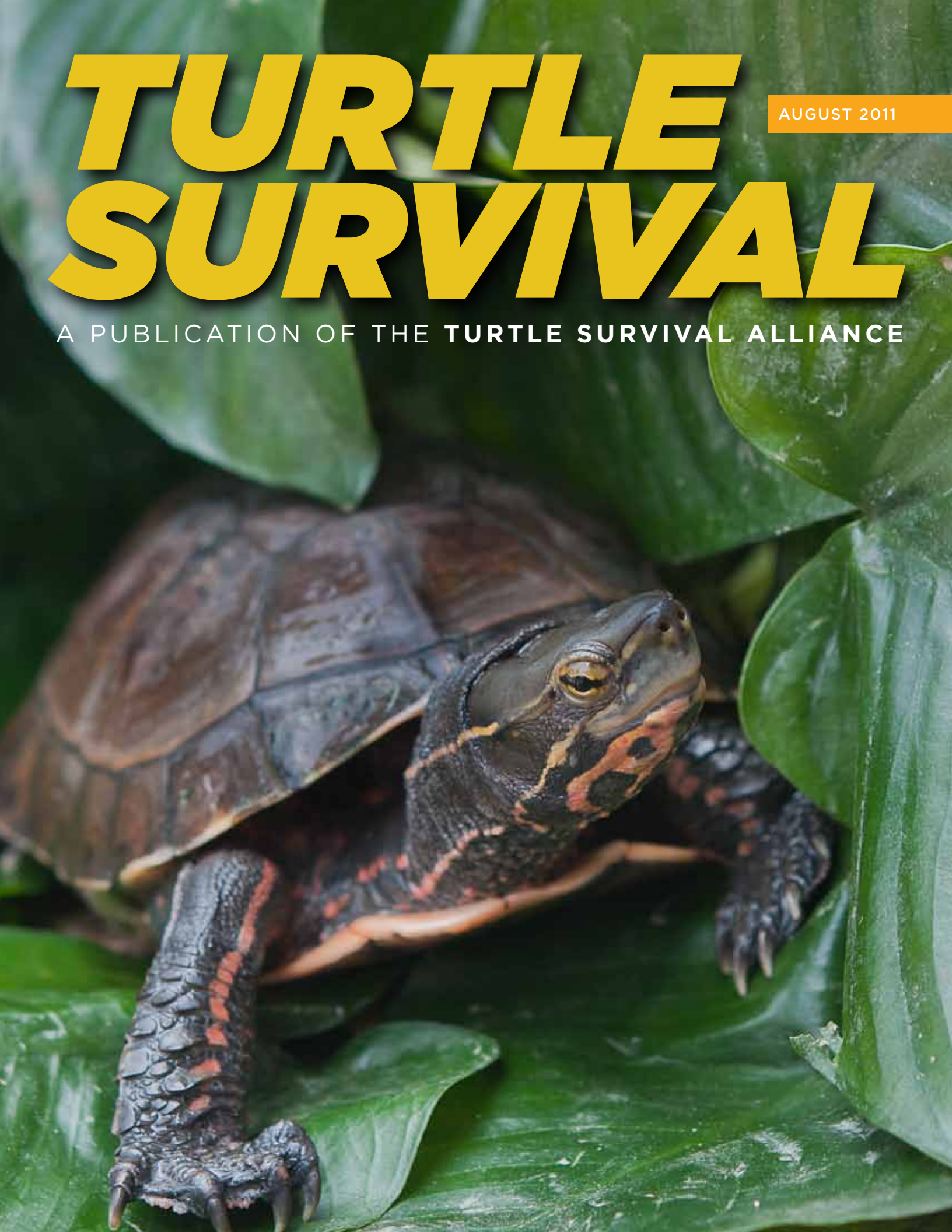


TURTLE SURVIVAL

AUGUST 2011

A PUBLICATION OF THE **TURTLE SURVIVAL ALLIANCE**



FROM THE PRESIDENT'S DESK

New People, New Facilities, New Programs: A Year of Remarkable Growth for the TSA



This past year has seen our strongest growth to date, made possible by ambitious individual commitments and new sources of revenue. We continue to strategically target high priority regions that we feel will give us the biggest bang for our limited bucks. And we constantly re-evaluate species priorities in light of new threats and emerging trends. Throughout this process we never forgot that saving species and preventing extinction is why the TSA exists.

New People: At the August 2010 meetings in Orlando the TSA Board took a leap of faith and boldly agreed to put three new people on the payroll. We are pleased to welcome Kalyar Platt (Myanmar), Herilala Randriamahazo (Madagascar) and Cris Hagen (Animal Management) to our growing list of full time employees; they join Heather Lowe (Program Coordinator) and Shailendra Singh (India). The hiring of Kalyar and Herilala as country coordinators greatly expands TSA's ability to respond to growing threats in two highly important turtle and tortoise diversity hotspots. As the new Director of Animal Management, Cris maintains oversight for a growing area of TSA work – the maintenance of our living assurance colonies and rescue operations. For more details see p. 18. And we are constantly impressed and surprised with the number of new faces that emerge to help when we put out a call for help. That so many are willing to respond in times of need truly represents one of our greatest assets, and is what sets us apart from other turtle conservation groups. Just as I am writing this, a notice has come in that Omaha's Henry Doorly Zoo's AAZK Chapter held a "race against extinction" that raised more than \$4,000 for the Sundarbans Batagur recovery program in Bangladesh!

New Facilities: This has been a big year for construction and we have new facilities in Myanmar, Belize and Bangladesh, all providing much needed assurance colonies for species ranked Critically Endangered. In Myanmar, after two years of fundraising, the TSA spent \$60,000 building six new facilities for Burmese Star Tortoises, Burmese Roofed Turtles, Asian Mountain Tortoises and Arakan Forest Turtles (see article

p. 55). In Belize we just completed the ponds and infrastructure for the Hicatee Conservation Research Center (for Central American River Turtles) that will allow us to establish successful breeding techniques for a species with a poor history in captivity; these methods will lead to the development of a large scale assurance colony that can provide offspring for restoring depleted wild populations (see article p. 82). And finally in Bangladesh, we have built or renovated two large ponds to support breeding colonies of the Sundarbans River Terrapins, currently considered the second most highly endangered of Asia's large river turtles. Thanks to the dedicated field work of a remarkable woman – Rupali Ghosh – we now have an adult captive breeding group of ten males and five females, and eggs in the ground!! (see article p. 60).

New Programs: Our prioritization process does not occur in isolation, but is a collaborative process involving many of our colleagues around the globe, often in strategic planning or training workshops. In the eleven month period from August 2010 to July 2011, the TSA sponsored or participated in workshops in Brazil (South American turtle red-listing), India (prioritizing regions for Indian turtle conservation), the U.S. and China (action planning for Asian box turtles), Singapore (setting priorities for Asian chelonians) and Malaysia (river terrapin conservation techniques). Some new priorities emerged that present challenges as well as opportunities, and one of the TSA's primary responses was to fund a new Seed Grant program that will target the following regions: India, Africa, Indonesia, and Colombia. These grants will mobilize projects recommended from the India workshop, help us

to gain traction in Indonesia (Sulawesi in particular), begin the arduous process of setting species priorities in Africa, and lead to the development of a new South American program, based in Colombia. Colombia is a turtle diversity hotspot, ranked seventh globally in number of species (27, tied with India and Vietnam). Colombia is also blessed with an exceptionally talented and motivated group of biologists. Meetings in Cali and Medellin in July 2011 set the stage for an Action Plan for that country's chelonian fauna. We look forward to bringing you exciting news and progress from this program as it develops, and we give special thanks to our esteemed colleague Vivian Paez for working with us to spearhead this initiative.

Final thoughts: The Singapore workshop in February 2011 allowed us to evaluate the past ten years of the Asian turtle crisis and plan how to adjust our game plan and priorities as we enter the next decade. One of the results from that workshop was particularly sobering: of the 86 total Asian species, 38% are now considered Critically Endangered (CR), up from 20% in 1999 - a 90% increase. Fifty-seven species (66%) are considered either CR or Endangered, a 40% increase since 1999. These figures are likely to grow worse as the food and pet markets in China continue to drain wild populations. The high volume trade in both Asian Mountain Tortoise and Arakan Forest Turtles for food is very disturbing (see article p. 80), as are the pet shops where large numbers of small forest turtles (*Cuora galbinifrons*, *C. bourreti*, *C. mouhotii*, *Geomyda spengleri*) are widely sold, essentially as "throw away pets" with little hope for survival in inexperienced hands or without veterinary care. We must find a way to salvage some of these market turtles and transition them into assurance colonies while wild stocks still exist; the TSA is currently investigating a process to do this.

I recently told a colleague that I was becoming increasingly disheartened by these figures because it appears that we are losing the battle to save Asia's turtles and tortoises. But he reminded me that these numbers would likely be worse were it not for our efforts. Not sure that I completely agree with that but I do know that we have to maintain hope and try to stay optimistic.

TURTLE SURVIVAL ALLIANCE

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ABOUT THE COVER: Described in 1906 from China's southern Yunnan Province, the Yunnan Box Turtle (*Cuora yunnanensis*) essentially vanished and had not been seen since the 1940's, despite intensive field searches. Known from only 12 museum specimens collected over a century ago, this species remained an enigma for decades. In 2000, the IUCN Red List officially listed the species as 'Extinct in the Wild'. But a glimmer of hope appeared in 2004, when photos of a female were posted on an Internet forum requesting assistance with identification. A few months later, an adult male appeared in the southern Chinese pet trade. A Chinese turtle breeder acquired both specimens and was able to produce hatchlings in 2006 as well as in subsequent years. Since then, other wild specimens have trickled into the market and commanded incredibly high prices. In 2008, Professor Rao Dingqi and his colleagues finally discovered the habitat for the species which will be formally reported to science at an appropriate time. There is great concern that the remaining wild animals could be illegally removed for the pet trade and the pressures on this unprotected wild population are expected to be intense. With a few animals from this population and some rescued from the markets and local village homes, an officially sanctioned assurance colony was established at a secure location in Kunming, under the oversight of Professor Rao, where this photo was taken. Captive reproduction in this colony first occurred in 2010. Now recognized by the IUCN Red List as 'Critically Endangered', *C. yunnanensis* has been given a "second chance" for survival. But with the only known remnant wild population in an unprotected area, this situation is still considered a crisis and there is an urgent need for additional support. Captive assurance colonies are critical at this juncture. The TSA, in collaboration with Kadoorie Farm and Botanic Garden in Hong Kong, is providing husbandry assistance and technical support to Professor Rao Dingqi and his capable staff to help ensure success for this important program.

The Strength of the TSA Lies in our Partnerships

From our inception, the TSA was intended to be an alliance of partners that shared in a common goal – zero turtle extinctions. In the ten years since our formation in 2001, that has proven to be the secret to our success. The partnerships with the organizations represented here are what sustain us, support us, provide us access to working with foreign governments, and ultimately enable us to grow and affect change. The challenge of protecting turtle and tortoise species today is far too great for just a handful of organizations. We must continue to be strategic in our development of partnerships in order to be most effective and we must work together to direct

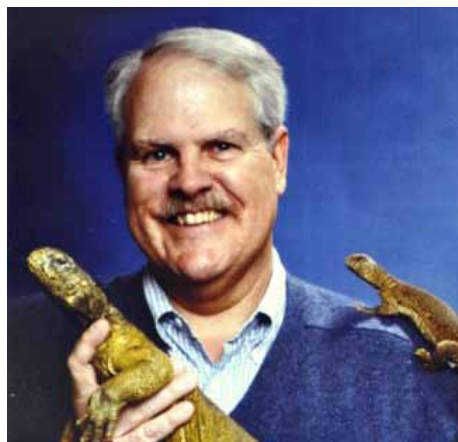
limited resources to regions and projects where they are most needed.

These myriad organizations provide a range of services to our collective mission, including guidance, networking, strategic planning, funding, turtle care and rescue facilities, animal management, marketing and public relations, field research, logistical and technical support, salaried positions, and a host of other resources. Significantly, some of these have been with us since the early days and were there when the TSA was “born.” All are integral to our success. On behalf of the Board of Directors of the TSA, we salute this remarkable group of dedicated partners.



TSA Welcomes Four New Board Members

The TSA is pleased to announce the appointment of four new members to the Board of Directors: Bill Dennler, Michael Fouraker, Raymond Saumure and Andrew Walde.



Bill Dennler began his 33 year zoo career as a Keeper at the Cincinnati Zoo in 1972 and then moved to the Toledo Zoo in 1975 as the Curator of Reptiles and Amphibians. He became the Zoo's Executive Director in 1981 — a position he held until retiring in late 2005 and now he is the Director Emeritus. He has a Master's in Business Administration and has served on the boards of the American Association of Zoos and Aquariums (AZA) and the World Association of Zoos and Aquariums (WAZA). His passion is, and always has been, turtles and tortoises and he is excited to be “going back to his roots” by joining the Board of the TSA.



Michael Fouraker is the Executive Director of the Fort Worth Zoo and has more than 30 years of animal, exhibitry and zoo management expertise. He has focused his career on building partnerships that support global conservation

initiatives. An advocate of sustainability and active wildlife management, Michael is a founder and board member of the International Elephant Foundation, founding board member of the International Iguana Foundation, Caribbean Wildlife Alliance, Caribbean Wildlife Foundation and board member of the International Rhino Foundation. These organizations have contributed millions of dollars in support of these rare species and their habitat. Michael has served on various committees for the World Conservation Union (IUCN), as a board member of the American Zoo and Aquarium Association, and is currently on the scientific advisory board for UNESCO. Under Michael's direction, the Fort Worth Zoo has been the leading supporter of the TSA, starting in 2001 when the zoo hosted the international workshop that led to the formation of the group. Since then, the Zoo has provided salary, office and financial support to TSA's staff, including the leadership position, record keeper and Program Coordinator.



Raymond A. Saumure received his B.Sc. in Biology from the University of Guelph in Ontario, Canada. His M.Sc. and Ph.D. (2004) were completed at McGill University in Montréal, Québec, Canada for his research on the impacts of agriculture on the North American Wood Turtle, *Glyptemys insculpta*. Dr. Saumure is a member of the Tortoise and Freshwater Turtle Specialist Group (TFTSG) Steering Committee; as well as, the Desert Tortoise Council Board of Directors. Thus far, he has 40 publications, most of which are on the population ecology, parasitology, and conservation of freshwater turtles. Currently, he is co-editing the TFTSG monograph entitled

Conservation Biology of Turtles and Tortoises. In addition to his academic credentials, Ray has 13 years of experience working for and opening innovative zoological institutions in the United States and Canada. His extensive animal husbandry experience was obtained while working at such facilities as the *Biodôme de Montréal* and the Springs Preserve in Las Vegas, Nevada. He serves on the Governing Board and as the Chelonian Section Editor of *Herpetological Conservation and Biology*, a journal he co-founded in 2006.



Andrew Walde is a Research Biologist with Walde Research & Environmental Consulting based in Atascadero, California. He obtained a B.Sc. from the University of Western Ontario in London, Ontario and a M.Sc. from McGill University (1998) in Montréal, Québec, Canada. His current dissertation research investigates microhabitat selection, burrow use, activity, and movement patterns in a large population of Desert Tortoises. He is a member of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. He also serves as the co-chair of the Program Committee for the Annual Symposium on Conservation and Biology of Tortoises and Freshwater Turtles. He was an Editor on the updated *Turtles in Trouble*, *The World's 25+ Most Endangered Tortoises and Freshwater Turtles* and serves as an Editor for *Herpetological Conservation and Biology*.

Board member and long-time TSA supporter **Chuck Landrey** recently stepped down from the Board, citing a desire to refocus his efforts toward local chelonian conservation in the northeastern United States — something that has long been a passion for him. Chuck served the TSA generously during his time on the Board and his input will be missed, though we have been assured that he will continue to lend his support to the TSA.

Strengthening the Alliance

HEATHER LOWE | HLOWE@TURTLESURVIVAL.ORG

Here at the TSA, we truly feel like our members are the secret to our success. With that in mind, we are pleased to announce that once again our membership has continued to grow in 2011. We have more members than ever before, representing 30 countries! We've heard time and again that "word of mouth" is our most powerful recruitment tool, so we'd like to say thank you to all of you who have helped to spread the word about the TSA and our conservation projects around the globe. Funds generated by membership dues help to offset the operating costs of the TSA and also allow access to non-restricted funds that can be used in the event of unexpected costs related to conservation projects. In essence, your support is critical to our success.

The TSA is truly a grassroots organization and we hope that each of our members and donors feel engaged in the work that is being done on their behalf for turtles globally. Aside from the magazine, you can keep up with the TSA and our field projects via the website, e-mail newsletter, Facebook page, even text messages! If you have any suggestions about how we may better serve you in terms of communications, please let us know.

We firmly believe that **anyone** can contribute to turtle conservation, regardless of background or experience. Each and every member has the ability to become an advocate for turtle conservation in their local community, increasing the TSA's presence around the world. In this issue, we are highlighting five truly exceptional members who do just that. We hope that you enjoy getting to know them.

formative workshop in 2001. Soon afterward, I got in touch with Rick Hudson (TSA President) to discuss loaning several large geoemydid species for TSA assurance colonies.

How would you describe your personal conservation philosophy?

My conservation philosophy is simple and selfish: I prefer the outdoors to every other human pursuit in life, so I want there to be enough outdoors to satisfy my preference. On a more professional level, I accept that we don't understand our planet adequately to confidently erase large swaths of its ecosystems and the services rendered by them. People will only work hard to maintain environments if they both understand the importance of nature and hold a direct personal stake in the matter, so it is more critical than ever for people to get outdoors and/or become educated on what they can do to reduce their impact. My focus on turtle conservation comes from whatever hardwired me to have a particular affinity to those critters.

Have you ever tried to educate others about turtles and turtle conservation?

Discussing biology in general has always come first for me, and with my bias for turtles, I naturally wind up talking turtle conservation more than many people would expect. I've given talks about this topic to regional herp clubs, classrooms ranging from elementary schools to colleges, and professional conferences. I prefer though to reach out to conscientious individuals one at a time, who otherwise may have no likelihood of learning about turtles' current status. In the big picture, those are the folks who elect the representatives that control (directly or indirectly) how turtles are managed.

Tell us about your job.

I'm a scientific illustrator via a graduate research assistantship at The University of Texas at Arlington. As a grad student, my research centers on river turtle ecology in Midwestern North America. During the long semesters, I use a digital setup to illustrate Central American herpetofauna, and during the summer I spend large amounts of time in Ozark rivers collecting data on turtle abundance. It's a livable gig.

STEPHEN ECREMENT

Hometown: Alliance, Ohio

Occupation: Wildlife Biologist at the Fort Polk military installation.

What are some of your hobbies?

I love traveling nationally and internationally to see different cultures and environments,



BEN ANDERS

Hometown: Little Rock, Arkansas

Occupation: Graduate Research Assistant

What do you enjoy about being a member of the TSA?

The networking fostered by TSA has allowed me to promote international collaboration in the conservation of an endangered turtle that otherwise may not have come about. I imagine

everyone participating in the conservation of turtles does so because it fulfills them on a personal level, and my own drive is no different; TSA continues to demonstrate it is the organization that will initiate or enhance this drive for people all over the world. I also enjoy TSA's annual conference, which is second to none.

How did you first learn about the TSA?

I first learned of the TSA shortly after its inception from Patrick Baker, who attended the



collecting “passport” stamps while visiting US National Parks, hiking, camping, canoeing, freshwater fishing, birding, searching for herps (especially adding to my turtle species list) and generally just being outside. I also enjoy listening to blues, bluegrass, folk, classic rock and many other genres of music, drinking beer or Flor de Caña rum with family and friends, studying history, reading non-fiction books, playing racquetball, working on my house and in the yard, playing with our cats and dogs, and spending as much time with my wife, Mariamar, as possible.

Tell us about your family.

My mom and dad still live in my childhood home in Alliance, Ohio. I have two sisters and one brother that live in northeast Ohio, one brother that lives in Delaware, 12 nieces and nephews, and two godchildren. I’m married to Mariamar Gutierrez, who is also a wildlife biologist, from Nicaragua. We met in 2004 when I was a summer employee at Cuyahoga Valley National Park and she was a Park Flight international intern at the same park. We currently live in DeRidder, Louisiana with our three rescued dogs Luna, Guthrie and Guinness and two rescued cats, Mango and Banjo.

What is your most memorable encounter with a turtle in the wild?

The first time I caught a common snapping turtle I was about seven years old. My friend and I pulled it out of the creek and took turns carrying it back to my house. We put it in an old kiddie pool, filled it with water, and observed it for several hours. I was going to convince my parents that this would be a great pet, but it was gone the next morning.

Have you ever tried to educate others about turtles and turtle conservation?

Mariamar and I hiked a section of the Appalachian Trail this year to raise money for the TSA’s efforts in Belize, which resulted in a lot of discussion about turtle conservation with family, friends, and coworkers. I also give a talk about freshwater turtle conservation every year at the

South Polk elementary wildlife field trip.

Tell us about your job.

I work for Colorado State University’s Center for the Environmental Management of Military Lands (CEMML). My main responsibilities at the Fort Polk military installation are to manage and monitor two separate populations of the endangered Red-Cockaded Woodpecker (RCW). In addition to RCW work, a large portion of my time is spent surveying for herpetofauna. I currently run several Louisiana Amphibian Monitoring Program (LAMP) routes to identify anurans by call, snake traps to target Louisiana Pine Snakes (a candidate species), and trap the headwater streams on Fort Polk to collect data on Alligator Snapping Turtles. Additionally, I am looking at amphibian productivity in artificial vernal pools created by old military maneuver damage.



MARIAMAR GUTIERREZ RAMIREZ

Hometown: Managua, Nicaragua

Occupation: Wildlife Biologist

What are some of your hobbies?

I enjoy cooking and trying new vegetarian recipes, gardening, hiking and bird watching.

Do you have any pets?

I have three dogs and two cats, all rescued from the Humane Society of Western Louisiana.

What first sparked your interest in turtles and tortoises?

When I was little, my dad would be away for weeks traveling to other countries for work. When he returned home, he would bring my

mother a new turtle ornament from the country he just visited. My mother’s turtle collection grew to include turtles from Mexico, Central and South America, the Caribbean, United States, Europe and Asia. I have now started my own turtle collection from the countries I have visited. I got my mother’s love of turtles and my father’s love of travel.

What is your most memorable encounter with a turtle in the wild?

My most memorable encounter with a turtle in the wild was very recent. I was sitting quietly in the woods in Western North Carolina trying to determine the nesting site of a bird. As I sat there, the ferns in front of me started to move. Very slowly, an Eastern Box Turtle emerged without ever noticing me. It was very exciting to see it moving through the woods so close to me.

Tell us about your job.

I’ve worked with migratory birds for eight years. I am currently working in western North Carolina, studying breeding Black-throated Blue Warblers.



KENAN HARKIN

Hometown: Jupiter, Florida

Occupation: Action Sports Broadcaster

Tell us about your family.

I’m from Long Island, New York and I am one of seven kids. Three of my sisters are involved in raising horses and caring for unwanted pets. I guess a love for animals runs in my family; I’m just drawn to scaly critters.

Do you have any animals?

I keep a small group of animals that are mine. I work with Cuban and Rhino Iguanas, African

Spurred and Elongated Tortoises, and one cat. The rest are animals that I foster for the TSA.

What first sparked your interest in turtles and tortoises?

When I was four years old, I was obsessed with Godzilla! That inspired me to learn more about dinosaurs, which in turn brought me to reptiles. At the age of six, my dad and I were in a pet store that had a small pond with adult Red-Eared Sliders. One just kept begging for food and I had to have her! My pop saw that I wasn't going to leave without my new friend. He bought the turtle for me and I had it for thirteen years!

What do you enjoy about being a member of the TSA?

I love the ability to help turtles worldwide. Being a steward for a large group of TSA animals here has been an honor. These are animals that surely would have ended up in a soup pot without the TSA's help. Now we are ensuring that they are able to live out their days in peace and reproduce to ensure the survival of the species. It's great to be a part of this process!

How would you describe your personal conservation philosophy?

I believe conservation is an "action sport." (LOL!) I like to be involved in rescues and health assessments of rescued animals. Getting involved in a "hands on" way brings you to new places and introduces you to new people. Plus, the best part is you are making a difference – no matter how small.

Tell us about your job.

I've been a Pro BMX freestyle rider. I've competed in the X Games and various action sports events all over the world. From there I became a television announcer for action sports. I have been very fortunate in my career, traveling to Beijing for the Summer Olympics and Vancouver for the Winter Games. I also give talks with my business "Reptiles on a Mission." I speak at schools, summer camps, and birthday parties to get the word out about reptile conservation.

ANDREA CURRYLOW

Hometown: Atascadero, California

Occupation: Wildlife Biologist/Graduate Student

What are some of your hobbies?

I am fortunate in that my interests are cohesive with my work. I very much enjoy being outside and active. I used to say I was a rock climber, kayaker, mountain biker, back-country camper, and cross-country skier. I still enjoy those things, but as my goals bring me to new areas and new



responsibilities, I usually find myself hiking and camping as part of my field research.

What first sparked your interest in turtles and tortoises?

As many people find, turtles are just so charismatic! In 2003, I was amazed to see Harriet, the 175-year old Galapagos Tortoise that Chuck Darwin brought back from the Islands at the Australia Zoo. I felt such a fantastic, living connection to science history. I have always found turtles relatable, but only recently did I realize that tortoises were where I wanted to focus my career. I had the opportunity to work with the Mojave Desert Tortoise for a couple of years straight out of college. I quickly developed a deep affection for the Mojave, but at first I didn't recognize the extent of my interest. It was only after emphatically describing what I had learned about desert tortoise biology to a friend that he suggested my obvious enthusiasm should guide my research goals.

What is your most memorable encounter with a turtle in the wild?

"C'mon" I yelled behind me as I ran through the downpour that had just begun to penetrate the thirsty desert crust beneath my feet, "we're gonna find one!" I could tell this first big rain would bring out those elusive and threatened Jurassic relics. In fact, I could feel it; I was going to see Desert Tortoise.

It was raining in late August. It was my first year in the Mojave Desert. And I found them.

What do you enjoy about being a member of the TSA?

TSA members form an earnest and cohesive community. The people I've encountered at the annual meetings intensely share my interests and passion for turtle conservation. The TSA provides an unparalleled venue for sharing ideas and compiling the skill sets necessary for the development of effective conservation projects.

Have you ever tried to educate others about turtles and turtle conservation?

Since I started working with turtles in 2004, public outreach and education has been a part of my job and has become a personal obligation. I headed up the Desert Tortoise education program at Edwards Air Force Base, briefing every new or entering Air Force employee, contractor, and their families on tortoise status and conservation. I had the opportunity to bring captive tortoises to girl scouts and school classrooms, allowing the kids to connect with the animals and encouraging them to convince me why tortoises are worth caring about. When I worked with Eastern Box Turtles in Indiana, I took every opportunity to share their story of severe decline with local newspapers, nature center programs, and landowners. I believe it is our responsibility as research scientists and wildlife professionals to publicly disseminate the knowledge we're discovering. Public education and involvement is the only way to achieve effective tortoise conservation.

Meet the Staff



CRIS HAGEN

The Turtle Survival Alliance is pleased to announce that Cris Hagen started as the organization's first Director of Animal Management in October 2010. Cris is now responsible for the strategic development and management oversight of turtle assurance colonies to support our conservation mission. Cris' extensive background includes a mixture of herpetoculture, animal collections management, biological sciences, field research and environmental education. His captive husbandry experience spans roughly half of the world's chelonians and he has successfully

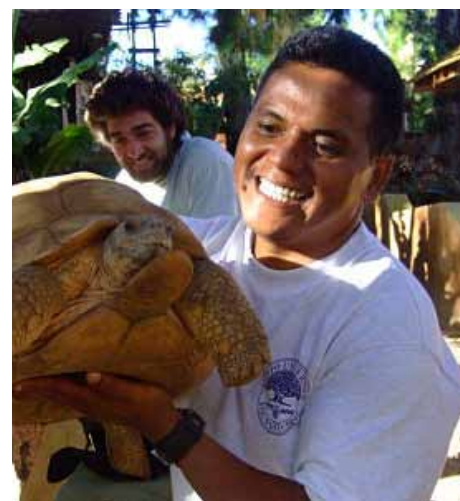
bred 40 species from six families. Cris has been an active member of the TSA since its inception and we are pleased to have him join the organization in this official capacity. This position is supported through grants from the Beneficia Foundation and the Mohamed bin Zayed Species Conservation Fund and a partnership with University of Georgia's Savannah River Ecology Laboratory.

KALYAR PLATT

Kalyar hit the ground running when she started as the TSA's Turtle Conservation Coordinator in Myanmar in January 2011. As a PhD (Chulalongkorn University, Bangkok) and turtle biologist with field experience in Thailand, Malaysia, and her native country of Myanmar, Kalyar brings years of practical experience to this position.

Kalyar will coordinate TSA's turtle conservation program in Myanmar in collaboration with the Wildlife Conservation Society, the Myanmar Forest Department, and other local academic and NGO partners. Kalyar will devote much of her time to managing and expanding existing captive assurance colonies for Burmese Roof Turtles, Burmese Star Tortoises, Arakan Forest Turtles, Asian Mountain Tortoises and endemic softshell turtles. Her field research efforts will be directed at developing reintroduction programs for Roof Turtles and Star Tortoises, and identifying safe release sites for rehabilitated turtles saved from the trade. Additionally she coordinates in-country support for rescue operations when turtles are confiscated by the Forest Department, and

is currently spearheading efforts to construct the country's first turtle rescue center. She will also be conducting mobile training workshops on turtle conservation and biology for government personnel at selected national parks throughout Myanmar. This position is supported by a grant from the Beneficia Foundation, with generous support from Andre Prost, Inc. / Taste of Thai. The TSA would also like to acknowledge the Wildlife Conservation Society for their logistical support and partnership.



HERILALA RANDRIAMHAZO

Herilala Randriamahazo, a long-time tortoise conservation biologist, came on board with the TSA in September 2010 as our full-time Madagascar Tortoise Conservation Coordinator. Herilala is based at the office of the Henry Doorly Zoo's Madagascar Biodiversity Partnership (MBP) in the capitol city of Antananarivo. Herilala brings a lot to the table politically because his reputation is well established, both within the Government and the Conservation NGO community. He speaks fluent English and Japanese (he received his PhD from the University of Kyoto) as well as several dialects of Malagash. He is a dynamic speaker and able to command a room and chair meetings with confidence. This position is supported, in part, by gifts from the Chelonian Research Foundation, Conservation International, the AZA Chelonian TAG, and Oregon Zoo's Future for Wildlife Fund. The TSA would also like to acknowledge Ed Louis and Henry Doorly Zoo's Madagascar Biodiversity Partnership and Conservation International Madagascar for their generous financial and logistical support.



COVER STORY
YUNNAN BOX TURTLE



Adult female *Cuora yunnanensis* from Yunnan, China. Without effective protection and management of the last remaining populations, this species will surely disappear from the wild. PHOTO CREDIT: CRIS HAGEN

Building an Assurance Colony for One Of The World's Rarest Turtles, the Yunnan Box Turtle (*Cuora yunnanensis*)

CRIS HAGEN, RICK HUDSON AND MICHAEL LAU

With only 12 museum specimens collected over a hundred years ago known to science, and after nearly 60 years of not being found alive anywhere, the Yunnan Box Turtle was officially listed as extinct on the IUCN Red List in 2000. Then in 2004,

rumors (along with a few Internet photos) had spread that one had been found in a pet market in Kunming, Yunnan, China. Since then, a very limited number of additional living individuals have been found in the local pet markets around

Kunming. Their taxonomic validity as *Cuora yunnanensis* has been subsequently confirmed through morphological and molecular studies.

In 2005, the Kadoorie Conservation China Department of the Hong Kong-based Kadoorie



Professor Rao Dingqi manages an assurance colony for the critically endangered Yunnan Box Turtle that may ultimately determine whether this species survives or not. **PHOTO CREDIT: RICK HUDSON**

Farm and Botanic Garden (KFBG) began supporting Professor Rao Dingqi of the Kunming Institute of Zoology, Chinese Academy of Sciences (KIZ-CAS) to conduct field surveys, and worked with him to develop *in-situ* conservation actions as well as a captive breeding program for this species. The surveys were also partly supported by a small grant from the World Wildlife Fund.

In 2006 Ting Zhou, a Chinese turtle specialist, succeeded in reproducing the Yunnan Box Turtle in captivity for the first time, and has continued to do so for the last few years.

After nearly 100 years one of the greatest mysteries in turtle biology was finally solved in 2008, when a small isolated population was located in the wild by Professor Rao Dingqi and his colleagues (Rao, Lau et al., in press). The site is now being closely studied and monitored by Professor Rao and KFBG's experts, local wildlife managers and villagers. All feasible options for protecting the wild habitat for this species are being explored at this time.

