters continue to enlarge. Pachytene oocytes surrounded by somatic cells are more frequent. Trabeculae composed of

dense irregular connective tissue divide cortical nests. Three months after hatching oocytes in meiotic stages of prophase I up to diplotene are present. The ovary displays many enlarged follicles with oocytes in diplotene arrest, thecal layers, lampbrush chromosomes, and complete layers of follicular cells. The medulla is an elaborated complex of vascularized lacunae underlying the cortex and often containing discrete lymphoid aggregates. While the general morphology of the alligator ovary is similar to that of the chicken ovary, the progression of oogenesis and folliculogenesis around hatching is notably slower in alligators. Diplotene oocytes are observed at hatching in chickens, but not until 3 months in alligators. Folliculogenesis is completed at 3 weeks in chickens whereas it is still progressing at 3 months in alligators.

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Amélie L. Vergne and Nicolas Mathevon (2008). Crocodile egg sounds signal hatching time. *Current Biology* 18: R513-R514.

Crocodylians are known to vocalize within the egg shortly before hatching. Although a possible function of these calls - inducing hatching in siblings and stimulating the adult female to open the nest - has already been suggested, it has never been experimentally tested. Here, we present the first experimental evidence that pre-hatching calls of Nile crocodile (*Crocodylus niloticus*) juveniles are informative acoustic signals which indeed target both siblings and mother.

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Rodrigues, S.L., Maseko, B.C., Ihunwo, A.O., Fuxe, K. and Manger, P.R. (2008). Nuclear organization and morphology of serotonergic neurons in the brain of the Nile crocodile, *Crocodylus niloticus*. *J. Chem. Neuroanat.* 35(1): 133-145.

The present study describes the location and nuclear organization of the serotonergic system in a representative of the order Crocodylia, the Nile crocodile (*Crocodylus niloticus*). We found evidence for serotonergic neurons in three regions of the brain, including the diencephalon, rostral and caudal brainstem, as previously reported in several other species of reptile. Within the diencephalon we found neurons in the periventricular organ of the hypothalamus, but not in the infundibular recess as noted in some other reptilian species. In addition we found serotonergic neurons in the pretectal nucleus, this being the first description of these neurons in any species. Within the rostral brainstem we found medial and lateral divisions of the superior raphe nucleus and a widely dispersed group of neurons in the tegmentum, the superior reticular nucleus. In the caudal brainstem we observed the inferior raphe nucleus and the inferior reticular nucleus. While much of the serotonergic system of the Nile crocodile is similar to that seen in other reptiles the entire suite of features appears to distinguish the crocodile studied from the members of the Squamate (lizards and snakes) and Testudine (turtles, tortoises and terrapins) reptiles previously studied. The observations are suggestive of order-specific patterns of nuclear organization of this system in the reptiles, reflecting potential evolutionary constraints in the mutability of the nuclear organization as seen for similar systems in mammals.

Pritz, M.B. (2008). Early diencephalon development in alligator. *Brain Behav. Evol.* 71(1): 15-31.

Abstract: Diencephalon development was investigated in a reptilian embryo, *Alligator mississippiensis*, beginning at a single compartment stage and continuing until internal subdivisions were present within major units. A variety of morphological techniques were used: immunocytochemistry, histochemistry, and cresyl violet staining. The diencephalon begins as a single unit. In the transverse domain, the diencephalon subsequently divides into two: the parencephalon and the synencephalon. The parencephalon then splits into the parencephalon anterior and parencephalon posterior. Still later, the synencephalon undergoes parcellation into the synencephalon anterior and synencephalon posterior. Subsequently, internal subdivisions occur in each of these four compartments. When the diencephalon has become subdivided into two compartments and continuing until internal subdivisions are present in each unit, a longitudinal border separating a dorsal, presumed alar plate, from a ventral, presumed basal plate, was seen. No clear cut subunits were reliably identified in the telencephalon or secondary prosencephalon during this period of early development in Alligator. Early diencephalon development in birds (chick) and mammals (humans) follows a similar pattern. Specifically, a single diencephalic compartment divides into two zones: the parencephalon and synencephalon. Subsequently, the parencephalon becomes subdivided into an anterior and posterior unit. Some studies, including the present one, have noted further parcellation of the synencephalon into an anterior and posterior component, whereas others have not. Notwithstanding differences as to whether the synencephalon is a single unit or not, these detailed analyses in reptiles (Alligator), birds (chick), and mammals (humans), suggest that the initial pattern of early diencephalon development in amniotes is similar.

