

CROCODILE SPECIALIST GROUP

NEWSLETTER

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IUCN--The World Conservation Union
Species Survival Commission

Cover Photo: Subadult *Crocodylus niloticus* at La Vanille Crocodile Park, Mauritius. The specimen was originally obtained from a crocodile farm in Madagascar. A. Britton photo.

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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
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-
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EDITORIAL

More Discussion in the Newsletter. Several recent correspondents have indicated their interest in promoting wider discussions of policies, issues and ideas in the Newsletter. We have tried to do this by inviting and accepting Guest Editorials but feel it is important that the Newsletter respond to the thoughts of the readership, and continue to present the broadest possible diversity of ideas and views within the Crocodile Specialist Group. We therefore introduce a new section 'Views, Opinions and Ideas' and invite all readers to contribute articles, and responses to articles, in this section. Submissions should be around 500 - 1,000 words (1-3 typed pages). A small number of very clear illustrations and figures may be included. A minimum number of properly cited references may be included, however, this section is not intended to substitute for proper publication of scientific results in refereed journals and general references and extensive citations are not encouraged. Articles in this new section, like all Newsletter articles, represent the views of the authors, and not necessarily the views of the CSG. We particularly encourage readers to respond to Opinion articles appearing in the Newsletter. We will also accept submissions of Opinion and Response submitted together and publish them back to back. The Newsletter can and should be a medium for discussion about broad issues of crocodilian conservation. We hope this new section will open opportunities and provoke thoughtful responses from all of you.—*Eds.*

NEW TELEPHONE NUMBERS AND E-MAIL.

The area code of our telephone and fax numbers is changing. Our phone is now 1 352 392 1721 and fax 1 352 392 9367. The old area code of 904 will continue to operate until March 1996. E-mail to CSG and to the Executive Officer should be sent to: [prosscsg@flmnh.ufl.edu]. E-mail to Professor King may still be sent to: [kaiman@flmnh.ufl.edu]. Our mailing address remains unchanged.

VIEWS, OPINIONS AND IDEAS

Safe Options for the Management of Crocodiles. Population models are of dubious value for demonstrating what can be done with crocodilian populations (Abercrombie 1989; Magnusson 1995; Abercrombie and Verdade 1995), principally because of the difficulty of estimating density-dependent effects (Hines and Abercrombie 1987). Here, we wish to show that several options that are generally considered "safe" in fact may be extremely dangerous.

Fixed Quotas. The CSG has always promoted interactive management with careful monitoring of the populations being exploited. However, CITES has adopted the option of allowing fixed harvest quotas (under Resolution Conference 5.16) as an alternative.

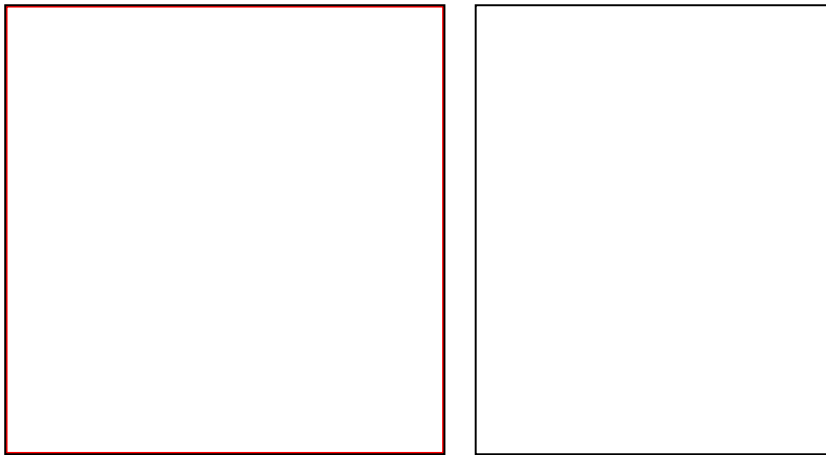


Figure 1. Computer simulated population trajectories under different regimes of harvest.

We demonstrate the dangers of this option with the following example. Imagine a population of a crocodilian with an intrinsic rate of increase (r) of 0.6 and a carrying capacity of habitat of 1,000 individuals. Assuming for simplicity that the growth of the population follows the logistic model, the maximum sustained yield (MSY) of this population is 150 animals/year. We are reasonably certain that no crocodilian population conforms to the logistic model, but while the calculations depend on this assumption, our conclusions are general. The Management Authority can either apply a fixed harvest quota or, alternatively, remove a fixed percentage each year based on the observed population size (fixed effort). We calculated the results when the fixed quota was 150, 151 or 175 assuming that the initial population was at carrying capacity. The results calculated for the next 200 years are shown in figure 1.

In both types of harvest the population is quickly reduced to 50% of the carrying capacity. In the case of the fixed-effort harvest, the harvest is sustainable for the next 200 years. In the case of the fixed quota model, if we overestimate the MSY by just one individual the population appears stable until about 160 years hence, when it falls suddenly to extinction. Overharvesting by 25 individuals sends the population to extinction even more quickly. Who believes that a population of 1,000 crocodilians can be surveyed with a precision of 1, or even 25? Adding random fluctuations, effects of age structure on the rate of increase, or any other complication, only speeds the population crash and increases the uncertainty of our predictions. Our conclusion is that fixed quotas should only be used in conjunction with constant and precise monitoring. They are never a "safe" option.

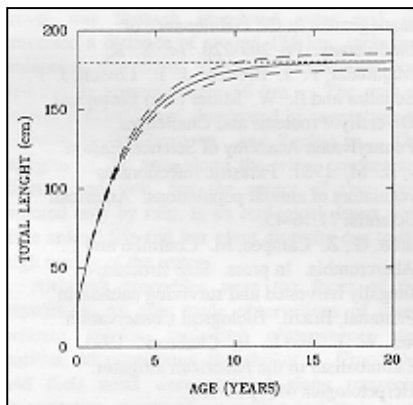


Figure 2. Growth of *Caiman crocodilus*.

Hunt only large males. This option appears to be 'safe' because it protects the reproductive females. We agree, but note that it may not be a safe option economically. Replacement of the larger males in the population depends not only on the dynamics of numbers in the population but also on the growth rates of individuals. Figure 2 shows a growth curve typical of male *Caiman crocodilus*. The curve represents the mean and the dotted lines indicate the range of growth rates individuals could have. For individuals near 180 cm TL, growth is very slow and it may take many years for an individual to grow a few centimeters. Even in captivity, with ideal food and temperature, growth rates of animals around 180 cm TL are slow. If the population of large animals is greatly reduced by hunting, density-dependent processes will not increase the growth rates of these sized individuals. The overall effect is a reduction in the numbers of harvestable size animals and subsequent economic difficulties for users. This may be why the program in Venezuela has problems (Velasco et al. 1995), while the illegal hunting of caiman in the Brazilian Pantanal appears to be successful and sustainable. Mourao et al. (in press) have shown that the Pantanal poachers took animals greater than 140cm TL with the compatible objectives of making a profit and maintaining their harvest. The program in Venezuela was designed to make a profit and maintain populations of size IV individuals (>180 cm TL). The slow growth rates of size IV individuals, which limit recruitment to this size class, may make these objectives mutually exclusive. Hunting only large males does not appear to be very safe economically.

Restocking with captive raised animals. Although the reintroduction of some critically endangered species has been successful (Conway 1989), release of captive-raised animals is dangerous for many reasons outlined in the IUCN Re-introduction Specialist Group's Guidelines for reintroductions. The possibility of disrupting natural populations, introducing disease, and narrowing the genetic and behavioral repertoire of the species requires careful screening and prior study. Here we consider only the potential effects on population dynamics. When restocking

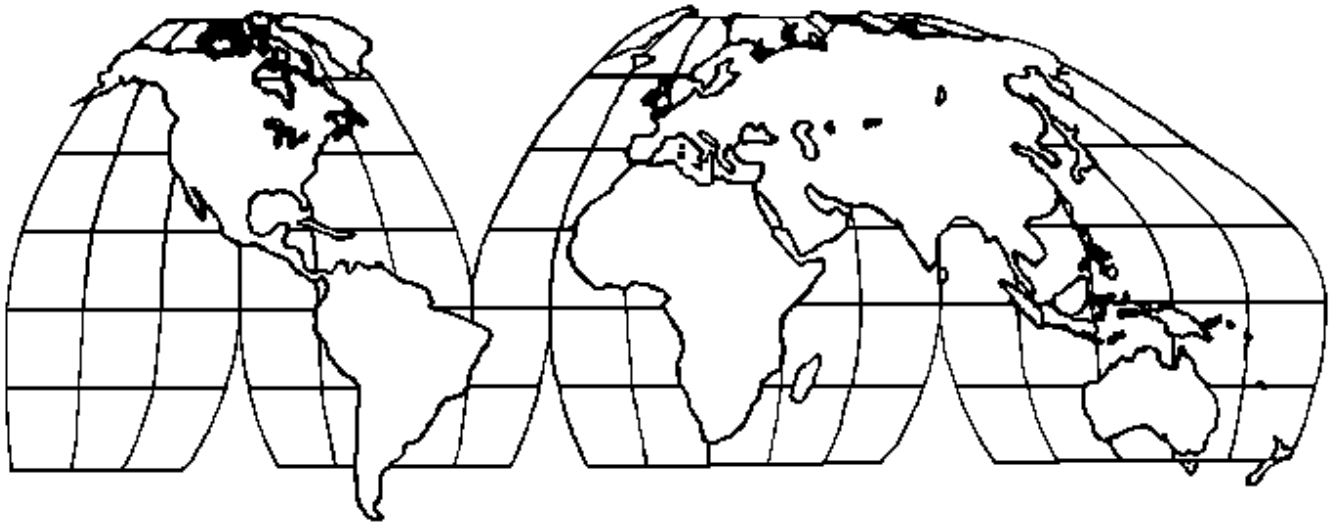
programs substitute natural recruitment, the population becomes dependent on human activities. If the density-dependent factors act on large animals (Magnusson 1986) or through cannibalism (Rootes and Chabreck 1993) this might not be too important. For populations near carrying capacity, the extra juveniles will just be absorbed by the higher juvenile mortality. The rate of increase of populations well below carrying capacity could be increased by increasing the input of juveniles but there is no evidence that this is an effective strategy for crocodilians if the original causes of the decline have not been corrected. If some change in the habitat occurs, such as the loss of refuges for hatchlings or the introduction of a new predator, natural recruitment could be curtailed. Normally, we would detect this through our monitoring. However, if the population is maintained artificially high through reintroductions of larger animals, we may not know until the industry collapses. The effect on aquatic communities is also a question. We will change the dynamics from the irregular and unpredictable input of large numbers of very small animals to the regular input of a small number of intermediate-sized animals. Predator and prey interactions will be drastically changed. We have essentially domesticated the species and it is dependent on market forces. Crocodilian products are luxury items which have to compete with rapidly expanding industries based on fish, ostrich, emu, frog, snake and lizard leather. These products do not have guaranteed prices. We question whether making crocodilian populations dependent on the survival of the crocodilian leather industry is really a safe option.

