CROCODILE SPECIALIST GROUP

NEWSLETTER

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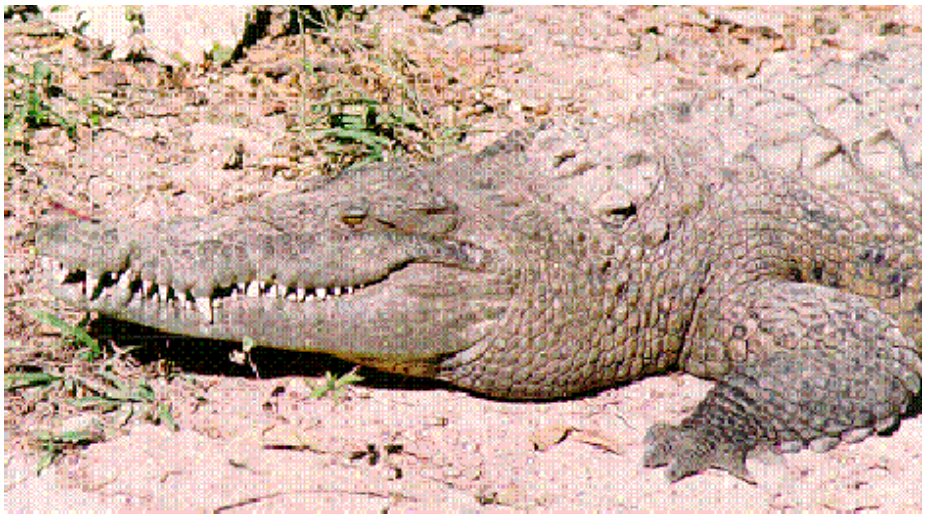

Cover Photo: *Crocodylus moreletii*, breeding stock held at facilities of Industrias Moreletii S.A., Villahermosa, Mexico. B. Figueroa O. photo.

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

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- Scott Anderson, Cypress Farms, Starke, FL, USA.

VIEWS, OPINIONS & IDEAS

A MODEST PROPOSAL. Adding to the long and honorable tradition of discussing issues related to the direction of the CSG here in this space, I offer for discussion a modest proposal for mechanisms that I feel would increase the efficacy of the group towards meeting its stated goal: the conservation of wild populations of crocodiles (Newsletter 12 (1):2). The CSG deals with two principal paradigms in its quest for crocodilian conservation: 1) the development of recovery plans to ensure the survival of highly endangered species, and 2) the use of commercial management to promote the conservation of wild crocodilian populations. Through it's role as an arbiter for CITES in the review of national management plans that propose international trade of crocodilian skins, the recommendations of the CSG wield considerable weight. But because it addresses issues on a case- by case basis as they arise in proposals to CITES, the work of the group has been largely reactive. The decisions of the group to support or not support particular proposals have been largely subjective in the sense that they are not based on well-defined criteria. At Steering Committee meetings this lack of "standardization" in how proposals are treated has been discussed, but never really addressed in terms of seeking a solution. Frequently, the CSG has found fault with specific CITES proposals, but in the name of promoting conservation through sustainable use, a compromise is reached in which we agree to work with the parties to 1) improve the proposal or 2) approve the proposal given certain conditions.

In many cases the process could be improved considerably if interested parties had clear guidelines regarding how the CSG would evaluate the proposals. This is particularly true now as the number of countries interested in commercial use increases, and the burden on the CSG to review programs grows.

Commercial use, in and of itself, does not promote conservation; this was demonstrated very clearly by the early harvesting strategies of the reptile leather industry. Commercial "sustained use" programs need to achieve a balance between economic benefits of harvesting and the conservation benefits to the crocodilian populations. Although the principal goal of the CSG is the conservation of wild populations of crocodilians, many proposals that come before the CSG do not clearly define how the programs will benefit the wild populations that will be harvested. To ensure that proposals address the issue, the group has the responsibility to codify mechanisms of achieving in situ conservation through commercial management, and use them in the evaluation of harvest programs. By clearly establishing guidelines or criteria for the development of CITES proposals, we could make the CSG review process more efficient and transparent.

The recent work of David (1994) to describe 'model' management efforts was a first step towards defining appropriate criteria, but this process has not continued nor has it been incorporated into the decision-making process of the group. My proposal is that first, the group, as part of its 'Action Plan' process, formally develop and use — as a matter of policy — a document that will help guide management authorities interested in implementing commercial management of their crocodilian resources. Secondly, from this document the CSG should distill conservation criteria by which the programs will be evaluated. While respecting the right of management authorities to design programs that best fit their individual needs, such a document should include: 1) a frank discussion of the conservation benefits of the three major types of exploitation (farming, ranching and cropping), 2) basic information regarding the legal and administrative structure of programs the CSG views as successful, and 3) recommendations for establishing monitoring and research programs. This effort would also re- invigorate the program-evaluation initiative that was discussed at the Pattaya meetings as a means of demonstrating the conservation value of sustainable use management programs and providing constructive recommendations for improvement.

A topic of considerable importance to all crocodilian managers involved in sustained use programs is the "sustainability" of the market. Substantial discussion has centered on how to ensure that crocodilian skins maintain their commercial value in the face of a growing supply of legal skins and a market demand that is not keeping abreast. It is clear that the CSG should not play any role in actively promoting the use of crocodilian skins, this is up to the reptile leather industry. Limiting of supply is difficult to accomplish without apparent bias or leading to a 'cartel' situation (Woodward et al. 1993). In the face of this dilemma the clear role of the CSG is to assure that the commercial use programs it approves have a well-defined conservation component, and that skins are not entering legal trade through programs whose primary goal is the

profit of individuals in the reptile leather industry.

Lastly, in an effort to direct some of the attention to the species that are in the most need of conservation action, I would suggest that the CSG emphasize the need to develop commercial use programs within the context of national management plans that include all native species of crocodilians. Such an exercise would be useful for 1) maintaining the conservation priorities for different species in their proper perspective, and 2) potentially identifying new mechanisms for funding basic population surveys and conservation action for priority species (e.g. government proceeds from commercial use programs used partially for other high-priority species or programs).—John B. Thorbjarnarson, *Wildlife Conservation Society, 185th Street & Southern Blvd., Bronx, NY 10460, USA*.

[Please Note: In the printed edition of the NEWSLETTER authorship of this editorial was incorrectly attributed to W. Magnusson. We apologize for the error.—*Editors*]

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- David, D. 1994. Harvesting wild crocodilians: Guidelines for developing a sustainable use program. pp. 274-308 *In:* Crocodiles. Proc. 12th Working Meeting of the Crocodile Specialist Group. Vol. 1. IUCN-The World Conservation Union, Gland, Switzerland.
- Woodward, A., D. David and R.L. Degner. 1993. The rise and fall of classic crocodilian skin prices: Where do we go from here? *In:* Crocodiles. Proc. of the Second Regional (Eastern Asia, Oceania, Australasia) Meeting of the Crocodile Specialist Group. IUCN-The World Conservation Union, Gland, Switzerland.

Black Caiman Reports Questioned. In NEWSLETTER Vol. 14(2) I read with interest and some confusion an account of alleged illegal exploitation of black caiman (*Melanosuchus niger*). The minutes of the CSG Steering Committee meeting reported discussion of information from Brazilian workers that trade in meat of black caimans occurs year round, and may be expanding to include skins. The trade was alleged to involve as much as several hundred tons of dried meat a year, and subadult male black caimans are the primary target. Lacking first hand information about the situation in the Amazon, I, like other biologists around the world, rely upon reports from CSG members, but this account concerns me because some of the details seem inconsistent or implausible.

The CSG CROCODILES, AN ACTION PLAN FOR THEIR CONSERVATION reports the black caiman as one of the most threatened species of New World crocodilians. Most biologists I have spoken to, who have firsthand knowledge of black caiman, consider them to occur in low densities relative to common caiman, and in most cases they are difficult to inventory because of their tendency to occupy sheltered rivers and lagoons. Therefore claims of several hundred tons reaching local markets surprise me. If we assume that 'several hundred tons' is a minimum of 200,000 kg and there is a 50% weight loss on drying (which I think is conservative), then it would require around 400,000 kg of fresh meat. If meat yields from black caiman are similar to alligators then a 1.8 m animal (the upper end of the subadult size class) would yield about 8 kg of meat and it would therefore require about 50,000 black caiman a year to supply the market. If that many subadult black caiman can be captured, then it suggests that the species is relatively abundant. This does not agree with the few status assessments of black caiman. Why were black caiman not seen in high density on surveys? Have black caiman densities changed drastically due to this purported onslaught? These important questions should be addressed.