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Guillette, L.J. Jr., Edwards, T.M. and Moore, B.C. (2007). Alligators, contaminants and steroid hormones. *Environ. Sci.* 14(6): 331-347.

Abstract: Steroids are essential for successful reproduction in all vertebrate species. Over the last several decades, extensive research has indicated that exposure to various environmental pollutants can disrupt steroidogenesis and steroid signaling. Although steroidogenesis is regulated by the hypothalamic-pituitary axis, it is also modified by various paracrine and autocrine factors. Furthermore, the classical two-cell model of steroidogenesis in the developing ovarian follicle, involving the granulosa and theca cells in mammals, may not be universal. Instead, birds and probably reptiles use the two thecal compartments (theca interna and theca externa) as sites of steroid production. We have documented that embryonic or juvenile exposure to a complex mixture of contaminants from agricultural and storm water runoff leads to altered steroid hormone profiles in American alligators. Our observations suggest that alterations in plasma steroid hormone concentrations are due in part to altered gene expression, modified hepatic biotransformation and altered gonadal steroidogenesis. Future studies must examine the interplay between endocrine and paracrine regulation in the

development and expression of gonadal steroidogenesis in individuals exposed to endocrine disrupting contaminants at various life stages if we are to fully understand potential detrimental outcomes.

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Roos, J., Aggarwal, R.K. and Janke, A. (2007). Extended mitogenomic phylogenetic analyses yield new insight into crocodylian evolution and their survival of the Cretaceous-Tertiary boundary. *Mol. Phylogenet. Evol.* 45(2): 663-673.

**Abstract:** The mitochondrial genomes of the dwarf crocodile, *Osteolaemus tetraspis*, and two species of dwarf caimans, the smooth-fronted caiman, *Paleosuchus trigonatus*, and Cuvier's dwarf caiman, *Paleosuchus palpebrosus*, were sequenced and included in a mitogenomic phylogenetic study. The phylogenetic analyses, which included a total of ten crocodylian species, yielded strong support to a basal split between Crocodylidae and Alligatoridae. *Osteolaemus* fell within the Crocodylidae as the sister group to *Crocodylus*. *Gavialis* and *Tomistoma*, which joined on a common branch, constituted a sister group to *Crocodylus/Osteolaemus*. This suggests that extant crocodylians are organized in two families: Alligatoridae and Crocodylidae. Within the Alligatoridae there was a basal split between Alligator and a branch that contained *Paleosuchus* and *Caiman*. The analyses also provided molecular estimates of various divergences applying recently established crocodylian and outgroup fossil calibration points. Molecular estimates based on amino acid data placed the divergence between Crocodylidae and Alligatoridae at 97-103 million years ago and that between *Alligator* and *Caiman/Paleosuchus* at 65-72 million years ago. Other crocodylian divergences were placed after the Cretaceous-Tertiary boundary. Thus, according to the molecular estimates, three extant crocodylian lineages have their roots in the Cretaceous. Considering the crocodylian diversification in the Cretaceous the molecular datings suggest that the extinction of the dinosaurs was also to some extent paralleled in the crocodylian evolution. However, for whatever reason, some crocodylian lineages survived into the Tertiary.

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Dawo, F. and Mohan, K. (2008). Use of immunoblotting to detect antibodies to *Mycoplasma crocodyli* infection in the sera of crocodiles (*Crocodylus niloticus*). *Vet. J.* 175(2): 279-281.

**Abstract:** An immunoblotting protocol for the detection of antibodies to *Mycoplasma crocodyli* was developed using sonicated antigen of the reference strain 266/93. Immunoblotting detected nine reacting antigens, of which the 33 and 40kDa antigens were immunodominant. There was no difference in reactivity of the antigens against sera obtained from vaccinated and infected crocodiles. Both antigens are candidates for other serological and molecular studies. This is the first report to develop and apply an immunoblotting test for detection of antibody to *M. crocodyli* infection in crocodiles.

