

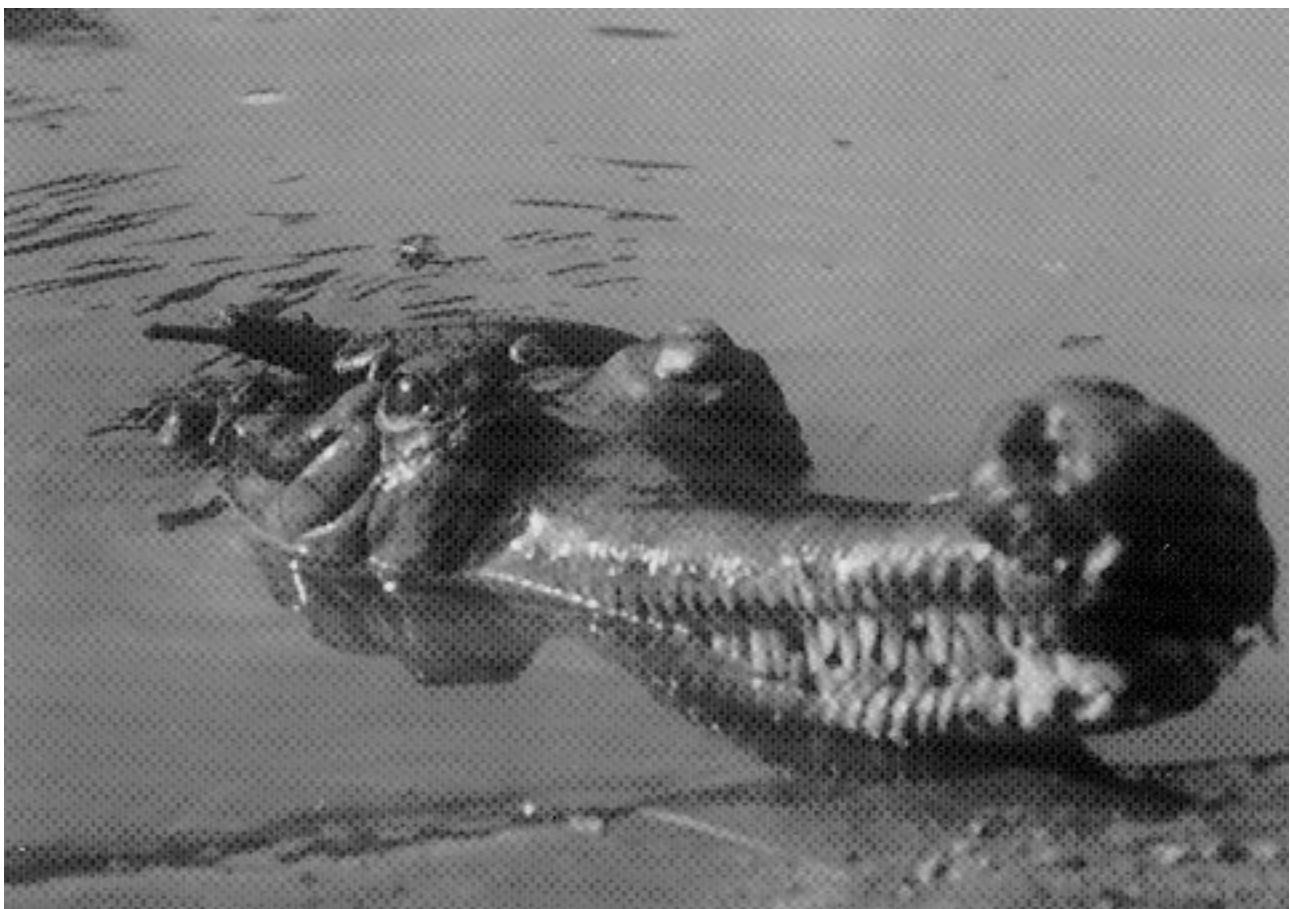
# CROCODILE SPECIALIST GROUP

## NEWSLETTER

VOLUME 13 NUMBER 4, OCTOBER 1994 - DECEMBER 1994 --- WWW Edition

IUCN--The World Conservation Union  
Species Survival Commission

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Cover Photo: Adult male gharial (*Gavialis gangeticus*) with hatchling at Nandankanan Biological Park, Orissa, India (see Crocodile Census in Orissa below). Captive breeding has been successful since 1980 and both males and females are said to show parental care of hatchlings. -- S. Maharana, Dept. Zoology, Khallikote College, Berhampur, Orissa 760 001, India.

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## Table of Contents

- PATRONS
- STEERING COMMITTEE MEETING
  - CSG business, finances
  - Newsletter subscriptions
  - Membership renewal
  - 13th Working meeting of the CSG
  - Thailand
  - CITES Identification Manual
  - CITES proposals
  - South Africa
  - Australia
  - Ecuador
  - Tanzania
  - Indonesia
  - Madagascar
  - India crocodile conservation crisis
  - Argentina
  - Yacare imports to the USA
  - Assessment of crocodylian management programs
  - DNA studies
  - Honduras crocodylian management
  - World trade in crocodylian skins 1990-1991
- CITES 9th Conference of the Parties
  - Australia
  - South Africa
  - Ecuador
  - Indonesia
  - Madagascar
  - Tanzania
  - Uganda
  - Somalia
  - Universal tagging crocodile skins
  - Criteria for listing and delisting species
- AREA REPORTS
- AFRICA
  - Seychelles:
  - South Africa:
  - Zimbabwe:
- WESTERN ASIA
  - India:
- EASTERN ASIA & OCEANIA
  - Australia:
  - China:
  - Nauru:

- Philippines:
  - CENTRAL & SOUTH AMERICA
    - Argentina:
    - Belize:
    - Brazil:
    - Venezuela:
  - NORTH AMERICA
    - Mexico:
    - United States:
  - PUBLICATIONS
  - ZOOS
  - REQUESTS
  - PERSONALS
  - EDITORIAL POLICY
  - CSG OFFICERS AND STEERING COMMITTEE MEMBERS
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The CSG NEWSLETTER is produced in both printed and www editions by the Crocodile Specialist Group of the Species Survival Commission, IUCN - World Conservation Union. The NEWSLETTER provides information about crocodilians, their conservation, status, and management, and on the activities of the CSG. The hardcopy edition of the NEWSLETTER is distributed to CSG members and, upon request, to other interested individuals and organizations. We hope you find this www edition of use. All subscribers and users are asked to contribute news and other materials---see Editorial Policy below. As a professional courtesy, the sources of the news and information are identified throughout the NEWSLETTER. If you use any of the information provided in the NEWSLETTER, please continue that courtesy and cite the source. Subscribers who receive the printed edition of the NEWSLETTER are requested to make a voluntary contribution (suggested \$40.00 US per year) to defray expenses of publication and mailing. Comments concerning the NEWSLETTER or this www page should be addressed to the CSG Editorial Office: Dr. J.P. Ross, Executive Officer, Florida Museum of Natural History, Gainesville, FL 32611-7800, USA.

Prof. Harry Messel, Chairman  
IUCN Crocodile Specialist Group  
Executive Chancellor  
Bond University  
Australia

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## **PATRONS**

*The following Patrons of the CSG have contributed more than U.S. \$500.00 during the past 12 months. The funds donated have been deposited with University of Florida Research Foundation, Inc., and are used to support the CSG program:*

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- Mainland Holdings Ltd., Lae, Papua New Guinea.
- Utai Youngprapakorn, Samutprakan Crocodile Farm, Samutprakan, Thailand.
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- Crocodile Farmers Association of Zimbabwe, Harare, Zimbabwe.
- American Alligator Farmers Association, Plant City, Florida, U.S.A.
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- Paul H. Slade, Nell and Hermon Slade Trust, Mona Vale, Australia.
- Crocodile Management Unit, Department of Environment and Conservation, Boroko, Papua New Guinea.
- Vic Onions, Edward River Crocodile Farm, Cairns, Australia.
- Keith Cook & Alecia Darbonne, Australian Crocodile Traders, Cairns, Australia.
- Crocodile Management Association of Thailand, Bangkok, Thailand.
- Prof. Harry Messel, Sydney, Australia.
- Rachmat Wiradinata, PT. Ekanindya Karsa, Jakarta, Indonesia.
- Wayne Sagrera, Vermilion Gator Farms, Abbeville, Louisiana, U.S.A.
- Mauri U.S.A. Inc., New York, NY, U.S.A.
- Robert and Ellen Young, Thonotosassa, Florida, U.S.A.
- Terry Cullen, Cullen Vivarium, Milwaukee, Wisconsin, U.S.A.

## **STEERING COMMITTEE MEETING**

### **Crocodile Specialist Group Steering Committee Meeting**

7 November 1994, Fort Lauderdale, FL, USA

Present: H. Messel, F. W. King, D. Jelden, P. Ross, H. Jenkins, G. Webb, A. Larriera, I. L. Brisbin,

D. David, T. Joanen, R. Elsey, O. Behra, A. Villa-Lopera, P. Ratanakorn, S. Broad, C. H. Koh, J. Villalba Macias.

Observers: Y. Takehara, N. Ishii, A. Saikyo, E. Carrillo, A. Sugiyama, K. Preiss, L. Roiter, U. Youngprapakorn, W. Leelapatra, W. Ramono, G. Letts, S. Ranot, E. Fernandez, J. White, E. Velasco, P. Evans, P. Viallejo, A. Paucar, N. Kinler, D. Ashley, A. Woodward, T. Hines, P. Wilkinson, K. Rice, D. Carbonneau, A. Taito, Y. Kobuchi, M. Kobuchi, K. Ogiso, S. Broad, F. Miadana Harisoa, J. Rahaja Harison, E-J. Rakotonanana, C. Carson, S. Tunhikorn, T. Waller, C. Vitale, E. Severre, R. Charette, R. Wiradinata, G. Saputra.

The CSG Steering Committee meeting at Fort Lauderdale was well attended with seventeen Steering Committee members and 41 members and observers from over 20 countries. After opening the meeting and thanking all present for their efforts, the chairman, Professor Messel, proposed that forty five minutes be used for routine CSG business and then the meeting would adjourn until 1 pm to allow members with commitments to CITES events to be absent.

**CSG business, finances.** A cumulative financial report for the first three quarters of 1994 and an interim report showing current balances was presented by the Executive Officer. Donations of \$44,655.46 and other revenues of \$30,210.05 were received and expenses to date totaled \$61,601.62 leaving a current balance of \$36,549.51. Of this current balance \$17,005.00 was committed to special projects leaving an \$19,544.50 available for general operations. All major expenses anticipated for the year had already been met so that a year end balance of just under \$20,000 was anticipated. While this cash situation was unusually favorable, CSG usually experiences extreme cash flow shortages in the new year until major donations are received. Careful fund management was creating an operating surplus to help buffer such shortages in 1995.

**Newsletter subscriptions.** Response to the request for subscriptions was received from 123 people. Of these, 55 (45%) were unable to make a donation and the remainder sent in \$2,320 in subscriptions and \$1,795 in additional donations for a total of \$4,115.00 toward Newsletter production. Brief discussion of whether a lower suggested subscription would increase responses and net revenue was held with a majority feeling the current suggested donation of \$40.00 should be maintained.

**Membership renewal.** Following the mandate from IUCN to renew membership every three years, 345 individuals nominated by regional Vice Chairmen were sent an invitation to be CSG members for the next triennium 1994 - 1996. Early returns indicate 65 acceptances, 2 inactive addresses and one declination. Nominated members have been asked to return the three page response sheet to IUCN and to send a copy of the first page with their current address to CSG in Gainesville, USA. A stabilized membership of around 340 is anticipated and additional members may be invited through the triennium.



Photo: Steering Committee of the CSG in session, Fort Lauderdale, USA. T. Kataoka photo.

**13th Working meeting of the CSG.** Following the receipt in Pattaya of tentative invitations to host the next CSG meeting, a questionnaire was sent to potential hosts asking for details of the facilities and services they could offer. Responses were received from Singapore, Argentina and Cuba. Representatives of each of these made brief presentations concerning their invitation. Discussion followed on the relative merits of each possibility and the desirability of alternating CSG meetings between regions and keeping costs low. Considerable support for the detailed invitation from Argentina was expressed and the chairman's proposal to accept this invitation was unopposed. The chairman thanked the other offers and proposed that Singapore be given priority consideration for the following (14th) Working Meeting should they choose to offer an invitation again. The 13th Working Meeting of the CSG will therefore be held in Santa Fe, Argentina, in May 1996, hosted by Proyecto Yacare and Convenio/Inta/Magic/MUPCN coordinated by Alejandro Larriera. The Executive Officer was instructed to coordinate with the hosts and inform the membership at the earliest possibility of the various arrangements.