In response to this discovery *C. yunnanensis* was officially recognized as “rediscovered” in 2009 and its status upgraded on the IUCN Red List from Extinct to Critically Endangered, symbolically providing a rare *second chance for survival*.

With a few animals from this population and some rescued from the markets and local village homes, an officially sanctioned captive assurance colony was established at a secure location in Kunming, under the oversight of Professor Rao; captive reproduction first occurred in this colony in 2010.

Following the May 2011 *Cuora* workshop in Gangkou, China, a TSA delegation travelled to Kunming, China to visit the *C. yunnanensis* assurance colony. The TSA worked with Professor Rao, KIZ-CAS, and KFBG in Hong Kong to provide improved husbandry practices, breeding conditions, and security for this valuable colony. In 2010, the TSA had shipped six medium sized Waterland Tubs to Kunming for the breeding program. During the May visit, the delegation worked closely with Professor Rao to upgrade the assurance colony habitats to improve water quality and nesting areas. The



(Above) Shade cloth that can be easily pulled back and forth over tubs is installed to protect turtles from summer heat. (Below) A hatchling *Cuora yunnanensis* that hatched in October 2010, from the assurance colony managed by Professor Rao Dingqi and his staff. PHOTO CREDIT: CRIS HAGEN



turtles were divided into individual and numbered enclosures, which contained both land and nesting areas. Live plants added sufficient cover for these shy turtles. Drains and overflows were installed on the Waterland Tubs for ease of cleaning, and new overhead shade cloth (that can be easily opened and closed) was repositioned to better protect turtles from overheating in the summer.

The first hatchling from this group provides

optimism for the future survival of this species and it is our hope that with improved husbandry techniques and the use of professional incubators the number of hatchlings produced from this colony will increase. It is an indication of Professor Rao's commitment to the project that on May 27, three females were determined to be gravid with multiple eggs. The TSA is exploring partnership with our colleagues at KFBG and Professor Rao and hopes to continue to provide financial and logistical support for this project, but our most important role will likely be in the form of capacity building. We will continue to provide assistance in any form that is requested and we hope to make frequent visits to lend a hand with future facility upgrades. This captive assurance colony may well hold the key to this species' survival, and we must not let this opportunity slip away. A third chance for survival may not be in this species' future.

IN RESPONSE TO THIS DISCOVERY *C. YUNNANENSIS* WAS OFFICIALLY RECOGNIZED AS “REDISCOVERED” IN 2009 AND ITS STATUS WAS UPGRADED ON THE IUCN RED LIST FROM EXTINCT TO CRITICALLY ENDANGERED, SYMBOLICALLY PROVIDING A *RARE SECOND CHANCE FOR SURVIVAL*.



PHOTO CREDIT: JOSEPH P. FLANAGAN

The Return of Tortoises to Pinta Island, Galapagos

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Conservation efforts to save endangered species often begin with breeding programs to propagate animals whose numbers have dwindled to a small fraction of their original proportions due to anthropogenic actions. Efforts are initially made to preserve the animals themselves despite ongoing threats to the animals in their native habitat. Unfortunately for many animals, the habitats they once inhabited are changed forever with little hope of re-introducing the species

to their natural environment. However, when threats to those species can be removed, and habitats restored, the lack of a keystone species in an ecosystem can doom the establishment of the natural balance originally present.

An ecosystem can be considered to be analogous to a living organism: each species in that system being analogous to the organs of a body, with the health of the whole, dependent upon the health and function of each of the constituent

parts. An ecosystem can be considered healthy if it retains all of the original species of plants and animals living in dynamic equilibrium without the influence of introduced species or significant anthropogenic change.

Giant tortoises of the Galapagos Islands were heavily exploited by whalers and buccaneers as food during the 18th and 19th centuries. Of 13 original species, eleven remain. Zoo attempts to save giant tortoises from extinction started with

the New York Zoological Society's Townsend Expedition in 1928, which brought 108 tortoises into captivity for captive breeding. Some of the animals collected at that time are currently producing offspring in zoos and private collections.

Protection of the Galapagos began with the establishment of the Galapagos National Park in 1959. The Charles Darwin Research Station established a tortoise rearing center on Santa Cruz Island in 1965. The initial efforts here were to hatch eggs and rear hatchlings from the Pinzon (Duncan) Island Tortoise. This species had shown no recruitment into the population for decades due to predation on hatchlings by the introduced Black Rat (*Rattus rattus*). The Española tortoise population had been nearly eradicated. A total of 12 individuals were found and moved to the rearing center between 1963 and 1974 for captive breeding.¹ These two programs, along with other efforts, established breeding, hatching, and rearing methodologies in order to repatriate a maximum number of tortoises to their native islands.

Additionally, giant tortoises which had been kept as pets in Ecuador (with no known source of origin) were surrendered to the National Park and maintained at the tortoise rearing center. For a short time these animals were allowed to breed, resulting in a group of hybrid animals which were also maintained at the center.

Working with biologists, wildlife veterinarians can play key roles in the conservation of biodiversity and the restoration of balance in an ecosystem. One typically would think the role played by veterinarians would be to enhance wildlife production, diagnose disease problems, treat diseased or injured animals, or provide anesthesia or chemical restraint for translocation of animals. However, in a unique situation, sterilized giant tortoises are being used to help restore a natural state of balance on the small island of Pinta in the Galapagos archipelago.

In December 2008 the Galapagos National Park Service (GNPS) inquired about the sterilization of giant tortoises. Could it be done, what would be needed, and when could it happen?

Island ecosystems tend to be relatively simple, having relatively few species when compared to larger land masses or continents. Loss of one species or the introduction of others can have a rapid, dramatic impact on other species in the habitat and can cause the ecosystem itself to fail. While remnant populations of native species may still exist, they may be at different population levels and their interspecies interactions, and impacts on the environment might be changed.



Ovariectomy through pre-femoral fossa of a hybrid Galapagos Tortoise. PHOTO CREDIT: JOSEPH P. FLANAGAN

Each of the islands in the Galapagos is unique. While there are many animal and plant species which are common to several of the islands, each island has a different combination of plants and animals, unique geology, terrain, weather, and especially, a unique degree of impact from human degradation. Humans have exploited the islands for nearly 500 years, harvesting wildlife - sometimes to extinction - and introducing domestic animals and pest species such as rodents, but also invertebrates and plants which threaten the well being and survival of native animals through competition or predation.

Pinta Island, in the northern part of the archipelago had an endemic species of tortoise (*Chelonoidis abingdoni*) which was reduced to functional extinction by the mid 1800s. Giant tortoises on Pinta were thought to be extinct for most of the last 100 years until a single animal "Lonesome George" was found there in 1971.² "George" was removed to the Charles Darwin Research Station in 1972 in hopes a mate might be found, and the pair could breed, resulting in repopulation of the island with the species of tortoise found nowhere else on earth. Despite world-wide efforts to locate tortoises with "Pinta" genes, no mate for George has been found.

Since its inception, the Galapagos National Park has been working to eradicate introduced species and restore populations of native and endemic species to their natural balance. Resto-

ration of the island of Pinta was nearly complete. Introduced goats were eradicated in 2003 and native vegetation, grazed to near extinction by over 40,000 feral goats, was returning with thick, herbaceous and woody growth. Other native wildlife species were still present. The only key species that was missing was the giant tortoise. With no large herbivore, surviving vegetation was growing unchecked. There was no disturbance, no large seed disperser, and no cropping of lush growth. What should be a mosaic of grassland pampas, scrub, and desert vegetation was becoming woodland, with a canopy of vegetation not conducive to the survival and well being of the other species of wildlife present on Pinta. Pinta Island needed a large herbivore, a giant tortoise. The "native" species is not available and the possible introduction of another species as surrogate is being studied, but a "habitat engineer," a non-breeding population of giant tortoises, was needed immediately to maintain the biodiversity of this unique island.

Elective sterilization in chelonians is not routinely performed. Surgery of the chelonian reproductive tract normally is performed when there is a health problem such as retained ova in females, or prolapsed phallus in males. In these cases, surgery is generally performed to salvage the life of the patient. There are a number of procedures that can be done to render tortoises reproductively sterile. Males can be castrated, vasectomized,

or their phallus can be amputated (the phallus is used for copulation, but does not play a role in the elimination of urinary waste). Females can be ovariectomized or hysterectomized. The goal was that both sexes would be rendered infertile, so there would be no chance of genetic contamination if a pure species from another island is one day introduced to the island.

Planning and logistics had to account for performing up to 50 surgeries in one week. A veterinary team, endoscopic surgical equipment, supplies, and medications all had to be brought in. A surgical “suite” had to be established, and housing identified for post-op and recovery. Contingencies for managing emergencies or adverse response to anesthesia, and aftercare of the patients were necessary. Most importantly, the team had to be able to adapt their skills to solve unique problems and achieve their goals. Surgeries were performed in November 2009.

Tortoises were selected from the group of hybrid animals maintained at the “Centro de Crianza” (tortoise rearing center) which had hatched in the 1960s and 70s, and others hatched to captive held animals on the island of Floreana, based on genetic confirmation of their hybrid status (G. Caccone pers. com). These animals had no “home island” where they could be released. If sterilized however, they could be used to help to restore the habitat on Pinta, while the search for the most appropriate pure species of tortoise can continue. Additionally, these animals would no longer need to be cared for in captivity throughout the remainder of their lives (up to 100 years or longer). These hybrid tortoises ranged in size from 20 to 100 kg and there were both male and female tortoises in the group.

Ultimately the decision to perform laparoscope assisted ovariectomy was made because it could be performed through the limited access of

the pre-femoral fossa. A small incision and minimal tissue handling would result in rapid healing and minimal discomfort to the animal. Males were sterilized by amputation of the phallus. The procedure could be done utilizing intrathecal anesthesia, resulting in minimal risk and discomfort to the animal. Castration or vasectomy would have required an intracoelomic procedure utilizing general anesthesia and a much greater risk of complications. In addition, the procedure developed and performed can be done in the future by local veterinarians without elaborate equipment or advanced surgical skills.

Prior to surgery, blood was collected from all animals to determine baseline hematology and serum chemistry values. Female tortoises underwent general anesthesia with a combination of medetomidine and ketamine. Buffered lidocaine was used as adjunct anesthesia at the site of the surgical incisions. They were placed in dorsal re-



Amputation of the phallus in hybrid Galapagos Tortoises to prevent successful copulation. PHOTO CREDIT: JOSEPH P. FLANAGAN

cumbency and stabilized using automobile tires as a cradle. The skin of their pre-femoral fossae was aseptically prepared, and small incisions were made bilaterally to permit the introduction of the laparoscopic instruments and to access ovarian tissues. All ovarian tissues were removed and the incisions closed using standard surgical techniques.³ Anesthesia was reversed using atipamezole and all animals were ambulatory within two hours.

Male tortoises were positioned in dorsal recumbency similar to the females. They were anesthetized with buffered lidocaine administered intrathecally (into the cerebro-spinal fluid surrounding the spinal cord) resulting in near immediate anesthesia of the tail, cloaca, and associated tissues.⁴ The phallus was exteriorized, ligated at the base, and excised. Mucosal tissues were sutured over the stump of the phallus. After surgery all tortoises were immediately able to ambulate normally.

All animals were administered post surgical analgesics and a long-acting broad spectrum antibiotic to minimize discomfort and reduce the chance of post surgical infection. Animals were monitored in small recovery pens for 1-3 days after surgery then were moved to an outdoor pen at the Centro de Crianza for holding and longer term monitoring while arrangements were made for their release on Pinta.

Before release all tortoises were given a physical exam. Blood was collected to assess health status, and fecal samples analyzed for parasites. To prevent the introduction of plants not native to Pinta, their intestinal tracts had to be free of seeds prior to transport. Their pen was monitored for any fruiting/seeding vegetation and they were fed a seed free herbaceous diet for two months before release. Finally, to prevent the introduction of parasites or other disease causing agents, the animals had to be screened and prophylactically treated for enteric nematodes prior to transport to their release site. Considering the normal gastrointestinal transit time, anthelmintics were administered four weeks, two weeks, and immediately prior to transport. Their skin was examined to assure that it was free from any invertebrates that should not be introduced. The tortoises were each fitted with a radio transmitter so they could be followed in their new habitat. 39 tortoises traveled by boat to Pinta Island in May 2010 to do their part in restoring the balance of nature in this remote part of the world. Graduate students from the State University of New York, College of Environmental Science and Forestry monitored the tortoises and their impact on the island for the first ten weeks



Dr. Divers visualizing internal structures via endoscopy while Dr. Rivera exteriorizes ovarian tissue in a hybrid Galapagos Tortoise. PHOTO CREDIT: JOSEPH P. FLANAGAN

after release, with follow-up visits planned over the next several years.

The success of this project depended on the collaboration of biologists, technicians, students, employees of the Galapagos National Park and Veterinarians skilled in medicine and surgery of reptiles. The release site was selected based on knowledge of historical habitat used by tortoises on the island. Post release monitoring of the tortoises is being performed to assess their impact on the environment and to monitor their interactions with other species on the island.

Editor's Note: The TSA invited Dr. Flanagan, a long-time TSA member, to share a report on this project in Turtle Survival as it is a great example of the role of veterinary medicine in chelonian conservation. The TSA did not provide direct support to this project.

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第二届闭壳龟保护国际研讨会
2nd TSA/IUCN Cuora Workshop



23rd to 25th of May 2011 - Gangkou, Guangdong, China

Workshops Recommend Intensified Focus on Imperiled Asian Box Turtles, genus *Cuora*

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The Asian Box Turtle Genus *Cuora* consists of 13 species, all of which have one thing in common: they are at very high risk of extinction. All but one of these species is listed as Critically Endangered (CR) by the IUCN Red List as of 2011. Five of these species are ranked among the 25 most endangered turtle species on the planet, four more can be found in the “top 40” as assessed by the Turtle Conservation Coalition. Without any doubt, *Cuora* is the genus of turtle in most trouble in the world, threatened by the overharvest for the pet trade, turtle farms, food markets, traditional Chinese medicine (TCM) and habitat destruction throughout its entire range. The desire for these turtles has created current market values reaching into the tens of thousands of dollars for individuals of certain

species. With such high market values and unsustainable rampant range-wide collection, it has taken only three decades to completely extirpate many populations of different *Cuora* species. Very little is known about the natural habits for most of the species, with one, Zhou's box turtle (*Cuora zhoui*), not yet even formally documented from the wild. It is feared that some species are probably already extinct in the wild or at least very close to it. Furthermore, breeding successes in captivity are low for many of these species. While for most *Cuora* species, quite a number of captive specimens exist, the hatching success is low in many of them. To further complicate these matters, there are a number of valuable founder specimens residing in isolated non-breeding collections, a luxury that is unsustainable in this

situation. Compounding the problem is the fact that they are often hybridized because of the complex taxonomic issues in this genus.

Three species, *Cuora trifasciata*, *Cuora cyclornata*, and *Cuora flavomarginata* are bred by the thousands in Chinese turtle farms to satisfy the huge Chinese market demand, whether it be for a pet, status symbol, or as a supposed cancer-curing medicine. Under certain circumstances, farming can be a good approach to helping take some pressures off of wild populations. However, the creation of these turtle farms has had a huge impact on the wild populations initially and still many farmers restock their farm stock with wild animals. This is especially true for males that are not bred in the farms because of the higher incubation temperatures that are used that produce all females. Others experience high losses due to stress caused by inappropriate maintenance conditions. This male loss might sooner or later have an impact on these farms if wild stock finally ceases. Most farms interbreed the different varieties of *Cuora trifasciata*, *Cuora cyclornata* and *Cuora flavomarginata*, making offspring unsuitable for possible conservation projects.

In order to combat the eminent risk of disappearance of an entire genus, the Turtle Survival Alliance (TSA) and the IUCN Tortoise & Freshwater Turtle Specialist Group (TFTSG) initiated a *Cuora* workshop to approach and evaluate potential ways to save these species both in the wild (at least trying to preserve some remaining



Opening talk by Prof. Dr. Hexiang Gu, President of the National Gangkou Sea Turtle Reserve, the host of the workshop.



On day two of the workshop, a “round table” was formed for discussing the required actions for each *Cuora* species.



One of the workshop organizers, Torsten Blanck, giving an overview on the genus *Cuora*.

habitat) and in captivity. The goal of this workshop was to create realistic action plans for each of the 13 species.

The first TSA/IUCN *Cuora* workshop was held August 19, 2010 in Orlando, Florida. A total of 35 participants from seven countries, mainly from the U.S. and Europe, participated in the workshop. Unfortunately, there was a distinct absence of Chinese representatives due to problems obtaining travel visas. The main focus and recommendations of this first workshop was clearly that of the captive sector, since most of the participants originated from this group.

The following general recommendations were made:

- Assurance colonies are likely the best way to prevent extinctions at the present time.
- Husbandry manuals need to be created.
- Placement strategies are needed for hatch-

lings that are produced.

- Improve the status of Studbooks in the U.S. Studbooks are well maintained in Europe.
- Range-wide genetic research on all *Cuora* species should be conducted to maintain pure groups in captivity and possibly identify important yet unknown lineages.
- Research on natural history is lacking for almost all species.
- Protection of remaining habitat is essential for future release programs.
- A workshop in China was suggested for 2011 to discuss further steps for *in-situ* and *ex-situ* programs with Chinese and Vietnamese (and nearby countries) experts.

Due to the absence of Chinese participants, it was clear that a second workshop needed to be held in China to include as many Asian attendees as possible so that achievable action plans could

be identified. The second TSA/IUCN *Cuora* Workshop was held in Gangkou, Guangdong, China from May 23-25, 2011. It was hosted by the National Gangkou Sea Turtle Reserve. Holding this *Cuora* specialist workshop in China was critical in facilitating the opportunity for Chinese academics, students, biologists, NGO's, turtle farmers, and *Cuora* specialist hobbyists to sit together in one room and have an open dialogue regarding the conservation of all *Cuora* species. There were 50 participants (over 70% from China) representing nine countries.

Day one of the workshop included presentations on the wild and captive status of *Cuora* species in China, Taiwan, Hong Kong, Vietnam, Indonesia, Malaysia, and the Philippines. The following two days were used to put the entire group together at a roundtable to complete the IUCN Red List recommendations for all *Cuora* species, as well as evaluate them all for recommendations and actions that will lead to conservation priorities. At this workshop it was recommended that all but one species of *Cuora* be listed as Critically Endangered (CR) on the IUCN Red List.

To combat the complex issues threatening this group of turtles, deliberate action is needed. The following is a summarized list of primary recommendations and action plans for each species developed from this workshop.

• ***C. amboinensis*** – Collect baseline data to monitor trends such as population, trade, and harvests. Establish baseline data where data doesn't exist (Philippines, Cambodia, Vietnam, Laos, Myanmar, Bangladesh, India, and Thailand). Gather data and raise awareness of the plastron trade.

• ***C. aurocapitata*** – Establish remote nature reserves to protect quality habitat for the species away from hydroelectric activity. Develop a government breeding center within known habitat to accommodate captive bred stock from Europe and U.S. Develop studbook management within China. Continue and strengthen current local community awareness and education programs.

• ***C. bourreti*** – Monitor and enforce protected areas. Needs protection under national law. Establish an assurance colony at the planned Turtle Assurance Colony (TAC) Center in central Vietnam. Confiscate turtles from markets and trade and get them into assurance colonies. Improve captive husbandry and breeding management.

• ***Cuora cyclornata* (AKA Vietnamese *C. trifasciata*)** – The few animals that are in western collections and KFBG should be exchanged to



Michael Lau (Kadoorie Farm & Botanic Garden) did a masterful job of translating and diplomatically interpreting the workshop exchanges so that there was clear understanding of the often complex issues on the table.



There were 50 participants at the workshop in China, representing nine countries.

maintain genetic purity and diversity. An *in-situ* breeding project should be established – possibly at the Cuc Phuong Turtle Conservation Center?

- ***Cuora flavomarginata*** - Elevate protection status on China's national species protected list to class II. Strengthen protection within existing nature reserves throughout range (mainland China, Taiwan, Ryukyu Islands). Expand *C. aurocapitata* protection area to include *C. flavomarginata* habitat. Evaluate suitable habitat and develop reintroduction protocols for repatriation and monitoring of the 2000 turtles being held in Taiwan.

- ***C. galbinifrons*** - Needs national protection in Vietnam and China. Confiscate turtles from markets and trade and get them into assurance colonies. Monitor and enforce protected areas. Conduct surveys in Shiwandashan Mountain range and provide incentives and capacity training for better enforcement at known sites. Place confiscated turtles from local villages within range on Hainan in a core habitat management area.

- ***C. mccordi*** - Identify a local biologist to champion the species and evacuate the last remaining specimens to a government sponsored *in-situ* captive breeding program. Create a protected area for future release projects. Initiate studbooks in China. Improve studbook management in U.S. and Europe and continue to investigate incubation regimes and place non-breeding specimens into breeding situations.

- ***Cuora mouhotii*** - Upgrade legislation and protection status across range countries to coincide with recent CR ranking. Conduct range wide surveys of distribution and status with emphasis

on western parts of their range (Assam, Bangladesh?, Myanmar, Yunnan). Evaluate and expand existing assurance colonies and create studbooks in U.S. and Europe. Increase breeding success in captive populations.

- ***C. pani*** - Conduct surveys to detect presence in existing protected and military areas. Increase enforcement throughout range with emphasis on Guangyuan, Sichuan province and Shenlongjia, Hubei province. Upgrade protection status to be included on the key national wild animals protection list. Create a photo identification guide for distinguishing between *C. pani* and *C. aurocapitata*. Improve studbook management and reproductive output of assurance colonies in Europe, U.S., and China.

- ***C. picturata*** - Deo Hoa Cultural Site in central Vietnam should be developed as a protected area. Needs protecting under national law. Work with province authorities to increase enforcement at known sites. Improve husbandry and breeding management. Develop studbooks in U.S., Europe, and Vietnam. Move the eleven individuals from Cuc Phuong TCC facility close to natural range to improve breeding potential. Confiscate turtles from markets and trade and get them into assurance colonies. Continue to monitor and document trade routes. Develop an identification manual.

- ***C. trifasciata*** - Recommended for listing on CITES Appendix I. Species identification guide needs to be prepared. Kadoorie Farm & Botanic Garden/WCS to conduct training courses for rescue centers. WCS to facilitate cooperation and documentation of confiscation process between customs officials and fisheries depart-

ment in China. Identify well protected small core area reserves for reintroduction of captive bred turtles. Develop best practices and process for conducting conservation based reintroductions (e.g. genetic and morphological identification, health screening, individual permanent ID, post-release monitoring). Previous release sites should be evaluated for appropriate habitat and survival.

- ***C. yunnanensis*** - Improve assurance colony management in Kunming through training, capacity building, and provision of husbandry and facility materials. Establish protected area for known wild population(s). Enhance management and enforcement of habitat. Establish a research, education, and breeding station in habitat. Expand range, distribution, habitat and population status surveys. Upgrade national protection status to class I. Conduct bloodline exchanges between captive populations.

- ***C. zhoui*** - Carry out field surveys to locate this species in the wild. When found, conduct distribution, population status, ecology, and natural history research. Develop international studbooks and bloodline exchanges. Facilitate cooperation among holders of captive specimens in the U.S. to encourage breeding. Coordinate assurance colony development within China.

It was suggested that the formation of a *Cuora* specialist working group may be beneficial. Time is running out rapidly for some of the rarest *Cuora* species. Without swift and decisive actions they will surely be gone from the wild in the very near future and without strict captive management plans, some might be gone forever sooner or later.



The first bloodline exchange of McCord's Box Turtles between TSA and the Muenster Zoo took place in 2011, likely the first of many more to come. Such transfers are necessary to improve the genetic diversity in captive assurance colonies, especially those with low numbers of founders.



An adult *Heosemys annandalii* confiscated in Hong Kong while being imported illegally to mainland China.

PHOTO CREDIT: STEVE GOTT



Upon their arrival in the U.S., 50 rescued adult Temple Turtles were unpacked, processed, and repacked during the middle of the night at the Jacksonville Zoo before being transferred to TSA members. (L to R: Dino Ferri, Brian Eisele, Steve Gott and Cris Hagen)

2011 Animal Management Report

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This year has been another active one for TSA's animal management program. On October 1, 2010, I started a new position as the TSA's first Director of Animal Management. I also continue to retain my position, in a part-time capacity, as a herpetologist, environmental educator, and genetics research technician at the University of Georgia's Savannah River Ecology Laboratory.

Since my position began with the TSA, confiscations have been imported and placed, an international bloodline exchange of a critically endangered species took place, dozens of animals have been transferred for breeding loans, adoptions, and new acquisitions, a master collection plan for the TSA's captive program is in development, important international turtle conservation workshops have been organized and

facilitated, and assurance colony programs for critically endangered species in Vietnam, China, and Bangladesh are developing and improving.

CONFISCATIONS

In October 2010, the TSA imported 50 endangered Yellow-Headed Temple Turtles (*Heosemys annandalii*) that were confiscated in Hong Kong en route to mainland China. For several months, the group was held at Kadoorie Farm and Botanic Garden (KFBG) until arrangements could be made to ship them to the United States. Upon arrival, the animals were transferred to south Florida where they have been thriving. In January 2011, one female laid a clutch of eight eggs. The eggs began hatching in mid-April and by May 1, all eight eggs had successfully hatched.

The hatchlings have been placed with three TSA members for rearing.

The TSA would like to thank everyone who donated funds to make this entire effort possible. The TSA membership responded generously to this need, as early as March 2010 when the confiscation took place, and large gifts from the Columbus Zoo and the BC Johnson Family in Kerrville, Texas put us over the top and made this costly import possible. We would also like to once again acknowledge KFBG for the excellent care that they gave the confiscated turtles while they were held in Hong Kong and for their tireless work to negotiate many of the details of their transport. Thanks also to the Taipei Zoo who helped to negotiate a fantastic sponsorship from EVA Airlines to bring the turtles to the U.S. With the generous discount on freight, the TSA was able to set up a rescue fund that will allow us to take swifter action for future confiscation rescues. Acknowledgements also go out to the Jacksonville Zoo, Bill Ninesling, and Zoo Atlanta for their assistance with processing these turtles when they arrived.



The TSA recently acquired a group of 18 Serrated Hinged-back Tortoises from the Congo, for the development of an assurance colony. African forest tortoise populations are heavily impacted by the bushmeat trade. PHOTO CREDIT: TERRY KILGORE

And a very special thank you goes out to Kenan Harkin who has provided this group of turtles with wonderful care at his facility.

CUORA EXCHANGE

The TSA's first international exchange of McCord's Box Turtle (*Cuora mccordi*) was completed in February 2011. This species is endemic to Guangxi Province, China and has been brought to the brink of extinction by unsustainable collection for the international pet trade. In October 2010, two subadult female *Cuora mccordi* captive bred at the Turtle Conservation Center at the Allwetter Zoo were shipped from Germany to Atlanta, Georgia. After the permitting process was completed, the TSA then returned two completely unrelated subadult female *Cuora mccordi* bred in the U.S. to the Allwetter Zoo in February 2011. This exchange is very important for the *Cuora mccordi* recovery plan by improving genetic diversity within the captive populations in both the U.S. and Europe. The TSA plans to continue this type of exchange with *Cuora mccordi* and other endangered species to ensure the best possible genetic diversity for captive managed species.

ANIMAL DONATIONS

Donations to the TSA this year have included: 11.5 Yellow-Margined Box Turtles (*Cuora flavomarginata*), 1.1 Bourret's Box Turtles (*Cuora*

bourreti), and 0.0.1 Arakan Forest Turtles (*Heosemys depressa*). (Editor's Note: Notation denotes sex as follows: males.females.unknowns. Example: 11.5 equals eleven males and five females)

ANIMAL ACQUISITIONS

The TSA has acquired a group of 7.11 Serrated Hinged-back Tortoises (*Kinixys erosa*) to establish an assurance colony for this species. 4.2 Flat-Tailed Tortoises (*Pyxis planicauda*), 2.1 *Pyxis arachnoides oblonga*, and 2.1 *Pyxis arachnoides brygooi* were also acquired from a long-term captive group and placed into existing TSA assurance colonies.

ANIMAL LOANS

Animal Management placed a total of 149 turtles and tortoises on breeding loan with members (19 private and 4 institutional) this past year. These include the following species: *Cuora bourreti*, *Cuora flavomarginata*, *Chelodina mccordi*, *Heosemys annandalii*, *Heosemys spinosa*, *Kinixys erosa*, *Manouria emys emys*, *Notochelys platynota*, *Pyxis arachnoides*, and *Pyxis planicauda*.

ANIMAL ADOPTIONS

A total of 17 animals were transferred to members through permanent adoption this year, including *Chelodina longicollis*, *Chelodina mccordi*, *Geochelone elegans*, and *Manouria emys emys*.



A group of confiscated Yellow-headed Temple Turtles (*Heosemys annandalii*) were introduced to their new home at this secure private facility in South Florida. This group will form an important assurance colony for this endangered species. PHOTO CREDIT: CRIS HAGEN



A one-week-old Yellow-Headed Temple Turtle – one of the eight hatchlings produced by adults from the 2010 confiscation. PHOTO CREDIT: CRIS HAGEN

WHAT DOES THE TSA'S ANIMAL MANAGEMENT PROGRAM HAVE PLANNED FOR THE COMING YEAR?

Following up on the recommendations of two *Cuora* workshops held in the U.S. (August 2010) and China (May 2011) is of critical importance. Developing new *in-situ* and *ex-situ* assurance colonies for *Cuora* species and improving the breeding conditions of existing ones is imperative for this genus. Also, developing a breeding loan program with the Turtle Conservation Center in Vietnam and moving forward with a planned Turtle Assurance Colony and reintroduction program for the Vietnamese pond turtle (*Mauremys annamensis*) in Central Vietnam is of high importance. The captive assurance colony of Northern River Terrapins (*Batagur baska*) in Bangladesh is beginning to produce hatchlings and the facilities where they are kept will need to be upgraded to accommodate safe hatchling rearing. With all the complexities surrounding them, some of these projects will require a regular presence, guidance, and support to achieve expectations for these breeding programs.

Significant Breedings

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Twin Burmese Star Tortoises (*Geochelone platynota*) have been successfully bred in captivity at the Wildlife Rescue Center of the Taipei Zoo. The egg with twin embryos was laid on 9 December 2009, one of six eggs in the second clutch laid by that female during that year. The twin embryo egg showed no discernable difference in terms of size and shape from the other five single embryo eggs of the same clutch. All six eggs hatched under temperature conditions between 28°C and 30°C after 184-186 days of incubation. The twin hatchlings weighed 9.8 g and 10.2g with the body sizes of 32 x 28 x 19 mm (L x W x H). This was approximately half the size of each of the turtles hatched from the other five eggs in the same clutch, with average body size 43 x 40 x 24 mm (L x W x H) and average weight of 23g.

PHOTO CREDITS: FIRST PHOTO SUSAN LAI DVM, SECOND PHOTO LU YU LING

Michael Ogle of the Knoxville Zoo reports on the hatching of their first Southern Spider Tortoise (*Pyxis a. oblonga*) on 24 May 2011. This represents only the sixth known hatching of this subspecies in the AZA/TSA population. The sire first arrived in the U.S. in February of 1975 and from 1983 through 2006, this animal did not have access to a female. Thanks to the TSA and Matt Frankel he has been paired with a female the last five years. For the first few years, the eggs were incubated in the same method used with *arachnoides* and *brygooi* but the eggs were either infertile or would die half way through incubation. This past season the Zoo followed the protocol used with *planicauda*: three months at 29°C, followed by two months at 18°C then placed back into the incubator at 29°C. During the last stage of incubation, the egg box is opened once per week and lightly spray-misted. After 145 days the egg pipped!

PHOTO CREDIT: PHIL COLCLOUGH



SIGNIFICANT BREEDINGS



In December 2001, the Rotterdam Zoo received a sub-adult pair of Burmese Star Tortoises (*Geochelone platynota*) from a confiscated shipment in the Netherlands. After several unsuccessful breeding attempts, the female produced a clutch of four fertile eggs in December 2009. The first two eggs hatched after an incubation period of 150 days at 31 °C. A third fertile egg, which showed no sign of a heartbeat with a Buddy egg monitor, was opened to reveal a living, fully grown embryo with an unabsorbed yolk sac. This tortoise survived although at present it is somewhat smaller than its two clutch mates.

In January 2011, the female laid a clutch of five eggs, three of which proved to be fertile. The first offspring hatched after 152 days of incubation at an incubation temperature of 31° C. With these 2010 and 2011 offspring the Rotterdam Zoo is significantly contributing to the European Studbook Foundation studbook/breeding program.