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Ciuraszkiewicz, J., Olczak, M. and Watorek W. (2007). Isolation and characterisation of crocodile and python ovotransferrins. *Acta Biochim. Pol.* 54(1): 175-182.

**Abstract:** Transferrins play a major role in iron homeostasis and metabolism. In vertebrates, these proteins are synthesised in the liver and dispersed within the organism by the bloodstream. In oviparous vertebrates additional expression is observed in the oviduct and the synthesised protein is deposited in egg white as ovotransferrin. Most research on ovotransferrin has been performed on the chicken protein. There is a limited amount of information on other bird transferrins, and until our previous paper on red-eared turtle protein there was no data on the isolation, sequencing and biochemical properties of reptilian ovotransferrins. Recently our laboratory deposited ten new sequences of reptilian transferrins in the EMBL database. A comparative analysis of these sequences indicates a possibility of different mechanisms of iron release among crocodile and snake transferrin. In the present paper we follow with the purification and analysis of the basic biochemical properties of two crocodile (*Crocodylus niloticus*, *C. rhombifer*) and one snake (*Python molurus bivittatus*) ovotransferrins. The proteins were purified by anion exchange and hydrophobic chromatography, and their N-terminal amino-acid sequences, molecular mass and isoelectric points were determined. All three proteins are glycosylated and their N-glycan chromatographic profiles show the largest contribution of neutral oligosaccharides in crocodile and disialylated glycans in python ovotransferrin. The absorption spectra of iron-saturated transferrins were analysed. Iron release from these proteins is pH-dependent, showing a biphasic character in crocodile ovotransferrins and a monophasic type in the python protein. The reason for the different types of iron release is discussed.

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Alibardi, L. and Toni M. (2007). Characterization of keratins and associated proteins involved in the corneification of crocodylian epidermis. *Tissue Cell.* 39(5): 311-323.

**Abstract:** Crocodylian keratinocytes accumulate keratin and form a corneous cell envelope of which the composition is poorly known. The present immunological study characterizes the molecular weight, isoelectric point (pI) and the protein pattern of alpha- and beta-keratins in the epidermis of crocodylians. Some acidic alpha-keratins of 47-68 kDa are present. Cross-reactive bands for loricrin (70, 66, 55 kDa), sciellin (66, 55-57 kDa), and filaggrin-AE2-positive keratins (67, 55 kDa) are detected while caveolin is absent. These proteins may participate in the formation of the cornified cell membranes, especially in hinge regions among scales. Beta-keratins of 17-20 kDa and of prevalent basic pI (7.0-8.4) are also present. Acidic beta-keratins of 10-16 kDa are scarce and may represent altered forms of the original basic proteins. Crocodylian beta-keratins are not recognized by a lizard beta-keratin antibody (A68B), and by a turtle beta-keratin antibody (A685). This result indicates that these antibodies recognize specific epitopes in different reptiles. Conversely, crocodylian beta-keratins cross-react with the Beta-universal antibody indicating they share a specific 20 amino acid epitope with

avian beta-keratins. Although crocodilian beta-keratins are larger proteins than those present in birds our results indicate presence of shared epitopes between avian and crocodilian beta-keratins which give good indication for the future determination of the sequence of these proteins.

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Ji, X., Wu, X., Yan, P. and Amato, G. (2008). Complete sequence and gene organization of the mitochondrial genome of Siamensis crocodile (*Crocodylus siamensis*). Mol. Biol. Rep. 35(2): 133-138.

Abstract: The complete sequence of mitochondrial genome of Siamensis Crocodile (*Crocodylus siamensis*) is determined by using PCR amplification, clone and primer-walking sequencing methods. The genome is 16836 bp in size, containing 13 protein-coding, 2 ribosomal and 22 transfer RNA genes. The mtDNA genome of Siamensis Crocodile is similar to most vertebrates in gene component, order, orientation, tRNA structure, low percentage of guanine and high percentage of thymine. The nonstandard stop codes (T) in two protein genes (Cox III and Cyt b) are more than those of most vertebrates. Transfer RNA genes range in length from 61 to 76 nucleotides, and their planar structure present characteristic clover leaf, except for tRNA-Ser (AGY) because of lacking the "DHU" arm.