Importance of Density Dependence. Density-dependent processes change the probability that an individual will die or reproduce as the number of other individuals varies. Possible mechanisms that may mediate density dependence in crocodilians include social interactions (Magnusson 1986), cannibalism (Rootes and Chabreck 1993) and disease (May 1983). We need information on these mechanisms and we will never have enough money to do such manipulations as pure science. We need to include them as part of applied management programs (MacNab 1983; Caughley and Sinclair 1994; Magnusson 1994; Abercrombie and Verdade 1995; Ross 1995). We make a plea for management authorities to include tests with valid experimental designs to test the efficacy of the program and identify the density-dependent mechanisms that drive them. Otherwise, we will be condemned to using 'safe' options, the safety of which is, at the most optimistic assessment, dubious.—William E. Magnusson, *Depto. Ecologia, Inst. Nacional de Pesquisas da Amazonia, Caixa Postal 478, 69011-970, Manaus AM and G. Mourao, CPA-Pantanal/Embrapa, Lab. de Vida Selvagem, Caixa Postal 109, 79320-900 Corumba MS, Brazil.*

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AREA REPORTS



AFRICA

Congo:

Expedition to the Likouala Swamps. An expedition sponsored by the Wildlife Conservation Society spent April and May 1995 in the Likouala swamps of Congo to collect information on the ecology, biology and parasitology of the African dwarf or forest crocodile, *Osteolaemus tetraspis*. At the same time a documentary was made by a team from Congo Television. The study area lies between the Likouala and Oubangui rivers. The expedition was undertaken and coordinated by M. Agnana, F. Huchzermeyer and J. Riley.

The expedition traveled from the village of Djeke on the Likouala, from west to east, in the direction of Lake Mboukou, to the village of Mombendzele on the Oubangui. Much of the travel was through inundated areas and we traversed a distance of around 124 km, including numerous diversions, although the straight line distance is approximately 66 km. The area is largely flooded forest, dominated by vegetation of *Uapaca* sp, *Pandanus* sp. and *Raphia* sp. The margins of the area along the water courses are diverse and rich, but the center of this area, watered only by rain, is an ecological desert with little animal life and low plant diversity due to the high acidity of the water.

Although crocodiles were the focus of the expedition, we also made observations of many primate species, including chimpanzees and gorillas, hippopotamus and duiker. Crocodiles and their nests were counted along transects. Quantitative counts of crocodiles and their nests were made in randomly placed areas 6 m wide and 300 m long. Numerous crocodiles were seen and we were also able to make observations of their nests. We were able to experiment with techniques and define a method for counting crocodiles in the future. A number of specimens were collected for stomach analysis and parasitological studies. Egg counts in eight nests indicated 12 eggs per nest except one which had eleven.

This expedition, the first to effect a passage on this route through the impenetrable swamps, and established that the area is virtually untouched by people and suitable for future research. The distribution of the crocodiles is restricted to particular parts of the forest where essential factors of water, pH, prey, soil and cover are found. The restricted distribution of the crocodiles in the swamp does not justify abusive exploitation. Further studies, which we hope to continue in this area, will assist the conservation of crocodiles in this area.—Freely translated by the editors from a report in French, by M. Agnana, *Wildlife Conservation Society, Project Nouabale-Ndoki, B.P. 14537, Brazzaville, Congo.*

South Africa:

Crocodile Update. As regards crocodile news all seems to be well here and we are all hoping for a better breeding season than 1994. The increase in tourism in South Africa has seen a few new tourist attractions opening including another crocodile farm in Natal near Richards Bay. Skin and meat sales have been good this in the first six months of 1995 and the demand for these two products is strong at the moment especially from eastern buyers. For NCFA news please contact Andrew Eriksen at Cango Crocodile Ranch, P.O. Oudsthoorn.—Howard Kelly, Graduate School of Business, Breakwater Campus, Private Bag, Rondebosch 7700, Cape Province, South Africa. E-mail: KLLHOW01@gsb2.uct.ac.za

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WESTERN ASIA

India:

Diet of muggers. Investigations were made on the dietary habits of the mugger crocodile (*Crocodylus palustris*) between October 1986 and May 1990. Diet was studied at three wildlife sanctuaries in Andhra Pradesh, South India, by examination of crocodile scats (feces) collected from the river bank; 289 scat samples were collected of which 216 were classified as from adult muggers based on scat size, and 73 were classified as from subadults. Scat contents were mobilized by soaking in water for 48 hours and separated through a set of sieves and identified. Fish was found to be an important component of the diet at all times of the year, occurring in scats with a frequency of 61% - 85% depending on the season. Subadult muggers had more arthropods and amphibian remains in their scat, while adults had more large mammals and birds. Identified prey of adult muggers included wild boar, buffalo, goat, sheep, hares, otters, domestic dogs, field rats, cormorants, moorhens, coots, egrets and turtles, in addition to the preponderance of fish.

These results are similar to those found by other studies of Nile crocodiles and American alligator, indicating ontogenetic changes in diet as the crocodiles grow. Possible causes of this change are discussed, including prey availability, habitats occupied at different life stages and changes in behavior of the crocodiles as they grow. Interestingly, no indication of cannibalism was found in this study. Seasonal changes in diet may be associated with seasonal changes in prey availability and water conditions.—Abstracted from V. V. Kumar, B. C. Choudhury and V.C. Soni, 1995. *Dietary habits of the Mugger (Crocodylus palustris) in Andhra Pradesh, South India. Hamadryad Vol. 20: 8 -12. Center for Herpetology, Madras Crocodile Bank Trust, Post bag 4, Mamallapuram, 603104 TN, India.*

Gujarat Mugger Studies. Dr. V. Vijaya Kumar has joined the Institute of Desert Ecology, Bhuj (Kachchh) in Gujarat, India's westernmost province, where he has taken up a study of the status of the mugger crocodile. The study is supported by the Fauna and Flora Society, (UK) and began in June 1995. To date the team has covered Rajkot, Banaskatha, Jamnagar and Kachchh (Kutch) districts. A good population of crocodiles was reported from the Kuchchh district outside protected areas. Following additional studies through the winter Dr. Kumar will be developing some views regarding the future management of crocodiles in Gujarat. Colleagues are asked to note his new address for correspondence: V. Vijaya Kumar, *Institute of Desert Ecology, Patwadi Gate, Bhuj, Kuchchh, Gujarat 370 001, India.*

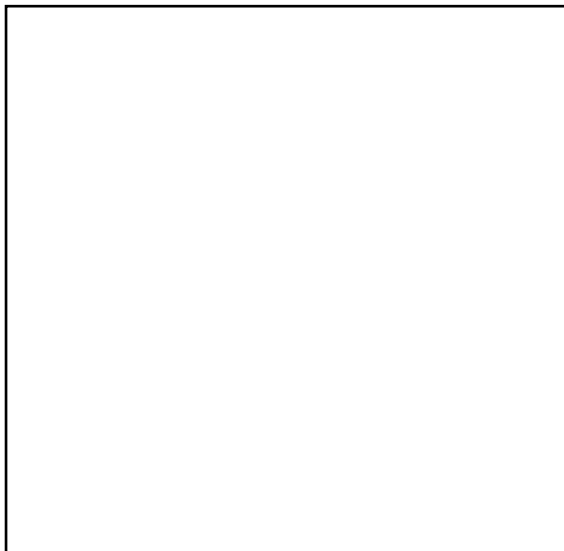
Tamil Nadu Crocodile Situation Set Straight. In response to an article published in the Hindu Newspaper (Madras, India), Romulus Whitaker and Harry Andrews wrote the following letter:

Dear Sir, This is in response to your article 'Crocodile Research to be Halted' 26 July 1995. The Madras Crocodile Bank/Center for Herpetology is not a government organization and though our permits for carrying out work come from the State and Central Government, we are certainly not

going to stop our research. We are talking about animals that grow to nearly 100 years old upon which research has barely scratched the surface of their fascinating life history.

We pioneered many of the research techniques in India, including temperature/sex determination and our collaborators include Dr. J. Lang, the Smithsonian Institution and National Science Foundation, USA, and the Center for Cellular and Molecular Biology (Hyderabad). We would happily release our 5,000 surplus crocodiles if suitable protected habitats can be identified. Most of the best habitat where the public is prepared to tolerate mugger restocking has reached saturation. Unfortunately, fishermen and village people in these areas are not so enthusiastic about having our scaly friends back in large numbers.