PHOTO CREDIT: HENK ZWARTEPOORTE



Phil Miskimon and Dorothy Levi report the hatching of Serrated Hingeback Tortoises (*Kinixys erosa*). Three of four eggs hatched after an incubation of 143 days at 84°F.

PHOTO CREDIT: PHIL MISKIMON



Bill Hughes at the Tennessee Aquarium reports hatching four Yellow-blotched Map Turtles, (*Graptemys flavimaculata*) on 27 June 2011. This is the third consecutive year that this federally protected species has reproduced at the Aquarium and more clutches of eggs are incubating. The Aquarium currently maintains 9.24.22 of this species. These eggs spent most of the incubation period in a nest box where temperatures fluctuate between 80 and 85°F. PHOTO CREDIT: BILL HUGHES



Paul Vander Schouw reports great success in breeding the Vietnamese Pond Turtle (*Mauremys annamensis*), a Critically Endangered species endemic to Vietnam. This photo (top) shows two females nesting simultaneously in close proximity within their pen in west-central Florida. The turtles are part of a group that have bred consistently for the past six years. The photo was taken on 18 May 2011 at approximately 2100 EST. This was the first clutch of the season for the front female and it contained eight eggs, and the second clutch of the season for the rear female which contained five eggs. A hatchling from the group is pictured, above right. PHOTO CREDIT: PAUL VANDER SCHOUW



Richard Struijk reports the hatching of second generation, captive bred Egyptian Tortoises (*Testudo kleinmanni*). The male was German F1 specimen from 2003 and both females were Dutch F1 specimens from 2004 and 2005. In January and February 2011, at the age of seven years, the female produced five eggs in three clutches. The eggs were incubated on top of dry sand at 30-31°C. Once every 25 days, water was injected at the bottom of the substrate. All five eggs hatched, two of them after 82 and 83 days. Average hatchling size was 27.9 X 23.3 mm (L x W, N=3) and average weight was 5.9 grams. Hatchlings show the most activity at dawn and dusk. PHOTO CREDIT: RICHARD STRUIJK

SIGNIFICANT BREEDINGS



A collaboration between William P. McCord, DVM, Michael G. Rapley, and Cord F. Offermann, DVM focusing on breeding *Geoemyda japonica* produced five hatchlings from a total of four clutches. Each clutch contained 1-2 elongated eggs ranging in length from 40.0-43.3 mm. One egg successfully hatched outdoors and was discovered while cleaning the adults' pen. The remaining four eggs were incubated at a constant temp of 30°C and hatched after an average period of 86 days. All turtles were robust and active upon hatching and began feeding on diced worms, pinhead crickets, and a commercially produced aquatic turtle food within a few days. This captive breeding effort is the result of continued partnership between members of the TSA and the Turtle and Tortoise Preservation Group (TTPG). PHOTO CREDIT: MICHAEL RAPLEY



Cris Hagen, Thomas S. B. Akre, Kurt A. Buhlmann, and J. Whitfield Gibbons report our first captive reproduction of the Keeled Box Turtle (*Cuora mouhotii*) from a small captive assurance colony maintained at the University of Georgia's Savannah River Ecology Laboratory in Aiken, South Carolina. A single clutch of two eggs was found on 25 August 2010. Unfortunately, one of the eggs was destroyed by the female during the nesting process. The eggs were deposited in a shallow (1-2 cm) nest chamber and covered. The nesting substrate was a mixture of top soil and shredded cypress mulch. The single undamaged egg was removed and incubated in a deli cup in moist vermiculite in a room with fluctuating temperatures ranging from approximately 20 - 30°C. The hatchling emerged on 25 December 2010. The hatchling began feeding on small crickets, diced worms, and commercial turtle pellets within three weeks.

A Workshop on the Conservation of Large River Turtles in the Genus *Batagur*

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ANDREW WALDE



Margaret Perry, a Fullbright Scholar working on *Batagur* conservation joined us for the workshop, here seen holding a young adult male *Batagur affinis* to show the distinctive head coloration exhibited during the breeding season. PHOTO CREDIT: ANDREW WALDE

Pelf Nyok and Brian D. Horne work together to measure a female *Batagur affinis* that was brought to the Turtle Conservation Centre by local fisherman. The turtle was weighed, measured and equipped with a PIT tag before release back into the river. This co-operative agreement between the Turtle Conservation Centre and the local fisherman on the Terengganu River is providing some of the best recapture data ever gather on *Batagur affinis*. PHOTO CREDIT: BRAD POYNTER

Five of the six species of *Batagur* are currently considered in the “Top 25” Most Endangered Freshwater Turtles and Tortoises.” The sixth species, *Batagur dhongoka*, is considered endangered in India and critically endangered in Bangladesh as it has disappeared from much of its former range. Thus, this genus of Asian large river turtles can be considered as one of the most imperiled genera of all chelonians, with 83% of the species ranked Critically Endangered by the IUCN Red List. Habitat destruction (e.g., sand mining and conversion of mangrove forests to shrimp farms), over hunting for human consumption (both its flesh and eggs) and incidental drowning in fishing gear have dramatically

reduced many populations of these large river turtles. All six species are in decline, and several face imminent risk of extinction unless urgent – and sound – conservation measures are enacted.

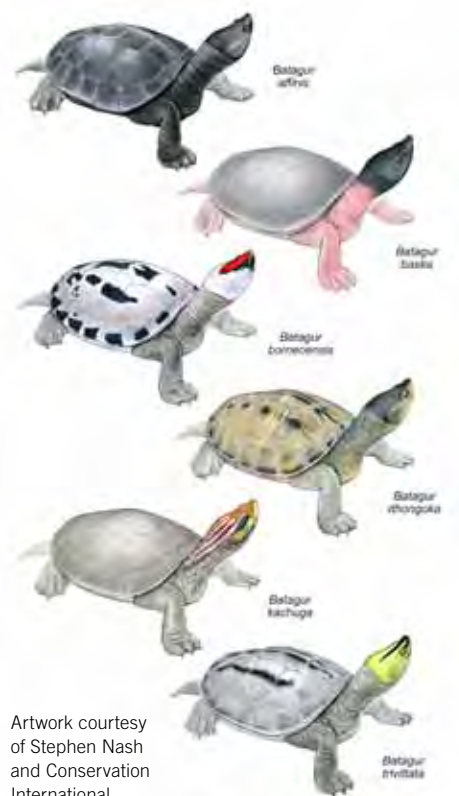
The Northern Mangrove Terrapin (*Batagur baska*) is now restricted to parts of northeastern India, Bangladesh and possibly Myanmar. However, there are no known active nesting sites and no population data exists for this species but it is apparent that wild populations have crashed with only remnant survivors remaining. The Southern Mangrove Terrapin (*Batagur affinis*) has continued to rapidly decline despite several decades of small-scale headstarting and captive breeding programs. This could be the result of these facili-

ties producing only males as up until recently nests were artificially incubated at relatively cool temperatures, which produces males. The Painted River Terrapin (*Batagur borneoensis*), much like *B. affinis*, is showing similar declines across its range and it too has been the focus of a number of small-scale headstarting programs. The Red-crowned Roof Turtle (*Batagur kachuga*) has only one known breeding population on the Chambal River with an estimated 500 nesting females remaining. The Turtle Survival Alliance (TSA) along with San Diego Zoo Global and the Madras Crocodile Bank Trust has been working to bolster its numbers for the past six years via anti-poaching patrols and riverside hatcheries. Lastly, the Myanmar Roof Turtle (*Batagur trivittata*) is also greatly restricted in range as it is now only found in a short section of the Chindwin River with as few as seven to ten females known to remain in the wild. The TSA and the Wildlife Conservation Society (WCS) have now grown this population to nearly 400 individuals through an intensive egg collection, hatching, and captive rearing program.

Currently there are a limited number of conservation programs operating independently in the following range countries: India, Bangladesh,



Workshop participants took a short survey of the Terengganu River to see habitats used by *Batagur affinis* and *Batagur borneoensis* both during the nesting season and during the remainder of the year. PHOTO CREDIT: BRIAN D. HORNE



Artwork courtesy of Stephen Nash and Conservation International

Myanmar, Thailand, Cambodia, Malaysia, and Indonesia. Unfortunately, these programs often exist in isolation, with little sharing of information and comparison of successful techniques. There also appears to be a lack of long-term planning along with periodic evaluations for the sake of making adjustments to the various conservation strategies. Nor are there mechanisms in place to evaluate these programs' successes. Unfortunately, some programs have been operating for many years and have very little quantitative data to validate their activities. Wild populations have continued to decline despite headstarting and release programs often due to the programs' failures to ameliorate high levels of hunting of adults and removal of eggs for human consumption. Over the years, we have inspected nearly all of the ongoing *Batagur* conservation programs throughout Asia. Given the critical conservation challenges that *Batagur* currently face to their survival, and the inconsistent methods used in the various programs, it became apparent that a workshop to bring *Batagur* practitioners together was long overdue. Because of this, a five-day workshop bringing together 19 *Batagur* conservationists from seven Asian and three western countries was hosted in February 2011. Wildlife Reserves Singapore, the Wildlife Conservation Society, the Turtle Conservation Fund, and the Turtle Survival Alliance jointly sponsored the workshop.



Morning discussions at Pukit Baloh centered on the importance of incorporating the eco-physiology of the turtles into facility design as well as how to design headstarting programs that can monitor the long-term survival of the released animals. Additional topics included the need for the group to draft a decision tree for when headstarting was appropriate as compared to when best to utilize nest protection and the accompanying immediate release of hatchlings.

PHOTO CREDIT: SHAILENDRA SINGH

The theme of the workshop was how *Batagur* conservationists can better utilize their individual strengths and successes to tackle the threats to this genus' survival. The workshop set out to identify what conservation practices have worked well and which have not produced desired results so that future initiatives that positively impact population growth for all *Batagur*

species can be generated.

The start of this workshop coincided with the end of another workshop "The Conservation of Asian Tortoises and Freshwater Turtles: Setting Priorities for the Next Ten Years" thus the first day was held at the Singapore Zoo as most participants had also attended the earlier workshop.

The first day of the workshop included



A beautiful setting, between the South China Sea and Terengganu River, where workshop participants discussed field data collection and how to best conserve *Batagur*. PHOTO CREDIT: ANDREW WALDE.

presentations on the phylogenetic relationships within the genus and founder effects in the creation of assurance colonies by Peter Praschag, the reproductive physiology and sex determination in *Batagur* by Gerald Kuchling, and the use of GIS to predict turtle distribution patterns by Brad Poynter. Chan Eng Heng presented on the status of *Batagur affinis* and *Batagur borneoensis* within Peninsular Malaysia, Shailendra Singh presented on *Batagur kachuga*, *Batagur baska*, *Batagur dhongoka* conservation in India, and Kalyar Platt presented on the status of *Batagur trivittata* conservation in Myanmar. After the presentations we held a round table discussion on 'best practices' for headstarting *Batagur*, collecting pertinent life history data, and methods for reducing adult mortality. An important point that was stressed was the need for all projects to collect data in a similar manner so that comparisons could be made between projects. The rationale is that if something was not working in one project, but was working well elsewhere, we would have the scientific analytical tools to try and assess why this was happening.

After this first day in Singapore, we traveled by bus to northeastern peninsular Malaysia where we would visit a headstarting facility, as well as do a night survey for nesting *B. affinis* before heading over to the Turtle Conservation Centre in Terengganu. Chan Eng Heng and Pelf Nyok were our fearless shepherds as we set off on this leg of the trip. We would have never been able to navigate all the language barriers without

their help. After some difficulty getting across the border (we found out the hard way that you are not allowed to walk across but instead must take a bus the approximately 100 feet, but there are no bus stops!) and nine hours later, we made it to a small guesthouse along the river just as the sun was setting. The only problem was that we were a few beds short so a number of folks ended up sleeping on mats on the floor. But spirits weren't dampened; as we knew that the next day we would be seeing *Batagur*.

We spent the majority of the next day at the government run Bukit Paloh *B. affinis* headstarting facility. This facility proved to be an ideal setting for discussing both the design and management of hatcheries as well as headstarting facilities. We discussed at length the proper way to transport eggs from the field to hatcheries to ensure the best hatching success as we were able to directly critique what was occurring at this facility. We were also able to critique the headstarting facility that had been built many decades ago before the eco-physiology of large river turtles was more appropriately accounted for in facility design. This was very important as new turtle facilities are currently planned in Bangladesh, Cambodia, India, and Indonesia.

In the evening we traveled to a nearby nesting site of *B. affinis* to observe the collection of eggs for the turtle hatchery. After being ferried across the river as the sun set, we huddled at the far end of the riverside sandbar waiting for it to get dark and the turtles to emerge to nest. This was

probably the most memorable night of the entire workshop as we were able to see eight females come out to nest. Yet, the night was also one of the most troubling as it was apparent that the program was poorly managed and the turtles were often interrupted before, during, and/or shortly after the nesting process by the locals who had been paid to collect the eggs. It was frustrating to the entire group that the females were often removed from their nests as soon as they finished laying instead of allowing them to complete covering the eggs. The project's staff felt "the turtle was done so why did it matter?" and they did this so they wouldn't have to work so much at uncovering the eggs. Additionally, it was distressing to see the project staff turn females on their backs shortly after nesting so they could first collect the eggs then record morphological data on the females.

The entire group felt this disappointment and frustration; however we were able to turn this into a 'teachable moment' with discussions of how things were done incorrectly, how they should be done, and how this particular project could be improved. In retrospect, it was an excellent experience as we all remember clearly what shouldn't be done. It also enabled group members to share with the entire group specific techniques that they had developed on their projects. This type of information exchange is critical in developing regional networks and partnerships for *Batagur* conservation, which was one of the primary goals of the workshop.



(Left) Workshop attendees (Chan Eng Heng, Peter Paul Van Dijk and Shailendra Singh) debate the best methods for managing hatcheries for *Batagur affinis* nests at Bukit Paloh as seen through the anti-predator fencing. Eggs are transferred to this hatchery because left in the field it is highly likely that locals will steal them as the eggs are a much sought after food item in this culture. PHOTO CREDIT: BRIAN D. HORNE



Batagur Workshop participants gathered for a group shot outside the Turtle Conservation Center.

The following day we took a bus to Kuala Terengganu where we were able to spend the morning boating the Terengganu River looking for signs of nesting *B. affinis* and hopefully see a few basking *B. borneoensis*. This area has been the long time research site of Chan Eng Heng and Pelf Nyok and where they have established the Turtle Conservation Center. We did see some nesting crawls along the sand bars, which was exciting after last night's field trip to see the nesting females. As we talked, it became apparent that there is near zero recruitment of hatchlings outside of the few hundred or so eggs Chan and Pelf are able to buy from the turtle egg collectors for hatching in their small facility. Hopefully the recruitment numbers will change soon as Malaysia passed legislation making *B. affinis* and *B. borneoensis* protected species. It was also revealed that things were about to get worse, as this area was soon to be permanently altered by the construction of a huge shrimp farm that will pump millions of gallons of sea water into the river. This will drastically change the salinity of this freshwater river system. It is not known how the *Batagur* will respond; the population may migrate elsewhere or it may simply perish because of the habitat alterations from the operation of this shrimp farm. The ecological consequences on the rest of the system are also unknown.

We ended the workshop at a small beach side boutique hotel that offered us the use of their rustic small pavilion. Our final discussion was on field data collection and to what degree this can

be used in determining how conservation actions can be more effective. We all agreed that our first priority for all species of *Batagur* needs to be research into how best to reduce adult mortality; be it law enforcement, poacher conversion programs, and/or targeted education programs. As conservationists we know that these dwindling populations simply cannot stand continued hunting of adults; the life history patterns of *Batagur* just cannot support it. Nor can populations persist in areas where there is near 100% egg collection (often in such areas consuming turtle meat is prohibited by religious beliefs but the eating of turtle eggs is not). In areas such as these, there must be renewed efforts to ensure that a sufficient number of hatchlings enter the population each year to maintain a healthy age distribution within the population. This is extremely important as often the case in areas such as these the remaining adult populations are quite old and there appears to be few young sub-adults nearing maturity. Once the old adults die these populations may disappear quickly if we are not careful. Secondary priorities included surveys for additional populations that are not currently protected as well as gaining better understandings on possible long distance nesting migration patterns. By gaining a better understanding of how animals move between mangrove habitats and upstream freshwater habitats we may be able to best pin point where our enforcement and education efforts should be addressed.

Leaving the river, we headed into town for one

more night in a hotel before early morning flights home. That evening, we all sat around talking, sharing stories as friends, not just as workshop participants. We view the workshop as a great success as it brought together many *Batagur* conservationists for the very first time. We all realized that we were not alone in this fight. The workshop allowed many of us to come to a better understanding of what challenges we all face and how we can work together to find creative solutions to save the last of Asia's giant river turtles.

ACKNOWLEDGEMENTS

We would like to thank the Wildlife Reserves Singapore Conservation Fund. Many thanks are also due to Saskia Lafebre and the staff at Wildlife Reserves Singapore for helping with the numerous logistics necessary for having a successful workshop. We must also thank the Wildlife Conservation Society (WCS) Malaysia office staff for all their help with hiring the buses and purchasing airline tickets, especially Eunice. Colin Poole of WCS is also due a great deal of thanks for helping make all this possible. Living in Singapore, Colin had to often answer phone calls and emails at odd hours from the two of us living on the west coast of the United States. We greatly appreciate the many hours he put into helping us develop the program for the workshop and helping us overcome some of the more difficult logistical hurdles. This workshop was generously supported by a grant from the Turtle Conservation Fund.



CONSERVATION OF ASIAN TORTOISES & FRESHWATER TURTLES WORKSHOP

workshop “Conservation of Asian Tortoises and Freshwater Turtles” at the Singapore Zoo. From February 21- 24, 2011, over 70 delegates from 20 countries- including 16 Asian nations - attended a three-day workshop on Asian turtle conservation. Wildlife Reserves Singapore and the Wildlife Conservation Society hosted the workshop, in collaboration with the Turtle Survival Alliance, Kadoorie Farm and Botanic Garden, San Diego Zoo Global and the IUCN Tortoise and Freshwater Turtle Specialist Group.

The overall goal of the workshop was to retrospectively appraise our collective turtle conservation activities over the past ten years in Asia so that as a community we could determine which conservation actions worked effectively and which did not. Based on this information our priorities and strategies could be re-evaluated and adjusted.

DAY 1 – SETTING THE STAGE

With so many representatives attending from different countries, and because of the numerous organizations present, the first day was dedicated to a series of country reports. It was a very dense day with presentations from 15 countries (in order: India, Bangladesh, Myanmar, Thailand, Malaysia, Indonesia, Vietnam, Cambodia, Papua New Guinea, Philippines, East Timor, Singapore, Taiwan, Hong Kong, and China). Each presentation was designed to first present information on key conservation species and which key partners were active in their country's turtle conservation programs. The next part of the presentations detailed historical turtle conservation activities within their country, and how such activities were now progressing. Presenters then outlined the current and emerging major threats to their country's turtles and how to best prioritize such threats for conservation action. Lastly, the presenters ended with species-specific recommendations for the key species. At the end of the day all were tired, as we had covered a lot of material, but everyone had been educated on each other's work and issues, which set the stage for the next day of the workshop.

It was obvious from the first day of the workshop that the turtle trade in Asia is still the



While at the workshop, some time was taken to view the collection of the Singapore Zoo. Here, Cris Hagen (TSA Animal Management) is discussing care and set-up with Saskia Lafebre (Singapore Zoo). PHOTO CREDIT: ANDREW WALDE

Conservation of Asian Tortoises and Freshwater Turtles: Setting Priorities for the Next Ten Years

*Uncertain Future Projected for Asia's Chelonians
if Illegal Trade Cannot be Curbed*

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ANDREW WALDE AND RICK HUDSON

Just over 10 years ago, the first workshop specifically aimed at countering the Asian Turtle Crisis was held in Phnom Penh, Cambodia. This pivotal event brought together for the first time the region's turtle experts in an attempt to formulate a plan for countering this crisis. The results of the gathering were staggering to all involved. Wild caught turtles were being traded for consumption, traditional Chinese medicines,

and as pets in quantities that caused many to fear the worst for the continued existence of the region's turtles. The establishment of the Turtle Survival Alliance (TSA) was a direct response to the Phnom Penh meeting and the 'Asian Turtle Crisis', as were the Turtle Conservation Fund and the Asian Turtle Conservation Network. Because of these origins, it seemed fitting that the Turtle Survival Alliance help organize this year's



Rick Hudson leading the Southeast Asia Mainland working group on Day 3, trying to come up with top priority specific recommendations for this region. PHOTO CREDIT: ANDREW WALDE

leading factor driving this extinction crisis, both in terms of the numbers of animals involved as well as the vast geographic area that is being impacted. We did not hear of a single area that was not being negatively impacted by trade in some manner and it became clear that unless we more thoroughly understand how to deal with this situation, the deterioration of Asian turtle populations will continue on a path to extinction. To emphasize this, one market in China is reported to sell over one million turtles a year, with many individuals of Endangered or Critically Endangered species being amongst this immense number. Furthermore, the costs of highly sought-after species have in some cases exceeded \$25,000 USD for a single individual. There were also numerous reports of an increasing number of turtles being seized from the illegal trade by law enforcement. Sadly, it was not clear if this means that law enforcement officials are getting better at intercepting illegal shipments or that the number of shipments is increasing.

DAY 2 – THE GRIM REALITIES

During the second day of the workshop Anders Rhodin and Peter Paul Van Dijk led an IUCN Red-Listing session to evaluate changes since



Having the right people together in one place prompted several impromptu “sideline” meetings, this particular one with eleven participants was to discuss the status of the Vietnamese *Rafetus swinhoei* in Hoan Kiem Lake and provide a recommendation for action regarding its health status. PHOTO CREDIT: ANDREW WALDE

the initial assessments in 1999. The Red Listing process is recognized globally as the authoritative means for measuring extinction risks for species and applies rigid criteria to determine how imperiled species are ranked. The results were sobering. Of the 86 Asian turtles species

assessed, 38% are now either ranked, or being proposed, as Critically Endangered (up from 20%), a 90% increase since the 1999 workshop in Phnom Penh. Fifty-seven species (66%) were ranked or recommended for either Critically Endangered or Endangered status, a 40% increase



Workshop participants at the Singapore Zoo.

since 1999. Only three species are now considered to be at the lowest rating of Least Concern. It is all too apparent that the overwhelming volume of illegal trade is still flourishing. If we cannot find a way to more effectively combat this trade, we will continue to see further population declines and losses, which may eventually result in species going extinct.

The second day also included several smaller breakout sessions; one being for the veterinarians to discuss advances in how to process large confiscations of turtles as well as how best to provide medical treatment to animals that are often in poor condition when seized from illegal traders. The other break out session was for participants wanting to learn more about advances in facility designs to best house Asian turtle species, many of which have been historically considered difficult to maintain in captivity due to their highly specific habitat requirements.

The day ended with presentations that detailed current and emerging trends in the rapidly modernizing turtle trade. Our colleagues at TRAFFIC presented excellent, albeit depressing data that they have been collecting. From this set of presentations it became apparent that the Internet is playing a crucial role in how wealthy collectors are trading the most highly sought after Critically Endangered turtles for the illicit pet trade. Social media has become a predominant means for illegal wildlife traders to connect with their clients in a clandestine manner, making traditional law enforcement ineffective. It is not uncommon to see wild caught Ploughshare

Tortoises, one of the rarest of all tortoises, now being offered for sale on such sites.

This session also noted growing numbers of farm-raised animals entering the trade. It is now believed that over 70% of live turtles traded for human consumption are farm raised. It was reported that over 180 million Chinese softshell turtles are hatched in Chinese and Vietnamese farms annually. Although this appears to show a shift away from China importing wild caught turtles to meet the demand for turtle flesh, it appears that many of the imported wild caught animals are now going directly to large scale industrial farms to supplement their breeding stock. Species that are proving difficult to produce in farms, for example wild caught *Cuora galbinifrons*, *Courea mouhotii*, and *Geoemyda spengleri*, are still being sold in pet markets across China. But perhaps the most shocking information to emerge from the trade talks was the practice of live turtles being indiscriminately processed in meat grinders for shipment to China. Traders then mislabel the contents as a means of circumventing CITES regulations. It is presumed that this minced turtle product is then used in making turtle jelly, a highly desirable product across China as well as Chinese communities abroad.

DAY 3- GLIMMERS OF HOPE AND CAUSES FOR OPTIMISM

Day three of the workshop was crucial in that we had to compile the information from the previous two days and synthesize that into a series of recommendations that outlined specific prior-

ity conservation actions for the most imperiled chelonians of Asia. Workshop participants were divided into four major working groups by regions representing Southern Asia (India, Pakistan and Bangladesh), Southeast Asia Peninsula/Islands (Malaysia, Indonesia, Philippines, Papua New Guinea, Singapore and East Timor), Southeast Asia Mainland (Myanmar, Thailand, Cambodia and Vietnam) and Northeast Asia (China, Taiwan, Hong Kong, and Japan). Each group was challenged to address five primary themes that had emerged from the country reports – Trade / Enforcement, Captive Facilities (Assurance Colonies and Rescue Centers), *in situ* management, Awareness / Demand Reduction and Research. Within each of those categories, actions for the priority species were identified. From this a series of overall workshop recommendations were generated.

The five top priorities were determined to be the most effective means to advance turtle conservation within the region, and these are based on immediate need and how broadly the action(s) will impact turtle conservation.

The first recommendation was that there is a greater need for enforcement of existing laws and regulation surrounding the international trade in freshwater turtle and tortoises. Additionally, the removal of legal loopholes that allow CITES trade restrictions to be circumvented must be closed.

The second recommendation is prefaced by the recognition that there is a complete lack of field locality data or notably limited distribution data on a number of the rarest and most recently described species (e.g., rare *Cuora* spp. from



Shailendra Singh (TSA India) and Kalyar Platt (TSA Myanmar) let off a little steam after a grueling four day workshop. PHOTO CREDIT: RICK HUDSON

southern China, Vietnam, and Laos that are only known from the markets or a limited number of locations). Field surveys are recommended to identify new field localities so that remnant wild populations can be safeguarded.

The third recommendation recognized that there is an immediate need for globally integrated assurance colonies for all Critically Endangered species within the next five years, with the goal of having at least three separate assurance colonies with a minimum of 25 male and 25 female founders per colony. Furthermore, these assurance colonies should be aligned with field conservation efforts so that captive bred offspring can supplement wild populations or re-populate habitats where turtles have been extirpated.

The fourth recommendation is that all Critically Endangered and Endangered species need focused *in-situ* conservation actions aimed at the creation of at least one designated protected area, staffed with adequate anti-poaching enforcement. Such an area should encompass the necessary habitat required for the species to complete all life stages.

The fifth recommendation is that range state countries need to provide adequate legislation to protect their native freshwater turtles and tortoises from illegal trade and exploitation. Critically Endangered and Endangered species, as well as their eggs, must be prohibited from sale in all countries where they are currently distributed. In addition, range countries must set national policies that include adequate financial support from the government for the long-term recovery of their imperiled chelonians.

Day three ended with an impromptu session where all the participants worked together to address how the group should make international

policy recommendations as reflected by changes in CITES status of species most impacted by international trade. Thirteen species were suggested to be included in Appendix II and seven were suggested for being moved *up* the list to the highest priority, to Appendix I. All the Chinese and Vietnamese endemic *Cuora* species were discussed for up listing to Appendix I but final determination was tabled until the May 2011 *Cuora* workshop in China. Other species considered for up listing to Appendix I included *Lissemys punctata*, *Manouria impressa*, *Pelochelys cantorii* and *Pelochelys bibroni* as they are heavily traded internationally. However, no final conclusions could be met on these species, primarily due to limited data about native populations, particularly for the wider ranging species

DAY 4 – SUCCESSFUL MISSIONS

On the last day a series of presentations were given that exemplified how far the turtle conservation community has progressed over the past eleven years. Model programs in India, Myanmar, Vietnam, Cambodia, Hong Kong, and China were highlighted for their broad and multi-faceted approach to turtle conservation as well as their overall commitment to conservation and species recovery. A compilation of these presentations will be the basis for a manual of 'Best Practices' one of the key deliverables planned for the workshop. Following these presentations, we summarized the workshop by re-addressing all the recommendations that had been generated over the previous days with the goal of condensing the list into the most important priorities necessary to prevent species extinctions.

FINAL THOUGHTS

Though at times frustrating and disheartening, we believe the Singapore workshop

will prove to be catalytic and further serve to strengthen the bond that our turtle conservation community shares. It is our hope that this workshop will be regarded in retrospect as having an equal impact to its predecessor in Phnom Penh eleven years ago.

We are a small and vastly outnumbered group, and the market forces that are aligned against us, and Asia's turtles, are formidable. We must continue to build new partnerships, alliances, and friendships if we are to build on our past successes. The positive spirit of the workshop shone through on the last day when participants were queried whether they felt more optimistic or less optimistic about the prospects of saving Asia's turtles and tortoises. We were encouraged, inspired, and a bit surprised when the majority responded "more optimistic." It is this optimism that we have to maintain as a means of steeling our resolve to see our mission – zero turtle extinctions in the 21st century – to completion.

ACKNOWLEDGEMENTS

We would like to make a special thanks to the Wildlife Reserves Singapore Conservation Fund, as well as all the staff at Wildlife Reserves Singapore that made this workshop possible. We would especially like to thank Saskia Lafebre who was instrumental as our go-to person for all things related to the logistics of organizing the accommodations, food, and venue. Biswajit Guha graciously helped the workshop become a reality after we first proposed the idea of it. Colin Poole must also be thanked for his many long hours of planning and dedication to the project. Lastly, a huge debt of gratitude is owed to Fanny Lai, who was a tireless supporter of the workshop and without her steadfast commitment to wildlife conservation the workshop would not have been possible.

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Wildlife Reserves Singapore Group



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92% of Asian box turtles, genus *Cuora*, are either ranked or recommend for Critically Endangered status, the highest percentage of any group of chelonians.



After (re-)assessing most North American turtle species recently, the IUCN Red List now ranks two of these species (Bog Turtle and Flat-tened Musk Turtle) as Critically Endangered (CR), six as Endangered (EN), and five as Vulnerable (VU), with 6 included in Near Threatened (NT) and 23 species considered of least conservation concern (LC) (which is not 'no concern'). These numbers will likely increase when the last eight species assessments are concluded, but already such assessments as the spotted turtle as Endangered and the Eastern Box Turtle as Vulnerable demonstrate that threatened turtle species are not only a problem of developing countries or localized areas, but also affect widespread species in countries with over a century of conservation ethic and wildlife management.

At the Trombetas workshop, participants concluded that the conservation outlook for South America's turtles is worse than feared: of the continent's 47 species, three were assessed as Critically Endangered, another three as Endangered, and ten are considered Vulnerable to extinction, with the remaining 31 species considered Near Threatened, Least Concern, or Data Deficient.

That the conservation status of Asian turtle species is dire will not come as a surprise to anyone interested in turtles; but that it has become still worse over the past decade is troubling. Draft re-assessments of 66 species previously evaluated in December 1999 indicate that 21 species probably warrant placement in a higher threat category, two species jumped up two categories, 41 species evaluations remain unchanged, and only two species now qualify for a lower threat assessment. Overall, including new assessments for species not previously evaluated, at least 33 species [38%] warrant Critically Endangered status (up from 18 [20%] in 1999, a 90% increase), at least 20 are Endangered, and nine Vulnerable, with only nine species qualifying for either Near Threatened or Least Concern. A few species assessments remain on the borderline between threatened categories, but 57 species most likely qualify as either CR or EN, a stunning

IUCN Red List Documents Continuing Decline of Turtles

PETER PAUL VAN DIJK, PH.D.¹

In the last twelve months, significant progress was made in updating the Red List status of the world's tortoises and freshwater turtles. Draft assessments for 40 North American species were reviewed and included in the June 2011 update of the Red List website. Draft assessments were prepared for all South American species, and these were reviewed in detail by 44 regional specialists from over 14 countries at a dedi-

cated workshop held at the Rio Trombetas field research station, Brazil, in October 2010. Draft assessments were also prepared for 85 species of turtles inhabiting Asia, and these were reviewed at the Asian Turtle Conservation workshop in Singapore in February, and the *Cuora* conservation workshop in Gangkou, China, in May 2011. The results that emerged from these different sets of assessments are remarkable.

66% of Asia's turtle species and a 40% increase since the 1999 assessments. Of particular significance are the speciose genera *Batagur* and *Cuora*, which share the dubious honor of each having only a single species which is NOT Critically Endangered.