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Fish, F.E., Bostic, S.A., Nicastro, A.J. and Beneski, J.T. (2007). Death roll of the alligator: mechanics of twist feeding in water. J. Exp. Biol. 210(16): 2811-2818.

Abstract: Crocodilians, including the alligator (*Alligator mississippiensis*), perform a spinning maneuver to subdue and dismember prey. The spinning maneuver, which is referred to as the 'death roll', involves rapid rotation about the longitudinal axis of the body. High-speed videos were taken of juvenile alligators (mean length=0.29 m) performing death rolls in water after biting onto a pliable target. Spinning was initiated after the fore- and hindlimbs were appressed against the body and the head and tail were canted with respect to the longitudinal body axis. With respect to the body axis, the head and tail bending averaged 49.2 degrees and 103.3 degrees, respectively. The head, body and tail rotated smoothly and freely around their individual axes of symmetry at 1.6 Hz. To understand the dynamics of the death roll, we mathematically modeled the system. The maneuver results purely from conservation of angular momentum and is explained as a zero angular momentum turn. The model permits the calculation of relevant dynamical parameters. From the model, the shear force, which was generated at the snout by the juvenile alligators, was 0.015 N. Shear force was calculated to scale with body length to the 4.24 power and with mass to the 1.31 power. When scaled up to a 3 m alligator, shear force was calculated at 138 N. The death roll appears to help circumvent the feeding morphology of the alligator. Shear forces generated by the spinning maneuver are predicted to increase disproportionately with alligator size, allowing dismemberment of large prey

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Hansen, A. (2007). Olfactory and solitary chemosensory cells: two different chemosensory systems in the nasal cavity of the American alligator, *Alligator mississippiensis*. BMC Neurosci. 8: 64.

Conclusion: The nasal cavity of the American alligator contains two different chemosensory systems incorporated in the same sensory epithelium: the olfactory system proper and solitary chemosensory cells. The olfactory system contains two morphological distinct types of ciliated olfactory receptor neurons.

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Chojnowski, J.L., Franklin, J., Katsu, Y., Iguchi, T., Guillette, L.J. Jr., Kimball, R.T. and Braun, E.L. (2007). Patterns of vertebrate isochore evolution revealed by comparison of expressed mammalian, avian, and crocodilian genes. J. Mol. Evol. 65(3): 259-266.

Abstract: Vertebrate genomes are mosaics of isochores, defined as long (>100 kb) regions with relatively homogeneous within-region base composition. Birds and mammals have more GC-rich isochores than amphibians and fish, and the GC-rich isochores of birds and mammals have been suggested to be an adaptation to homeothermy. If this hypothesis is correct, all poikilothermic (cold-blooded) vertebrates, including the nonavian reptiles, are expected to lack a GC-rich isochore structure. Previous studies using various methods to examine isochore structure in crocodilians, turtles, and squamates have led to different conclusions. We collected more than 6000 expressed sequence tags (ESTs) from the American alligator to overcome sample size limitations suggested to be the fundamental problem in the previous reptilian studies. The alligator ESTs were assembled and aligned with their human, mouse, chicken, and western clawed frog orthologs, resulting in 366 alignments. Analyses of third-codon-position GC content provided conclusive evidence that the poikilothermic alligator has GC-rich isochores, like homeothermic birds and mammals. We placed these results in a theoretical framework able to unify available models of isochore evolution. The data collected for this study allowed us to reject the models that explain the evolution of GC content using changes in body temperature associated with the transition from poikilothermy to homeothermy. Falsification of these models places fundamental constraints upon the plausible pathways for the evolution of isochores.

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Starck, J.M., Cruz-Neto, A.P. and Abe, A.S. (2007). Physiological and morphological responses to feeding in broad-nosed caiman (*Caiman latirostris*). J. Exp. Biol. 210(12): 2033-2045.