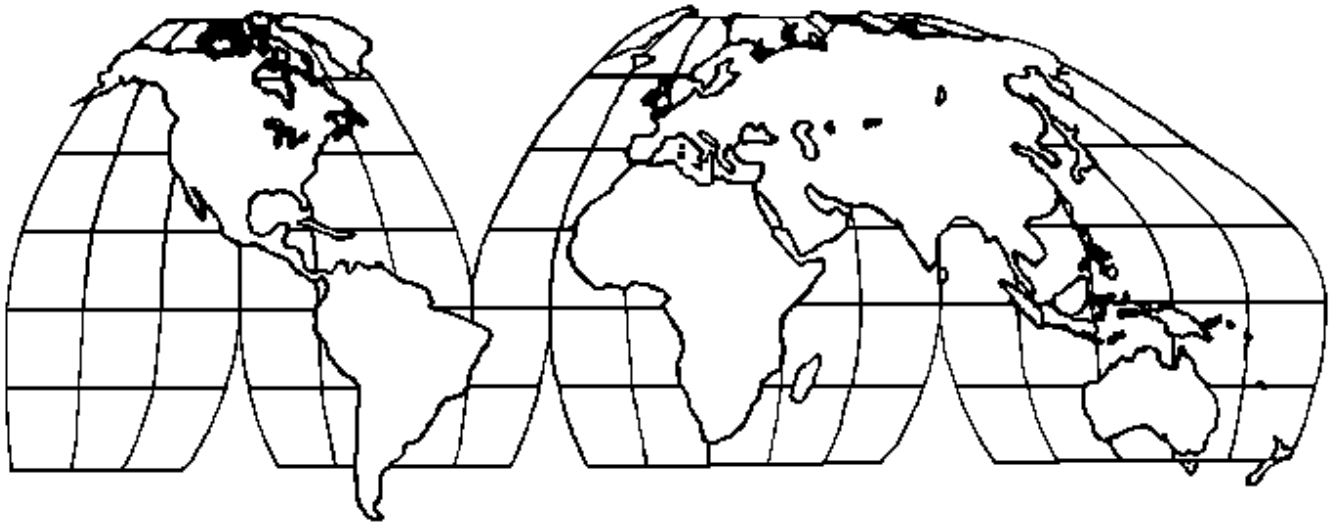
Why would hunters select sparse and inaccessible black caiman for meat over abundant and accessible common caiman? Is it superior in taste to other species? Probably not. My own sampling of alligator, Nile crocodile, salt water crocodile and common caiman indicates little difference in texture or taste. Other NEWSLETTER reports indicate that in Ecuador and Peru black caiman is rejected while common caiman is relished. It seems that special appetite for black caiman may be cultural rather than due to flavor. In addition, I question whether anyone could distinguish species of dried crocodilian meat. If it is true that tons of caiman meat are traded in the region, I expect it is mostly common caiman, which is abundant and easy to acquire throughout the Amazon and also from the legal Venezuelan harvest program. Antonio Villa Lopera, in his response to the meat trade information, reported in NEWSLETTER 14 (3), that caiman meat trade occurs in Leticia, but is isolated and seasonal. This supports some of my own impressions, but additional information is needed to draw a conclusion.

The numbers and likelihood of these reports just don’t seem to add up to me. Additional details to clarify these questions would be welcome.

With these doubts expressed, how should the CSG react as a scientific organization to such allegations of illegal trade? I think the recommendation developed by the CSG in Argentina, calling on range states and importers to be vigilant, was warranted. However, from my perspective as a remote CSG member, I would like to see more detailed and substantiated information before taking action beyond information gathering. My concern is that an over-reaction to such allegations may have a negative effect on the development of managed caiman sustainable use programs in South America that may ultimately have conservation benefits.

These programs have a difficult enough time achieving their conservation goals without having to contend with negative, and perhaps inaccurate, accounts of illegal trade.—Allan ‘Woody’ Woodward, *Florida Game and Fresh Water Fish Commission, 4005 S. Main St., Gainesville, FL 32601 USA.*

AREA REPORTS



Africa

Egypt

CROCODILE GOD MUSEUM. Egypt will open a museum during 1996 devoted to worship of crocodiles by the pharaohs. Sobek, the crocodile god, become the chief god of pharaohs in the 12th Dynasty (2000-1785 BC), and at that time, a temple was built to him in Kom Ombo, 880 kilometers (540 miles) south of Cairo, where the museum will be located.—INTERNATIONAL HERALD TRIBUNE, *5 September 1995*.

Ethiopia

IMPACT OF FISHING METHODS ON CROCODILE OF LAKE CHAMO. Studies on compatibility of fishing methods with crocodiles were conducted in mid January 1995, after being considered one of the most important factors in determining the crocodile's current status. The studies revealed that the crocodiles of lake Chamo are in decline. Since fishing and tree cutting are the only readily available source of income for the people of Arba Minch and the surrounding areas, pressures on them are enormous.

Until recently, fishing was done using mainly line and hook. Later the nets were introduced and their use has expanded to a stage where it has reached incompatibility with crocodiles. The newly introduce net, locally know as "Gancho" is ten times stronger than the net used before. Gancho is used to catch Nile perch, the only lucrative business in the area. Among the various reasons that inspired a community to produce a net that has been proven to be lethal to crocodiles, are that these animals represent a threat to their livelihood by competing for fish or causing damage to their nets. Unlike the old nets, Gancho makes the intruder a victim, which perishes submerged, caught by the jaw, after a prolonged struggle to free itself.

Had it not been for a law reinforcement, which existed during the peak of the massacre (1992), the crocodile of lake Chamo would have become extinct. But the decline of Nile perch due to heavy fishing, prompted the fisherman to eventually lose interest in using the deadly net, Gancho. We will let you know the results of the survey when the data are available.—Assegid Gebre & Kumara Wakjira, *Arba Minch Crocodile Ranch, PO Box 42, Arba Minch, Ethiopia*.

Kenya

PROBLEM CROCODILE. The residents of the Sankuri Division in Garissa District on the Tana River, have appealed to the Kenya Wild Life Service to kill the crocodile that has been terrorizing them for two years. The crocodile has killed eight people and over 30 goats since 1994. Speaking on behalf of the residents, councilor Ahmed Shekh Aden appealed to Kenya Wildlife Service to either kill it or authorize the administration police to kill it.—KENYA TIMES 25 January 1995 *submitted by* Pritpal Soorae, *PO Box 48177, Nairobi, Kenya*.

CLUTCH AND EGG SIZE OF A WESTERN AFRICAN DWARF CROCODILE. In the Herpetology Department of the National Museum, Kenya, there is a collection of embryos (advanced pre-hatching stage) and eggs of *Osteolaemus tetraspis*. This collection (catalogs # CR/5), which is preserved in alcohol, was collected by A. Forces Watson at Zor, Cavalla river near Mt. Nimba in Liberia, West Africa on 12 June 1967. The nest contained a total of 10 eggs out of which 6 eggs were collected. The eggs are hard and white shelled with small white pores. Their average size is 68.8 mm x 39.8 mm.

Table 1. Egg size of a clutch of *Osteolaemus tetraspis* from Liberia.

Egg Size (mm)

69.5 x 39.5
67.5 x 40 6
72.0 x 39.0
68.0 x 39.5
68.5 x 40.0
67.5 x 40.0

The pre-hatching embryos have a conspicuous brown patch on top of the head and snout. The dorsal surface including the tail consists of black bars and the ventral surface has black blotches on yellow background.—Pritpal Soorae, *PO Box 48177, Nairobi, Kenya*.

South Africa

CROCODILE EXPORTS TO CHINA. Seventy two Nile crocodiles, ranging from two to 17 years age and measuring up to 2.5 m length, were transported by South African Airways Cargo to China in late 1995. This was the first shipment of this nature to China as well as the first time so many crocodiles had been transported at once by air. The crocodiles originated from Cango Wildlife Ranch near Oudtshoorn in South Africa and will form the nucleus of a breeding center at their new home on Hainan Island in southern China.

Snugly packed on beds of straw in individual crates, their eyes covered with padding and with a comforting dose of sedative to ensure stress free travel, the animals were transported by road from Oudtshoorn to Cape Town, and then by SAA flight to Johannesburg. After a night in the SAA cargo warehouse they set of for their flight to Hong Kong, accompanied by owner Andrew Eriksen and handler John Field. Once in Hong Kong it was a short flight to Hainan Island.

The subject of this transfer was first brought to the attention of the CSG in February 1995 by the CITES Secretariat who requested a CSG opinion. In response, letters were sent to the CITES Management Authorities of both South Africa and China, quoting the CSG policy against commercial transfers of exotic species into the range of other species, and presenting both general and specific objections and potential detrimental consequences of this exchange. Additional correspondence followed with the exporter in June 1995. The matter was reported in the NEWSLETTER Vol. 14 (1):2. It is also noteworthy that another potential supplier of exotic crocodilians to China, contacted the CSG for our opinion, and declined to provide the animals requested after hearing our argument. —from correspondence and SPRINGBOK, in flight magazine of South African Airways, January 1996. *submitted by* C. Foot, *Crocodile Farmers Association of Zimbabwe PO Box HG 11 and J. Hutton, African Resources Trust, Harare, Zimbabwe*.

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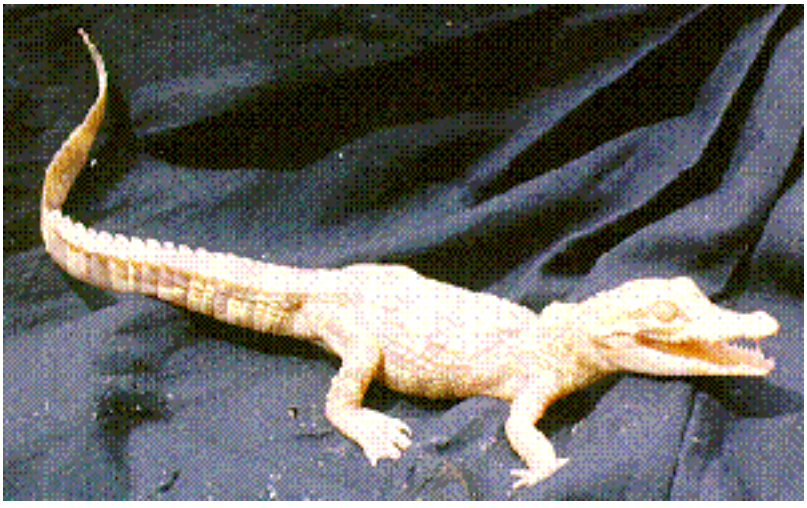
South East Asia, Australia & Oceania

Australia

CROC OF GOLD. Nick Robinson has the most dangerous job in Australia. He is a crocodile trapper, who traps 200 crocs a year in Darwin Harbor. He was contracted to keep a growing population of salt water crocodiles to a minimum. No one knows the exact number of crocodiles inhabiting Australia Top End, but since they became a protected species in the early 1970 after being hunted almost to extinction, the population has soared. Estimates put the figure of salt water crocs in the NT at nearly 70,000. Add to that the unknown number of salties in Queensland and Western Australia, and the less threatening freshwater variety, and the total could well be more than 150,000. There are so many crocodiles living wild in Australia that people are beginning to fear for their safety. Nearly 20 people have been killed by crocodiles since 1971 and many more injured. The number of narrow escapes are also increasing especially among fishermen and children. Even larger inland communities are not exempt of the threat. Salties, which can also live in freshwater are increasingly moving upstream. Some communities demand culling. Others want to return to safari style hunting to reduce numbers and raise revenue. The federal minister of Environment, Senator John Faulner, believes that the current program, which allows for the killing of the problem crocodiles, is more than adequate to protect the community. Bill Freeland, acting director of the NT's Parks and Wildlife Commission points out, a form of crocodile culling already exits. "We remove up to 15,000 crocodile eggs a year, and by doing that, we are hopefully slowing the rate of growth".—THE BULLETIN, 5 March 1996, *submitted by* Professor H. Messel, *Chairman CSG, Bond University, Gold Coast, Australia*.

Cambodia



Albino Siamese crocodile born on a farm in Cambodia. Nao Thouk photo.

WHITE CROCODILES. Four baby white crocodiles hatched in Siem Reap have been sold in Phnom Penh despite the effort of the Agriculture Ministry to have them in state custody. Phnom Penh hotelier Em Bum Tha paid more than US$10,000 for the rare beasts which gained publicity last month when their owner Chhay Ly was considering several lucrative offers from Thai

businessmen to buy them. The government stepped in to halt the sale, saying the white crocodiles, a powerful symbol in Khmer culture and believed to appear only when Cambodia is at a major crossroad, are national treasures.—Bangkok Post 15 August 1995, *submitted by* M. Bezuijen, *Project Tomistoma Officer, Wildlife Management International Pty, Ltd. PO Box 530 Karama, N. T. 0812, Australia*.

Indonesia

CROCODILE STUDIES IN KALIMANTAN. A preliminary study of fresh water crocodiles in Kalimantan was undertaken between September and December 1995. The project was a cooperative activity between LIPI (Indonesian Institute for Sciences) and the Smithsonian Institution, USA. A field team consisting of Charles A. Ross of Smithsonian, Jack Cox, and Ms. Helen Kurniati of the Museum Zoologicum Bogoriense, LIPI, examined captive crocodiles on farms in Kalimantan Barat, Selatan and Timur, and obtained information from local people in the Barito, Kapuas and Mahakam river systems.

A population of wild *Crocodylus siamenis* was documented in the Mahakam river system, (vicinity of 00°30' S, 112°15' E) confirming that the captive *C. siamensis* reported by Frazier and Maturbongs in 1990 and Cox *et al.* in 1993 were probably of local origin. Voucher specimens were obtained by LIPI staff and deposited at the Museum Zoologicum Bogoriense. This wild population occurs in an area where study, protection and management is feasible. Future management might include harvest of wild eggs, rearing and restocking as an incentive for the protection of nesting areas. At present most young crocodiles removed from this population are caught in fish traps and a management plan must take this accidental catch into account. Incubation of eggs and release of young crocodiles larger than those typically caught in traps may help resolve this problem. However, hybridization of crocodiles in farms, where it occurs, should be discouraged.

Two captive crocodiles at the P.T. Alas Watu Utama farm near Bandarjasmin exhibited scale patterns similar to the type of *C. raninus* and other possibly related crocodiles *C. mindorensis* and *C. novaeguineae* (north coast population). These were said to have come from a logging foreman stationed near the Kalimantan Tengah-Kalimantan Barat border. We did not obtain any indication of this form in Kalimantan Barat.

Opportunistic observations were made on *C. porosus* and *Tomistoma schlegelii*. *C. porosus* was encountered on crocodile farms and in village pens in the vicinity of Danau Sentarum. *T. schlegelii* was observed at the village level in all the river systems visited. From our observations *T. schlegelii* appears to be the common crocodilian in Kalimantan. However, we did not conduct surveys in estuarine or coastal habitats expected to be suitable for *C. porosus*. Interviews with villagers suggest that there is no longer any organized trade in *T. schlegelii*. From our interviews with villagers it is evident that there is a seasonal movement of crocodilians from flooded swamp forest during the wet season to permanent water during the dry season and census work must take this movement into account. We suspect that *C. siamensis* uses 'danaus' or lakes that are permanent marshland while *T. schlegelii* appears to occupy danaus that are more open and also rivers and streams. This difference may be reflected in nesting strategy with *C. siamensis* nesting on floating mats of vegetation while *T. schlegelii* nests on solid ground but it is premature to infer ecological partitionaing without further study.

Further studies are anticipated in 1996 and a list of priority investigations to follow up on these

results is recommended.—*extracted from* C. A. Ross, J. Cox & H. Kurniata, PRELIMINARY SURVEY OF PALUSTRINE CROCODILES OF KALIMANTAN, *a LIPI/ SI Cooperative Project. Submitted by* Dr. Soetikno Wirjoatmodjo, *Director, Research and Development Center for Biology, LIPI, Jl. Ir. H. Juanda 18, P.O. Box 208, Bogor 16002, Indonesia*.

Malaysia

TASIK BEHRA WETLAND PROTECTED. On 9 October 1995, the Prime Minister officiated at the opening of the International Conference on Wetland Developments, organized by the Asian Wetland Bureau, Wetland Research Bureau and Wetlands for the Americas. Participants heard success stories from Brazil, Costa Rica, Nepal, and Kenya, and Malaysia announced its declaration of the Tasik Behra in Pahang province as the first Malaysian site for wetlands protection under the RAMSAR Convention. RAMSAR is an inter- governmental agreement that provides the framework for international cooperation for wetland conservation and Malaysia acceded to RAMSAR in March 1995.

Tasik Behra and its associated marshes, with extensive areas of reeds, freshwater and peat swamp forest, covers a total area of 6,510 hectares. The lake is the prime example in Malaysia of freshwater swamp and blackwater lacustrine habitats and supports a rich biodiversity, including one of the few remaining populations of *Tomistoma schlegelii* in Malaysia. There have been no confirmed sightings since the mid seventies, although a 5 meter *Tomistoma* was recently caught upstream by fishermen and is currently on display at the Zoo Melaka, Air Keroh in Melak. WWF Malaysia have proposed a management plan for the area, however, having a plan is one thing, but implementing it is another. Faisal Parish of Asian Wetland Bureau has recommended assessment of resources, development with the local community, tourist facilities, research center and public awareness activities as components of the plan. One of the conditions is that there should be no significant impact on the area from these activities. The assistance of the Crocodile Specialist Group is needed in providing advice to crocodile breeders in Malaysia who are ready to play a role in wild crocodile conservation.—Tan Hiok Jeng, *Langkawi Crocodile Farm, PO Box 50, Langkawi 07000, Malaysia*.

Papua New Guinea

ANOTHER ATTACK IN PNG. The Papua New Guinea National Newspaper reported 10 January 1995 that a 52 year old villager at Tambunum village who wanted to have a dip in the Sepik River had a gory end. The man dived straight into the mouth of the crocodile, watched by his helpless wife. East Sepik Police Commander, said the man has been fishing along with his wife when he decide to cool off. He dived once into the river and emerged safely, but when he dived for the second time, he landed straight into the crocodile's mouth.

The woman watched as the crocodile pulled her husband into the middle of the river before disappearing under the water. Police searched the area with the help of villagers but could not find the body.

The crocodile reported to have attacked people in west New Britain (NEWSLETTER 14(2)) is still at large despite police efforts to capture it.—G. Solmu, *National Crocodile Unit, Department of Environment and Conservation, PO Box 6601, Boroko, Papua New Guinea*.

Taiwan

CROCODILE FARMS CLOSED. Dr. Minna J. Hsu, who is conducting research into wildlife trade and reptile use in Taiwan, recently informed Rom Whitaker of Madras Crocodile Bank Trust, India, that a new wildlife conservation law in Taiwan has caused the closure of all of the several crocodile farms that previously were in operation. A single farm remains in operation, concentrating mainly on snakes, although this farm does have "a few species of crocodiles and mostly caimans from South America". It is not clear whether the farm remains in commercial production and it too is destined for closure.—*from litt.* R. Whitaker, *Madras Crocodile Bank Trust, Post bag 4, Mammalapuram, 603104, TN, India*.

Vietnam

CROCODILES IN THE NEWS. Wildlife experts have warned that rare local crocodiles are in danger of extinction. The warning was issued at a seminar in October to promote the preservation and development of crocodiles sponsored by the HCM City Forestry Department. Most of the danger could be attributed to illegal poaching and the unqualified breeding of the two rare local species the *Crocodylus porosus* and the *C. siamesis*. Massive crossbreeding with the Cuban *C. rhombifer* species had threatened the local breed. The abdomen skin of two rare local species sell at between US$6 and $8 a centimeter and the meat between $4.5 and $6 a kilo on the world market. The belly skin of a Cuban crocodile sells for between $1 and $2.45 a centimeter. A kilo of the reptile's meat fetches about the same.—Vietnam News Service 3 October 1995, *submitted by* Mark Bezuijen, *Project Tomistoma, Wildlife Management International Pty. Ltd. PO Box 530, Karama, NT 0812, Australia*.

VIETNAM SITE REPORT. Stephan Gorzula recently visited Vietnam as team leader on an Environmental Impact Assessment of a hydropower plan for the Southern Highlands and took a little time to look at the crocodile situation. He teamed up with new CSG contact Mr. Pham Van Muoi and visited crocodile farms around Ho Chi Minh City and an area of the Mekong delta where there are still some wild saltwater crocodiles. Stephan inspected six farms and reports that although each farm was slightly different, he was impressed with the health of the crocodiles. Obviously the Vietnamese are breeding and raising crocodiles successfully. He also reported seeing scores, if not hundreds, of juvenile crocodiles that are reportedly the offspring of *C. siamensis* and hybrids with *C. rhombifer* (i.e., F1 hybrids backcrossed to pure *siamensis*). Stephan comments, "I personally do not see escapes as being a threat to Southeast Asian crocodiles. The surrounding land is all farmed and the waterways heavily fished (I qualify this by saying that if these were *Caiman crocodilus* I would be very worried indeed!). What I see as the issue is that the Vietnamese have put a lot of time and effort into setting up these installations. The replacement of the hybrids with local stock would take some years. It should be phased in, but there should be some legal mechanisms by which the hides of the hybrids could be traded internationally."

Adult Siamese crocodile of Vietnamese origin in Bao Ngu Crocodile Farm, Ho Chi Minh City. M. Pham photo.

—Stephan Gorzula, *614 West Main Street, Newbern, TN 38059, USA*. [*Editors note:* hybrids are treated by CITES as the same Appendix listing as their most endangered parent (Resolution Conference 2.13), therefore these hybrids would be treated as Appendix I. They could theoretically be traded under the provisions of the captive bred specimens (Res. Conf. 2.12 and 8.15) if the facilities in which they were captive bred met the criteria for registration (Res. Conf. 8.15)]

Central & South America

Brazil

CAIMAN STUDIES IN THE AMAZON. John Thorbjarnarson, working with Wildlife Conservation Society research zoologist Marcio Ayres, has begun a 3 year effort to study the ecology and management potential for crocodilians and freshwater turtles in the Mamiraua Ecological Reserve in Amazonas State. Crocodilian work will center on the ecology and (currently illegal) harvesting of black caiman. Ronis da Silveira, a graduate student who is working with Bill Magnusson at INPA, has been conducting population censuses and ecological studies of both black and spectacled caiman in the reserve since 1993.

The reserve covers over a million hectares of varzea forest and is the largest protected area of flooded forest habitat in the world. The caiman work will be a part of a large multi disciplinary project, directed by Marcio Ayres, that relies heavily on the involvement of local communities. Much of the work will be focused on implementing workable management strategies based on the sustainable use of varzea resources by these local communities. Principal funding for the reptile work is coming from the European Economic Community. The Brazilian government is providing major support through the establishment of a 'National Institute for the Varzea', which after the Museo Goeldi in Belem and INPA in Manaus will be the third major research center in the Brazilian Amazon.—John Thorbjarnarson, *Wildlife Conservation Society, 185 Street & Southern Blvd. Bronx, NY 10460, USA*.

CAIMAN FARMERS ASSOCIATION. In the State of Mato Grosso del Sur, Brazil, we have formed an association of caiman farmers that will include farmers from other Brazilian States. The objectives of the association, called Asociación de Criadores de Caimán de Piel Clásica (ACCAPEC), are to promote caiman farming. Retardation of the formation of osteoderms in the skins of Brazilian farm raised caiman has enabled us to produce better skins that are easily tanned. We are planning the possibility of holding a meeting in Santa Fe, Argentina, in conjunction with the 13th Working Meeting of the CSG.—Elias Lemos Monteiro, *Rua Pedro Celestino 233, Campo Grande MS, CEP 79004-560, Brazil*.

Ecuador

Estado Poblacional, Utilización de Tipos Vegetales y Crecimiento de *Melanosures niger* y *Caiman crocodilus crocodilus* en Zancudococha y Cuyabeno, Amazonia Ecuatoriana. Desde Agosto de 1992 hasta enero de 1994 se estudiaron las poblaciones de *Melanosuchus niger* y *Caimán crocodilus* en la laguna de Zancudococha, en el oriente de la Amazonia ecuatoriana. Ademas se incluyeron datos de cautela y de crecimiento provenientes del sistema lacustre del Río Cuyabeno, en la misma región.

En los conteos nocturnos realizados se encontró una considerable variación en el numero de los individuos observados (de 8 a 46). La mayor parte de esta variación se explica por los cambios en el nivel del agua de la laguna, la presencia de viento y de lluvia. El porcentaje de los caimanes vistos que fueron capturados en Zancudococha varia en las diferentes clases de tamaños y es menor mientras la longitud del animal aumenta. Los cambios en los niveles de cautela, podrían estar relacionados con eventos importantes de la historia natural de la especie, tales como el termino del cuidado parental o de la maduración sexual. En el SLRC la cautela de los animales es mayor. Esto pudría explicarse por diferencias genéticas que hagan mas arisco a *C. crocodilus*, especie dominante en el Cuyabeno y por la actividad humana mas intensa que existe en esta localidad.

A partir de un experimento de captura y recaptura, se estima que el numero de los caimanes en Zancudococha es de alrededor de 153 individuos, de los cuales 138 serian *M. niger* y 15 *C. crocodilus*. Se encontraron densidades relativas promedio de 2.26 *M. niger* /km. y de 0.29 *C. crocodilus* /km. Con la elaboración de las ecuaciones de calibración de los conteos nocturnos es posible predecir la proporción de la población detectada a distintos niveles de agua. De esta manera se puede calcular, a partir de esos conteos, un estimado de la población total.

Para una mayor precisión en la estimación, se sugiere la exclusión de los animales de menor tamaño, ya que pueden causar variación que no esta contemplada en las curvas resultantes. La proporción de especies de la laguna es de 8.42 individuos de *M. niger* por cada *C. crocodilus*. Para *M. niger* se encontró una estructura poblacional normal para una población saludable de cocodrilianos, es decir mayor frecuencia de los tamaños menores. La población de *M. niger* posee individuos en tamaño de reproducirse y al menos algunos lo hacen. Aunque *C. crocodilus* también presenta animales en tamaño reproductivo, la baja proporción de individuos de menos de 60 cm sugiere que no lo hacen con éxito, o que la predacion sobre los neonatos es alta. En los censos con bajo nivel de agua la clase de menos de 60 cm represento menos proporción que en los con alto nivel. Para los otros grupos de tamaño no hubo diferencias. Hay importantes diferencias en la composición de los diferentes tamaños de *M. niger*. Tanto en el análisis de todas las observaciones de *M. niger*, como en las del segmento de su población menos de 90 cm, se encontró la preferencia por el tipo vegetal denominado mandial (dominio de la Araceae montrichardia linifera). Esta

mayor frecuencia en el mandial fue en detrimento de las frecuencia de observaciones en la zona de las palmas y la de tierra firme. Los tamaños pequenos (menor a 90 cm) se encuentran en las aguas abiertas en menos proporción que la que representan en la población general, mientras que los animales mayores de 180 cm se encuentran en mayor proporción que la que representan en la población. Los diferentes tamaños de *M. niger* utilizan de distinta manera los diferentes tipos vegetales. Hay un solapamiento total de la utilización de tipos vegetales entre *C. crocodilus* y los individuos menores de 90 cm de *M. niger*. Mientras tanto, el solapamiento que *C. crocodilus* presenta con los individuos de *M. niger* mayores de 180 cm es menos que con el de los demás tamaño.

La distribución de los individuos a lo largo de la orilla de la laguna no es al azar. Los individuos de *C. crocodilus* están en mayor proporción en la orilla occidental del la laguna y prefieren tener como individuo mas cercano a un miembro de su propia especie. Esta preferencia no se encontró en *M. niger*. El promedio de crecimiento hallado en el complejo lacustre del Río Cuyabeno para *C. crocodilus* fue de 13.82 cm/año, con una variación de 3.59 cm/año a 34.33 cm/año. El ultimo dato obtenido en Zancudococha (12.18 cm/año) se encuentra en este promedio. Para *M. niger*, en Zancudococha se encontró un crecimiento promedio de 12.45 cm/ano con una variación de 1.72 cm/ano a 25.13 cm/año. El único individuo capturado en Cuyabeno creció 12.42 cm/año. Estos crecimientos son bastante mas lentos que los encontrados en otras localidades, por lo que la recuperación de las poblaciones puede que sea mas lento que lo que otros estudios predicen. No se encontró relación entre la taza de crecimiento y el tamaño del individuo para ninguna de las dos especies.—*Abstract of Masters thesis,* A. Vallejo, *P.O. Box 17-03-1419, Quito, Ecuador*.

[Please note: In the printed edition of the NEWSLETTER authorship of this article was incorrectly attributed to S. Rom. We apologize for the error.—*Editors*]

Population Status, Vegetation Utilization and Growth of *Melanosuchus niger* and *Caiman crocodilus crocodilus* at Zancudococha and Cuyabeno, Ecuadorian Amazon. (Translation of preceding article) Between August 1992 and January 1994 a study of populations of *Melanosuchus niger* and *Caiman crocodilus crocodilus* was carried out at Zancudococha, in northeast Ecuadorian Amazon. Wariness and growth data from the Cuyabeno lakes in the same region is also included.

A high variation in the number of individuals detected was observed on the night counts conducted (from 8 to 46). Most of it was explained by changes in the water level, wind and rain. The percentages of observed caimans captured in Zancudococha differs among the various sizes, and it decreases as their size increases. The changes in wariness could be related to crucial events in the natural history of the species, such as the end of parental care or the reaching of sexual maturity. In Cuyabeno wariness is higher. This could be explained by genetic differences that could make *C. crocodilus*, the dominant species in Cuyabeno, more wary, or/and by the higher intensity of human activity in that area.

By means of a capture-recapture study, the total number of caimans in Zancudococha is estimated at around 153 individuals, 138 of which would be *M. niger* and 15 *C. crocodilus*. The average relative densities were 2.26 *M. niger* /km and 0.29 *C. crocodilus* /km. From the calibration equation for the night counts presented in this work, it is possible to predict the proportion of the population detected in a count at specific water levels. In this way, an estimate of the total population can be derived from night count data. For a greater accuracy in such estimations, it is suggested that the smaller animals be excluded from the analysis, since they can cause variation that is not accounted for in the equation. The ratio between species is 8.42 *M. niger* for every *C.*

crocodilus. The size structure expected for a healthy crocodilian population was found for *M. niger*: greater frequencies of small sizes. Among the *M. niger* population there are individuals large enough to reproduce, and at least some of them do so. Even though there are also some *C. crocodilus* at reproductive size, low frequencies of individuals smaller than 60 cm suggest that they do not do it successfully, or that hatchlings suffer high predation. Significant differences in sex ratio were found between *M. niger* size classes. *M. niger* smaller than 90 cm, showed preference for the vegetation type know as 'mandial' (elephant ears), and was less common in the palm zones and in the terra firma shores. The proportion of animals smaller than 90 cm found in open waters is smaller than their proportion in the general population, while the larger animals (> 180 cm) are present in open waters at higher proportion than they represent in the population. The overlap in the utilization of the vegetation types by *C. crocodilus* and the *M. niger* smaller than 90 cm is complete.

The caiman spatial distribution along the lake shore is not random. *C. crocodilus* are at greater proportion at west shore, and prefer to have a member of its own species as their closest neighbor. This preference was not found for *M. niger*. The average growth rate found in the Cuyabeno system for *C. crocodilus* was 13.82 cm/year, with a range between 3.59 and 34.33 cm/year. The only data from Zancudococha (12.18 cm/year) approaches this average. For *M. niger*, in Zancudococha the average growth rate was 12.45 cm/year with the range between 1.72 cm/year and 25.13 cm/year. The individual captured in Cuyabeno grew 12.42 cm/year. This growth rate is much lower than those found at other localities, and therefore recovery could be even slower than the ones predicted in previous studies. No correlation was found between the size of the individual and its growth rate at any of the species.

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Costa Rica

FORMACIÓN DE LA ASOCIACIÓN COSTARRICENSE DE INVESTIGADORES EN CROCODILIDOS. En Costa Rica se encuentran registradas dos de las especies de cocodrilidos del mundo, *Caiman crocodilus fuscus* y *Crocodilus acutus*, recurso faunistico que representa una llave de valor tanto ecológico como económico. Actualmente, la perdida del hábitat y la cacería furtiva continúan siendo factores de riesgo para la conservación de los cocodrilos y de los caimanes. Es necesario antes de que finalice este decenio, adoptar estrategias de uso sustentable sobre las especies de crocodilidos de Costa Rica, de manera que se promueva su conservación y la de su hábitat.

Es por eso que se invito a profesionales e investigadores del país a aceptar activamente este reto, para proponer pautas y ofrecer apoyo a las entidades encargada de esta temática, para la recuperación y utilización racional de este importante recurso. El proyecto de 'Manejo sostenido del cocodrilo y el caimán' de la escuela de Ciencias Biológicas de la Universidad Nacional de Costa Rica, consiste de este reto, se fijo como objetivo la formación de la agremiación con esos fines, la cual es hoy una realidad con el nombre de Asociación Costarricense de Investigadores en Crocodilidos (ACIC), en la que participan hasta el momento doce miembros fundadores provenientes de instituciones académicas como la Escuela Centro Americana de Ganadería y el Instituto Tecnológico de Costa Rica y la Universidad Nacional, así como del Gobierno Central con funcionarios del Ministerio del Ambiente y Energía. Nuestra asociación tiene como objetivo principal contribuir a la conservación de las especies de crocodilidos en Costa Rica fomentando el manejo sostenido y la protección de su hábitat. Esta realiza reuniones mensuales en la que se elaboran el plan de trabajo para los próximos cinco anos, y se continua con las investigaciones ya iniciadas. Se invita a quien desee formar parte de ACIC a integrarse activamente al gremio y a los grupos de trabajo.—Juan R. Bolanos, *Lab. De Manglares, Aptdo. 86-1000 Escuela de Ciancias Biologicas, Univ. Nacional, Heredia, Costa Rica*.

COSTA RICAN ASSOCIATION OF CROCODILE INVESTIGATORS (Free translation of preceding article). Two species of crocodilian are found in Costa Rica, *Crocodylus acutus* and *Caiman crocodilus*. At the present time, habitat loss is the primary cause of decline. To prevent further decline it is necessary to develop strategies of sustainable use that will promote the conservation of their populations and habitat.

For this reason we have invited active researchers and professionals in Costa Rica to join in a network and propose ideas for the recuperation and rational use of this important patrimony. Our project in the School of Biological Sciences at the National University is the basis of the new association under the name Associacion Costariccicense de Investigadors en Cocodrilos (ACIC), which now involves 12 members from academic institutions including the Central American School of Agriculture, The Institute of Technology, the National University and the Ministry of Environment and Energy.

The primary objective of our Association is the conservation of crocodilian species, sustainable management and protection of habitat. We will hold monthly meetings and are developing a five year plan, as well as continuing ongoing studies. We offer an invitation to others to join us and we wish to integrate our activities with other similar groups.—Juan R. Bolanos, *Lab. De Manglares, Aptdo. 86-1000 Escuela de Ciancias Biologicas, Univ. Nacional, Heredia, Costa Rica*.

Guatemala

LOST PERMITS ALERT. The CITES Management Authority of Guatemala has informed the Secretariat that three CITES permits (bearing serial numbers 01736, 01749, and 01750) and 25 security stamps (serial numbers GT9120151 to GT9120175) have disappeared. Parties are therefore asked to check the serial numbers of CITES permits issued by Guatemala and the serial numbers of security stamps affixed to such permits. Parties are requested to informed the CITES Secretariat of any discovery involving the use of the lost permits and security stamps.— *CITES Notification from TRAFFIC USA Vol. 15, No. 1, January 1996*.

Nicaragua

MONITORING AND TRAINING. Following discussions with CITES Nicaragua Management Authority personnel in September 1995, I accepted their invitation to assist with training and crocodilian monitoring and this program was structured into the TR & D, US AID Nicaraguan Natural Resource Management Project.

Objectives of the program were:

1. To inform a wider circle of resource managers in Nicaragua about the crocodilian management program and the potential for sustainable use as a conservation tool.
2. To present a training seminar of crocodilian management principles and monitoring techniques.
3. To conduct field exercises in crocodile monitoring built around the initial phase of a national monitoring effort.
4. To present recommendations to facilitate the continuation of a national crocodilian management and conservation program.

These objectives were addressed during field work conducted in Nicaragua between 26 and 31 March 1996. I presented a seminar to an audience of 46 people on 27 March. The audience included representatives from the Nicaraguan wildlife management authority (MARENA), local university, private sector, press and personnel responsible for conservation and protection of wildlife in several of Nicaragua's most prominent protected areas (Bosawas and Si a Paz). I presented basic information on principles of sustainable use as a conservation tool. A key element was emphasis of the difference between 'Ranching' (Spanish *Granja* = collecting eggs from the wild and raising these for commercial use) and 'Farming' (Spanish *Criadero* = maintaining adult breeding stock in captivity and raising their offspring for commercial use). The substantial conservation advantages of ranching were presented, although most successful crocodile management programs combine elements of hunting, ranching and captive breeding (farming). Determination of a suitable mixture of use programs that will aid conservation of crocodilians in Nicaragua requires consideration of many factors including national technical capacity, regulatory capacity, economic factors and conservation objectives. Information on the status of crocodile populations in Nicaragua and basic biological information is fundamental to developing this synthesis.

In the three days following the seminar, 15 individuals joined me for a series of training exercises in the field. Based from a hotel in Leon near the Pacific coast, we spent 10 - 12 hours a day at a La Garita, a small community situated at the mouth of the Estero Real de La Garita, a 20 km^2 area of

protected mangroves which harbors a small population of crocodiles (*C. acutus*), located and first counted in the national survey of 1993. Daylight hours were spent testing and familiarizing with basic field equipment and in discussion of principles of monitoring and each night for three nights we surveyed crocodile density in a 16 km transect of the system. Emphasis was placed on using standard techniques and in data management and manipulation. The site also offered an opportunity for extended discussion of the ecology of crocodiles in Nicaragua and various options for conserving this small population. I conclude that this small population remains stable under its present regime of partial protection although no large breeding adults were seen. The population provides a nucleus on which a small sustainable use program might be based, but a period of recovery, increased protection from illegal killing and development of incentives for local participation in the program are necessary. A series of recommendations was developed to build upon the existing foundation of information and personnel, and progress toward a national system of crocodilian conservation and sustainable use.

1. Implementation of monitoring of selected crocodile populations in Nicaragua.
2. Analysis of use of crocodilian materials.
3. Draft regulations for crocodilian use and export.
4. Investigate pilot projects for community use of crocodilian resources as an incentive for conservation at the local level.
    i. Ecotourism and population augmentation and ranching of *C. acutus* at La Garita.
    ii. Ecotourism and population augmentation and ranching of *C. crocodilus* at Kukulaya lagoon, RAAN
    iii. Community protection and regulated hunting of *C. crocodilus* in the Las Guatusos/ Rio Frio region RAAS.
5. Development of technical capacity in crocodilian husbandry to support crocodile ranching in the future.

—from Final Report, Nicaraguan Training in Crocodilian Management, J. P. Ross, *Florida Museum of Natural History, Gainesville, FL 32611, USA*.

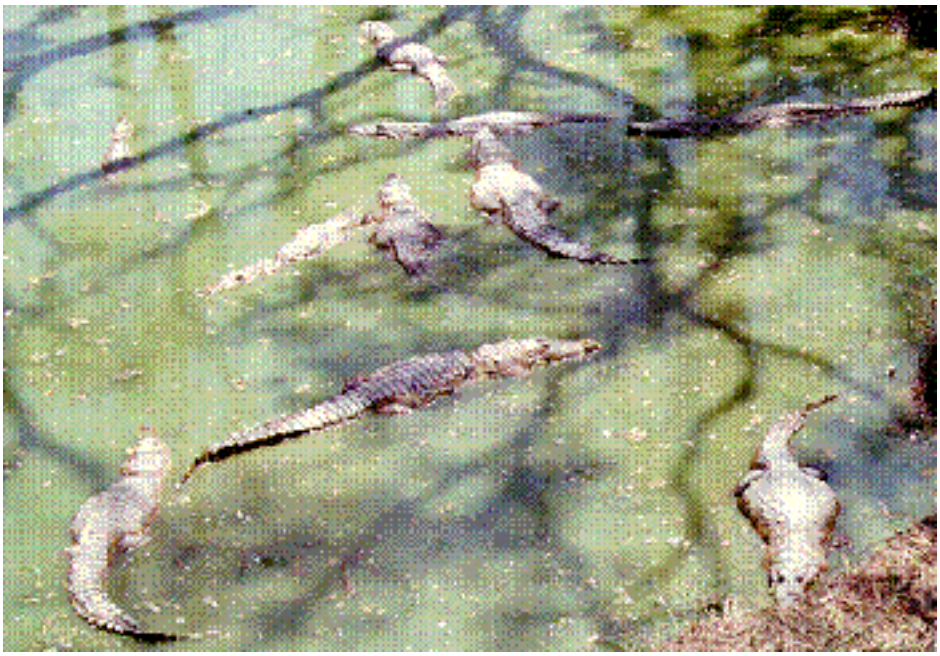
Europe

Russian Confederation

POW CROCODILE STILL ALIVE IN MOSCOW. The New Russians have a fascination for crocodiles, and despite many difficulties, not least among them the climate, pet crocodiles are not uncommon in Moscow flats. However, Moscow's favorite crocodilian is an American alligator who has lived in the Moscow Zoo since the mid 1940's. In the new era of cooperation and openness, it can now be revealed that the animal was saved (or stolen, it depends upon your point of view) by Russian soldiers in May 1945 from the Berlin Zoo and remained behind the iron curtain until the present time. Now the terrible secret of the Moscow Zoo is revealed. Will the Berlin Zoo ask to have him back? In fact, zoo records in Moscow show the animal to have been received from Berlin Zoo in 1946, with its origin quite properly recorded as a zoo to zoo transfer.—Nikolai Formazov*, Moscow State Museum, and* Aleksei Makarov, *Moscow Zoo Terrarium, Bolshya Gruzinskaya 1, Moscow 123242, Russia*.

North America

Mexico



Crocodylus moreletii at breeding ponds of Industrias Moreletii S.A., Villahermosa, Mexico. B. Figueroa photo.

Crocodile ponds and research facility of Centro de Investigaciones en Conservacion de Especies Amenazadas, Villahermosa, Mexico. B. Figueroa photo.

Tile mural of crocodiles at the entrance to CICEA, one of several active centers of crocodilian research in Mexico. B. Figueroa photo.

NATIONAL CROCODILIAN MANAGEMENT PLAN. On 26 and 27 February 1996, a meeting was convened by the Instituto Nacional de Ecologia (INE) at the National Autonomous University of Mexico (UNAM) to discuss the preliminary draft of a the new 'National Plan for Conservation, Research, Management and Sustainable Use of Crocodiles and Caimans in Mexico.' The plan was drafted by a small working group and was presented for fuller discussion and input by a wide audience of crocodilian interests in Mexico. There were more than 30 participants at the meeting including many CSG members such as Professor Gustavo Casas- Andreu, Marco Lazcano, Dr. Luis Sigler, many active field workers including Beatrix Ocaña, Carlos Aguirre Hori, Pancho Remolina, Alejandro Cabrera, and representatives from the private sector such as Francisco Leon and Jose Carlos Rodarte. After introductory comments and an introduction on principles of sustainable use of crocodilians, the group broke up into two working groups and discussed in detail the various actions and priorities outlined in the plan. Putting these group inputs together, a new synthesis of priorities including short term, medium term and long term actions was assembled. This material will now be incorporated into the next draft of the plan. At the time of writing a second national meeting is scheduled for 16-17 April to continue the evolution of the Mexican National Plan.—J. P. Ross *Executive Officer CSG, Florida Museum of Natural History, Gainesville, FL 32611, USA*.

SOCIEDAD PARA EL ESTUDIO DE LA CONSERVACIÓN DE LOS COCODRILOS EN MÉXICO. Nuestra sociedad es un organismo integrador de instancias académicas, agrupaciones civiles, iniciativa privada y toda persona interesada en la conservación de los cocodrilos. Nuestra misión es concientizar a los distintos sectores de la sociedad, sobre la importancia que representa el recurso cocodrilo, mediante la gestión, elaboración y ejecución de programas destinados a conservar, restaurar y manejar acertadamente las especies y sus hábitats. Entre nuestros objetivos figuran los siguientes: evaluar las prioridades concernientes con la conservación de las tres especies de cocodrilos distribuidos en México (*Caimán crocodylus fuscus, Crocodylus acutus* y *Crocodylus moreletii*); elaborar políticas relacionadas con la conservación de estas especies; promover la aplicación de programas de manejo; proporcionar servicios de capacitación y asesoría técnica; compilar los trabajos de investigación y experiencias regionales de los últimos 30 años; establecer convenios de colaboración con centros de investigación, organizaciones nacionales e

internacionales; difundir a nivel nacional e internacional los trabajos de investigación y experiencias realizadas en los distintos Estados Mexicanos; guiar y promover actividades de recaudación de fondos que permitan apoyar las actividades de conservación del cocodrilo.— *Presidente:* Beatriz Figueroa Acuna*, Av. Gregorio Mendez, No. 2006, Col. Rovirosa, CP 86000, Villahermosa, Tabasco, Mexico*.

SOCIETY FOR THE STUDY OF CONSERVATION OF CROCODILES IN MEXICO (Free translation of the preceding article). Our Society is an integration of academics, civil groups, private initiatives and all people interested in the conservation of crocodilians. Our mission is to raise the consciousness of the different sectors of society to the importance of crocodilian resources and to assist the birth, elaboration and implementation of programs for their conservation and the restoration of the species and their habitats. Among our objectives are the evaluation of priorities for the conservation of the three species found in Mexico; elaboration of policies relating to their conservation; promotion and application of management programs; provision of technical and review services; compiling work reports and regional experiences over the last 30 years of crocodilian research; establishing cooperative agreements between research centers, national and international organizations, diffusion of information; and to guide and promote fundraising activities for crocodilian conservation. Biannual national meetings and an information Bulletin are planned.

***CROCODYLUS ACUTUS* ON THE COAST OF MICHOACAN.** *Crocodylus acutus* has been previously reported from some localities at the coast of the Mexican state of Michoacan, however, those reports are pretty old, the most recent of them published in 1965 by Duellman (Univ. Of Kansas Pub. Mus. Nat. Hist., 15 (14): 627-709). In order to know the present distribution and the status of the populations of *C. acutus* we started this project in Michoacan. The study area is on the coastal plain of Michoacan and located between the Mexican States of Guerrero and Colima. This is a tropical-subhumid place, with the rainy season in summer. Most of the streams, rivers, mangroves and coastal lagoons, drain into the Pacific Ocean. We surveyed 22 coastal lagoons and mangroves area along the coast of the State, to assess the presence of crocodiles there, between February 1992 until November 1993. We conducted night and day counts from the boat and walking along the lagoon edge. Results show that at least 7 locations support crocodile populations, and is quite possible that other 5 localities have them too, according to the references

of local people. Crocodiles are located on the three separated regions or municipalities, Coahuayana, Aquila, and Lazaro Cardenas. We counted 121 crocodiles and made a gross estimation of the size. Sixty nine percent of the sample were juveniles, 13% hatchling, 12% adults and 6% subadult.

According to these results, the population of *C. acutus* from the coast of Michoacan is composed mainly of juveniles. Localities showing higher abundance were the Santa Ana Lagoon (37 sightings) and Los Tules Lagoon (22 sightings). We also found nesting areas at those places. Results show that the population from the coast of Michoacan are small, but what is interesting is that there are still crocodiles in the area, and in some places it is quite possible to find healthy populations, and it appears that after adequate conservation efforts, these local populations could be recovered.—Jose Cerdeno Vazquez, Dolres Huacuz Elias & Gustavo Casas-Andreu. *Laboratorio de Herpetologia, Universidad Michoacana de San Nicolas Hidalgo. Edificio R, Ciudad Universitaria, Morelia, Mexico*.

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USA

FEED AND ALLIGATOR FARMING, ECONOMIC CONSIDERATIONS. A noticeable trend in Florida alligator farming toward sources of inexpensive or free feed has become more prevalent since the run- up in prepared alligator feed price in 1995 and 1996. Dry feed is approaching the US$700 per ton mark which translates into $80 to $90 per 5 foot market size alligator feed costs on those farms feeding only dry. Other factors have contributed to the trend. The Florida poultry industry is all-but gone. A ban on fishnetting has cut the availability of trash fish in Florida and driven up the cost of what remains. Feed transport cost are $0.12/ton/mile or more. Also the ban on Freon 12 has made life difficult and more expensive for Florida alligator farmers who have relied on aging refrigeration equipment to store frozen fish, poultry, and meat by-products to feed their alligators.

Several states have recently enacted environmental waste disposal requirements for poultry and fish producers which now place disposal cost for deads, culls, and processing waste at an estimated $0.03 to $0.04 per pound for odorless composting or incineration. The late Ernie Nuñez was one of the first Florida farmers to successfully use commercial numbers of alligators for livestock waste disposal cost reduction using dead hogs and runts from his swine production for alligator feed. Leo Ray, an Idaho aquaculturist of trout, catfish, tilapia, and sturgeon, imported 200 hatching alligators from a Florida farm in 1994. Eighty percent of his 1994 alligators are now, eighteen month later, over 5 feet. Leo's alligators are fed trout mortality and fish waste from his filleting plant, and heated with geothermal water. This success prompted Leo to increase his alligator herd by 300 hatchling in 1995, with an anticipated 1,100 Florida alligators on his farm this year, turning a waste disposal expense into immediate profit. One Florida farmer is joint-venturing an alligator grow- out project with a north Mexico crocodile farm fortuitously located outside the range of any Mexico crocodilian species, and adjacent to major poultry producers. With hide market price still below the true cost of production, this migration of Florida alligator farming to sources of fresh, free feed is likely to continue.—Roger Ruvell*, Geneva Farms, Geneva FL, USA*.

ZOOS

CROCODILIANS IN US ZOOS. In its 1995 Regional Plan, the Crocodilian Advisory Group (CAG) of the American Association of Zoos and Aquaria (AZA) for management of crocodilians in US Collections made the following recommendations. Each entry follows the format: Species, number held as indicated from ISIS data base records (males. females.unknown sex); number of institutions holding specimens, Total founder stock (unrelated breeding individuals or 'genetic lines'), living breeders, CAG recommendation summary.

Alligator mississippiensis. 128.80.192; 81 collections, 10 founders, 9 living breeders. Should be held only for education (i.e. to display an endemic species and for its successful conservation story) or other special reasons. Do not breed, replace with targeted taxa.

Alligator sinensis. 16.21.168; 11 collections, 9 founders, 4 breeders. Manage in a Species Survival Plan (SSP) to preserve genetic diversity. A high priority for space, targeted species for SSP.

Caiman crocodilus (=*sclerops*) *crocodilus* & *fuscus*. 7.8.11; 11 collections with 0 founders and 0 breeders. No unified effort warranted, replace with other crocodilian taxa.

Caiman latirostris. 8.10.7; 6 collections with 5 founders and 2 breeders. No unified effort warranted, replace with other crocodilian taxa. Wild populations and conservation programs in South America should be monitored.

Caiman yacare. 9.9.9; 6 collections with 7 founders and 3 breeders. No unified effort warranted, replace with other crocodilian taxa.

Melanosuchus niger. 1.4.0; 3 collections with 0 founders and 0 breeders. Because of difficulties maintaining this species in captivity, the CAG recommends support of in situ conservation efforts.

Paleosuchus palpebrosus. 40.27.46; 24 collections with 9 founders and 10 breeders. Excellent small species for zoos with

limited resources, targeted as small caiman species for zoos, discontinue studbook.

Paleosuchus trigonatus. 1.11.3; 6 collections with 2 founders and 0 breeders. In view of recommendation for *P. palpebrosus* above, do not breed, not targeted for American zoos.

Crocodylus acutus. 5.8.27; 11 collections with 6 founders and 3 breeders. Should be maintained for display only where necessary. Do not breed. Support in situ conservation efforts.

Crocodylus cataphractus. 5.8.27; 11 collections with 6 founders and 3 breeders. Targeted as the large species of African crocodile for North American zoos. Studbook should be compiled.

Crocodylus intermedius. 1.2.0; 2 collections, 0 founders, 0 breeders. Support in situ conservation, not targeted for North American Zoos.

Crocodylus johnsoni. 2.3.0; 3 collections, 1 founder, 1 breeder. Well protected in Australia. Do not breed, not targeted.

Crocodylus mindorensis. 5.3.11; 2 collections with 1 founder and 2 breeders. Support captive breeding effort by Gladys Porter Zoo in conjunction with Filipino conservationists. Support in situ efforts if possible. Targeted for North American zoos.

Crocodylus moreletii. 5.3.1; 4 collections with 8 founders and 3 breeders. Do not breed, support in situ efforts, replace with target species where possible.

Crocodylus niloticus. 13.15.14; 8 collections with 1 founder and 1 breeder. Do not breed, replace with targeted species where possible.

Crocodylus novaeguineae. 1.1.0; 1 collection, 0 founders, 0 breeders. Do not breed, replace with targeted species where possible.

Crocodylus palustris. 1.2.1; 2 collections, 0 founders, 0 breeders. Replace with targeted species where possible. Support in situ efforts in India.

Crocodylus porosus. 4.4; 3 collections with 0 founders, 0 breeders. Replace with targeted species where possible. Support in situ conservation in Palau and other areas where applicable.

Crocodylus rhombifer. 13.24.4; 8 collections with 8 founders and 5 breeders. Species Survival Plan management in progress. Targeted for North American zoos.

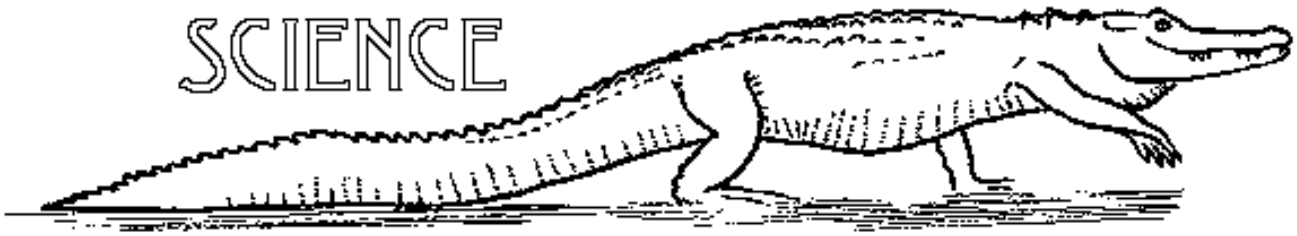
Crocodylus siamensis. 11.6.37; 9 collections with 7 founders and 4 breeders. Maintain studbook management for self-sustaining population in North American zoos.

Osteoleamus tetraspis. 17.18.22; 24 collections with 11 founders and 10 breeders. Recommended for display when enclosure space limited. If applicable, replace with A. sinensis to support SSP program. Targeted as small crocodile for display.

Tomistoma schlegelii. 8.14.2; 9 collections with 3 founders and 2 breeders. This taxa was carefully reviewed at the 1995 CAG meeting. Initial recommendations were formulated to facilitate reproduction but it is clear that intensive management is necessary to maintain this species in North American institutions. Establish an SSP program and target for American zoos.

Gavialis gangeticus. 6.11.2; 8 collections with 0 founders and 0 breeders. Targeted for North American Zoos for a self sustaining population under studbook management.—extracted and summarized from AZA Crocodilian Advisory Group, North American Regional Collection Plan, 1995.

SCIENCE



FACTORS AFFECTING SURVIVAL AND GROWTH OF JUVENILE *CROCODYLUS POROSUS* ON A NORTHERN TERRITORY CROCODILE FARM. The study focused primarily upon factors which influence food intake, and on the non-nutritional aspects of growth in hatchling *C. porosus*. Shelter, photoperiod, density, and social behavior were correlated with growth rates of healthy and poor condition *C. porosus*. Blood samples were taken and analyzed for plasma corticosterone.

The effect of pen shelter on *C. porosus* growth showed no overall significant response of hatchling growth to increased or decreased shelter, but further examination revealed significantly improved growth in a sub-sample of large clutches provided with shelter. Experimental replicates showed very large variation in growth, independent of treatment. During warm season trials, doubling of stocking densities approximately halved the rate of hatchling growth. Attempts to mitigate the effects of high density through the modification of light conditions found photoperiod had no discernible influence upon growth in hatchlings and no interaction existed between density and photoperiod. When the density/ photoperiod trials were repeated during the cooler season, overall growth rates declined, with no significant difference between the high and low density treatments.

Experiments testing the effect of social interactions upon growth showed clutch-specific interactions influence growth in hatchling *C. porosus*. Average growth rates of hatchlings varied according to the growth rates of the animals they were combined with. The introduction of slow growing hatchlings into a fast growing group resulted in an increased rate of growth in the slow growers. Conversely, the introduction of fast growing hatchlings into a slow growing group resulted in a reduced rate of growth in the fast growers. Results from blood sampling showed plasma corticosterone levels in juvenile *C. porosus* over a 24 hour period ranged from 5.494 ng/ml at 00.00 hours to 2.386 ng/ml at 04.00 hours, with an overall average of 3.406 ng/ml. Diurnal fluctuations were not statistically significant. Plasma corticosteroid levels were inversely proportional to rate of growth and animal size, and sensitive to outside disturbance. Long term observations of the growth rate of hatchling *C. porosus* in initially emaciated condition demonstrated grow at rates far in excess of rates reported for healthy *C. porosus*. Injection of a Vitamin B complex and modifying pen light conditions did not accelerate growth or improve survival in emaciated hatchlings. Analysis of hatchling deaths showed mortality to corresponded more closely with age, than with time of year or season. Age of mortality in emaciated hatchlings was significantly correlated with bodyweight at hatching. The results indicate that mortality in emaciated hatchlings may be the result of maladaptive behavior rather than of pathogenic origin.

Hatchling *C. porosus* appear sensitive to negative environmental stimuli associated with captive management including, crowding, social interactions and pen design. The importance of psychological stimuli on feeding behavior in captive crocodilians is not generally recognized and likely to be of greater overall significance to growth than nutritional or disease factors which have in the past received more research attention. A model is proposed which ranks growth-influencing factors for captive crocodiles.—*Thesis abstract,* G. Riese*, 44 Pine St, East, Cammeray, NSW 2026, Australia*.

CROCODILE SYSTEMATICS. In my dissertation project at the University of Texas I have been re- examining the morphological evidence for crocodilian phylogenetic relationship, including as much of the skeleton as possible and numerous fossil taxa that have never been systematically assessed. So far, previous morphological hypotheses are strongly supported - *Tomistoma* is a crocodylid, and *Gavialis* is the sister taxon to all the others crocodilians. I don't know why molecular and morphological data sets differ on this point, but the fossils are clear about tomistomines, which first appear in the Eocene, being crocodylids; we now have Cretaceous gavialoids. Of course the morphological characteristics could be convergent, but since some of the strongest evidence I have for these relationship comes from the postcranium - a more slowing-evolving region than the skull - I am inclined to think otherwise.

I have also been using high-resolution CAT Scanning on skulls to access the braincase and nasal capsules in an effort to

assess variation in these regions.

CAT Scan images of *Alligator mississipiensis* skull, mid-sagittal (top) and approx. 2cm right offset (bottom), see text.

The CAT Scan technique enables us to see the interiors of the skulls without damaging them. The photos above are of a young alligator and represent 200 micron slices. The top image is nearly a mid- sagittal section. The basisphenoid rostrum is barely visible, but you can clearly see the median eustachian canal between the basisphenoid and the basioccipital. The lower section was taken a couple of cm into the right side of the skull, parallel to the first. The big gap on the top is the orbit and right behind that is the supertemporal space and the otic capsule.

These images were generated at Scientific Measurement Systems Inc. in Austin Texas, USA. Similar images of a fossil skull of Thrinaxodon, an early, non-mammalian synapsid, have been published in CD-ROM format with a complete study by Tim Rowe of University of Texas.— Chris Brochu*, Department of Geological Sciences, University of Texas, Austin, TX 78712, USA*.

CROCODILIAN DNA WORKSHOP. A workshop was held 4-6 March 1996 at Riverbanks Zoological Park and Botanical Gardens in Columbia SC, USA, to determine how techniques of DNA analysis might be applied to the conservation of crocodilian species. The workshop was sponsored by the Crocodile Specialist Group, Center for Environmental Policy, Institute of Public Affairs and Department of Biological Sciences, University of South Carolina, Savannah River Ecology Laboratory and the Riverbanks Zoo, and attended by 34 participants.

In the first session devoted to outlining the context for crocodilian DNA research, Perran Ross summarized the current conservation situation, Lou Densmore discussed inferences about species groupings based on mitochondrail DNA evidence, and Brian Bowen related the experience of his work on sea turtles. In the second session on technical advances, Travis Glenn described the characterization of microsatellites in nuclear DNA, describing promising work in the American alligator. Lou Densmore described TAPS, a new method for molecular characterization using polymerase chains; Shlaja Akkaraju spoke on thermal profiling and Eduardo Espinosa described training possibilities. Bert Ely ended the day by discussing the development of single locus nuclear DNA assays.

The second day was devoted to accounts of recent results on crocodilians. Nancy Fitzsimmons discussed her work on clutch parentage and reproductive success of *C. johnsoni*; Herb Dessauer addressed microsatellite loci and population genetics of alligators and Jaime Alvarado presented his work toward characterizing the alligator mitochondrial DNA genome. Roger Sawyer followed with results on the similarities of genetic coding for keratin in the skins of birds and alligators and Scott Davis presented his analysis of hybridization in crocodiles in US zoos. Lehr Brisbin shared the results of ongoing work in using DNA analysis to evaluate effects of metal and radionuclide contamination.

The last day of the workshop was spent in open discussion moderated by Craig Moritz. The primary conclusion was that

all the techniques described at the workshop had some application, but that matching appropriate techniques to particular classes of questions was necessary. The potential for cooperative studies between laboratories was enthusiastically recognized by the workshop. It is clear that complete characterization of the alligator mt DNA genome is well advanced when the results of different workers are combined. Complete characterization may be achieved quickly and would greatly accelerate applications to field questions. The difficulties of obtaining necessary permits for international sampling of crocodilian species was discussed and a preliminary proposal for CSG to serve as a central clearing house to facilitate permitting was outlined. Ideas for sharing samples, tissues and probes were proposed. The workshop provided a valuable opportunity for communication and coordination in this field and several cooperative endeavors have already been launched as a result. A report of the meeting is being published as an Occasional Paper in Environmental Policy.—J. Dantzler, *rapporteur and editor, Center for Environmental Policy, Institute of Public Affaires, University of South Carolina, Colombia, SC USA*.

PUBLICATIONS

ADAPTIVE MANAGEMENT AND SUSTAINABLE HARVEST MODELS. "Sustainable harvests and maximum sustainable yield are concepts derived from a common theoretical body yet the two retain unique distinctions that are seldom distinguished. Between an inexact definition of the former and questionable assumptions of the latter, there is the path of adaptive management, or learning by doing. Adaptive management requires a flexible management program to respond to feedback gained by concurrent population monitoring but can be a vague concept unless a distinction is made between passive and active adaptive management. Passive adaptive management is largely a trial and error process that incorporates a monitoring scheme. Active adaptive management involves experimentally probing for an optimal harvest strategy. As crocodiles are long lived species, possess variable demographic characteristics and live in an unpredictable environment, it remains difficult to forsee the sustainability of various harvest strategies. Computer simulations and experimental manipulations form complementary decision aids in adaptive management, especially if the population status is poorly known."

With this concept-filled abstract, Tony Tucker opens a thought provoking analysis of both the theory and the practice of crocodilian sustainable use. Although focused on use options for Johnstone's crocodile in Queensland, the article brings together a summary of experience in management of various crocodilian species against the broader background of general theory and published thought in other wildlife management fields faced with the same problems. Tucker defines some new subdivisions in the sustainable use field that are helpful in differentiating some quite different concepts and applications. Lumping these together in the past under the rubric of 'sustainable use' has obscured some important differences in application and value of different techniques and generated confusion among both supporters and critics. Tucker's thoughtful treatment goes a long way toward clarifying these concepts and is a 'must read' for anyone interested in the topic.—*Editors review of* Tucker A. D*., 1995. Are sustainable use harvest models relevant to Johnstones's crocodile? The role of population simulations in adaptive management. Pp: 151-160 In: Conservation through Sustainable Use of Wildlife. G.C. Grigg, P.T. Hale & D. Lunney (Eds), Center for Conservation Biology, The University of Queensland, Brisbane, Australia*.

CSG ON-LINE

CSG HOME PAGES. Since we established the CSG pages on the World Wide Web in October, contacts have increased from around 100/month to 591/month or between 3 and 20 contacts per day. Between 25 and 90 people a month have looked at the NEWSLETTER on the web. Our pages are provided courtesy of the Florida Museum of Natural History, and the large volume of traffic to the web site has necessitated a re-organization of the pages, and hence a change in our page address. You can now find us at http://www.flmnh.ufl.edu/natsci/herpetology/crocs.htm (but don't worry, an inquiry to the old address takes you to a page where you can automatically link to the new address).

CROCODILES ON THE NET. The amount of information about crocodilians available on the internet continues to expand. The American Association of Zoos and Aquariums, Crocodile Advisory Group has established a discussion group on crocodiles in the zoo world coordinated by Andy Odum, e-mail Andy for information at: RAOdum@aol.com. Chris Brochu has his current work on crocodilian systematics at http://uts.cc.utexas.edu/~brochu/systematics.html. Patricia de Oliveira, at the Base de Dados Tropical in Brazil, e-mailed us to say thanks for putting the NEWSLETTER on the web and gave us the new address for the *Caiman latirostris* data base at http://www.bdt.org.br/structure/jacare/jpa.

jacare.html. [Since the printed edition of the NEWSLETTER was mailed out, this address has changed again to http://www.bdt.org.br/bdt/jacare/—*Editors*.] SSC has established a homepage at the IUCN headquarters that will become a central nexus connecting to all the SSC Specialist Group web sites, including ours. SSC can be found at http:w3.iprolink.ch/iucnlib/themes/ssc-home.html. An intern is being engaged to assemble these connections for SSC. In the commercial sphere, Bob Young has set up Gator Bob's homepage at http://www.gatorbob.com/. You can read about crocodilian conservation and order some smoked alligator snacks, all on the internet!—*Editors*.

ANNOUNCEMENTS

ALLIGATOR CURRICULUM / HANDS-ON ACTIVITIES. Curriculum products / hands on activities on alligators from the 1990-1993 Rice University Teacher Research Program, sponsored under NSF grant TPE89-55157 have been compiled. They are designed for children of school grades K-12 (ages 5-16) and include classroom and outdoor activities. Some outdoor activities are designed to be used where crocodilians are found in the wild, but could be adapted for use in a zoo habitat. A limited number of free copies are available. Write to: Louise Hays-Odum*, Living Resource Center, 11833 Chimney Rock Road, Houston, TX 77035, USA*.

QUANTITATIVE METHODS FOR THE STUDY OF ANIMAL POPULATION DYNAMICS. An advanced course in techniques is being offered, especially for Latin American participants. The course is suitable for professional biologists and ecologists and advanced students. Details in Spanish follow. El curso esta especialmente diseñado para profesionales biólogos y ecólogos, estudiantes avanzados de las universidades, organizaciones no gubernamentales y gobiernos de los países de América del Sur. Los tópicos incluyen: La dinámica de las poblaciones y modelos de las poblaciones; la inferencia estadística; La estimación de la abundancia, la densidad, las tasas de sobre vivencia y reproducción. Los análisis serán basados en datos muestrales. Costo del curso: $US 200.00. La instrucción del curso sera en idioma Ingles con traducción al Español. Casi todo el material didáctico ha sido traducido. Inscripción: Enviar solicitud y currículum vite a:— Eduardo Asanza*, Director Ejecutivo, Fundación Cuyabeno, Casilla Postal 17-12-512 Quito Ecuador. Fax (593 2) 464717, E-mail: easanza@ecology.uga.edu*.

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