Even when some of these higher assessments are due to changes in assessment criteria and a better understanding of the field status of species, on balance the trend in turtle status is getting worse: very few turtle species improve their conservation status, while more and more species move up into higher threatened categories. But it would be wrong to conclude that conservation efforts for turtles are futile. The declining trend indicates the severity and pervasiveness of threats to the survival of turtle populations and species; but if it were not for our actions to address impacts and work towards population recovery, the trend would be an even steeper decline, and almost certainly species extinctions would already have occurred in recent years. They have not, and with continuing efforts we can secure a future for turtles without extinctions.

Completed Red List assessments of turtles (and other species) and listing criteria can be found at www.iucnredlist.org. Preparation of Red List assessments for North American tortoise and freshwater turtle species was supported by the US Fish and Wildlife Service. The Trombetas Redlisting workshop was convened by the IUCN Tortoise and Freshwater Turtle Specialist Group, organized and co-hosted by the Instituto Nacional de Pesquisas da Amazônia and the Reserva Biológica do Rio Trombetas, and co-sponsored by Conservation International, the Frankel Family Foundation, and the Panaphil Foundation. The Red List sessions at the Singapore and Gangkou workshops were made possible by the support of the Wildlife Conservation Society, the Wildlife Reserves Singapore Group, Kadoorie Farm and Botanic Garden, San Diego Zoo Global, the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, the Turtle Survival Alliance, and the IUCN Red List Programme. Preparation of draft assessments was made possible by the Panaphil Foundation, Pieter Borkent, and George Meyer and Maria Semple.

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(Left) The Bog turtle, *Glyptemys mühlenbergi*, is one of only two North American turtle species ranked Critically Endangered



(Below) The Eastern box turtle, *Terrapene carolina*, is now ranked Vulnerable reflecting the impacts of habitat loss and fragmentation over much of their range.

TABLE 1

Numbers of tortoise and freshwater turtle species with finalized assessments included in the June 2011 IUCN Red List update

Number of recognized species (TTWG, 2010): **321**

Number of assessed species: **221**

Category	number of species	% of assessed species	% of total species
Extinct	6	3%	2%
Critically Endangered (incl. Extinct in the wild)	30	14%	9%
Endangered	42	19%	13%
Vulnerable	57	26%	18%
Threatened (CR, EN, VU and EW combined)	129	58%	40%
Near Threatened (incl. Conservation Dependent)	37	17%	12%
Least Concern	39	18%	12%
Data Deficient	10	4%	3%
Not Evaluated	100	--	31%



Adult female Ploughshare Tortoise at the Behler Chelonian Center. Notice the engraved "H" and "K" on the carapace, a form of branding now used to discourage poaching. PHOTO CREDIT: ERIC GOODE



blooded animals on earth (with possibly only a few hundred adults remaining in the wild) but also one of the most sought after by unscrupulous collectors, commanding prices ranging from a few thousand dollars for juveniles to several tens of thousands for adults. Saving this species is a truly global problem and is a two-front war. The immediate goal is both to stop poaching and to reclaim animals from illegal collections and place them in an accredited captive breeding program.

The enigmatic history of the Angonoka begins in the late 19th Century when a resident of Anjouan in the Comoro Islands in the Mozambique Channel between Madagascar and East Africa received a strange tortoise from Arab sailors who made vague reference to the animal's origin from small islands to the north near Aldabra. Forwarded to the Paris Museum, the specimen was described as a new species, *Testudo yniphora*, in 1885 by the herpetologist Leon Vaillant. Fifteen years later, the true natural range of the tortoise was discovered by the German biologist Alfred Voeltzkow who secured a few specimens from the wild at Cape Sada (Baly Bay) on the coast of northwestern Madagascar. Over the next half-century, less than a half-dozen Angonoka specimens found their way into international museum collections. In 1950, the French zoologist Raymond Decary described the species as possibly on the verge of extinction in his book *La Faune Malagache*. Encouraged by Southern California tortoise aficionado Ronald Beltz in the 1960s, James Juvik teamed up with French Zoologist Charles Blanc in April 1971 to visit the Baly Bay area to resolve the status of this elusive species. They encountered a few Angonoka at Cape Sada on Baly Bay. However, cattle grazing, dry season burning and predation by the introduced African bush pig were seen as severe threats to the small remaining population.

With permission of the Malagasy Government, a total of six Angonoka (mostly secured

Turtle Conservancy (TC) and Behler Chelonian Center 2010-2011

*The Ploughshare Tortoise (Astrochelys yniphora):
a Struggle for Survival*

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The history of the Madagascar Ploughshare Tortoise or Angonoka (*Astrochelys yniphora*) reads like a Dashiell Hammett novel, except, unlike the desperately pursued Maltese Falcon, this tortoise is a critically endangered species and not a figment of the imagination. It is a tragic story of both habitat degradation, and a dark, sordid tale of international smuggling, manhunts, imprison-

ment, and even murder. Recent books such as Bryan Christy's *The Lizard King* and Jennie Erin Smith's *Stolen World* have appeared documenting the spectacular intrigues surrounding this species and the larger clandestine endangered species trade in general.

The Angonoka today has the dubious distinction of being not only one of the rarest cold-



Ploughshare enclosure at the Behler Chelonian Center appointed with natural graze and direct sunlight.

PHOTO CREDIT: JAMES LIU

from captive pets in nearby villages) were transferred to the Honolulu Zoo to launch an *ex situ* assurance colony. The San Antonio Zoo secured an additional two tortoises in 1973 and, at about the same time, noted tortoise breeder and field associate in herpetology for the Wildlife Conservation Society (WCS) Bill Zovickian imported a specimen from France. These nine animals are the only Angonoka legally imported into the US over the past 40 years. With the exception of one offspring produced at the Honolulu Zoo in 1983 (which later died of metabolic bone disease), captive breeding of these animals has been unsuccessful. Only two survive outside of Madagascar today (one adult male at the San Antonio Zoo and an adult female at the Honolulu Zoo). The female was deemed sterile decades ago when part of the reproductive tract had to be surgically removed in association with attempted egg laying.

Meanwhile, in 1982 Juvik, Andrianarivo, Blanc and Bour wrote the first IUCN Species Recovery Plan for the Angonoka bringing worldwide attention to its plight. Soon thereafter the Jersey Wildlife Preservation Trust, known now as the Durrell Wildlife Conservation Trust (DWCT), began to implement several elements of the Species Recovery Plan. A captive breeding and head-starting program was started in 1986 at Ampijoroa in Ankarafantsika National Park. This represented collaboration between DWCT and Madagascar's



Richard Lewis examines a Ploughshare Tortoise at the reintroduction site in Baly Bay, Madagascar. PHOTO CREDIT: MAURICE RODRIGUES



Ross Kiester, Eric Goode, Jim Juvik, and Saskia Lafebre examining two Ploughshare Tortoises that were recently confiscated in Southeast Asia. PHOTO CREDIT: MAXIMILIAN MAURER



We observed these tortoises in 2010 only to return in 2011 to find them mounted. PHOTO CREDIT: ERIC GOODE (LIVE TORTOISES) AND MAXIMILIAN MAURER (DEAD TORTOISE)



A new boat donated by the Turtle Conservancy for patrolling the coastal waters for poachers. PHOTO CREDIT: ANGELO RAMY, DWCT

La Direction des Eaux et Forêts. Unlike the U.S. efforts, breeding occurred from year one of the project and to date more than 200 offspring have been produced. In 1996, the project was compromised by the theft of 73 juveniles and two adult females from Ampijoroa. Only half of these animals were ever recovered. Today this is the only legal breeding program anywhere in the world. Durrell's 25 year commitment working with Ploughshare Tortoises has resulted in the introduction of 24 head-started tortoises, with an additional 20 scheduled for release in November 2011.

The Turtle Conservancy (TC) has made multiple trips to Madagascar in recent years and in January 2008 participated in a workshop for the conservation of Malagasy Chelonians, "Turtles on the Brink," which was held in Antananarivo to draft action plans for their conservation. This was held, in part, due to a growing realization between the government of Madagascar, IUCN, DWCT, Conservation International, TSA, and

TC/BCC that all of Madagascar's chelonians were in much more trouble than previously thought. The Ploughshare Tortoise is facing imminent extinction and all other Malagasy endemics are now listed as critically endangered. The workshop resulted in an Action Plan that sets out the conservation priorities for the species. The main objectives of this Action Plan are to stop poaching and illegal traffic, to reinforce in-country captive breeding and re-introduction actions, and to spread out the *ex situ* assurance colonies to provide a safety net for the species. This last initiative is somewhat controversial and was excluded from the final draft. The TC produced a documentary on the plight of the Ploughshare Tortoise the same year.

In 2009, conservation of the Angonoka suffered a serious blow when the Malagasy government collapsed. Without an effective central government, protection of the tortoise sank to new lows. With rapid advances in international



web-based communication, ploughshares can now effectively be stolen to order from the Baly Bay National Park. The range of the Ploughshare Tortoise is largely coastal and unpopulated, allowing for easy access to poachers by sea. The region is among the poorest in the world where the average income is less than \$2USD per day. The combination of poverty and lack of enforcement creates the ideal conditions for exploitation. Poaching and trafficking are the primary threats, drawing parallels to the drug trade and its complexities of effective enforcement. This means that the conservation of this species requires a multi-pronged approach: 1.) the global collaboration and support of non-governmental, inter-governmental and state organizations to apprehend and prosecute wildlife traffickers; 2.) the formation of multiple *ex situ* captive breeding assurance colonies (by securing illegally held animals); and 3.) support of in range capacity building (creating tortoise villages and/or sustainable conservation projects run by local communities).

In 2009, Durrell and the Turtle Conservancy received \$30,000 in funding from the U.S. Fish and Wildlife Service to implement more effective local conservation efforts. Both Durrell and the Turtle Conservancy matched this amount so that \$90,000 was focused on meeting the primary ob-



(Left) The digital age has made it easier than ever to buy and sell illegal wildlife. PHOTO SOURCE: INTERNET



(Above) On June 3, 2011, the Turtle Conservancy received eight Ploughshare Tortoises from Kadoorie Farm and Botanic Garden in Hong Kong. The tortoises were flown to their new home at the Behler Chelonian Center.

PHOTO CREDIT: JAMES LIU

jective of the Action Plan through the provision of support to local law enforcement to protect and monitor the tortoise in Baly Bay National Park. Richard Lewis of DWCT leads conservation efforts in the field with technical guidance provided by TC personnel who have extensive experience working with threatened chelonians and with field assessment of the Ploughshare Tortoise in particular. Durrell, working with the Madagascar Ministry of National Parks, established a network of para-rangers, who provide a permanent surveillance presence in the National Park. The project established the network and provides the essential communication equipment and training to support the rangers in the field. This equipment included a new boat that greatly facilitates movement of the rangers. Some real success has been achieved. Two poachers have been arrested and stolen tortoises retrieved. In the second half of 2011, plans will be made for the expansion of the breeding and quarantine facilities in Ampijoroa. The expansion of this *in situ* facility will be made possible by the support of the Sabin Family Foundation, Turtle Survival Alliance, Durrell, and the Turtle Conservancy.

Over the last four years, the TC has been studying the trade of Angonoka in Madagascar, China, Japan, Taiwan, Thailand, Singapore, and the Philippines. The TC has investigated the

problem on the Internet, in animal markets, zoos, and rescue centers, and by tracking down confiscated and seized tortoises – many of which have now died or disappeared. It is possible that there are now nearly as many illegally held animals in captivity as there are remaining in the wild. The TC has documented over 50 confiscated Ploughshare Tortoises throughout Southeast Asia, and many more on the Internet.

As smuggling of Angonoka has increased, there has been a corresponding increase in confiscations, especially by Asian governments. Recognizing that these confiscated animals are a critical conservation resource, the U.S. Fish and Wildlife Service granted a CITES Import Permit to the TC for ten *confiscated* tortoises. This was the first CITES Permit issued for this Critically Endangered species.

In 2010, the Turtle Conservancy traveled to Taiwan to examine four tortoises confiscated by the Taiwanese government. Two juveniles held at the Taipei Zoo and a subadult female and a juvenile held at the Pingtung Wildlife Rescue Center. Ultimately a loan agreement was negotiated and in October of 2010, the two animals from Pingtung arrived at the Behler Chelonian Center (BCC), the first Ploughshare Tortoises to enter the U.S. legally in nearly 40 years.

Around the same time, officials in Hong

Kong seized 30 Ploughshare Tortoises. They were placed in the care of Kadoorie Farm and Botanic Garden. Once the legal cases surrounding the tortoises were adjudicated, Kadoorie Farm took ownership of these animals. The TC Team visited Kadoorie Farm to evaluate the health and care of the tortoises and to meet with the staff. Kadoorie Farm graciously donated seven juveniles and one adult female to the TC in June 2011. Amazingly, we were able to meet the quota of the CITES Import Permit in only one year – the group of Ploughshare Tortoises at the Behler Chelonian Center now stands at 0.2.8 (no males, two females and eight individuals of unknown sex).

For 34 years, Bill Zovickian has cared for an adult male Ploughshare Tortoise that was loaned to him in April 1977 by the San Antonio Zoo. Bill and the San Antonio Zoo have arranged to send this tortoise to the Behler Chelonian Center to complete the breeding group. If the BCC's success with breeding Radiated Tortoises is any indication (having produced 136 hatchlings over the last few years), similar success can be expected with this species. For some of us on the Turtle Conservancy Team this moment has been decades in the making, and even more importantly this adult male has been waiting over 25 years for a mate.

TURTLE CONSERVATION FUND

*Cuora picturata* PHOTO CREDIT: TORSTEN BLANCK

Turtle Conservation Fund Report: A Mystery Unfolds and a Challenge Begins

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The Vietnamese Box Turtle (*Cuora picturata*) was described to science in 1998, a description that was based entirely on turtles from the markets of southern Vietnam. Scientists had never observed this species in the wild, and its natural whereabouts was a mystery yet to be solved. In 2009, Tri Ly, Huy Duc Hoang and Bryan Stuart sent a proposal to the Turtle Conservation Fund (TCF) outlining a plan to solve this mystery. Funds were provided by TCF, and the search was on.

The suspected origin of this species was

southern Vietnam or adjacent Cambodia, based on its appearance in the markets in this area. To further define where this elusive species might exist, the investigators utilized evidence from phylogeny and biogeography patterns of other Vietnamese Box Turtle species and primates. Yes, primates! How could langurs and gibbons help find our mystery turtle? Read on.

Molecular phylogenetic analysis told our authors that *C. picturata* is most closely related to the Indochinese Box Turtle (*C. galbinifrons*) and

the Bourret's Box Turtle (*C. bourreti*), both of which occur in Vietnam, Laos and China. These species occur in upland, moist, closed canopy forest, so perhaps our mystery species may also be found in such habitat. This helped narrow the search, as the researchers now looking for such habitat near the markets where the turtles occasionally appeared. The Langbian Plateau of southern Vietnam is just such a place.

Now for the clues that came from the primate connection: in examining two primate clades (lineages), a genus of Gibbons and a genus of Langurs that occur in Vietnam, each has a species that occurs with the Indochinese Box Turtle in the northern Truong Son Mountains of Vietnam, and each has different species that occurs with the Bourret's Box Turtle in the central portion of this mountain range. Additionally, each has an additional species in the southern end of the mountain range, on the Langbian Plateau. Perhaps searching where these two southern species of primates occur within the Plateau might lead to the mystery turtle.

Success! Searches in this area in 2010 and 2011 located several *Cuora picturata*: three males, four females and one unsexed juvenile. Excitement reverberated throughout the turtle conservation community with this critical discovery. However, the challenge of conserving this species in its natural habitat now begins. Large areas within the habitat are being converted to coffee plantations and other agricultural uses. Additionally, residents continue to collect and sell the turtles to commercial traders. Stay tuned for the next chapter in the story of the Vietnamese Box Turtle.

This is the story behind only one of the 112 proposals TCF has funded since its inception in 2002, providing a total of \$536,000 in support of turtle conservation to date. All funded projects carry their own tales that not only address the challenges of conserving turtles, but also exemplify the passion of those working to save these magnificent creatures about which we all care so deeply.



A Burmese Star Tortoise hatchling in the Taipei Zoo Wildlife Rescue Center. PHOTO CREDIT: YU LING LU, TAIPEI ZOO

Turtle Conservation in the Taipei Zoo Wildlife Rescue Center

JEFFREY CHEN¹, YU-LING LU², YI-CHUN CHANG³, MING-HSUNG CHANG⁴



The Taipei Zoo Wildlife Rescue Center (the “Center”) was established in 1995 with the support of the Forestry Bureau under the Executive Yuan Council of Agriculture, to provide shelter for animals that had been confiscated by local law enforcement agencies and customs authorities. This came as a result of crackdowns on the illegal wildlife trafficking that was rampant in Taiwan during the 1990’s. From its inception, the

Center has taken in many wild animals, mostly reptiles, as well as birds, cats and primates. Of the approximately 1000 wild animals currently residing in the Center, 80% are reptiles. In fact, there are more than 200 specimens of Radiated Tortoises (*Astrochelys radiata*) and more than 100 African Spurred Tortoises (*Centrochelys sulcata*) currently residing in the Center.

With Taiwan’s liberalization of the pet trade in 2003, the focus of wildlife traffickers shifted to the import of valuable and rare wild animals, which were in high demand among exotic pet owners. In recent years, the Center has seen a fair number and varieties of valuable and rare wildlife specimens, again mostly reptiles, confiscated and brought to the Center, includ-

ing Spotted Pond Turtle (*Geoclemys hamiltonii*), Angonoka or Ploughshare Tortoise (*Astrochelys yniphora*), Spider Tortoise (*Pyxis arachnoides*) and Chinese Three-striped Box Turtle (*Cuora trifasciata*).

Today, the Center is a task force unit under the auspices of the Taipei Zoo Conservation & Research Center (CRC), and its role has evolved from merely providing shelter to confiscated animals to playing a more extensive role in Taiwan’s wildlife conservation efforts to help chelonian species. As part of an effort to find ways of extending the conservation value of the Center’s wildlife residents, the Center’s CEO at the time, Frank Hwa-Ching Lin (“Frank”), launched a conservation breeding program focusing on the Burmese Star Tortoise (*Geochelone platynota*). Due to widespread collection for the international pet trade, this species is now considered functionally extinct in nature and is ranked Critically Endangered (CR) by the IUCN Red List. In 2003, the Taipei Zoo Wildlife Rescue Center achieved a significant breakthrough when they recorded their first successful hatching of *G. platynota* in captivity, believed to be the first captive breeding of this species among zoos worldwide.

During these years, the Center has continued its work on the conservation breeding program for *G. platynota* independently as well as in



Radiated Tortoises in the Taipei Zoo Wildlife Rescue Center. PHOTO CREDIT: JEFFREY CHEN, TAIPEI ZOO



Directors of the Taipei Zoo and Forestry Bureau presenting check to TSA. From Left, Fu Feng-Chi (Curator of Taipei Zoo/Conservation Area) Inside Turtle Costume, Peter Praszag, Rick Hudson, Jason Yeh (Director of the Taipei Zoo), Li-Hao Kuan (Director of Conservation Division, Forestry Bureau), Ming-Hsung Chang (CEO of the Taipei Zoo/CRC) PHOTO CREDIT: JEFFREY CHEN, TAIPEI ZOO

cooperation with other organizations around the world. In 2008, the Center's then-CEO Frank contacted William ("Bill") Holmstrom, then of the Wildlife Conservation Society, to communicate the Center's wish to participate in other *G. platynota* conservation programs. As a result, Bill introduced us to Maurice Rodrigues of the Behler Chelonian Center (BCC) in California, an institution with the largest collection of *G. platynota* outside of Myanmar. This led to the beginning of a long-term cooperation for turtle conservation between the Taipei Zoo and the Turtle Conservancy/ Behler Chelonian Center.

In 2007, the Center launched a genetic

management program for both *ex-situ* captive breeding programs and *in-situ* Species Recovery Plans involving *G. platynota*. To avoid a loss of genetic diversity, and avoid the negative effects of inbreeding depression – both potential consequences of captive breeding programs with small populations - it was decided that genetic paternity analysis would be a focus of this program. In cooperation with the Taiwan Normal University, the Center developed five microsatellite DNA loci markers for use in genetic paternity analysis, in order to construct pedigrees of *G. e platynota*. The genetic paternity analysis derived from those microsatellite

markers yielded some very interesting results. While we did find a clutch laid by a single dam with eggs that had been fertilized by two sires (multiple paternity), the most interesting finding derived from this research was the presence of an alpha male specimen in each breeding group. In fact almost 80% of the hatchlings belonged to the same sire, notwithstanding the fact that the sex ratio in each breeding group was evenly balanced. This unexpected phenomenon served as a warning for us to take care in the separation of breeding groups to ensure the involvement of more sires in the contribution of offspring to prevent any reduction of genetic variability in the captive population from generation to generation.

As part of our ongoing genetic research conducted by the Center's molecular genetics laboratory to compare mitochondrial and nuclear DNA, we tried to collect all available *G. platynota* DNA samples. We analyzed the mitochondrial DNA cytochrome b (cytb) gene of *G. platynota* extracted from wild-caught specimens at Taipei Zoo, BCC and Myanmar. We were able to detect seven distinct mitochondrial haplotypes from the 95 samples taken in this study. The objective is to establish appropriate captive breeding guidelines to improve our management techniques that will, in turn, help us make better decisions for selecting breeding pairs and determining which specimens would be suitable for future reintroduction in Myanmar.

At the end of 2008, we paid a visit to the Behler Chelonian Center in California, where we met with Peter Praszag and Lukasz Pogorzelski. Peter and Lukasz generously and unreservedly shared with us their knowledge and expertise on the improvement of chelonian reproductive techniques. This information exchange was very useful to us and brought tremendous dividends to our work. For a number of years, the Center had successfully bred fourteen species of tortoises and freshwater turtles, but had only been able to hatch one to five offspring from 60 *G. platynota* eggs each year, or 8% or less. After certain breeding techniques (learned from the experts at the Behler Chelonian Center) were introduced to the Center, we saw significant improvements in the hatchling survival rate among clutches of eggs laid between 2008 and 2009, i.e., a yield of 40 hatchlings from a total of 80 eggs, or 50%.

In conjunction with our 2008 visit to BCC, we also visited Robert ("Bob") T. Zappalorti who lived in Ocala, Florida at the time. Bob is the Executive Director of Herpetological Associates,

Inc. and a long term cooperative partner with the Taipei Zoo who has worked with us since the summer of 2000. Bob took us on a tour of the Ocala National Forest and the Withlacoochee Wildlife Management Area to show us the habitat and ecology of the Gopher Tortoise (*Gopherus polyphemus*) in Florida's sandhills. This was in preparation for our work on an upcoming project relating to the Horsfield's or Central Asian Tortoise (*Agryonemys horsfieldii*) to be conducted in cooperation with the Huocheng county government in the People's Republic of China.

On September 12-13, 2009, the Center hosted a workshop on the "Links Between *In-Situ* and *Ex-Situ* Conservation Activities for the Endangered Tortoises in Asia." Workshop attendees included experts from Kadoorie Farm & Botanic Garden (KFBG), the Turtle Conservancy/Behler Chelonian Center and Herpetological Associates, as well as renowned Taiwan turtle expert, Chen Tien-hsi. Chen provided an overview and introduction of turtle species that are indigenous to Taiwan for our foreign guests. This was followed by extensive discussions on how the Center could contribute to and work together with other stakeholders to achieve a common goal of ensuring future survival of Asian chelonians. At the end of the workshop, the Center and the Turtle Conservancy/Behler Chelonian Center signed an agreement for the establishment of a co-operative partnership dedicated to advancing the work of conserving chelonian species.

In late September of 2009, we traveled to Huocheng Municipality of the Xinjiang Uyghur Autonomous Region in China for a project relating to *A. horsfieldii*. Huocheng, which borders Kazakhstan on the west and lies north of Ili River, had been part of the historical range of this species. We are currently working with the Huocheng County Government to determine the feasibility of allocating protected land for the purpose of reintroducing *A. horsfieldii* to the area.

In October, 2010, we paid a visit to Wildlife Conservation Society (WCS) office in Yangon, Myanmar, where we met with Than Myint and Win Ko Ko, who gave us an opportunity to witness firsthand the impressive long-term conservation programs that WCS had established in Myanmar. We also visited Lawkananda Wildlife Sanctuary and Mandalay Zoo and discussed the possibility of sending *G. platynota* back to Myanmar as a first step towards returning this species to its natural habitats.

In early February 2011, our friends from Turtle Conservancy/Behler Chelonian Center paid a short visit to the Center, during which



Taipei Zoo Team visits the Lawkananda Wildlife Sanctuary From Left, Win Ko Ko, Yu-Ling Lu, Shwe Htay Aung (Park Warden of Lawkananda Wildlife Sanctuary), Ming-Hsung Chang, Lay Lay Khaing, Yi-Chun Chang, Jeffrey Chen.

PHOTO CREDIT: JEFFREY CHEN, TAIPEI ZOO



400 Indian Star Tortoises hidden in suitcases that were being trafficked by a passenger in the Taipei Airport.

PHOTO CREDIT: CARL HSIEH, TAIPEI ZOO

we discussed potential cooperative projects to conduct scientific research on temperature dependent sex determination (TSD) and disease control in an effort to improve the survival rate of juvenile turtles born and raised in captivity. Later in the month, we also invited TSA President Rick Hudson and Peter Praschag to the Center for further discussions on future projects for turtle conservation. To commemorate the TSA visit, the Taipei Zoo Animal Adoption Programs and Forestry Bureau Conservation Grant jointly contributed \$10,000 to TSA in

support of its work with the Lawkananda Star Tortoise Facility in Myanmar.

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TSA PARTNER NEWS
COURSE ANNOUNCEMENT



Students from the 2010 course *Field Methods for Studying Freshwater Turtles* aboard *The Enigma*.



Virginia Bernardes lifts a female giant Amazon River Turtle during the 2010 field course at the Trombetas River Biological Reserve

Course Announcement — Field Methods for Studying Freshwater Turtles: Research, Management and Conservation

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This course was taught for the 21st time at the Trombetas River Biological Reserve from 26 September to 8 October 2010. In addition to 14 Brazilian graduate students, one Portuguese student, an Australian student and two Australian women working in turtle conservation participated in the course. Funding for the course was provided by the TSA, Turtle Conservation Fund, Conservation International, Brazilian Institute of the Environment (IBAMA), and The National Institute of Amazonian Research (INPA). Students and project managers are taught how to conduct field research with turtles and how to analyze conservation and management measures that are being taken. In addition, they are provided with an awareness of the problems facing turtle conservation. The course trains people who will eventually be working in research or conservation with turtles either in the field or administrative positions throughout the world. The purpose is

to prepare students for the understanding of the general biology and ecology of freshwater turtles and the methods used in conducting field and laboratory research such that they will be capable of designing and implementing field or laboratory projects to determine management plans, conservation strategies, and basic research.

In 2011, the participants will leave Manaus aboard the research vessel *The Enigma* in the early morning hours of October 3; all students and crew must be on board the day prior. During the two day journey from Manaus to the Trombetas River field station, the time will be spent in lectures on turtle biology and delving into the literature of turtle biology to prepare seminars. Once at the station, the day will be divided between field work, laboratory work, and lectures. It will be the nesting season for three species of *Podocnemis*, so students will have the opportunity to participate in nesting surveys both at night

and in the early morning to mark nests, transfer eggs to protected areas when necessary, mark and measure post-nesting females, attach sonar and vhf transmitters to females that have nested, egg biometry, and implanting temperature data loggers in nests and turtles.

Turtles will be captured using various techniques, and students will learn different marking and measuring techniques, how to flush stomachs, collect blood, obtain eggs through the use of oxytocin, attach transmitters and follow turtles with transmitters attached. The first few days will be spent on the nesting beaches of *Podocnemis expansa* and *P. sextuberculata* near the main channel of the Trombetas River. Later *The Enigma* will take us into a large lake, Erepecu, where we will observe and work with a nesting population of *Podocnemis unifilis*. The more adventurous in the group will be assigned the task of maneuvering up a jungle stream in search of *Peltecephalus dumerilianus* with transmitters.

During free time, students will prepare assigned seminars on specific turtle topics, and then present them on the return trip to Manaus. After leaving the Trombetas Reserve we will visit another turtle conservation project site where we are working with local communities. The course will arrive back in Manaus on October 14. The fees for the course are paid for registered graduate students at INPA. Students from Latin America are requested to make a \$500 USD donation to the course to offset food and transportation costs; those from the rest of the world pay \$1000 USD. The course provides four college credits.

NATIONAL INSTITUTE OF AMAZONIAN RESEARCH



Dick Vogt's turtle research group at the gala celebration kicking off the \$2 million US grant from Brazilian petroleum giant Petrobras for *Amazonian Turtles: Conservation for the Future*

Amazonian Turtles: Conservation for the Future, Implementing a New Strategy for Turtle Conservation in the Brazilian Amazon Basin

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In October 2010, Richard Vogt's research group received a \$2 million (USD) grant from petroleum giant Petrobras, from their *Petrobras for the Environment Program* to promote the conservation and management of endangered Amazonian turtles. The grant is for two years and will be automatically renewed for an additional two years if we are successful with our program. The project is now broader in its conceptual base, and while we are continuing to conduct basic ecological research to be able to define the ecological and habitat requirements of Amazonian turtles and training graduate students, we now also include a program of environmental education for the inhabitants of riverine communities along the Trombetas River. The project, *Amazonian Turtles: Conservation for*

the Future, aims to attack the chain of exploitation of these species from the bottom up (the riverine communities, to the river boats that transport the turtles) and the top down (the consumers in the big cities of Manaus - population 2 million - and Oriximiná). Ten people are working full time on the project, including persons trained in environmental education and working with social problems. We are continuing our full time research in the Trombetas River Biological Reserve, but additionally we are including the river communities in hands-on beach and nest protection as well as implementing courses to explain the life histories of these turtles and the need for their sustainable use. The beneficiaries of the project will be the riverine people, a combination of Portuguese descendents, indigenous people, and quilombolas, who live in small villages along the Trombetas River and eventually other tributaries of the Amazon Basin as well. The basis of the project is to provide alternative income sources for these people such that they will abandon the destructive non-sustainable sale of endangered species of turtles, particularly the giant Amazon River Turtle (*Podocnemis expansa*). Our project will also train them in managing the resource so that it can be used on a sustainable

basis. Another beneficiary will be the population of turtles, which if managed properly will be able to recuperate and continue to fulfill their function in the ecosystem: transforming plant material (leaves, fruits and seeds) into animal protein that is important in the diet of many other animals (fish, mammals, birds, as well as humans). If managed properly, this resource will be available for the benefit of future generations. There have been many attempts to try and convince rural riverine people to not harvest turtles or their eggs. Mainly these projects have failed because the government officials only protected the nesting beaches, prohibiting the local people from collecting eggs or turtles while nesting. They failed to offer the local people a positive incentive for not collecting eggs or turtles to eat, only fines if caught doing so. No effort was made to provide protection for the turtles throughout the year during their migrations or in their feeding areas. In addition, the local people were not integrated into the project. Our project will integrate the communities into the conservation and management of the nesting beaches. We will conduct courses in the communities showing them how to protect the nesting beaches and why it is important for them and future generations. Members of the community will be hired to work on the nesting beaches. Courses will be given to these people training them in other livelihoods that they can practice in their native communities to make a living rather than illegally poaching turtles. An entirely novel idea in this project is that we will also be giving environmental education classes in the large cities. These classes will highlight the need to use the turtle resource on a sustainable basis and educate consumers to purchase legally-raised farmed turtles rather than those poached from nature. Besides protecting the nesting beaches, we will study the entire life cycle of these turtles to make sure that their feeding areas are protected as well. By working with both ends of the cycle—the collector and the consumer - we hope to diminish the demand for wild caught turtles and create a native pride in recuperating populations of endangered animals both at the level of riverside inhabitants as well as city dwellers.

The impact of the project will be an increase in nesting female turtles, an increase in the survivorship of hatching turtles, an overall increase in the biomass of the population of turtles, and a decrease in nests and females predated by humans. These impacts will be monitored by marking and counting nesting females, and the number of eggs laid, monitoring survivorship of the eggs to hatching and monitoring the hatchlings to document the percent surviving to

maturity. Initial interviews with the local communities will be made to document their ideas about conserving turtles and using turtles. After a two year period of integrating the communities into the conservation program and administering environmental courses, the same interviews will be applied to determine if our program has had any effect on the way the people think. We will also continue monitoring the nesting beaches to see if after our courses there are fewer nests and adults poached. We know who some of the major violators are, and intend to employ them in the project so that they will not be free to poach turtles and will be able to use their knowledge about turtles to help manage them.

In addition we are developing courses to train them in alternative ways to make a living rather than a *scorched earth* use of natural resources. Alternatives include raising bees for honey, woodworking, crafts, and raising cash crops that are not harmful to the soil, river or forest.