Abstract: Broad nosed caiman are ectotherm sauropsids that naturally experience long fasting intervals. We have studied the postprandial responses by measuring oxygen consumption using respirometry, the size changes of the duodenum, the distal small intestine, and the liver, using repeated non-invasive ultrasonography, and by investigating structural changes on the level of tissues and cells by using

light- and electron microscopy. The caimans showed the same rapid and reversible changes of organ size and identical histological features, down to the ultrastructure level, as previously described for other ectothermic sauropsids. We found a configuration change of the mucosa epithelium from pseudostratified during fasting to single layered during digestion, in association with hypertrophy of enterocytes by loading them with lipid droplets. Similar patterns were also found for the hepatocytes of the liver. By placing the results of our study in comparative relationship and by utilizing the phylogenetic bracket of crocodiles, birds and squamates, we suggest that the observed features are plesiomorphic characters of sauropsids. By extending the comparison to anurans, we suggest that morphological and physiological adjustments to feeding and fasting described here may have been a character of early tetrapods. In conclusion, we suggest that the ability to tolerate long fasting intervals and then swallow a single large meal as described for many sit-an-wait foraging sauropsids is a functional feature that was already present in ancestral tetrapods.

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Muller J.K., Scarborough, J.E., Sepúlveda, M.S., Casella, G., Gross, T.S. and Borgert, C.J. (2007). Dose verification after topical treatment of alligator (*Alligator mississippiensis*) eggs. *Environ. Toxicol. Chem.* 26(5):908-913.

**Abstract:** Numerous studies have used temperature-dependent sex determination in reptilian eggs to investigate potential developmental effects of exogenously applied substances. However, few studies have measured the dose carried across the eggshell. We report embryonic mortality and internal egg concentrations determined by gas chromatography-mass spectrometry two weeks after exposure of American alligator (*Alligator mississippiensis*) eggs to chlorinated organic pesticides via injection or topical application. Puncturing the eggshell for injection produced high mortality compared with unpunctured controls; therefore, further evaluation of this method was abandoned. Although higher than controls, mortality was much lower in eggs treated topically than in those injected. Transfer of chemicals across the eggshell was very low, highly variable, and did not correlate with the applied dose after topical application. These results are consistent with previous reports in the literature, casting doubt on whether a reproducible internal dose can be achieved in reptilian eggs by topical treatment.

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Skovgaard, N. (2007). Low cost of ventilation in the vagotomised alligator (*Alligator mississippiensis*). *Respir. Physiol. Neurobiol.* 159(1): 28-33.

**Abstract:** Pulmonary ventilation requires energy, but the estimated costs of breathing in reptiles vary from 1 to 30% of resting metabolic rate. The low values have been estimated from changes in oxygen uptake during hypoxia or hypercapnia, but it remains possible that these treatments affected metabolism. We equipped alligators with masks for simultaneous measurements of ventilation and oxygen

uptake during hypercapnia, hypoxia and bilateral vagotomy. Hypercapnia and hypoxia caused a marked increase in total ventilation, but oxygen uptake remained unchanged indicating a very low energetic cost of breathing. Upon vagotomy, breathing pattern changed to occasional and exceedingly deep breaths ( $76.1 \pm 11.1 \text{ ml kg}^{-1}$ ) followed by buccal oscillations and shallower breaths ( $22.2 \pm 2.3 \text{ ml kg}^{-1}$ ) interspersed between long non-ventilatory periods. This change in breathing pattern did not affect oxygen uptake. The duration of inspiration increased substantially upon vagotomy, so that inspiratory flow rate did not increase proportionally to tidal volume. These prolonged inspiratory times leads to less flow resistance and may explain that tidal volume could be increased substantially without a measurable energetic cost.

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Bishop, E.J., Shilton, C., Benedict, S., Kong, F., Gilbert, G.L., Gal, D., Godoy, D., Spratt, B.G. and Currie, B.J. (2007). Necrotizing fasciitis in captive juvenile *Crocodylus porosus* caused by *Streptococcus agalactiae*: an outbreak and review of the animal and human literature. *Epidemiol. Infect.* 135(8): 1248-1255.

