CROCODILE SPECIALIST GROUP

NEWSLETTER

VOLUME 21 No. 2 ■ APRIL 2002 – JUNE 2002

IUCN - World Conservation Union ■ Species Survival Commission

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IUCN−The World Conservation Union
Species Survival Commission

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COVER PHOTO. *Osteoleamus tetraspis* from the Bossematie Forest Reserve, Ivory Coast. See pages 5-7. B. Shwedick photo.

The CSG NEWSLETTER is produced and distributed by the Crocodile Specialist Group of the Species Survival Commission, IUCN – The World Conservation Union. CSG NEWSLETTER provides information on the conservation, status, news and current events concerning crocodilians, and on the activities of the CSG. The NEWSLETTER is distributed to CSG members and, upon request, to other interested individuals and organizations. All subscribers are asked to contribute news and other materials. A voluntary contribution (suggested $40.00 US per year) is requested from subscribers to defray expenses of producing the NEWSLETTER. All communications should be addressed to: Dr. J. P. Ross, Executive Officer CSG, Florida Museum of Natural History, Gainesville, FL 32611, USA. Fax 1 352 392 9367, E-mail prosscsg@flmnh.ufl.edu

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Editorial

CROCODILE ATTACK FILE? Recent publicity about shark attacks in Florida and elsewhere have relied heavily on a centralized data base maintained at the University of Florida that details information on shark attacks (see http://www.flmnh.ufl.edu/fish/Sharks/ISAF/ISAF.htm). The site also has extensive general information about sharks, avoiding shark attack and shark biology. Interactions between crocodilians and people have emerged as a significant conservation problem in recent years as many crocodile populations recover to former abundance or expand back into their natural range. Several CSG correspondents have asked me why we don't also have a croc attack file?

To consider this I spoke with George Burgess, Co-chair of the Shark Specialist Group and coordinator of the shark attack file (SAF). George advised me that the process of establishing the SAF began in 1958 and has developed over many years. SAF involves an international network of scientific correspondents who provide data. SAF is a joint program with the American Elasmobranch Society, and while not formally part of the Shark Specialist Group, has broad overlap of interest and network participants.

SAF required both research to collect authentic attack information in the past and an ongoing effort to keep the data file current. A full time data entry, web service and correspondence assistant services the file as well as several volunteer and part time student assistants. Costs are estimated to be in the order of $45,000/year including paid staff time, George's donated time, communications, mailings and other expenses subsidized by the Florida Museum of Natural History. A new grant from US National Marine Fisheries Service will pick up the majority of future costs.

In terms of results, the SAF website attracts an average of between 5 million and 10 million hits/month representing 60-100,000 people, but leaps to over 20 million hits following well publicized shark attacks. It has become the major media source for shark information resulting in hundreds of letters and inquiries each month. Between June and September last year, following a series of shark attacks in the USA, George Burgess personally gave 950 interviews

to the media, many involving hours of filming with visiting TV crews. He notes that he got little other work done in that period.

What would a croc attack file involve? Comparison of documented attacks in areas where the data is reliable (USA, Australia, South Africa) suggests that in those areas crocodilian attacks run approximately 10-20% the annual frequency of shark attacks. However in some regions where the data are weak for both sharks and crocs, like eastern Africa, we suspect that crocodile attacks may be more frequent. The geographic scope of both groups is comparable. A reasonable working assumption would be that a croc attack file will require approximately equal effort to SAF.

Based on the SAF experience, establishing and maintaining a global data file of this kind requires a significant effort of personnel, funding and institutional support, but yields proportional dividends of visibility, fundraising opportunities and conservation influence. CSG should carefully consider the ramifications of developing such a program. I thank CSG members Bill McLean, Kent Vliet, Paulino Ponce and Lehr Brisbin for initiating discussion of the issue. — Perran Ross, *CSG Executive Officer*.

Views and Opinions

COUNTING CROCODILES. I recently attended an international meeting in which a delegation expressed interest in accessing the US market with crocodile products, and were trying to gather data needed for a USFWS review needed for a status change for the species in question.

Viewing some of the preliminary data generated questions for me on the latest fashions for presenting croc survey data. One form, based on advice from CSG, was number of crocs counted/km, referred to as 'density'. However, it can't be a density unless it's crocs/unit of area (e.g., ha or km^2). Similarly it can't be called abundance because abundance is an estimate of numbers in a defined area. Crocs/km is an encounter rate. It could also be called an index of abundance, which I understand is the way it is generally used. It seems to me that for management purposes, an estimate of abundance might be the most useful parameter-how many crocs are there and how many can be removed?

I see some problems with using encounter rate data from single field transects. Transects that both encounter 8 crocs/km, one made in a small circular pond and one made in a vast complex lagoon, can translate to very different numbers of crocs. Similarly, transects that encounter 8 crocs/km in a river 30 m wide and another 1.2 km wide will not be comparable. How do you allow for the difference between a km along a complex interdigitated shoreline vs. a km along a smooth planar shoreline. While the boat traveled the same distance, the shoreline did not. Without some extrapolation to sampled area, abundance is not accurately estimated. The standard way to resolve this in wildlife surveys is to factor in both sightability and area, e.g., N= n/bc, with n being the number seen, b the sighting fraction, and c the proportion of area sampled to area of interest, with emphasis on c.

Sighting fraction is obviously a very difficult variable. It involves both crocodiles invisible beneath the water and crocodiles not seen in those parts of the transect route that cannot be surveyed (e.g. behind vegetation, tributary creeks, shoreline swamps). There may also be a complex interaction between the amount of time each croc spends invisible beneath the surface (dive time) and the rate of passage of the survey boat (survey speed). As surveys are conducted from a variety of vessels and at various speeds from a hand-paddled canoe to a high speed outboard or airboat, this could introduce additional variation.

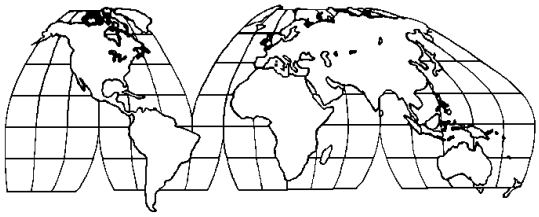
Presenting survey data as the actual numbers counted has similar problems. Seeing 123 animals in a 10 km survey is fine, but since the habitat/habitats may be much larger, and 123 animals is not very many, it runs risk of under-representing the real number of crocs present. Admittedly, extrapolating samples can generate additional problems due to the dynamics of season, variable water depths, differing shorelines and limitations of mapping, as well as the fact that not all sections of a river/lagoon are equal. Croc densities in the sampled area may or may not represent average croc density for the total aquatic habitat's area. Concentrations of crocs could bias estimates upwards or down depending upon transect placement.

More rigorous sampling schemes and detailed analyses would give more robust results. However, I do understand that the transect survey

method is based on a very rigorous consideration of these factors (Messel et al., in the Northern Australia monograph series) and that it has been effectively applied and tested in numerous locations. The CSG and its members may have developed ability to interpret encounter rates as an index of abundance and indicator of a population's ability to withstand harvest. It is also evident that as long as survey techniques and conditions are strictly standardized, then the trend of encounter rate data over time should be a true measure of crocodile abundance and allow reasonable inferences about population trajectory and effects of management actions such as harvest.

However, interpretation of survey transect results expressed as encounter rate (crocs/km) should be tempered by careful consideration of all the numerous factors that are not being either controlled or estimated. — John Polisar, *Bureau of Western Hemisphere Affairs, Department of State, 2201 C Street, NW, Washington, D.C. 20520-6258, USA.*

Regional Reports



Africa

Ethiopia

CROCODILE ATTACK ON THE RISE. In less than 3 months, 4 men at Lake Abaya, 2 men at Lake Chamo, a boy at Kulfo River and one youth at Harre River were attacked by crocodiles. The boy, a student who was fourteen, and the youth, also a student, who was 18, were both killed and their bodies were recovered the following day near the place where the attack occurred. The other six, who are all fishermen, survived after having received a range of injuries, from losing a chunk of their flesh to a foot.

Kulfo River drains in Lake Chamo and Harre in Lake Abaya. In the case of Harre River, the victim's arms were both eaten, and the body was found at the bank of the river near a gaping big crocodile, about 3.5m long. The victim's body at Kulfo River was intact, except teeth marks in the hands and legs of the victim. Recovering the boy's body was hard; divers had to spend time diving a total of more than 2 hours before they finally dragged him out of a side pocket.

The crocodiles at Lake Abaya, where prey species are in short supply, are more feared than the ones at Lake Chamo, as their menu quite often includes man.

It appears that, in the majority of the incidents, crocodiles were attracted by the victim's activity, which took place in the water. For instance, the man in the picture, who lost his right foot, was trying to remove a snagged hook and line by his foot, while hanging on his small wooden boat, which was anchored by a friend using his long paddle. The tug of war, which lasted more than five minutes ended when the crocodile finally managed to spin and break the foot right at the ankle.

A victim of Lake Abaya's crocodile. A. Gebre photo.

Since more people are increasingly coming into contact with these crocodile-infested

wetlands, for either fishing or other activities, crocodile attacks will me more frequent, and taking some control measures will be inevitable. Assegid Gebre, *Arba Minch Crocodile Ranch, P.O. Box 42, Arba Minch, Ethiopia*.

Ivory Coast

COTE D'IVOIRE, PROJECT CROCODILES. The crocodile project in Cote d'Ivoire began in 1980 and has been based at the National Zoo of Abidjan since 1981.

Between 1981-1984 crocodiles of the three species native to West Africa were hatched at the zoo from eggs produced by captive females and from eggs collected in the wild during field studies conducted by Wolf E. Waitkuwait in the Tai, Marahoue, Azagny and Comoe National Parks.

Table 1. Crocodiles hatched at the National Zoo of Abidjan between 1981-1984.

Species	Wild Egg Collection	Captive Breeding
C. niloticus	44	13
C. cataphractus	88	56
O. tetraspis	34	0

In January 1990, Bruce Shwedick assisted Dr. Waitkuwait with the capture and removal of the zoo's largest male crocodiles from their breeding enclosures and two *Crocodylus niloticus* and one *Crocodylus cataphractus* (all about 3.5 m TL) were released into the Comoe National Park. Zoo reared crocodiles (1.7 – 2.0 m TL) were then moved from the zoo's rearing pens into the breeding enclosures.

The new breeding group of *C. cataphractus* consisted of nine males and thirty females. The new group of *C. niloticus* consisted of nine males and eleven females. No breeding enclosure has been constructed at the zoo for *Osteolaemus tetraspis* but eight males and four females were grouped together in the rearing pens for reproduction purposes.

In February 1999 Wolf Waitkuwait and Bruce Shwedick conducted an inventory of the crocodiles at the Abidjan Zoo and met with the zoo's director Dr. Frederic Aoussou in order to discuss the future of the crocodile project.

Table 2. Inventory of crocodiles at the National Zoo of Abidjan taken in February 1999.

Species	Breeding Enclosures	Rearing Enclosures
C. niloticus	23	30
C. cataphractus	44	51
O. tetraspis	0	13

Crocodylus cataphractus at the Abidjan Zoo. B. Shwedick photo.

All parties considered that the breeding enclosures have become overcrowded making the husbandry and management of the crocodiles difficult. The concrete pools in the breeding enclosures have begun to deteriorate and are in need of repairs.

The zoo was facing a shortage of medical supplies to treat crocodiles injured in territorial disputes and the crocodile rearing enclosures become flooded during periods of heavy rains. The director reported several cases of crocodile poaching at the zoo.

Crocodiles are still utilized locally for their meat, skins and their gall bladders. The local belief maintains that the gall bladder contains a powerful poison.

Plans are underway to renovate the zoo to promote tourism. The construction of a perimeter fence has been proposed to increase security. In August 2000, a local construction company estimated the minimum cost of repairing the concrete pools in the crocodile breeding enclosure to be US$3000.00.

In light of a reduced budget at the zoo for carnivorous animal diets the possibility of releasing some of the crocodiles into suitable habitats inside the national parks was discussed, as well as the potential of moving some the crocodiles to other zoological parks, exhibits or crocodile farms.

The zoo staff reported that from time to time they receive inquiries from individuals interested in purchasing crocodiles for farming purposes.

Wolf Waitkuwait with trackers of SODEFOR, the Ivorian Forestry Development Service. B. Schwedick photo.

Bio-monitoring in the forest reserves of Cote d'Ivoire. In 1990, Wolf E. Waitkuwait was contracted by the German technical corporation GTZ as a technical consultant on ecology for SODEFOR, the Ivorian Forest Development Service that is responsible for forest reserves throughout Cote d'Ivoire. He has been based in Abengourou, the eastern provincial capital since then and most of his work has been focused on the 224 sq. km. semi-deciduous Bossematie forest. He started a biomonitoring program as part of an integrated forestry management project by surveying the entire forest on foot and by air to identify water holes and other attraction points for wildlife such as hollow trees. Since 1993 anti-poaching efforts have resulted in the elimination of elephant hunting in this forest and the current population is estimated to be about 80. Bush meat hunters from the two villages located at the edge of the reserve have been selected, trained and hired by SODEFOR as full time trackers for data collection to monitor plant and animal species in the forest.

The biomonitoring program, developed by a team around Dr. Waitkuwait and his Ivorian counterparts, monitors sixteen permanent sample plots in the Bossematie forest on a monthly basis. Monitoring along 2000 m transect lines, spoor rings maintained around water holes, seedling beds, hollow trees and salt licks is conducted by a team of Ivorian ecologists and local trackers. Monitoring techniques include direct and indirect observation. Species are selected for monitoring based on three criteria; indicator species for habitat integrity, key species involved in seed

dispersal and popular species known by local communities as game or mystic animals. This includes the standard program, which focuses on thirty species of mammals and thirty species of birds. Special studies have been conducted on several species of plants, snails, spiders, butterflies, dragonflies, and crocodiles. Human activity in the forest, such as poaching and agricultural encroachment is also monitored and the occurrence and location of tracks, snares, spent cartridges and gunshots are recorded. When it is determined that a more detailed study is required these are undertaken with researchers, experts and technical advisors. The biomonitoring program is now being conducted in all of the forest reserves in Cote d'Ivoire and in the Tai and Comoe National Parks. Dr. Waitkuwait and his colleagues have traveled to other African countries at their request to present workshops on biomonitoring and he his currently under contract to establish a similar biomonitoring project in Liberia.

Osteolaemus tetraspis was selected to be a part of this monitoring program based upon its status as both a popular and an indicator species. In the Bossematie forest it is found regularly in isolated water holes during the dry season and in small seasonal creek beds. These waterholes and creek beds are located in depressions with critical soil conditions that exclude them from timber exploitation.

During a four-year period the tracks of *Osteolaemus* were observed 125 times on spoor rings surrounding these water holes. Direct observation of *Osteolaemus* was recorded 16 times on trails and their tracks were observed 19 times on the transect lines. Despite seasonal periods of heavy rain or prolonged drought no significant fluctuation in the number of observations can be established. The number of observations on an annual basis suggests that the population of *Osteolaemus* in the Bossematie forest reserve has remained stable over this four-year period under the current forestry management techniques. These findings suggest that the management of tropical forests on a sustainable basis can have a positive impact on the maintenance of forest ranging crocodile populations. Wolf Ekkehard Waitkuwait, *Am Sommerberg 22, 79877 Friedenweiler, Germany, <Wwaitkuwait@aol.com>*. Bruce Shwedick, *Crocodile Conservation Services, P.O. Box 3176, Plant City, FL 33564, <shwedick@aol.com>*.

West Asia

India

AMERICAN ALLIGATOR NESTS AT THE MADRAS CROCODILE BANK TRUST IN INDIA. The two pairs of alligators at the Crocodile Bank are 1988 captive breed animals from Hammat-Gader Alligator Farm in Israel. We acquired them in July 1996 and upon arrival, they averaged 2 m in total length. Single pairs were housed in separate enclosures and fed on beef bones, fish, and rats. During July 2000, one of the females constructed a large mound with leaf litter and grass and laid one single, infertile egg. That same year, the other female began nest construction with grass, and on May 26, she laid 9 eggs at 0130 hrs. Besides the eggs being small, the eggshells were comparatively thin. Of the nine eggs, only five were fertile and averaged 58.9 mm in length (range 65-76.6 mm), 43.9 mm in diameter (range 43.6-44.6 mm), and weighed an average of 75.5 gm (range-80 gm). The five fertile eggs are being incubated in the lab at 31 C.

Meanwhile, the problem of too many crocodiles at the bank still remains. We have been giving away surplus exotics to other zoos within India and now maintain only pairs and smaller breading groups. Harry Andrews, *Madras Crocodile Bank, Post Bag No. 4, Mamallapuram 603 104 Tamil Nadu, India.*

Europe

Britain

SPECIALIST WILDLIFE CRIME UNIT ESTABLISHED. A specialist police unit dedicated to combating wildlife crime was established recently. Illegal trafficking in animals is worth billions of pounds a year worldwide, second only to the drugs trade in terms of its cash value, and demand for certain products or species is so high, and the profits so great, that some creatures were pushed to the brink of extinction, police said. Now the National Wildlife Crime Intelligence Unit, the first of its kind in Britain, has been set up in an effort to help in the fight against the trade across the UK. The new unit, based at the London headquarters of the National Criminal Intelligence Service (NCIS), will gather intelligence, co-ordinate

action, identify trends and investigate links to other serious crimes to target and disrupt the illegal trade at the highest level. John Abbott, the NCIS director general, said: "Britain is not only a consumer of endangered species, but also a principal point of entry to Europe. This is why we have a responsibility to help bring this pernicious trade under control. Wildlife crime is a specialist area of crime which needs a specialist and co-ordinated response."

The new unit will be funded by the Department for the Environment, Food and Rural Affairs (DEFRA), the Association of Chief Police Officers (ACPO), the Home Office and the Scottish Executive. Experts have warned that the illegal trade is on the increase and say there are clear links between criminals involved in wildlife trafficking and other serious offences, including drug-smuggling. The trade is attractive because the rewards are so high, with wildlife products such as rhino horn worth more per ounce than Class A drugs or gold, they say.

Michael Meacher, the Environment Minister, told the new unit's launch: "I am convinced that the need for this unit is greater now than ever before. Crimes against wildlife continue, pushing some of our most endangered species ever closer to extinction." Richard Brunstrom, who leads the Association of Chief Police Officers group on wildlife crime, said criminals were attracted to the illegal animals trade because punishments were traditionally less severe than those for other crimes. But sentences were now increasing, he said. People convicted of smuggling protected species could now face penalties of up to seven years in prison as well as unlimited fines, he added. The new unit will be managed on a day-to-day basis by its new head, Chris Kerr, who has been seconded from Cleveland Police. *From PA NEWS. Submitted by* P. Hall, *University of Florida, Gainesville FL 32611 USA.*

Germany

FOSSIL TOMISTOMID CROCODILIAN FROM GERMANY. A poorly preserved anterior part of a mandible in the old collection of the Hessisches Landesmuseum Darmstadt is identified as the first remains of a tomistomid crocodilian so far from the Middle Eocene fossil locality Grube Messel near Darmstadt.

The fragmentary nature of this specimen does not allow an assignment to a particular species or genus. This new record represents the eighth crocodilian species for Grube Messel! The occurrence of a tomistomid in the Palaeogene of Central Europe is interpreted as the result of accidental vicariance in a small group of individuals originating from Western European localities. ROSSMANN, T. (2002): *Studies of Cenozoic crocodiles: First evidence of a tomistomid crocodilian (Eusuchia: Tomistomidae) from the Middle Eocene (Geiseltalian, MP 11) of Grube Messel, Germany, (N.Jb.Geol.Paläont.Mh., 2002 (3), 129-146).*

Latin America

Argentina

CAIMAN CONSERVATION IN THE CHACO. The Chaco Province, in the northeast of Argentina, is the location of a conservation and sustainable use project of yacarés. It's developed through an agreement between Fundación Vida Silvestre Argentina and Eduardo Boló Bolaño, the owner of "El Cachapé" Wildlife Refuge, a private natural reserve with conservation and sustainable use objectives. The activities began in 1996, with the experimental application of a ranching model involving *Caiman latirostris* and *Caiman yacare*. The activities, in addition to commercial objectives, are based on a long term program of biological and ecological studies of these species.

Although the main threat that puts in risk the yacarés of the region is the transformation of the habitat, there are numerous cases of mortality due to the pressure of the residents. Chaco province is one of the poorest states in Argentina, and rural habitants, who manage very little resources, find in wild species a source to complement their diet.

Besides, a disproportionate fear also exists to these animals that leads to the unjustified slaughter of some individuals. On the other hand, the cases of real or supposed predation of yacarés toward domestic animals (chick, duck, lamb and dog), reinforce this negative behavior on part of the inhabitants of the area.

With this background, considering that the only solution to these problems is the education,

we began two years ago, with several activities directed to diffuse the knowledge of the biology and conservation of *Caiman latirostris* and *Caiman yacare* in the region. Since the prejudices toward the yacarés are deeply ingrained in the mature population, the campaign was directed to the children in school. Our intent is to create a conservationist mentality in the future adults of the area, showing them that people can coexist with yacarés, and also, they can obtain several benefits from their conservation. This educational project began with a survey to evaluate the knowledge about the yacarés and the interaction between these reptiles and the residents. More than 90% of the children of school age participated from the three little villages included in the area of the Proyecto Yacarés Chaqueños. This basic information, was the start point for an educational strategy which began with a plan of meetings in schools and community centers. Also, children from different schools participate under supervision in some tasks of routine of the ranching project in "El Cachapé" Wildlife Refuge.

During the first week of October 2000 we developed with the portal of Internet **www.chicos.net** a week of field work with reports and chats where the children from Argentina and other Hispanic countries could communicate daily with those responsible for the Proyecto Yacarés Chaqueños. Information about the biology, conservation and ecology of the Argentinean caimans, was available at this web site. Local schools, which don't have access to the web, wrote reports about people-yacarés relationship in the area, and this information was published in www.chicos.net, and a brief magazine. In addition, we developed another website, www.yacare.net, with basic information about the natural history of the Argentine caimans, which is visited mostly by school age children. We continue with this educational program with the main goal of changing the point of view of the local people, who are slowly understanding that the yacares are more than a mere ugly creature that feeds on their ducks and dogs.— Lic. Walter Prado; <*walterprado@yacare.net*> *Fundación Vida Silvestre Argentina*; <*refugios@vidasilvestre.org.ar*>

Belize

SOME PRELIMINARY RECOMMENDATIONS FOR A CROCODILE MANAGEMENT PROGRAM FOR BELIZE. During the 1990's the status of crocodiles in Belize has been well studied by Steve Platt and John Thorbjarnarson of the Wildlife Conservation Society, Tom Rainwater, Scott McMurry, Lew Densmore, and others from Texas Tech University, and Mark and Monique Howells of the Lamanai Field Research Center. Based on their observations, it appears that in the absence of over-hunting and habitat loss, Morelet's crocodile is secure, especially in northern Belize. However, environmental contamination is of concern, and DDT and metabolites have been found in eggs of Morelet's crocodiles. The same is not true for American crocodiles, whose continued survival in Belize is tenuous. Although American crocodiles are not being over-exploited, development of nesting (sandy beaches) and associated nursery habitat poses the greatest threat. Drowning of crocodiles in monofilament gill nets also is a significant source of mortality throughout the coastal zone.

Both species are affected by residential development in wetland habitats. Although not aggressive, American and Morelet's crocodiles rapidly lose their natural fear of humans when fed and become accustomed to humans. Under these circumstances crocodiles can pose a risk to humans and pets. With development of wetland areas occurring at a rapid pace in Belize (especially Belize City and San Pedro) and with crocodiles being fed regularly (either deliberately or through the disposal of seafood and slaughterhouse offal), crocodile attacks on humans and pets have increased in Belize City, Orange Walk, San Pedro and Dangriga in recent months. Fatal attacks have occurred in Belize City and Orange Walk.

These incidents have sparked concern in Belize over the future of crocodiles and the safety of people. To obtain assistance in dealing with these problems and to provide advice on how to keep humans and crocodiles safe, the Ministry of Natural Resources, Environment & Commerce and Industry and the Belize Audubon Society requested help from the Florida Association of Volunteer Agencies for Caribbean Action. In response, Dr. Frank J. Mazzotti, University of Florida, traveled to Belize, 2-9 December 2001, to evaluate the situation.

Ms. Nigeli Sosa, Director of the Forest Department, Ministry of Natural Resources, Environment & Commerce and Industry, and Mr. Marcelo Windsor, Wildlife Biologist and Forest Officer, Forest Department, hosted Dr. Mazzotti in Belize. Ms. Sosa made all of the logistical arrangements, especially the two stakeholder meetings in Belize City and San Pedro and the media spots (two national TV news shows, one radio talk show and front page coverage of the San Pedro stakeholder meeting in the San Pedro Sun). Mr. Windsor provided guide services and expert local knowledge. The objectives of the visit were to examine locations where human/crocodile interactions were occurring, to train and equip Forest Department and Belize Audubon Society staff to handle problem crocodiles, to determine issues important to stakeholders, and to initiate a public education campaign through media exposure. Training in the handling of problem crocodiles took place at the Lamanai Field Research Center, Lamanai Outpost Lodge, Indian Church, Belize.