We sincerely believe in the good sense of wildlife management techniques, including commercial crocodile farming, as measures to save wildlife and habitats in the long term. The preservation approach is laudable, but it has never worked in any country in the world where humans have to compete with wildlife for food and habitat. India is a star example of continuing depletion of wildlands and wild creatures as humans eventually spread into every nook and corner.



Ranges of Gharial and Mugger on the Indian

Subcontinent.

Just to set your record right, a more accurate estimate for the numbers of crocodiles in the country (based on State by State returns in 1993) is 3,000 - 4,000 in the wild (just a "guesstimate") and 12,000 in captivity.—Romulus Whitaker and Harry Andrews, *Center for Herpetology, Madras Crocodile Bank Trust, Post Bag No. 4, Mamallapuram 603 104 TN, India.*

EASTERN ASIA & OCEANIA

Cambodia:

Crocodile Farmers Association. On 7 October 1995, 65 crocodile farmers from the three main crocodile raising provinces in Cambodia met in Siem Reap province to discuss their common interests in raising crocodiles. Farmers were present from Siem Reap, Battambang and Kompong Chhnang provinces. After a long and serious discussion, they have unanimously agreed that there is an imperative need to organize themselves in an association. The association will have the name of

the Crocodile Farming Development Association of Cambodia (CROFADAC). Five members were selected from 3 provinces to form the Association's Executive Committee. Nao Thuok, Director of Fisheries in Siem Reap province has been selected as chairman of the Association.— Nao Thuok, *Chairman, CROFADAC, c/o Dept. Fisheries, Siem Reap, Kampuchea.*

China:

Alligator Lake in Beijing. An alligator lake with an island has been established at the Beijing Natural Rare Animals Land. Three hundred alligators from Anhui Province have established their new home in this facility recently.

Beijing Natural Rare Animals Land is located in the outskirts of Beijing. Visiting the Land is very convenient as it is on the way to the Famous Badaling Great Wall. This facility is the only one for wildlife combining tourism and trade in China and combines observation and research on rearing commercially valuable species of animals and plants with scientific development, commercial trade and tourist recreation. Although the Land has established preliminary activities and is open to tourists, its construction is still continuing. Professor Zhujian Huang from the Institute of Zoology, Academia Sinica, was invited to be the chief engineer. He will start a project with associate professor Cuijuan Nui, Department of Biology, Beijing Normal University, on reproduction and overwintering problems of the Chinese alligator.

The Land is a private single capital enterprise, Mr Lianjiu Xing, president, and we welcome everybody who is interested in investment or in cooperating with us using economic alligator species. Visits and tourists are also welcomed.—Zhujian Huang (Huang Chu Chien) & Cuijuan Nui, 3 Song Shu Jie De Sheng men Nei, Beijing, 100009, Peoples Republic of China.

Federated States of Micronesia:

Caroline Islands Crocodile Records. In late March and early April 1986, tracks of a crocodile were found at Paliyaw Island, Woleai Atoll. The tracks were 2-3 feet wide with a slide mark in the middle and led from the lagoon to a brackish swamp. At the same time a large log 4 feet diameter and 30 - 40 feet long was seen floating in the lagoon and the islanders speculated that the crocodile had ridden on the floating log from Palau. A previous report from the Caroline Islands was 3.8 m male crocodile caught in trap at Pohnpei Island in 1971. Palau, 700- 1000 km west, is the nearest and most likely source of the crocodiles reported here.—from Eldredge L. G. 1993. *Perspectives in Aquatic Exotic Species Management in the Pacific Islands, Vol. 1. Page 113. South Pacific Commission, Noumea, New Caledonia.*

Vietnam:

Bao Ngu Crocodile Farm. In 1987 we began keeping crocodiles from a passion for wild animals. At that time it was very difficult for private farms to keep crocodiles because crocodiles were considered ferocious and unlucky. Since 1990 we have been trying to alter this perception by providing written materials and pictures to journalists. We have been trying to show that crocodiles in captivity are not ferocious or unlucky, but give us an interesting subject to study and have promising economic gains for our tropical nation in the future. Our efforts have been quite successful and there are now many private enterprises investing in crocodile farming in the south

of Vietnam.

There are two species of crocodile found in Vietnam, freshwater crocodiles (*C. siamensis*) and saltwater crocodiles (*C. porosus*). Prior to 1975 people did not go deep into the forest to exploit wild crocodiles and so we still had quite large quantities of wild crocodiles. From 1980 to 1992 Vietnamese and Cambodian smugglers purchased crocodiles and skins and sold them in neighboring countries and crocodiles in Vietnam became endangered. Since 1992 there have been decrees prohibiting hunting crocodiles but control was not strict and crocodiles are still bought and sold in Vietnam. Recently people have caught a 3 m saltwater crocodile at Kien Giang and 21 freshwater crocodiles at Buon me Thuot, indicating that there are still wild crocodiles in Vietnam.

Mr. Pham Van Muoi, owner of Bao Ngu farm,

Vietnam.

There are currently 20 institutions and private enterprises with captive crocodiles in Vietnam. Nine private enterprises are combined in the Vietnam Crocodile Group. Total captive holdings are estimated at 54 saltwater crocodiles, 435 freshwater crocodiles of Vietnamese origin, 665 freshwater crocodiles of Cambodian origin and 470 Cuban crocodiles (*C. rhombifer* or hybrids of *C. siamensis* and *C. rhombifer*).

The Bao Ngu farm stock was founded on 12 six month old crocodiles purchased from local people in the swamps at Buon Me Thuot in 1987 and 6 adult crocodiles caught in 1990 at Cat Tien. Presently the farm has 36 adult freshwater crocodiles (*C. siamensis*) and 110 freshwater crocodiles of 1-5 years age. We also have 20 saltwater crocodiles (*C. porosus*) of 1-4 years. My personal interest and passion for crocodiles led me to study the techniques for raising crocodiles in neighboring countries of Cambodia, Thailand, Malaysia and China. In August 1995, I had the honor to visit the United States and received much information about crocodiles and crocodile farming. I would like to express my sincere appreciation to Dr. Zug, Mr. Charles Ross in Washington, DC, and Mr. Dennis David and Dr. Perran Ross in Gainesville, for their help with information and documentation about techniques for farming and incubation.

For the future, we now have the information on techniques but we still have difficulty raising capital as interest rates are very high. In order to assist further development we have prepared draft proposals for UNDP and FAO and the Rockefeller Foundation for funds to develop our crocodile farm for both conservation of Vietnam's crocodiles and as a source of economic benefit.—Eng. Pham Van Muoi, *Bao Ngu Crocodile Breeding farm, 588/2 Le Quang Dinh, Go Vap Dis., Ho Chi Minh City, Vietnam.*

Crocodile 'Ut Song'. The Dong Nai River winds southwards through the central highlands of Vietnam before reaching the sea 70 km north of Ho Chi Minh City. Its waters were once infested with crocodiles and local people from riverine settlements were forever mindful of the danger. but gradually this danger has diminished as the crocodile population shrank. However, in a tributary of the Dong Nai, the La Nga, a new industry of crocodile farming is growing. The crocodiles are raised in the river itself in large wooden cages attached to rafts which suspend them in the water. One of the largest cages is owned by 64 year old Nguyen Ven Song, who is known by the title of 'Ut Song' - the crocodile. He has been hunting and breeding crocodiles for 40 years and said that he sometimes caught as many as 500 crocodiles in the Mekong Delta. He is a pioneer of the new farms. Ut Song's cage measures some 32 m² and is made from wood and steel. In it he keeps 80 crocodiles each of which weighs 30 kg - 60 kg. The crocodiles are fed daily on fish when young, and less often as they grow, to restrain their ferocity.

Ut Song is also adept at artificial hatching. His raft floats next to a fenced site on the bank and the crocodiles lay their eggs there at night. Ut Song collects the eggs and places them in a specially prepared pile of straw which he heats to a desired temperature. This rudimentary method is quite effective and he claims 70% success of hatching.

Although the idea of crocodile farming has spread, there is still a wait-and-see attitude about the new ventures as their owners want to be sure of the market first. Farmers are shifting from fish farming to crocodiles as pollution and veterinary costs are reducing the profits for fish. Elsewhere in Minh Hai province, in the U Minh cajepur forest, Vietnam's largest submerged forest, many people are setting up crocodile farms encouraged by forestry officials. Other suitable areas are Dong Nai, Tien Giang and Phut Khanh and Danang. An IUCN official said that Vietnam was endowed with natural conditions making it ideal for tropical crocodile rearing. Already IUCN has asked Vietnam to reserve some areas for crocodile breeding. Vietnam became a member of CITES in January 1994 and CITES stipulates that member countries should strictly observe a minimum obligatory number of crocodiles to be preserved each year, estimated at somewhere between 2,000 and 3,000. With little effort the numbers of crocodiles should be far higher than the minimum. This will allow Vietnam to sell crocodile produce on the international market. [A novel and incorrect interpretation of CITES—Eds.].—*Extracted from Vietnam News 17 September 1995, submitted by Grahame Webb, Vice Chairman for East Asia, Oceania and Australia.*

CENTRAL & SOUTH AMERICA

Brazil:

Population Study of *Paleosuchus*. Despite the extensive geographic distribution of the dwarf caiman, *Paleosuchus palpebrosus*, there are no published studies of populations of this species in the wild. The density, size structure and sex ratio was evaluated for dwarf caiman, in two small tributaries of the Paraná river at 600 m north of Corumbá, Brazil. The two clearwater streams arise in the nearby mountains and have bottoms of sand and rock and a water depth of 30 -120 cm. In June 1993 and August 1994, we walked 4 km stretches of the two streams on two consecutive nights. Dwarf caiman were captured, measured and marked. In 1993, 19 dwarf caiman were captured in each stream. In 1994, we caught 11 dwarf caiman in one stream and 13 in the other. The size structure in one stream was dominated by smaller individuals, while larger individuals

were found in the other stream and we found a dead caiman with SVL of 92 cm, larger than any individual measured in previous studies. The sex ratio of one stream was 1 male : 7.5 females and in the other 1 male : 2 females. The change in density from 1993 to 1994, and the low recapture rate (5%) suggests that many animals are not resident in these 4 km stretches of these streams, although the presence of hatchlings in both years indicates reproduction. Caiman populations and their habitat are now reasonably well protected within this study area. However, we also examined two apparently similar streams in Serra Urucum, near Corumbá. Both of these streams had been impacted by mining pollution, and we found no dwarf caiman in them.—*Abstracted from Campos Z., M. Coutinho and C. Abercrombie. 1995. Size Structure and Sex Ratio of Dwarf Caiman in the Serra Amolar, Pantanal, Brazil. Herpetological Journal 5:321-322.*

Dominican Republic:

Crisis with American Crocs at ZOODOM. Over 140 American crocodile eggs have been removed from natural nests in Lago Enriquillo, Dominican Republic (DR), in 1993 and 1994 and maintained at the Santo Domingo Zoo. The aim of this program was to enhance survival for future re-introduction and to serve as insurance against a catastrophe in the only remaining wild habitat for crocodiles in the DR. The program was developed by the Department of Wildlife, in collaboration with a private group, Grupo Jaragua, with funding from the German and Swiss overseas aid organizations.

Since 1994, the Zoo has been under new leadership and has suffered severe economic and morale problems. A large number of the technical and animal care staff have left and many of the animals in the collection are suffering from poor care. In the case of the crocodiles, excessive mortality from disease, due largely to poor management and hygiene, has caused the death of more than half of the crocodiles held. In May of 1995, there were 106 individuals and by September 1995 fewer than 60 survive. This situation poses problems for the proposed re-introduction of these animals back to the wild population of Lago Enriquillo. Prior to release these juveniles require a period of adaptation to increasing salinity so that they can survive in hypersaline Lago Enriquillo. The current high incidence of disease and mortality in the captive crocodiles present the problem of introducing captive derived diseases back into the DR's only wild population of crocodiles. Quarantine and veterinary screening is required prior to their release. To date, discussions of these problems and needs with authorities have been unproductive and a program that was developing as a conservation success is now in danger of failure.—from correspondence Michael Brown, *Apartado Postal 2234, Santo Domingo, Dominican Republic.*

Lago Enriquillo Results. Studies on the American crocodile population at Lago Enriquillo, Dominican Republic were conducted during 1994 as part of the second phase of the program for improvement of the environment in the proposed Enriquillo biosphere reserve. The crocodile population was monitored by diurnal counts and reproduction was monitored at nesting areas from January 1994 to February 1995. The mean number of non-hatchling crocodiles observed was about 80, ten more than 1993. In one of three nocturnal counts conducted in 1994, 160 crocodiles larger than 1.5 m were recorded. Based on this count our estimate for adult and subadult crocodiles has increased from 160 to 200 individuals.

Nesting began on 14 January 1994 and peaked in the second week of February. Forty eight nests

and an estimated 950 eggs were laid, the highest number in recent years. The nesting beaches were the same as those reported earlier, except that in 1994 no nest were laid on the western tip of Isla Cabritos and a new nesting site was opened at the mouth of the Rio Guayabal. Hatching occurred from the second week of April to mid June and a total of 529 hatchlings were recorded based on either counts of egg shells or number neonates found at each nest. Total production of hatchlings on the Lake was estimated to be 804.

Throughout the hatching season, neonates were collected and taken to freshwater habitats to improve their survival. Some 218 neonates were collected, measured, weighed, sexed and marked before being released along the northwest and northern shore of the lake. Physical characteristics of the nesting beaches and nests were registered and the most nests were located in La Islita and Playa Najayo.

Between September 1994 and February 1995, 45 juveniles born in 1993 were captured and marked. Four of these were from a group of 17 juveniles marked and released in September 1993. Of the 41 juveniles receiving marks for the first time, 11 were subsequently recaptured again. A total of 218 neonates of 1994 were marked and released and 18 subsequently recaptured. Another 31 small crocodiles from this year class were marked in September 1994 and 7 of these recaptured. The seven km of the northwestern shore, between La Azufrada and Los Borbollones is of great importance for juvenile crocodiles with up to 25% of the 1993 year class remaining in this area through 1994. Juveniles showed mean growth rates of 34- 44 mm per month. In their second year the juveniles grow more slowly in length but gain weight faster.

In summary, the non-hatchling crocodile population of Lago Enriquillo seems to be maintaining its size and more recently increasing to about 200 individuals. Reproductive success has improved from 3 nests in 1992 and 36 in 1993 to 48 in 1994. Human impacts on the lake ecosystem are significantly reduced with the cooperation of military personnel and environmental education initiatives in the area.—*Extracted from Mejoramiento de la Situacion Ambiental en la Propuesta Reserva de Biosphera Enriquillo, Tomo 2. Servicio Alemán de Cooperación/Departamento de Vida Silvestre, Santo Domingo, Dominican Republic. Submitted by Andreas Schubert SEV.*

Guyana:

Crocodile Research Expedition. As a recent zoology graduate faced with a year of unemployment, I decided to organize and run an expedition to Guyana through the Exploration Society at Glasgow University.

The project that I ran was concerned with caimans found in the Iwokrama International Rain Forest Program Reserve (other projects performed were on butterfly ecology, forest vulture feeding ecology, a frog survey and a caecilian collection). My project was a wet season survey of *Caiman crocodilus* and a verification of the species of crocodylians within the Reserve. Unfortunately only *C. crocodilus* and *Melanosuchus niger* were positively identified but reports of *Paleosuchus trigonatus* were received from adjoining areas. Indeed, the observation of three individuals that possessed marked keeling of neck and body scutes more commonly observed on *P. trigonatus* but with the majority of features more akin to *C. crocodilus* suggests the possibility of cross breeding between the two species within the Reserve. Further identification of these individuals is being performed from photographs taken of them.

Despite very low densities of caimans due to it being the wet season and the subsequent dispersal of caimans into the flooded forest, numbers and population structures of *C. crocodilus* appear to be fairly healthy. *M. niger* was encountered very infrequently, again probably primarily due to dispersal throughout the flooded forest but possibly also due to low numbers caused by previously intense hunting pressure. However, hunting pressure in this area has been very low in recent years, Gorzula and Woolford (1990) report increased numbers up river of the Reserve (Apoteri) and local Amerindians report high densities of fairly large individuals (>10 feet total length) observed during the dry season, so much so that they are becoming a nuisance to fishermen. A caiman farmer in Georgetown also has plans to farm *M. niger* if it is moved to CITES Appendix 2, which he anticipates for Guyana populations soon. The possible candidacy of *C. crocodilus* and maybe even *M. niger* for use in the sustainability program intended for the Reserve shows that these animals require a decent amount of research, especially in the form of dry season surveys and mark and recapture measurements in the near future before any such program is implemented.

Observations in Georgetown indicate that the undocumented use of caimans (except for illegal export) is largely restricted to the selling of stuffed juveniles or skins to tourists. Out of the two traders observed in Georgetown, one admitted to taking up to 20 caimans a week when trade was doing well. His specimens were mainly taken from an area just north west of the inhabited coastal strip around Georgetown. I am keen to become actively involved in crocodylian research and would be interested to hear from researchers with projects.—Alastair I. Ward, 20 Southpark Avenue, Hillhead, Glasgow, G12 8RH, Scotland, UK.

Jamaica:

Crocodile Management Workshop. Following an invitation from the Jamaican Natural Resources and Conservation Authority (NRCA), CSG Deputy Vice President for North America, Dennis David, and Executive Officer, Perran Ross, spent 18 - 21 December examining the current situation of crocodiles in Jamaica and presenting a workshop on management of nuisance crocodiles. NRCA has received a growing number of complaints from the public concerning crocodiles which turned up near peoples homes, in commercial fish raising facilities, and other inconvenient locations. It has become quite common for local people to take matters into their own hands and either kill or capture these crocodiles. The Jamaican National Zoo had received several crocodiles in this way and other private individuals were also holding crocodiles saved from public wrath.

We visited several locations where problem crocodiles were reported and assessed the apparent cause of these problems and the public responses to them. A workshop on crocodile biology and management of problem crocodiles was presented to over 30 participants from NRCA, the Hope Zoo, other government departments and several conservation organizations. This was followed by a demonstration of equipment and crocodile handling techniques using captive crocodiles at the Hope Zoo, and a further day of discussions and practice in safe crocodile handling using crocodiles from the private collection maintained by Mr. Laurence Henriques at Serge Island.

It is clear from discussions with many experienced and knowledgeable people, that crocodiles, and crocodile habitat, remain widespread in Jamaica. A preliminary estimate of current crocodile habitat was obtained by marking known sites on a 1:250,000 map. Area of crocodile habitat was estimated by planimeter to total about 118,000 acres, with major areas being the Black River area (37,500 acres), the Salt River and Old Harbour Bay (21,400 acres), the coastline and small creeks

of the Clarendon district, and several small coastal swamps along the south coast. The total number of crocodiles was said by several observers to be in the thousands, rather than dozens or hundreds, but this impression needs confirming by quantitative surveys. Mr. Charles Swaby has had many years experience studying crocodiles, including working with Leslie Garrick in his early researches, with Jeff Lang and with Ab Abercrombie during their work in the 1980's. Mr. Swaby is sure that crocodile numbers and crocodile habitat has reduced over the last 20 -30 years, but that there are still viable breeding populations in many areas. It was also clear from our brief inspection that large areas of habitat have been destroyed or impacted by agricultural development, deforestation, and unauthorized building of houses in and near wetlands. One cause of the 'problem crocodiles' is that people are in the crocodile's backyard, not that crocodiles are in people's backyards. An additional contributing factor may be that in many areas crocodiles have not been heavily hunted in recent years and recovering populations in restricted areas of habitat are producing numbers of juveniles who disperse into settled areas in search of living space. Most of the nuisance crocodiles reported are in the 5-8 foot size range.

The interaction between crocodiles and people in Jamaica is often quite remarkably benign in both directions. We spoke with several rural people who were quite unconcerned about large resident crocodiles near their homes. However, in other cases people were more concerned. There are two cases in recent years alleging that large crocodiles attacked and killed children and many urban and suburban dwellers are uncomfortable with large crocodiles nearby. There is no evidence of recent commercial hunting for skins, although we heard several accounts of people eating crocodile meat, or selling meat to the Asian crews of visiting ships. There has been extensive capture and relocation of crocodiles for the purpose of presenting tourists with opportunities for an eco-tourism experience viewing crocodiles. These have served in many cases to have a positive effect of removing unwanted large crocodiles into safer and partially protected locations.

Crocodile conservation in Jamaica is still relatively underdeveloped. Crocodiles (which feature on the Jamaican national coat of arms) are legally protected, but enforcement is lax and there are no protected habitat areas. Discussions at the workshop identified several areas for future action. These included developing a policy for identifying nuisance crocodiles and a policy for disposing of them appropriately by removal to suitable habitat, to captivity, or, if necessary for public safety, by killing them. A program of public education in crocodile biology and safety was highly recommended. A survey to quantitatively evaluate crocodile habitat and numbers is a priority. Based on these results a coherent national policy for crocodile conservation needs to be developed. There is interest in some commercial quarters in developing crocodile ranches or farms, but NRCA feels that this should await survey results and the development of adequate regulations. Participants in the workshop discussed the advisability of forming an association or working group to coordinate crocodile conservation between government, private and conservation organizations and requested guidance and advice from the CSG for this. A meeting to promote such a working group is tentatively scheduled for January 1996. We would like to thank NRCA and their staff, and particularly Ms. Andrea Donaldson, for arranging this visit. Ms. Rhema Carr of the Hope Zoo provided a venue for the workshop and Mr. Laurence Henriques allowed us to practice on his very fine private collection. We are grateful also to Mr. Charles Swaby for sharing his extensive experience and to John Below and Charles Moody for help and information.—Perran Ross, *Executive Officer CSG and Dennis David, Deputy Vice Chairman for North America, 4005 S. Main St., Gainesville, FL 32611, USA.*

Jamaican Crocodile Traditions. During a short visit to Jamaica we were informed of the widely held belief among rural Jamaicans that crocodiles bark like dogs. The barking is differentiated from crocodile roaring or grunting, which is well known to some rural Jamaicans. This belief is so widely held that a newspaper article in the national press showing a photograph of a large crocodile, reported that it swam up the river, "barking loudly". Mr. Charles Swaby, of Black River, who holds several large crocodiles at his facilities, reports that his neighbors sometimes complain that, "Your crocodiles kept me up all night, barking, man!" Mr. Swaby has attempted to discover the source of this belief and reports his only clue came from a very old woman who he observed collecting firewood at the river's edge and calling, "Crocodile, crocodile, dog got your tongue." When questioned this old lady recounted a story that Charles believes may be of African origin. She recounted the legend that one day, as the crocodile lay asleep on a river bank with his mouth wide open, the dog crept up and bit out his tongue. This explains, she said, why to this day the crocodile has no tongue and is always eager to kill dogs in revenge for this loss. The crocodiles bark to attract dogs to their fate.

We also inquired about medicinal use of crocodiles and most respondents had no knowledge of such use. However, Roderick Clark, a park ranger at the Montego Bay Marine Park, recounted that when he was a teenager in the mid 1970's, his grandmother took him and another child who has bronchitis or asthma to the Maroon community of Accompon Town where she was advised to treat the child with oil from the fat of a crocodile. The Maroons are isolated traditional communities descended directly from escaped slaves and are a repository of traditional information.—P. Ross, *Editor, from conversations with Charles Swaby, 1 Crane Road, Black River and Roderick Clark 8 New St., Port Royal, Kingston, Jamaica.*

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Venezuela:

Pausa Ecológica para 1996 en el Programa Aprovechamiento de Babas. Las razones que motivaron al Servicio Autonomo del Fauna (PROFAUNA) ha suspender el Programa de Aprovechamiento Commercial de la especie Baba (*Caiman crocodilus*) para la temporada de 1996 fueron las siguientes:

1. El Gobierno nacional debe garantizar el uso sustentable del recurso.
2. Existe un stock de aproximadamente 110,000 pieles, suficientes para abastecer el mercado internacional durante el año 1996.
3. Que el monitoreo o censo de las poblaciones naturales es la herramienta idonea para conocer su status actual.
4. Que durante el monitoreo o censo haya la menor interferencia posible para obtener una informacion mas real que permita cuotas de cosechas mas justas y proporcionales a la abundancia del recurso estimado.
5. Que el programa de aprovechamiento comercial de la Baba ha sido considerado modelo y piloto para la region del neotropico y que ha sido puesto de ejemplo a nivel de la comunidad cientifica internacional, siendo necesario fortalecerlo a traves de estudios tecnico-cientificos.

Por lo tanto durante la pausa ecologica, se realizara un censo en un minimo de 500.000 ha de terreno bruto, dividido en tierras que han aprovechado babas (250.000 ha) y en donde no se han cosechado (250.000 ha) en los ultimos tres años respectivamente, despues de haber sido monitoreadas en los años 1991 y 1992 durante el Proyecto MARN-CITES, en las cuales se definieron las regiones ecologicas y las caracteristicas de abundancia y estructura de tamaño en cada region.

Este trabajo nos permitira determinar el efecto de las cosechas entre fincas que aprovechan y no aprovechan el recurso por region ecologica, el status de la poblacion por region comparando con el estudio MARN-CITES, y actualizar las cuotas de extraccion por tipo de finca y region. Esta propuesta de trabajo fue presentada durante la III Jornada de Evaluacion Cientifica del Programa Baba y Otros Cocodrilos, celebrado en Caracas el 3 Octubre 1995, donde participaron el Dr. Hank Jenkins (Presidente del Comite de Fauna de CITES) y el Dr. John Thorbjarnarson (Deputy Vice Chairman Science del CSG), investigadores del pais, representantes de las universidades, productores, criadores e industriales del ramo, funcionarios y guardafaunas de PROFAUNA, donde se produjeron recomendaciones, las cuales han sido incluidas en la propuesta formulada por PROFAUNA.—Mirna Quero y Alvaro Velasco, *PROFAUNA, Edif. Camejo, Entrada Oeste, Messanina, CSB, Caracas 1010, Venezuela, E-mail: [profauna@dino.conicit.ve]*.

Ecological Pause for Caiman Harvest. PROFAUNA has suspended wild harvest of skins of Baba (*Caiman crocodilus*) in Venezuela for the 1996 season with the following motivation:

1. The national government has an obligation to guarantee that the harvest is sustainable by the resource.
2. There is a current stock of approximately 110,000 skins, sufficient to satisfy the international market during 1996.
3. Monitoring or surveying of natural populations is a sufficient tool for understanding their

current status.

4. During monitoring it is best to have as little interference as possible in order to obtain the most accurate information, which will permit the most just harvest quotas which are in proportion to the estimated abundance of the resource.
5. The Venezuelan program of commercial caiman harvest is considered to be a model and a pilot for the neotropical region and is widely used as an example of successful sustainable use by the international scientific community. It is therefore necessary to fortify this program with technical and scientific studies.

Alfredo Arteaga releases a captive raised *C. acutus* to replenish stocks in western Venezuela. PROFAUNA photo.

For these reasons a survey will be conducted during the 'Ecological Pause' on at least 500,000 ha, divided between areas where babas have been harvested (250,000 ha) and areas which have had no harvest in the last three years (250,000 ha). This study will be conducted in the areas monitored in 1991 - 1992 during the MARN-CITES project, in which characteristics of abundance and size structures of caiman populations were defined.

This work will allow us to determine the effect of harvest on approved ranches and non-approved ranches by ecological region, status of the population defined by the MARN-CITES Study, and current extraction quotas for each type of ranch and region. The proposal for this work was presented during the IIIrd Workshop for Scientific Evaluation of the Caiman Program, held in Caracas on 3 October 1995, with the participation of Dr. Hank Jenkins (Chairman of the CITES Animals Committee), Dr. John Thorbjarnarson (Deputy Vice Chairman for Science of CSG), Venezuelan researchers and representatives of the universities, producers, farms and processing industries and representatives and wildlife wardens from PROFAUNA. This meeting produced recommendations which have been incorporated into the proposal formulated by PROFAUNA.— [Translation of preceding article.—*Eds.*]

Reintroducción de *Crocodylus acutus* en Venezuela. Desde 1990 PROFAUNA, con el apoyo económico de la Fundación para el Desarrollo de la Ciencia y la Tecnología de Estado Aragua, viene implementando el proyecto de reintroducción de caimanes del costa al medio natural en la Bahía Turiamo en las costas occidentales de Venezuela. En el año pasado, en Turiamo se liberaron

15 caimanes el 10 Octubre, siete de ellos en el caño San Miguel y los restantes en una laguna costera al oeste de la bahía. La longitud total promedio de 0.875 m y peso promedio de 2.39 kg. En Cuare se reintrodujeron 48 ejemplares en el 20 Octubre, provenientes de la bahía de Turiamo y mantenidos en cautiverio en la Estación de Servicio Autónomo PROFAUNA, Maracay. Los caimanes presentaron una longitud total promedio de 0.776 m y peso promedio de 1.667 kg, en cinco caños, cuerpos de agua ubicados en la margen este del Golfete del Refugio.

A los Caimanes de la Costa que fueron reintroducidos, se les practicaron como prevención a deficiencias inmunológica y riesgos de introducción de agentes patógenos a las poblaciones naturales, los siguientes exámenes sanitarios dos meses antes de la liberación: 1. Exámenes coprológicos o de heces. Las muestras fecales se obtuvieron por medio de lavales cloacales y recolecta de las heces frescas en las tanquillas, y analizadas por medio de los métodos de flotación o Willis y el directo. Los resultados fueron positivos para tremátodes, endoparásitos comunes de la flora intestinal de cocodrilos.

2. Bacteriología y micología. Se practicaron hisopados esofágicos y cloacales, como también raspados de piel para determinar micosis encontrándose *Proteus vulgaris*, *Escherichia coli* y *Candida albicans*. Estos microorganismos conforman la flora normal de reptiles, pudiendo ser patógenos oportunistas en caso de disminuir la respuesta inmunológica del huésped en situaciones de stress.

3. Histopatología. Estos estudios se efectuaron en un ejemplar que murió en los días cercanos a la toma de las muestras. Los resultados evidenciaron esteatitis o deficiencia de vitamina E, deficiencia de tiamina o vitamina B1, además de un cuadro infeccioso en el tracto intestinal.

Como tratamiento preventivo todos los animales fueron desparasitados con albendazole por vía oral en el alimento, ya que este actúa contra los nemátodos y tremátodos (helminths). Se les suministró una alimentación conformada por 50% de carne roja y/o de res inclusive carne de pollo, 30% de hígado de equino (caballo, burro) y/o pollo, 14% de pescado de río o mar, y 6% de vitaminas liposolubles e hidrosolubles con sus minerales por dos meses aproximadamente, dieta recomendada por cuatro semanas, periodo en el cual se tomaría la decisión de reintroducirlos al medio natural.

Todos estos caimanes se les realizará un seguimiento mensual en el área de liberación, de manera de medir su adaptabilidad, crecimiento y aumento de peso, lavado estomacal entre otros factores.— Ernesto Boede, *Apartado 1595, Valencia 2001*, Alfredo Lander & Maria J. Gonzalez-Fernandez, *PROFAUNA, Apartado 184, Maracay, Edo. Aragua y Alvaro Velasco, [profauna@dino.conicit.ve], Venezuela*.

Reintroduction of *Crocodylus acutus*. Since 1990 PROFAUNA, with the economic assistance of FUNDACITE-Aragua has been implementing a project to reintroduce crocodiles in Turiamo Bay in the State of Aragua. In the last year, 15 crocodiles were released at Turiamo on 10 October 1995, seven of them in San Miguel creek and the other 8 in a coastal lagoon on the east side of the bay. Their average total length was 0.87 m and average weight 2.39 kg. In Cuare, in Falcon province, 48 specimens were released. These were originally from Turiamo, and maintained at the PROFAUNA station in Maracay. Their average total length was 0.77 m and weight 1.66 kg and they were released in five creeks at the east side of the Golfete refuge.

All the released crocodiles were given health examinations two months prior to their release in order to prevent immunological deficiencies and to reduce the risk of introducing pathological agents into the natural populations.

1) Fecal examination. Fecal samples were obtained by cloacal lavage or as fresh feces collected from the holding tanks. These were analyzed by the flotation method of Willis and by direct examination. The samples were positive for trematodes, common parasites in the intestines of crocodiles.

2) Bacteriology and Mycology. Sample swabs from the esophagus and cloaca, and skin scrapings were collected to examine bacteria and fungi. We found *Proteus vulgaris*, *Escherichia coli* and *Candida albicans*. These microorganisms are normal flora of reptiles, but they are able to be opportunistic pathogens in the case of depressed immune response of their host in stressful situations.

3) Histopathology. These studies were undertaken on a sample from a crocodile which died around the time we were collecting samples. The results gave evidence of steatitis or deficiency of vitamin E, Thiamin or vitamin B1, due to an infection site in the intestinal tract.

As a preventive treatment, all the animals were treated with albendazole (which is active against nematodes and trematodes) given orally in the food. The animals were also given a special diet for a two month period prior to making the decision to release them to the wild. The special diet consisted of 50% red meat (either beef or chicken), 30% liver (either horse, burro or chicken), 14% fish (freshwater or marine) and 6% of fat and water-soluble vitamins.

All the released animals will receive follow-up measurements and stomach flushing in the area where they are liberated to monitor their adaptability, growth and weight increase, among other factors.—[Free translation of preceding article.—Eds.]

EUROPE

Sweden:

Origin of Cuban Crocodiles in Sweden. When Cuban crocodiles in the bathroom of a Russian cosmonaut grew too large they were given to a Swede in Moscow. Well it was not quite that simple. A cosmonaut from the USSR visited Cuba in 1979 and was given a pair of baby crocodiles as a gift from President Castro. The crocodiles were later given to the Moscow Zoo who gave them to Jonas Wahstrom when he was in Moscow in 1981. Mr. Wahstrom is the owner of Sweden's largest terrarium, Skansen's Aquarium, and was aware of the Cuban crocodile situation from an earlier visit to Cuba.

The two young crocodiles were about 70 - 80 cm long when he acquired them in Moscow, says Mr. Wahstrom, and today are three meters long with the male a few cm longer than the female. The pair has been breeding for some years and produce 10 -20 hatchlings every year. The female often puts the eggs in the water, perhaps after being disturbed by the male, but the eggs are quickly collected from the water and seem to usually hatch without a problem. Mr. Wahstrom incubates the eggs at around 28 C° in plastic bags filled with 'frigolite-like-material' and the bags are opened

once a week to breath. "It works," says Mr. Wahlstrom. Hatching success is around 80%. These Swedish Cuban crocodiles maintain their reputation for aggression and the female will attack anyone who enters the enclosure. To collect the eggs one person distracts the female at the other end of the enclosure while Wahlstrom picks up the eggs.

Some years ago many zoos were interested in Cuban crocodiles but today few show interest. The Skansen Aquarium has produced more than 100 Cuban crocodiles and exported Cuban cosmonaught crocs to Korea, Bangkok, Germany, Finland and USA, as well as other zoos and nature parks in Sweden.—Tony Hakansson, *Skogsbaken 10, 17241 Sundbyberg, Sweden.*

NORTH AMERICA

Mexico:

Conservation of Morelet's Crocodile. At the invitation of the Mexican CITES Management Authority, and with financial support from two crocodile farms in Mexico, I visited Mexico 27 November - 3 December 1995. The objectives of the visit were: 1) To evaluate the Cocodrilos Mexicanos facility at Culiacan in regard to the comments offered on the proposal to register the farm with CITES as a captive breeding facility for *Crocodylus moreletii*. 2) To evaluate and assist the Management Authority with crocodilian conservation. 3) To compile available information and assess the status of *C. moreletii* in Mexico. 4) To assist the Management Authority in responding to comments on the proposal.

I visited the farm of Cocodrilos Mexicanos in Culiacan, Sinaloa; the farm of Industrias Moreletii in Villahermosa, Tabasco; the facilities of the Center for Study of Endangered Species at the University Juarez Autonoma of Tabasco and the Centla Biosphere Reserve. I engaged in discussions with a wide variety of Federal, State, Academic, private sector and non governmental organization representatives with interests in crocodile management, conservation and sustainable use.

The Cocodrilos Mexicanos farm near Culiacan compares favorably with other CITES registered crocodile captive breeding facilities around the world. Additional information on genetic diversity of the founder stock, recent improvements in facilities and recent success of breeding and incubation were provided. It appears that the Management Authority will be able to make adequate response to the questions raised concerning farm operations. Although the security level of the farm is good, the potential for escapes remains a possibility and several levels of additional vigilance are proposed by the farm and the Management Authority.

The Instituto Nacional de Ecologia (the CITES Management Authority of Mexico) has adequate legal and regulatory power, personnel, biological expertise, infrastructure and facilities to regulate crocodile farms and skin exports. Procedures to define how they will do this are not sufficiently developed and urgently need to be completed. Presentation of written regulations and procedures to the CITES Secretariat are recommended prior to approving the current proposal for captive breeding. The interacting structure of Federal and State Agencies and Academic institutions, and the existence of an extensive network of protected areas in which crocodiles occur, provides a basis which could ensure adequate research and conservation of the species in the wild. Development of a concrete program to achieve this guided by a National Management Plan for Crocodiles should

proceed over the next several years. The Management Authority has proposed a national meeting in early 1996 to develop this plan.

Available information provided by knowledgeable informants suggests with some confidence that *C. moreletii* remains widely distributed in much of its original habitat, including several major areas of aggregation that are thought to harbor large populations. Casas and Guzman 1970 reported 22 separate localities for *C. moreletii*. The combined information of our informants indicated 40 sites, with substantial overlap with Casas and Guzman's information. Uncertainty exists about the current status of localities in Tamaulipas, which have not been reported on for some years. It is not thought that the present distribution represents any expansion of the distribution of *C. moreletii*, but rather that a more detailed biological knowledge of the current generation of Mexican biologists allows a finer grained indication of the species current distribution. Quantitative estimates of densities are very sparse. Remollina reported 5.3 crocodiles/ km surveyed and an estimated population of 900 in 756 km² of the Centla Biosphere Reserve (total area 3,020 km²). Alejandro Cabrera and his students estimate around 100 individuals and 12-15 adult females in 196 ha of Laguna Illusiones in the center of the city of Villahermosa. Cabrera further asserts with confidence that *C. moreletii* are found in small numbers in nearly every permanent water body in Tabasco and that the population in that State must number more than several thousand. Juan Perez indicated that populations in Campeche adjacent to Centla Reserve appear to have similar habitats and densities. Sigler is more conservative about the situation in Chiapas indicating eight localities were breeding occurs but no estimate of numbers. The populations in Sian Ka'an (Quintana Roo) and Lacondona (Chiapas) are thought to be substantial based on the large area of habitat. Lazcano has published, reporting *C. moreletii* to be common and present at nine localities in Lacondona, where *C. acutus* is also recorded. Quantification of these assessments is a priority and proposals to initiate the necessary work at the Centla Biosphere Reserve are presently seeking funds.

Detailed information was solicited on the presence of *C. moreletii* in the range of *C. acutus* in the Pacific. There are now at least three well known self-sustaining populations of *C. moreletii* in Pacific drainages of Mexico. In Colima State at Laguna de Alcozahué approximately 6 adults escaped from a government sponsored crocodile farm in 1985 and about 20 adults are now present in this 8 ha lake. Distribution to other areas is not reported (Pedro Estaban Diaz, pers. comm.). The species occurs naturally in that part of Oaxaca that lies in the Atlantic drainage of the River Palaloapan but has also been introduced, around 1975, to Lagunas de Chacahua in the Pacific when approximately 20 adults escaped from another government farm during a flood. The population now numbers around 40 adults and is breeding. As *C. acutus* also occurs in this lagoon system, interaction between the two is likely (Luis Sigler and Juan Perez, pers. comm.). In the Pacific slope of Chiapas a private land owner near Villaflores deliberately released 6 individuals in 1965 into a lake on his ranch. This population now numbers more than 40 adults and some distribution onto waterways on adjacent properties has been observed (Luis Sigler, pers. comm.). It is possible that there are other less well known examples and so the presence of *C. moreletii* in Jalisco and Guerrero cannot be discounted, but, if present, they are almost certainly the result of introductions. Monitoring of these locations, and a policy to minimize additional such introductions is advisable. Crocodile conservation in Mexico appears to be on the verge of a significant expansion. The country has adequate resources of trained personnel, a functioning conservation infrastructure, and good remaining populations of crocodilians. Challenges that need to be addressed include coordinating efforts at a national level, developing a coherent strategy and policies for crocodile management and improving the field data on wild populations.—*extracted from Conservation and Management of C. moreletii in Mexico, field trip report, December 1995. J. P. Ross, Executive Officer CSG.*

USA:

Parasites of *Caiman* in Puerto Rico. A recent study of the incidence of parasites in freshwater sport fishes in Puerto Rico has revealed the presence of a larval tongue worm (Pentastomida, Sebekidae) occurring on largemouth bass (*Micropterus salmoides*) and the peacock bass (*Cichla ocellaris*). This parasitic worm, of unknown species, is of a family known only from members of the Crocodylia as the primary host and is commonly known as the caiman tongueworm. Pentastomids are a distinct phylum of wormlike parasites thought to have originated on the dinosaurs, and persisting as adults today primarily in reptiles. The larval forms occur in fish, amphibians, reptiles and a few mammals. The presence of these parasites in fish in Puerto Rico is strongly associated with water bodies where introduced populations of feral common caiman occur. The history of introduction of caiman to Puerto Rico is unclear but caiman are currently found in Tortuguero Lagoon, Lake Toa Vaca and Lake Guajataca and possibly other lakes, rivers and lagoons on the island. Populations appear fairly sparse at all these locations.—from correspondence and literature submitted by E. H. Williams, *Sportfish Disease Project, Department of Marine Sciences, University of Puerto Rico, P.O. Box 908, Lajas, Puerto Rico 00667-0908, USA*, and Adam Britton, *School of Biological Sciences, University of Bristol, Woodland Road, Bristol, Avon BS8 1UG, UK*

ZOOS



AZA, Regional Collection Plan for Crocodylians. The Crocodile Advisory Group (CAG) of the American Association of Zoos and Aquariums (AZA) reviewed and updated its data base and priorities for crocodylians in North American collections during its annual meeting in 1995. Priorities for inclusion of crocodylians in North American collections were based on several factors. Endangered species that do not have adequate in situ protection were given high priority. The probability of successfully contributing to a species conservation, availability of founders and prospects of aiding conservation in the wild were factored in. In some cases (e.g. *Crocodylus moreletii*) the CAG has initiated and supported conservation in the wild, while recommending that these animals not be maintained in AZA institutions. Second, consideration was given to the biological uniqueness of each taxon to produce a regional collection plan that will represent the diversity of the Crocodylia. Third, consideration was given to ongoing and future proposed research projects in zoos. Finally, the CAG recognizes that there are sub-regional considerations and individual institution needs that must be considered in the allocation of crocodylian space in zoos. These include the necessity to display the American alligator within its range and zoogeographic themes in some institutions.

The greatest problem facing AZA crocodylian conservation is the lack of holding space and breeding space for adult specimens. Generally, crocodylian programs have been given a low priority for construction funds in most North American zoos. As this trend continues, the CAG has been recruiting space in the private sector to hold and breed animals for AZA conservation programs, as well as hold less important specimens that would otherwise take up valuable zoo

space.

CAG is making a plea for space and resource allocation in North American institutions for crocodylians. The Crocodylia represents the sole survivors of an ancient group, the Archosauria (which includes *Tyrannosaurus rex*). Some crocodylians are among the most endangered vertebrates in the world. Crocodylians make spectacular displays and draw great interest from the visiting public. Yet, they are often omitted from new zoo projects. Consideration must be given to more resource allocation for crocodylians if the AZA is going to make a long term contribution to the conservation of the last of the Archosaurs.—*summarized from the Introduction, AZA, CAG Regional Collection Plan 1995*. R. Andrew Odum, Peter Brazaitis & William McMahan coordinators.

CSG ON-LINE

We Have Changed Our Address. Please note that general CSG inquiries and Newsletter materials can be sent to Perran Ross by E-mail to [prosscsg@flmnh.ufl.edu]. Professor King continues to be reached at [kaiman@flmnh.ufl.edu]. Our telephone area code will also change in May 1996. Our new phone will be 1 352 392 1721 and Fax 1 352 392 9367. We continue to receive an increasing volume of information and material by E-mail (26 items in the first week of this year!) and to receive your E-mail addresses. At a suitable time in the future we will provide a directory of CSG E-mail addresses, but in the meantime, if you are trying to find someone - E-mail me.—J.P. Ross, Editor.

New World Wide Web Listings of Interest. A bunch of new crocodile stuff is available on the web. For general information and extensive links to other sites, Adam Britton's Croc Natural History is a great place to start at: http://www.bio.bris.ac.uk/research/bats/ab_croc.htm. A detailed look at the American alligator extracted largely from materials provided by the Florida Game and Fresh Water Fish Commission is accessible at UF/IFAS AgriGator at: <http://gnv.ifas.ufl.edu/www/agator/htm/aligator.htm>. This presentation also has some very nice photographic illustrations, many taken by CSG member Allen 'Woody' Woodward. Jacare de Papo Amarelo - *Caiman latirostris* at: <http://www.ftpt.br/structure/jacare/jpa.jacare.htm> provides information in Portuguese on this species including the text of all three Workshops convened by Luciano Verdade and Alejandro Larriera, the studbook and zoo holdings for Latin America and a selected bibliography. We should also note that this was in fact the first crocodylian homepage brought to our attention in December 1994 before we really began paying attention to these things (Newsletter 13(4):17).

A web site that is still under construction but bears future watching is the crocodylian circulatory system from Michael Axelsson of Goteborg University, Sweden. This site is found at: <http://vivaldi.zool.gu.se/crocodyl.htm>. You need fancy software to view the video footage of functioning crocodile hearts, from the inside ! and sequences from an angioscope study of circulatory function. We also just found a couple of alligator farmers who are on line, Everglades Alligator Farm, Florida City, at: <http://florida.com/gatorfarmer/> and Frank Godwin's The Gator Hole, Orlando/Kissimmee, at: <http://magicnet.net/~mgodwin/>. Goodwin references both Mason Meers Bibliography at: http://www.welch.jhu.edu/home_pages/mmeers/html/croc.bib.cover.html and Adam Britton's Croc Natural History. Axelson's page also has a hyperlink to Adam Britton's Croc Natural History, which in turn hyperlinks to the CSG Newsletter homepage, where you can read

this. So by just clicking on words and symbols you can jump from one to the next. This is not just running round in circles. It is clear that we have an emerging network of substantive and useful information on crocodilians available on the world wide web.

There is also a bunch of fairly simple stuff listed by various zoos and other facilities which we list here for your 'netsurfing' pleasure:

- Birmingham Zoo (Amer. alligator) at: <http://www.bhm.tis.net/zoo/animals/gator.html>.
- Busch Gardens, Tampa (Amer alligator) at: http://www.bev.net/education/SeaWorld/animal_bytes/alligatorab.html.
- Lowry Park Zoo, Tampa (Amer alligator) at: <http://www.med.usf.edu/NINA/park/florida/alligator.html>.
- Lowry Park Zoo, Tampa (Amer croc) at: <http://www.med.usf.edu/NINA/park/florida/crocodile.html>.
- Sawgrass Recreation Park, Fort Lauderdale at: <http://www.introweb.com/airboats/>. Their alligator attraction page is at: <http://www.introweb.com/airboats/gators.htm>.
- St. Augustine Alligator Farm at: <http://pequin.aug.com/~oldcity/around/attractions/gatorfarm/gator.html>.
- IFAS Wildlife Resources Handbook pages on Alligators and Crocodiles at: <http://hammock.ifas.ufl.edu/txt/fairs/uw/16877.html>. The same page can be accessed at: <http://hammock.ifas.ufl.edu/txt/fairs/16877>.
- Okefenokee Critter Center (Amer alligator) at: .
- TCU (Texas Christian Univ) Crocodilians at: <http://geowww.geo.tcu.edu/faculty/crocodile.html>.

What's next? Are we ready for the crocodile chat page? Farm problems and veterinary diagnosis by Internet? The sky is the limit.

PUBLICATIONS



Wildlife Review Closes. We have been advised that the US National Biological Service will no longer publish the literature indexing service Wildlife Review. For the last several years Mr. Terry Sexson, Managing Editor of the Review, has provided the CSG Newsletter with an annual uplisting of crocodilian publications appearing in the previous year. We will greatly miss this very valuable service and take this opportunity to thank Mr. Sexson and his staff for several years of cooperative and collegial interaction.

The annual listing of recent publications in the Newsletter is a service that many readers, particularly those who do not have instant access to modern literature indexes, have appreciated.

We will attempt to continue this service. Readers are therefore encouraged to send copies of reprints or full citations of their work to the CSG office. We will coordinate with one of the several crocodilian bibliographies curenly being developed and try to issue an annual list of new publications.—Editors.

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DNA WORKSHOP

Croc DNA Meeting in South Carolina. Registration is still open for the Workshop on Crocodilian DNA to be held at Riverbanks Zoo, Colombia, SC, USA, 4-6 March 1996. Initial response to this meeting has been very enthusiastic with researchers throughout the USA and several from overseas, including Mexico, Canada, Germany and Australia, expressing interest.

A preliminary program has been drafted with sessions on the Conservation Context for DNA Studies of Crocodilians; Current Technical Advances and Techniques; Recent Results on Crocodilians, and a Panel Discussion on Research Directions for the Future. Invited speakers who have indicated their participation include Lou 'Dracula' Densmore, Jeff Lang, Val Lance, Scott Davis, Nancy Fitzsimmons, George Amato, Brian Bowen and Travis Glenn. Never heard of some of these folks? Perhaps that's an indication of how rapidly this field is expanding into crocodilian interests.

DNA analysis, including mitochondrial DNA, micro-satellite analysis and thermal profiling are new tools that are being applied to basic questions of crocodilian conservation and management, including taxonomic diversity and species questions, stock definition for harvest programs, forensic applications for trade control and genetic diversity in captive breeding programs. The workshop will bring together the foremost practitioners of this cutting edge science and will hopefully lead to an international synergy and cooperation.

To obtain registration materials contact.—Barrie Brownlee, Institute of Public Affairs, The University of South Carolina, Colombia SC 29208, USA. Phone 803 777 4568, fax 803 777 4575, E-mail brownlee@iopa.sc.edu

REQUESTS



Forelimb Research. Mason B. Meers, of the Johns Hopkins School of Medicine's Functional Anatomy and Evolution program, is conducting his dissertation research on the role of the forelimb in the evolution of crocodilian locomotion. Part of his work requires the dissection of forelimbs (shoulder through manus) of extant species and using behavioral data to draw functional correlates with anatomical specialization. Consequently, he requires a range of specimens for dissection. To

date, he reports he has sufficient numbers of *Alligator mississippiensis*, and will soon have enough *Crocodylus acutus* (thanks to Paul Moler!), but many other taxa are still needed. Most important are: *Crocodylus johnsoni*, *C. rhombifer*, *C. novaeguineae*, *C. palustris*, *C. niloticus*, *C. porosus*, *Tomistoma schlegelii*, *Gavialis gangeticus*. All other taxa would also be of great value! Finally, Mason also reports that he may also skeletonize specimens upon completion and return them to lenders, or arrange to have them donated to museums. Anyone who would like further information on his work, or who may be able to help with specimens should contact him electronically at e-mail: mmeers@welchlink.welch.jhu.edu or via an e-mail link in the Bibliography of Crocodylian Biology at: <http://www.welch.jhu.edu/homepages/mmeers/html/croc.bib.cover.html>. Or non-electronically at: Mason B. Meers, Dept. Cell Bio. and Anatomy, Johns Hopkins, 725 N. Wolfe St., Baltimore, MD 21205 USA. Phone: (410) 955-7145 Fax: (410) 955-4129.

EDITORIAL POLICY

The newsletter must contain interesting and timely information. All news on crocodylian 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.

Special Section

13th WORKING MEETING

The 13th Working Meeting of the Crocodile Specialist Group will be held in Santa Fe, Argentina, 13 - 17 May 1996. Host and organizer of the meeting is Alejandro Larriera of Proyecto Yacare, and Fundación Habitat & Desarrollo.

Please contact the organizers immediately to advise them of your interest and to receive detailed registration materials.

Participants should arrange their own international flight arrangements to Santa Fe, Argentina. Flight details, including transfer arrangements in Buenos Aires, will be sent upon receipt of your preliminary registration.

All inquiries for the meeting should be addressed to the organizers at:

Fundación Habitat y Desarrollo
San Lorenzo 1582

3000 Santa Fe, Argentina

FAX: 54 4 259 6154

E-mail: yacare@unl.edu.ar

Call for Papers Extended. Response to the call for papers has been excellent and over 35 papers have been received. Authors will receive notification of acceptance shortly. Space exists on the program for additional papers on any aspect of crocodylian biology and conservation. To request space on the program send authors names, mailing address and a brief summary of your topic to:

Dr. J. P. Ross
Executive Officer CSG
Fax 1 352 392 9367 or
E-mail

Papers and posters will be accepted on a space available basis and authors advised of acceptance and instructions for paper presentation.

Credit Card Payment for Meeting Registration and Hotel Deposits. The organizers are pleased to announce that they have made arrangements to receive payments of your registration and Hotel deposits by VISA and MASTER CARD. To avail yourself of this opportunity please return a standard credit card authorization with your registration and Hotel reservation information.

CREDIT CARD AUTHORIZATION

I authorize Fundacion Habitat y Desarrollo to charge my registration fee and Hotel deposit for the 13th Working Meeting of the Crocodile Specialist Group to my credit card.

Card type: (VISA / MASTERCARD)

Card Holder Name:

Card Number:

Expiry date:

Signature:

Special Accommodations and Registration for Students and Developing Country Participants. Accommodation at the meeting without charge, and a special reduced registration fee is available to qualifying students and others of limited financial resources. Some space

remains available at the free, hostel style, accommodation provided by the meeting organizers. To apply:

- 1) Immediately send your name, mailing address, telephone, fax and e-mail information to the organizers (address above) to receive full registration information.
- 2) Contact Dr. J. P. Ross, Executive Officer CSG at the Newsletter letterhead address/fax/e-mail, indicating i) that you have requested registration materials, ii) indicating your source of funds for travel and subsistence expenses and (if applicable) iii) your intention to present a paper or poster (see call for papers above).

Successful applicants will be informed by mail.

IUCN - World Conservation Union Species Survival Commission

The 13th Working Meeting of the IUCN/SSC
Crocodile Specialist Group

13nd to 17th May, 1996 Santa Fe, Argentina.

Preliminary Registration

To receive registration materials and detailed information on bookings, accommodations and local transport, please return this form by mail, Fax or E-mail to :

Fundación Habitat y Desarrollo
San Lorenzo 1582
3000 Santa Fe, Argentina

FAX: 54 4 259 6154
E-Mail yacare@unl.edu.ar

NAME (Family/Apellido): TEL:
(name(s)/nombre): FAX:
AFFILIATION: E-Mail:
ADDRESS for mail:

How many people in your party will travel to Argentina?

(* This is a preliminary registration to allow planning and booking of adequate space. Please return the form if you have the slightest possibility or intention of attending. Firm committments to bookings and reservations will follow.

Most visitors to Argentina do not require a visa, but it is wise to check with the Argentine consulate in your country for details. Most international flights arrive at the international airport in Buenos Aires and there is regular air service to Santa Fe from the domestic airport. There is a bus

service between the international and domestic airports. One can also travel to Santa Fe by bus from Buenos Aires. Argentine currency is the Peso divided into 100 cents and One Peso is equal to \$1 US. US dollars are widely accepted in Santa Fe and major credit cards are commonly used.

The city of Santa Fe, venue of the 13th Working Meeting of the CSG, is the capital of the Province of Santa Fe, and is located 476 km north of Buenos Aires. The city was founded in 1573 and retains an old colonial district with many fine examples of early Spanish architecture. The city is located next to the Paraná river is surrounded by its tributaries. To get anywhere you have to cross a river! A tunnel of 2,939 m length beneath the Paraná connects Santa Fe to the neighboring Province of Entre Rios and the city of Paraná. The average annual temperature is 19 C° and during May the temperature during the day rises to 24 C°, but a light jacket and sweater is recommended for the cool evenings. Santa Fe is a relaxed cosmopolitan center with a rich mixture of Spanish, Italian and German culture. Normal business hours in Santa Fe are 7 am - 12 noon and 3 pm - 7 pm. Banks are open from 7 am to 1 pm. A variety of restaurants of all kinds are found throughout the city as well as numerous cafes and snack bars.

Caiman can be seen in their wild habitat within 1 hour's drive of the city.

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