**Abstract:** We observed an outbreak of necrotizing fasciitis associated with *Streptococcus agalactiae* infection in a group of juvenile saltwater crocodiles (*Crocodylus porosus*). We undertook screening of crocodiles and the environment to clarify the source of the outbreak and evaluated the isolates cultured from post-mortem specimens with molecular methods to assess clonality and the presence of known group B streptococcal virulence determinants. The isolates were indistinguishable by pulsed-field gel electrophoresis. They were a typical serotype Ia strain with the Calpha-like protein gene, epsilon (or alp1), the mobile genetic elements IS381 ISSag1 and ISSag2, and belonged to multi-locus sequence type (ST) 23. All of these characteristics suggest they were probably of human origin. We review the medical and veterinary literature relating to *S. agalactiae* necrotizing fasciitis, epidemiology and virulence determinants.

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Rom Whitaker and Laurel Converse (2007). Gharials: the fight against extinction. *Herpinstance* 4(2): 34-36.

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GECV (Grupo de Especialistas en Cocodrilos de Venezuela) (2007). Estado Actual del Programa de Conservación del Caimán del Orinoco. Special Edition of Biollania No. 8.

(= Updated Status on the Conservation Program for the Orinoco Crocodile). Comprises the Proceedings of Workshop III for the Conservation of the Orinoco Crocodile; San Carlos, Venezuela, 17-19 January 2007 [also see Crocodile Specialist Group Newsletter 27(1): 9-10]. Part I. Species synopsis; Part II. Workshop presentations; Part III. Abstracts of other works; Part IV. Conclusions and recommendations of 4 workshops; Part V. Strategic plan.

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## Book Reviews

Rueda-Almonacid, J.V., Carr, J.L., Mittermeier, R.A., Rodriguez-Mahecha, J.V., Mast, R.B., Vogt, R.C., Rhodin, A.G.J., de la Ossa-Velasquez, J., Rueda, J.N. and Mittermeier, C.G. (2007). *Las tortugas y los cocodrilianos de los países andinos del Trópico*. Serie de guías tropicales de campo No. 6. Conservation International: Bogota, Colombia.

This wonderfully illustrated book covers the turtles and crocodilians of the Andean countries of the tropics of South America. With regard to crocodilians, sections deal with a range of topics, including methods for studying crocodilians in the field, egg management, capture, population monitoring and assessment, etc. The skin and skull morphology of each species is described in detail, using simple, clear diagrams and images. A key for the identification of South American crocodilians is included, which also uses representative photographs of different morphological features to assist the user.



Written in Spanish, and dedicated to the memory of CSG member Federico Medem, the book is a very useful guide to the turtles and crocodilians of the region.

Javier Castroviejo, José Ayarzagüena and Alvaro Velasco (eds.) (2008). *Contribución al conocimiento de los caimanes del género Caiman de Suramérica*. Asociación Amigos de Doñana: Seville, Spain.

“Contribution to the Knowledge of the Caimans of the *Caiman* Genus in South America” deals with the conservation and management of *Caiman* spp. using case studies of programs from Venezuela (*C. crocodilus*; Alvaro Velasco), Colombia (*C. crocodilus*; Sergio Arturo Medrano-Bitar and Antonio Jose Gómez), Brazil (*C. yacare*; Marcos Coutinho and Vera Luz), Bolivia (*C. yacare*; Alfonso Llobet and Ana K. Bello), Paraguay (*C. yacare*; Aida Luz Aquino and Norman J. Scott) and Argentina (*C. latirostris*; Alejandro Larriera, Alba Imhof and Pablo Siroski). An updated chapter on the biology and ecology of *Caiman crocodilus* is provided by José Ayarzagüena and Javier Castroviejo.

Each of the programs presented not only outlines current management practices, but also the way in which the programs have been adapted to overcome problems as they were encountered. They are good examples of how adaptive management can and should proceed with crocodilians. Another important theme is clearly stated by Grahame Webb (CSG Chairman) in the preface; “A common theme through most of these case histories is recognition that the prime beneficiaries of harvest programs should be local people.”

The book represents an important contribution to crocodilian management generally, with ramifications beyond caimans in South America.

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