In Manaus, we are constructing a two story building that will be known as the Center for the Study of Amazonian Turtles. The Center will serve as a base for the project at The National Institute of Amazonian Research (INPA) in Manaus, built on the edge of a small lake and open to the public for scientific education tours. It will have large display aquaria with all 17 species of Amazonian turtles, laboratories, library, offices, gift shop, snack bar, and a lecture room for 60 people. In addition to providing guided tours to the visiting public, we will use the Center as a base for indoctrinating the school children of Manaus into the chain of turtle conservation, and the problems involved in the conservation and management of these species. We are hoping to stimulate the population of Manaus to be more conscious of the problem they create by purchasing black market turtles, and make them aware that turtles can be purchased from farms that are legally raising them. Finally, there are farms that are not simply growing turtles from hatchlings to sell, but are getting reproduction from both *Podocnemis expansa* and *P. unifilis* in captivity. Thus the cycle is completed in captivity, with the increase in production of these farms the black market could be squeezed out of existence if the consumers can be convinced to do their part.

Parallel to the program of environmental education for the city people regarding the effect of illegal commercialization of turtles, we will be working directly with the river people who captured turtles in the past in the Trombetas River, localities where the populations of turtles were much larger decades ago. Our major objective is



Environmental education instructor Adriana Kulaif gives a talk on turtle conservation to elementary school children at INPA, to make them more aware of the plight of Amazonian turtles

to increase the collective spirit of turtle conservation in these communities, to increase their interest and respect for nature. In the Trombetas Reserve we will continue with a diverse research plan with the family Podocnemididae (*Podocnemis expansa*, *P. sextuberculata*, *P. unifilis*, and *Peltocephalus dumerilianus*).

Even though we have yet to begin the construction of the building, we are functioning in our new role both in Manaus and in the Trombetas Reserve. In Manaus, over 1000 children have attended seminars about turtle conservation and have participated in environmental education activities. In May we organized a workshop on nesting beach protection with the participation of researchers, environmental agents and students from throughout the state of Amazonas who fight for the conservation of freshwater turtles. The official party to inaugurate the beginning of the project was held the evening of 3 June 2011, and was a salute to Petrobras, the sponsor of our project. Dignitaries from Petrobras, INPA, the Federal University of Amazonas (UFAM), the University of Amazonas State (UEA), the Brazilian Institute of the Environment (IBAMA) and politicians at the municipal, state, and federal level, as well as researchers and students participated in the event. The evening featured the cuisine of Chef Paulo from the research vessel *The Enigma* and live music. Since Dr. Vogt was recovering from hip replacement surgery, the event began with a video of his presentation. The evening went on without a hitch as he directed the event from home in bed, thus only five barrels of beer were consumed before the event closed at 3 a.m.

In the Trombetas Reserve, activities of our research group continue to increase and diversify. At the moment we are tracking two species

of turtles with VHF transmitters: *P. expansa* subadults to define their movements and habitat use, and *P. sextuberculata* to define their post nesting movements and habitat use. Other research projects include:

- Dietary studies of three species of *Podocnemis* including seed dispersal.
- Population dynamics of *Podocnemis unifilis* and *P. sextuberculata* through intensive mark and recapture studies
- Bioacoustics of all species of turtles.
- Tracking adult and hatchling *Podocnemis expansa* with sonar tags during their migration from the nesting beaches to the flooded forests.

The activities of the environmental education group have also begun. More than 500 people, primarily secondary and primary education school teachers, have received lectures and participated in a workshop aimed at the importance of studying the biology of turtles in order to manage and conserve them, and the importance of turtles in the environment. Recently a group of 30 school teachers participated in a workshop directed at capacity building in techniques of eco-agriculture, where alternatives for income and nutrition apart from consuming and selling turtles were outlined. We expect to gain a foothold in the process of regenerating populations of turtles doing these first two years, with the project living on to see populations of turtles reach levels of pre-European colonization. This will perhaps take less time than the 200 years it took to destroy those populations.

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Christopher Jenkins, CEO and Executive Director, participating in the Gopher Tortoise monitoring program at the Orianne Indigo Snake Preserve in southern Georgia. PHOTO CREDIT: DIRK STEVENSON

The Orianne Society Strengthens its Commitment to Turtle Conservation Worldwide

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*Blue-steel, powerfully built, and magnificent, the Eastern Indigo Snake (*Drymarchon couperi*) is the king of the forest. Captivated, respectful, and sympathetic, a young girl named Orianne sets in motion a plan to save it from extinction. From little things big things grow: The Orianne Society was established in 2008 to ensure the survival of the Eastern Indigo Snake across its range through land protection and management, captive breeding, re-*

introduction to the wild, environmental education, and scientific research.

Today the challenges to wildlife conservation are greater than ever. The preservation of animals, especially threatened species, and their habitats has never been more critical. The demands of a growing population and the pressures of habitat loss, over-exploitation, emerging diseases, and now climate change are

driving species to near extinction. About 30% of all reptiles and amphibians are considered to be at risk, and 22 reptile and 39 amphibian species have now disappeared completely from the wild (IUCN, 2009). The Orianne Society envisions healthy and sustainable populations of reptiles and amphibians in nature living harmoniously with human societies that value them. We aim to achieve this by using scientific research and community outreach and education programs to direct on-the-ground conservation initiatives for these organisms. The Orianne Society's conservation model for reptiles and amphibians is species-based and includes genetic, demographic, behavioral, and ecological factors within ecosystem, landscape, and human perspectives.

The Eastern Indigo Snake is the flagship species of our Society; it is vulnerable to extinction and represents the struggle of threatened species globally. Its charismatic nature makes it effective at engendering support for reptile and amphibian conservation. The Orianne Indigo Snake Preserve (OISP), which is located along the Ocmulgee River in southern Georgia, provides protected natural habitat for this species and a suite of others including the threatened Gopher Tortoise (*Gopherus polyphemus*). Moreover, the newly established Orianne Center for Indigo Conservation in Lake County, Florida will facilitate captive breeding and reintroduction efforts for reptiles and amphibians. The complex will include a breeding center, quarantine facility, indoor and outdoor enclosures, a veterinary clinic, and research laboratory.

Since the inception of the Eastern Indigo Snake Conservation Initiative, two more have emerged: the Viper Conservation Initiative and the Turtle Conservation Initiative. The Viper Conservation Initiative is focused on four species: Eastern Diamondback (*Crotalus adamanteus*), the world's largest rattlesnake that is restricted to the coastal plain in the southeastern United States; Timber Rattlesnake (*Crotalus horridus*), one of the few remaining top predators in the Appalachian Mountains; Midget Faded Rattlesnake (*Crotalus oreganus concolor*), a diminutive species that is mostly restricted to the Green River formation of the

Colorado Plateau and that manufactures one of the most lethal rattlesnake venoms known; and the Black-headed Bushmaster (*Lachesis melanocephala*), a symbol of the wildness of the Latin American rainforest. Timber and Midget Faded Rattlesnakes are dependent on rocky outcrops for shelter from predators, dens for overwintering, and birthing sites in late spring and summer. Likewise, the Eastern Diamondback uses the burrows of other species like the Gopher Tortoise for the same reasons. The loss of these natural habitat features has caused a reduction in the abundance and distribution of these species. Similarly, the Black-headed Bushmaster is declining as its lowland rainforest habitat in Central and South America is being lost to logging and agriculture.

Vipers are often persecuted by people who fear them or do not understand the essential roles they play in their environments. Scientists and conservationists throughout the world are combining their efforts to preserve rapidly-declining viper populations. The Orianne Society has recently formed a partnership with the International Union for Conservation of Nature (IUCN) to bring together viper experts from around the world to form the Viper Specialist Group (VSG). The VSG will serve as a global voice and force for implementing viper conservation programs.

In 2011, the Turtle Conservation Initiative (TCI) was established in order to advance the Society's strategy for turtle conservation, expand the number of target species and programs, generate a roadmap to implement the strategy, and ultimately achieve significant conservation outcomes for endangered chelonians. Our mission through this initiative is science-driven conservation action for turtles, which is being achieved through a portfolio of projects that address seven key action areas: ecology, community conservation, habitat protection and management, captive breeding and reintroduction, environmental education, professional training, and public awareness. Each TCI program is underpinned by applied science in order to fill knowledge gaps and aid in decision-making for the conservation of threatened turtles. Research projects focus on the ecology and biology of little-known species, monitoring demographic properties of small populations, assessment of threatening processes (e.g., overharvesting, habitat loss, and climate change), improvement of captive breeding and re-introduction techniques, evaluation of land management practices, and determining



Riana Rakotondrainy, Research Assistant, investigating the ecology of Radiated and Spider Tortoises at the Cap Sainte Marie Special Reserve, Madagascar.

PHOTO CREDIT: CHRISTINA CASTELLANO



Christina Castellano, Director of Turtle Conservation, examining a pile of shells from illegally harvested Radiated Tortoises in Madagascar. PHOTO CREDIT: RIANA RAKOTONDRAINY

the effectiveness of community conservation and environmental education programs. These priority research areas are being addressed by incorporating experimental designs into field-based projects and captive breeding programs, partnerships and collaborations with research institutions, and supporting and mentoring students.

Through the TCI, we are applying the Orianne Society's species-based model to turtle conservation. We are currently in the process of selecting a suite of threatened species to target for multi-faceted conservation programs. Target species are selected according to their conservation status, level of threat, and characteristics as a flagship species that include endemism, rarity, size and appeal. There is also a geographic emphasis on North America and the potential to protect other turtle and wildlife species that live in the same habitat and experience the same

threats. We are seeking opportunities for collaboration and partnerships with like-minded organizations that will allow us to add value to specific conservation efforts.

In addition, our level of expertise and experience with a particular species and its country of origin are also important considerations in our species selection process. The Orianne Society's TCI is presently focused on four species: Radiated Tortoise (*Astrochelys radiata*), an endemic species of Madagascar that is being heavily collected for bushmeat and the international pet trade; Spider Tortoise (*Pyxis arachnoides*), a small habitat specialist that has been lost from most of its range in southern Madagascar due to unsustainable land use practices; Gopher Tortoise (*Gopherus polyphemus*), a native of the southeastern United States that has declined primarily due to the urbanization of its longleaf pine habitat; and Bog Turtle (*Glyptemys muhlenbergii*), the

smallest North American turtle species that has nearly vanished from most of its range mainly due to habitat loss but also predation and illegal collection.

The Madagascar Tortoise Conservation Program (MTCP) is the focal program of The Orianne Society's TCI. The MTCP aims to secure the long-term survival of Critically Endangered Radiated and Spider Tortoises in the wild. The Radiated Tortoise is being decimated by the illegal harvest for bushmeat with some 22,000 to 250,000 individuals being harvested each year. Consequently, harvesting pressure on the Spider Tortoise has increased as Radiated Tortoise populations have become depleted (Randriamahazo et al., 2007). In addition, thousands of tortoises are traded illegally each year as both species are openly sold in pet markets in Asia (Sheppard and Nijman, 2007). Habitat destruction through forest conversion for agriculture, charcoal production, human-induced wildfires, and invasive plants - especially sisal (*Agave* sp.) and prickly pear cactus (*Opuntia* sp.) - further exacerbates the problem (Harper et al., 2007). Through the MTCP we are working on the long-term monitoring of populations that are critical to the survival of these species, and we are supporting and mentoring students who are investigating the spatial ecology and habitat preferences of the tortoises at the Cap Sainte Marie Special Reserve. We are also finding strength in numbers through new partnerships and growing collaborations with other dedicated organizations working on the ground in Madagascar, including the Turtle Survival Alliance, Madagascar Biodiversity Partnership, World Wildlife Fund, Conservation Fusion, and Emerging Wildlife Conservation Leaders. In collaboration with these groups, we are moving forward with environmental education, outreach, and public awareness projects to gain support, foster awareness, and mitigate threats to these declining species.

The Gopher Tortoise and Bog Turtle conservation projects allow us to be the stewards of threatened species that occur as near to us as in our own backyards. The OISP provides a safe haven for a healthy population of Gopher Tortoises in Georgia. In 2010, we initiated a long-term monitoring program for this species on the preserve in order to identify population trends, measure recruitment, and gather information that will allow us to actively manage important habitat features. We will also use the tortoise project on the preserve as an education and outreach venue to raise awareness of the pro-



Christina Castellano holding a wild Radiated Tortoise during population surveys conducted with the TSA earlier this year. PHOTO CREDIT: RICK HUDSON

cesses that threaten this species in the wild and to involve people in conservation actions. We are undertaking a similar project for Bog Turtles in partnership with a local school. The Rabun Gap Nacoochee School and The Orianne Society have teamed up to undertake a bog restoration project that will provide students with an outdoor classroom and a hands-on opportunity to learn about habitat restoration and the preservation of Bog Turtles and other species that depend on these wetlands. At the same time, we are working with the Georgia Department of Natural Resources to determine the occurrence of Bog Turtles in north Georgia.

The Orianne Society's TCI will be expanding over the next several months and years. We are committed to turtle conservation especially in these times when more species are at risk of extinction than ever before. Through strong

partnerships, science, and public participation we aim to help conserve these ancient creatures.

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Vienna Zoo Makes International Headlines with First Hatching of the Northern River Terrapin (*Batagur baska*) Outside Their Natural Range

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PETER PRASCHAG²



Hatchling Northern River Terrapin. PHOTO CREDIT: PETER PRASCHAG

Situated in the center of Europe, Vienna Zoo was founded in 1752 and thus is known to be the world's oldest zoo. Today it is also famous for its high standard in animal husbandry, its continuing breeding success with various endangered species, and its efforts in nature and species conservation projects. For several years Peter and Reiner Praschag have been co-operating with zoologists from the Vienna Zoo and have launched a turtle conservation program for endangered Asian turtle species.

Over the years the Praschags placed 2.2 Northern River Terrapins (*Batagur baska*), 1.1 Black Softshells (*Nilssonina nigricans*), 1.1 Flapshell Turtles (*Lissemys punctata andersoni*) and 1.1 Spotted Pond Turtles (*Geoclemys hamiltonii*) from their private collection into the Asian House of the Vienna Zoo. In February 2010, upon the arrival of the *B. baska* at the zoo, a series of veterinarian and radiographic tests on all individuals was performed which confirmed that both females were gravid. After several careful attempts to make the turtles lay their eggs naturally had failed, the zoo team eventually used hormonal stimulation (Oxytocin 10 u/kg + Prostaglandin 1.0mg/kg) to which both females responded. To minimize the risk of damage to the eggs, sump trays with mesh grate were placed in a water basin and both turtles smoothly dropped their eggs into them. The next step was

to develop a strategy to create suitable incubation conditions. Due to the fact that neither data from natural nests, nor from any captive breeding was available, we based our incubation parameters from data available from the closely related Southern River Terrapin (*Batagur affinis*) and placed the two clutches in Vermiculite with a humidity level of 90%. The eggs were divided into 3 groups and exposed to different temperature regimes (29.5°C, 31.5°C, 33.5°C). After a few days it was evident that all 17 eggs from one of the females - and none of the 13 eggs of the other one - were fertile. During the first month all 17 eggs developed well, but in the course of the second month most of the eggs suddenly died within a few days. At that moment, the zoo team guessed that the cause of death was the high humidity of the substrate and decided to replace the Vermiculite for another substrate known to work better with high humidity levels - a mix of Cocopeat and Seramis, a plant substrate made of clay. Eventually, after 63 days, two turtles (both from the 29.5°C group) hatched - the first successful breeding of *B. baska* in captivity. During the next months the two hatchlings responded well to the nutrition and conditions offered by the zoo, and today - one year later - both seem to be in good health.

The enormous international media response that followed the zoo's press announcement of the hatching success was unexpected; a largely unknown and highly endangered species had suddenly become "famous" to a broad public. The zoo management subsequently decided to join the support team of conservation work for *B. baska* that already consisted of - among other partners - Peter Praschag, the TSA, World Wildlife Fund (WWF) Canada, CARINAM and Rupali Ghosh. Rupali has been working closely with Peter Praschag in Bangladesh and Northeast-India for several years and must be seen as a key figure when it comes to finding remaining individuals - most of them kept in village ponds - buying them and transferring them to the State Forest Department of Bangladesh. An important step was the meeting of Rupali and the management of Vienna Zoo, resulting in a binding declaration of the zoo to support her work during the next few years. For Vienna Zoo the conservation of *B. baska* has become one of its most important projects. During the zoo's most popular conservation event the "Conservation Days", which were held at the beginning of August 2010, facts about *B. baska* were presented to an audience of more than 30,000 visitors. Furthermore, the zoo's scientific staff has already proposed a number of funding



In the absence of a suitable nesting area in the zoo's quarantine area, a PVC grate was set up to prevent the female from crushing the eggs after laying. PHOTO CREDIT: DANIEL ZUPANC



Dagmar Schratter (Zoo Director), Rupali Ghosh, Anton Weissenbacher (Curator), and Peter Praschag in the Vienna Zoo's Asia House with male *B. baska* in the foreground. PHOTO CREDIT: DANIEL ZUPANC



A beautiful underwater view of a juvenile Northern River Terrapin. PHOTO CREDIT: NORBERT POTENSKY

applications to various national and international organizations and received positive resonance. The ZGAP (Zoologische Gesellschaft für Arten- und Populationsschutz e.V.) was among the first to financially support the project. Even IUCN has agreed to support *in-situ* conservation activities and WAZA has decided to list the project as

one of the official WAZA conservation projects (<http://www.waza.org/en/site/conservation/waza-conservation-projects/overview/project-batagur-baska>).

The same exhibit is shared by the only captive pair of Black Softshell Turtles (*Nilssonina nigricans*) outside their countries of origin. With

an age of 12 (male) and 14 (female) years and a carapace length of more than 40 cm, both specimens reached maturity in 2010. After leaving the water first on 26 April, the female finally laid a clutch of 23 round eggs, six meters from water, on 27 April. The eggs have an average diameter of 35.8 mm and at least 10 look fertile, but have not yet started to develop. The zoo team is just going to try to stimulate development by providing a temperature diapause period.

At this early stage it can already be said that the conservation project of Asian turtle species, in particular of *B. baska*, is off to a good start. The scientific data that the team of Vienna Zoo has collected until now as well as the zoo's PR activities will hopefully contribute to continued success.

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Important Actions for *Cuora* species: Position of the European Zoos and an Overview of the Current *Cuora* holdings in the European Studbooks

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IN CLOSE COMMUNICATION WITH TORSTEN BLANCK (ESF)



Cuora mccordi juvenile. PHOTO CREDIT: TORSTEN BLANCK

THE GENUS *CUORA*

During the 1980's and 90's there were a number of importations of Chinese and Vietnamese *Cuora* species into Europe with the majority of those turtles being sold to private keepers. Only a few zoos acquired those species for their collections in those years. Over the past two decades, however, zoos became more aware of the critical status of the majority of *Cuora* and now appreciate the extinction risk of wild populations. Some species are likely already gone from nature.

Although almost all *Cuora* species are represented in European Association of Zoos and Aquaria (EAZA) collections only a limited number of those institutions are really involved in the conservation of the genus. The numbers kept are still not significantly high. Within EAZA just one European Studbook (ESB) for *Cuora amboinensis* is managed on

Therefore, husbandry and reproduction of *Cuora* species within the European private sector is a high priority now and cooperation with the private sector, organized within the European Studbook Foundation (ESF), was established. This will be stipulated in a respective Memorandum of Understanding as requested by both EAZA and the ESF this year.

The International Center for Turtle Conservation (IZS) at Münster Zoo and several other EAZA Members (Rotterdam Zoo, Chester Zoo, London Zoo, Whipsnade Zoo, Cologne Zoo, Tierpark Hagenbeck and Amsterdam Zoo) as well as the ESF have already established specific breeding programs (since the early 1990's) for these critically endangered species, involving both engaged private turtle breeders and several European zoos.

In order to establish genetically viable, healthy captive populations we must rely on



DIERGAARDE
BLIIDORP
ROTTERDAM ZOO

the private sector and a handful of specialized and dedicated zoos such as the Münster Zoo including the International Centre for the Conservation of Turtles (IZS), the Rotterdam Zoo and the Bristol and Chester Zoos in the UK. Exchange of animals between the EAZA and ESF parties as well as placing zoo-born animals at private ESF locations on breeding loan will require a contract. Sometimes the high costs for individual housing and management of *Cuora* specimens is a matter of financial concern for zoos. At the IZS center in Münster the efficiency of the operation could be increased by 50-100% if funding for a part-time position were secured on a long term basis.

All *Cuora* species can be bred *ex situ* reliably and on schedule if appropriate methods are used and adequate conditions provided. This is also true for aggressive and stress-sensitive species, given that the social behaviour, requirements for food and climate and simulation of a natural habitat are taken into consideration. The appropriate methods for breeding have been adapted and improved continually over the past years by IZS/Münster Zoo and Rotterdam Zoo.

Due to the persistent pressure on the wild populations combined with ineffective protection, it is necessary to establish *ex situ* breeding populations of all *Cuora* species as well as subspecies and even local morphs. The species *Cuora aurocapitata*, *C. cyclornata*, *C. mccordi*, *C. pani*, *C. trifasciata*, *C. yunnanensis* and *C. zhoui* are sold for high prices in the illegal wildlife trade and are therefore critically threatened, but their natural habitat still persists. All *Cuora* species need to be genetically analysed (mtDNA and nDNA) in order to determine how many genetically different variants exist and if these subspecies can be assigned geographically. Nowadays local forms and not

yet fully described or recognized thus “subspecies” are mixed during breeding attempts - mostly unintentionally. These genetic mixes pose serious challenges to species conservation programs.

The IZS plans to provide 50-70% of the offspring of the respective species to *in-situ* breeding projects given that the necessary requirements, as stated below are met. The remaining 30-50% shall be used to establish further safety populations in other institutions. The distribution of the offspring into different subpopulations at various locations minimizes the risk of a catastrophic loss due to disease or epidemic.

Proposed actions for the various species and current holdings/efforts in the ESF/IZS/EAZA

CUORA AUROCAPITATA

In 2010, 12 *Cuora aurocapitata* hatched at the IZS, the largest annually produced number so far. The International Center for Turtle Conservation (IZS) at the Münster Zoo currently holds 13.11.45 *Cuora aurocapitata*.

For this species, the establishment of an official government breeding station located in the province Anhui should be realized as soon as possible. Detailed *in situ* field research is urgently required to understand the species natural history, to identify suitable remaining sites as protected areas and possibly find remaining specimens in the wild. We regard the collecting and transfer of the last wild individuals to the proposed breeding station a necessity. Linking *in situ* to *ex situ* captive management is a very important component and exchange of knowledge and skills is very important to setup husbandry and breeding guidelines. Education and awareness raising programs for the local people have to be initiated. Additional back up colonies in zoos and private facilities need to be established and the management of captive specimens in Studbooks like the ESF needs to be improved.

CUORA GALBINIFRONS COMPLEX

Since the three former subspecies *Cuora galbinifrons galbinifrons*, *Cuora (galbinifrons) bourreti* and *Cuora (galbinifrons) picturata* are recognized and accepted as separate species, studbook management became easier and reproduction increased. Though still not in high numbers, a growing number of breeders in Europe have now been successful. ESF studbook keeper Richard Struijk has published several accounts on those successes in this publication over the years.

The current living ESF studbook population counts are:



Cuora zhoui. PHOTO CREDIT: TORSTEN BLANCK

- *Cuora bourreti* 4.9.11 specimens kept by seven participants in four EU countries,
- *Cuora galbinifrons* 22.33.24 specimens kept by 17 participants in seven EU countries
- *Cuora picturata* 10.17.30 specimens kept by 14 participants in seven EU countries.

In our view, detailed genetic studies on this complex, as well as habitat conservation, are the two key priorities for these species at the moment along with *ex situ* captive management.

CUORA MCCORDI

The ESF-studbook population, based primarily with the initial Münster Zoo collection, has seen its successes increase to 61 specimens since 2004 and now has 6.17.38 specimens. With the recent pledges for participation this number will increase to 90 very soon. Worth noting here is the exchange of captive born specimens in 2010 and 2011 between the zoos of Atlanta and Münster; two captive-hatched animals acquired by TSA were exchanged for two Münster hatched stock. The first exchange between two continents will hopefully be continued in the near future with respect to other rare *Cuora* species!

The breeding program is lacking sufficient males, although the first males have been bred in the last few years. Egg incubation has to be improved and in particular lower temperatures (down to 23 °C) must be used in order to hatch males. Endoscopy of young animals should be performed in order to transfer unrelated animals earlier to new locations.

Since this species is likely extinct in the wild, the current focus has to be set on maintaining a high level of genetic diversity in the captive populations and to protect and study the remaining habitat.

CUORA PANI

The studbook numbers are still low. The European studbook keepers are doing their best to find new additional keepers of this species. The International Center for Turtle Conservation (IZS) at the Münster Zoo currently holds 1.4.2 *Cuora pani*. The first priority for this species is to identify possible remaining wild populations and create protected areas.

CUORA TRIFASCIATA AND C. CYCLORNATA

Over the past few years the studbook population of *C. trifasciata* increased and nearly doubled in size. Since both *C. trifasciata* and *C. cyclornata* are regarded by many to be two separate species, the studbook populations are separately managed as well. During 2010, 17 hatchlings of both species were reported to the studbook, six of them being *Cuora trifasciata* and eleven *Cuora cyclornata*.

CUORA ZHOU

The first priority is to locate the species in the wild. In case this is successful, the recommendations will be the same as for *C. aurocapitata*. The basis for the conservation breeding program is the captive population of the Münster Zoo where six founder animals have produced more than 40 hatchlings so far. This offspring have served to establish eight different breeding groups in different institutions (among them London and Rotterdam zoos) or private collections, although males have not yet been hatched with certainty. The studbook, managed by IZS lists 2.6.20 animals. So far only IZS Münster Zoo is reproducing this species in Europe.

Within Europe, there are five additional wild caught founder animals and in the United States approximately 15 adult wild caught specimens exist, which could altogether form a sufficient basis for a successful conservation breeding



Hatchling *Cuora picturata*. PHOTO CREDIT: CHRIS TABAKA



Cuora trifasciata at Munster Zoo. PHOTO CREDIT: HENK ZWARTEPOORTE

CURRENT ESF *CUORA TRIFASCIATA* AND *C. CYCLORNATA* STUDBOOK NUMBERS.

Note: non sampled trifasciata are counted to Clade A currently

Cuora trifasciata/cyclornata Studbook

Holdings as of 14.06.2011

Studbook Keepers: **Torsten Blanck/Elmar Meier**

	Clade A (G)	Clade B (H)	Clade C cyclornata	Clade C cf cyclornata	Clade C meieri	Clade D "zhoui"	Hybrids	Total
Male	24	8	2	7	2	1	7	51
Female	30	15	2	6	3	0	11	67
Juv	11	13	0	17	3	0	3	47
New 2011	1	0	0	1	0	0	0	2
CB 2010	3	3	0	6	5	0	0	17
Eggs 2010	15	0	0	16	7	0	0	38
Losses	2	0	0	0	0	0	0	2
Exchanges in Studbook 2010	0	1	0	1	0	0	0	2
USA	0	0	0	0	0	1	0	1
Total Holdings M/W/JU	24.30.14	8.15.16	2.2	7.5.23	2.3.10	0	7.11.3	50.66.68
Total Numeric	65	36	4	30	8	1	21	164

program. However, breeding success is low. It is important to collaborate with the owner of the remaining founder animals to increase breeding success and not to lose this valuable gene pool.

As can be seen above, the ESF-Studbooks for *Cuora* are becoming fairly successful; however, cooperation between EAZA zoos and ESF studbooks could still be improved.

REMAINING PROBLEMS AND TASKS

1. Genetic variability vs. Morphology

Several specimens within the studbooks for *C. trifasciata*, *C. cyclornata*, *C. aurocapitata* and *C. pani* show significant morphological variation, however we were not able to make a clear taxonomic assignment based on mtDNA analysis. For this reason both the Münster and Rotterdam zoos, in close cooperation with the respective ESF-studbook keepers, decided to carry out more sophisticated DNA analysis as explained below.

Studying the genetic variability and phylogeny of the critically endangered *Cuora trifasciata*, *C. aurocapitata* and *C. cyclornata* using microsatellite markers

Within the European captive populations, *Cuora trifasciata* and *Cuora aurocapitata* are known to exhibit more phenotypic diversity than previously assumed. Delineation of species and subspecies has so far been conducted on the basis of various methods, i.e. morphological differences as well as analyses of mitochondrial DNA sequences. However, different opinions about

the species/ subspecies status of several forms persist and cannot be resolved using the methods available to date. Numerous genetic hybrids without any value in regard to conservation (may) thus have been produced already. For the successful implementation of captive breeding programs, animals need to be assigned to groups that correspond to known natural populations. Therefore, further analyses of the phylogenetic and biogeographic patterns found within the genus *Cuora* are urgently needed.

As the preparatory work has already been done by the involved zoos and organizations it is fundamental to clarify the uncertainties regarding phylogenetic and biogeographic relationships immediately to continue conservation breeding in the proper way for "pure" assurance colonies and potential reintroduction or restocking projects. This basic groundwork will then also be available for use in captive breeding programs of other regions.

Total costs for the research are 15,000 EUR (\$19,000 USD) to conduct this study; additional funds amounting to approximately \$5,500 USD has already been earmarked by other donors. From the Shellshock campaign money the Turtle Conservation Fund awarded a grant of \$6500 USD in 2009. At present another 3,000 EUR are needed.

The first results of 168 samples have already led to respective recommendations for specimen exchange within several studbooks which led to appropriate breeding results, in particular with respect to *C. trifasciata* reproduction. It

is advised that unknown or morphologically different types and possible hybrids should be separately housed pending conclusive species identification.

2. Uplisting *Cuora* species to CITES Appendix I

Several people and organisations aim for upgrading most species of the Genus *Cuora* to CITES Appendix I, this is especially true for *Cuora trifasciata*. We think that this is not the adequate measure, as there is no longer any international trade of these critically endangered species – in species such as *Cuora aurocapitata*, *C. cyclornata*, *C. mccordi*, *C. pani*, *Cuora trifasciata* and *C. zhoui* the trade collapsed 10-20 years ago. The illegal trade in East Asia with these species will not be influenced by CITES upgrading though. Transferring captive bred offspring from one institution, not to mention from a private breeder to another, however, will be considerably impeded by upgrading. Only international trade of *C. amboinensis* is still proceeding and will be intensified in the years to come. Law enforcement on this species and its subspecies has to be improved. Upgrading may also be justifiable for the *Cuora galbinifrons* complex but needs to be evaluated carefully.

In case of confiscations within Europe, priority species must be registered and reported directly after confiscations and legal procedures should be as brief as possible. These animals then have to be placed directly into studbooks/breeding programs. An EAZA policy statement is in progress at present.



The two McCord's Box Turtles shortly after their arrival in Muenster. PHOTO CREDIT: MARTINA RAFFEL



Curator Dr. Dirk Wewers unpacks the two McCord's Box Turtles which just arrived from Atlanta. PHOTO CREDIT: MARTINA RAFFEL

Update from the International Centre for the Conservation of Turtles (IZS) at Münster Zoo

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The IZS currently houses 282 specimens of 19 species and 22 subspecies and is a joint project managed by the Münster Zoo, the Zoological Society for the Conservation of Species and Populations (ZGAP) and the German Herpetological Society (DGHT). Remarkably, this highly successful program is managed by the co-author, his wife and a few friends in their spare time. A total of 54 offspring hatched in 2010 (see table 1), while eggs of *Chinemys nigricans* and

Mauremys annamensis were either incubated in part or not at all due to lack of interest from other institutions. The focus was on breeding Asian box turtles of the genus *Cuora* and a total of 44 hatchlings were produced this year.

Up until now, a total of 297 specimens hatched since the start of operation in 2003. An international network of assurance colonies has started being established with surplus wild-caught specimens. More than 150 offspring from IZS have been trans-

ferred to other institutions and private breeders on breeding loan. After long preparations, the first exchange of McCord's Box Turtle (*Cuora mccordi*) succeeded: two specimens were transferred from Münster to the TSA and Atlanta Zoo at the beginning of December 2010. In exchange, two unrelated specimens arrived in Münster at the beginning of February 2011, one of which was given to Rotterdam Zoo. Further exchanges of specimens would be highly beneficial to increase the genetic diversity of the founder population.

To further the establishment of assurance colonies in captivity, the exchange of knowledge on biological aspects and reproduction of the managed species is a high priority. This was also the aim of the 2nd International Chelonian Congress at Münster Zoo which took place in April 2010 and attracted chelonian experts from all over the world, including several Chinese participants.

Breeding data at Münster Zoo to date again suggests that 2011 will be a highly successful year. Besides numerous *Cuora* eggs being incubated, the first fertilized eggs of the Tricarinate Hill Turtle (*Melanochelys tricarinata*) have been laid.

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TABLE 1: OFFSPRING HATCHED AT IZS IN 2010

No. of hatchlings	English name	Scientific name	Comment
12	Yellow-headed Box Turtle	<i>Cuora aurocapitata</i>	one malformed
1	Bourret's Box Turtle	<i>Cuora bourreti</i>	
2	Golden Coin Box Turtle	<i>Cuora cyclornata cyclornata</i>	Central Vietnamese form
5	Meier's Golden Coin Box Turtle	<i>Cuora cyclornata meieri</i>	Northern Vietnamese form
10	McCord's Box Turtle	<i>Cuora mccordi</i>	one malformed, died later
2	Southern Vietnam Box Turtle	<i>Cuora picturata</i>	
9	Golden Coin Turtle	<i>Cuora trifasciata</i> spp.	
3	Zhou's Box Turtle	<i>Cuora zhoui</i>	
1	Arakan Forest Turtle	<i>Heosemys depressa</i>	
2	Sulawesi Forest Turtle	<i>Leucocephalon yuwonoi</i>	
7	Vietnamese Pond Turtle	<i>Mauremys annamensis</i>	



MYANMAR



The recently constructed Myanmar star tortoise (*Geochelone platynota*) breeding facility at Lawkanandar Wildlife Sanctuary near Bagan. Note the inner predatorproof building to house hatchlings surrounded by pens for adults. The entire facility is surrounded by a high fence topped with razor wire to discourage theft. PHOTO CREDIT: RICK HUDSON

From Assurance Colonies to Field Research: TSA's Rapidly Expanding Turtle Conservation Program in Myanmar

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ME ME SOE, WIN KO KO, KHIN MYO MYO, KYAW MOE, AND STEVEN PLATT



TSA's Myanmar Program underwent a significant expansion in 2011 with the addition of key personnel and major investments in assurance colony infrastructure. This expansion was made possible by an investment of over \$60,000, the result of two years of successful fundraising. In January 2011, Dr. Kalyar Platt assumed the position of country coordinator responsible for overseeing all TSA projects in Myanmar. Kalyar is working closely with Wildlife Conservation Society's (WCS)

Myanmar Program based in Yangon. In addition to Kalyar, Daw Me Me Soe joined the TSA/WCS Turtle Team as a field assistant in March 2011. Me Me Soe will be conducting fieldwork throughout Myanmar, and also supervising the construction and operation of a planned Turtle Rescue Facility in Lashio. TSA's conservation efforts in Myanmar continue on many fronts with a strong emphasis on the country's endemic chelonians, all of which are critically imperiled by unsustainable exploitation to supply the seemingly insatiable food, medicinal, and pet markets of southern China.

Burmese star tortoise (*Geochelone platynota*): Significant improvements were made to the facility housing the assurance colony at Lawkanandar Wildlife Sanctuary (near the world renowned archaeological site in Bagan) during 2011. This is the second largest captive breeding colony of star tortoises in Myanmar, and the largest of the government-run facilities. The breeding pens were enlarged, overhead vegetation trimmed to allow greater exposure to sunlight, and a high security fence topped with concertina wire now surrounds the compound. A double mesh predator proof juvenile rearing facility was also constructed, along with a substantial quarantine area to house tortoises transferred from Griffin Enterprises, a commercial breeding facility. Under a cooperative agreement with the Myanmar Forest Department, Griffin Enterprises is required to transfer 20% of their annual production to the Lawkanandar facility.

Outstanding reproductive success was achieved during the 2010-11 nesting season at Lawkanandar Wildlife Sanctuary. Females began laying in November 2010 and continued depositing clutches through March 2011; each clutch averaged about seven eggs. By the end of the nesting season, 20 nesting females had laid 269 eggs, which are expected to begin hatching in late May and early June 2011. To date this has been the most successful nesting season since the facility was established eleven years ago. Additionally, 12 adult *Manouria emys* were transferred from the Mandalay Zoological Gardens to Lawkanandar Wildlife Sanctuary in early May. These tortoises are being housed in a separate enclosure within the star tortoise facility. Nesting material was provided to the tortoises shortly after their arrival, and almost 70 eggs were deposited in May and early June. Although some eggs were laid without being covered and later trampled by females, 58 are currently being incubated. We expect nesting success to improve as the tortoises settle into their new enclosure.

Because captive assurance colonies (in addition to Lawkanandar Wildlife Sanctuary, other colonies are housed at Shwe Settaw and Minzontaung Wildlife Sanctuaries, and the Mandalay Zoo) are enjoying considerable success and producing relatively large numbers of hatchlings, these facilities are expected to reach maximum capacity in the near future. Recognizing the need to initiate reintroductions of captive-bred tortoises into suitably protected habitat, the TSA/WCS Turtle Team plans to conduct an assessment of potential release sites in September 2011, and develop a comprehensive reintroduction plan for *G.*



Lay Lay Khaing with some of the hundreds of juvenile Star Tortoises that are produced at the Lawkanandar facility annually. PHOTO CREDIT: RICK HUDSON



In May 2011, 100 captive-reared Burmese roof turtles (*Batagur trivittata*) were transferred from the Yadanabon Zoo in Mandalay to this 3.5 acre pond at Lawkanandar Wildlife Sanctuary near Bagan. Two artificial nesting beaches are visible to the right and left of the photograph. These turtles are expected to begin breeding within the next few years. PHOTO CREDIT: RICK HUDSON



This Burmese Peacock Softshell Turtle (*Nilssonina formosa*) is one of the targeted species for this new facility. PHOTO CREDIT: RICK HUDSON



Permanent pools for soaking are featured in each of the four separate enclosures and provide a cool respite from the heat during the dry season. PHOTO CREDIT: RICK HUDSON



Members of the TSA Board visit the new tortoise facilities at the Lawkanandar Wildlife Sanctuary in February 2011. From left to right: Rick Hudson, Pat Koval, Colin Poole, Chuck Landrey and John Mitchell. PHOTO CREDIT: KALYAR PLATT

platynota in Myanmar. Planned site visits include Minzontaung and Shwe Settaw wildlife sanctuaries, and Mya Leik Taung, a mountain where star tortoises were abundant as recently as 2001 and protected by strong local religious beliefs.

Rakhine Forest Turtle (*Heosemys depressa*):

A new enclosure to house Rakhine Forest Turtles, an enigmatic species endemic to western Myanmar, was completed in April 2011 at the Rakhine Yoma

Elephant Sanctuary in Gwa. The enclosure includes a spacious land area and two shallow pools separated by a wooden divider. Six turtles confiscated from illegal traders and held briefly at the Mandalay Zoo were transferred to the new facility in late April. These six turtles joined seven others confiscated earlier by the Myanmar Forest Department from traders near Gwa. The group appears to be doing well, and apparent mating behavior was observed



Adult Rakhine Forest Turtles (*Heosemys depressa*), part of a recently established assurance colony at the Rakhine Yoma Elephant Sanctuary headquarters in Gwa, avidly devour papaya shortly after being released into the spacious breeding pen. These turtles were originally confiscated from illegal wildlife traders by Myanmar Forest Department officials.
PHOTO CREDIT: KALYAR PLATT

on several occasions.

In December-January Daw Khin Myo Myo, a member of the TSA/WCS Turtle Team, conducted a survey of the eastern side of the Rakhine Yoma Elephant Sanctuary, the only protected area known to harbor *H. depressa*. Unlike the western side of the sanctuary, which remains relatively pristine, Khin Myo Myo found considerable evidence of human activity in the eastern region and it appears that turtles, including *H. depressa* are being harvested in significant numbers. Moreover, cutting of the extensive bamboo brakes that cloak hills in this region is underway to supply a paper pulp factory constructed in 2005 and this activity undoubtedly deprives *H. depressa* of its preferred habitat. Khin Myo Myo recommended an increase in patrolling by sanctuary staff to curb this illegal harvest of turtles. Nonetheless, the interior of the sanctuary remains difficult to access and is thought to be at minimal risk from turtle hunters – at least for the time being.

Myanmar Roofed Turtle (*Batagur trivit-*



The survivors of a confiscation of Big-Headed Turtles (*Platysternon megacephalon*) were transported to the Kyeikhteeyo Wildlife Sanctuary and released into some of the many swift-flowing streams in this area.



Win Ko Ko and officials from the Myanmar Forest Department conduct a ceremony to mark the successful return of headstarted *Batagur trivittata* to the Chindwin River.



The captive husbandry of Myanmar's two endemic softshells will be the focus of this new facility. Three new ponds at the Yadanabon Zoo will provide space for rearing juvenile softshells on a trial basis. PHOTO CREDIT: RICK HUDSON

tata): Conservation efforts for the endemic and Critically Endangered *B. trivittata* continue to focus on *in situ* propagation at the Yadanabon Zoo in Mandalay, an *ex situ* head-start program on the Upper Chindwin River, and field surveys of the Dokthawady River, a drainage now heavily impacted by the recent completion of a large hydropower dam. The *ex situ* headstart program enjoyed excellent success during the 2010-11 nesting season; six to nine females deposited 179 eggs in sandbanks along the Upper Chindwin River. These eggs were collected by the TSA/

WCS Turtle Team and returned to the field camp for incubation; 93 eggs had hatched by late May. These hatchlings will be held for several years at the field camp before being returned to the river.

Because apparently infertile eggs have repeatedly been found in *B. trivittata* nests deposited on three sandbanks, males are thought to be lacking among the small population remaining along this stretch of the river. Therefore the decision was made to augment the existing population with seven young male turtles from the head-start program. After being held in a temporary facility on

the riverbank, and following an educational campaign among local villagers and fishermen, the turtles were released in late December 2010. The males are believed to be reproductively mature and it is hoped fertile eggs will be forthcoming in the 2011-12 nesting season.

A permanent head-starting facility has been proposed for the nearby Htamanthi Wildlife Sanctuary, although construction has yet to begin due to funding constraints. Field surveys of several creeks in Htamanthi Wildlife Sanctuary are planned for late 2011 and early 2012. If successful in locating hitherto unknown populations of *B. trivittata*, protection of nesting beaches will be implemented and the head-starting program extended into these areas. Furthermore, hatchlings will be reared to diversify the genetic base of the existing assurance colonies, which are currently descended from a relatively small number of founders.

A second assurance colony was established in early May when 100 captive-reared *B. trivittata* (approximately 4-5 years old) were transferred from the Yadanabon Zoo to a new breeding pond at Lawkanandar Wildlife Sanctuary. A small-mesh fence was erected around this 2.5 acre pond in early 2011; an island in the pond provides seemingly suitable nesting habitat which was enhanced with the addition of a new sandy beach. It is hoped the turtles will begin laying here as they attain sexual maturity within the next few years.

Field surveys for *B. trivittata* were conducted in the Dokthawady River, a major tributary of the Ayeyarwady River during April 2011. It was in the Dokthawady River that a WCS Team "rediscovered" *B. trivittata* in 2001, after it was long-presumed extinct. A remnant population of *B. trivittata* is thought to persist in the river, although completion of a hydropower dam in October 2010 makes survival of this population tenuous. The TSA/WCS Field Team visited the Dokthawady River upstream from the rapidly filling impoundment to investigate the effect of the dam on the remaining turtles. Their findings were not encouraging and paint a grim picture with regards to the continued survival of *B. trivittata* in the Dokthawady; encampments of fishers, tree-fellers, and charcoal makers now occur throughout the area and illegal harvesting of fish and wildlife is rampant. One wildlife trader recently claimed to have purchased three *B. trivittata* in breeding coloration that were later sold to a dealer in Mandalay. Other *B. trivittata* have apparently been eaten by local villagers rather than being sold; the high cost of transporting large, hard-shelled turtles makes them difficult to sell to wildlife dealers. These findings

highlight the ongoing threats faced by wild *B. trivittata* and the urgency of TSA/WCS efforts on behalf of this critically endangered species.

Big-headed turtle (*Platysternon megalcephallum*): In July 2010, Forest Department officials confiscated almost 200 Big-Headed Turtles destined for markets in southern China at the border crossing near Lashio. The confiscated turtles, most in poor and rapidly deteriorating physical condition were held briefly in Lashio and then transferred to the Mandalay Zoo. By the time the turtles reached Mandalay, only 50 remained alive. These turtles were rehabilitated at the Mandalay Zoo under the supervision of zoo veterinarian Dr. Tint Lwin. In August, the 50 surviving turtles were released by the TSA/WCS Turtle Team at Kyeikhteeyo Wildlife Sanctuary, a site of great religious importance situated in the rugged mountains of eastern Myanmar. The numerous swift-flowing streams descend from Kyeikhteeyo Mountain are expected to provide excellent habitat for the repatriated turtles.

Expansion of assurance colony infrastructure at Yadanarbon Zoological Garden: In September 2011, the Yadanarbon Zoological Garden in Mandalay received a grant of \$30,800 from TSA to undertake a major expansion of their assurance colony infrastructure. As part of this project, a new facility was constructed to house the breeding group of *Manouria emys phayrei*. Seventy-nine of these big tortoises were being kept in an overcrowded pen after being seized by Forest Department officials from illegal wildlife traders in 2007. The new facility (4536 ft²) triples the space available to the tortoises and is subdivided into six separate enclosures; each is surrounded by a low brick wall and has a shallow concrete pool that will allow the tortoises to remain cool during the hot weather typical of Mandalay. A food preparation building was constructed adjacent to the new breeding enclosure.

Facilities for the highly successful *Batagur trivittata* breeding program were also upgraded in the infrastructure expansion program. Four fiberglass tanks were set on an elevated platform for rearing hatchlings outside full time; this was previously done in large plastic pans that had to be moved outside during the day. As hatchlings increase in size they will be transferred to one of four new rearing ponds, each measuring 10 × 20 ft and completely enclosed in heavy mesh fence to deter predatory birds (such as crows) that are common on zoo grounds. Another rearing pond – choked with water hyacinth and used to filter water for the breeding pond – was modified to accommodate sub-adult *B. trivittata*, thereby relieving



Three young male *Batagur trivittata* prior to their release in the Chindwin River. PHOTO CREDIT: WIN KO KO

ing overcrowding in the existing grow-out facility. A pond divider was installed to separate the turtles from the water hyacinth – so as to maintain a source of food for the turtles – and a perimeter fenced was built to prevent young turtles from escaping. Finally, three grow-out ponds (each 18 × 6 ft) were constructed to house the rapidly expanding population of captive-bred endemic softshell turtles (*Nilssonina formosa*) at the zoo.

Turtle Surveys of National Parks: Turtle surveys of two national parks in Myanmar were completed during the previous year. In June-July 2010, Mount Popa National Park in central Myanmar was surveyed. This park is located in the dry zone (a natural desert-like region noted for high levels of endemism) and encompasses an extinct volcano, which rises over 2,000 feet above the surrounding arid lands. Although no evidence for the occurrence of *G. platynota* was found in the park, significant populations of *Indotestudo elongata* inhabit the arid lands surrounding the volcano, and the lush evergreen forest in the central crater was deemed suitable as an experimental reintroduction site for repatriated *Manouria emys*. During May-June 2011 a turtle survey was conducted of Natma Taung (Mount Victoria) National Park. Located in the southern Chin Hills, the park encompasses a diversity of habitats ranging from lowland valleys clad in deciduous forest to high elevation montane evergreen forest, and even alpine meadows. Although much of the park is too high and cold to support turtles, significant populations of *Indotestudo elongata*, *Cyclemys* spp., and *Amyda cartilaginea* occur in southern regions of the protected area. Little evidence of commercial harvesting was found except with regards to *A. cartilaginea*; this species is imperiled throughout Myanmar owing to high demand from Chinese wildlife markets and the exceptionally large amount of money (often the equivalent of their annual income) traders are willing to pay villagers to collect these large softshell turtles. Training workshops were conducted at the conclusion of each survey in which Forest Department staff was

briefed on turtle conservation and the specific objectives and results of the TSA/WCS survey. Site-specific conservation recommendations were also provided to each park warden and the Nature Conservation Division of the Myanmar Forest Department, the entity responsible for overseeing management of the national parks.

Turtle Rescue Center in Lashio: Funding is currently being raised for construction of a turtle rescue center in Lashio, a town astride the Myanmar-China border and the terminus of a major trade route for wildlife moving illegally into China. Major confiscations of illegally harvested turtles have occurred near Lashio in the past, but owing to the lack of proper holding facilities, many confiscated turtles perished while being stored at a warehouse until a decision could be made concerning their disposition. Others were released without consideration of their origin or appropriate natural habitat. The planned rescue center will rectify many of the problems that have plagued past turtle confiscations. The facility is designed to include spacious enclosures for tortoises such as *Indotestudo elongata* and *Manouria emys* – which comprise the majority of confiscations – as well as *H. depressa* and *M. impressa*, two species now being seen in significant numbers in Chinese food markets and believed to pass through Lashio. Four large ponds designed to provide multiple basking opportunities for aquatic species are also planned with water to be supplied by a stream flowing through the property. Construction of this facility is slated to begin in December 2011.

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BANGLADESH



A pair of *B. baska* about to be released in one of the breeding ponds in January 2011. PHOTO CREDIT: RUPALI GHOSH

Frustrations and First Successes with Efforts to Save the Northern River Terrapin (*Batagur baska*) in Bangladesh

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Only a century ago the Northern River Terrapin (*Batagur baska*) was a very common turtle in rivers and river mouths of East India, Bangladesh and Myanmar (Annandale 1912, Guenther 1864, Maxwell 1911), and in winter hundreds of females could be observed basking along the river banks.

Having a reputation for providing the most tasteful meat and eggs of all south Asian turtle species, the Northern River Terrapin was over-harvested and exploited throughout its range. Today *B. baska* is at the very brink of extinction, listed as number four in the document *Turtles in Trouble: The World's 25+ Most Endangered Turtles and Freshwater Turtles - 2011*. Dealing with such a depleted wild population, both in range and *ex situ* captive breeding programs, with the last remaining specimens, are the only chance for the survival of the species (Magin

et al. 1994, Schnyder et al. 1996). In general, a minimum effective population size (reproducing specimens) of 25 males and 50 females is suggested, but experience shows that even with fewer than ten females a viable population can still be established (Yamada and Kimura 1983). A carefully considered breeding strategy, with studbook management, and rapidly expanding the population size will be essential.

After failing to locate any *B. baska* in the East Indian states of Orissa and West Bengal in the winter of 2008, we decided – based on anecdotal stories from local fishermen – to focus on the mangrove areas of Bangladesh. Following up on every single piece of encouraging information such as “for sure” captures of river terrapins, or “for sure” terrapins kept in village ponds, the search turned quickly into a nerve-racking and arduous quest for a very elusive species. Changing the vernacular name for *B. baska* from region to region, countless “river terrapins,” either freshly caught or kept in village ponds, turned out to be Olive Ridley Sea Turtles (*Lepidochelys olivacea*). One owner offered us a wondrous specimen, which emerged exactly on the day of our arrival with flippers. But he ensured us that on the next day the turtle will show up again with four claws on her front legs. Covering the entire south of Bangladesh we slowly identified the key persons in the illegal turtle trade and gathered more and more data about possible occurrences in the wild. But what proved to be the most important was the information that we received on captive specimens in fish breeding ponds.

In November 2009, we finally saw our first specimens. In February of the following year we settled a deal with the pond's owner who handed over the first specimen (a male) to Dr. S.M. A. Rashid from the local NGO CARINAM (Centre for Advanced Research in Natural Resources & Management). The forest department of Bangladesh, in consultancy with CARINAM, turned out to be interested in and supportive of efforts to assemble a breeding group for placement in a protected location. They agreed to provide ponds in the Bhawal National Park, north of Dhaka. Two ponds are situated in an animal park open for visitors, but fortunately the turtle ponds are not accessible to the public. With initial funding support from Patricia Koval / WWF Canada, the ponds have been renovated and modified, increasing the depth in the smaller pond to two to three meters.

Since we began our work in Bangladesh, our efforts have been fraught with frustrations and heartbreak. We arrived too late by only a couple of days for one gravid adult female, as she had been recently slaughtered at a local market. We had



This large female surveys her new surroundings after being released into the breeding pond.

PHOTO CREDIT: MR. MORSHED



Dr. S.M.A. Rashid and Rupali Ghosh, the driving forces behind the *B. baska* recovery program in Bangladesh. PHOTO CREDIT: MR. MORSHED



The provisional mesh protection for the translocated *B. baska* clutch on the sand beach. The improved cage protects the eggs against predators like mongoose and monitor lizards. PHOTO CREDIT: RUPALI GHOSH

finalized a deal for another female with a local fisherman, but she was lost when he carried her out of the fish pond on his head and she was dropped and eventually died. On 3 November, at Kali Puja (every year vast numbers of turtles gets slaughtered at this event), Rupali and Brian Horne arrived a couple of minutes too late at the market and had to witness the butchering, already in progress, of a wild caught male *B. baska* on the street.

After all these frustration and disappointments we finally acquired five male and two female *B. baska* in June/July 2010 from private fish breeders who kept them in their breeding ponds as talismans. In October of the same year we obtained three additional males. None of the turtles had been caught during the last 10 years, and some of them had been in captivity for at least 30 years. By improving our network of informants we learned that nearly all of the turtles kept in the ponds are males and the number of females is very limited. Luckily, we were able to acquire an additional two males and one female specimen in January 2011. The last river terrapin that was obtained was a gravid female in April 2011, but due to improper temporary holding conditions the female had to release her eggs in water.

Currently the breeding group consists of ten males and four females, and we are still working hard to acquire more females to prevent loss of genetic diversity and inbreeding depression in future generations. Creating a studbook to track bloodlines and ancestry will be crucial in our efforts to develop a long-term breeding strategy.

Genetic studies will also aid in the selection of breeding pairs by identifying those specimens that are most unrelated, and known to be carrying rare alleles. Therefore, the big breeding ponds will have to be divided into smaller water bodies to avoid herd breeding, so that known parentage offspring are produced.

In the very first year of this program all three females produced eggs, and all three nested on the night of 1 April 2011. Only one clutch was found and it was translocated to the artificial sand bank of the breeding pond and surrounded with protective mesh to deter predators. We are seeing promising signs of development and are extremely optimistic for a successful hatch this first year. Although the project is off to an encouraging beginning – despite some setbacks and angst - we still have a long way to go to prevent *B. baska* from near extinction.

The project has been supported through the

generosity of the following donors: Patricia Koval and WWF Canada, Ed Louis, the Beneficia Foundation, Chuck Landrey, Andre Gaudette, The Fagus Foundation, Columbus Zoo, Toronto Zoo, Omaha's Henry Doorly Zoo AAZK Chapter, and Zoo Vienna, which initiated "Project Batagur baska". Additional funding is necessary to cover local keepers, acquire more specimens, rebuild the hatchery for the expected hatchlings, genetic studies (create microsatellite primers for parental studies), divide and modify the breeding ponds and lease the animal park for better control of any activities on site. Please join us in our efforts to save this spectacular river turtle, which deservedly is called "the royal turtle" in several areas of its distribution.

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MADAGASCAR



This exceptionally patterned Radiated Tortoise is one of 13 confiscated in Beloha and then released into the sacred forest around the village of Ampotoka. Tortoises are depleted in this area and the TSA will begin working to restore tortoises in this forest as a protected population. Installing a communications network here will enable villagers to report poaching activity. PHOTO CREDIT: RICK HUDSON

Radiated Tortoises and the Fading Taboo

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 RICK HUDSON, SYLVAIN MAHAZOTAHY AND SOARY RANDRIANJAFIZANAKA

In March 2011, Christina Castellano, newly appointed Director of Turtle Conservation Programs for The Orianne Society, and Rick Hudson (TSA President) traveled to Madagascar to try and identify possible solutions to the ongoing Radiated tortoise crisis. Based on numerous discussions and first-hand experiences, we have launched a strategic partnership that we hope will be able to save this iconic symbol of Madagascar's southern spiny forest. This crisis was described in detail by Rick and Brian Horne in the 2010 TSA publication, *Troubled Times for Radiated Tortoises*, and since that article appeared, the situation has only grown worse. Christina and Rick were accompanied by Herilala Randriamahazo, Director of TSA's Madagascar Tortoise Program, and a field consultant, Sylvain

Mahazotahy, who is familiar with the customs and dialects of rural southern Madagascar. The following article was prepared by Herilala and is interspersed with clips from the travel blog that Rick wrote upon his return in April 2011, and those will be highlighted. They start their trip in Antananarivo on a somber note:

DAY 1, MARCH 16

We return to the hotel for a meeting with Ryan Walker (Nautilus Ecology) who has just returned from a month in the south, doing field surveys of the Southern Spider Tortoise (Pyxis a. oblonga). Ryan and his team worked east from Cap St. Marie to document the diminishing extent of the range of this tortoise, while concurrently studying the dramatically shrinking

range of the Radiated Tortoise. Ryan admitted that he had not fully appreciated the extent of the crisis until he began looking at populations in the east, closer to Ft. Dauphin, a major center of tortoise consumption. He describes the work of well-organized bands of poachers who are dropped off in an area and then very efficiently clean out the tortoises. In Ryan's words we are witnessing the "systematic extermination of the Radiated Tortoise across its range" and predicts that soon we could find ourselves trying to protect small populations of tortoises such as we are now faced with in the northwest with Ploughshares. He believes that our prediction last year of 20 years to extinction may be, in his words, a "bit generous."

The Malagasy Decree 60-126 promulgated in 1960 by the Republic of Madagascar offers full protection for the Radiated Tortoise (*Astrochelys radiata*). At that time, this species - also known locally *sokake* or *kotroke* - was widely distributed in southern Madagascar and highly abundant in some areas despite hunting pressures. It is unclear what factors went into decision to protect Radiated Tortoise at that time, when there were many tortoises left in the wild. Plus, two of the four tribes that share habitat with this species - Tandroy and Mahafaly - do not collect or eat tortoises by tradition. However, our recent observations explain how important the *sokake*-related tradition is for some villages.

Within the current range of Radiated Tortoise's distribution, there is little running water except for the Menarandra River; two other rivers - the Linta and the Manambovo - flow only during the rainy season. The Menarandra splits the two brotherhood tribes into Mahafaly on the western side and the Tandroy on the eastern side. Food insecurity is common, owing to droughts and other factors. Tandroy are mainly farmers but practicing the hunter-gatherer tradition from time to time in the spiny forest. On the other hand, the Mahafaly - living on the limestone plateau - are dedicated farmers but those inhabiting the coastal area are able to do farming and fishing depending upon the weather. Zebu cattle are considered the most important source of wealth for men in Mahafaly or Tandroy society and they are sacrificed to invoke ancestors in traditional ceremonies. However, zebu can rarely be sold to address family problems such as food shortages, health problem, schooling of children, or social obligations. These needs must wait for cash earned from other means - such as sale of crops, chickens or goats - to be resolved.

Eating *sokake* was commonly practiced in

the ancient time for both Mahafaly and Tandroy traditions. But there was a significant change in their traditions and it eventually became taboo to eat *sokake* for Tandroy people and likewise it is now prohibited for the Mahafaly people as well. For unknown reason, all lemur species are also taboo for both tribes. Nonetheless, there are different stories reported by villagers about their tortoise beliefs. Three out of the five villages where the Turtle Survival Alliance (TSA) is actively involved in conserving tortoises have a very strong and well-respected taboo. Antsakoamasy, a Tandroy village near Cap Sainte Marie Special Reserve, is one of them.

DAY 5, MARCH 20

In the afternoon we drive to the village of Antsakoamasy to discuss the upcoming festival and to see the zebu that we are buying for the occasion. The zebu is trotted out, we approve, the price is agreed upon and a celebration ensues. The village erupts into displays of traditional dancing and singing in what is to be a prelude to the real festival five days later. With my receipt for one zebu in hand, this could likely be the first of many that I present for reimbursement, as zebu and rum celebrations are the standard means of sealing a deal with villages in the rural south. And given the situation with rampant tortoise harvesting in this difficult to patrol and enforce environment, creating incentives for protecting tortoises at the community level will almost assuredly become an important strategy for us. Antsakoamasy was selected as a site for this pilot program because of the strong fady (taboo) that protects tortoises here where, it is believed, the tortoises are the embodiment of their ancestors.

Here, Radiated Tortoises are considered among their ancestors. It remains customary to allow tortoises to move freely in and out of the village. Tortoises entering their fenced cropland are not killed. Therefore, in order to engage in a Memorandum of Understanding for tortoise conservation with TSA, the Antsakoamasy community had to sacrifice a zebu through a ritual tradition invoking the ancestors. This experience demonstrates that the Radiated Tortoise has an important social value for Antsakoamasy people. It is also an indication of a sincere agreement from the local community to contribute to our goal to conserve tortoises in their village and surrounding areas. To illustrate the concrete collaboration between the two parties, TSA has agreed to construct a school allowing children to receive a basic education in their home village.



This large adult female was found in the sacred forest around Ampotoka, and represents hope that this population can recover after being heavily poached. Large females such as this will be important to ensure natural recruitment.
PHOTO CREDIT: RICK HUDSON



Sealing the deal in Ampotoka: TSA President Rick Hudson with one of the village leaders celebrate the beginning of what we hope will become a model for tortoise population recovery in southern Madagascar.

PHOTO CREDIT: CHRISTINA CASTELLANO

Our primary challenge is to identify healthy populations of tortoises that are in close proximity to villages that practice a strong protective fady, and then work with those communities to provide incentive for protecting tortoises.



A robust population of Radiated Tortoises thrives around the village of Antsakoamasy and is well protected due to a strong cultural taboo related to their ancestors. Providing incentives to honor and strengthen this tradition will help ensure the survival of some populations of tortoises. PHOTO CREDIT: RICK HUDSON



By the time the zebu festival got underway at Antsakoamasy an estimated 1200 people were on hand, most of them children. Madagascar's human population is growing rapidly with the majority of the population under the age of 12. The importance of conveying the tortoise protection message to this demographic cannot be over emphasized.

PHOTO CREDIT: RICK HUDSON

Even though water availability is such a vital issue for their well-being and survival, the Antsakoamasy people determined that the schooling of their kids was their priority. This school will be the first to be built based on an agreement focused purely on Radiated Tortoise conservation in Madagascar. This accord will lead to the development of a curriculum on environmental education that highlights the role and plight of the tortoise.

DAY 10, MARCH 25

We check out of Lavanono early and drive to Cap St. Marie headquarters. We pick up the MNP warden in addition to tables, chairs, and a portable generator to power the sound system for the celebration. These are dropped off at Antsakoamasy then on to Marovato to pick up the mayor and other officials for the ceremony. The road is crowded with people walking to the festival site and we arrive to a lively and anticipatory crowd with loudspeakers already blaring music. We estimate that roughly 500 people are there. Visitors and guests are seated up front in a shaded area and the ceremony begins with Sylvain welcoming the crowd and explaining the reason for the celebration. We are here to recognize the village for their strong efforts to protect the sokake and sign an agreement between the TSA and Antsakoamasy to build them a primary school. Herilala reads the terms of the agreement out loud to the crowd and then a huge banner is unfurled that will be used to seal the accord. Over the next hour selected villagers, including men, women and children, come forward and trace their hand print on the banner to signify their commitment to the agreement and sokake protection.

A series of speeches follows the hanging of the ceremonial banner, with a particular rousing one by the Maravato mayor who extols the crowd to embrace sokake protection as a means to a better future for their village. We look around and realize that the size of the crowd has more than doubled to over 1,000 people, making it the largest crowd I have ever addressed.

The zebu has been sacrificed and is cooking, the rum starts to flow, and the dancing, singing and celebrating begins. We join in the traditional dancing as long as the midday heat will permit, then repair to the village president's house to share zebu and rice.

We believe that the significance of the agreement between Antsakoamasy and TSA (and building the much needed school) will be far-reaching. Word will travel fast and we hope



Herilala Randriamahazo (left) inspects a pot of cooked tortoise meat being offered for sale in Tsihombe. The seller was nervous about having his picture taken and it is obvious that he is aware that this practice is illegal. PHOTO CREDIT: RICK HUDSON



Herilala Randriamahazo records GPS data on another pile of discarded Radiated Tortoise shells in Tsihombe. Throughout the towns of southern Madagascar tortoises are consumed with increasing frequency, and meat is now available every day rather than just on special occasions. The situation has finally reached crisis proportions and is not sustainable. PHOTO CREDIT: RICK HUDSON



Christina Castellano and Herilala preparing Radiated Tortoises for release in the forests around Ampotoka. Both shell notches and red paint marks are used for identification.

PHOTO CREDIT: RICK HUDSON

that other villages will begin to understand the connection between protecting their local tortoise populations and seeing positive outcomes in their communities. We must be willing to provide incentives and reward tortoise protection locally, else we will surely lose the battle to save the sokake. This is a first step, but one that we believe can be catalytic throughout the region. Our challenge is to continue the process of identifying key tortoise populations that have nearby villages with a strong tradition of protection. This strategy, we believe, may hold the key to the survival of the sokake in the wild.

In addition, villages surrounding the Cap Sainte Marie Special Reserve [CSM] will benefit from the collaboration between TSA, The Orianne Society (TOS) and Madagascar National Parks (MNP) at CSM by establishing a communication network using two-way radios. It is expected that park agents and villagers will be able to communicate more effectively, and villagers will not have to walk long distances – sometimes up to two days – to report tortoise poaching activity.

Although Ampotaka is a village in the Androy Region, inhabitants are essentially Mahafaly whose territory lies just across the Menarandra River. This village was exposed to several tortoise harvests in the last 40 years according to Mister Ralay, a village elder. Our visit in March 2011 witnessed the scarcity of adult tortoises but a few juveniles in a nearby sacred forest known as Sirempo. The Ampotaka community would like to improve the outlook for the Sirempo forest by strengthening its protection using a community-managed forest system. It was a great opportunity for TSA to work with Ampotaka village given their conservation interests. In collaboration with Mosesy Valisoa, the forestry agent based in Beloha, TSA and TOS helped reintroduce four adult and nine juvenile Radiated Tortoises into the Sirempo forest. These tortoises were seized in Beloha when a car from the “Orange Money” cell phone company attempted to smuggle them. We measured and identified them individually with a visual notch and red paint mark before releasing them in front of village representatives. Ampotaka village and TSA agreed to try and put a stop to tortoise harvesting in the village vicinity including the forest of Sirempo. In order to do so, all heads of household will wear a Radiated tortoise T-shirt on Independence Day, June 26, while the entire “commune rurale” of Marolinta will perform a parade. TSA provided 260 T-shirts to the village to wear on that day using a grant from Conservation International. The impact of this awareness

campaign against tortoise harvesting is expected to be huge. Moreover, TSA offered to provide a cell phone with credits to Ampotaka village to allow them to alert Mr. Mosesy Valisoa in Beloha of tortoise poaching activity using “Airtel”, a cell phone company. This action contributes to the improvement of communications among stakeholders aimed at a rapid response involving local communities, gendarmes and the forestry service. None of these three entities are able to carry out the investigation and prosecution of poachers without help from the others. Poaching takes place in remote areas where a communication network does not often exist. However, the number of cell phone towers continues to grow in southern Madagascar, and increasingly rural people have access to cell technology, making them less isolated. We hope that the use of cell phones will contribute to the improvement of the tortoise poaching alert system.

Tortoise beliefs are fading in Tandroy and Mahafaly towns like Beloha, Tsihombe, Ejeda and Ambovombe despite the continuous appeals from conservation groups seeking respect for the taboo. Local authorities seem to ignore the infractions, which are visible and known to almost all people in town. Tortoise meat is available on a daily basis upon request using the word “special” in these towns. In March 2011, a TSA team posed as tourists in Tsihombe and sent our driver to look for a “special” while we had a drink at a well-known restaurant “Paradis du Sud” in Tsihombe. Half an hour later, our driver came back followed by two men, one of them Tandroy. They presented us with a bowl of tortoise meat, asking 5,000 Ariary, or \$2.50 in US! We reflected on the sad fact that such a remarkable animal was rapidly facing extinction for such a paltry fee. The grim reality of this situation was “driven home” when Sylvain Mahazotahy, our Tandroy guide and facilitator, showed us some of the many dump sites in town with the accumulated remains of tortoise shells and bones, both from old and freshly killed tortoises. Tsihombe is a confirmed tortoise-consuming center, and this practice is growing and spreading, not only here but in other cities in the south. Tortoise meat is now eaten every day, not just on special occasions as was previously the case.

Once arrived back in the capital of Antananarivo, we reported our findings to the Minister in charge of the environment and forests. He took our recommendations very seriously and planned to conduct an awareness campaign against tortoise hunting in Tsihombe in the weeks to come. The following four points were suggested by the Minister to be the main focus of the workshop in



Herilala (left) and Sylvain Mahazotahy talk with the leaders of a small village that values their tortoises. When we stopped along the road in this village to photograph tortoises, a little girl told us “don’t take our tortoises” so we stopped to learn more. Understanding the basis of this tradition could be critical in identifying important sites for building partnerships for tortoise protection. PHOTO CREDIT: RICK HUDSON

Tsihombe: (a) assessing of the social conventions or “Dina” and their effectiveness in relation to the framework of the justice system; (b) mobilizing regional and districts authorities to meet their obligations to protect tortoises; (c) dismantling the “tortoise mafia” network; and (d) establishing an action plan for Radiated Tortoises. We also shared our findings with other conservation organizations such as World Wildlife Fund (WWF) Madagascar and Durrell and pressed them to formalize an MOU focused on urgent actions for Radiated tortoise conservation. Actions to be considered in the MOU include mobilizing a rapid response to reports of poacher activity, a media campaign that can be activated utilizing WWF’s extensive network of workers in the south, and empowering local communities through training and education. The following organizations, all sharing similar goals with respect to tortoise conservation but with very different strengths, include Conservation Fusion, Madagascar Biodiversity Partnership, TSA, TOS and WWF. This MOU will become an important tool as we move forward together, and help foster a spirit of cooperation and understanding.

We believe that the taboo is an important component that could save this tortoise species but it is no longer sufficient to protect it on its own. The political crisis has influenced the respect of the taboo, especially in cities, and a

general sense of civil disobedience now pervades the country. Southern Madagascar has suffered greatly for it. A huge investment of resources will be required to reverse the current trend given the high rate of illiteracy here, but the stakes are simply too high not to make this commitment. We will likely only get one chance to save the Radiated tortoise, and if we fail to at least secure *some* important populations for future generations to see, then history will likely judge us harshly.

BLOG SUMMARY

The Radiated Tortoise shares its range with four tribes – two that eat tortoises and two that do not. The Vezo tribe in the west and the Antanosy in the east have been eating tortoises for generations hence populations in the regions around Tulear and Ft. Dauphin are mostly cleaned out. In between are the Mahafaly and the Tandroy, the more numerous of the two. Together their practice of fady (taboo to harm tortoises) is largely responsible for the fact that the Radiated Tortoise still survives today. If all four tribes in the south ate tortoises, they would almost certainly be gone by now.

But tortoise consumption has increased dramatically in recent years and they are eaten now every day in some towns rather than just for special celebrations. This has resulted in a rapid reduction in population numbers, and the rate of

decline is downright scary, certainly unsustainable, and the reason that the species was elevated to Critically Endangered status in 2009.

So with Vezo poachers invading from the west and the Antanosy coming in from the west, the strength of the protective fady is being put to the test. In some villages it is very strong and they will go out of their way to confront poachers, believing that the tortoises harbor their ancestors' spirits. In other villages the fady may be weak and benign, and though they may not eat or harm tortoises, they do not mind if others come in to take them. This is why we must create a strong connection between having tortoises in your village with an improved community. Antsakoamasy is the example that we hope will carry this idea forward. Our primary challenge is to identify healthy populations of tortoises that are in close proximity to villages that practice a strong protective fady, and then work with those communities to provide incentive for protecting tortoises. However this could be fraught with challenges as well because - increasingly - poachers are growing bolder and more aggressive. There are reports of bands of tortoise collectors being dropped off in an area for two weeks and effectively cleaning out the forests. Both adults and juveniles are often taken, leaving little potential for population recovery.

The Radiated tortoise may be on its last legs, but the battle to save them is not over yet, and we (TSA, The Orianne Society, Nautilus Ecology, Henry Doorly Zoo's Madagascar Biodiversity Partnership and WWF) are approaching this challenge with a renewed sense of vigor. The period of disbelief following last year's shocking visits is over and now we must roll up and sleeves and re-commit ourselves to the survival of this remarkable species. We cannot allow this tortoise to become relegated to piles of shell fragments in trash heaps.

ACKNOWLEDGEMENTS

The TSA's Madagascar Tortoise Program is growing rapidly and in complexity, and must continue to expand given the current levels of threat. We benefit from several strategic partnerships in Madagascar, including Conservation International and Omaha's Henry Doorly Zoo's Madagascar Biodiversity Partnership, which provides office support to Herilala Randriamahazo. We would also like to acknowledge local partners DREF Androy and Atsimo Andrefana for allowing us to work in their respective regions. For their generous donations and various other forms of support over the past two years we thank Na-



The zebu festival in Antsakoamasy began with a ceremony whereby local officials and 150 villagers of all ages had been selected to seal the agreement with TSA. Each person traced their handprint and signed their name on a large banner that was later raised. The TSA agreed to build a primary school here as a means of strengthening their commitment to protecting Radiated Tortoises. PHOTO CREDIT: RICK HUDSON



The celebration that followed the signing of the agreement was lively and spirited and men, women and children of all age classes participated. The turnout was remarkable and we believe that word will travel fast and hopefully raise the profile of the tortoise in nearby communities. PHOTO CREDIT: RICK HUDSON

ture's Own, San Diego Zoo Global, Brian Bolton, Sedgwick County Zoo, Toronto Zoo, Knoxville Zoo, Chelonian Research Foundation, Cleveland Zoo and Houston Zoo AAZK Chapters, Robert Krause, Frank Slavens, Ab Abercrombie, Herpetofauna Foundation, Oregon Zoo's Future for Wildlife Grants, HATZH Donation Fund, AZA Chelonian Advisory Group, Los Angeles Zoo, and

Bill Sawey. The donation of carved onyx tortoise sculptures by Nature's Own provides a steady source of income to this program and Sheena Koeth is commended for her unexcelled ability to consistently sell these products. We also thank the many zoos that sell these sculptures for us, all of the proceeds from which benefit the Madagascar tortoise program.

MADAGASCAR



A hatching *P. arachnoides*, photographed in the dunes of southwest Madagascar. Hatchlings are susceptible to trampling by livestock grazed by local communities within the species coastal, dry forest habitat. PHOTO CREDIT: TSILAVO H. RAFELIARISOA

The Precarious Conservation Status of the Critically Endangered Madagascar Spider Tortoise (*Pyxis arachnoides*) and Radiated Tortoise (*Astrochelys radiata*); What We Now Know Through Three Years of Field Operations

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TSILAVO H. RAFELIARISOA^{3,4}

The critically endangered Madagascar Spider Tortoise (*Pyxis arachnoides*) and Radiated Tortoise (*Astrochelys radiata*), endemic to the coastal dry forests of southern Madagascar, face a significant risk of extinction within the next 20-50 years as

a result of habitat loss and poaching. On account of the dire situation facing these two species, the TSA and TCF have made these species a focus of their Madagascar program, with the authors and colleagues embarking on a three year field pro-

gram to assess the biogeography of the remnant populations of these two threatened species.

This field program involved selecting areas of suitable, remaining dry forest habitat within the region of southwest coastal Madagascar using remotely sensed imagery and visiting these, often quite remote, sites and surveying them for remnant populations of tortoises. The team visited 131 sites over the course of three field seasons, during February and March of 2009, 2010 and 2011. Field operations included the use of Distance Sampling (Thomas et al., 2010) to estimate the current population size and status for both species, in addition to thorough time dependent searches for tortoises to establish presence or absence for a population within a region (Walker, in press).

The historical ranges of the two species was established by obtaining all available published maps detailing the range of both species at any given point in history. These maps were scanned, geo-referenced and range digitized, with result-

TABLE 1

Current range displayed against the suspected range of occurrence documented by Bour (1981) and Pedrono (2008) †, in addition to the extent of these ranges for each population of tortoise that fall within existing or proposed protected areas or sites of proposed mineral extraction (Walker et al., in press).

subspecies	Current range (km ²)	Suspected area of occurrence† (km ²)	reduction in range (km ²)	% reduction in range	Current range in Protected Areas (km ²)	% of current range in Protected Areas	Current range in proposed extraction areas (km ²)	% current range in proposed extraction areas	Protected areas	Proposed resource to be extracted	No. of potential extraction sites
<i>P. a. brygooi</i>	499.59	2438.76	1939.17	79.51	499.59	100.00	0.00	0.00	Zone 1 - Mikea Forest National Park, Mangoky Ihotry Protected Area Complex, Zone 2 -Velondriake Community Managed Protected Area Zone 3 Mikea Forest National Park	N/A	0
<i>P. a. brygooi</i> / <i>P. a. arachnoides</i> intergrade	99.71	-	-	-	55.10	55.26	37.80	37.91	PK32-Ranobe Protected Area	Zircon, Ilmenite	2
<i>P. a. arachnoides</i>	1029.09	3177.70	2148.62	67.62	795.50	77.30	205.47	19.97	Tsimanampesotse National Park Extension, Tsimanampesotse National ParkD, Tsinjoriake Protected Area, SAPM Unnamed/Unpromoted Protected Area	Calcaire, Ilménite, Monazite, Zircon, Granite	26
<i>P. a. arachnoides</i> / <i>P. a. oblonga</i> intergrade	266.97	-	-	-	186.48	69.85	10.66	3.99	Southwestern Coastal Wetlands Protected Area, Mahafaly Plateau South, Unnamed/Unpromoted Protected Area	Ilménite, Granite, Calcaire, Zircon	3
<i>P. a. oblonga</i>	568.45	2865.48	2297.03	80.16	268.00	47.15	196.94	24.64	Cap Sainte Marie Special Reserve, SAPM South Unpromoted Protected Area	Ilménite, Zircon	1
Total	2463.81	8481.94	6018.13	70.75	1804.67	73.52	450.87	18.30			32

ing shapefiles added to a GIS database. Following this shapefiles detailing current and proposed protected areas and proposed mineral extraction sites for southern Madagascar were also added to the database. Finally, the current ranges of both species, derived from the results of the three year field program were added to the GIS database.

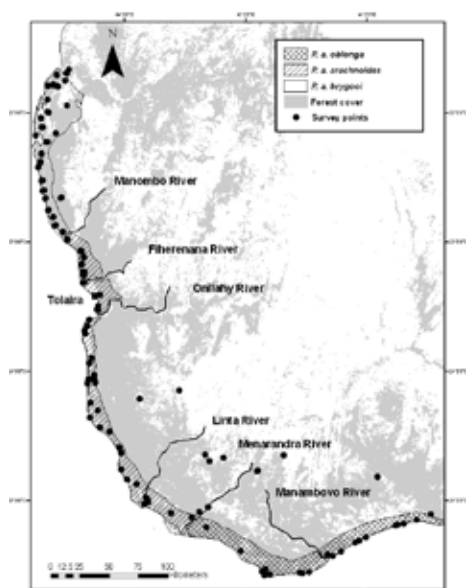
Results allowed us to establish an accurate, real time duplication of both species' range. Sadly, the current biogeographical status of both species is of great conservation concern and only confirms the species' Critically Endangered (CR) status. *P. arachnoides*' range has contracted by as much as 70.7% and the species is now confined to eight fragmented populations occupying a total of 2,464 km², of which 18.3% of this remaining population is threatened by proposed mineral extraction (Walker, 2010; Walker et al., in press). *A. radiata* has undergone range contraction of 65% to 15,019.8 km². A conventional distance sampling model produced global, wild population estimates of 664,980 (95% CI; 492,680-897,550) (Walker and Rafelarisoa, in press) and 6,307,900 (95% CI 4,028,500-9,877,000) for *P. arachnoides* and *A. radiata* respectively. Of greatest concern is the population crash of 47.4% suffered by *A. radiata*



The majestic Madagascar Radiated Tortoise (*Astrochelys radiata*) captured by photograph walking along the edge of a dirt road close to Cap Sainte Marie on the extreme south coast of Madagascar. PHOTO CREDIT: TSILAVO H. RAFELIARISOA



The team research vehicle, supplied to the project by the Madagascar Biodiversity Partnership. The terrain in southern Madagascar during the wet season was often challenging, with the team exploring some remote parts of the region. PHOTO CREDIT: TSILAVO H. RAFELIARISOA



Suspected historical area of occurrence of the three subspecies of Spider Tortoise (*Pyxis arachnoides*) as described by Bour, (1981) and Pedrono (2008) with vegetation cover data and survey point location data overlaid.

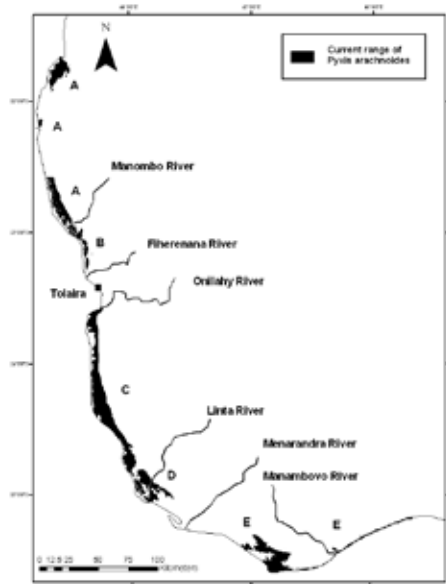
(unpublished data) in just 11 years from the 12 million described by Leuteritz et al. (2005), mostly attributed to the local bush meat trade (O'Brian et al., 2003). The authors propose that targeted, community based conservation initiatives such as those currently being implemented by the Madagascar Biodiversity Partnership (Rafaeliarsoa et al., 2010), World Wildlife Fund (WWF, 2010) and TSA are expanded and developed within the remaining core areas of both species' range, in an effort to prevent the extinction of these iconic species.

ACKNOWLEDGMENTS

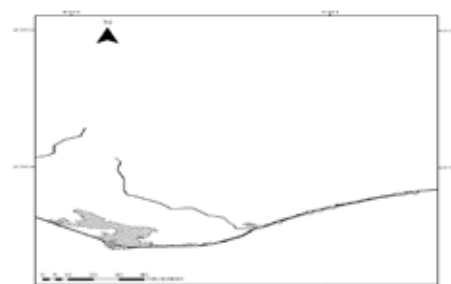
This work was supported financially by the following organizations: EAZA/Shell Shock, Turtle Conservation Fund, Turtle Survival Alliance, The Royal Geographical Society, British Chelonia Group, Mohamed Bin Zayed Species Conservation Fund, Leicester Tortoise Society and Chelonian Research Foundation. Logistical support and assistance with field work were provided by Inge Smith, Solonombana Vitantsoa, Alice Ramsay, Al Harris, Eddie Louis, Brian Horne, Julien Bréhard, Richard Razafimanatsoa, Jean Caude Rakotoniana and Herilala Randriamahazo. Blue Ventures Conservation, Madagascar Biodiversity Partnership, Madagascar Institut pour la Conservation des Ecosystèmes Tropicaux, Ministère de l'Environnement et de Forêts, Madagascar National Parks and the University of Antananarivo. Thank you to the coastal forest



Adult Madagascar Spider Tortoise (*Pyxis arachnoides oblonga*) photographed in the windswept, coastal dunes of the Faux Cap region of southern Madagascar. PHOTO CREDIT: TSILAVO H. RAFELIARISOA



(Left) Eight areas of forest known to be occupied by *P. arachnoides* as described by Walker et al, in press and Walker (2010). A= three sub populations of *P. a. brygoi*, B= 1 sub population of *P. a. brygoi*/*P. a. arachnoides* intergrades, C= 1 sub population of *P. a. arachnoides* D= 1 sub population of *P. a. arachnoides*/*P. a. oblonga* intergrades, E= 2 sub populations of *P. a. oblonga*. (Below) Range of *P. a. oblonga*, showing very narrow area occupied to the east of the range as a result of habitat loss forcing tortoises to occupy coastal sand dunes.



communities of southwest Madagascar for allowing us access to community-owned land.

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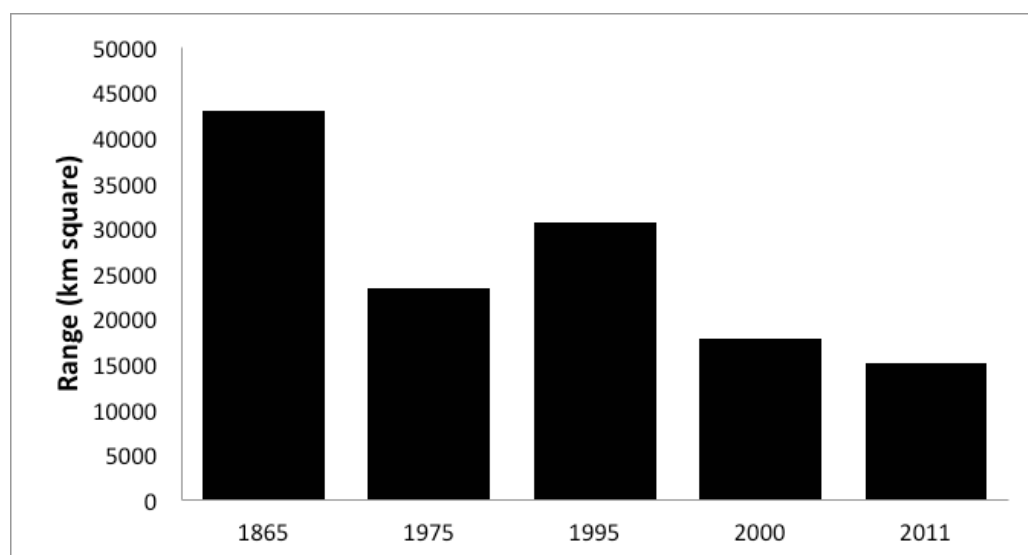
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The suspected range of *A. radiata* during 1865 as documented by Vinson (1865) from observations or recovered of sub fossilized tortoise remains. Suspected range depiction by Juvik (1975). Range during 1995 from results presented by Lewis (1995). Range during 2000 documented by Leuteritz et al. (2005). Results of field operations undertaken during 2010/11 by the authors including, specific survey points.



Total range of *A. radiata* in km² throughout time as documented by Vinson (1865); Juvik (1975); Lewis (1995); Leuteritz et al. (2005) and the authors (2011).



The survey team photographed in the field in February 2011 and comprised of members from the TSA, The Madagascar Biodiversity Partnership, Madagascar National Parks and the UK's Open University. The authors RW (back row, right) and TR (front row, right). PHOTO CREDIT: TSILAVO H. RAFELIARISOA

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MADAGASCAR

Radiated Tortoise or *sokake*. PHOTO CREDIT: TSILAVO HASINA RAFELIARISOA

Creating Conservation Champion's for Madagascar's Critically Endangered Radiated Tortoise (*Astrochelys radiata*) Through Local and Global Education Programs

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The Radiated Tortoise (*Astrochelys radiata*) once abundant in the dry, spiny forests of southern Madagascar with an estimated total population of over 4 million individuals in 2001, is rapidly nearing extinction with less than 200,000 individuals remaining. This tortoise, known lo-

cally as *sokake*, is threatened by illicit pet trade, habitat loss, harvesting for international food markets and domestic consumption. This drastic decline has been intensified by Madagascar's current political instability, compounding conditions in the poorest region of the island. At

the current rate, wildlife authorities predict the *sokake* may become extinct in the wild within the next five years.

In response to this perilous situation, several organizations have teamed up to implement a multi-faceted approach of research, sustainable alternatives and education. Education is the key component of conservation. At Conservation Fusion (CF), our mission is to engage communities in education about their unique biodiversity to instill knowledge, understanding, and ownership, all of which ultimately lead to responsible actions for a sustainable future. Furthermore, to help spread a global conservation message, we are connecting kids living in areas of high biodiversity with youth in the United States because we are all connected, sharing one world. To achieve conservation objectives, we must think outside the box, forming collaborative alliances on a local and global scale to address threats that might seem insurmountable such as the plight of the Radiated Tortoise in southern Madagascar.

Building multidisciplinary teams to include diverse professions and backgrounds allows us



During Global Youth Service Day, American students created a giant interactive game to engage Malagasy students to learn about clean water, alternatives to habitat destruction and the economic benefits of protecting the Radiated Tortoise. PHOTO CREDIT: SUSIE MCGUIRE



A great deal of remaining tortoise habitat has been infested with the *Opuntia* cactus, an invasive species. PHOTO CREDIT: SUSIE MCGUIRE



Students at Omaha North High School's Engineering and Technology Magnet are currently working on a three pronged approach to provide the Malagasy communities with alternatives to habitat destruction and empower local people to create economic engines through sustainable biofuel enterprise. This grinder and press are used to turn invasive *Opuntia* cactus into biofuel briquettes. PHOTO CREDIT: SUSIE MCGUIRE

to envision creative, innovative solutions from new perspectives to achieve our conservation goals. CF has partnered with the University of Nebraska at Omaha's (UNO) Service Learning Academy to produce educational materials for children in Madagascar. During Global Youth Service day, over 500 student volunteers colored and cut thousands of 3D tortoises, assembled

vegetable seed packets for school lunch programs in Madagascar, and constructed booklets translated into Malagasy with simple tortoise conservation messages. Additionally, youth created a giant interactive game to engage Malagasy students to learn about clean water, alternatives to habitat destruction and the economic benefits of protecting the *sokake*. Students also painted

paper plate "tortoise shells" and cut tortoise body parts to be made into tambourines by Malagasy children to celebrate their biodiversity. These service projects create awareness amongst American students regarding conservation challenges threatening tortoise populations in Madagascar and empower them to educate their peers, parents and teachers.

Education is the basis for another unique CF partnership with Omaha North High School's Engineering and Technology Magnet. A great deal of remaining tortoise habitat has been infested with the *Opuntia* cactus, an invasive species. To address this, students are currently working on a three pronged approach to provide the Malagasy communities with alternatives to habitat destruction and empower local people to create economic engines through sustainable biofuel enterprise. Youth have adopted the name "Telo Hevitra", the Malagasy translation is "Three Ideas". The three prongs consist of a grinder and press to make biofuel briquettes utilizing the cactus and a fuel efficient Rocket Stove. The team of twelve students has won numerous awards and recognition for their project, increasing awareness on a local scale and the team will be one of four in the nation to present this June



American students helped paint paper plate "tortoise shells" and cut tortoise body parts to be made into tambourines by Malagasy children to celebrate their biodiversity. PHOTO CREDIT: SUSIE MCGUIRE

sustainable tortoise conservation program throughout the region. The Fall Semester activities will conclude with a "festival of tortoises" involving the local community called "Sokake-O-Rama". This education program will conclude with dissemination in the form of reports and presentations to each of the partners working to protect the Radiated Tortoise. The conservation plan for the Radiated Tortoise is more than just a battle of numbers. It is a story of hope for the people of Madagascar.

Editor's note: The TSA asked Susie to submit this article to introduce the work that Conservation Fusion is doing. We believe that community outreach and education is critical to successful conservation in Madagascar and look forward to partnering with them in the future.

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Special thanks to the Madagascar Biodiversity Partnership for their guidance and infrastructural support, the University of Nebraska at Omaha's Service Learning Academy for supporting our conservation initiatives and orchestrating thousands of volunteer hours dedicated to Radiated Tortoise awareness and the staff and students at Omaha North High Magnet for their tireless dedication and passion. Additionally, we would like to thank the Turtle Survival Alliance and the Orianne Society for their commitment to tortoise conservation. Financial support was provided by the Massachusetts Institute of Technology's Lemelson Inventeams, and Zoos and Aquariums Committed to Conservation.

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Students cut and colored thousands of 3D tortoises during Global Youth Service Day. PHOTO CREDIT: SUSIE MCGUIRE

at Massachusetts Institute of Technology (MIT) in Boston, as part of the Lemelson Invent Team Program, which supported the project. These student driven conservation initiatives offer new ways to educate, empowering youth through hands on, inquiry-based education to find innovative solutions to real world problems, affecting us all. A liaison between these distant cultures, people and ideas, CF helps foster ways we can all conserve and live sustainably for our future.

Wildlife films serve as a popular way to disseminate conservation messages to large groups of people and help promote positive conservation behavior. Malagasy children, teachers and community members are often surprised to know that their home is so special. Since they have always lived in remote villages, they see these animals everyday and don't realize the value they hold. By learning the treasures their country possess, they are more likely to protect them. CF is collaborating with talented film production crew at Torchwerks. By creating a video showcasing this unique tortoise, in tandem with other educational outreach, we will spark a change in how the Malagasy people view the Radiated Tortoise and empower the people to spread the message of conservation. The video will create a feeling of national pride around the Radiated Tortoise

in the same way people in the United States feel pride for the Bald Eagle as a national symbol. This is done in an educational style on four points, which relate tortoise conservation to the people. These include clean water, food alternatives, enterprise and eco-tourism. The film will convey the idea that Madagascar harbors unique biodiversity found nowhere else on the planet. It promotes a positive message to the Malagasy people who may not know that Madagascar is in need of conservation now, and that what is done now will affect everyone, as well as future generations yet to come.

Conservation objectives to distribute the educational materials will be carried out in Lavavolo Madagascar during July 2011. CF has also created unique mascot costumes to encourage pride in the Radiated Tortoise, the flagship species, and conservation branded T-shirts to serve as a daily reminder that engages the entire community. The results from this initiative will be shared as an emergent network among the working partners in five recently designated regional centers established across the remaining Radiated Tortoise populations. By producing conservation messages tied to community based efforts, education ultimately functions as the key component in creating a united and therefore

CHINA



Suzhou Zoo, male *Rafetus* eating a sausage. PHOTO CREDIT: GERALD KUCHLING

The Fourth Year of *Rafetus swinhoei* Breeding Attempts in China

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LU SHUNQING², EMILY H. KING³

Success in the form of hatchlings may again elude the *Rafetus swinhoei* breeding program at Suzhou Zoo in China. The last known female of its kind (originally from Changsha Zoo) deposited her first clutch overnight on 07/08 June 2011. We incubated the eggs in various media and at various temperatures and candled them after one and after three weeks of incubation, but all (100%) appear to be infertile (not fertilized). In 2010, the estimate was about 93% infertile

and in 2009 about 75% infertile (unfortunately all other presumably fertilized eggs then died at early stages of development). A possibility is that the pair did not copulate properly and that the female has not been inseminated in 2010 and 2011. The female laid a second clutch overnight on 27/28 June 2011, but even though we have not yet candled those eggs by the time of writing this note, chances are slim that their fertilization rate is better.

This disappointing result follows some major improvements in the breeding project: last summer, Emily King developed a method to fill sausage skins with a mixture of fresh, high quality minced food and supplements. These sausages are readily eaten by both the female and the male, ensuring good nutrition. The second glass barrier around the large breeding pond (built with funds from the Chinese government following the TSA-funded glass barrier around the smaller breeding pond) was completed during the summer of 2010. Since 24 August 2010 both the male and the female *Rafetus* roam together in a pond area about four times the size of the small breeding pond. For the first time the male and the female were together throughout fall, winter and spring. Abrasions on the neck and front limbs of the female when she emerged from hibernation indicated several mating attempts (the male grabs the neck of the female with his jaws prior to mounting). A much larger beach area is now available which the female already used to nest in 2011. An improvement which we still have to implement is a filtration system (reed bed filters) to improve the water quality.

Artificial insemination, in particular semen collection, may well be dangerous for the evidently very old *Rafetus* male and TSA rejected AI as preferred breeding strategy in 2007 (see TSA

(Right) Preparation of sausages as food for *Rafetus swinhoei* at Suzhou Zoo. PHOTO CREDIT: GERALD KUCHLING

(Below) Live spermatozoa of *Amyda cartilaginea* under the microscope. PHOTO CREDIT: GERALD KUCHLING



(Above) Dimin, primary keeper for the *Rafetus* at Suzhou Zoo (foreground) and Emily King add vitamin supplements to the diet prior to feeding. PHOTO CREDIT: RICK HUDSON



Newsletter, 2008). However, since the preferred strategy of natural mating still does not show success after four years of attempts, AI is again being discussed as a possible option. Very little is currently known on semen collection techniques, sperm quality criteria, and semen preservation for turtles. In May 2011, Dr. Gerald Kuchling started a preliminary investigation together with Dr. Wachira Kitimasak (Kanchanaburi Inland Fisheries Development Center, Thailand) and a veterinary team headed by Dr. Nantarika Chan-sue (Aquatic Animal Disease Research Center, Faculty of Veterinary Science, Chulalongkorn University, Thailand) to collect and evaluate

sperm from large male softshell turtles *Amyda cartilaginea*. These investigations will continue as pilot studies for a possible future artificial insemination of *Rafetus*.

Discussions also started with Team *Rafetus* in Vietnam regarding future cooperation between the Chinese and Vietnamese conservation programs. With still only four live *Rafetus swinhoei* specimens known in the world the situation is close to desperate and this cooperation will be essential for the long term conservation of the species. A first step will be to jointly compare the genetic makeup of the Yangtze specimens (the two in China) and the Red River specimens (the two in Vietnam). We also

plan a new *Rafetus* survey in China (Yunnan) to try again to find wild specimens.

We thank Suzhou Zoo, Changsha Zoo, and the China Zoo Society for facilitating the breeding program and for their collaboration. The 2011 breeding attempt was again funded by the Turtle Survival Alliance, with a generous grant from Kadoorie Farm and Botanic Garden. Additional financial support was provided by the Jacksonville Zoo, Nanjing International School, and John Iverson.

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CHINA



Large numbers of *Cuora mouhotii* continue to be offered for sale in Chinese pet shops, basically as “throw away pets” that will languish and die in captivity. PHOTO CREDIT: RICK HUDSON

A Visit to Some Food and Pet Markets in Southern China

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TORSTEN BLANCK, RICK HUDSON

On 27 May 2011, along with a few fellow *Cuora* workshop participants (see article p. 15), we visited the primary food and pet markets in Guangzhou, Guangdong, China, namely the famous Qingping Market and the Huadiwan Yuentu pet market where live wild-caught and farm bred turtles can be observed openly for sale. We arrived late in the day, just before closing, so we didn't get to see everything, but even in the final business hour of the day we were able to see thousands of turtles. Just one quick look and it was obvious that many wild-caught endangered and protected turtle species were being traded

internationally and offered for sale as food and “throw-away” pets. The conditions were very poor, with many ill and dead turtles observed. In the Qingping food market, wild-caught stock has almost ceased with 90% of the former shops closed or changed into different business areas, the main species there are captive bred *Trachemys scripta* and *Mauremys sinensis*. In the Huadiwan pet market, an estimated 75% of the specimens offered are still wild-caught and many traders there are former Qingping traders. The following wild-caught species were noted (1= Qingping, 2= Huadiwan): *Carrotochelys insculpta*

(2), *Chelodina rugosa* (2), *Cuora amboinensis* (1,2), *Cuora bourreti* (2), *Cuora flavomarginata* (1,2), *Cuora galbinifrons* (1,2), *Cuora mouhotii* (1,2), *Geomyda spengleri* (2), *Heosemys annandalei* (1,2), *Heosemys depressa* (1,2), *Heosemys grandis* (1,2), *Hydromedusa tectifera* (2), *Indotestudo elongata* (1,2), *Malacochersus tornieri* (2), *Malayemys macrocephala* (1,2), *Malayemys subtrijuga* (2), *Melanochelys tricarinata* (2), *Melanochelys trijuga* (1,2), *Mesoclemmys gibba* (2), *Manouria emys phayrei* (2), *Manouria impressa* (2), *Morenia ocellata* (2), *Platysternon megacephalum* (2), *Pyxis arachnoides* (2), *Sacalia bealei* (2), *Sacalia quadriocellata* (2), *Testudo graeca* (2), *Testudo kleinmanni* (2). A shell of a dead juvenile Ploughshare Tortoise (*Astrochelys yniphora*) (2) was also seen. It was reported that there were a few juvenile Philippine Pond Turtles (*Siebenrockiella leytenensis*) in one shop at the Huadiwan market just days before we arrived. We were also informed by farmers that they had purchased larger quantities of adult *Melanochelys tricarinata*, *Chelodina mccordi* and *Chelodina gunaleni* a few weeks prior to our visit.

Blanck had the opportunity to visit the Dongmen market in Haikou, Hainan, China on 3 June 2011 and found a large quantity of wild-caught *Cuora mouhotii* and *Lissemys scutata* among



Impressed Tortoises (*Manouria impressa*) and three species of *Cuora* can be seen in this photo taken at a pet market in Guangzhou. How much longer can wild populations survive this insatiable exploitation?

PHOTO CREDIT: CRIS HAGEN

captive bred *Pelodiscus* sp., *Amyda cartilaginea*, *Trachemys scripta* and *Mauremys sinensis*. Blanck also visited Tung Choi Street, better known as Goldfish Street in Hong Kong, on 20 May and 3 June 2011. More than 65 species of turtles and tortoises were observed, notably among them six *Cuora trifasciata* (some probably wild-caught), wild-caught *Cuora galbinifrons*, *Cuora mouhotii*, *Emys orbicularis*, *Geoemyda japonica*, *Geoemyda spengleri*, *Mauremys rivulata*, *Platysternon megacephalum*, and *Siebenockiella leytenensis* (on 3 June only, probably the individuals mentioned earlier from the Huadiwan pet market). Large quantities of hatchling size *Carrotochelys insculpta*, *Malayemys macrocephala*, and *Podcnemis unifilis* were observed as well as tortoise species like *Aldabrachelys gigantea*, *Pyxis arachnoides*, *Testudo hermanni*, *Testudo marginata*, and many more. In addition, the Bird and Flower Market in Kunming, China and the Pet Market on Pi Si Jie in Suzhou, China were visited and wild-caught *Cuora flavomarginata*, *Cuora galbinifrons*, *Cuora mouhotii*, *Geoemyda spengleri*, and *Platysternon megacephalum* were all observed in both markets. Clearly, the illegal trade in endangered turtles and tortoises has not ceased in any of these cities despite strict protection in many countries the species are documented to originate from and most of them being listed on CITES Appendices I and II.

The TSA continues to be concerned about

WE HAVE BEEN ASKING OURSELVES THIS QUESTION FOR YEARS: “HOW MUCH LONGER CAN POPULATIONS SUSTAIN THIS LEVEL OF COLLECTING?”
AND WE WONDER WHEN THIS WILL END.



(Above) Farm bred species such as *Mauremys sinensis*, *Mauremys reevesi*, *Trachemys scripta*, and *Macrochelys temminckii* seen here, are available in astounding numbers. The conditions these turtles have to live in are deplorable



(Left) The Burmese endemic Arakan Forest Turtle – another Critically Endangered species – is showing up in large numbers in Guangzhou's pet and food markets.

PHOTO CREDIT: CRIS HAGEN

the number of wild-caught turtles that are consistently offered in markets throughout much of China, particularly those ranked Critically Endangered (CR) and known to be in serious decline. These populations simply cannot sustain this level of constant removal of adult turtles, especially those with low reproductive output such as *Cuora galbinifrons*, *C. bourreti*, *C. mouhotii*, *Platysternon*, *Geoemyda spengleri*, and *Sacalia* sp. If one considers the weekly turnover of these species in pet markets, and the associated high mortality due to poor care, and then multiplies that by all the cities in southern China with pet markets, then the drain on wild populations becomes even more daunting. We have been asking ourselves this question for years: “How much longer can populations sustain this level of collecting?” and we wonder when this will end. No doubt as populations

crash, collectors move farther afield to locate turtles, and use extensive collecting networks and children to cover more ground.

We believe the time has come to get serious about finding a way of moving market turtles into captive assurance colonies. This transition will require a facility with experienced staff, veterinary assistance and considerable financial resources to become a reality. Should we look for a partner in China to hold and rehabilitate market turtles prior to import? Taking the long view, this is no doubt our best option (and most expensive) as opposed to an occasional importation of fresh market animals. We will continue to explore our options but we realize that we may have a finite window of opportunity to accomplish this before wild stocks crash completely. Those interested in supporting or participating in such a project are urged to contact Cris Hagen.

BELIZE



Close-up of an adult female *Dermatemys* captured on the Rio Grande in southern Belize during the 2011 *Dermatemys* Survey and Monitoring Workshop. PHOTO CREDIT: THOMAS RAINWATER

Forging Partnerships in Belize to Protect the Hicatee: A Team Building Approach to Conservation

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The Central American River Turtle (*Dermatemys mawii*) was historically found in the coastal lowlands of southern Mexico, northern Guatemala and Belize. Due to years of intense harvesting for its meat, *Dermatemys* has been virtually eliminated from much of its former range in southern Mexico, while its status in Guatemala remains unclear. In 2010, the Turtle Survival Alliance (TSA) conducted a country-wide survey in Belize to assess the current conservation status of *Dermatemys* in what is believed to be its last stronghold. Results of the survey indicated that *Dermatemys* (locally known as “hicatee”) is

heavily depleted in most of Belize, but healthy populations remain in a few remote areas. This trend was similar to that observed in previous *Dermatemys* surveys in Belize during the 1980s and 1990s, but the current findings were of particular concern because the number of localities where turtles were observed and the number of turtles observed at those localities were both much reduced compared to the earlier investigations. In addition, we learned that large turtles (reproductive adults) continue to be targeted during harvests, significantly reducing the most demographically important segment of the

population. Further, interviews with fisherman and hunters indicated that laws and regulations enacted for the protection of *Dermatemys* in Belize are largely ignored by locals, as broad-scale enforcement is difficult to impossible to achieve.

Despite this gloomy outlook, however, there is good news to report. The 2010 *Dermatemys* surveys generated much interest and support from the Belizean government (Belize Fisheries Department, Belize Forestry Department), as well as several Belizean non-governmental organizations (NGOs), individual conservationists, scientists, students, guides, and general citizens. This momentum resulted in a TSA-sponsored Hicatee Conservation Forum and Workshop held at the University of Belize in December 2010, during which a National Hicatee Conservation and Monitoring Network (NHCMN) was formed. The NHCMN quickly sprung into action with *Dermatemys* conservation initiatives on multiple fronts and established three primary focal areas for *Dermatemys* conservation in Belize: education and outreach, legislation and enforcement, and science.

In March 2011, as part of NHCMN efforts in the focal area on science, the TSA, in collaboration with the University of Belize’s Environmental Research Institute (ERI) and Lamanai Field Research Center, sponsored two Hicatee Survey and Monitoring Workshops in Belize. The primary purpose of these workshops was to teach Belizean NHCMN members standardized methods for surveying and monitoring *Dermatemys* throughout the country so the species’ status can be examined on a broader scale and a more consistent basis.

The first workshop was conducted on the Rio Grande in southern Belize, near the town of Punta Gorda. A diverse and enthusiastic group of attendants representing several key groups in Belize participated in this workshop, including the Belize Fisheries Department, the Belize Foundation for Research and Environmental Education (BFREE), the Community Baboon Sanctuary (CBS), ERI/University of Belize, the Toledo Institute for Development and Environment (TIDE), and Ya’axché Conservation Trust (YCT). For two and a half days, trainees learned netting and spotlight survey techniques, as well as methods of determining gender, collecting morphometric measurements, and marking captured turtles before release. Importantly, the trainees also learned how to record data on standardized data sheets so that information from surveys conducted around the country can be stored in a central database and compared.

During the workshop, several *Dermatemys* were captured, examined, and released, and others were encountered during surveys. It was telling that the only people in the group that had ever actually seen a live *Dermatemys* prior to the workshop were three of us that had conducted surveys in 2010 and an older gentleman with the Fisheries Department that was once a *Dermatemys* hunter in his younger days. Everyone was elated to finally see the turtle up-close that they are working so hard to protect.

The second workshop was conducted in northern Belize on the New River Lagoon and associated tributaries. Like the southern workshop, the northern workshop was attended by an outstanding and diverse group of participants, including representatives from the Belize Audubon Society, the Belize Fisheries Department, the Belize Forestry Department, BFREE, and Lamanai Field Research Center. Over the ensuing two and a half days, trainees learned net and spotlight survey techniques, as well as the methods for processing captured turtles and recording data on standardized data sheets. Similar to the southern workshop, none of the trainees in the north had ever seen a live *Dermatemys* before. Thus, the entire group was quite excited and inspired when we landed the first turtle of the workshop, an adult female. During the course of the training, the group engaged in numerous in-depth conversations regarding *Dermatemys* status and exploitation in Belize. Trainees from different backgrounds and representing different groups exchanged information on the threats to *Dermatemys* in Belize and provided ideas on how to address these threats. Conversations like these underscored the critical knowledge that Belizeans have regarding the realities (including politics) of *Dermatemys* conservation in their country and the importance of a united effort by different stakeholder groups to effectively address *Dermatemys* declines. Indeed, perhaps the most valuable component of both training workshops was bringing these groups together in the field, allowing them to see wild *Dermatemys* up-close, and providing a forum for discussion and networking.

In parallel with our efforts to improve monitoring of natural *Dermatemys* populations, the TSA has advanced the concept of developing a captive program that could meet several long-term goals including building an assurance colony and providing headstarted turtles for restoring depleted wild populations. Unfortunately, we believe that Hicatee populations will



Participants of the 2011 *Dermatemys* Survey and Monitoring Workshop in northern Belize with two female “hicatee” that have just been examined and are ready for release. Similar to the workshop conducted days earlier in southern Belize, this was the first time most trainees had ever seen a live *Dermatemys*. Like the Rio Grande in southern Belize, the New River Lagoon and its tributaries in northern Belize provide critical habitat for *Dermatemys*, but increasing human presence in these areas has led to escalating pressure on *Dermatemys* populations, primarily through commercial exploitation. Thomas Rainwater (front left) served as primary instructor for the field courses.



Tom Pop, who supervised the breeding facility construction, stands with the solar panels that will power the well pump. PHOTO CREDIT: JACOB MARLIN

continue to decline across their range and in ten years may only exist as isolated populations in remote areas. Eating Hicatee is too culturally ingrained to simply go away. Restoration efforts will be needed and potential for recovery could likely depend on head-starting and release or translocations, and this effort will need to be done to scale. Small breeding efforts will not be sufficient. We contend that we should develop the basic captive techniques now and begin to lay the foundation for what may be inevitable.

However, given the rather dismal history that *Dermatemys* has experienced in captivity, we recognize the need to better understand the reproductive biology of this species under artificial conditions. In response to this the TSA launched a partnership with the BFREE, a non-profit with 18 years of experience conducting conservation work in Belize. The goal of this collaboration is to build the Hicatee Con-

servation Research Center (HCRC) at BFREE where we can address some basic questions about *Dermatemys* in captivity (for example, when and where they lay their eggs), and to test the feasibility of large-scale captive management. After a number of site visits by Rick Hudson and consultants Dave Manser (Ponds and Plants) and Rob Crook (Floating Islands Southeast), plans for the facility were well underway by the beginning of the year. With start-up funds provided by the Batchelor Foundation, construction of the HCRC began in February 2011. The site is located on two acres of tropical broadleaf rainforest within the 1,153 acre BFREE private reserve in southern Belize, and is under the direction of Jacob Marlin. BFREE staff member Thomas Pop, a local Mayan and field assistant to Thomas Rainwater during the 2010 surveys, was hired to assist with the construction of the facilities. BFREE

resident biologist Dan Dourson oversaw the digging of the ponds by a local contractor.

Since breaking ground in February, three large ponds have been installed: two breeding ponds, 100' x 80' and 120' x 60', and one bio-filtration/food pond, 50' x 40'. A freshwater well has been dug and reinforced, a pump house has been constructed over the well, and a solar system has been installed to power the submersible solar water pump. Fresh water is pumped automatically into the ponds when the sun rises each day and turns off at dusk. Overflow from the breeding ponds flows into the bio-filtration pond where semi-aquatic food plants will be grown. Currently, the ponds are being kept full and are being allowed to settle and find equilibrium. When finished, the HCRC will house close to 50 adult breeding *Dermatemys* and all of their food plants will be raised on site. To protect turtles from natural predators living in the area (jaguars, pumas, ocelots, coatimundis, etc.), a ten-foot chain-link electrified fence will encircle the ponds. TSA and BFREE hope to procure the breeding stock from the illegal meat trade, either directly from hunters or confiscated turtles, in Belize in early 2012. Completion of the HCRC is planned for December 2011, and we hope the facility will be fully operational by March 2012. The HCRC is expected to become an important part of the BFREE biological research and educational field station facilities. Currently, BFREE is accepting interns to assist with this innovative and exciting program. Interested individuals should contact Jacob Marlin at bfree@hughes.net or Heather Lowe at hlowe@turtlesurvival.org.

Conservation efforts on behalf of *Dermatemys* are occurring on multiple fronts, by a range of Belizean environmental NGOs, and in concert with the Belize Fisheries Department and the University of Belize. These local organizations are joined by TSA, and work collaboratively under the umbrella of the NHCMN. The group's first attempt to mount an awareness campaign aimed at *Dermatemys* hunters and consumers, and targeting area festivals where *Dermatemys* meat is openly served, was met with resistance, and often hostility. It is obvious that eating *Dermatemys* meat is a deeply and culturally engrained practice that will not go away easily, and recent government actions confirm that the political will simply does not exist to more strenuously enforce *Dermatemys* hunting regulations. Old habits die hard and if we are to be successful over time we must be patient and work to engage stakeholder groups.



One of the two large *Dermatemys* breeding ponds beginning to fill at the Hicatee Conservation Research Center at BFREE; both will be 9 – 10 feet deep, providing cool water so the turtles can avoid overheating.



Participants of the 2011 *Dermatemys* Survey and Monitoring Workshop in northern Belize use calipers to carefully measure the shell depth of a female "hicatee." For each turtle captured, gender, body weight, and multiple shell measurements were recorded prior to release. (Left to right: Derick Hendy, Neri Bol).

PHOTO CREDIT:
THOMAS RAINWATER

We are seeking support to conduct a series of community meetings to better understand what the consumer/hunter groups are willing to accept in terms of regulation and enforcement. We believe that engaging this group as a partner, rather than as an adversary, will likely be more productive than legislating without their involvement. We recognize, at least for the near future, that we will have to accept the limited harvesting of *Dermatemys*, especially in the months leading up to Easter holiday celebrations. It is difficult to determine if this level of hunting is having a significant negative impact on wild populations, but we do know that commercial hunting does have an adverse impact, and local *Dermatemys* population extinctions have been documented following observed large scale harvests. In other words, a local family consuming several *Dermatemys* a year may be a sustainable practice, but harvesting

truckloads of *Dermatemys* to supply a festival is not. It is this latter level of harvest that we must confront, and fortunately the law is clear in its regulation of such activity.

We believe the answer lies in increased enforcement activity, particularly during the five months leading up to the Easter harvest and associated festivals when *Dermatemys* consumption peaks. However, patrolling rivers is expensive and the agency charged with *Dermatemys* protection, Belize Fisheries Department, lacks the personnel and transportation to conduct regular excursions. The local environmental NGOs (TIDE, SATIIM, YCT, Belize Audubon Society) also have constabulary status and can patrol and monitor illegal hunting activity; however, they are limited by a lack of funding for fuel and other expenses. In order to provide economic incentives for these authorities to increase their patrol activities,

the TSA established a fund, managed through the University of Belize, to cover the costs associated with additional patrols. The TSA is also seeking funding to hire and outfit a Hicatee Protection Officer that would work under the Belize Fisheries Department, and whose sole responsibility would be to patrol well-known *Dermatemys* collecting sites to monitor turtle hunting.

Since the TSA first became involved with *Dermatemys* conservation in Belize, our stated goal has been that we want to be catalytic and help move *Dermatemys* to the conservation forefront. We believe that we can develop a captive technology, in partnership with BFREE that can be passed on, not only within Belize but to Mexico and Guatemala as well. Good conservation work is already occurring with *Dermatemys* in Guatemala under the Wildlife Conservation Society (WCS) Program, and it is important that we link these programs to foster better communications and exchange of ideas and techniques.

In the near future we hope this will lead to the development and implementation of a regional *Dermatemys* Conservation Action Plan that is shared between the three range countries. Saving representative *Dermatemys* populations across their range will be extremely challenging and require a multi-faceted approach. Increased enforcement and protective legislation will be necessary, and this will test the political will of the three countries. We must improve monitoring capacity through training and outfitting field teams and our public message must be clearly articulated through a targeted and consistent media awareness campaign involving radio, billboards, print and television. We must be willing to engage hunters and user groups and try to provide them with alternatives. Most importantly, we must identify and vigorously protect robust natural source populations that can be used to “re-seed” depleted populations through natural (migration) or artificial (translocation) means.

ACKNOWLEDGMENTS

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Ya'axché Conservation Trust Launches Hicatee Awareness Campaign in Belize

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Following Dr. Rainwater's confirmation that a cohesive and sustained national effort is required to ensure that *Dermatemys* does not suffer declines like neighboring Mexico and Guatemala, a national awareness-raising campaign was one of the primary conservation needs identified. That campaign would alert Belizeans that *Dermatemys* is at risk of extinction unless significant actions are taken. Ya'axché Conservation Trust (YCT) secured funding from the Mohamed bin Zayed Species Conservation Fund to undertake this campaign using diverse media sources to reach the target groups, primarily those who are involved in the hunting and consumption of *Dermatemys*.

Belize is a small country with an even smaller population. Given these characteristics, Ya'axché was able to reach the vast majority of the identified target group employing innovative media sources, even with a relatively low budget. Sponsorship of, and presence at, major events and festivals, with support from Belizean students, provided direct contact with the public. A poem, written in creole about the cultural and intrinsic value of *Dermatemys*, was created, recorded and broadcast repeatedly on the national radio station, Love FM, by a national celebrity. Two TV commercials that featured a song and dance by talented Belizean students were sponsored by the national news and broadcast throughout the peak season for *Dermatemys* consumption (March through May). The campaign was supported by billboard promotions using strategic points alongside Belize's busiest cities and highways to reach tens of thousands of residents. Ya'axché was also able to use its private sector contacts to get the message out on the back of phone bills, reaching an estimated 35,000 households.



A pair of adult Hicatee - the male (front) is recognizable by the yellow head. Photo credit: Robert Flanagan

It is essential that this awareness campaign is sustained over the next few years, in order for the message to get through to all those who want future generations to see *Dermatemys*. Ya'axché is currently seeking funding to ensure this (www.yaaxche.org). We wish to thank Joel Friesch and the International Reptile Conservation Foundation (IRCF) for the Hicatee artwork featured in this campaign.





Pape Malick Dial holding an adult female Adanson's Terrapin. PHOTO CREDIT: TSA AFRICA

TSA Africa launches Adanson's Terrapin conservation project at Tocc Tocc Natural Reserve, Senegal

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A program for the conservation of the freshwater turtle *Pelusios adansonii* is taking place in the Tocc Tocc Natural Reserve, a community-based effort in Lac de Guiers in northwest Senegal. The numbers of these turtles, which have been known in Lac de Guiers for over two centuries

(source Michel Adanson, Natural History of Senegal-1757), have been declining since the construction of the Diama agricultural dam on the Senegal River in the 1980's. This dam produced significant changes in the nesting and feeding habitats of this species. *P. adansonii* is a moder-

ate sized freshwater turtle, with the carapace length (CL) of specimens from Senegal typically reaching 220 mm (maximum CL 238) in females and 200 mm in males, with maximum weights of 1,620 g for females and 650 g for males. The typical and maximum lengths are variable depending on the locality; until recently the largest known specimens of *P. adansonii* were from Sudan at only 185 mm CL, and average length of adults along the range of the species was closer to 150-160 mm CL.

This species only exists in the wild in Senegal in Lac de Guiers, and it is on the list of animals fully protected by Senegalese law #86-844 in the code for the protection of nature and hunting. However by-catch and bushmeat consumption, by both the local population and migrant fishermen from Mali and Gaya-Gaya, have only increased the pressure on the species which has seen its numbers shrink rapidly and disturbingly in the wild.

Faced with this situation, and following the 2004 field visit of three eminent herpetologists (Dr. Roger Wood, of the Wetlands Institute, New Jersey, Dr. Peter Pritchard, of the Chelonian Research Institute, Florida, and Roger Bour, of



Young fisherman holding dead Adanson's Terrapins caught by abandoned nets at Tocc Tocc Reserve.
PHOTO CREDIT: TSA AFRICA

the Natural History Museum of Paris), I began a detailed study of this population in its natural environment to determine its characteristics (size, age structure, sex ratio, and threats). The findings of this fieldwork have enabled the production of a well-documented report from which to base conservation and management decisions.

We have identified some key habitats for the nesting and the development of hatchlings of this species at a place called Tocc Tocc-North, on the edge of Lac de Guiers. The biological richness of this area is impressive, with such varied wildlife as freshwater fish, West African manatees, and many species of migratory and native birds, monitor lizards, and freshwater snakes. Encouraged by these findings and with the help of my friend, the village chief of Toleu (near Tocc Tocc), Mr. Boh Ndiaga, we started a bold and innovative approach to the classification of the area with local authorities and central government of Senegal. Support for this work was provided by the Turtle Survival Alliance and other partners such as Wetlands International Africa, Save the Manatee Club, the Chelonian Research Foundation, and the British Chelonia Group.

After much administrative effort with the government, Tocc Tocc was classified as a nature reserve under regulation of Law 96-07 of March 22, 1996. It covers an area of 273 hectares (almost 675 acres) of diverse habitats (lagoons, wetlands,



Entrance sign of Tocc Tocc Reserve with workers and members from the local conservation committee.
PHOTO CREDIT: TSA AFRICA



Local conservation committee members working to clean Adanson's Terrapin nesting sites of invasive vegetation.
PHOTO CREDIT: TSA AFRICA

and land area). A local committee for management and conservation of the reserve is made up of volunteer members from the four villages along the new nature reserve and is led by Ndiaga Boh, the chef of Toleu village. Conservation activities in the field for 2011 were funded primarily by the Turtle Survival Alliance. The first activity was a clean-up of all abandoned nets within the reserve. These are now illegal there, and are very destructive to local wildlife, including turtles that are captured and drown because they cannot reach the surface to breathe. More than 200 turtles are killed annually by abandoned nets (often gravid females during the nesting period). The second activity was the creation of an accurate GPS map of *Pelusios adansonii* nesting sites, and clearing of overgrown vegetation that has invaded these sites, to make them more attractive to the mass nesting of female turtles. Our field experience has shown that *Pelusios* females

prefer to lay eggs in dry sites, well exposed to the sun with little or no vegetation. At the end of 2011 we will evaluate the impact of these measures to conserve this species in Lac de Guiers. The results of this survey will be very important in the selection of future conservation activities.

The Senegal Flap-Shelled Turtle (*Cyclanorbis senegalensis*), is another species of special concern that was common in this area during the 1980's. It has now completely disappeared from Lac de Guiers and no one can explain the exact cause. It is possible that the disappearance may be an indirect effect of the Diama dam construction, but whatever the cause, it is important to learn more about *Pelusios adansonii* in this region so that they will not suffer a similar fate.

I thank Anders Rhodin (CRF), Rick Hudson, Heather Lowe (TSA), and Anne Rowberry (BCG) for their financial support and advice and also Lucy Keith Diagne who helped with the translation.

PHILIPPINES



Testing water quality in the treatment tank and turtle enclosures is done routinely to monitor pH.

PHOTO CREDIT: KATALA FOUNDATION, INC.

Philippine Forest Turtle Assurance Colony: Improved husbandry and facilities provide optimism for the future of this challenging species

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government authorities had seized some 157 individuals at a seaport in Liminangong, Taytay in May (Lopez and Schoppe, 2004), and another dozen in July (Diesmos et al., 2004). In 2005, 63 were confiscated in Taytay, and six individuals were seized in 2006 (KFI, 2007). Most of the confiscated turtles are deposited at rescue centers in Luzon and Palawan that have insufficient facilities. The 2005 seizure for example had been turned over to the Palawan Wildlife Rescue and Conservation Center (PWRCC) in Puerto Princesa City where the turtles are kept in a roughly 25 m² enclosure with a cemented shallow pond without any furniture. Animals had abrasions caused by the cement, showed intraspecific aggression and were violently competing for food. Hence when in 2007, KFI had built facilities to hold an assurance colony of *S. leytenensis* in KIEBC, 40 individual were turned over from PWRCC to the new facility (Schoppe, 2008).

The species has turned out to be difficult to manage in captivity. They are stress prone and show high intraspecific aggression, especially among males (Schoppe and Fernando, 2009; Schoppe, 2010). The former curator at Avilon Zoo in Manila further noted that the species is prone to respiratory problems (Matthew Yuyek in litt. to SS on 12 October 2009) and we met the same problems in KIEBC. In KIEBC, the husbandry has been further complicated by water quality issues resulting in a high incidence of shell rot recently. Local veterinaries and a visiting veterinary from Ocean Park Hong Kong - facilitated by the Turtle Survival Alliance (TSA) - tried to evaluate the situation and diagnose the problem but the underlying basis seems to be husbandry and management related (Schoppe and Fernando, 2009).

KFI sought help through the IUCN Tortoise and Freshwater Turtle Specialist Group. In response to that request, the TSA mobilized a team (headed by Rick Hudson) to address the husbandry problem at KIEBC. During their visit in September 2009, they designed a facility expected to meet the needs of *S. leytenensis* and that addresses the factors that might contribute to those health problems such as: 1) High pH; 2) fecal coliform contamination from surrounding cow pasture; 3) shallow water that warms quickly; 4) semi-rough concrete pool surfaces; and 5) social stress. Thanks to the expertise in husbandry and pond filtering systems of the TSA team members, combined with KFI experience

as one of its three major objectives.

Siebenrockiella leytenensis is a Palawan endemic Critically Endangered (IUCN, 2010) freshwater turtle threatened by over exploitation for the international pet trade, habitat destruction and exploitation for local consumption (Diesmos et al., 2008; Fidenci and Maran, 2009; Schoppe et al., 2010; Turtle Conservation Coalition, 2011, Diesmos et al., in prep.). While most individuals that are illegally collected for the international pet trade leave the country without hindrance (Yuyek, 2004) some are confiscated. In 2004 for example,



Katala Foundation Incorporated (KFI) is a Palawan-based NGO working on the conservation of threatened native species. Its Katala Institute for Ecology and Biodiversity Conservation (KIEBC) located in Narra, Palawan aims at developing procedures for rescue, conservation breeding, habitat restoration and eventually re-introduction of selected highly threatened wild species from Palawan, like the Philippine Forest Turtle (*Siebenrockiella leytenensis*),

and knowledge on the species, we designed a tank system to treat water drained from the enclosures, and implemented methods for improving *S. leytensis* enclosures. We then submitted proposals for funding to TSA and Turtle Conservation Fund (TCF) which were granted in February and March 2010, respectively.

To improve the accommodations of the existing *S. leytensis* collection at KIEBC we converted the original 20x6m enclosure into 20, 2x3m compartments. Each of the new enclosures has a 2x2m pond area and a 1x1m land area. Each enclosure is designed to hold a maximum of two individuals, either male/female or two juveniles. The pond system is sealed from the environment to avoid ground water intrusion. Each enclosure has an inflow and a drainage pipe through which they are connected to the filter tank system.

The filter tank system encompasses four units: a collection tank, a settling tank, a treatment, and a filter tank. The system is designed to prevent contaminated water from washing back into the pools by adding a below ground collecting tank. From there water pumps back to the settling basin that contains plants for biological filtration. From the settling basin water flows to the treatment tank filled with plenty of leaf litter as acidification agent. We use leaves of the Talisay tree (*Terminalia catappa*) that contain several flavonoids, tannins and saponins and are known to lower the pH of aquarium waters. This helps in lowering the pH of the well water that can be as high as pH 9. From the treatment tank the water passes through a filter unit and is then gravity fed back to the ponds.

On 31 August 2010 all but three *S. leytensis* that were still under medical treatment were transferred to the new enclosures. All females were paired with a male, while the remaining males were placed in individual units. Mating was observed immediately after release. Water pH of the treatment tank is measured regularly and old leaves are removed and new ones added once pH is above 8. We also monitor NO_2 , NO_3 and NH_3/NH_4 in the enclosures and the treatment tank before and after cleaning. Water is changed in the enclosures once a week - the day after providing animal protein food.

Whether the new enclosures and water filter system will prevent the occurrence of shell rot in the future remains to be seen. Health problems used to peak during the wettest time of the year (July to October), hence we are looking with fearful anticipation to what the 2011 rainy season may bring. What is certain is that the new setup has solved problems caused by intra-specific aggression



Vegetation cover as of September 2010. PHOTO CREDIT: KATALA FOUNDATION, INC.

since the turtles are now kept in pairs or individually. A sign of positive change is also that one of our females deposited a clutch of three eggs during the first week of May and another egg on May 25, 2011.

ACKNOWLEDGEMENTS

This project would not have been realized without the generous support of the Turtle Survival Alliance (TSA) and the European Association of Zoos & Aquaria (EAZA) - Shellshock Campaign through the Turtle Conservation Fund (TCF). Most especially we would like to thank Rick Hudson, Bill Zeigler, Dr. Anders Rhodin, Dr. Hugh Quinn, Eric Goode, Dr. Gerald Kuchling and Dr. Peter Praschag.

Prior to the present project, our assurance colony of *S. leytensis* kept in Narra has received financial and technical support from EAZA Shellshock Campaign, the Loro Parque Fundacion, the North of England Zoological Society Chester Zoo, the Zoological Society for the Conservation of Species and Populations, Conservation des Espèces et des Populations Animales, ZooParc de Beauval, the Turtle Survival Alliance, the Turtle Conservation Fund, the Turtle Conservancy, the IUCN Tortoise and Freshwater Turtle Specialist Group, Kadoorie Farm and Botanic Garden Hong Kong, and Ocean

Park in Aberdeen - Hong Kong, especially Dr. Nimal Fernando.

KFI also wants to acknowledge the support from local partners like the Department of Environment and Natural Resources, especially its Protected Area and Wildlife Bureau and the Environment Management Bureau, the Palawan Wildlife Rescue and Conservation Center, the Palawan Council for Sustainable Development Staff, the Provincial Government of Palawan, the local government of Narra and Antipulan, and the Philippine Association of Wildlife Veterinarians, