TSA

TURTLE SURVIVAL ALLIANCE

AUGUST 2007

An IUCN Partnership Network for Sustainable Captive Management of Freshwater Turtles & Tortoises — www.TurtleSurvival.org

BRIAN D. HORNE

Impressed Tortoise (*Manouria impressa*) (See page 4)

From the TSA Co-Chairs

Welcome to the seventh TSA newsletter and our fifth annual Symposium on Conservation and Biology of Tortoises and Freshwater Turtles, the second held in conjunction with the IUCN Tortoise and Freshwater Turtle Specialist Group (TFTSG). Each year, this gathering gives us the opportunity to reflect on the year's successes and the challenges ahead. Last year's conference in St. Louis was truly a watershed event, and we predict that the Turtle & Tortoise Symposium will grow to become the premiere gathering for chelonian biologists and enthusiasts. This symposium is acquiring a distinctly international flavor, and we are particularly heartened by the steadily growing number of foreign turtle biologists in attendance each year. As our symposium grows, so do the costs, so we are particularly grateful to all who contributed to sponsor speaker travel or support evening events and coffee breaks. And as always, for their continued support and generosity, we graciously thank both *Reptiles* magazine and ZooMed, Inc.

We strive to keep the articles in the TSA newsletter upbeat, and use the space to report conservation success stories and positive happenings. However, Gerald Kuchling's report on a recent visit to the Qing Ping market in Guangzhou, China (see p. 8) is disturbing and needs to be told. It underscores the optimistic news from the Asian markets last year. There are still many wild caught turtles, many of them CITES listed, appearing in the markets. Some time ago, we reported a shift toward farm raised turtles in Chinese markets with reliable estimates that wild-caught numbers had decreased to ¼ to ⅓ of turtles sold. But Gerald's report is distressing because of the number of IUCN Red Listed Critically Endangered turtles (five) there. Turtles from Myanmar make up the majority of wild-caught specimens now offered for sale, indicating that viable trade routes are open and expanding. That 90 Arakan Forest Turtles, *Heosemys depressa*, and a lone female Burmese Roofed Turtle, *Kachuga trivittata*, were seen emphasizes the scope of the trade. Too many *Cuora galbinifrons* from Vietnam show up in markets and there continues to be an active trade in both *Manouria impressa* and *Manouria emys*. And to make matters worse, the markets are using increasingly barbaric methods of processing live tortoises, photos of which easily sicken hardened biologists. As disturbing as this story is, it's one that needs to be told because it confirms that we are still entrenched in a serious battle to save Asia's turtles. The illegal trade in China continues to threaten the survival of many Asian turtle species, and the legal trade extends to the US, where efforts are underway to stem the tide of native turtles being sent to China for food and to stock farming operations. We hope that this information will serve to steel your resolve to put an end to this carnage, and strengthen your commitment to turtle conservation and the TSA.

Restructuring: In February 2007 the TSA Steering Committee held a strategic planning meeting hosted by Disney. We adopted a new mission statement that we feel better reflects who we are and how we operate; we hope you approve: Transforming passion for turtles into effective conservation action through a global network of living collections and recovery programs. We also expanded the Steering Committee, nearly doubling the number of members to 25. This is part of a reorganization that now includes six standing committees, each working somewhat autonomously to more effectively utilize the talents of our core volunteer group. Those committees include Animal Management, Field Conservation, Development, Communications, Membership and Annual Conference.

The TSA's range country programs continue to expand in India and Myanmar, and we are also actively supporting and participating in projects in Thailand, China, Cambodia, Vietnam, Malaysia and Mexico. Our work in range states has been greatly enhanced by the $100,000 Batchelor Foundation grant in 2005, and we are expecting to hear positive news on the second round of funding in August 2007. We are also particularly excited about our relationship with the EAZA Shellshock campaign. Recently we have partnered with, or leveraged matching funds from Shellshock to advance programs and build new facilities in Cambodia, India, and Myanmar.

We are pleased to announce that our membership program, now in its third year is growing, and that we have more than 250 members – both individuals and institutions – that provide a steady stream of operating revenue. To better serve and inform this growing member base and to help spread TSA's message, look for a new look and reworked TSA website coming soon.

As always, thanks for your support of the TSA. Together we can and must put our passion for turtles to work for their survival.

Rick Hudson and Dwight Lawson
Co-Chairs, Turtle Survival Alliance

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INTERNATIONAL REPTILE CONSERVATION FOUNDATION

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Hopes are high for the future of the beleaguered Impressed Tortoise

The trend may be improving for the Impressed Tortoise (*Manouria impressa*) in captivity, long considered a delicate and difficult-to-maintain species. Among TSA partners a successful hatching occurred at the Behler Chelonian Center in Ojai, California, and a female belonging to Dwight Lawson nest mounded and deposited a clutch of 21 eggs on 18 June 2007. Ironically, an Impressed Tortoise in Europe nested around the same time. Unfortunately this beautiful tortoise continues to be harvested for markets in China and is showing up now in confiscated shipments in Myanmar.

BRIAN D. HORNE

Behler Chelonian Center hatches some notable firsts in 2007

The John L. Behler Chelonian Conservation Center (JLBCCC) has achieved some significant results since its our inception in October 2005. All animals have acclimated nicely to their planted outdoor and indoor enclosures, resulting in numerous breeding attempts and several fertile clutches of eggs.

The following is a list of hatchlings, including some firsts at our center:

- 24 Radiated Tortoise (*Geochelone radiata*).
- 7 Spotted Pond Turtle (*Geoclemys hamiltoni*), hatched from a clutch of 18 eggs.
- 1 Speckled Padloper (*Homopus signatus signatus*), a first for the center in 2006.
- 16 Burmese Star Tortoise (*Geochelone platynota*).
- 1 Bowsprit Tortoise (*Chersina angulata*).
- 1 Impressed Tortoise (*Manouria impressa*).

Two notable firsts in 2007 are the Bowsprit Tortoise (*Chersina angulata*) and the Impressed Tortoise (*Manouria impressa*), both rarely bred in captivity.

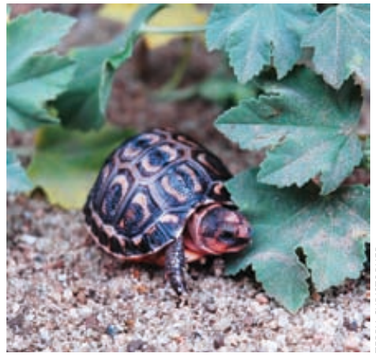
The center maintains a group of 1.2 *Chersina angulata* in planted outdoor and indoor enclosures where the tortoises are able to browse on natural vegetation. In mid-November 2006 a female laid a single large egg , which was incubated in a closed plastic container at 5:1 vermiculite to water ratio at 30º C for 96 days. The egg hatched on 19 February 2007 and the hatchling weighed 12 grams and measured 33 mm in carapace length (see photo).

The center maintains a group of 6.7 adult *Manouria impressa* in large planted outdoor and indoor enclosures. These tortoises mainly feed on oyster mushrooms, but do occasionally browse on the plants in their enclosures, such as pothos. A female laid a clutch of 18 eggs on 3 December 2006. Many of the eggs were dimpled initially, but all were incubated in a closed plastic container at 1:1 vermiculite to water ratio at 25.5º C. Some of the eggs lost their dimples and only one began to develop and later hatched on 14 March 2007. Unfortunately, this hatchling did not absorb its yolk sac and died 15 days later. This represents only the second time that this difficult species has bred in the U.S. and hopefully heralds much future breeding success at our center.

The JLBCCC strives to maintain all its tortoises in as natural conditions as possible by providing them with outdoor planted enclosures, when weather permits, in the spring, summer, fall and sometimes sunny southern California winter days, as weather permits. In order to mimic their natural habitats, all indoor and outdoor enclosures are planted with numerous species of plants that allow the tortoises to browse and forage freely. We strongly believe that the most important factor contributing to our reproductive success is that we provide our tortoises with the most natural conditions that we possibly can.

TERRY CHRISTOPHER

Homopus signatus signatus

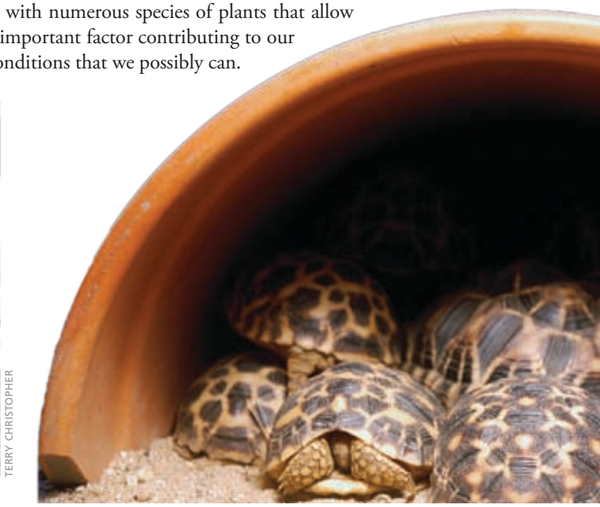


TERRY CHRISTOPHER

Chersina angulata

TERRY CHRISTOPHER

Burmese Star Tortoise (*Geochelone platynota*)



Reintroducing the Bolson Tortoise into its former range

Ross Kiester, Myles Traphagen, and James Juvik

JAMES O. JUVIK

A Bolson Tortoise near its burrow, Bolson de Mapimi, Mexico.

The Bolson Tortoise (*Gopherus flavomarginatus*) has declined to near extinction since the end of the Pleistocene about 10,000 years ago. Formerly ranging throughout much of the Chihuahuan Desert from northern Durango in Mexico to Arizona in the United States, it is now restricted to the Bolson de Mapimí, an interior basin located where the states of Chihuahua, Coahuila, and Durango meet. Here it is regarded as one of the world's rarest tortoises. Not discovered by science until 1959, it was the subject of many research and conservation efforts from the 1970s through the 1990s under the leadership of such scientists as David Morafka and Gustavo Aguirre. After something of a lull in the years since then, the tortoise is now the subject of renewed efforts by Mexican and American conservation biologists and managers. In particular, the long-term goal of our efforts is to reestablish the tortoise throughout much of its former range.

The Turner Endangered Species Fund and the John L. Behler Chelonian Conservation Center jointly sponsor our work with support from the Desert Tortoise Council and the Turtle Survival Alliance. We envision a comprehensive approach that asks the question: What do we need to know and what support do we need to have to be able to meet our goal of rewilding the Bolson Tortoise? Our program consists of four components:

1. Ensure the security and sustainability of the resident Bolson de Mapimí population.

Most of the current range of the tortoise is in the Mapimí Biosphere Reserve designated by the Federal Government of Mexico to protect the tortoise and the rest of the extraordinary biodiversity found here. The Biosphere Reserve, which is part of the United Nations Man and the Biosphere Program, has a core area of over 28,000 hectares and a buffer zone of more than 300,000 hectares. The Reserve is managed by La Comisión Nacional de Áreas Naturales Protegidas (CONANP at www.conanp.gob.mx). As with other Reserves in Mexico, the government does not own the land, but rather creates a management plan and works with existing local landowners to enforce it. The plan for the Mapimí Reserve was completed in 2006 and can be found at the CONANP website. The activities under the plan range from reduction of cattle grazing to environmental education to tourism. Monitoring is a major component. Our work on the Reserve will be to support various aspects of the plan. We are particularly interested in resurveying areas that were censused by David Morafka and Bruce Bury in the 1980s.

The Instituto de Ecología runs the Laboratorio del Desierto in the Reserve which has been the home to Bolson Tortoise research since 1978. Now there is a small captive breeding program underway. We are planning to lend support to this effort this summer.

We are also pursuing the possibility of direct land purchase within the Biosphere Reserve. A 6000 hectare parcel with many (perhaps 2000) tortoises may be for sale. Because the Mexican government cannot own land, we are pursuing other options.

2. Understand the mechanisms of decline of the tortoise over the last 10,000 years.

The decline of the Bolson Tortoise is part of the general scientific question of the extinction of large vertebrates in North America at the end of the Pleistocene. Did early Native Americans exterminate it or did climate and vegetation change play a role? The answer to this question is important because if Pleistocene overkill is the answer, then reintroduction should be straightforward since the cause of decline has been removed. On the other hand, if climate change has played a role, then some areas of the former range may no longer be suitable.

3. Develop captive breeding to the point where it could supply animals for reintroduction.

In the fall of 2006, 30 Bolson Tortoises were translocated from the Audubon Appleton-Whittell Research Ranch in Elgin, Arizona, to the Armendaris Ranch in south central New Mexico. Here they are managed by the Turner Endangered Species Fund. These tortoises are known as the Appleton tortoises in commemoration of Ariel Appleton, a champion of Bolson tortoise conservation. She had obtained them from David Morafka in 1973. The tortoises range in age from about 10 to 60 years of age and weigh 2.2 kg to 11.5 kg. Seven hatchlings recovered in 2006 from these tortoises are being raised on the Ladder Ranch in New Mexico. In 2007 more than 20 eggs have been identified by x-ray.

4. Create the political and managerial constituencies for the support of rewilding in Mexico and the United States.

David Morafka first proposed reintroducing Bolson Tortoises in Big Bend National Park over 20 years ago. We have restarted discussions with managers at the Big Bend National Park and begun discussions with other areas in Texas as well as with their counterparts across the Rio Grande. The idea of reintroducing Bolson Tortoises now seems like an idea whose time has come. On our time scale rewilding will take a long time, on the tortoises's time scale perhaps less so as their Holocene nightmare comes to an end.

Below: Entry sign for the Bolson de Mapimi Biosphere Reserve.

JAMES O. JUVIK

Turtle market survey in China reveals disturbing number of Myanmar endemics and critically endangered species

Gerald Kuchling

Burmese turtles have been illegally but heavily traded into China since 1993, with the bulk of traded species including the Burmese endemics *Lissemys scutata* and *Morenia ocellata*. In the late 1990s and the early 21st century some Burmese species which had not been scientifically recorded since the early 20th century (*Heosemys depressa*, *Kachuga trivittata*) were "rediscovered" at Chinese markets before wild populations could be located again in Burma, and a new species (*Chitra vandijki*) was scientifically described from turtles bought at Chinese markets prior to its discovery as a Burmese endemic.

Three species endemic to Burma, *K. trivittata*, *H. depressa*, and *Geochelone platynota*, are listed under the "world's top 25 most endangered turtles." The two species *K. trivittata* and *G. platynota* had once relatively large ranges in Burma, but most of their populations have been extirpated or nearly extirpated in the late 20th century. *H. depressa*, however, has a very restricted range in the Arakan mountains, but until recently exploitation pressure on this species appeared low. As would be expected from their rarity and endangerment, only small numbers of those three Burmese endemics on the "world's top 25 most endangered turtles" list were generally offered for sale on Chinese markets.

While on a TSA mission in China, I visited the Qing Ping turtle market in Guangzhou on 22 and 23 May 2007. The bulk of the turtles offered for sale were North American, in descending order of quantity: *Trachemys scripta elegans*, *Chelydra serpentina*, *Apalone ferox*, *Macrochelys temminckii*, *Apalone spinifera*. Next in bulk came evidently captive bred Chinese turtles: *Pelodiscus sinensis*, *Ocadia sinensis*, *Chinemys revesii*, *Mauremys mutica*. I did not estimate numbers for those species, but for evidently wild-caught SE Asian species, the next in bulk, I estimated the following numbers for sale:

Table 1: Estimated minimum numbers of turtles per species at Qing Ping market on 22—23 May 2007, all stalls combined, and range of species in neighboring countries (+: present):

Species	Numbers at Qing Ping	Burma	Vietnam/Laos
Amyda cartilaginea	2	+	+
Cuora amboinensis	50	+	+
Cuora galbinfrons bourreti	300		+
Cuora g. galbinifrons	300		+
Cyclemys sp.	120	+	+
Geoemyda spengleri	1		+
Heosemys depressa	80	+ (endemic)	
Heosemys grandis	3	+	+
Indotestudo elongate	200	+	+
Kachuga trivittata	1	+ (endemic)	
Lissemys scutata	60	+ (endemic)	
Manouria emys	100	+	+
Manouria impressa	90	+	+
Melanochelys t. edeniana	50	+	
Morenia ocellata	40	+ (endemic)	
Platysternon megacephalum	70	+	+
Pyxidea mouhotii	600	+	+

GERALD KUCHLING

Eighty Arakan Forest Turtles, endemic to Myanmar, were recently offered for sale in the Qing Ping market in China. This is one of four species ranked Critically Endangered by the IUCN Red List that were observed.

A rare Myanmar endemic, this female Burmese roofed turtle was also observed in the Qing Ping market and is emblematic of the extent and growing volume of illegal turtles flowing into China from that country.

GERALD KUCHLING

GERALD KUCHLING

Although over the last 15 years most turtle populations in Burma have been heavily exploited and dramatically reduced, the number of Burmese endemics on the market suggests that a large proportion of the SE-Asian turtles may have originated in Burma (though some species were also well represented that do not occur in Burma, but in Vietnam and Laos). Particularly shocking was the number of *H. depressa* relative to species like *M. ocellata* and *L. scutata,* which provided the bulk of the Burmese endemics in the illegal trade in the past. The restricted range and the mostly large, adult specimens of *H. depressa* (Fig. 1, 2) suggests that this species is presently specifically targeted for exploitation and export to Chinese turtle markets. This species may soon be cleaned out of its restricted forest habitat and move further towards the top of the "world's top 25 most endangered turtles."

Another shocking discovery was an adult female *Kachuga trivittata* (Fig. 3). Although the specimen had its right front limb missing (healed, old wound) and the 3rd and 4th digits were ½ missing on the left front foot, it clearly had claws on digits 1, 2 and 5 (no claw on 5 in *Batagur baska*). And the head and shell form was not that of an adult female *Callagur borneoensis* (apart from the total lack of other Malay/Indonesian species on the market), which would be the two most similar species and sometimes difficult to distinguish from *K. trivittata*. Given the extreme rarity of *K. trivittata*, even one adult female represents a significant proportion of the world population of the species.

It is clear that this short survey only represents a snap shot of the turtle trade in China and may under-represent some species, in particular those of high trade value (e.g. *G. platynota*), which may not have been openly displayed. What is on offer on a particular day may also depend from which region transports recently arrived. For example, in April/May 2007 several turtle shipments from Vietnam have been confiscated. Apparent was the lack of turtles from the Indian subcontinent and from Malaysia/Indonesia. The good representation of wild-caught Burmese turtles at the Qing Ping market suggest that law enforcement and confiscation of illegal shipments is largely lacking along the trade route from Myanmar into China.

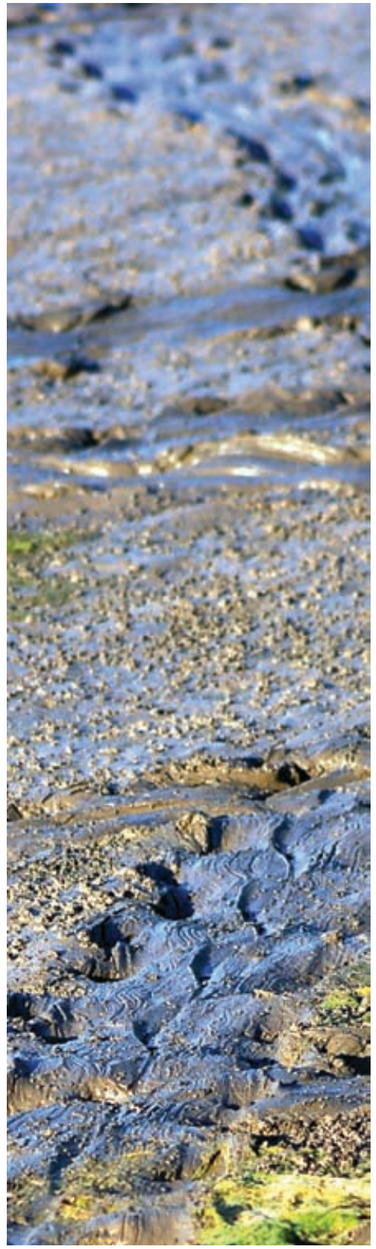
TSA supports the return of Alligator Snappers to Oklahoma

Day Ligon

A group of radio-transmittered Alligator Snapping Turtles awaiting release at Tishomingo National Wildlife Refuge. Monitoring via radio telemetry and mark-release is planned to continue through at least 2010.

Ongoing Alligator Snapping Turtle (*Macrochelys temminckii*) conservation efforts in Oklahoma got a boost in early 2007 with the translocation of over 250 adult turtles to the southern part of the state from the Joe Hogan State Fish Hatchery in Arkansas. The turtles had been moved to the hatchery after being confiscated following permit violations by a nearby commercial turtle breeder. A lot of manpower was necessary for assessing, processing and transporting the turtles, and was provided by volunteers from the Tulsa Zoo, Oklahoma State University College of Veterinary Medicine and Zoology Department, Tishomingo National Fish Hatchery and U.S. Fish and Wildlife Ecological Services, Tishomingo National Wildlife Refuge, University of Central Arkansas, West Texas A&M University, Arkansas Game and Fish Commission, and the Joe Hogan Fish Hatchery.

Health assessments were conducted on a subset of the turtles a month prior to moving them to quantify their condition after living for years under extremely crowded conditions, and to ensure that they did not carry parasites or pathogens potentially detrimental to conspecifics or other aquatic biota. Based on information available for the species, parasite loads and body condition compared favorably with those from wild *M. temminckii* populations.



Day Ligon, Kay Backues, DVM and Rebecca Bloch, DVM (left to right) examine an Alligator Snapping Turtle for ectoparasites during health assessments designed to gauge the suitability of a large group of snapping turtles for translocation.

As an additional precaution, intensive post-release monitoring of the turtles was a prerequisite to moving the confiscated turtles to Oklahoma, and much-needed funding for radio telemetry equipment was generously provided by the TSA, DELTA Foundation, and Tulsa Zoo Conservation Program. Sixteen adult turtles were equipped with transmitters to track movement patterns and survival rates over the next four years. Additionally, mark-recapture monitoring techniques were started to keep track of the new population, as well as to measure effects of the reintroduction on the existing turtle community.

Alligator Snapping Turtle conservation is not new to Oklahoma. Rusty Grimpe, former curator of reptiles and amphibians at the Tulsa Zoo, published some of the first detailed descriptions of captive breeding *M. temminckii* in 1987. Comprehensive state-wide population surveys were conducted a decade later, and in 1999 a headstart program was initiated by Tishomingo National Fish Hatchery and Sequoyah National Wildlife Refuge in response to the steep population declines that had been documented. Consistent production of hatchlings at the hatchery began in 2002, and in the intervening years, care has been taken to validate each step of the headstart process, from captive husbandry of adults and juveniles to post-release survival. In addition, a thorough analysis of the genetic composition of *M. temminckii* populations in the state was completed in 2006 by researchers at Oklahoma State University, and detailed egg incubation protocols for the species were developed.

Supplementing established head-start efforts with this large group of reproductively mature *M. temminckii* is expected to benefit conservation efforts in southern parts of Oklahoma by advancing *in situ* reproduction by more than a decade, and by immediately establishing normal population demographics. In coming years, reintroductions of head-started juveniles are expected to continue in river systems throughout the eastern one-third of the state following intensive site-specific sampling to ensure that native populations are not impinged upon. Finally, discussions have been initiated with neighboring states to explore expanding the range of release sites to include other regions in the Mississippi River drainage where Alligator Snapping Turtles have declined.

Daren Riedle and Aaron Goodwin drill small holes in a unique combination of marginal scutes to facilitate individual identification following release of the turtle.

Rusty Grimpe (Tulsa Zoo) prepares a snapping turtle for processing prior to transporting it and over 250 conspecifics to Oklahoma for release.

Update on the International Center for the Conservation of Turtles in Münster

Martina Raffel

The International Center for the Conservation of Turtles (ICCT) is **a** breeding facility for critically endangered Asian turtles located at the Allwetter Zoo in Münster, Germany. The ICCT has been supported by the Turtle Conservation Fund and Conservation International amongst others, and has already achieved some notable breeding successes. After operations started in October 2003 with the completion of the first breeding room, the whole 'BioCity' complex at the entrance of the zoo was inaugurated in July 2005. Besides the turtle breeding centre consisting of two rooms (one each for tropical and subtropical species), this building also features an information and education centre on biodiversity – with the Asian Turtle Crisis as one of its major subjects. Viewing possibilities into the breeding facility are supplemented by large signboards with information about the species kept within the center (Table 1), exhibition tanks with attractive species, hands-on elements for children and a touch screen that presents playful short films on the *in situ* conservation projects of Münster Zoo and its partners. The associated "Research Workshop" with a laboratory, computer work stations and media equipment aims to inspire pupils towards science, engagement in nature conservation and sustainability.

The ICCT features an information and education centre on biodiversity – with the Asian Turtle Crisis as one of its major subjects.

Table 1. Species currently cared for within the ICCT.

Scientific name	Common name
Chinemys megalocephala	Chinese Broad-headed Pond Turtle
Chinemys nigricans	Red-necked Pond Turtle
Cuora amboinensis	South Asian Box Turtle
Cuora aurocapitata	Yellow-headed Box Turtle
Cuora mccordi	McCord's Box Turtle
Cuora (galbinifrons) galbinifrons	Vietnamese Box Turtle
Cuora (galbinifrons) bourreti	Bourett's Box Turtle
Cuora (galbinifrons) picturata	Southern Vietnam Box Turtle
Cuora flavomarginata evelynae	Ryukyu Yellow-margined Box Turtle
Cuora trifasciata (Southern Chinese form)	Golden Coin Box Turtle
Cuora trifasciata ('meieri', Northern Vietnamese form)	*
Cuora trifasciata ('cyclornata', Central Vietnamese form)	*
Cuora pani	Pan's Box Turtle
Cuora zhoui	Zhou's Box Turtle
Chelodina mccordi	Roti Island Snake-necked Turtle
Heosemys depressa	Arakan Forest Turtle
Leucocephalon yuwonoi	Sulawesi Forest Turtle
Mauremys annamensis	Annam Leaf Turtle
Melanochelys tricarinata	Tricarinate Hill Turtle
Notochelys platynota	Malayan Flat-shelled Turtle
Ocadia sinensis	Chinese Stripe-necked Turtle
Sacalia quadriocellata	Four-eyed Turtle

* The validity of these newly classified forms is still being discussed.

The first breeding success was celebrated in 2004 with the hatching of Roti Island Snakenecks (*Chelodina mccordi)* in September, followed by one Golden-headed Box Turtle (*Cuora aurocapitata)* and three McCord's Box Turtles (*C. mccordi)*. In 2005, five *C. mccordi*, four Zhou's Box Turtles (*C. zhoui)*, two Golden Coin Box Turtles (*C. trifasciata)*, two '*Mauremys pritchardi*' (now considered a hybrid form and subsequently removed from the program), and one Vietnamese Box Turtle (*C. galbinifrons)* hatched. For the latter, Münster Zoo received the EAZA Shellshock Captive Breeding Award as this was the first successful breeding of this *Shellshock Red Alert* species in a European zoo. 2006 was a very successful year with a total of almost 80 turtle offspring (Table 2), among them the first ever European breeding of the Sulawesi Forest Turtle (*Leucocephalon yuwonoi*). Regrettably, this offspring only survived for three months. The parents, however, have already mated again and we are hopeful that this species will reproduce successfully in 2007. This year, more than 100 fertile eggs of nine taxa have been laid so far with more expected soon.

Besides establishing breeding and assurance colonies in captivity, the ICCT also aims to preserve turtles in their natural habitats. A first study in China was conducted in autumn 2006 in cooperation with the Museum of Zoology Dresden by means of the EAZA Shellshock Campaign. According to this survey, *C. aurocapitata* appears to have been collected heavily from the wild, possibly to the point of near extinction. Though some intact habitat for *C. aurocapitata* remains, pressure from turtle collectors remains high and the future for this species in the wild is dismal.

Top: In 2006, the ICCT recorded the first ever European breeding of the Sulawesi forest turtle.

Bottom: The Münster Zoo received the EAZA Shellshock Captive Breeding Award for the first European successful zoo breeding of a Vietnamese Box Turtle, a Shellshock Red Alert *species.*

Table 2. Offspring produced in 2006.

Scientific name	Number of hatchlings in 2006
Chinemys megalocephala	5
Chinemys nigricans	29
Chelodina mccordi	5
Cuora aurocapitata	7
Cuora flavomarginata evelynae	2
Cuora mccordi	3
Cuora trifasciata	8
Cuora zhoui	8
Leucocephalon yuwonoi	1
Mauremys annamensis	10

Veterinarians to the Rescue: Caring for a Confiscated Group of Forsten's Tortoises

Sam Rivera

A large group of *Indotestudo forstenii* was placed under the custody of the TSA in March 2007. This tortoise, also know as Forsten's Tortoise, inhabits the islands of Sulawesi and Halmahera in Indonesia and is currently listed in CITES appendix II. A large percentage of the tortoises were in poor health and were subsequently placed in facilities where veterinary care was readily available, including the Bronx Zoo (Bronx, NY), the New England Aquarium (Boston, Massachusetts), the Fort Worth Zoo (Fort Worth, Texas), Lake Howell Animal Clinic (Maitland, Florida), and Zoo Atlanta (Atlanta, Georgia).

The tortoises' condition was dire. Some of the clinical signs included anorexia, lethargy, ulcerations in the oral cavity, nasal and ocular discharge, and diarrhea. Many were tested for the usual (and not so usual) suspects such as mycoplasma, chelonian herpesvirus, intranuclear coccidia, and intestinal parasites. The first culprit identified was amoeba. Many of the tortoises that died had severe amoebiasis and septicemia, but this was suspected to be the result of a more serious underlying illness. The tests for mycoplasma, chelonian herpesvirus, and intranuclear coccidian were all negative. However, the pathologists found evidence of severe damage to multiple organs consistent with a systemic viral infection. The sick tortoises were treated with antibiotics, antiparasitic medications, parenteral fluids, and nutritional support.

Polymerase chain reaction testing of tissues and choanal swabs from affected animals were positive for an adenovirus. Sequencing data revealed an adenovirus that has not been described in reptiles. Currently, there is ongoing work to further characterize this novel adenovirus.

Many of the surviving tortoises tested positive for the adenovirus; their future is still uncertain. This case demonstrates the importance of thorough diagnostics in chelonians of unknown origin that are showing high morbidity and mortality rates. It also emphasizes the importance of strict quarantine guidelines.

SAM RIVERA

Top: The quarantine set up for Zoo Atlanta's group of Forsten's Tortoises.

Below: Despite their various pathologies and diseases many of these tortoises displayed a surprisingly healthy appetite.

SAM RIVERA

SAM RIVERA

The TSA is extremely grateful to the clinicians, pathologists, and scientists that have contributed immensely to the elucidation of this mysterious illness. They include; Orlando Diaz-Figueroa, DVM, MS, Dipl. ABVP(avian) from Lake Howell Animal Clinic, Maitland, FL; Salvatore Frasca Jr, VMD, PhD, DACVP, Akinye Nyaoke, BVM, MSc, and Guillermo R. Risatti, DVM, PhD from the Dept. of Pathobiology and Veterinary Science, University of Connecticut, Storrs, Connecticut; Michael M. Garner, DVM, Dipl. ACVP from Northwest ZooPath, Monroe, WA; Christopher R. Gregory, DVM, PhD and Rita McManamon, DVM from the Infectious Diseases Laboratory, Zoo and Exotics Path Services, Dept of Small Animal Med, UGA, Coll of Vet Med, Athens, GA; Charles J. Innis, VMD from the New England Aquarium, Boston, MA; Annajane B. Marlar DVM, MRCVS, Dipl. ACVO from the Fort Worth Zoo, Fort Worth, TX; Bonnie L. Raphael, DVM, Dipl. ACZM from the Dept of Clinical Care, WCS, Bronx, NY ; and James F.X. Wellehan Jr., DVM, MS, Dipl. ACZM, Dipl ACVM(virology, bacteriology/mycology) from the Zoological Medicine Service, Coll of Vet Med, UF, Gainesville, Fl.

New habitat design for Sulawesi Forest Turtles at Zoo Atlanta

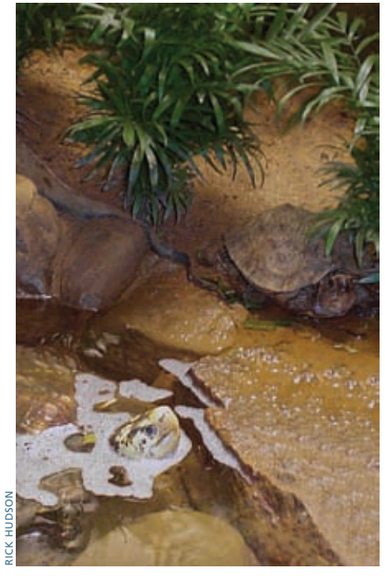
Brad Lock

In 2006 Zoo Atlanta built two new behind-the-scenes stream/pond habitats for their two breeding groups of Sulawesi Forest Turtles (*Leucocephalon yuwonoi*). The habitats extend out from the wall approximately 3 meters and the main pond ranges in depth from 8 – 10 cm to .6 meters. Each habitat has two small streams with three small ponds or depressions in each that flow into the main pond. The animals spend the majority of their time in the small pond/stream system and a significant amount of the time on land. One male and three females are currently housed in each habitat. Since placing the 1.3 *L. yuwonoi* in each new breeding habitat, four eggs have been deposited and at the time of this article, at least two appear to be viable. *L. yuwonoi* is considered problematic in captivity, and to date there have been only three instances of captive reproduction, two in the U.S. and one in Europe. Stress appears to be a contributing factor to poor reproductive success and large enclosures with multiple water features such as these allow for at least partial segregation of the sexes. Space considerations should be a driving factor when designing new *yuwonoi* habitats, especially for wild-caught adult specimens.

RICK HUDSON

RICK HUDSON

Above: One of two breeding enclosures specifically designed to meet the needs of Sulawesi Forest Turtles, a stress prone species with a dismal breeding record in captivity. Live plants, ample UV light, flowing water and multiple pools for isolation will hopefully contribute to improved breeding success



RICK HUDSON

Left: A pair of Sulawesi Forest Turtles in their new off-exhibit breeding facility at Zoo Atlanta

A Collaborative Effort to Save the River Terrapin in Cambodia

Heng Sovannara and Joe Walston

The Sre Ambel and Kaong Rivers in the remote coastal area of Cambodia, are home to what is thought to be the region's sole remaining population of River Terrapins (*Batagur baska)*. Critically Endangered throughout their range, *B. baska* was thought to be extinct in Indochina up until the discovery of this small population in 2000 by the Wildlife Conservation Society's (WCS) Cambodia program. Since the inception of the subsequent conservation initiative the status of the population has gradually stabilized and the future of Cambodia's royal turtle is looking decidedly less bleak.

RICK HUDSON

This new headstart facility was built in 2006 near Sre Ambel Cambodia with funding from the TSA and the EAZA Shellshock campaign.

The *Batagur baska* project is a collaborative effort between WCS, the Fisheries Administration (FiA), and the local communities surrounding the Sre Ambel and Kaong Rivers. In 2007, as in previous years, the primary focus has been on the guarding of nesting beaches and the adjoining sections of river throughout the nesting and incubation seasons. During the nesting season two conservations teams were deployed, one, along each river, to identify *B. baska* nests and to construct temporary enclosures around each one to ensure protection from predators and disturbance. This year three nests were located, containing a total of 63 eggs. Although the number of nests was lower than in some previous years, one of them was from a female that had last nested three years ago, indicating that there may be more breeding females than the nests suggest.

At the end of May, 47 hatchlings emerged, all of which were taken to the Terrapin holding center in Sre Ambel to facilitate further protection. This center was built in 2006 with funding from the TSA and the EAZA Shellshock campaign, and represents a significant achievement for the conservation program, as it allows for the release of terrapins into the wild to be controlled and monitored. The majority (approximately 70%) of the hatchlings will be integrated into the center's nascent captive breeding program while the remainder will be released into their natural habitat in August. The objective of these activities is to find a balance between head-starting some animals to reduce the likelihood of mortality and the need to keep a regular number of animals entering the population naturally. This year's hatchlings joined 47 of last season's yearlings and one juvenile which was rescued from a fisherman's gillnet earlier in the year.

HENG SOVANNARA

Signs along the Sre Ambel River provide local awareness for the plight of Batagur *and urge fishermen to release turtles trapped in nets.*

This year has also seen the successful release of a proportion of last year's hatchlings and the event provided an ideal opportunity to raise awareness of the conservation project's objectives and achievements among the local communities. The release ceremony was attended by villagers, school children, local and national officials from the FiA and the Country Program Director of WCS. The FiA and WCS have always placed a strong emphasis on the inclusion of local people within the project's development and project staff have continued to devote considerable time and resources to community outreach. This is aimed at mutual understanding between the needs of fishing communities and the need to protect *B. baska*. This year's

PHOTOS THIS PAGE BY RICK HUDSON

Dr. Paul Calle (WCS) trains Sitha Som (CI Cambodia) and Heng Sovannara (WCS Cambodia) in PIT tag implant techniques.

activities have also included the production of conservation education media such as signboards, which were erected along the rivers, school exercise books for local children, and a 30 minute *Batagur baska* conservation documentary which was shown on national television. Meetings were also convened by project staff to keep fishermen informed on project activities, the importance of turtle protection and on the new fisheries law.

Community participation in the nest protection activities and, most recently, the handing-in of a juvenile animal accidentally caught by a local fisherman, are positive indications that the conservation message is finding a receptive audience. In terms of the ecological dimensions of the project, the fact that numbers of hatchlings have remained relatively stable since 2002 is hugely encouraging for a species that was probably undergoing massive and steep decline in the years before the project began.

Cambodia's *B. baska* population still faces many challenges, analogous to those being experienced by all of the country's wildlife. These include habitat loss and degradation, mainly though land clearing and conversion to agricultural use, and further threats from poaching and illegal fishing practices. Although their status remains critical, the project has given the species a fighting chance and is now looking to build a secure future for Cambodia's national reptile.

Paul Calle instructs Sitha and Heng on proper antiseptic technique.

RANGE COUNTRY: Malaysia

Temperature-dependent sex determination studies in the River Terrapin

Gerald Kuchling, Chan Eng Heng, and Soh Chong Leng

A main focus of the Setiu and Dungun River Terrapin (*Batagur baska*) Research and Conservation Program in 2006/07 was the evaluation of egg incubation in wild nests, translocated nests (eggs reburied), and artificial incubation in styrofoam boxes and incubators. At the Dungun River, a total of 564 eggs were deposited along the two major nesting banks (Pasir Kumpal, 33 nests and Pasir Tok Chu, 11 nests) between January-March 2006, with all the eggs incubated on the sandbanks. The first four nests had to be excavated and kept in plastic basins due to severe flooding from 10-16 February 2006, but they were reburied in the riverbank after flooding had fully subsided. Nests in Pasir Kumpal were allowed to incubate *in situ* and in 10 nests the temperature was monitored with data loggers. Nests in Tok Chu were excavated on 23 March and placed in styrofoam boxes of sand for continued incubation at the University Malaysia Terengganu.

A newly hatched Batagur *with the egg-tooth.*

At the Setiu River, a total of 387 eggs were successfully purchased from egg collectors for incubation. The eggs were from 24 different clutches. Sixteen clutches were each incubated in separate styrofoam boxes of sand, with 12 boxes placed in an indoor incubation room (temperature range of 30.0 – 39.0^{0}C, average of 32.4 ± 2.3 ^{0}C) and 4 in a roofed and well-ventilated shed (temperature range of 28.0 – 34.0 ^{0}C, average of 30.7 ± 2.0 ^{0}C). The remaining 8 clutches were incubated in 3 temperature-controlled incubation boxes in which the temperatures were also monitored with data loggers (mean temperatures of 29.7°C and 31.7°C).

The Turtle Survival Alliance funded trips of Gerald Kuchling to Malaysia in February and May 2007 to sex headstarted *B. baska* from the 2006 nests by endoscopy. The temperature monitored nests at the Dungun River all showed mean incubation temperatures of roughly 32.5°C. Forty five juveniles of those were sexed and all found to be female (0% males). As part of his UMT Masters program, Soh Chong Leng sexed endoscopically under Kuchling's supervision 66 headstarted *B. baska* hatchlings from the temperature-controlled incubation boxes. The combined results of these studies suggest that *B. baska* has a pivotal temperature (that produces an equal sex ratio) close to 31.5°C, with mainly males being produced at lower temperatures and mainly females at higher temperatures. However, due to technical problems with the incubator boxes, all incubation temperatures fluctuated. The constant temperature pivotal temperature may be slightly different (e.g., higher).

Thus, the large tropical Asian-sandbank-nesting river turtle *B. baska* seems to have a similar high pivotal temperature (where an equal sex ratio is produced) as the large tropical South American-sandbank-nesting river turtles *Podocnemis expansa* and *P. unifilis*. This may not be a surprise for a turtle biologist, but it could be for some US zoos that were already breeding and artificially incubating *B. baska* eggs for many years, presumably most of them at masculinizing temperatures. In addition, more than 30 years of *B. baska* egg collection, incubation, head starting and release programs in Malaysia have not yet translate into any stabilization of the wild populations which are still in steep decline. Although it is difficult to evaluate retrospectively what went wrong, the possibility of such programs producing heavily biased sex ratios is a reality (see TSA Newsletter Feb. 2005). Recovery and conservation programs of critically endangered species that include nest translocations and/or captive breeding should never proceed without investigating the male and female producing incubation temperatures at the start of the project, even if a species (e.g. a softshell turtle) is believed not to have TSD (see report on *Chitra chitra*, this newsletter). Since this can be done by endoscopy without sacrificing any offspring, there is no longer any excuse for not evaluating sex ratios immediately in all recovery projects of critically endangered turtles.

Workers rescue Batagur *eggs from a waterlogged beach nursery in Malaysia.*

RANGE COUNTRY: Thailand

TSA assists breeding program for Siamese Narrow-headed Softshell Turtle

Gerald Kuchling, Wachira Kitimasak, and Jonathan Murray

Based on recommendations of the TSA-sponsored evaluation of the *Chitra chitra* captive breeding program of the Kanchanaburi Inland Fisheries Development Center (KIFDC) in January/February 2006 (see TSA Newsletter August 2006), several changes were implemented regarding husbandry and egg incubation. According to the ultrasound assessment of gonadal activity of the adult breeding stock in early 2006, the only remaining adult female *Chitra*, which had not laid any eggs since 2002, was moved into a different pond with two different males. One of the males she was originally paired with was in poor health and the second one was relatively small, whereas the two new males were large and in good condition.

GERALD KUCHLING

This beach was supplemented with additional sand to create a more suitable nesting environment, one of a number of husbandry modifications funded by the TSA.

Again on a TSA mission in early 2007, Gerald Kuchling continued the histological examination of gonads of dead juvenile *C. chitra* and confirmed the preliminary results from 2006 of a male-biased sex ratio of captive-bred juveniles (now standing at about 80% males). In the past, eggs were incubated in sand in a drum placed in a shed without temperature control. In late January 2007, Gerald and Jonathan Murray delivered three new TSA-financed electrically heated incubators to Wachira Kitimasak (KIFDC), which were soon put to good use. The husbandry changes enabled the female *Chitra* to produce eggs again after a five year pause, and she laid four clutches of 25, 60, 63 and 60 eggs during February - April 2007however several eggs were broken during nesting and some eggs were smaller than usual. When this female last reproduced in 2002, her eggs were also smaller than those of another female (which is no longer available).

A proportion of the eggs were incubated at constant temperatures of 29, 31, and 33°C. Once the hatchlings have grown enough they will be sexed by endoscopy to evaluate if *C. chitra* hatchling sex ratios depend on incubation temperature. Ten eggs had hatched by April-May 2007.

WACHIRA KITIMASAK

The incubators allow for three temperature regimes to determine if a TSD pattern exist for the Siamese Narrow-headed Softshell Turtle.

WACHIRA KITIMASAK

An artificially incubated C. chitra *hatching.*

RANGE COUNTRY: **Myanmar**

Last Chance for the Burmese Roofed Turtle

Kalyar, Win Ko Ko, and Rick Hudson

The Burmese Roofed Turtle, *Kachuga trivittata*, is critically endangered and considered one of the most at-risk species in the world today. The goal of the field research and recovery program is to prevent the immediate extinction of this Myanmar endemic and to secure its future through a range of conservation actions, aimed at both the wild and captive populations. A wild breeding population is known only from the upper Chindwin River, and this is the current focus of field program activities, managed by the Wildlife Conservation Society (WCS) turtle conservation team. A base camp and head-starting facility was constructed in Limpha village in 2006, centered near all potential nesting beaches along the upper Chindwin River. In the 2006-2007 season, nesting occurred as early as 12 December 2006 and continued through 19 March 2007. During this period a total 152 eggs were recovered for incubation. Approximately seven females were thought to have nested on these beaches and, excluding damaged eggs, clutch size averaged 21.7 eggs (n=7; range=4-37). Females excavate one to eight holes to deposit eggs; although there was no direct observation of nesting activity, tracks indicated that adjacent holes on the same beach were made by a single female.

WIN KO KO

Translocated clutches of eggs are moved to this fenced enclosure on Linpha beach for protection and hatching.

Each nest was carefully excavated from the beach, transported to the base camp, and incubated separately in a purpose-built fenced enclosure. According to local informants, eggs from 2 additional nests were collected by villagers to eat. According to the GPS measurements of nesting beaches and potential beaches, *K. trivittata* nest along a 65-mile stretch of the upper Chindwin River. Incubation periods ranged from 70 to 170 days. Eggs deposited in December and March hatched about the same time. To date, hatching success for 2007 is 32 out of 152 eggs (20%), down from 2006 when overall hatching success was 38% (range=0 to 94%). Based on the results of this work, changes in incubation methods are urgently needed to improve hatching success, otherwise the eggs should be left *in situ.* Data loggers were deployed in the translocated nests in 2007 and that data will hopefully shed some light on this situation.

WIN KO KO

From eggs collected during the 2005-2006 nesting season, 71 1-year old turtles remain at the upper Chindwin head-starting facility and 16 hatchlings are being raised at the Yadanobon Zoo in Mandalay. Repeated measurements of hatchlings indicate growth rates are slower during the winter season. The growth rate of hatchlings was considerably higher at Yadanobon Zoo when compared with the Chindwin facility, most likely due to superior diet provided at the zoo. Hatchlings at the Chindwin facility are fed primarily locally grown vegetables. However, hatchlings at the Chindwin facility are more active and exhibit good shell development. Since initiation of the project, survival of hatchlings at both facilities has been 99%.

A heightened sense of urgency now exists for this species. Dam construction is already underway that will flood the last known nesting habitat of *K. trivittata* in less than five years. The highest elevation of nesting beaches is 480 feet above sea level based on GPS measurements. Given that the planned dam and impoundment (estimated area of 539 sq miles) will raise the water level a minimum of 580 feet above sea level, those nesting beaches will be inundated. One hundred and seventy four villages, including the turtle project base camp, will be moved in 2010. This means that we have roughly five years (projected date of completion) to determine how to breed and manage this turtle in captivity in the event that the wild population becomes extinct. The potential for this is far greater once the river is dammed. Additionally, it is extremely important that rivers where *K. trivittata* historically occurred be evaluated as potential reintroduction or relocation sites.

Given the critical nature of this situation, and the impending loss of the remaining wild breeding population, a Species Recovery Workshop for *K. trivittata* is being planned for November 2007 in Mandalay. A small group of chelonian conservation biologists will gather to draft a sound and aggressive conservation strategy for *K. trivittata* that should address the following questions and issues that will ultimately determine the survival of this species:

- How many additional captive "assurance colonies" are needed in addition to the one at Yadanabon Zoo?
- Where should these be located and how will they be financed?
- What should be done with future hatchlings from wild nests on the Upper Chindwin? What percentage should be retained for captive management, and how many should be released?
- Should subadult and juvenile *K. trivittata* caught in fishing nets be brought into the captive population?
- Can habitat mitigation measures be planned that will reduce the extinction risk of the wild population? Can artificial nesting habitat be created prior to impoundment?
- What education and awareness messaging should be aimed at local villagers within the range of *K. trivittata,* both now and in the future?

We are in a race against time with the Burmese Roofed Turtle and the next few years will be critical to the survival of this species. From the perspective of the primary collaborators on this recovery program – WCS and TSA – we must be willing to engage the best turtle conservation biologists in the world and then marshal the financial resources to support their efforts. An important step will be the Recovery Plan workshop late in 2007. Stay tuned and please respond to requests for funding.

WIN KO KO

This freshly laid nest has been marked and awaits excavation and translocation to a riverine hatchery.

Juvenile Burmese Roofed Turtles bask at the headstarting facility on the upper Chindwin River.

WIN KO KO

New Captive Facility for Burmese Roofed Turtles Opens

Rick Hudson

The Turtle Survival Alliance (TSA) is pleased to announce that efforts to save one of the world's most endangered turtles took a major step forward recently. A new captive breeding and management facility for the Burmese Roofed Turtle, *Kachuga trivittata*, was officially opened on 2 December 2006 at the Yadanobon Zoo in Mandalay, Myanmar. This project is a joint endeavor of the TSA, the British Chelonia Group (BCG), and the Wildlife Conservation Society (WCS). Dr. Tint Lwin (Yadanobon Zoo), Bill Holmstorm (WCS), Win Ko Ko (WCS) and Rick Hudson (TSA) helped coordinate the opening ceremony that was attended by representatives from the Myanmar Forestry Department, the Yadanabon Zoo, Crystal Perception engineering firm, and faculty and students from the University of Mandalay. The opening culminated with the release of 2.3 adult *K. trivittata* into the breeding pond; turtles were released at the nesting beach and allowed to slowly find their way to the water in hopes that the females would orient to this area when it comes time to nest. Due to the large size of the breeding pond, four adults were fitted with radiotransmitters so they could be monitored. It was especially gratifying to see one of the males up basking on the ramp to the nesting beach, and the females feeding on floating vegetation, the next day.

RICK HUDSON

Adult females make their way down the ramp from the nesting area, heading to water.

The new facility also features a floating basking platform, a fenced feeding area, a water hyacinth-filled biological filtration pond, security fencing and a juvenile rearing area with six grow-out ponds. Sixteen 2006-hatched *K. trivittata* hatchlings, collected from wild nests on the Upper Chindwin River, are now being raised here. Construction funds were provided by the BCG and the TSA through grants from the Batchelor Foundation and Walter Sedgwick.

The Burmese Roofed Turtle recovery program is proving to be a model example where field and captive efforts are strongly linked and support one another. This year the WCS turtle team located eight wild nests and collected 88 hatchling *K. trivittata* for head starting, 16 of which were brought to Yadanabon Zoo. Several subadults trapped in fishermen's nets on the Chindwin were also turned over to the WCS team and often incorporated into the breeding program. With dam construction already begun, and the remaining known nesting habitat of this species projected to be underwater within five years, the captive management program takes on a greater sense of urgency. Within the next few years biologists must collect critical data on natural nesting ecology, particularly incubation temperatures and TSD patterns, as well as determine how to successfully breed and raise *K. trivittata* in captivity. To address these as well as a range of other questions and concerns, plans are underway for a Species Recovery Workshop, to be held late in 2007 in Mandalay.

RICK HUDSON

The new breeding pond at the Yadanabon Zoo is large and features a nesting beach, a floating basking platform and a fenced feeding area to assist with capture.

The TSA is also developing plans for two new breeding facilities for the Burmese Star Tortoise, *Geochelone platynota*, in Myanmar. The first will be at the Minsontaung Wildlife Sanctuary, in conjunction with EAZA Shellshock, the second at the Yadanobon Zoo in collaboration with WCS and others. Both places already have successful breeding programs but the facilities are either too small or lack adequate security.

RICK HUDSON

This "growout" facility at Yadanabon Zoo was designed to hold various sizes of growing Burmese Roofed Turtles.

Opening ceremony for the new breeding and management facilities for Burmese Roofed Turtles, Yadanabon Zoo, Mandalay.

RICK HUDSON

Bill Holmstrom holds an adult male Burmese Roofed Turtle, equipped with radio transmitter, prior to release into the breeding pond.

RANGE COUNTRY: **Mexico**

Conservation of the Central American River Turtle in Veracruz

Gustavo Aguirre

Historically, fishing in inland waters was an activity that provided food for small scale consumption by local people. After the 1970s, fishing began diversifying and growing in scope. Rural fishermen represent an impoverished sector that labors intensively, lacks organization, and generally woks at a subsistence level. Besides fish, these fishermen capture other aquatic vertebrates such as turtles, crocodiles, caiman and otters. In particular, freshwater turtles are important to inland water fishermen and represent a significant source of protein to local people. However, there are no statistics on their capture and trade because of the illegality and hence clandestine nature of this activity in Mexico, despite the fact that turtles have been protected by Mexican environmental and wildlife laws since 1994.

This floating module in Veracruz, Mexico is designed as a sustainable ecotourism-based model that promotes the large-scale production of Dermatemys.

Thirty one freshwater turtle species are present in Mexico, and southern Veracruz supports one of the most diverse assemblages of these reptiles in the country. Nine species are distributed there, including *Chelydra rossignoni*, *Dermatemys mawii*, *Rhinoclemmys areolata*, *Trachemys venusta*, *Claudius angustatus*, *Kinosternon acutum*, *Kinosternon leucostomum*, *Kinosternon scorpioides* and *Staurotypus triporcatus*. Most populations of these taxa are under excessive pressure for human use and have been locally extirpated in some areas. This situation makes it necessary to expand research activities that are oriented towards developing alternatives to using turtles, or promoting their use in a sustainable manner. Such activities should discourage illegal trade, while promoting wise use of the resource and creating a positive impact on the rural people that depend on these resources.

In the state of Veracruz, located along the coast of the Gulf of Mexico, a number of initiatives for the protection of threatened freshwater turtles are underway. The establishment of a State Committee in 2004 to protect, conserve and manage wetlands, has promoted the consolidation of task forces dealing with related conservation issues such as threatened freshwater turtles. The prospects for the conservation of the endangered river turtle, *Dermatemys mawii,* in Veracruz are promising. In the last three years two internationally designated Ramsar sites, comprising 268,985 hectares of wetland habitat, have been established within the range of *Dermatemys* in Veracruz. They are "Humedales de la Laguna La Popotera" and "Sistema Lagunar de Alvarado" and

An inside view of the module containing groups of young Central American River Turtles and soil areas for cultivating forage plants.

management plans for these two sites are now being developed that will consider conservation strategies for *D. mawii.*

In Ramsar site No. 1462 "Humedales de la Laguna La Popotera" ecotourism and environmental education are being promoted in coordination with a local fishing group, Sociedad Cooperativa de Pesca "La Popotera." This initiative aims to provide employment to fishermen through low- impact ecotourism and sustainable use of wetland resources, and to discourage overexploitation of threatened species including several turtles. With this idea in mind, a floating module for environmental education was designed and built with support from the Turtle Survival Alliance (TSA). This is a demonstration module that contains both hydroponics and aquaculture pilot systems, and that illustrates a technique for maximizing sustainable use of wetlands.

The floating module has two vegetable production containers for raising turtle forage and two units holding *Dermatemys.* Written information is provided concerning freshwater turtles and their protected status. The module is installed on the Papaloapan River at the entrance to the "la Popotera" Ramsar site where local fishermen gather. Printed materials are provided to visitors that illustrate productive alternatives to those with legal access to freshwater turtles; the situation for the critically endangered *D. mawii* is emphasized with suggestions for potential ways to help protect them at the local level. In the future we hope to develop other sustainable ecotourism-based models that promote the large-scale production of *Dermatemys*, thus relieving hunting pressures on natural populations.

BRIAN HORNE

The Central American River Turtle, Dermatemys mawii.

Indian turtle research and recovery program focuses on the National Chambal River Sanctuary

Shailendra Singh

The Turtle Project team of the Madras Crocodile Bank Trust (MCBT) started a variety of activities in National Chambal Sanctuary in late January this year, to meet the nest protection and headstarting targets determined for 2007 for the Red-crowned Roof Turtle (*Kachuga kachuga)* and the Three-Striped Roof Turtle (*Kachuga dhongoka)* as per the Indian Turtle Action Plan of the MCBT/TSA 2005 Workshop in Lucknow. Various sections of the Chambal River in Uttar Pradesh (UP) and Madhya Pradesh (MP) were rapidly surveyed in January to select locations for setting up *in situ* turtle hatcheries. Various criteria like turtle abundance, nesting habitat suitability, levels of human disturbance and logistic ease, and experiences of the previous year were used in the selection of the sites. Three localities, which included Garhaita and Baswara in UP and Rajghat in MP, were selected for setting up the riverside hatcheries for the turtle headstarting program for 2007. Four field assistants were engaged for each of the two hatcheries in UP and two for the hatchery in MP. Some of the persons engaged possessed experience of hatchery techniques from the previous year while some were new. Sessions in egg collection and hatchery techniques were conducted, both for training new workers and as refresher courses for those who had worked before.

The setting up of hatcheries in UP at two locations, namely Garhaita and Baswara, was completed by 31 January 2007. These hatcheries were located within 6 km of each other at about 30 km from the district town of Etawah. At each hatchery, an area 30m x 20 m on the Chambal River was fenced off against egg predators. The two hatcheries were located respectively on a sandbank and a mid-river island that were in no way different from nesting habitat of turtles and where nesting of turtles, in fact, occurs. The hatcheries were fenced using thorn bushes and old nylon fishnets as had been done in the previous year. However, in order to test a precautionary suggestion that shade from the thorn bushes may significantly affect the temperature regimes on that hatchery, the hatchery at Baswara was enclosed using fishnets only, while a double fence was used for the hatchery at Garhaita. Here, the outer fence of thorny branches of the exotic mesquite (*Prosopis juliflora*) enclosed, at a distance of 2m, the inner fence of nylon fish netting. These fencing materials had proved to be predator proof during the previous year and, because of low cost, were again used this year.

Three field assistants led by a researcher searched for turtle nests between 0600 to 0900 hr and 1600 to 1800 hr each day. The teams covered a section of river approximately 3km up and downstream of the hatcheries. Occasional nest searches were also conducted on islands and sandbanks at more distant locations during nesting surveys of river sections extending from 15 to 50 km from the hatcheries. Roughly 2400 man hours were spent in searching for nests at each of the hatcheries, during February to April 2007. Additionally, efforts were made to capture females during nesting emergences during hours of darkness.

Above: One of the many threats to turtles on the Chambal River is fishing, using either lines of hooks or nets. Here a female Kachuga dhongoka *is snagged on a hook.*

Right: This group of freshly hatched Three-striped Roofed Turtles will be marked with an ID tag and then released, in an attempt to assess survival rates in this species.

Earliest nesting of *K. dhongoka* was observed on 31 January 2007 in a nest that had been predated; the first nest collectecd for the hatchery was on 1 February 2007. The frequency of nesting activities such as crawl tracks, trial nests, and egg clutches began to intensify by the first week of February. This ceased for about a week, due to moderate but regular rainfall in the 2nd and 3rd weeks of February, and resumed thereafter. Nesting continued through the entire month of March before discontinuing, approximately in mid April.

A riverbank nesting habitat at a site called Chilonga in MP (ca. 3 km length; close to the Garhaita hatchery) is being kept under observation as a control site, to determine predation pressure. One hundred and twenty two natural nests of *K. dhongoka* were enumerated at this site but not collected in order to observe them throughout the incubation season. Till mid-April, predation in 93 nests was observed, suggesting that the egg protection and head starting program contributes significantly to improving the survival rates of *Kachuga* in the Chambal.

37 nests (697 eggs) of *K. kachuga* and 258 nests (5,871 eggs) of *K. dhongoka* and 6 nests (136 eggs) of *K. kachuga* and 219 nests (4,842 eggs) of *K. dhongoka*, were collected and are being incubated at the Garahaita and Baswara hatcheries respectively. Clutches transported to the hatchery were buried at the same depth at which the egg mass had been recorded in the nest. The clutches were incubated in holes excavated 100 cm away from each other. Plastic boards displaying clutch number, size, and date of collection of each nest have been fixed over each clutch for easy identification.

Nesting parameters such as nest-hole dimensions, and distances and heights of nests from the stream edge were recorded. Temperatures of all nests were recorded before collection of eggs using accurate and calibrated thermo-probes. Spoor width of all observed nesting crawls of turtles were measured. Dimensions of captured live turtles was also correlated with their spoors to develop a reliable method of estimating sizes of nesting females. Eggs were measured for random nests. All nesting females captured were measured and marked. All predated nests were recorded to quantify the predation rate. After recording predation of a nest the eggshells were covered in the nest holes, and nesting signs manually obliterated, to prevent recounting of predated nests already recorded. A total of 1,124 predated nests were counted on 10 nesting banks in UP from February through April 2007.

Nesting patterns and predation pressures on riverbanks as opposed to midriver islands will also be compared from our data. Since riverbanks are more prone to predation, more emphasis was placed on collecting the turtle nests from sandbanks rather than islands. Clutches have been separated from each other by close-packed stick fencing of 25- 30 cm in height to prevent hatchlings of nests incubated at specific temperatures or collected from specific areas from mixing with others. Turtle surveys to locate nesting and habitats for target species, commenced from early February and continue till now. 100 km out of the 172 km of the River in Uttar Pradesh and 250 km in MP Chambal were also surveyed to monitor turtle nesting and nesting habitats in the entire sanctuary. All locations were inventoried with the help of GPS and permanent reference points. Nest counts, including predated nests were done, besides the carapaces of all turtles found in net entanglements, whether dead or alive are being recorded and measured. Details of remains of adult dead turtles found so far in UP stretch are *Kachuga dhongoka (12), Kachuga kachuga (4), Hardella thurjii (15), Aspiderestes gangeticus (10), Chitra indica (2), Lissemys punctata andersonii (3) Pangshura tentoria circumdata (20).*

All observed human impacts on turtle activity and habitat are being recorded and comprise mainly agriculture, illegal fishing,

sand mining, fuel wood trafficking, cattle activity and camels. Information on poaching and other human dependencies on river have been collected as far as possible. One hundred forty five turtle nests were seen to have been robbed at Pachhaygaon sand bar in the month of February, while local villagers near Baswara village fed 17 nests of *dhongoka* to feral dogs. Extensive photographic records of dead turtles and illegal gear being clandestinely used in this Protected Area are being collected during the head starting and nest protection operations.

In MP preparation of a turtle hatchery at a sandbank near the Rajghat railway bridge, 20 km from Deori Gharial Rehabilitation Center in Morena district, was completed on 3 February 2007. 28 clutches (554 eggs) of *K. kachuga* and 37 clutches (937 eggs) of *K. dhongoka* are being incubated at this hatchery. In addition, six nests (105 eggs) of *K. kachuga*

Mid-river small islands, which emerge in late March to early April, have been observed to be important nesting sites for late nesters, especially *K. kachuga*. Untimely floods (water level rise due to water releases from upstream dams) during the mid-April, 2007 were observed to wash away five such *K. kachuga* nesting islands with 29 nests and inundated four other small nesting islands in a ca. 12 km stretch of the Chambal in UP while 41 nests of both species were washed away from six major nesting islands in MP.

Above: Newly hatched Three-striped Roofed Turtles are tagged and released along the Chambal River Sanctuary.

Below: This Kachuga *egg hatchery at Garhaita in the Chambal River Sanctuary has an exclosure fence to protect against nest predation.*

Shailendra Singh manages the India turtle conservation program for the TSA and is shown here measuring a nesting female Kachuga dhongoka.

and 9 nests (207 eggs) of *K. dhongoka* are also being incubated at the Deori Gharial center. A total 265 predated nests were observed from February to mid April during the surveys of the Chambal in MP. Eleven mid-river nesting islands (believed to be predation free) with 102 nests of *K. kachuga* and 202 nests of *K. dhongoka* are being monitored to determine their fate in Madhya Pradesh. These nests will be kept under observation continually until hatching. On hatching, hatchlings from some protected nests will be collected for captive rearing and head start program. All hatched nests will be excavated and checked for the presence of unhatched eggs and their numbers will be recorded. Temperature data loggers were deployed in 11 nests of both species in all three hatcheries, three wild nests and one of the natural nests that are being built with metal mesh by the UP Forest Department. Data loggers are also deployed to record soil, air, and water temperatures.

Hatching of *K. dhongoka* in 2007 began on 4 – 6 May at the Rajghat and Garhaita hatcheries. Hatchlings at Garhaita are collected and marked on the plastron with a permanent marker for identification. Hatchlings are measured, selectively photographed and tagged with colored plastic tags before being released during 0600-0700 hr and between 1700-1800 hr to reduce the risk of heat stress. Future plans include the rearing of 400 hatchlings of both species at the Deori (MP) and Garhaita (UP) turtle rearing facilities for the head-starting program. It is expected that in the coming season surveys, nest collection (headstarting) and trade monitoring will be initiated for another critically endangered target species of the Indian Turtle Action Plan, the Narrow headed Soft-shell Turtle (*Chita indica)* in Chambal River as well as the Sarju Rivers in North UP in the month of September. Post-monsoon recapture exercise is also proposed to determine the survivorship of head-started and released *Kachuga* hatchings in the Chambal River.

Training on various aspects of turtle biology and conservation like survey techniques, egg collection, and hatchery management has been given to several students, volunteers from different NGOs, and staff of the UP and MP State Forest Department. Education program are also conducted whenever possible, to make local communities aware about the diversity and conservation of turtles in the Chambal. The team members involved in the program are Shailendra Singh, Rishikesh K. Sharma, Ashutosh Tripathi, Dhruvjyoti Basu and Harry V. Andrews.

The MCBT Turtle Conservation Project is highly indebted to Mr. Rick Hudson and Dr. Brian D. Horne for their support, encouragement, and suggestions. The Turtle Survival Alliance, EAZA Shellshock, Batchelor's Foundation, Zoological Society of San Diego, Turtle Conservation Fund, and the Detroit Zoological Institute are gratefully acknowledged for funding the conservation of endangered Indian turtles through the current project.

TSA
TURTLE SURVIVAL ALLIANCE

Transforming passion for turtles into conservation action

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RANGE COUNTRY: **China**

TSA supports efforts to establish a breeding program for the last Yangtze Giant Softshell Turtle

Gerald Kuchling and Lu Shunqing

Female Rafetus *at Hunan Zoo, Changsha, in old enclosure in January 2007.*

The Yangtze Giant Softshell (*Rafetus swinhoei*) is arguably the largest freshwater turtle in the world, and the most critically endangered. A *Rafetus* Conservation Workshop in Suzhou from 20-21 September 2006 drafted an "Action Plan for the Conservation of the Giant Yangtze Softshell *Rafetus swinhoei*." Immediate priorities identified in this draft Action Plan include:

- Sexing of the known individuals of *Rafetus* at Shanghai Zoo, Suzhou Zoo and West Garden Buddhist temple in Suzhou.
- Input from turtle reproductive physiologists on how to get old turtles to start reproducing.
- Plans for housing and husbandry of animals.
- Recommendations for diet.
- Contact zoos, buddhist temples, safari parks, etc about large softshell turtles they may be keeping.

In January 2007 the TSA sent Dr. Gerald Kuchling to Suzhou in order to conduct a workshop with the Chinese stakeholders (Zoos, Chinese Zoo Association, West Garden Buddhist Monastery) and counterparts (WCS-China Program, in particular LS) to address the points listed above. Unfortunately, the *Rafetus* of Shanghai Zoo had died in mid-December 2006 and could only be examined in a freezer. The good news of January 2007 was that after the workshop a previously unknown live female *Rafetus* was identified at the Changsha Zoo in Hunan Province.

In May 2007 the TSA again sent Gerald to China to examine and complete the sexing of all known *Rafetus* (those at Suzhou were hibernating in January). The combined January and May 2007 missions allow the following assessment regarding gender:

- Shanghai Zoo: the deceased *Rafetus* was a male.
- Suzhou Zoo: the only remaining *Rafetus* is a male.
- West Garden Buddhist Temple: the only remaining *Rafetus* is a male.
- Changsha Zoo: the *Rafetus* is a female.

It is not straightforward and easy to sex *R. swinhoei*, in particular if the turtles are not flipped on their backs to avoid unnecessary stress. Although in undamaged males the tail has a thick base and the cloaccal opening is near the tip of the tail directly under or behind the posterior rim of the carapace, the tail length of the female is only very slightly shorter, the cloaccal opening also being near the tip of the tail directly under or only slightly cranial to the posterior carapace rim. Although our sample size is very small, a sexually dimorphic character seems to be body size: males are larger. For example the body mass at death of the male at Shanghai Zoo was 117 kg, whereas the body mass of the old female at Changsha fluctuated for many years between 37 and 40 kg (37.2 kg in May 2007).

All three living *Rafetus* individuals are from the Lake Tai Hu area of the lower Yangtze plain (the northernmost population of the species) and were already large individuals in the respective institutions in 1949, the year of the independence of the PR China. It is not known how long the Suzhou Zoo male has been in his pond. His pond/enclosure is part of an old World Heritage- listed Garden that existed for a long time. According to the monks, the West Garden male had been there for over 400 years. Prior to 1949 the Changsha female had been part of a traveling animal exhibit and had traveled all through China. Thus, all presently known surviving individuals of *R. swinhoei* in China seem to be old (at least > 70 years) and may be very old (100+ years).

Rafetus swinhoei does not seem to survive well in "modern" zoo exhibits. A *Rafetus* in a reptile exhibit at Beijing Zoo had died in 2004. The male at Shanghai Zoo (which had been there since 1975) had been moved into a new reptile exhibit in 2005 and had died by late 2006. In contrast, the two surviving males at Suzhou both live year-round in large and relatively deep outdoor ponds where they hibernate during winter (November to April). The female at Changsha had also been kept outdoors and had hibernated in a large outdoor pond from 1949 until the fall of 2006. However, in October 2006 she was for the first time moved into an indoor reptile exhibit where she could not hibernate (so that zoo visitors can also observe her during winter). This caused concerns regarding her health and survival prospects when we discovered her in late January 2007. Unfortunately Changsha Zoo neither took part in the *Rafetus* workshop in September 2006 nor in January 2007, since by then their turtle had not yet been identified as *Rafetus*. Suddenly realizing the importance of their turtle - the last presently known female of the species - Changsha Zoo immediately constructed a new outdoor enclosure and moved her on 7 February 2007 (less than two weeks after her discovery). Although we do not consider her new enclosure to be optimal, this move may have saved her life.

In conclusion, the external assessments of health and reproductive conditions of all known Chinese *Rafetus* alive in May 2007 revealed:

- The male at Suzhou Zoo is very old and scarred. About 15 years ago (early 1990s) another *Rafetus* was moved into his pond. A battle started immediately and the resident *Rafetus* killed the other one (also a male, now stuffed) the same day. During this battle the survivor may have lost the back part of his leathery carapace flap. For that reason its tail now protrudes from under the carapace and is visible from above. It shows a thick tail base and identifies the turtle as male. The turtle has white patches on the neck, probably also old battle scars. Unexpectedly, in May 2007 Suzhou Zoo suddenly refused permission to touch and closely examine this *Rafetus*. No further assessment was, therefore, possible.

- West Garden Buddhist Temple allowed their *Rafetus* to be touched, but did not allow capture and restraint of the turtle for closer examination. Gerald was able to palpate its tail for over 30 seconds while the *Rafetus* was basking in shallow water on a basking island. This clearly allowed it to be identified as male (thick tail base where the penis is palpable). This *Rafetus* is strong and seems to be healthy and in good condition.

- Despite concerns regarding health and reproductive condition of the female at Changsha following her partly warm over-wintering in 2006/07, she was in good condition in May. Ultrasound scanning revealed that she had recently ovulated and had soft-shelled eggs in the oviducts, plus batches of vitellogenic ovarian follicles. This suggests that she may even produce two clutches of eggs in 2007. This caused some excitement in the Hunan media with several newspapers and TV stations reporting this finding.

With two males (at least one - West Garden - in good condition) and one female *Rafetus* in breeding condition in the spring of 2007, the biological prerequisites were present to start captive breeding of *Rafetus* immediately. However, institutional and bureaucratic hurdles delayed this dream. All three institutions holding *Rafetus* are unwilling to make their specimen available for breeding loan. They are considered too valuable for each institution. In this situation artificial insemination could be a solution, but again such a trial was not possible in 2007. This would have required restraining a male for a short time in order to attempt sperm collection. This was not possible with Suzhou Zoo even refusing to let their *Rafetus* be touched and West Garden only letting their *Rafetus* be touched while unrestrained.

Thus, the good news for captive breeding of *Rafetus* in China is that one or two clutches of eggs will be produced in 2007. The bad news is that the female had been kept isolated from any males for at least 58 years (and probably much longer) and that there is no immediate prospect to rectify this problem. Despite the advanced age of the potential breeding stock the present captive breeding obstacles for *Rafetus* in China do not seem to be biological or reproductive physiological, only political and bureaucratic. The TSA wishes to thank Ocean Park Conservation Foundation, Hong Kong, for generously underwriting some of this work.

Basking Rafetus *male at West Garden Buddhist Temple. Posterior carapace flap is undamaged and more or less covers the tail.*

Gerald Kuchling conducts a reproductive assessment, using ultrasonography, on the female Rafetus *at Huan Zoo in Changsha.*

Gerald Kuchling palpating the tail of unrestrained Rafetus *male at West Garden Buddhist Temple.*

Turtle conservation developments in Vietnam

Tim McCormack and Douglas Hendrie

An update from the Turtle Conservation Centre (TCC) of Cuc Phuong National Park and the Vietnam-based Asian Turtle Program (ATP)

At the turn of the new millennium, the Asian Turtle Crisis was at its most visible with hundreds of turtles and tortoises on sale in markets around the region. In recent years however, the crisis seems to have receded with lower numbers of animals being observed in the trade.

Although it is likely that to some extent this change is a result of improved public awareness and wildlife law enforcement there are indications that this is simply reflecting the relative scarcity of turtles remaining in the wild, with remaining turtle populations unable to sustain collection and trade at the levels seen a decade ago. Data from interview-based surveys in Vietnam have shown that turtles remain a highly economically-valuable species, and although the intensity of focused-collection has reduced in some areas with depleted wild populations, opportunistic collection is ongoing and the situation for Vietnam's turtles now is more desperate than ever.

Since the Asian Turtle Crisis was first recognised, Vietnam led the region in targeted conservation activities to address the crisis. A new generation of national educated and enthusiastic biologists is now leading the conservation of Vietnam's chelonian fauna. The Turtle Conservation Centre (TCC) of Cuc Phuong National Park, established in 1998 during the height of trade activity, remains a flagship initiative that has put turtle conservation on the map in Vietnam, motivating government as well as NGOs to prioritize turtle issues. Initially receiving small numbers of confiscated turtles it has expanded into a range state assurance colony for specific species, implements rigorous research in the field and in captivity, and has carried out awareness and training programs. The 2000m^2 facility was transferred in 2002 to National Park Management, but continues to receive technical support from the Asian Turtle Program (ATP), a Hanoi based entity supported largely by Cleveland Zoo with support from other organisations which collaborates with the TCC on research, training and awareness programs.

TIM MCCORMACK

A functioning stream in the Vietnamese Box Turtle enclosure at the Turtle Conservation Center (TCC) at Cuc Phuong.

Currently the TCC maintains 1161 turtles (April 2007) representing 19 of the 25 species native to Vietnam. Species-specific outdoor enclosures, two hatchling rooms, an incubation room and a vet building enable the centre to prioritize captive breeding on seven focus species, *Cuora galbinifrons, Cuora bourreti, Cuora picturata, Mauremys annamensis, Cuora mouhotii, Sacalia quadriocellata,* and *Indotestudo elongata.* Breeding success has increased; in 2002 only two species, *Heosemys grandis* and *Indotestudo elongata* were successfully hatching. By 2006 this had improved to 13 species including *Cuora galbinifrons, Cuora bourreti, Geoemyda spengleri, Cuora mouhotii, Mauremys annamensis, Ocadia sinensis* and *Sacalia quadriocellata*. During 2006, 277 confiscated animals arrived at the center, and an additional 34 *Mauremys annamensis* were returned to Vietnam from Kadoorie Farm and Botanical Garden in Hong Kong, importantly representing the first turtles returned to Vietnam from overseas.

By autumn the TCC will also have completed its most ambitious projects to date — the construction of a visitors centre. Featuring three underwater viewing tanks for aquatic species, a hatchling and incubation room, and an interpretive tour of the centre. The experience is intended to raise individual awareness of the plight of turtles in some of the 70,000 visitors Cuc Phuong National Park receives annually.

TIM MCCORMACK

A hatchling Cuora galbinifrons *at the TCC.*

Training and conservation research update for the Asian Turtle Program (ATP) and Turtle Conservation Centre (TCC)

The Asian Turtle Program (ATP) has also undertaken a number of training and research initiatives during 2006 and 2007, many of these in collaboration with the TCC. As part of ongoing training, the third annual weeklong tortoise and freshwater turtle field skills training course was held in 2007 at Cuc Phuong National Park, as well as the third half day university presentation on turtle ecology and the Asian Turtle Crisis. Day long enforcement training has also been held in three provinces for 60 FPD rangers in 2006 and for 55 FPD rangers and 19 customs officials in 2007, focusing on cross border trade of turtles from Cambodia into Vietnam.

The ATP has also started to develop a number of species-focused conservation and research projects. In Cuc Phuong National Park a radio telemetry study has now been running since 2003 on the Three Keeled Box Turtle, *Cuora mouhotii*, investigating for the first time the wild behaviour of this secretive species including home range and seasonal activity. A small group of confiscated animals have also been monitored to determine survivorship, and to assess release as a potential option for animals confiscated from the trade.

In Quang Nam province, central Vietnam, surveys have also been undertaken to locate populations of the Vietnamese Pond Turtle, *Mauremys annamensis*, an endemic species last reported in the area in 1939. Since then the species has suffered considerably from loss of lowland wetland habitat to agricultural conversion and development, as well as from collection for the wildlife trade. An interview survey revealed eight *Mauremys annamensis* in local trade and a series of sites were identified where the species had a high probability of persisting. In November 2006, one site was revisited and aquatic traps set which resulted in the capture of a single juvenile *Mauremys annamensis*, confirming the species' presence at the site. In 2007, a localized conservation program is being developed at the site.

TIM MCCORMACK

The first Vietnamese Pond Turtle observed by scientists in the wild for 67 years.

DOUG HENDRIE

Students of the 2007 training at Cuc Phuong National Park celebrate completing the course.

Bourret's Box Turtle (*Cuora bourreti*) is critically endangered and restricted to central Vietnam. During 2006, a month of interviews and field surveys focused on the species were conducted in Song Thanh Nature Reserve, Quang Nam province. It was found that while *Cuora bourreti* still occurs at the site, illegal collection has greatly reduced numbers. The survey found a high level of chelonian diversity, with seven species occurring in the area, or identified as having a high probability of occurring. This included five endangered or critically endangered species, *Cuora bourreti, Cuora mouhotii, Platysternon megacephalum, Palea steindachneri,* and *Sacalia quadriocellata.*

Efforts have also been made to locate remaining populations of the most endangered chelonian in the world, Yangtze Giant Soft-shell Turtle, *Rafetus swinhoei*. During 2006 surveys were conducted in seven provinces and 29 districts along the Red River and its tributaries in northern Vietnam. A skull was observed and another potential site may persist. Surveys at a main site are ongoing where it is hoped efforts will be rewarded. The ATP is also working in cooperation with Education for Nature Vietnam (ENV), a local NGO, to develop an awareness program on turtles, particularly *Rafetus swinhoei,* in communities surrounding areas where the species potentially occurs.

TIM MCCORMACK

Asian Turtle Program field research officer Mr. Nguyen Xuan Thuan measures three Cuora bourreti shown to the team by a trader near Song Thanh Nature Reserve.

The TCC and ATP will continue to collaborate on developing conservation strategies for Vietnamese chelonian species. With efforts since 1998 and the establishment of the TCC having a positive effect, the number of individuals working in research and conservation on turtles has increased dramatically as has the interest in the species group by the government and NGO sector.

For further information relating to the TCC or ATP projects please E-mail:
ATCnetwork@fpt.vn

Or visit the ATC Network website:
wwwAsianTurtleNetwork.org

TURTLE SURVIVAL ALLIANCE — PARTNER GRANTS

Update: Temperature Sex Determination (TSD) Project for the Yellow-margined Box Turtle, *Cuora flavomarginata*

Ray Farrell

In 2005 a study was initiated to determine if the sex of hatchling *Cuora flavomarginata's* could be influenced by temperature during incubation. If so, this information would provide a method to determine the gender of hatchlings by manipulating the temperature during incubation. This information would be beneficial in that it would provide a management tool to help meet our Taxon Management Plan (TMG) of 300 TSA F1's (100 males and 200 females).

Female *Cuora flavomarginata* were palpated twice a week from 1 June to 15 August to determine if they were gravid. Gravid females were removed from their outdoor pens and placed individual in 50 to 75 gallon tanks containing several inches of peat and topsoil. These turtles were checked daily until they deposited their eggs. Data was collected on each female that laid eggs, the sire recorded if known and the number of eggs laid. The eggs were individually placed in clear plastic pint containers with a mixture of vermiculate and water (six to five ratio). The plastic containers were randomly placed within eight incubators that were set at 25°C, 27°C, 29°C, and 30°C. As the hatchlings emerged from their eggs each turtle was assigned a turtle number i.e. (L1-R2) by cutting a number in their marginals. A data sheet was prepared for each hatchling recording incubation time, sire and dam along with their measurements and weight. The results to date are as follows: The data suggests that lower incubation temperatures produce a greater number of males and higher temperatures produce more females. Additional data needs to be collected this year to test the findings. We also plan on incubating eggs at 26°C, 28°C and 31°C.

Temp	# of Hatchlings	Males	Females
25°C	22	22 (100%)	0 (0%)
27°C	22	17 (77%)	5 (23%)
29°C	17	6 (35%)	11 (65%)
30°C	12	0 (0%)	12 (100%)

Brian Horne, PhD, performed a laparoscopy on each hatchling in 2005 and 2006 to determine the sex for this study. This was a difficult and time-consuming procedure given their small size and the egg yoke that was still in their body cavities. Our thanks go to Brian for donating his time and expertise in performing this procedure. He has performed this procedure on 73 hatchlings without injury or loss to any of them. Without his efforts we would not have been able to sex the hatchlings until they showed external sexual characteristics several years from now. These results are preliminary and additional data needs to be collected and analyzed. This research was funded by a 2006 TSA Partner Grant.

Update: Temperature Sex Determination (TSD) in Four Chelonian Species at Knoxville Zoo

Michael Ogle, KZG

The second year of this study has had some successes as well as a few setbacks. The numbers of tortoises hatched this season is on par with last year. This has given us a clearer idea of what direction to go in with the project. With a need to produce 10-15 hatchlings (as in previous studies) at each set temperature, it currently seems unrealistic to produce that many of three of the four species (*Geochelone elegans*, *Geochelone platynota*, and *Pyxis planicauda*) originally set in the study. Not that those species will be removed from the project entirely, it just appears it will take a much longer time to get the final numbers needed. The current thought is to focus primarily on Madagascar Spider Tortoises (*Pyxis arachnoides spp.*). Over the last two seasons we have hatched over 30 Common Spider Tortoises (*P. a. arachnoides*) for the study. We are also increasing our captive bred and potential founder numbers with Northern Spider Tortoises (*P. a. brygooi*) and Southern Spider Tortoises (*P. a. oblonga*) too. As long as we are able to continue our current success with *Pyxis a. arachnoides* over the next few years we should have enough data to report on this portion of the project.

DISNEY WILDLIFE CONSERVATION FUND — UPDATE

Community-based environmental education for turtle conservation in coastal Cambodia

David Emmett, C I

The flooded coastal forests of southwest Cambodia are regionally important for freshwater turtle conservation, yet these habitats are largely unprotected. Studies show that the forested coastal region contains the only known Cambodian population of the Mangrove Turtle *Batagur baska*, as well as populations of Elongated Tortoise (*Indotestudo elongate)*, Yellow-headed Temple Turtle (*Heosemys annandalii)* , Asian Box Turtle (*Cuora amboinensis)*, Asian Giant Pond Turtle (*Heosemys grandis),* Asiatic Softshell Turtle (*Amyda cartilaginea)*, Black Marsh Turtle (*Siebenrockiella crassicollis),* and Asian Leaf Turtle (*Cyclemys atripons)*.

The coastal region consists of a mosaic of lowland evergreen forest, seasonally inundated forest, and mangroves, criss-crossed with rivers and interspersed with villages. These villages are situated along the coast and rivers. Our work focused on those communities whose location and activities pose the most direct threat to turtle conservation in this area, either through accidental captures in fishing nets or through illegal harvesting of turtles for local consumption or trade.

This project aimed to initiate long-term conservation of wild, breeding populations of globally threatened turtles in the coastal region of Cambodia, with particular emphasis on conservation of *Batagur baska* and *Heosemys annandalii,* by implementing environmental education activities in the main communities around known turtle breeding areas. The project utilised existing training programs in Vietnam, where we sent five people – Prum Sitha from the Cambodian Fisheries Administration and four young Cambodian conservationists from the BP-funded Cambodian Turtle Conservation Team (Som Sitha, Sun Yoeung, Chey Kagna, and Sok Sokhorn) - for a 2-week formal training course in environmental education by Environment for Nature (ENV) in Vietnam. During the training and on their return, these five individuals developed education activities for children in schools and adults in the communities, as well as producing educational resources and activities which they then provided to schools and communes throughout the focal conservation area.

The team, with support from ENV, developed and delivered a set of four structured lessons to children in schools across six communities. Each lecture built on the last, and provided students with a culmination of knowledge on key conservation issues such as the environmental and social impacts of losing the coastal forests, the need to protect Cambodia's turtles, and useful conservation activities they can put into practice to protect and manage their environment.

Our team also provided the schools with biology and conservation books, turtle posters, turtle calendars, children's notebooks, chalk and other basic yet essential school equipment, and framed pictures depicting turtle images and turtle conservation messages.

Supplemental resources which are currently being developed as part of this grant include an illustrated story-book highlighting the Mangrove turtle *Batagur baska,* and a children's colouring book that provides information and conservation messages for the younger generation.

There were also many discussions with the local communities to hear their ideas on opportunities and needs for turtle conservation, and to see how the local communities can be involved.

This project has kick-started conservation of turtles in southwest Cambodia and has focused national and international interest on this area. This increased interest has led to the development of a 2-year turtle conservation project focusing on training, empowering and supporting teams of community rangers who will patrol key sites in the flooded forests during the breeding season. The Cambodian Turtle Conservation Team has raised over $45,000 from British Petroleum to continue the work started by the Disney Wildlife Conservation Fund (DWCF) - TSA funded project, and the team will provide crucial support and supervision to the community ranger teams.

If this project is a success, breeding populations of turtles will be secured and conserved within the coastal region. The area will effectively become a safe source from which turtles can disperse into four contiguous Protected Areas. The measure of success of the project will be independently assessed by Conservation International and the Cambodian Turtle Conservation Team, who will monitor key sites through systematic trapping and mark-recapture studies.

It is also our long-term aim that the environmental education activities and training provided to Cambodian turtle conservationists by this project will be recycled and put to use in other key conservation sites across Cambodia.

Hieremys annandalii *is a focal species for the project; this specimen was caught by our survey team in flooded forest.*

TSA SEED GRANT— PHILLIPPINE FOREST TURTLE

The Philippine Forest Turtle Project: A Model TSA Seed Grant Program

Pierre Fidenci

The Philippine Forest Turtle (*Heosemys leytensis*) is one of the most endangered freshwater turtles of the world and is endemic to Palawan and Dumaran Islands in southern Philippines. The Philippine Forest Turtle project started in 2006, however most our research and conservation activities began in January 2007. Throughout our project, we are assessing the distribution, habitat use, natural history, and threats to the Philippines Forest Turtle in southern Palawan Island. We are also organizing educational programs to raise awareness among local communities and to strengthen capacity of students from Palawan State University in conjunction with our field expeditions. Palawan is a large island that represents one of the most pristine, unexplored regions of the Philippines, and is a "hot spot" of biodiversity. Rampant illegal trade and habitat alteration could lead to the extinction of the Philippine Forest Turtle. At present, we have completed in-depth interviews and many field surveys for the Philippine Forest Turtle. Now, we are starting comprehensive surveys where we have accumulated the most reliable information that the Philippine Forest Turtle could still be found.

The Philippine Forest Turtle is known in the northern part of Palawan from the municipality of Peurto Princesa to El Nido in the north. However, its presence in the south has never been confirmed and remains a mystery despite a few unverified reports. Our surveys and conservation activities occurred in southern Palawan from the municipality of Nara (northern part) to the municipalities of Rizal and Bataraza (southern tip). The hard topography, weather conditions, access, and endemic diseases make turtle research a true adventure in this part of the world. Our team, composed mostly of young local conservationists and indigenous people, has explored the most unknown parts of southern Palawan from the municipality of Nara all the way south to Rizal and Bataraza. We also have extensively surveyed Balabac Island, a smaller island with a low population density.

PIERRE FIDENCI

Balabac Island is located in the extreme southwestern Philippines, about 35 km south of Palawan Island, and about 70 km north of Borneo. For its size (36 km long and 12 km wide), Balabac has an incredible biodiversity with various types of natural habitats ranging from pristine rainforest with elevation up to 576 meters, wetlands, mangroves, and coral reefs. The island is home of an endemic and endangered wildlife such as the Philippine mouse deer, the world's smallest ungulate.

Never before surveyed for turtles, Balabac remains an island of harsh terrain and unexpected discoveries. Beside its remoteness, safety remains the main reason why most scientists have been pushed back from the island. Moving through the island has never been easy. Dirt roads are rare, and most of the exploration is on foot. We interviewed more than 300 people in Balabac ranging in age from 10 to 75 years old. The majority were from the Molbog indigenous tribe, other respondents were farmers, fishermen, hunters, officials, and students. We explored the entire island except the north east where it was unsafe to adventure even for locals. Throughout Balabac, only four elders responded with a fairly high confidence of encountering a turtle with a yellowish line or band around its neck, probably *H. leytensis*, more than three years ago. Intensive night surveys were then conducted at various locations of the island.

Despite prolonged effort and the presence of potential aquatic and upland habitats, we did not detect the Philippine Forest Turtle in Balabac. We encountered numerous Asian Leaf Turtles (*Cyclemys dentata),* and Malayan Box Turtles (*Cuora anboinensis*), both adults and juveniles. The past unverified "reports" of probable occurrence of the Cantor's Giant Softshell Turtle (*Pelochelys cantorii*) were negative. The absence of the Cantor's Giant Softshell Turtle is probably not that surprising since large water systems are practically non-existent in Balabac. We did not encounter the Maylasian Softshell Turtle (*Dogania subplana*) despite the presence of suitable forested creeks such as the ones where we observed this turtle in southern Palawan. As far as the Philippine Forest Turtle, our searches were also negative. We had some hope to find the Philippine Forest Turtle in Balabac since numerous creeks are wrapped by primary and secondary forest. We would have been very happy to find it in Balabac since the latter offers good conservation opportunities such as low turtle hunting because of religious belief, presence of primary forest, and low human density. Furthermore, the local authorities were very supportive of our conservation work, which was very encouraging for future activities.

As far as southern Palawan, we are still conducting surveys and conservation awareness activities. We have not detected any Philippine Forest Turtles in areas where we thought we would, based upon illegal trading data and local interviews. The Philippine Forest Turtle was for most part observed by locals for the last time more than three years ago. During that time the Philippine Forest Turtle was traded heavily. While our team explored mostly the lowland areas (below 300 meters), I ventured into very remote areas by spending as much time as possible with indigenous people who understand nature best. One interesting finding was that the Philippine Forest Turtle appears to be unknown by the Tao't-Bato indigenous people, meaning that this turtle has probably never occurred above 300 meters from sea level. The Tao't-Bato, which means "people of the rock," usually live in cave-homes at least during the rainy season of south-west Palawan, in the high valley and mountain of Singnapan. The higher mountain areas are covered in primary forest but the valleys are mostly secondary forest with a few patches of primary forest that are considered sacred.

Overall, the Philippine Forest Turtle appears to be extremely rare in southern Palawan. Deforestation, past intensive illegal trading activity, lack of numerous suitable aquatic and upland habitats, and other unknown causes could explain why the Philippine Forest Turtle is so difficult to find in the wild. During May and June, we had to temporarily stop our field activities due to fierce fighting over the elections! However, we will resume our comprehensive surveys in July and August and hope to discover populations of this indeed very rare and endemic turtle. Finding wild populations of the Philippine Forest Turtle in southern Palawan is a challenge and additional discoveries in this part of the island would provide better conservation opportunities for this endangered turtle.

Acknowledgments

I thank the following organizations: Endangered Species International (ESI), Turtle Conservation Fund (TCF), BP Conservation Programme, Turtle Survival Alliance (TSA) with Batchelor Foundation funding, British Chelonia Group (BCG), Sophie Danforth Conservation Biology Fund, Soptom, Palawan State University (PSU), Palawan Council of Sustainable Development (PCSD). I am also very grateful to the following individuals: Dr. Teresita L. Salva (PSU President), Dr. Michael Pido (PSU), Dr. Lorna Gelito (PSU), Reymar Castillo (PSU), Maria Rosefa Lanuzo (ESI), Andreas Rytz (ESI), Marianne Carter (BP Conservation Programme), Kate Stokes (BP Conservation Programme), Robyn Dalzen (Bp Conservation Programme), Lynn Duda (Wildlife Conservation Society), the Palaw'ans, Tegbuanas, Molbogs, and all the team members from Palawan.

ANDREAS RYTZ

PIERRE FIDENCI

Above photos: The local turtle team in Palawan conducting surveys and conservation activities for the Philippine Forest Turtle.

PIERRE FIDENCI

Distribution of posters and calendars on the Philippine Forest Turtle to the local communities.

PIERRE FIDENCI

Small cards distributed to locals to learn how to identify the Philippine Forest Turtle from other native turtle species.

TURTLE CONSERVATION FUND: A FIVE YEAR HISTORY

TCF: A Five Year History

Hugh Quinn and Anders Rhodin
Turtle Conservation Fund Co-Chairs

The Turtle Conservation Fund (TCF) is a strategizing and granting agency that was formed in May 2002 from a need to help curb the growing global turtle crisis. A partnership of Conservation International's Center for Applied Biodiversity Science (CI/CABS), The World Conservation Union/ Species Survival Commission/ Tortoise and Freshwater Specialist Group (IUCN/SSC/ TFTSG) and the Turtle Survival Alliance (TSA), the TCF mission is to assure that no tortoise or freshwater turtle species becomes extinct, and that sustainable populations of all species persist in the wild.

A turtle conservation action plan was prepared to provide a directional basis to implement the mission. Examples of activities included in the plan are support for *ex situ* captive breeding and management programs both in-range and out-of-range, *in situ* protection and management of natural populations, field-based conservation biology and applied research, field and trade surveys, threatened status and regulatory needs determinations, protected areas evaluations and development, and capacity building. A list of the "Top 25 Turtles on Death Row" provided further direction to TCF's endeavors.

Several sources of funds were secured to implement this plan. Since inception, TCF has received 84 grant requests for turtle conservation funding. Total project support requested for these 84 proposals was $1,588,360, of which $543,273 was requested specifically as support from TCF. Of these proposals, TCF funded 29 critically important turtle conservation projects for a total Grants Program disbursement of $111,974. The average annual disbursement over 4 years has been $29,993, which represents 7.6% of the total grant support requested, and 20.6% of the grant support requested specifically from TCF. Awards have averaged $3,861 and ranged from $1,000 to $6,000, and were provided to projects conducted in (or concerning) 26 different nations: Philippines, Cambodia, Colombia, India, Indonesia, Germany, Ghana, Togo, Benin, Nigeria, Egypt, Malaysia, Brazil, Vietnam, Mexico, Myanmar, Bolivia, Guatemala, Bangladesh, Cuba, Cayman Islands, Jamaica, Puerto Rico, Haiti, Dominican Republic, and China.

A few examples of results from funded projects include: providing key information to communities along the upper Magdalena River in Columbia about the plight and conservation needs of its endangered Magdalena River Turtle (*Podocnemis lewyana*); documentation of illegal trade of the critically endangered Roti Island Snake-necked Turtle (*Chelodina mccordi*); head-starting and release of the critically endangered River Terrapin (*Batagur baska*) in Malaysia; development of community-based conservation programs for the endangered Egyptian Tortoise (*Testudo kleinmanni*); formation of a turtle conservation facility at the Münster Zoo, Germany; and gaining a better understanding of the ecology, distribution, and conservation needs of the poorly known, critically endangered Philippine Pond Turtle (*Heosemys leytensis*).

Building on the successes and challenges of the past, TCF will enhance its future by 1) more proactively soliciting proposals; 2) focusing its limited resources more on projects that enhance the survival of only the most critically endangered species; 3) seeking more funding sources while retaining existing ones, and striving for higher contribution levels; 4) critically reviewing its five-year-old action plan and list of target species; 5) seeking to coordinate turtle conservation efforts further with other organizations; and 6) formally evaluating its progress in fulfilling its mission. By addressing these issues, TCF can more effectively meet the challenge of making a lasting difference in turtle conservation efforts worldwide.

Visit: **www.TurtleConservationFund.org** to learn more.

*The Magdalena River Turtle (*Podocnemis lewyana*) has been the subject of several TCF funded projects designed to provide a greater understanding of the biology of this poorly known species.*

PIERRE FIDENCI

This Philippine Forest Turtle was encountered along a small creek in Palawan.

*Some of the early field work on the Philippine Forest Turtle (*Heosemys leytensis*) was provided by the TCF.*

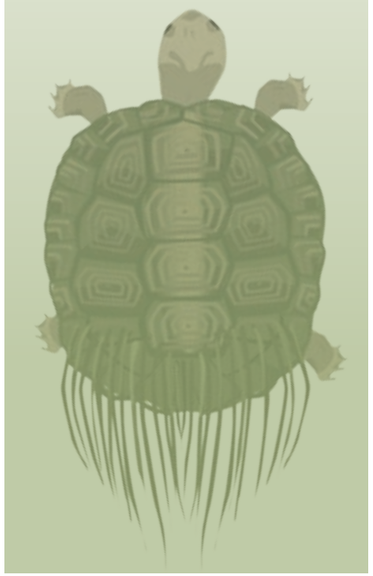
BATCHELOR FOUNDATION: EXECUTIVE SUMMARY 2005—2007

Batchelor Foundation funding for the TSA: Executive Summary, 2005 – 2007

Rick Hudson

The 2005 Batchelor Foundation grant provided TSA with $100,000 in support for turtle conservation projects and programs in eight Asian countries plus Mexico. Furthermore, the grant provided critical assistance to over half (10) of the 18 Asian chelonian species ranked Critically Endangered (CR) by the IUCN Red List. One of the fortuitous impacts of the grant was the additional money that TSA leveraged through matching funds and partnerships. Nearly $30,000 in outside funds were contributed toward facility construction in Myanmar, India, and Cambodia from three organizations including the Wildlife Conservation Society (WCS), British Chelonia Group (BCG) and the European Aquarium and Zoo Association (EAZA) Shellshock Campaign. The grant also strategically positioned the TSA in three of the top five most important countries for turtle conservation in Asia – Myanmar, Vietnam and India. Support for existing programs in those countries, such as the Cuc Phuong Turtle Conservation Center in Vietnam, the Burmese Roofed Turtle program at Yadanobon Zoo in Mandalay and the Indian Turtle Conservation Program with the Madras Crocodile Bank Trust, has tremendously expanded the scope of these efforts. Notably the Batchelor Foundation-funded workshop in India produced the *Conservation Action Plan for Endangered Freshwater Turtles and Tortoises of India,* published in 2006 and now being implemented on numerous fronts throughout that country. Our support for KUSTEM University's (Malaysia College of Science and Technology) River Terrapin research program in Malaysia, and the Siamese Narrow-headed Softshell breeding program at the Kanchanaburi Inland Fisheries Development Center in Thailand have both generated credible and useful scientific data with direct management implications. Also important has been the provision of start up funding through seed grants to projects in the Philippines, Brazil and Bangladesh, all impacting critically endangered turtle species.

Likewise, the 2007 Batchelor Foundation proposal, if successful, will produce substantial and far-reaching impacts. Additional funding will increase our level of involvement in India, Myanmar and Vietnam, and extend our involvement in the single most important country for turtle conservation in Asia - China. There our efforts will be directed towards the recovery of the Yangtze Giant Softshell Turtle, a species with the dual distinction as being the world's largest and most endangered freshwater turtle. Our 2007 program will also move the TSA into Madagascar, a hotspot of tortoise diversity and endemism, with six taxa all facing imminent threats. Our immediate focus there will be the protection of the Ploughshare Tortoise, ranked critically endangered the IUCN Red List. We will also expand our program in Mexico for the critically endangered Central American River Turtle, with emphasis on the development of a sustainable model for farming this heavily exploited species. Another new component for the 2007 program includes North American efforts to improve museum facilities for the highly endangered Yellow-blotched Map Turtle in Mississippi with an eye towards developing a prototypic solar-powered hatchling rearing tank that can be exported to our range county programs that lack electricity. Funds were also earmarked to monitor a recently reintroduced population of Alligator Snapping Turtles in Oklahoma, which will provide important new information on the behavior and survival of this species in a novel environment. Finally, the 2007 Batchelor Foundation funds will mobilize a significant amount of matching funds. With a generous offer of $125,000 for turtle conservation work in Myanmar and Madagascar on the table (WCS donor), dependent on securing a 1:1 match, this grant will leverage an additional $30,600 for work in those two vitally important countries. Funds allocated ($15,000) for the much -heralded and highly successful Vietnam-based Asian Turtle Program will match equal contributions from the Cleveland Metroparks Zoo and the Wade Foundation. We hope to be able to announce this next round of funding in August 2007.



2007 ASIAN SCHOLARSHIP PROGRAM

William Espenshade, Director
Asian Scholarship Program for in-situ Chelonian Conservation

FEIYAN ZHANG is the 2007 Asian Scholarship Program for *in situ* Chelonian Conservation (ASPin-situCC.org) program participant. She works at the Chelonian Garden at Huidong Gangkou, Sea Turtle National Reserve Management Bureau in Guangdong Province of China, also known as Sea Turtle Bay.

FeiYan recently completed a four-year degree at Guangdong University in Agriculture, and when she returns to China this fall, she will enter an MSc program in molecular biology. Part of her undergraduate work involved surveying the turtle farms in her home province; some farm complexes are 4,000 hectares in size, and others are intensely managed roof top ponds.

FeiYan is a very committed and enthusiastic ASP participant. Her dedication and interest in chelonian conservation comes from a lifelong passion. For people like FeiYan, with the continued support of the Turtle Survival Alliance, the Wetlands Institute, and several chapters of the Californian Turtle and Tortoise Club, chelonian conservation becomes a tenable goal.

CHRIS TABAKA

Chris Tabaka reports several significant breedings including an **African Hingeback Tortoise** (*Kinixys belliana belliana)*. Three eggs were laid on 5 December 2005 weighing 28 – 32 grams each; one hatchling pipped on 18 July 2006 after 223 days of incubation and weighed 13.3 grams with a large yolk sac.

CHRIS TABAKA

Chris also hatched his fifth southern **Vietnamese Box Turtle** (*Cuora picturata*) after getting one or two hatchlings a year for the last four years. This egg was laid on 27 March 2006 and weighed 26.6 grams; the hatchling emerged on 18 July after a 111-day incubation period and weighed 16.1 grams. Chris reports that he has had the best success incubating in a sphagnum/vermiculite mix in one of his warm turtle rooms with variable temperatures and humidity. He experienced a number of late embryonic deaths using a standard set temperature incubator. Clutch size is one to two eggs, and his breeding groups lay one to two clutches per year.

DON BOYER

The San Diego Zoo successfully reproduced three species of Asian turtles in the first half of 2007. **Roti Island Snake-necked Turtles** (*Chelodina mccordi)* produced a clutch of 13 eggs on 20 January. After a 97-day incubation at 30° C the eggs began to hatch and six young emerged from this clutch. Another clutch of five eggs was laid on 3 March and is still incubating.

The San Diego Zoo also had its first reproduction of **Malaysian Giant River Turtles** (*Orlitia borneensis)* with a clutch of nine eggs laid on 25 January (photo). These began to hatch after an incubation period of 113 days at 30° C.

DON BOYER

The Fort Worth Zoo reports their first hatching of **Pan's Box Turtle** (*Cuora pani*) in 2006. Eggs were laid on 19 Jun and hatched on 21 - 23 August. The two hatchlings measured 33.4 mm and 32.1mm SCL and weighed 13.3g and 11.4g. The Zoo maintains a breeding group of 2.3 adults that were acquired in 1997 and 1998. Infertile eggs were first produced in 2002 and fertile eggs were laid in 2003 and in subsequent years; however, all went full term and died in the egg despite employing an array of incubation temperatures and media.

MATT VAUGHAN

Bill Ninesling reports the first U.S. captive breeding of **Mangrove Terrapins** (*Batagur baska*) outside of a Zoo (photo). Only one U.S. facility – Bronx Zoo – had previously experienced breeding success with this species but not in recent years. To encourage reproduction this group was moved to south Florida where they could be maintained outside under more natural conditions with sunlight. To stimulate breeding the water temp was raised to 30° C plus. On 24 December the smaller female from the group of 4.2 hauled out on the bank and laid 20 eggs. Eggs were incubated at 30.5° C, but only two were fertile, both of which hatched 69 days later. Both juveniles are growing rapidly on a diet of blood worms, fish, fruits, and vegetables. A **Malaysian Giant River Turtle** (*Orlitia borneensis*) also hatched during this time frame, the adults coming from the 2001 Kadoorie – TSA turtle rescue.

BILL NINESLING

CHRIS TABAKA

Ben Forrest reports on a successful captive breeding program for the **Forsten's Tortoise** (*Indotestudo forsteni*). His breeding group of 6.7 adults are maintained separately, and all hatchlings have been produced by one pair. He has maintained them as pairs, but due to aggression, he feels that group situations are too stressful. Nesting has been recorded every month except October, and there is no defined nesting period under captive conditions. Nesting seems to occur every four to eight weeks, with one to two eggs per clutch. He incubates on a shelf in his turtle room, on a moist vermiculite medium, at temps ranging between 25.6—29.4° C, for roughly four months. Nine hatchlings have been produced since 2005, three so far in 2007 with more fertile eggs incubating. He feels that they need time to settle into captivity and that the keys to success are stable temps and an abundance of food. 80% of their diet consists of soft fruits and vegetables (steamed carrot, sweet potato, and pumpkin) and mushrooms; the remainder is greens and some, meat, preferably shrimp.

RICO WALDER

A **Beal's Four-eyed Turtle** (*Sacalia bealei)* hatched at the Tennessee Aquarium in Chattanooga on 9 June 2007 after a 59-day incubation period. The Beal's Four-eyed Turtle was once common throughout southern China but has seen significant declines in its population in recent years. The species is currently maintained by only three North American zoos and aquariums and is listed as Endangered by the IUCN Red List. This hatching may represent the first successful reproduction of this species in a North American public institution. The clutch of three eggs was deposited from 11 – 14 April 2007. Only one egg was determined to be fertile. The egg was partially buried in and incubated on moist vermiculite at 28.3° C. The incubation period lasted 59 days and the hatchling weighed 6 grams upon emergence.

ANDY KAUKEINEN

Andy Kaukeinen reports that Zoo Atlanta hatched their third **Arakan Forest Turtle** (*Heosemys depressa*). An adult pair, on loan from Scott Davis, first reproduced at Atlanta in 2005 when a single hatchling emerged on 8 April from a clutch of four eggs laid 16 November 2004; incubation was at 28.8° C. A second clutch of four eggs was deposited on 1 January 2006 and two hatched on 1 May, after 120 days of incubation. Unfortunately, both hatchlings developed yolk peritonitis and succumbed within a month of hatching. Poor hatching success was attributed to a Hovabator incubator that maintained low humidity and fluctuating temperatures. Using improved incubation techniques, a clutch of two eggs laid on 20 December 2006 hatched on 25 April and 2 May 2007. Eggs were set on vermiculite at a 1:1 ratio with water, and incubated at 29.4° C, at a steady 70% humidity. Both hatchlings are reported to be vigorous and healthy. In total, three hatchlings currently survive from five hatched over a three year period.

Thank you for your support!

The TSA gratefully acknowledges the following supporters for their generous contributions of $200 or more during the July 2006 to June 2007 time frame.

Brett and Nancy Stearns, Beneficia Foundation, California Turtle and Tortoise Club (CTTC) – Too Slo Chapter, CTTC – Turtle and Tortoise Care Society, Central Illinois Herp Society, Cleveland AAZK Chapter, Columbus Zoo, Conservation International, Dallas Zoo, Denver Zoo, Detroit Zoological Institute, Fort Worth Zoo, Jack Cato, Los Angeles Zoo, Lombardino Family Fund, Matt Frankel, Ocean Park Conservation Foundation in Hong Kong, Orlando Diaz, San Antonio Zoo, Walter Sedgwick, David Shapiro, Taste of Thai Foods, Ron and Marilyn Tremper, Woodland Park Zoo, and ZooMed, Inc.

2007 TSA Conference Support

The TSA joint annual Turtle and Tortoise Symposium has grown tremendously in scope and attendance, and is now an international event, widely recognized as THE tortoise and freshwater turtle meeting to attend. Likewise, the planning and execution have become a rigorous and time consuming process that demands the hard work and commitment of a growing number of individuals and organizations. We are grateful to those that who dedicated so much of their time and energy to making this Symposium possible. First to our sponsor Zoo Atlanta, we want to recognize the work of Dwight Lawson and Julia Knox for handling the logistics of getting this conference established. Ron Determan and Ellen Martin of the Atlanta Botanic Garden are also to be commended.

Several individuals in particular deserve special mention: Lonnie McCaskill (Conference chairman), Chuck Schaffer (Conference Program chairman), Julia Knox (Zoo Atlanta) and Heather Lowe (Fort Worth Zoo) all have gone above and beyond to make this event a success. Both took on demanding duties and performed them effectively, exceeding the level of efficiency that we have grown to expect. Rose Tremblay and her team from Disney organized the TSA merchandise booth and handled all the TSA auction details; both of these are major fundraisers for us and we count on their expert support.

Donors and sponsors for the 2007 TSA joint annual Turtle and Tortoise Symposium include ZooMed, Inc, *Reptiles* magazine, Eric Goode, Nancy and Brett Stearns, Matt Frankel, CTTC – Turtle and Tortoise Care Society, and the BBQ Boys – Greg George, Dave Manser and Jay Allen.

We owe a special debt of gratitude to a dedicated group of volunteers whose time and commitment mean so much to TSA's continue success: Darrell Senneke (web site and communications), Bill Ninesling (animal management), Annabel Ross (records and permits), Heather Lowe (memberships), Sandy Binns (web site), John Binns (newsletter), AJ Gutman (newsletter review), Joel Friesch (T-shirt artwork), ECO WEAR (T-shirt manufacturer), Rose Tremblay (conference support), and the many veterinarians who give tirelessly to care for TSA turtles. Special thanks are extended to the Fort Worth Zoo for their generous institutional support, and for allowing staff members the time to pursue TSA activities.

The TSA was founded on partnerships and today those collaborations represent our core strength. The following is a list of some of the strategic partnerships that have contributed to the success of the TSA in the past year:

Asian Turtle Conservation Network
California Turtle & Tortoise Club
Chelonia Enterprises
Chelonian Research Foundation
Chelonian Research Institute
Cleveland Metroparks Zoo
Conservation International
Cuc Phuong Turtle Conservation & Ecology Program
Disney's Animal Kingdom
Fort Worth Zoo
International Reptile Conservation Foundation
John L. Behler Chelonian Conservation Center
Kadoorie Farm & Botanic Garden
Madras Crocodile Bank Trust
Petraworks, Inc.
Purina Mills / Mazuri
Reptiles Magazine
Savannah River Ecology Lab
Taste of Thai Foods
Wildlife Conservation Society
World Chelonian Trust
Zeigler and Zeigler, Inc.
Zoo Atlanta
Zoological Society of San Diego
ZooMed, Inc.

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