Daylight surveys were made of areas of human/crocodile interaction in the communities of Belama, West Landiver, and Port Loyola in Belize City. All of these are residential areas built in reclaimed mangrove swamp. Homes are built along finger canals dug for fill and drainage. For most homes there was a barrier-free, direct connection between a backyard and canal. Port Loyola especially is undergoing continued development with the yards of many homes less than 0.25 m above water levels. The problem area in Orange Walk was a slaughterhouse that dumped offal directly into the New River. Our investigation found that the slaughterhouse had been moved and that remains of slaughtered animals were no longer being disposed of in the New River. Day and night surveys of human/crocodile habitat were made in San Pedro and surrounding communities on Ambergris Cay. Resort development occurs at areas of higher elevation (possible nesting beaches) and residential development for service personnel occurs in adjacent mangrove swamps. In San Pedro, as in Belize City, finger canals, small ponds, and lagoons are created in the mangrove swamps for fill and to aid drainage. One large (3 m) friendly crocodile approached us at a location reported in the local San Pedro newspaper as where crocodiles are fed.

The manner of development (creation of finger canals and ponds for drainage and fill) taking place in Belize promotes contacts between humans and crocodiles. Not only are humans moving into crocodile habitat, but also the modifications made for human habitat (creation of open water areas) enhances the habitat conditions for larger crocodiles. At all locations where crocodiles were known to occur, residents related stories of crocodiles being fed, and in many cases stories of pets being attacked. The problem of a human population expanding into crocodile habitat is exacerbated by the widespread practice of feeding crocodiles in proximity to humans and pets.

The following recommendations are the based on these surveys, interviews with local residents, and meetings with stakeholders in Belize City and San Pedro.

Immediate Action. **Signs.** Signs are need to increase the awareness of people in areas where crocodiles occur as to the presence of crocodiles and how to behave around them. Not feeding crocodiles, not swimming in areas with crocodiles, and securing pets are important messages for living safely with crocodiles.

Public education.. An education program was identified as a critical component of a crocodile management plan. If people know to respect crocodiles and to not fear them or be friendly with them, people can live safely with crocodiles. Target audiences should include residents in areas with crocodiles. The danger of feeding crocodiles must be stressed.

Problem crocodile program. The purpose of a problem crocodile program is to insure public safety. A problem crocodile program should be adaptable to local conditions. In urban residential areas where Morelet's crocodiles are common, large crocodiles may be removed before they become problems. This will not only increase human safety, but also will encourage people to support crocodile conservation efforts. Due to the lower abundance of American crocodiles and the proximity of humans to prime crocodile habitat, a more cautious approach should be used in conjunction with a concerted education effort to reduce conflicts. Existing development practices for low-lying wetland areas serve to promote contact between people and crocodiles. That coupled with widespread feeding of crocodiles are the root causes for problem crocodiles in Belize.

Identify willing partners. A crocodile management program for Belize will be a big job with many components. Accomplishing this task

will require many partners. The Forest Department of the Ministry of Natural Resources will have a lead role. NGO's have additional expertise and resources that they can bring to assist the Forestry Department. Additional willing partners, including ecotourism operations and development interests, need to be identified and engaged in developing and supporting a crocodile management program. Potential partners include NGO's, tourism interests, and other government agencies. It is very important to identify funding sources for public education.

Next Steps. **Status surveys and monitoring.** As described above, a survey of both Morelet's and American crocodiles in Belize done in the early to mid-1990's provide baseline data of crocodile populations. Continued studies of Morelet's crocodiles in northern Belize have kept the information on status of the population in that area up-to-date. We need similar data for Morelet's crocodiles in southern Belize, especially the Stann Creek District, and for the American crocodile throughout its range in Belize. Completing and updating information on nesting, growth, and survival of the American crocodile on offshore cays and atolls is a very high priority.

Planned development of coastal and island areas. The ultimate cause for negative human crocodile interactions is residential and tourist development of crocodile habitat. The problem for American crocodiles is particularly acute because crocodiles require the same elevated sandy beaches sought for development of resorts. Each tourist room built requires ten people to service it. In San Pedro these service communities are built on lower elevation mangrove areas by digging canals and filling wetlands with refuse capped with sand. This manner of development promotes conflicts between crocodiles and humans by bringing them into close contact. Proactive planning is needed to insure the survival of crocodiles and to reduce problems for people.

Develop protection plans for habitats identified as critical for the continued survival and recovery of crocodiles. At least in northern Belize habitat loss is not a problem for Morelet's crocodiles. The same is not true for American crocodiles, where development of nesting beaches and nursery habitat threatens the continue survival of the American crocodile. Here planning for development means identifying and protecting critical habitat from development.

Interagency cooperation – establish communication channels. Since many partners will be required to effectively manage crocodiles in Belize it is essential that channels of communications be kept open among the different organizations involved in crocodile management.

Public education. Public education is both a short-term priority and a long-term need. A long-term program of educational activities including, visits to schools, brochures, posters, and television and radio spots can be used to inform the public how to behave around crocodiles and their ecological and economic importance. Educated tour guides can inform tourists about crocodiles.

Ecotourism development. Crocodiles are a destination species. That is, people will travel and pay money to see crocodiles. Several jungle river tours in Belize already feature Morelet's crocodiles as a main attraction. The American crocodile has only recently been recognized for its potential as an ecotourism attraction. On offshore cays night tours for crocodiles will well compliment day tours for snorkeling or fishing. Two essential components of developing the American crocodile as an ecotourism attraction are a thorough understanding of the toured population and training programs for tour guides.

Professional development. Managing crocodiles requires an experienced and knowledgeable staff. For example, capturing crocodiles and conducting status and monitoring surveys have been identified as key components of a crocodile management program. Although initially Belize may want assistance from outside the country, eventually the capacity to perform these activities should be developed within the country.

Management plan. A plan should be written detailing how the previous tasks will be completed, when, and who will be responsible for them. An important aspect of a crocodile management plan will be to clearly identify problems and opportunities. Management plans should be flexible to meet local conditions, economically sustainable, and realistically enforceable.

Both Morelet's and American crocodiles are experiencing increasing contacts with humans in Belize. Although Morelet's populations appear secure, conceivably dispersing into human

habitats, American crocodiles are not. For both species the rate of interactions with humans is likely to increase with unplanned development of wetland habitats. Contacts with crocodiles are turned into conflicts with crocodiles by the ubiquitous practice of accidentally or deliberately feeding crocodiles. In addition to populations of Morelet's crocodile being more secure than those of the American crocodile, the relative location of human/crocodile interactions also differs. For Morelet's crocodiles most of the problems reported to the Forest Department and Belize Audubon Society occur in developed areas (for example, Belize City, Orange Walk and Dangriga) and not in core habitat for Morelet's (interior freshwater wetlands). Although continued development of coastal wetlands will effect local populations of Morelet's crocodiles, this probably will not affect their overall status in Belize. It may even be possible to craft a problem crocodile program that removes crocodiles before they become problems. Unfortunately the same is not true for American crocodiles.

Core nesting and nursery habitat of the American crocodile is being developed. If anything, the creation of open water areas in what was previously mangrove swamp creates habitat more suitable for adult crocodiles. Bringing crocodiles to even closer proximity to humans, and, hence, increasing the risk to both species. Bringing a halt to the feeding of crocodiles should be an immediate priority. As an alternative to no development a landscape architecture that separates humans and crocodiles could be designed. A priority management action should be to identify and protect nesting and nursery habitat critical for the survival and recovery of the American crocodile. Without this the prognosis for the American crocodile in Belize is dim.

Taken together these steps can help insure the continued recovery and survival of crocodiles in Belize. The Forest Department, Ministry of Natural Resources, Environment & Commerce and Industry working cooperatively with the University of Florida will present a preliminary crocodile management plan at the 16th Working Meeting of the Crocodile Specialist Group to be held in Gainesville, Florida in October 2002. — Frank J Mazzotti, *University of Florida, USA,* and Marcelo Windsor, *Forest Department, Belize*.

Brazil

YACARE CAIMAN MANAGEMENT MEETING. I attended a meeting in Campo Grande, Brazil, at the invitation of IBAMA, the Brazilian national wildlife agency February 20-24.

The meeting was convened by IBAMA to promote discussion of a new program of sustainable development for the Pantanal region that focuses on use of *Caiman yacare*. The meeting was attended by Ibama personnel (both local and national), about 40 current and potential caiman 'farmers' and a diversity of academics, press, commercial interests - total about 70 people. The Pantanal is the largest wetland in South America, comprising 140,000 km^2 in SW Brazil around the upper Paraguay river.

I presented an outline of regulatory constraints on international trade of caiman (CITES, US regulations) and also introduced some general considerations about conservation of the resource and caiman data from MacGregor's global trade report.

Other presentations covered an overview of the new program, national regulations and CITES administration, history and current status of use of *Caiman yacare* including current captive breeding developments, recent studies of yacare biology, and technical and marketing presentations.

A core component of the meeting was presentation of the combined results of the IBAMA research team in the Pantanal (CSG members Zilca Campos, Guilherme Moraou, Marcos Coutinho and others). Studies over the last 15 years have provided detailed data on growth, reproduction, feeding ecology, numbers, distribution and population dynamics of *C. yacare*. This material has produced a number of papers published in the international refereed literature over the past several years and a recent (2000) Ph.D. thesis at University Queensland, Australia, by Marcos Coutinho. The whole body of research conducted by the Pantanal IBAMA group constitutes a significant addition to crocodilian biology and very sound foundation for design of management and conservation. A key part of the thesis is a population model from which various management strategies have been evaluated and the current new proposal based.

Basically, a new program involving egg collection, grow-out in 'ranches' and return of a

proportion of juveniles to the wild, as well as controlled wild harvest is proposed. The exact details (egg collection quotas, release proportions and ages. wild harvest regulation etc.) may require adjustment based on monitoring as the program is initiated.

However, in the course of the meeting a serious conflict appeared to arise between the proponents of the new program (the national wildlife agency and Pantanal research group) and some local Ibama personnel and established caiman captive breeding operations. The opponents have a strong local political base. It is evident that the biologist proponents are facing an uphill political battle in the local arena to establish the program.

I had the opportunity in the days following the meeting to visit the Pantanal group's field area, spend time with a caiman breeder and leading critic of the new program, and also examine a completely independent initiative for captive breeding of *Caiman latirostris* in Sao Paulo State developed by CSG Steering Committee member Luciano Verdade.

The emerging picture is quite complex. Ibama is interested in developing resource use in the Pantanal that provides benefits to lower class rural dwellers and land owners with better linkages to habitat conservation. The setting for all these initiatives is a highly developed agricultural economy with sophisticated agro-industrial and economic bases. A number of entrepreneurs have developed captive breeding of *C. yacare* in the Pantanal region, including manipulating diet to produce skins with greatly reduced osteoderms. However these producers seem to have unrealistic expectations about the value of their product in the international market and have already committed very large, possibly unrecoverable, investments in captive breeding. This group is currently opposed to developing a ranching/wild harvest program that might undercut their product or their current monopoly on production. Some flexibility in integrating this group into the proposed program that protects their investments and recruits their support is needed.

The possibility of introducing a variety of management actions on an experimental 'pilot' basis in different parts of the Pantanal might allow testing of model assumptions and soften opposition to the proposed program. I also suggested that research and development into market opportunities prior to initiating large scale production was needed to avoid leaving producers stranded with unsaleable product (one presentation at the meeting by a marketing manager also made this point strongly).

Sao Paulo State supports a highly fragmented and reduced population of *C. latirostris* surviving in an urban and agricultural landscape. The University of Sao Paulo at Piracicaba has an excellent new wildlife studies program headed by Luciano Verdade with a new crop of keen and energetic graduate students studying many aspects of *Caiman latirostris* biology. I spent a delightful Sunday morning discussing their work and crocodilian biology with them. The program has also developed successful captive breeding of the species and is now supporting commercial development. The Sao Paulo captive breeders of *C. latirostris* are developing a highly regulated program based on captive breeding from long-term F_2 stock. They believe that the domestic market for meat and medium value products will support their production (currently in the order of 1000-2000 hatchlings/yr.). Sao Paulo has a population of over 10 million, mostly middle class and quite affluent, as well as a vigorous domestic fashion industry. This, with other urban centers in southern and eastern Brazil, may be a sufficient market for moderate crocodilian meat and skin production. Wild populations of *C. latirostris* appear too small and fragmented to support economically viable use but some mechanism to connect captive breeding with habitat and resource conservation needs to be developed.

So the situation in Brazil continues to be complex and open ended, but certainly with the strong possibility of production of *Caiman yacare* and *Caiman latirostris* by several means, initially for domestic consumption, but likely for international exports in future. The visit renewed active contact with both the management authority and with scientific and commercial interests in Brazil. — Perran Ross, *Executive Officer CSG, Florida Museum of Natural History, P.O. Box 117800, Gainesville FL 32611, USA.*

Colombia

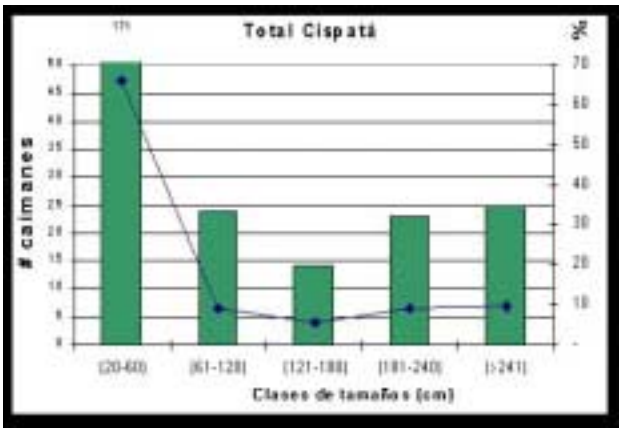
CONSERVATION OF *CROCODYLUS ACUTUS* IN THE BAHIA DE CISPATA. This project is designed to formulate a conservation strategy for American crocodiles in the Bahia de Cispata near the

mouth of the Sinú River on the Caribbean coast of Colombia. The proposal is based on sustainable use of the population with a combination of preliminary and secondary studies, monitoring and the formulation of a management plan.

The objective of this first stage of the investigation was to compile bibliographic information, and acquire field data to address two basic aspects of the management plan: 1) Diagnostic description of the habitat and 2) Characterization of the wild crocodile population.

The investigation was developed with support of the Mangrove Project of Colombia and the participation of Fundacion Natura, Agrosoledad CVS and the Administrative Unit of the National Natural Parks System.

The investigation began with several field trips in 2000 and 2001 and from the results of these, the best area to initiate a conservation program was identified. In this area, the general startegy will be first to recuperate and then to sustainably use the crocodilian population. The



area was determined to have appropriate conditions for development and supported a population of between 500 and 1,000 indivduals of all sizes. From these studies it was also possible to establish that the Bahia de Cispata is, at this time, the most representative area in the national distrubution of this species.

We were able to survey 26 water bodies including swamps and mangrove channels with an extent of around 13 km^2 and containing about 160 km of shoreline. We located and established GPS positions for 257 crocodiles in 7 swamps and 4 creeks. These were distributed into size classes of 20-60 cm (Class 1), 157 neonates and 7 small subjuveniles; 61-120 cm (Class 2) 22 juveniles, 121-180 cm (Class 3) 14 juveniles; 181-240 (Class 4) 23 subadults and adults and >240 cm (Class 5) 25 adults.

Although we could not discount the possibility of migration between the water bodies examined, for some of these their distribution allowed us to consider them as isolated and independent units. Summing all 71 km of the 11 water bodies where crocodiles occurred we derive an average distribution of 3.6 animals/km or 0.29 animals /ha, although each individual survey has its own estimate of variabilty. Individually for each water body and generally for the Bahia de Cispata, the crocodile populations reflect an apprent demographic disequilibrium marked by the relative absence of individuals in the smaller size classes. Unsustainable use in the form illegal removal of eggs for ranching is thought to be the cause of the present population status, although possibly interacting with other metorological and ecological factors. However, the quality of the habitat and the number of pre-adult and adult animals suggests that conservation efforts could be effective. But this will depend greatly on the positive attitudes of members of the local community. From this we consider that the current conservation status of the crocodile population is moderately critical but that conservation is feasible.

In the final report of this phase of the study several lines of development for a conservation strategy based on these results and suggestions from the specialist literature were considered. These were: surveys, recovery programs, monitoring of the population, biological studies relevant to sustainable use; precautionary mechanisms to ensure that any use was not detrimenetal; benefits for local communities; agreements to establish the structure of the project between communities, environmental authorities and the commercial sector; control of trade and economic benefits to support the sustainability of the project.

We are now considering activities to develop the project through 2002. One of these is to integrate additional studies on the babilla (*Caiman crocodilus*) in the same area with monitoring of the crocodile populations.

Unfortunately we must mention that to date, there has not been any experience in sustainable management of wild populations in the country. Therefore, the methods and preliminary results

obtained here will be useful experience in other situations where crocodiles occur. In Bahia de Cispata we have an approximation of the state of conservation of *Crocodylus acutus* in its natural habitat, with natural distribution and population status. Therefore we need to continue this and other projects that assist the understanding and sustainable management to guarantee the perpetuation of these species in Colombia's wild fauna. — Freely translated and adapted from *Proyecto de Conservacion del Crocodylus acutus Cuvier, 1807 Bahia de Cispata Departamento de Cordoba-Colombia, Informe Final Fase 1, Enero 2002*. Giovanni Andres Ulloa Delgado and Clara Lucia Sierra Diaz. *Cartagena de Indias, Bolivar,Colombia.*

Guyana

BLACK CAIMAN SURVEYS IN THE RUPUNUNI. The Black caiman (*Melanosuchus niger*), is a key component of the North Rupununi Wetlands ecosystem in Guyana. Populations of Black caiman declined precipitously through hunting in the 1960s and 1970s. The declines in Guyana occurred concurrently with declines throughout their range. Commercial hunting for Black caiman meat continues in the Upper Amazon and Black caiman populations tend to be locally dense but patchily distributed and severely depleted compared to original numbers.

Large predators complicate the management of human ecosystems. These animals are frequently targets for overexploitation for the meat and skin trades. They are also dependent on food chains and so are good indicators of ecosystem health. Unfortunately, when abundant, large predators can be the source of conflicts with local communities where they may attack people, attack domesticated animals, and affect people's use of resources.

The changes in Black caiman densities over the last 70 years have far reaching, but not fully understood, implications for the management of South American aquatic ecosystems. A primary concern is that these recovering populations are potentially susceptible to future declines through poor management. In addition, increasing Black caiman densities are likely to lead to conflicts with people. Black caiman also offer some management opportunities including the potential for sustainable harvests and megafauna values as ecotourism attractions. Finally, while not well understood, Black caiman also play key roles in regulating aquatic communities and ecosystems.

Recovery, and future stability, of Black caiman populations will depend on the management of these animals and the human ecosystems in which they live. An improved understanding of Black caiman socio-ecology is therefore important for the effective management of South American aquatic ecosystems. Unfortunately, data on the distribution and abundance of caiman are not extensive and rarely of sufficient detail for local planning. We report on population estimates for Black caiman in the Rupununi, Rewa, and Essequibo Rivers in Guyana.

This work is a collaborative effort involving Iwokrama, the NRDDB, and the communities of Fairview, Apoteri, Rewa, and Crash Water. These studies result from discussions between the Iwokrama International Centre (Iwokrama) and members of the North Rupununi District Development Board (NRDDB) representing communities near, and within, the Iwokrama Forest in central Guyana. During early discussions, community members raised two major Black caiman management issues. Community representatives voiced strong interest in the prospects for sustainable harvesting of Black caiman for generating income. There were also numerous concerns raised about Black caiman attacking hunting dogs and people. Similar concerns had been raised by communities during an earlier study of caiman in the North Rupununi by Gorzula, Woolford in 1990.

While the boundaries of the North Rupununi Wetlands remain undefined, they include a land area of approximately 11,500 square kilometers comprising the Rupununi, Tumulao, Rewa, and Essequibo Rivers, including over 300 lakes, ponds and inlets. In the survey area, we carried out 114 censuses of different ponds covering 1,622 ha with 275 km of shoreline and 46 censuses of different sections of the main rivers covering 2,434 ha with 300 km of shoreline. The mean area and perimeter for each of the lakes and inlets surveyed were 14.2 ($\pm$ 7.3 2SE) ha with a shoreline of 2.4 ($\pm$ 0.46 2SE) km. The mean area and perimeter for river transects were 54.3 ($\pm$ 16.8 2SE) ha with 6.5 ($\pm$ 0.97 2SE) km of shoreline. The research team attempted to survey all of the accessible ponds in the area and surveyed river channels close to field camps.

During the surveys, we observed 2,443 Black caiman (1,695 non-hatchlings and 708 hatchlings

and 40 whose size could not be accurately determined). This is equivalent to 0.41 non-hatchling caiman per ha or 2.95 caiman per km shoreline. The density of non-hatchling caiman (>60 cm TL) in lakes was 0.71 caiman per ha (4.18 per km), and in rivers was 0.22 per ha (1.82 per km).

A more complete paper will include size class distributions for the population and also descriptions of the spatial distribution of the population in relation to communities and major fishing lakes. — Graham Watkins, *Senior Wildlife Biologist, Iwokrama International Center, Georgetown, Guyana.*

Honduras

INVENTORY OF CROCODILES IN THE TRUJILLO BAY CONSERVATION AREA. This study had two main objectives, to determine the population size of American crocodiles (*Crocodylus acutus*) and *Caiman crocodilus* in the coastal wetlands between Laguna Guiamoreto and the Rio Aguan, and provide crocodile conservation and survey training for a group of five guards from four protected areas in coastal regions of the Atlantic and Pacific coasts of Honduras. The study area consisted of the wetlands associated with the Laguna Guaimoreto, Rio Chapagua, Laguna El Lirio and the lower 15 km of the Rio Aguan. Surveys were conducted 18-23 April and training courses continued through 25 April 2001. A total of five diurnal reconnaissance's and five nocturnal counts were conducted in the area using two boats with outboard motors. Animals were located from the boats at night by their reflected eyeshines, and identified to species. Size was estimated by approaching to within five meters and observing the size of the head.

Training classes were conducted in the facilities of a local conservation NGO (FUCAGUA) located in the town of Trujillo as well as in the field. Course material consisted of information on crocodile biology, taxonomy, identification, research and management for both species and was designed to be of use in the protected areas where the park personnel are employed.

Abundance was expressed as the number of individuals of each species observed per kilometer of survey along rivers and lake perimeters. A total of 84 *C. acutus* and 36 *Caiman crocodilus* were observed. The estimated population size and encounter rates for both species were 139 and 2/km for *C. acutus* and 36 and 0.86/km for *C. crocodilus*. These values represent an increase from similar surveys carried out in the area in 1989.

Attempts to find nests of *C. acutus* in the area were unsuccessful due to the effects of Hurricane Mitch that hit the area in November 1998. However, evidence of at least two pods of hatchling *C. acutus* was found during the survey. The project was funded through the Wildlife Conservation Society and the results of this work will be used by FUCAGUA and the Honduran government for the management of both species of crocodilians in the Laguna de Guiamoreto National Park. — Carlos Cerrato, *Universidad Nacional Autónomo de Honduras*, *Translated by* J. Thorbjarnarson *from a report (Inventario de Cocodrilos en el area de conservación Bahia de Trujillo) submitted to the Wildlife Conservation Society*.

North America

Mexico

THIRD WORKING MEETING OF THE COMITE DE MANEJO DE LOS CROCODILIANOS DE MEXICO (COMACRON). COMACROM is an official national body integrating research, government agencies and private sector interests to develop national goals and policy for crocodilian conservation and use in Mexico. The meeting began, 19 September 2001, with reports from COMCRON President Manuel Muniz and regional representatives from the North Pacific (Marciano Valtierra) South Pacific (Luis Sigler), Yucatan (Javier Antonio Pavi, Research (Paulino Ponce and Commercial sector (Jose Carlos Rodarte).

These summarized a past year of great work and large advances. Among the principle themes mentioned were research and status of wild populations, interactions between people and crocodiles and trade. The remainder of the day comprised presentations of recent work on wild populations of *C. acutus*, *C. moreletii* and *Caiman crocodilus* in Mexico. Thursday, 20 September, continued with presentations from those working in farms and from the national CITES Authority, TRAFFIC Mexico and

comments from the representative of the Director General of Wildlife (Instituto National de Ecologia). This was followed by a field trip to Crocodilos Mexicanos, now thought to be the largest and best farm in Mexico where the care and processes to obtain quality skins was demonstrated.

On the following day proposals and elections for the new directive board of COMACRON were held. President: Manuel Muñiz, Secretary: José Juan Pérez Ramírez, Treasurer: Odra Bustillos, Pacífico Norte: Marciano Valtierra y Francisco León, Pacífico Sur: Luis Sigler M. y David Montes, Golfo de México: Pablo Lavín y Fernando Rodríguez, Península Yucatán: Javier Antonio Pani y Javier Omar Gómez, Investigación: Paulino Ponce y Fabio Cupul, Inspección y vigilancia: Adrián Reuter Difusión: Enrique Beltrán Brozon y Sara Huerta.

Then a general discussion about topics, procedures and organization of working groups was concluded and working groups convened. Detailed conclusions and recommendations were developed by working groups on Commerce, Actions to address human-crocodile interactions, Standardization of methods for wild population studies, Communication and Veterinary management of crocodilians.

The meeting concluded with adoption of recommendations developed by the group. Prominent among these were recommendations to continue developing the necessary data and process to modify the US Endangered Species and CITES listings and obtain approval to import legal skins into the USA and other consumer countries. The next meeting of COMACROM will be held in August or September of 2002 in Puerta Vallarta, Jalisco. — *extracted from the meeting report,* Manuel Muniz, *President COMACRON, Aptdo Postal 41 601, Lomas de Chapultepec, Mexico DF CP 11000, Mexico.*

Veterinary Science

TEETH AS INDICATORS OF CALCIUM LEVELS. Crocodile teeth can be hard and sharp practically without containing any calcium at all. Such "glassy teeth" are seen in hatchlings suffering from nutritional osteomalacia (Huchzermeyer, 1986). Recently I have noticed several cases not quite as advanced as that, which I should like to call "diaphanous teeth". As an example see the teeth of the Australian freshwater crocodile on page 22 in Webb & Manolis (1989). The symptom has been seen in farmed and captive Nile crocodiles of all ages. A common feature was that they were fed predominantly broiler chickens. Broiler chickens are fed minimal calcium levels in order to achieve optimal feed conversion ratios, and their bones are thin and soft, not a good source of Ca and P. It is possible that prevalently fish-eating crocodiles naturally deposit less Ca in their teeth.

None of the animals in my experience showed any obvious clinical symptoms. However, there is a possibility that latent calcium deficiency as expressed by diaphanous teeth could be linked to an increased incidence of uterine prolapses in laying crocodiles and perhaps also penile prolapses in subadult males, both occurring in groups of crocodiles with these symptoms.

It might be warranted to monitor the state of the teeth of captive and farmed crocodiles and adjust mineral supplementation accordingly. References: F. W. Huchzermeyer, *1989. Osteomalacia in young captive crocodiles (Crocodylus niloticus). Journal of the South African Veterinary Association. 57, 167-168.* G. Webb & C. Manolis, *1989 Australian crocodiles a natural history. New Holland Publishers, Sidney, London, Cape Town, p 22. F. W. Huchzermeyer, P. O. Box 12499, 0110 Onderstepoort, South Africa, <crocvet@mweb.co.za>*

EFFECT OF SELECTED BACTERIOSTATIC AGENTS ON THE MORTALITY OF CROCODILIANS. Crocodilian breeders have noted problems with the morbidity and mortality rate of neonatal Yacare caiman and Morelet's crocodiles. Artificially hatched crocodilians imprint upon humans and suffer from severe stress when left alone, which leads to behavioral disturbances and an increased susceptibility to infectious agents. This research project utilized selected soluble bacteriostatic agents in environmental water to determine if mortality and morbidity in newly hatched Yacare caimans and Morelet's crocodiles would be reduced. It was hypothesized that the addition of selected bacteriostatic agents will reduce mortality and morbidity.

Newly hatched baby Morelet's and Yacare were housed in four 121.92cm^2 livestock tanks. Test groups were housed in a solution containing 2.5 mg methylene blue, 122 mg nitrofurazone, and 24 mg furazolidone per 37.85L of H_2O. The solution was changed every 72 hours (after each feeding). The control group was housed in H_2O. Shelters were supplied to both groups to reduce stress. Specimens were selectively weighed, and the general health of each group was monitored weekly by a D.V.M. Mortality and morbidity rates were assessed at the end of a 12-week period. Results showed that the test group Yacares had the highest weight average at 83.3g with the control's average at 80g. The test group Morelet's had a higher weight average at 54.3g than the control's average of 46.2g. Only three deaths were recorded, and those were from the control Yacare caimans. Analysis showed that weights recorded for the Yacare caimans were not statistically significant, but those of the Morelet's crocodiles were significant at a 0.05 level of significance. This proved the hypothesis for the Morelet's crocodiles, but not for the Yacare caimans. — *The Effect of Selected Soluble Bacteriostatic Agents on the Mortality of Neonatal Crocodilians Due to Stress-Induced Bacterial Infections. Abstract, Research paper, 2001* Aaron Wyndham, *Timberland High School, Monks Corner, SC, USA.*

Science

DOME PRESSURE RECEPTORS IN CROCODILIANS. A recent study published in Nature by Daphne Soares indicates the presence of sensory receptors on crocodilians. Soares refers to the sensors as dome pressure receptors (DPRs) and associates them with the largest cranial nerve in the alligator, the trigeminal nerve. The domes are pigmented and located not only on the faces of crocodilians but also inside their mouths. Nerve recordings indicate the receptors respond to pressure differences in the water when the surface is disturbed. Test results also show the receptors work only when the animal is resting with its head partly submerged in water, and if covered, the receptors are no longer able to function.

Following further examination, Soares found all presently living crocodilians to have the DPRs as well as the foramina characteristic of the DPRs. Soares analyzed extinct crocodilians, and specimens believed to have been semi-aquatic exhibited the same foramina as the living animals observed, indicating the ancient history of the crocodilians' dome pressure receptors. — *Compiled from 'An ancient sensory organ in crocodilians,' Nature vol 417* . Daphne Soares, *Department of Biology, University of Maryland, College Park, Maryland 20742, USA, <daph@wam.umd.edu>.*

TSD IN BROAD-SNOUTED CAIMAN. The sex of aves and mammals is determined chromosomally at conception. Other vertebrates' sex results from external stimuli including temperature, the most studied agent among reptiles. Temperature dependent sex-determination (TSD) has been reported in turtles, lizards, and all crocodiles studied to date.

In this thesis, *Caiman latirostris* eggs were incubated at different temperatures (29^o, 31^o, 33^o, and 34.5^o +/- 0.5^o C) in order to investigate if temperature determines the embryo's sex. Another experiment was carried out to study when sex is determined during incubation.

Temperature affected *C. latirostris'* sex and occurred during days 19 to 45 of incubation. Incubation temperature affected the incubation period, total length, and snout-vent length, but a 'temperature x nest' interaction was present at hatching. Temperature also affected one-year survivorship, but had no effect on weight.

In a natural incubation experiment completed in forest, grass-land, and floating vegetation sites, sex ratio was found to be related to average temperature in a quadratic equation and was dependent to ambient conditions. — *Abstract, Ph.D. thesis, Un estudio del efecto de la temperatura de incubacion en la determinacion sexual y el primer ano de crecimiento del yacare overo, Caiman latirostris (Daudin, 1802).* Carlos Ignacio Pina, *Universidad Nacional de Cordoba, Argentina*.

TRADE

CSG AT CITES ANIMALS COMMITTEE. The

CITES Animals Committee met 8-12 April 2002 in San Jose, Costa Rica. I represented CSG to present the results of a consultancy commissioned by the CITES secretariat for us to assist in the discussions of how to register captive breeding operations. Resolution 11.14 (Nairobi 2000) established a new procedure to register captive breeding facilities, requiring a list of species that were 'endangered' and 'difficult to keep and breed in captivity'. This list would serve as guide to species requiring careful scrutiny of registration proposals, and species not listed, by default, would be registered by a rapid process. However, at the AC meeting in USA in December 2000 great disagreement arose upon how to generate such a list.

CSG was engaged by the Secretariat to produce a 'model list' covering just reptiles to see if an objective and widely acceptable process could be developed. Between December 2001 and March 2002 CSG members Hank Jenkins and Alvaro Velasco and consultants produced a rationale and draft list that I presented to Animals Committee in San Jose. A working group on the issue strongly praised the CSG effort and the general principles of our report were accepted. However, after discussion it was determined that even with objective and scientific rationale, the list of endangered and difficult to breed species still contained a very large proportion of all Appendix I reptile species and a similar result was likely for other animal groups. The AC finally recommended that CITES must reconsider the new process developed by Res. Conf. 11.14 and in the meantime the earlier registration process (Res. Conf 8.15) could continue to operate. It remains to be seen how the general meeting of the Conference of the Parties responds to this suggestion at the meeting in Santiago, Chile in November 2002. — Perran Ross, *Executive Officer CSG.*

TRADE PROPOSALS FOR CITES COP 12, SANTIAGO CHILE. There are 54 proposals for changing CITES Appendix listings submitted for consideration to 12th CITES Conference of the Parties, but none address crocodilians, crocodilian ranching or crocodilian quotas. However there are three proposals that will be of general interest and concern to CSG members.

A draft proposal to more clearly define and recognize the exemption provided for personal effects under the Convention was drafted by the CSG Task Force on Market Driven Conservation. Many countries enforce stricter domestic measures that discourage travelers from carrying personal items such as belts, wallets and bags, made of crocodilian skins. This is perceived as an impediment to trade of legal and sustainably produced materials. The draft resolution provides a framework for the CITES parties to clearly define personal possessions and to modify national laws and regulations so as not to require onerous CITES documentation for such items. The proposal has been discussed with several crocodilian trading Parties who are generally supportive of the concept and the proposal was formally submitted to the secretariat by Venezuela (COP 12 Doc 52.4).

A draft proposal to facilitate the entry and re-export of trade samples of Appendix II and III specimens was prepared by the CITES Management Authority of Italy and, after discussion by all the EC CITES nations, has been submitted to the Secretariat (COP 12 Doc 52.2). CSG members were active in promoting the proposal and commented extensively on early drafts. The proposal is to extend the use of the 'Customs Carnet' system whereby materials enter a country under a special CITES certificate and customs designation for display at trade fairs and sales venues and then are re-exported back to the country of origin with the same documents. The material may not be sold and must return to its source. This process, if adopted by COP will greatly ease the regulatory burdens on commercial operators seeking to display samples of their products to potential buyers.

Thirdly, there is a detailed proposal in preparation addressing the need for a streamlined process for CITES document issuance for some scientific specimens (COP 12 Doc 51). The proposal addresses specimens that require rapid international transport, either because of their perishable nature (e.g. live cells) or because of the urgency of need for diagnostic analysis in

another country, for example to quickly identify disease in a critically endangered species. The proposal recommends a variety of mechanisms to achieve rapid CITES clearance including prior issuance of general permits, registration of recognized diagnostic facilities in each country that could freely exchange specimens (modeled on the functioning system for registered Museums and other scientific institutions) and expedited permit issuance by Management Authorities.

CSG is very grateful for the widespread assistance and support it has received from CITES Authorities in many countries, and from the CITES secretariat staff in promoting these proposals. The proposals now appear on the agenda of the 12th CITES Conference of the Parties for discussion, amendment and (hopefully) adoption in Chile in November. These documents can be viewed at the CITES web page. — fromCITES Web page www.cites.org/eng/cop/12/docs/index.shtml

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ECONOMIC REPORT ON INTERNATIONAL CROCODILIAN SKIN TRADE. One of the outputs of the 14th CSG Working Meeting in Singapore and the subsequent Task Force on Market Driven Conservation was the need for an objective economic analysis of the crocodilian skin trade. Funding for this project was obtained in 2001 from the Florida Alligator Marketing and Education Council and the Louisiana Fur and Alligator Council and a professional consultant economist, Dr. James McGregor was engaged to develop the project under the direction of John Hutton. After compiling data, meeting with numerous representatives of the crocodilian trade and receiving new data from a wide variety of commercial and regulatory sources. James submitted preliminary drafts in September 2001 and working draft report in December 2001.

The report is the most extensive and thoughtful compilation and analysis of global trade data of this sort and the first to apply standard economic methods and theory to the subject. The report has been reviewed by the Task Force, by CSG Steering Committee members, by the financial sponsors, and by several external and objective expert economist reviewers. Overall the report has received high marks for content, for the depth of analysis and for providing a new and unique view of the crocodilian skin trade. The report has also been criticized by some reviewers for being unclear, going beyond its defined brief and for a variety of concerns about facts, assumptions and terms used. The debate among reviewers has been 'lively' reflecting diverse views, interests and expectations for the study.

Any new perspective, coming from a source outside the usual round of stakeholders, and presented in the format and language of a discipline that most CSG members are not familiar with is likely to create discussion and debate - this is good. It is also inherent upon CSG to ensure that any report appearing under its name and with its support, is accurate, objective and useful.

In recognition of the legitimate queries raised about some aspects of the report, and in an attempt to further improve and clarify it, the consultant is currently working on revisions that will be reviewed by Dr. Hutton and the Steering Committee. A revised report will be presented at the CSG Working Meeting in October. A detailed summary and review will appear in a later Newsletter. — *From correspondence of the Task Force of Market Driven Conservation*.

16th CSG Meeting

16TH WORKING MEETING OF THE CSG, GAINESVILLE USA, 7-10 OCTOBER. Arrangements for the meeting are progressing at full speed. This will be last newsletter you receive before the meeting, but the CSG web site and meeting site will continue to be updated with new information. A total of 54 abstracts were submitted by 30 June and additional submissions continue to flow in. The program subcommittee is assigning presentations to sessions and will advise authors shortly. Submissions that continue to be received will be accepted on a space available basis.

We are pleased to welcome additional new sponsors to the meeting, Louisiana Fur and Alligator Council and Florida Alligator Marketing and Education Council. We have also received several offers of in-kind support and assistance at the meeting from individuals and industry groups.

The meeting website at http://www.flmnh.ufl.edu/natsci/herpetology/crocs.htm (click the meeting button) has new material regarding travel to Gainesville, updates on program and registration and views of the meeting site and local fauna. Additional information will be placed at the website up to the meeting.

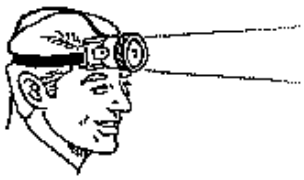
Current plans, in addition to the scientific presentation program, include an evening poster session where drinks and snacks will be served to encourage attendance and interaction with poster presenters, a field trip to view a remarkable concentration of alligators in wild habitat, and a closing banquet featuring distinctive local cuisine with a wildlife flavor. Post meeting field trips to see alligators and American crocodiles in south Florida habitats and a river trip along the St John's River are being planned.

Participants with questions should contact 16thCSG@fwc.state.fl.us or fax an inquiry to 850 921 7793.

URGENT ALERT
Hotel Registration

The Meeting Hotel, Gainesville Sheraton, is offering the Special room rate of $79/night+10% tax for single or double occupancy (2 double beds) However to obtain this rate, advance reservations specifying "**CSG meeting**" should be received by the Hotel by **7 September** at latest. Participants booking into the Hotel after this date may face rates of $99-$109/night + tax. Reservations may be secured with a credit card and are fully refundable up to 48 hours prior to arrival. To make reservations call 888 627 8043 or go on-line at www.sheratongainesville.com

Personals



Dr. Lala A. K. Singh, *Similipal Tiger Reserve, Baripada, Orissa, INDIA,* has written to inform us that since August 2001, he has been acting as a Consultant to one World Bank supported Forestry Research Project launched by Forest Departments of Uttar Pradesh and Uttaranchal States through Tata Environment Research Institute. He is involved in three projects: Rehabilitation of Crocs and Rhinos, Zoo Project, and Wetland Project. Crocs are well covered under the first two projects. The states are in the process of reviewing the gharial/crocodile rehabilitation program.

Requests

FREE TO GOOD HOME. Centre College's psychobiology department has three *Caiman crocodilus* that have been used for educational purposes. The caiman came to the college from unwanting pet owners. The first two arrived in 1993 and were approximately 60 cm in length. They are now both approximately 120 cm. The third arrived in 1994 and was also 60 cm. The animal is now 100 cm. The sex of the three is unknown. Due to their size, Centre College resources are no longer adequate to maintain the animals. The department is inquiring about possible sanctuary for the three animals. Please contact directly — Justin T. Phillips, *Centre College 600 West Walnut Street, Danville, Kentucky 40422, USA. jtphil00@centre.edu*

EDITORIAL POLICY - All news on crocodilian conservation, research, management, captive propagation, trade, laws and regulations is welcome. Photographs and other graphic materials are particularly welcome. Information is usually published, as submitted, over the author's name and mailing address. The editors also extract material from correspondence or other sources and these items are attributed to the source. 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 are not the opinions of CSG, the SSC, or the IUCN-World Conservation Union unless so indicated.

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