**Thailand.** Mr. Wattana Leelapatra, of Department of Fisheries, presented a response from the Thai Authorities to the review of crocodile management in Thailand that took place in May 1994. In a report to the CSG Review Committee responding to the recommendations of the Review, Mr. Wattana noted that the necessary regulations have now been approved as a Ministerial Notification and are now in place. Additional actions and plans to address the remaining recommendations of the review were presented including a draft management plan for crocodiles in Thailand. CSG was requested to review and comment upon the draft Management Plan. The persistent problem of bringing caiman imports under regulation was discussed and the Thai authorities have proposed action in this regard in conjunction with major importers. Dr. P. Ratanakorn reported that the issue of imports of crocodiles from Cambodia was now clearly recognized in Thailand and that the issue would be addressed in bilateral discussions with Cambodia in January 1995. The chairman congratulated Thailand on their prompt and vigorous response to the review and hoped that progress in crocodile management and trade control would be maintained.

**CITES Identification Manual.** Mr. Richard Charette of Environment Canada was introduced and outlined the work he was undertaking for the CITES Secretariat to produce new ID manuals for crocodilians suitable for use by customs officials. He explained the approach he had taken with an ID manual for birds and invited assistance and comments from CSG. In response it was agreed that the Executive Officer should maintain contact with Mr. Charette and coordinate his contact with suitable CSG experts on identification.

The meeting then adjourned and re convened at 1.00 pm.

**CITES proposals.** A statement drafted by CSG and adopted by IUCN as its recommendations on crocodilian proposals was presented. This document reflected CSG decisions made in Pattaya and immediately following and stated that final recommendations would be presented to the CITES meeting. Each proposal was then reviewed and a recommendation finalized.

**South Africa.** A response by David Blake, to the CSG enquiry of May 1994 regarding surveys clarified the depth of surveys. The question on sport hunting under Conf. 8.22 has been addressed in the modified proposal section 32, para 5 and section 77.

**Recommendation: Support.**

**Australia.** The unqualified support for this proposal was reiterated.

**Ecuador.** In response to the CSG request for clarification of implementation procedures for black caiman management the following information was received:

- The Management Authority, INEFAN, has clarified its policy and assigned a fulltime staff person to crocodilian management.
- A draft management plan outlining licensing and permitting procedures, ranch inspection, technical development and control measures has been prepared.
- An additional survey of the Rio Curaray revealed additional areas where black caiman appear relatively dense.
- Copies of legislation and regulations from Venezuela, Colombia and USA have been provided by CSG to the Management Authority as a guide to develop similar regulations appropriate to Ecuador.
- The cautious approach, extensive data and documentation and very small harvest of eggs (1,500 annually for 3 years) was emphasized.

Despite these advances some apprehension remains about the value of downlisting black caiman prior to the full development of the ranching and management program. After discussion it was proposed that the Ecuadoran Management Authority should propose a zero export quota under 3.15 listing for the next two years and request a CSG review team to evaluate management and recommend to CITES Secretariat when the export quota could be increased. Costs of review would be borne by Ecuador following the procedure established in other CSG reviews. This mechanism is feasible under Conf. Res 3.15. This mechanism was thought to provide adequate safeguards and at the same time encourage the development of management procedures. In this developmental period additional surveys and studies of black caiman biology were encouraged.

**Recommendation: Support with conditions as set forth above.**

**Tanzania.** The report by Dietrich Jelden of his inspection in late September was presented and discussed. Jelden recommended extensive revision of the ranching program to enhance its operation and a quota (200-300 annually) for nuisance crocodile control. The Tanzanian representative presented a newly modified proposal that requested a wild harvest quota of 2,000 annually and presented updated and improved data on human mortality due to crocodiles. The political and human issues of this problem in Tanzania were recognized. Following prolonged discussion it was agreed that actual number of large crocodiles removed from the wild to protect human life was not a critical issue and that a wild harvest of between 200 and 2,000 annually might

be required. The higher figure seems inconsistent with recent nuisance crocodile control of fewer than 200 per year. A more important issue was identified as the control measures necessary to ensure that animals collected for this quota were actually taken from areas of human crocodile interaction and not taken from protected areas such as the Selous Game Reserve. After discussion and examination of the government-approved management policy for crocodiles, it was agreed that the necessary mechanisms were available through existing government agency and hunting controls. It was recommended that these measures be explicitly stated in the proposal document and that a component of documentation, reporting and verification of the effectiveness of the program in reducing threats to humans be added. Concern was expressed that the revised wild quota requested of 2,000 annually would be perceived as too high. Following additional discussions with the Tanzanian Management Authority it was determined that the available information appears inadequate to support a wild harvest of the size requested following the requirements of either 3.15 or 8.22. The CSG must therefore take the conservative approach of concurring with the Jelden report recommendations of a wild quota of 300 annually.

**Recommendation: Support, contingent upon amendments to the proposal as outlined above and a quota of 300 and an additional quota for sport hunting of 100 annually.**

**Indonesia.** In response to CSG and other concerns Indonesia recently (22 Oct 1994) made an official commitment to impose a voluntary moratorium on all crocodile exports (except personal possessions) pending development of the crocodile management plan. At such time as Indonesia established the management plan and implemented it, and a CSG review committee could recommend to the CITES Secretariat that the plan was implemented, then an export quota would be established. Indonesia proposed to proceed with the 3.15 downlisting request with special conditions under Conf. Res 8.22 for Irian Jaya to parallel the PNG management program. The necessary Decree establishing crocodile management regulations was signed by the Minister in October. Recognizing these substantial developments, and noting that the Standing Committee of CITES had also recognized progress made in crocodile management, the CSG recommends supporting this structure.

**Recommendation: Support as described above.**

**Madagascar.** Information was received from the Malagasy Management Authority clarifying the nature of crocodile management and problems with country wide application due to social factors. The growing success of the egg collection/ranching program in the Bessalampy region was described. With the incentive of economic returns over 5 years of the program, local people are now protecting wild crocodiles in this restricted area. Appendix I listing would end this small successful program. The Group agreed that the Madagascar proposal clearly does not qualify for approval as a 3.15 downlisting. Numerous components of monitoring, management, status of the wild population, and trade control are absent. In an attempt to preserve the conservation gains achieved, changing the proposal to a special 7.14 (quota) proposal was suggested. This will require a special extension for 2 years by the Parties. The proposed quota under 7.14 should be restricted to ranched animals from current stock and a figure in the region of 2,000 - 5,000 annually is appropriate. A working group was asked to analyze the available data and propose a suitable quota figure for adoption by the Madagascar authorities.

**Recommendation: Reject 3.15 listing, Support 7.14 with a quota for ranched animals only.**



These recommendations were circulated to IUCN, the CITES Secretariat and selected Parties. Additional modifications were made to some proposals in the course of negotiations at CITES and the final outcomes are described in a separate report.

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[\[NEXT PAGE\]](#)----[\[TOP OF THIS PAGE\]](#)----[\[TABLE OF CONTENTS\]](#)

**India crocodile conservation crisis.** Copies of correspondence and newspaper articles on crocodile conservation in India forwarded by Harry Andrews and Rom Whitaker were discussed. The Ministry of Environment has called on all State Forest Wildlife Departments and crocodile breeding facilities to stop breeding crocodiles and repeated their determination not to allow commercial crocodile ranching or farming in India. Although many state forest departments are favorable to ranching or farming the central government is preventing this and the fate of the thousands of captive crocodiles in India is in doubt. Monitoring of wild populations has been terminated. After discussion the Executive Officer was asked to arrange a meeting with Indian authorities at CITES to discuss the issue. During the following two weeks preliminary enquiries were made but it became evident from the public and private comments of the Indian delegation leader and other members of the delegation that no change in their position could be anticipated at this time. The problem remains deeply rooted in political and cultural realities in India that are obscure to CSG. The considerable gains of crocodile conservation in India are in danger of being reversed and the problem appears intractable.

In other news, Harry Andrews reports that 3 adult pairs of *C. palustris* are being provided from Madras Crocodile Bank for breeding programs and restocking in Bangladesh and Tamil Nadu State Forest Department will provide 300 muggers to Pakistan for restocking there.

**Argentina.** A summary of progress to date in the *C. latirostris* program in Santa Fe province was presented for discussion. Alejandro Larriera summarized the report and suggested that a proposal for downlisting *C. latirostris* populations in Argentina under 3.15 ranching could be anticipated at the next Conference of the parties.

**Yacare imports to the USA.** Carmen Vitale of CITES-Paraguay, representing Lucy Aquino, presented a draft statement on the ongoing problems generated by the failure of USA to down list *Caiman crocodilus yacare* under its domestic legislation to become compatible with the CITES Appendix II listing. After discussion the chairman proposed that while CSG supported their efforts, the solution to this problem lay between US and South American representatives.

In subsequent action a meeting was convened by CSG on 15 November to promote informal discussion of the problem between representatives of producer and consumer countries of yacare. Following this meeting a detailed statement was prepared by representatives of Argentina, Brazil, Bolivia, Paraguay and Uruguay, and presented to Mrs. Mollie Beatie, Director of the US Fish and Wildlife Service. The substance of this statement officially calls on the US to take some action with regard to downlisting *yacare*.

**Assessment of crocodilian management programs.** Following the discussion of this issue at Pattaya a draft set of criteria for carrying out such assessment was presented. The preparers of the draft then withdrew the document as preliminary and unfinished and no further discussion was held. Subsequent to the Steering Committee meeting a revised set of criteria were forwarded by Jon Hutton for consideration by the chairman and the Steering Committee as follows:

#### DRAFT GUIDELINES FOR CSG REVIEWS OF MANAGEMENT PROGRAMS.

The following are suggested as guidelines for the review of crocodilian management programs that have been ongoing for some time:

- Is the country aware of and fulfilling its obligations under CITES, particularly with respect to tagging and annual reporting?
- Is there a current management plan which is adequate to ensure a high probability that harvesting will be sustainable?
- Is there an adequate legal framework for the implementation of the management plan and the fulfillment of international obligations?
- Is there a monitoring system adequate to detect trends in meaningful population indices and what are these indices and trends?
- Is the management regime non-detrimental or does it give benefits to the wild crocodilian population, and if so, how and to what extent?
- Is there any evidence of illegal trade, and if so, to what extent?
- Are any animal husbandry elements of the management program unduly wasteful and does the management program adequately take into account animal welfare issues in harvesting and husbandry?

Other points of interest are:

- Does the management program give benefits to rural communities and if so how and to what extent?
- Does the management regime give a positive economic return?

**DNA studies.** Prof. I. Lehr Brisbin introduced some recent advances and results on the use of DNA probes as a tool for crocodilian stock identification with considerable potential for CSG use. He noted that the technique has become user friendly and inexpensive and some preliminary results on *Alligator* suggested that specific DNA markers allowed differentiation of Florida, Louisiana and South Carolina gators. The potential for forensic application was obvious, for example in determining the source of skins collected in the Tanzania nuisance control program. He suggested that CSG needed to take a proactive stance to direct these efforts and proposed a meeting of croc DNA experts to bring scientists together in fall of 1995 and present detailed results to the CSG Working Meeting in Argentina in 1996. Receiving approval in principle he agreed to work with the Executive Officer to coordinate this plan.

**Honduras crocodilian management.** Eric Fernandez made a presentation on recent developments in the Management Authority of Honduras to strengthen CITES implementation and crocodile management. Effective regulation and conservation of natural wildlife resources in Honduras has taken great steps forward with the development of the rules for protective regulation of wildlife, the creation of a Scientific Authority incorporating academic inputs and the strengthening of the Management Authorities role in CITES implementation. Dr. Polo Micheletti was in charge of CITES implementation directly under the Minister of Natural Resources and with the cooperation of CODEFOR for technical and scientific issues. The proposal to register the farm at San Pedro Sula as a captive breeding facility under Conf. Res 8.15 was submitted to CITES Secretariat and Honduras was informed that the proposal is being circulated to CITES Parties. It was hoped that the recent developments would reassure CSG and Parties that the Management Authority was now fulfilling its obligations. Mr. Fernandez was invited to submit written comments for the minutes on this issue.

**World trade in crocodylian skins 1990-1991.** Don Ashley presented copies of the new compilation of trade statistics prepared by Richard Luxmoore and Lorraine Collins of World Conservation Monitoring Center under a contract from the International Alligator and Crocodile Trade Study (IAACTS). The report updates previous reports covering 1980 -1987 using CITES trade data from 1988-1991. Imports and exports of whole skins and sides (flanks) are listed by species and country and volume of national and world trade estimated.

The meeting closed at 6.15 pm.

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**Crocodile Specialist Group, CITES 9th Conference of the Parties, 7 -18 November 1994, Fort Lauderdale, USA**

*Summary of results. These come into effect 90 days after the Conference of the Parties (Appendix listings) or upon issuance of an official notification by the Secretariat to the Parties (Resolutions). Effectively, these changes will apply by March 1995.*

**Australia**--*C. porosus* listed in Appendix II under Berne criteria approved.

**South Africa**--Appendix II listing for *C. niloticus* under 3.15 ranching approved.

**Ecuador**--*Melanosuchus niger* listed on Appendix II ranching 3.15, subject to conditions: zero export quota for 1995 & 1996 and subsequent export quota determined after CSG and CITES Secretariat approves management program.

**Indonesia**--Proposal to list *C. porosus* on Appendix II approved subject to conditions: No exports of either *C. porosus* or *novaeguineae* until CITES Secretariat and CSG approve the new management program, a special wild harvest quota will be established under 8.22 for Irian Jaya.

**Madagascar**--Proposal for ranching 3.15 amended (withdrawn) and Madagascar granted special extension of quota for ranched *C. niloticus* under 7.14 ; 1995= 4,500, 1996 = 5,000, 1997 = 5,000, plus 200 sport and nuisance animals each year. Madagascar must submit a proposal to downlist its *C. niloticus* population at the next Conference of the Parties or it will automatically revert back to Appendix I.

**Tanzania**--Special quota for export of wild harvest for control of nuisance crocodiles under 8.22. Original request for 12,000 *C. niloticus* over three years (1995 -97) amended to 6,000 over three years. Approved, after negotiation to 1,000 in 1995, 1,000 in 1996 plus 200 specimens for sport hunting in each year. Special conditions; careful record must be kept of location, size and numbers of animals removed, information forwarded to CITES Secretariat as part of 3.15 ranching reports. Future wild harvest quotas will be approved on basis of apparent success of the program. Changed political climate and increasing foreign investment makes ultimate success of ranches more likely and so this quota was approved as an interim measure and encouragement towards good management. Tanzania also continues to operate a ranching program under 3.15.

**Uganda**--Request to continue current quota of ranched *C. niloticus* under 7.14 for the next 2 years approved. (2,500 ranched specimens each year 1995 - 1997).

**Somalia**--Automatic reversion of Somali population of *C. niloticus* to Appendix I as no alternative proposal received and 7.14 status expired.

**Universal tagging crocodile skins**--An amended and considerably simplified version of 8.14 was approved. Basic requirements for approved tags, tagging crocodylian skins and monitoring trade remain unchanged. Whole skins and single flanks must be individually tagged and CITES documents should include the same information as is on the tags (unique identification numbers, ISO country codes, species codes and, where appropriate, year of production or harvest). Small pieces of skins such as tails, throats, feet and other parts do not need to be individually tagged, but instead can be placed in a transparent container sealed with one tag, a description and the weight of the contents. Re-exports should either have original tags intact, or have a replacement tag applied, unless the pieces originally imported have been further processed or cut into smaller pieces. In the latter case of processed or cut up pieces, or finished products, no tag is necessary but re-exporting countries are called upon to implement an administrative system for the effective matching of imports and re-exports. Procedures for resolving apparent mismatches between tags and accompanying documentation, without unduly penalizing legal trade, are proposed. The new resolution will replace 8.14.

**Criteria for listing and delisting species on Appendix I and II**--New more flexible and objective criteria were approved. This should make rational decisions in favour of conservation and sustainable use easier. The New Criteria are firmly based on Article II of the Convention and detailed in six annexes to the resolution which specify:

Annex 1: Biological criteria for Appendix I. These include A. population size, B. restricted or fragmented area of distribution, C. a decline in the number of mature individuals or D. status likely to satisfy one of A-C within a period of five years if the species is not included on Appendix I. Only one of A. through D. need apply to list a species. Procedures and guidelines for the application of these criteria are specified in Annexes 3 - 6.

Annex 2: Criteria for Appendix II according to Article II para 2(a) detrimental impact of trade & 2(b) similarity of appearance.

Annex 3: Special cases, split listings and listing higher taxa.

Annex 4: Precautionary measures, specifying measures that will ensure that any amendments to the Appendices serve in the best interest of the conservation of the species and including procedures for implementing quotas and transfer back to Appendix I should control measures fail. No

species listed in Appendix I shall be removed from the Appendices unless it has first been transferred to Appendix II with monitoring of the impact of trade for at least two intervals between meetings of the Conference of the Parties.

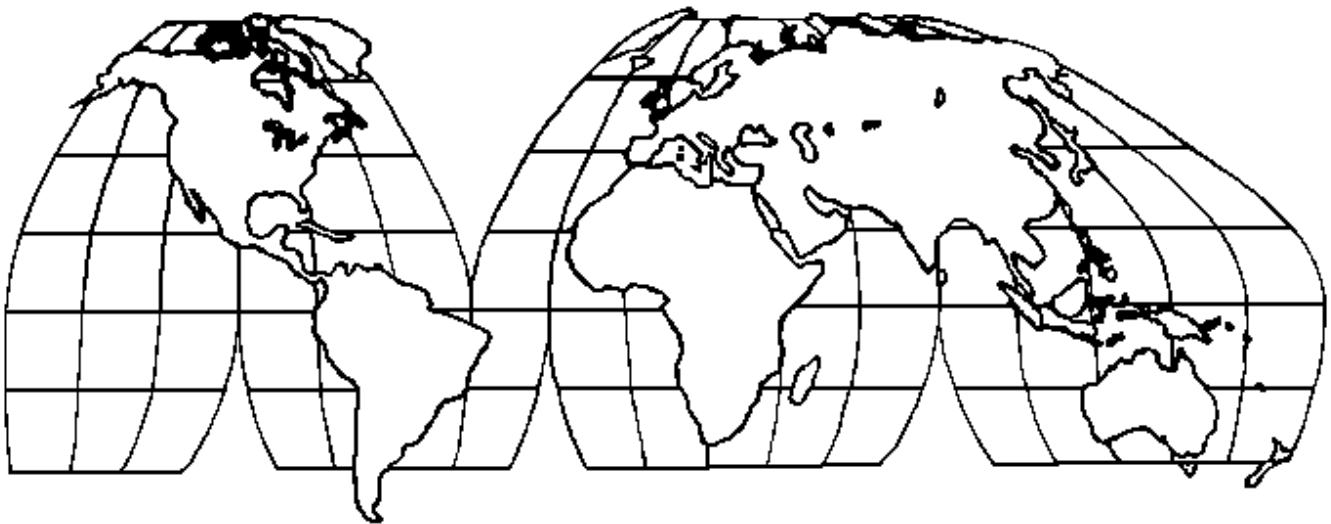
Annex 5: Definitions, notes and guidelines, including examples of appropriate areas of distribution, population sizes, fluctuations and rates of decline, that might be considered when evaluating proposals to change appendices. The language repeatedly specifies that these "...have been found to be an appropriate guideline (not a threshold). However, this figure is presented only as an example, since it is impossible to give numerical values that are applicable to all taxa. There will be many cases when this numerical guideline does not apply."

Annex 6: Format for Proposals.

The new resolution repeals a series of earlier resolutions [1.1, 1.2, 2.17, 2.19, 2.20, 2.21, 2.22, 2.23, 3.20, 4.26, 7.14 and 8.20], all of which are addressed in the new resolution. Note that as 7.14 is now repealed, future extensions are not possible and quotas will have to be applied for under the new resolution. It is noteworthy that the form of several of the crocodile Appendix listings suggested by CSG (e.g. Indonesia, Ecuador, Madagascar, Tanzania) are very much in step with the new listing criteria.

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## AREA REPORTS



### AFRICA

#### Seychelles:

**Seychelles Crocodile is *Porosus*.** In a recent paper in *Phelsuma* vol. 2 (1993):54-58, J. Gerlach and K. L. Canning compare three specimens of crocodile skull in the Mahé, Seychelles, museum with representatives of *C. niloticus*, *C. palustris*, *C. porosus* and the extinct *C. robustus*. They conclude on the basis of skull morphology that the Seychelles crocodile was *C. porosus* and not *C. niloticus* as had been previously assumed. An identical observation was reported by Charles A. Ross at the May 1994 CSG working meeting in Pattaya. Crocodiles were abundant on the Seychelles, a remote archipelago approximately 1,600 km east of Africa in the Indian Ocean, when they were explored in the 1600's. The crocodiles were exterminated by 1819. The closest source area of recent distribution of *C. porosus* is India (2,700 km) and Sumatra (4,400 km) east across the Indian Ocean. --from R. Honegger, *Zurich Zoo, Zurich, Switzerland*.

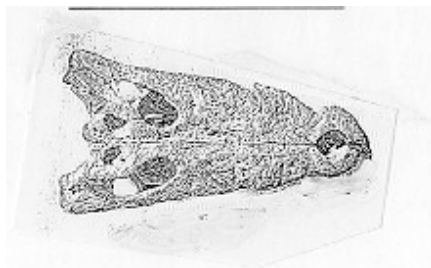


Photo: Crocodile skull from the Mahé Museum, Seychelles. From *PHELSUMA* vol. 2: pg 55.

#### South Africa:

**Dead Crocodile to Give Birth.** In what is believed to be a first in South Africa, eggs were removed from a dead crocodile and placed in an incubator at the Natal Parks Board crocodile center at St. Lucia where staff are hoping they will hatch. The 2.6 m female crocodile died after being injured by people near a village. David Blake and Terry Coleman of the St. Lucia Crocodile Center removed the severely injured animal to the center where it died of its injuries. A post mortem was conducted by Mr. Blake assisted by Allison Leslie, a St. Lucia based researcher who wanted to examine the animals stomach for food contents. "I suspected the crocodile was pregnant and when we opened her up we found she was fully gravid with 33 eggs. We decided to take the chance and removed 32 of the eggs for incubation. We should know in two or three weeks if they are fertile," said Mr. Blake after the two hour operation. The dead crocodile is believed to have made its way from the Mzunduze River to a kraal (enclosure) where cattle and chickens were kept, where it became entangled in a fence. The Natal Parks Board has been unable to establish who attacked it. -- *From The Natal Mercury, 20 October 1994. submitted by David Blake, St. Lucia Crocodile Center, P.O. Box 662, Pietermaritzburg 3200 South Africa.*

## **Zimbabwe:**

**Crocodile Research Group Forms.** At a meeting held in June 1994 attended by nine interested persons, it was decided to inaugurate an informal group for research on the Nile crocodile in Zimbabwe. The main thrust was to coordinate research effort on Zimbabwe's crocodiles, to review what had been achieved, what was currently being undertaken and to discuss priorities for future research activities.

A number of issues were highlighted by the first meeting, including some related to crocodile farming, to the system of management of the wild population, to demographic modeling and to population monitoring. The conclusions were that the following were priority actions:

- To improve the population model proposed in 1992 by Craig, Gibson and Hutton, estimates of the following would be required:
  - a) hatchling survival,
  - b) age of maturity,
  - c) survival of juveniles from 1 year to maturity. Although Richard Fergusson is currently working on the last of these his study lacks the necessary long term element.
- An urgent requirement was to institute population monitoring, particularly of the Lake Kariba population. This may be achieved through:
  - a) surveys, particularly concentrating on repeatable nightlight counts and accurate estimation of size distribution at various localities,
  - b) estimation of catch per unit effort during the commercial egg collecting operations and
  - c) measurement of clutch and egg sizes as indicators of female size, with a view to estimating the size distribution of the reproductively active females in the population.

The intention is to initiate some of these research programs during the current rainy season. Clutch and egg sizes at two localities on Lake Kariba have already been measured by Richard Fergusson in conjunction with egg collection by crocodile farmers. Later this season it is hoped to do a capture and mark exercise of hatchlings at several sites. This, of course, will have to be followed up in future years if a realistic estimate of hatchling survival is to emerge. At the same time, night light counts and size classifications will be done to provide the first data in nearly 10 years for Lake Kariba west of the Ume River (data from Ian Games for the Ume and Richard Fergusson for the Gache Gache are available in the intervening years). -- Professor John P. Loveridge, *Department of Biological Sciences, University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe.*

## **WESTERN ASIA**

### **India:**

**Crocodile Conservation Gains in Jeopardy.** In a July 1994 letter distributed to Forest Management Authorities throughout India the Indian Ministry of Environment and Forests has rejected calls for the examination of the conservation potential of commercial crocodile raising. Instead, breeding centers have been advised to cease breeding crocodiles and to solve their critical crowding problems by "rehabilitation of farm bred crocodiles in the wild habitat".

The letter, by S.C. Dey, Additional Inspector General of Forests (Wildlife) of the Ministry of Environment and Forests, ignores the realities of restricted wild habitat availability and flies in the face of advice offered by numerous Indian crocodile experts, the State Forestry and Wildlife Authorities and the CSG. There are not enough protected aquatic habitats left in India to release any substantial numbers.

The CSG attempted to make contact with Mr. Dey and other Indian Government representatives at the recent CITES conference to initiate dialog on this problem but were advised that at the present time no change in this official policy is likely. This position places the very significant gains made for crocodile conservation in India over the last 25 years in jeopardy. The Indian program has successfully solved all the problems of incubation and husbandry necessary to successfully raise crocodiles and has implemented a very successful re-stocking program. However the further progress of the program, and the conservation of crocodiles in India, is dependent upon establishing a stable base of economic support for conservation and breeding and the necessary follow up studies and protection for restocked crocodile populations. Sustainable use for international trade from captive breeding and ranching has been strongly recommended by CSG. Under the current trade controls imposed by CITES the value of such an approach for conservation has been amply demonstrated. The Indian government decision to officially reject this option places the future of crocodile conservation in India in great doubt. CSG will continue our efforts to convince the government that sustained use of crocodiles is a positive conservation move. -- J. P. Ross *from material supplied by D. Jelden, Bundesamt fur Naturschutz, D-53179, Bonn, Germany and R. Whitaker, Madras Crocodile Bank, Mamallapuram, TN India.*

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**Crocodile Census in Orissa.** The annual census of saltwater crocodiles in the river systems of Bhitarkanika Wildlife Sanctuary was conducted during the first two weeks of January 1994. A total of 582 *C. porosus* were counted, including 62 hatchlings from August 1992, 76 yearlings, 200 juveniles, 98 subadults and 66 adults. Due to rigid protection and better management of the mangrove habitat in the sanctuary there is an apparent increase in the crocodile numbers. The average density of *C. porosus* in Bhitarkanika was 0.87/km in 1976-77 prior to restocking. The density has shown a steady increase from 1.27/km in 1984 to 4.47/km in 1994. During the survey we observed that the crocodile population is closely associated with good mangrove forest habitat and a number of hatchlings were observed in rivers and creeks which are free from human interference and have good mangrove cover.

To date, 1,384 young captive raised *C. porosus* have been released into suitable habitats in the Bhitarkanika Sanctuary. At present 510 crocodiles, from hatchlings to 19 year olds have been reared in the nature-simulating rearing and breeding pools at Dangmal Crocodile Research and Conservation Center. Collection of eggs from both the wild and the breeding enclosures have been carried out on a very modest scale. Three or four clutches have been collected and incubated in the hatchery and the majority of the nests are left in nature. More than 15 of the crocodiles released between 1977 and 1980 are known to have laid eggs in the wild. In the last three years 4 or 5 released females have nested in the forest about 200 m away from the Dangmal Research Center. Studies on sex determination, carrying capacity, human-crocodile conflict and movement and survival of released crocodiles have been undertaken and a management plan formulated accordingly.

Captive breeding of gharials, saltwater crocodiles, mugger and spectacled caimans has been conducted very successfully at Nandanakanan Zoological Park [see cover]. At present there are 250 gharial, 107 mugger, and 3 saltwater crocodiles at the Zoological Park. Captive reared gharials of 1.0 m and above are taken to the Gharial Research and Conservation center at Tikerpada for release into the Satoskia Gorge and Mohanadi River. -- Sudhakar Kar, *Research Officer, C/O the Chief Wildlife Warden, Orissa, 7-Saheed Nagar, Bhubaneswar, 751 007 India.*

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**Gharial PHVA.** A Population and Habitat Viability Assessment (PHVA) is planned for 16 - 20 January at Jiwaji University to examine the gharial (*Gavialis gangeticus*) in India. This is the first PHVA conducted for a crocodylian and the first such activity conducted entirely in-country. The workshop will be coordinated by Dr. R.J. Rao with assistance for coordination, modelling and facilitation from S. M. Hasan, S. Walker, S. Molur, R. Sukumar and R. Chellam. Invited participants include knowledgeable experts from numerous Indian gharial projects and field managers from the concerned forest departments.

The PHVA process attempts to consolidate a wide range of information on the biology, status and management of a species. From the data base assembled, a computer modelling process allows a series of different scenarios to be examined and the probable outcomes for the population estimated into the future. Using these modelled scenarios, managers and biologists can evaluate the likely effects of different management actions, identify priorities, and make educated decisions about future directions. The PHVA is not a recipe for conservation, but a very useful tool that allows the visualization of different options and evaluation of their probable outcomes.

Objectives of the current PHVA are to assess the success of the last 20 years gharial conservation and determine a strategy for long term planning. Results of the PHVA will be reported in future a Newsletter. -- R.J. Rao, *Department of Zoology, Jiwaji University, Gwalior, 474 011 India.*

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**Man-Eating Muggers.** *C. palustris* is widely distributed on the Indian sub-continent and although occasional attacks on humans are reported, man eating is rare. Two earlier cases from Gujarat State are known. In 1960 a crocodile reportedly ate a young boy, and in 1965 a pair of crocodiles attacked and ate a beggar who was sleeping on a footpath near a reservoir at night.

In May 1991 newspapers reported the death of a ten year old boy at Dundelav village, Vadodara district. In June 1991 I visited the lake where the incident took place with personnel of the Sayaji Buag Zoo assigned to trap the crocodile. The lake is approximately 5 sq km and about 2 m deep. We saw a large crocodile in the middle of the lake which approached to within about 5 m of us, swimming with open jaws and snorting loudly.

We returned on 28 June and were able to confine the crocodile to a small part of the lake with nets and then noose it and transport it to the zoo. The crocodile was a large male mugger with a total body length of 336.5 cm and weighing 210 kg.

Although there are several reservoirs and ponds in Gujarat state where crocodiles and humans come into close proximity, there have been almost no untoward incidents. However, soon after the May 1991 incident it was reported that a man was attacked by a crocodile at Rudra Mata Dam near Bhuj in Kutch. In gathering information about these attacks it was found that domestic animals, including goats, dogs, sheep and chickens, had been taken by crocodiles in the recent past. The crocodiles involved were large specimens which had become habituated to taking livestock. It is surmised that such a crocodile may lose its fear of humans and occasionally attack them. -- From R. Vyas, 1993. *Recent cases of Man-Eating by the Mugger (Crocodilus palustris) in Gujarat State. Hamadryad (Madras) Vol 18:48-49.*

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[\[NEXT PAGE\]](#)---[\[TOP OF THIS PAGE\]](#)---[\[TABLE OF CONTENTS\]](#)

## EASTERN ASIA & OCEANIA

### Australia:

**FACT AND FANCY.** Exaggerated reports about monster crocodiles are a staple of the tabloid press. We have reprinted some of these stories for their entertainment value. Rarely, the origin of these bizarre tales becomes known. Lillian Lever reports the remarkable transition of a straightforward story and photograph in the Rockhampton (Australia) Sun 10 January 1989. The Sun story recounts the capture of a 4.5 m male *C. porosus* by John Lever at Goorganga Creek. Lillian says that Goorganga, where the crocodile was captured, is an aboriginal term for "place of danger and bad spirits", suggesting problem crocodiles were experienced here before. The crocodile was well known by local residents but with the encroachment of tourism the decision was made to have him captured and moved.

In contrast is a lurid item from the Weekly World News 28 February 1989 titled "Kill-crazy Cult fed Human Sacrifices to Monster Crocodile". The photograph is exactly the same one, John Lever and trapper Brett Caldwell with a well restrained large croc. However, in the Weekly World News the crocodile has grown to 27 feet and two tons weight, 'fattened by more than 100 human sacrifices and captured from a swampy pond along with the crushed skulls of the men, women and children it had been fed'. A completely fictitious "government official" recounts a steamy tale of kidnapped teenagers, armed police raids and the killer cultists, some of whom are still at large.

[The CSG Newsletter strives to avoid this degree of journalistic licence. However, being reliably informed that at least one Queensland crocodile farm occasionally feeds its crocodiles with Timex watches, attached to the arms of its staff, we must ask what the Levers feed their crocs to account for their breeding success?- Eds]. -- *materials submitted by Lillian Lever, Koorana Crocodile Farm, Rockhampton Mail Center 4702, Qld. Australia.*

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**BREEDING BEHAVIOR IN *C. POROSUS*.** The following photo essay was sent in by -- Frank Seebacker, 44 Sherriff St. Townsville Qld 4812, Australia.



Photo: Figure 1. A 4-5 m male approaches the smaller female who is in a submissive posture, back arched and head and tail raised.



Photo: Figure 2. The male overtakes the female as she swims away in the submissive posture.

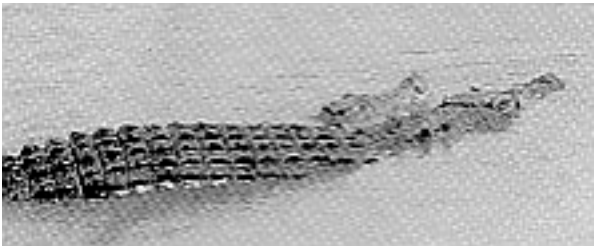


Photo: Figure 3. The male (foreground) approaches the female (background) to mount.

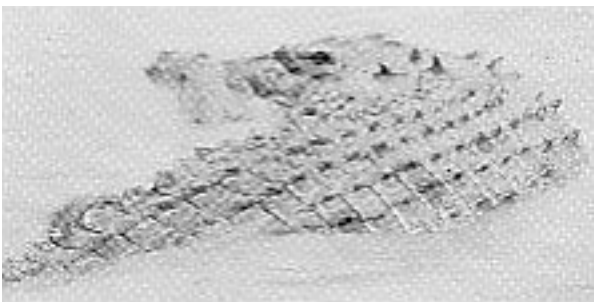


Photo: Figure 4. During mounting the male raises one hind leg over the base of the females tail and twists his body around the longitudinal axis.

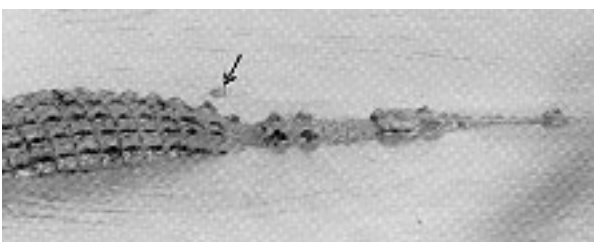


Photo: Figure 5. During coitus the female is submerged with only the tip of her snout showing (arrow).

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## China:

**HAINAN ALLIGATOR DEVELOPMENTS.** The Hainan Qiongsan Tian Yi Alligator Development Co., which was established in 1993 (Newsletter 13(1):8) is successfully raising 190 *Alligator sinensis* originally hatched by the Anhui Research Center of Alligator Breeding. The



animals are growing well and approaching maturity (see photo above). The company, which established its facility on 14.5 ha, represents a new phase of diversification of Chinese alligator protection in China.



Photo: Chinese alligators, captive bred F1's originally from ARCCAR, at Hainan farm. Z.D. Zhang photo.

A second company, Hainan Chang-Sheng Alligator Development Co. was established at the end of 1993 and is also planning to build a breeding base of alligators for commercial use. Once F2 alligators can be reproduced in large numbers a limited commercial utilization will proceed.

In other news, the advertised "largest crocodile farm in the world" at Hainan island (Newsletter 12 (4):6) is now said to be merely "propaganda". Plans to develop the facility are apparently now inactive. The facility imported 40 *C. porosus* from Thailand which have been confiscated by the Hainan Forestry Bureau and are now being raised at the Lizhigou Town, Sanya City. -- Zhang Zheng-dong, *Anhui Research Center of Chinese Alligator Reproduction, Xuancheng, Anhui, Peoples Republic of China.*

## **Nauru:**

**VAGRANT CROCODILE.** On Sunday, 18 September 1994, a group of people swimming in the ocean sighted a crocodile. No crocodiles have ever been known from this small island nation located just over 1,000 km north east of the closest crocodile populations in the Solomon Islands. The crocodile was caught and taken to a Police Station where it was photographed by a number of people, it being quite a unique event. Pending verification from the photographs, the animal is presumed to be *C. porosus* and is a particularly significant record, both for the long distance of its movement and the fact that it is described as a small, and therefore young crocodile, which has undertaken this long movement. -- G. Webb, *Wildlife Management International Pty. Ltd. P.O. Box 38151, Winnellie NT. 0821, Australia.*

## Philippines:

**GROWTH OF CFI HATCHLINGS.** Body measurements were made on 305 *Crocodylus mindorensis* and 762 *C. porosus* to plot the growth curves of hatchlings raised at CFI. The results, expressed as log body size and age on the accompanying graphs, indicate that in the first year of rearing, growth in *C. mindorensis* is faster than *C. porosus* for both total length and weight. In the second and third years this trend reverses and *C. mindorensis* growth rate slows down while *porosus* continue to increase. The rapid increase in *C. mindorensis* during the first year is attributed to the fact that no problem is encountered in feeding *C. mindorensis* after hatching. In *C. porosus* some problems are experienced in early feeding, as observed also by Manolis et al. in Australia.

In other news, the results of a comparison of breeding success of crocodiles maintained as isolated pairs, compared to larger breeding groups, indicated that single pairs breed more successfully (Table 1).

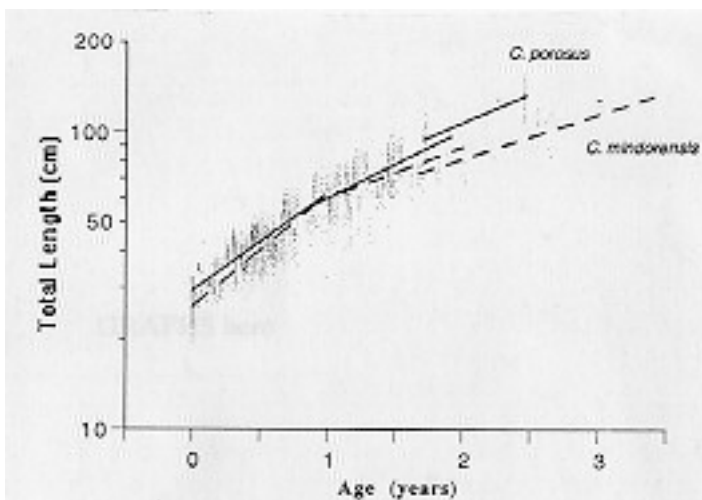


Figure 3a. Growth of CFI bred crocodiles.

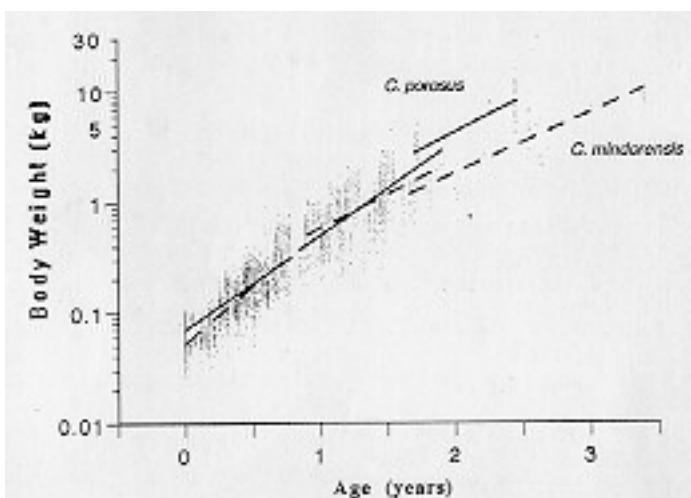


Figure 3b. Growth of CFI bred crocodiles.

The pairing trials were based only on successful male-female pairs established prior to the breeding

season. Generally, maintaining breeders in a single pair showed better results. This was more significant for the *C. mindorensis*, possibly due to the origin of this stock (91%) from private collections and therefore used to captive conditions. In contrast 84% of the *porosus* breeders are from the wild and require more time to acclimate to captive conditions. Although the improvement taken over both species is not statistically significant, the use of paired breeding allows much better control of genetic lineage. As compatibility between partners is a significant factor, and there is no anticipated addition to the captive gene stock from other sources expected, pairwise breeding is an important component of the conservation strategy for *mindorensis*. Captive breeding rates have increased steadily for both species at CFI, however, some problems remain with low fertility of a group of *C. mindorensis* breeders acquired from a private collection. Studies are underway to improve fertility in this group and bring the hatching rate for *mindorensis* up to the 80% value achieved with *C. porosus*.

Table 1. Breeding results

	Females	Females laid eggs	
<i>C. mindorensis</i>			
Single *	49	35	(71.4%)
Groups	16	1	(6.3%)
<i>C. porosus</i>			
Single *	34	16	(47.1%)
Groups	99	25	(25.2%)

\* One female with one male

Two observations of multiple clutching in *C. mindorensis* have been made. During 1991 a crocodile laid 29 eggs in the first clutch on 4 March and the second clutch was unnoticed until 4 hatchlings were observed swimming in the pond on 22 July. Another six unhatched eggs were discovered in the nest. Assuming the incubation period for the two clutches were similar the second clutch is calculated to have been laid in early May, some two months after the first. In 1992, another crocodile produced one clutch of 24 eggs laid around 10 April and a second clutch of 23 eggs on 20 October, six and a half months later. In both cases the second clutch was laid in the same nest as the first. Both clutch sizes were large compared to the size of the female and fertility-hatch rate was 92% and 72% in the first case and 74% and 46% in the second. -- from CFI News, Vol. 6, No. 2. April - June 1993.

## CENTRAL & SOUTH AMERICA

### Argentina:

**PROTEIN ELECTROPHORECTIC STUDIES ON CAIMAN.** La concentración de las proteínas sericas y las fracciones en que las mismas se dividen en las especies autoctonas de *Crocodylia* son poco conocidas. Debido a las limitaciones que provocan este desconocimiento de datos esenciales, tanto a nivel de manejo clínico en individuos aislados en zoológicos o reservas de

fauna o en explotaciones intensivas, se realizo la medicion de proteinas sericas totales y electroforegramas de ambas especies de genero *Caiman*.

Fueron utilizados 2 pool de sueros de 40 ejemplares de cada especie *Caiman crocodilus jacare* (caiman negro) y *C. latirostris* (jacare overo). Se cuantificaron las proteinas totales, albuminas y globulinas por metodos colorimetricos y electroforesis en acetato de celulosa, observandose que la mejor division de fracciones se logro con una hora de corriente a 200 voltios y 2,5 mA.

Los partones electroforeticos demostraron diferencias entre ambas especies. Las albuminas y las fracciones relacionadas a las alpha globulinas de *Caiman latirostris* migran mas anodicamente, que las identicas fracciones de *C. c. jacare*, presentado ademas el primero mayor numero de fracciones electroforeticas (15) que la otra especie (9).

En ambas especies se observa un predominio de bandas anodicas relacionadas con las alpha globulinas y en la caso de *C. latirostris* con las alpha y beta globulinas. Los patrones de *C. c. jacare* poseen similtud con los valores encontrados por otros autores en *Alligator mississippiensis* comunmente comparado con nuestras especies mientras que *C. latirostris* no muestra similitudes. Este primer acercamiento al conocimiento de las proteinas sericas de estas especies, importante en la conservacion y futura explotacion economica, es de mucha utilidad. Entre otros aspectos, la evaluacion del estado de salud de especimenes mantenidos en condiciones de cautiverio y su comparacion con especimenes de la naturaleza y se puede contar con una base para el seguimiento de la cinetica de las proteinas sericas en las diferentes patologias que los afectan, especialmente aquellas de origen infeccioso, parasitario, nutricional o tumeral. Tambien se podra contar con una base para el estudio de la inmunidad humoral de las diferentes especies de reptiles autoctonos. -- A. R. De Roodt, J. C. Troiano y G. Duronto, *Facultad de Ciencias Veterinarias, Universidad de Buenos Aires, Chorroarin 280 (1427) Buenos Aires, Argentina*.

*Translated summary of the preceding article.* The concentration and fractionation of serum proteins in native species of crocodilia are poorly known. This information is needed to assist the clinical management of specimens isolated in zoos or faunal reserves or in intensive raising facilities. To meet this need, the study of serum proteins and electrophoresis in some species of *Caiman* was undertaken.

Two pools of serum from 40 samples of each species (*C. latirostris* and *C. c. jacare*) were analyzed. Total protein, albumins and globulins were quantified using colorimetric methods and electrophoresis on cellulose acetate were scored for major fractions after running for one hour at 200 volts and 2.5mA.

The electrophoretic patterns showed differences between the two species. Albumins and the fraction related to alpha globulins of *latirostris* migrated further toward the anode than identical fractions in *yacare*, and *latirostris* showed a larger number of primary bands (15) than *jacare* (9). In both species a predominance of anodic bands related to alpha globulins were observed and in the case of *latirostris*, also beta globulins. The patterns seen in *jacare* were most similar to values obtained by other authors on *Alligator mississippiensis*. Alligators are more commonly compared to *latirostris* but the electrophoretic patterns were not similar in this study.

This study is a first approach to the understanding of the serum protein of these species and will be of some utility in conservation and future economic exploitation. Among other aspects, the

evaluation of the health of specimens kept in captivity, the comparison with wild specimens, and as a base to follow the dynamics of serum proteins which are affected by pathologies, especially of infectious, parasitic, nutritional or cancerous origin. We can also use these results as a baseline for the studies of immune systems in different species of local reptiles. The paper is an abstract of a longer presentation in Spanish which is available from the authors. -- A. R. De Roodt, J. C. Troiano y G. Duronto, *Facultad de Ciencias Veterinarias, Universidad de Buenos Aires, Chorroarin 280 (1427) Buenos Aires, Argentina.*

## **Belize:**

***CROCODYLUS MORELETII AND CROCODYLUS ACUTUS IN BELIZE.*** This project was a continuation of a study initiated in 1992 with the objectives of gathering data on the nesting ecology of Morelet's crocodile (*Crocodylus moreletii*) and assessing populations in northern Belize. Additionally, in 1994 a project was initiated in conjunction with the University College of Belize and Coral Cay Conservation to survey American crocodile (*Crocodylus acutus*) populations in the Turneffe Atoll, a large coral atoll off the coast of Belize. Fieldwork was conducted from May through October 1994.

The Morelet's crocodile study was centered on study sites identified in 1992 and 1993, and additional sites located in 1994. Particular effort was devoted to Cox Lagoon, an area under consideration for protection as a National Park, and Gold Button Ranch. Forty-two nests were located and 38 of these contained eggs. The remainder had either been opened by predators or had hatched before being found. Nesting effort appeared to be greater in 1994 than in 1992 or 1993, perhaps in response to a prolonged drought and lowered water levels that exposed potential nesting sites normally flooded.

Most clutches were deposited in late June or early July, but extremes were noted. Based on embryo head length, it appeared that the earliest clutch was deposited in early June, and the latest in early August. Average clutch size was 24.08. Small islands seem to be the preferred nesting sites, but nests were also constructed in heavy vegetation along shorelines. Some nest sites have been used in all three years of this study. Nests were monitored throughout the incubation period. Eighteen nests were successful, one failed to hatch (although most of the eggs contained well-developed embryos), 13 were lost to predators, one was lost to flooding, and the fate of five nests was unknown. Nests on islands appeared less likely to be lost to predators than shoreline nests.

Hatching occurred throughout September and into early October. Seventy-three hatchlings were captured at Gold Button Lagoon, marked, stomach-pumped, and released. Hatchlings began feeding within five days; insects and spiders were the primary foods. A small number of hatchlings were found to have stones in their stomachs. Efforts will be made in 1995 to recapture marked animals and obtain estimates of first-year survival. Spotlight surveys were conducted in 1994 in areas not previously surveyed. These surveys support earlier conclusions that crocodiles are found throughout northern Belize, but are most common in remote or protected areas. However, crocodiles are found even within the limits of Belize City. Nuisance crocodile complaints to the Forestry Department have increased dramatically in the past few years, probably reflecting increased crocodile abundance. The major crocodile/human conflicts occur when large crocodiles frequent the vicinity of villages and take dogs. These animals are perceived as a threat and most illegal killing seems directed at them.

While Morelet's crocodile is not usually considered a man-eater, one crocodile attack on a swimmer was documented. The victim was floating on the surface of a creek near Hattieville, and was seized by a large crocodile. He suffered severe head wounds, but survived. American crocodile surveys were conducted in the Turneffe Atoll in May, June and October. Fifty crocodiles were observed and 94.6 km of shoreline were surveyed (0.52 crocodiles/km). In general, low density populations have been found throughout the atoll with concentrations around Blackbird Cay, Calabash Cay, and in Northern (Vincent's) Lagoon.

Two nesting beaches were found on cays in the northern region of the atoll. Both hole and mound nests were found. Two recent (1994) nests were found on a small beach on Blackbird Cay, and five recent nests were found at a larger beach on Northern Cay. Based on eggshells and unhatched eggs found in the nests, an average clutch size of 9.8 was estimated. Recently excavated nests and hatchlings were observed in late June. The major threat to the continued viability of the Turneffe Atoll population appears to be the development of nesting beaches for tourist facilities and fishing camps. Nesting habitat seems to be very limited and many potential sites were either developed or showed signs of impending development.

The status of the American crocodile throughout the rest of the coastal zone of Belize remains largely undocumented. A limited survey of Maps Cay/Gallows Point, just offshore from Belize City, found crocodiles to be relatively common and a recent nest was found on a spoilbank. Anecdotal accounts suggest the American crocodile may be more widespread than previously known. Further surveys are planned. -- Steven Platt, *Department of Biological Sciences, Clemson University, Clemson SC 30624, USA.*

## **Brazil:**

**CAIMAN LATIROSTRIS STUDBOOK.** The Regional Studbook Committee for the Broad-Snouted Caiman (*Caiman latirostris*) is working with the Tropical Data Base - BDT, aiming at making information on this species in Brazil available via internet. The result is a Web server (<http://www.ftpt.br/structure/jacare/jpa.jacare.html>) and a Gopher server (<gopher://gopher.ftpt.br:70/11/thematic/.zoology/.jacare>) with information available in Portuguese, such as workshop proceedings, selected bibliography, census of the captive population in Brazilian Zoos and the Regional Studbook.

The Tropical Data Base - BDT is a department within the Fundacao Tropical de Pesquisas e Tecnologia "Andre Tosello", a Brazilian not-for-profit, private foundation. BDT (Base de Dados Tropical) will coordinate, with help of an advisory committee responsible for the establishment of policies and priorities, a pilot project for the establishment of the Brazilian Biodiversity Information Network, BINBr. At a first stage BDT is helping out recognized institutions and societies in making their information available online and in publicizing the Internet, providing training to individuals and/or institutions in how to access and use the network. BDT will point to available resources on the Internet and does not intend to hold all information at one site.

BDT is open to collaborative projects with international NGO's that hold information about Brazilian species, such as IUCN. For more information, please contact BDT staff: Vanderlei Peres Canhos ([vcanhos@ftpt.br](mailto:vcanhos@ftpt.br)), Dora Ann Lange Canhos ([dora@ftpt.br](mailto:dora@ftpt.br)), Sidnei de Souza ([sidnei@ftpt.br](mailto:sidnei@ftpt.br)), Carlos Alberto Fonseca Brefe ([brefr@ftpt.br](mailto:brefr@ftpt.br)), Patricia de Oliveira ([patricia@ftpt.br](mailto:patricia@ftpt.br)) Base de Dados Tropical Caixa Postal 1889 13001-970 Campinas SP BRAZIL. -- Luciano M. Verdade,

## Venezuela:

**FUDENA EVALUA LA SITUACION ACTUAL DEL CAIMAN DE LA COSTA EN VENEZUELA.** Entre 1991 y 1993 se realizaron estudios para evaluar la situacion actual del Caiman de la Costa o Cocodrilo Americano (*Crocodylus acutus*) en siete localidades de la costa oriental del estado Falcon, en la region nor-occidental de Venezuela. Se utilizo como metodo de estudio el conteo nocturno con luz de alta intensidad. Una vez detectado un ejemplar, se estimó su Longitud Total (LT), desde la punta del hocico hasta el extremo de la cola, clasificandose en base a los intervalos o clases tamaños establecidos por Seijas en 1988. Estas clases son : Clase I <60 cm LT; Clase II = 60 a <120 cm LT; Clase III = 120 a <180 cm LT; Clase IV = 180 a <240 cm LT y Clase V = > 240 cm LT. Se usaron mapas a escala 1:25.000 y 1:100.000, para calcular las distancias recorridas, para así estimar índices de abundancia poblacional en terminos del número de caimanes >60cm por kilometro de orilla censada.

Obteniendose los siguientes resultados: Refugio de Fauna Silvestre de Cuare (Golfete de Cuare) = 0.92/km; Parque Nacional Morrocoy (5 sectores) = 0.71/km (DE = 0.28); Rio Yaracuy = 4.48/km; Rio Tocuyo = 5.10/km; Rio Aroa = 0.71/km; Embalse de Tacarigua = 5.26/km, y Embalse de Jatira = 3.22/km. Los resultados obtenidos en 6 localidades, se compararon con los reportados por otros investigadores que han usado el mismo metodo de estudio. En este sentido, se encontro que la abundancia de caimanes permanece critica en RFS Cuare (Lopez 1986 - 0.38/km), Rio Aroa (Seijas, 1986 - 1.53/km) y PN Morrocoy, mientras que ha mejorado en el Rio Yaracuy (Seijas 1986 - 3.50/km, 1988 - 2.62/km y 1990 - 6.35/km), Rio Tocuyo (Seijas 1986 - 1.63, 1988 - 0.76/km), embalse de Tacarigua (Seijas 1986 - 0.27/km, 1988 - 2.11/km); y se ha mantenido relativamente estable en embalse de Jatira (Seijas, 1988 - 3.89/km). El incremento estimado en el embalse de Tacarigua probablemente se deba al repoblamiento con 40 caimanes criados en el Zoológico de Caimanes del Fundo Pecuario Masaguaral, que llevo a cabo FUDENA entre 1991 y 1992. El aumento del índice en el rios Yaracuy y Tocuyo probablemente se ha producido por crecimiento natural, debido al alto porcentaje estimado de juveniles (72% y 93% Clase II).

Aunque la abundancia de caimanes en el RFS Cuare y PN Morrocoy es menor que la encontrada en los rios y embalses estudiados, la mayoría de los individuos se clasificó como subadultos (71% y 44% Clase IV), lo cual puede ser importante dentro de la dinamica poblacional de la especie en la area. Tales localidades costeras con asociaciones de manglar, pueden ser refugio de individuos desplazados de los rios Yaracuy, Tocuyo y Aroa, posiblemente por presiones territoriales de individuos adultos dominantes. Si los caimanes logran sobrevivir y desarrollarse en tales habitats de tipo marginal, posiblemente regresan a los lugares de habitat optimo (agua dulce, playas de nidificación y asoleamiento, entre otros). Este modelo ha permitido explicar la dinamica poblacional de *Crocodylus porosus* en las costas de Australia (Messel y col.) y lo considera Thorbjarnarson (1998) en un estudio similar con poblaciones de *C. acutus* en Haiti.



Photo: Carcass of *C. acutus* recovered in Cuare Faunal Refuge. A. Arteaga photo.

Finalmente, a pesar de los resultados de este estudio, no existen razones para asegurar que las presiones sobre las poblaciones silvestres ha disminuido, y tiendan a decrecer en el futuro, ya que continuamente hay reportes y se encuentran caimanes muertos por pescadores de la region, a quienes les interesa su carne, grasa y dientes, estos dos ultimos por supuestos fines medicinales y m gicos. -- Alfredo Arteaga, FUDENA, Aptdo 70376, Caracas 1071- A, Venezuela. E-mail: [fudena@dino.conicit.ve](mailto:fudena@dino.conicit.ve)

**FUDENA STUDIES OF AMERICAN CROCODILE IN VENEZUELA.** Between 1991 and 1993 studies have been conducted on *C. acutus* in seven localities on the east coast of Falcon State, in the north east of Venezuela. Nocturnal spotlight counts were utilized. Once a specimen was detected the total length was estimated from the tip of the snout to the end of the tail, classified on the basis of size classes established by Seijas in 1988. The classes were: Class I < 60 cm; Class II = 60 - < 120 cm; Class III = 120 - < 180 cm; Class IV = 180 - < 240 cm & Class V = > 240 cm. We used maps of 1:25,000 and 1: 100,000 scale to calculate survey distances in order to estimate index of abundance as individuals >60 cm per km of shoreline surveyed. The following results were obtained: Cuare Fauna Refuge = 0.92/km; Morrocoy National Park (5 sectors) = 0.71/km; Yaracuy river = 4.48/km; Tocuyo river = 5.10/km; Aroa river = 0.71/km; Tacarigua reservoir = 5.26/km and Jatira reservoir = 3.22/km. Results obtained at six of the localities were compared with the results of other workers who used the same study methods. These are enumerated in the article above. In summary, the abundance of crocodiles remains critically low in Cuare, Aroa river and Morrocoy N. P. However, abundance has increased in Yaracuy and Tocuyo rivers and Tacarigua reservoir and remained relatively stable in Jatita reservoir compared to surveys made between 1986 and 1990. The increase estimated in Tacarigua is probably due to the repopulation with 40 juveniles raised by FUDENA at Masaguaral and released between 1991 and 1992. The increase in the Yaracuy and Tocuyo is probably due to natural reproduction as there is a large proportion of juveniles (72% and



93% Class II respectively). Even though the abundance of crocodiles in the Cuare faunal refuge and Morrocoy National Park are lower than found in the rivers and reservoirs, the majority of these individuals are subadults (71% & 44% Class IV). This may be important for the population dynamics of the population in the area. These coastal localities are mangrove associations which could be refuges for individuals displaced from the adjacent rivers Yaracuy, Tocuyo and Aroa, possibly due to territorial pressures of dominant adults. If these subadults are able to survive and grow in these marginal habitats, they may possibly return to more optimum habitats (fresh water, nesting and basking beaches). Such a model explained the population dynamics of *C. porosus* in Australia and was considered by Thorjarnarson in a similar study of *C. acutus* in Haiti. Finally, despite the results of this study there is no reason to assume that the pressures on these wild populations have decreased or will be decreased in the future. We have continually received reports, and found dead crocodiles, killed by local fishermen for the meat, fat and teeth. The last two are thought to be used for medicinal preparations and for magic. -- *Free translation of the preceding article, Eds.*

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[\[NEXT PAGE\]](#)----[\[TOP OF THIS PAGE\]](#)----[\[TABLE OF CONTENTS\]](#)

## NORTH AMERICA

### Mexico:

**REPRODUCTION OF MORELETS'S CROCODILE IN MEXICO CITY.** In order to have a small piece of jungle in his garden, Dr. Salom>n Gonzalez, a urologist, built a greenhouse at his home in 'Las Lomas' at 2,600 m elevation in Mexico City. In the greenhouse he keeps a pair of *C. moreletii*. The greenhouse is 8 x 4 x 3 m and is constructed of concrete with glass on one wall and the ceiling. The proportion between the ground and the pond is 50:50 and a cauldron [boiler, Eds] maintains the water at 28° C. Air temperature fluctuates between 19° and 35° C. The male crocodile came from Villahermosa in Tabasco State and the female from Zoo Miguel Alvarez del Toro in Chiapas. The couple were first introduced at Cuernavaca, Morelos (1,000 m elev.), where they bred. Five hatchlings were obtained from 35 eggs in 1982 and 5 more eggs from 28 eggs in 1989. In 1990 the animals were moved to the Mexico City facility. They mated in February and March and the female laid eggs in the pond on 20 May 1990 and 30 June 1991.

In 1990, 30 eggs were collected and incubated on vermiculite in plastic trays in a glass incubator. Sixteen of the eggs incubated at 31° - 32° C and 85 -92% humidity produced 12 live hatchlings averaging 237 mm length. The other 14 eggs were incubated at 32° -34° C and 88 - 96% humidity and produced 11 live hatchlings measuring 243 mm. In 1991, using the same incubation system 18 eggs were incubated at 29.5° - 30° C and 90% humidity, producing 16 hatchlings measuring 241 mm. Seventeen eggs were incubated at 32.5° - 34° C and 92% humidity, producing 10 hatchlings measuring 237 mm.

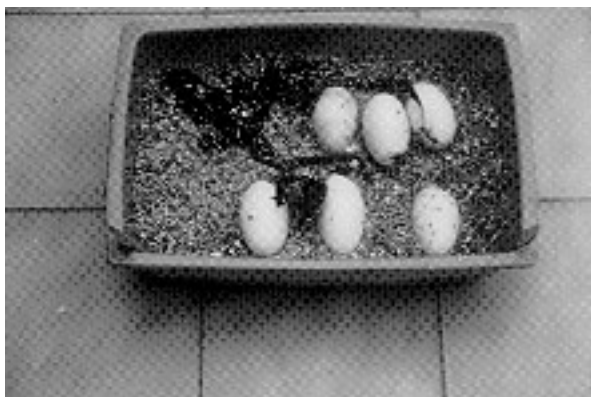


Photo: Newly hatched *C. moreletii*, Mexico City. S. Gonzalez photo.

All of the hatchlings were sent to a crocodile farm and zoo in Tapachula, Chiapas, near the Pacific coast where *C. moreletii* is exotic. To our knowledge, this is the first crocodile breeding in captivity at elevations above 2,000 m where incubation was artificially controlled and healthy hatchlings were obtained. This is without doubt another record for Mexico City. -- Luis Sigler, *Instituto de Historia Natural, A.P. 6, Tuxtla Gutierrez, 29000 Chiapas, and Salomon Gonzalez Blanco, Sierra Nevada #779, Lomas de Chapultepec, Mexico D.F., Mexico.*

### United States:

**FLORIDA ALLIGATOR HARVEST REPORT.** An experimental harvest of commercial size (> 122 cm = 4 feet) Alligators was conducted on three treatment areas in Florida during 1981- 1990 (Lochloosa, Orange and Newnan's lakes) and response to harvest was compared to two unharvested control areas (Paynes Prairie and Lake Woodruff). The number of licensed hunters, methods used and hunting season were carefully regulated. Harvest quotas were estimated each year from population surveys. An overall mean of 13% of the estimated population of commercial size alligators was harvested annually. The median length of harvested alligators varied by area and smaller alligators constituted an increasingly greater proportion of the harvest over years. The harvest was predominantly (69.9%) male. Increased hunter effort was necessary over the years to maintain success rates because of an apparent increase in wariness of larger alligators. Annual population estimates of harvestable alligators ranged from 2,023 to 3,299 for the three study areas together and a total of 3,307 alligators were harvested over the ten years of the study.

Night-light counts remained stable on all harvest and control areas but some evidence of lower counts of larger alligators were evident. Counts of juvenile alligators increased on two of the three study areas. Nest production was mostly influenced by water levels and predation and remained stable or increased during the study. Clutch sizes varied between the five sites but did not change on either treatment or control areas. The proportion of mature females ovulating did not change over the years although it was lower on Newnan's Lake (15.8%) than either Lochloosa (38.5%) or Orange Lake (39.8%). Detailed analysis is presented on fecundity, growth rates, sex ratios and survival. Additional information is given on movements, diets, ecological effects and sociological parameters of the study.

No evidence was found that the alligator harvest affected fish populations or nutrient levels in the lakes. Daylight visibility of alligators dropped immediately after hunts but recovered fully by the following year suggesting that the harvest had only a temporary effect on daylight viewing of alligators by tourists.

The total wholesale value of hides and meat produced by the harvest over 10 years was \$1,074,756 and gross hunter income was \$4,183/yr with a mean annual take of 15.8 alligators per hunter. Fees collected by the Florida Game and Fresh Water Fish Commission amounted to \$158,020 or \$48 per alligator, which averages 15% of the gross value.

The study concluded that a sustained harvest of 13% of the commercial size alligators had no measurable negative effects on alligator populations. However, differences between the study areas in response of demographic parameters to harvest indicate that wetlands with dissimilar characteristics may not respond in the same manner to alligator harvest. -- *Summarized from A. R. Woodward, C. T. Moore & M. F. Delany, 1992, Experimental Alligator Harvest, Final report, Study number 7567:118 pages. Florida Game and Fresh Water Fish Commission, 4005 South Main Street, Gainesville, FL 32601, USA*

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**CRUTCHFIELD'S CROCODILE FARM.** In September, 1994, I was a week-long "guest" of Tom and Penny Crutchfield's 40 acre Crocodile Farm, located in Sumter County near Bushnell, Florida.

The farm consists of 16 ponds ranging in size from 4 to 1/4 of an acre. The ponds are naturally dug

with pumps constantly running water, and drains. The ponds are secured by either 4 foot or 8 foot high chain link fence. The "haul-out area" is equal in size to the pool area. Shading is provided in a combination of either oak, palm, or banana trees. Water temperature is maintained at 72 degrees year round.

Breeding stock at the farm consists of 1.1 *Tomistoma schlegelii*; 0.2 *Crocodylus palustris*; 1.1.40 *C. acutus*; 1.2.2 *C. porosus*; 1.5.19 *C. rhombifer*; 0.0.29 *C. niloticus*; 3.3 *Osteolaemus t. tetraspis*; 1.0.8 *Caiman c. yacare* and several hundred *Alligator mississippiensis* in various sizes. This year has been a good breeding year for Tom, having over 40 *C. rhombifer* eggs laid. Unfortunately, only 13 hatched out due to incubator problems. Also bred at the farm was *C. porosus*, 19 eggs are incubating now and should hatch by late October. The reason this is interesting is that the 0.1 is literally "snow white"! She should produce some outstanding offspring. The *C. niloticus* female is a solid yellow specimen! The 1.0 *T. schlegeli* is a monster! He is very personable and "user-friendly". As you can tell by the photo, he will come right up to you so you can hand feed him. Also, I was equally impressed by his large *C. porosus* male, aptly named "Morton". He chased me around the pen to see how fast my legs would move!



Photo: L to R. Randal Berry, Tom Crutchfield and 'Tommy' *Tomistoma*. P. Crutchfield photo.

The farm also has 4 "grow-out" enclosures that are filled with yearling *A. mississippiensis*, *C. acutus* and *C. niloticus*. The farm is of course managed by Tom, and his assistant manager, David Fowler, is in charge of maintenance, feeding, etc. The enclosures are kept mowed and are very clean.

I was very impressed with the farm and Tom and Penny were the most gracious hosts. It is already a solid gold memory for me and I would encourage interested individuals to contact Tom for a visit. Tom is very proud of the farm and rightly so. -- Randal Berry, *Little Rock Zoological Gardens, # 1 Jonesboro Drive, Little Rock, Arkansas 72205, USA.*

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**IMPORT OF SYNTHETIC DNA.** In July 1994 the Society for the Study of Amphibians and Reptiles adopted a resolution calling on the US Fish & Wildlife Service to review its policy on import of DNA specimens of endangered and CITES Appendix I species for research and conservation purposes. In a letter, 13 December 1994, Dr. Susan Lieberman, Chief of the Branch of Operations, Office of the Management Authority (USF&WS) informed the CSG that the

Service's policy requiring full US Endangered Species Act and CITES regulations for DNA samples would be maintained. Dr. Lieberman referred to the rejection of a proposal to exempt DNA samples at the CITES Kyoto meeting.

However, in a major improvement of policy, the Service has decided that synthetic DNA from which all trace of original animal DNA has been removed by magnetic bead cleansing or similar procedure, contains no part of the original template and is therefore not subject to permitting and other requirements of CITES or the US Endangered Species Act. This sensible interpretation of policy will be an assistance to workers wishing to exchange DNA for research and conservation purposes. Cloning synthetic DNA from the animal template is relatively simple and the derived PCR products are as good as the original for research work. -- *from correspondence, Dr. S.*

*Lieberman, Chief, Branch of Operations, Office of the Management Authority, US Fish and Wildlife Service, Washington DC 20240, USA.*

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**CROC STUDY WOUNDS DINOSAUR THEORY.** Crocodiles and their ancestors have heated up the debate about the extinction of the dinosaurs 65 million years ago. Geologist Paul Markwick of University of Chicago presented results to the annual meeting of the Geological Society of America in Seattle tracing fossil records of crocodiles, alligators and their relatives over the last 100 million years.

The study shows that crocs apparently thrived while the dinosaurs were disappearing. In contrast, at two known periods of global cooling and glaciation at 35 million and 1 million years ago, crocodile populations appear to decrease dramatically. This suggests that the cause of the dinosaur extinction at the Cretaceous-Tertiary boundary is unlikely to have been a period of massive climate change as has been previously postulated. The impact theory postulates that a massive asteroid striking the earth at that time might have caused worldwide climatic upheaval and caused the demise of the dinosaurs. Markwick's analysis contradicts this scenario. Responding to the study, experts on mass extinction said that Markwick's research will help refocus current thinking on other possible explanations for the end of the dinosaurs. Markwick's computer database of global crocodile distribution provided striking evidence against a long term climatic change and researchers are now examining other possible effects of the asteroid impact such as volcanic eruptions, changes in atmospheric chemistry, acid rain and disruption of the food chain. The crocodile data confirm similar patterns of frog, fish and turtle fossils indicating those species also survived whatever catastrophe wiped out the dinosaurs. -- *from the Toronto Star 6 November 1994 submitted by J. Davidson, 207 Haddington Ave. Toronto, Ont. M5M 2P7, Canada.*

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**ALLIGATOR SUSTAINABLE USE DISPLAYS.** Displays promoting sustainable use of alligators were opened at international airports in Orlando, Florida and New Orleans, Louisiana, during July 1994. The displays feature photographs, mounted specimens and alligator hide products and are aimed at educating the travelling public about alligator management, sustainable use and conservation.

The displays were designed and coordinated by Ashley Associates Inc. and constructed by Configurations Inc. The Florida display includes a marsh diorama depicting an alligator defending

her nest from a predated raccoon built by Drews Taxidermy. Funding for the project was provided by the Louisiana Fur and Alligator Advisory Council, Louisiana Department of Wildlife and Fisheries and the Florida Alligator Marketing and Education Committee. Funds for promoting the sustainable use of American alligator are allocated from license and tag revenue in both Louisiana and Florida. The goal of these displays is to educate both the trade and the public about the conservation benefits of sustained use of alligators. Similar promotions are planned for ten additional US cities as well as several international venues beginning in 1995. -- Don Ashley, *Ashley Associates, P.O. Box 13679, Tallahassee FL 32317, USA.*

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## PUBLICATIONS



**PROCEEDINGS OF THE 12TH WORKING MEETING OF THE CROCODILE SPECIALIST GROUP, IUCN** - The World Conservation Union, Gland, Switzerland. 2 Volumes (cited as CSG, 1994.) are now available. The Proceedings contain 43 papers presented at the meeting and an additional 14 papers either invited or submitted, but not presented. Copies have been sent by surface mail to all registered participants. Others wishing to obtain a copy should send \$30.00 to the CSG, Florida Museum of Natural History, Gainesville Florida 32611, USA.

Volume 1 of the Proceedings contains *Harvesting Wild Crocodylians: Guidelines for Developing a Sustainable Use Program* by Dennis David. This is the long awaited outcome of the CSG project termed the 'model management plan' and represents inputs from many members of the CSG. This document is being prepared as a separate reprint.

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**STANDARD REFERENCE FOR CSG PROCEEDINGS.** Dr. Kent Vliet, of University of Florida, drew our attention to the fact that some of the CSG Proceedings of Working Meetings, particularly earlier volumes, do not have any indication of how they should be cited. As a result these Proceedings are variously cited referring to the CSG, SSC, IUCN, the individual editors and the location of the meeting. Additional confusion arises from the publication of some of the Proceedings some years after the meeting. Which date is therefore correct, the year of the meeting or the year of publication?

The more recent Proceedings indicate a format for citation and we propose here that all Proceedings should be cited in the same fashion following the format as indicated most recently for the Proceedings of the 12th Meeting, i.e.:

For individual articles:

[Author]. 1994. [Article title]. pp. [numbers]. In: Crocodiles. Proceedings of the 12th Working Meeting of the Crocodile Specialist Group, IUCN - The World Conservation Union, Gland, Switzerland. Volume 1. ISBN 2-8317-0238-0. xii + 309 p.

For the volume:

Crocodile Specialist Group. 1994. Crocodiles. Proceedings of the 12th Working Meeting of the Crocodile Specialist Group, IUCN - The World Conservation Union, Gland, Switzerland. Volume 1. ISBN 2-8317-0238-0. xii + 309 p.

The year indicated is the year of publication, following standard citation practice.

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**A HANDBOOK OF INDIAN CROCODILES.** Prof. M.V. Subba Rao, 1993, Andhra University Press and Publications, Visakhapatnam 530 003, India: 55 pages, 22 figures. This handy popular volume is issued in a limited edition of 500 copies from Andhra University and is dedicated to Dr. H. R. Bustard. In the preface the author addresses himself to non- biologists and to "the youth upon whose interests the future of many species, including crocodiles, is dependent", and expresses the hope that the book will create awareness among the public and strengthen the conservation movement.

The volume has chapters on biology, breeding, economic importance, causes of decline, status of Indian crocodiles and status of crocodilians of the world. These are clearly written in a style suitable for the lay reader, with the exception of part of the descriptive morphology section which becomes a little technical. Useful perspectives are given on the economic value and causes of decline. The section describing management and conservation in India describes the successful captive breeding and restocking programs but does not address the current crisis in the program [see this Newsletter]. However, this is not a serious lack in a general handbook intended for the public and it may be a wise strategy to avoid contentious current issues in favour of building general understanding and sympathy for crocodiles. Overall the book is clearly written and will be useful source for the interested layperson or student. -- J. P. Ross, *Executive Officer, CSG*.

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[\[NEXT PAGE\]](#)----[\[TOP OF THIS PAGE\]](#)----[\[TABLE OF CONTENTS\]](#)

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## ZOOS



**MIGUEL ALVAREZ DEL TORO ZOO.** In April 1993 we noticed that our female American crocodile (*C. acutus*) was biting recently laid eggs in her pond. We assume the eggs had about two hours under water. Against all prognostics we attempted to incubate them artificially and after 99 days, ten hatchlings were obtained from 16 eggs.

In 1994 the female tried to nest in a new sandy area we prepared in the enclosure, but the events of the previous year repeated and she laid the eggs in the water. Fortunately we were expecting the event and collected the eggs immediately from the bottom of the pond. Again she laid 16 eggs and after 88 and 92 days of incubation we obtained four and four hatchlings.

The hatchlings resulting from the 1993 breeding were sent to the Universidad Ju rez Aut noma de Tabasco where biologist Beatriz Figueroa will study their growth in captivity for one year. After that the University will liberate the crocodiles at Canon del Sumidero National Park about 15 minutes away from the zoo. The 1994 hatchlings will be maintained at the zoo for one year to study their growth in comparison to another seven hatchlings obtained directly before hatch from a wild nest at the Canon del Sumidero National Park. In 1995 we will release all the hatchlings back into the National Park when they are one year old. -- Luis Sigler *M.V.Z., Instituto de Historia Natural, A.P. 6, Tuxtla Gutierrez, 29000, Chiapas, Mexico.*

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**GLADYS PORTER ZOO.** A national plan for conservation of *Crocodylus mindorensis* in the US has been drafted by Colette Hairston and is currently being circulated for comment and approval by AAZPA, Philippine authorities and other relevant experts. The plan envisages coordinated breeding among US institutions with the possible injection of new unrelated stock in the future. The plan will complement existing captive breeding programs in the Philippines and Australia to maintain this species which is critically endangered in the wild.

In the meantime Colette writes that "It is a good thing *mindorensis* does not get as large as *porosus* or they would already have killed us all!" -- Colette Hairston, *Gladys Porter Zoo, 500 Ringgold Street, Brownsville TX 78520, USA.*

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## REQUESTS





**QUESTIONS ABOUT STOMACH STONES.** I have recently read about 200 articles about crocodilian stomach morphology, and the stomach contents of living and fossil crocodiles, and also about stomach stones in fossil reptiles like plesiosaurs and brontosaurus. I am convinced that the function of the stones in crocodilians is not yet understood, and that there is a real need for more information.

Hugh Cott concluded that stomach stones in East African Nile crocodiles function as ballast. Many subsequent authors have belittled Cott's evidence and gone back to a popular belief that the stones aid digestion in a manner analogous to chickens eating grit to grind food in their crop. The crocodile stomach is described as being muscular, like a bird gizzard.

Perhaps crocodile farmers know the answer? Do they routinely add stones to crocodilians diet, like poultry farmers adding grit to chicken food? If not, it would be an interesting experiment to compare growth and digestion in two groups of captive crocodiles, one given stones and the other scrupulously deprived of stones. Additional comparison of the kinds of stones, size, hardness, sharpness and color might also be instructive. Do the crocodiles choose one kind of stones over another? How do they get rid of excess stones? Do they defecate stones? Crocodile breeders with multiple pens of captives could control these variables and experiment. If you discovered that captive crocodiles grow to marketable size more rapidly on less expensive food if they are offered a certain kind of stones, it would pay for the experiment.

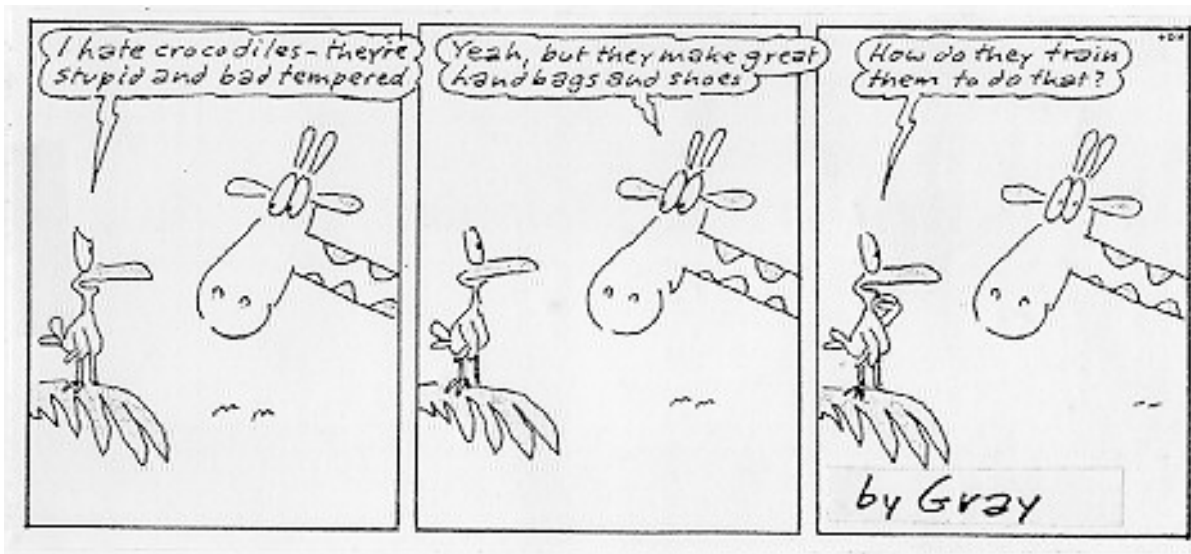
Some wild crocodilians do not have stomach stones, but instead have nuts, hard pieces of wood or hard undigested food items. An additional question concerns Cott's ballast theory. He found that the quantity of stones in Nile crocodiles was always around 1% of body weight. If captives have unlimited access to stones, do they eat a fixed percentage of body weight? or does the percentage vary under different conditions? The effect of ballast is probably more significant for wild crocodiles that may contend with river currents or varying salinity and buoyancy that may have an influence on fitness in a demanding environment.

Field reports on stomach contents should include data on rocks. Rock type, hardness, scratches and wear, and color should be noted. Are the rocks all the same? Are they similar to rocks common in the environment or are they brighter, larger, softer than average? The published data are generally deficient in such details. Typically, anecdotes describe how the biggest crocodile had a really big polished stone in its stomach but the quantity and relationships to other material is not reported.

Additional useful information can be gained from X-rays which clearly show rocks. Comparison of seasonal differences in living crocs would be interesting. I recommend a series of still X-rays of comfortably resting animals rather than attempting video tapes of digestive motions. A fluoroscopic

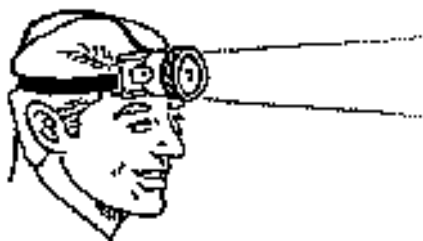
motion picture of a caiman digesting a mouse at Yale University was made around 1968 but the observations were never published, although it is mentioned in the popular paleontological literature. The observations were said to be inconclusive because of the interference with natural digestion by the equipment and procedure.

My reading has created more questions than answers. I suspect that too many different kinds of reptiles are being compared, although comparisons with other rock eating vertebrates would be instructive (for example some fish, seals, sea lions, penguins, mutton birds and some sharks have stomach stones). Any information that readers of the CSG Newsletter can provide to this publication would be appreciated. -- Franklin D. Ross, *Boekelstraat 14, 2131 WT Hoofddorp, The Netherlands.*



**MELANOSUCHUS MALES IN THE USA?** Dale Bakken asked in the last Newsletter if there were any adult male black caiman in North America. In response, Bruce Shwedick of Crocodile Conservation Services reports that he has two adult male *M. niger*. One is on loan to Zoo Atlanta and the other housed at Gator Jungle, Plant City, Florida. Two sub-adult females have been sent to Zoo Atlanta from St. Augustine Alligator Farm. Bruce agrees that sexing this species as young animals is difficult. -- Bruce Shwedick, *Crocodile Conservation Services, P.O. Box 3176, Plant City, FL 33564, USA.*

## PERSONALS



**Ana Maria Trelancia**, Ricardo Gutierrez 2049, 1640 Martinez, Buenos Aires, Argentina, writes that she is now settled down with her husband at her new home in Buenos Aires and is hoping to become more involved in crocodylian research and conservation.



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**Randal Berry**, formerly of Little Rock Zoological Gardens, has accepted the position of Manager of Tom Crutchfield's Reptile Enterprises, P.O. Box 1145, Bushnell FL 33513, USA. He writes that not only is he in crocodile heaven but also sees snakes that most people never see in a lifetime. He is building up a collection *Lachesis muta muta* and *L. m stenophrys*. What more could a herpetologist ask for? Crocodiles and bushmasters! Talk about adventure!

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**Alberto Yanosky**, Fundacion Moises Bertoni, Gaspar Rodriguez de Francia 770, Cassilla de Correos 714, Ascuncion, Paraguay, has moved to Paraguay to be the scientific member of Fundacion Moises Bertoni, which is involved in nature conservation.

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**Luis Pacheco**, Casilla 9641, La Paz Bolivia, is presently in his homeland of Bolivia but remains a PhD student at the University of Chile.

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**Louise Hayes-Odum**, Living Resource Center, 11833 Chimney Rock Road, Houston TX 77035, USA, is currently Curator of the Living Resource Center.

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**Frank Seebacher**, 44 Sherriff Street, Hermit Park, Townsville Qld 4812, Australia, completed his PhD with Professor Gordon Grigg in May 1994. His thesis was on "Thermal Relations of Freshwater Crocodiles in the Wild" and he is now seeking employment.

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**Kate Jackson**, Department of Zoology, University of Toronto, Toronto, Ontario M5S 1A1, Canada, spent a month last summer doing research at the Long Kuan Hung Crocodile farm in Singapore. The farm is owned and operated by CSG member Mr. Lee Bak Kuan and maintains about 2,000 *C. porosus*. In addition the farm has a dozen or so large *Tomistoma* that were placed with him after being confiscated from another owner by the Singapore Government. Kate reports that Mr. Lee was very supportive of her work and is interested in having other scientists conduct research at his farm.

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The Newsletter is sad to report that Dr. Graham Caughley, a respected member of the CSG, died early in 1994 after a prolonged illness. Dr. Caughley made significant contributions to the science of counting crocodiles and many other large vertebrates and inspired many other workers with his rigorous understanding of the statistical and biological requirements for population assessment and aerial survey. His impact on crocodylian surveys will continue to be felt for many years.

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We also regretfully note the deaths last year of member Pieter Schoeman, South Africa, and correspondents and crocodile enthusiasts Dean Mann, Australia, J. Magadan, Zambia, and Ernest Nunez, USA. Our condolences are offered to the families of each.

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**EDITORIAL POLICY** - The Newsletter must contain interesting and timely information. All news on crocodilian conservation, research, management, captive propagation, trade, laws and regulations is welcome. Photographs and other graphic materials are particularly welcome. Information is usually published, as submitted, over the author's name and mailing address. The editors also extract material from correspondence or other sources and these items are attributed to the source. The information in the Newsletter should be accurate, but time constraints prevent independent verification of every item. If inaccuracies do appear, please call them to the attention of the editors so that corrections can be published in later issues. The opinions expressed herein are those of the individuals identified and, unless specifically indicated as such, are not the opinions of the CSG, the SSC, or the IUCN-World Conservation Union.

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[\[STEERING COMMITTEE MEMBERS\]](#)----[\[TOP OF THIS PAGE\]](#)----[\[TABLE OF CONTENTS\]](#)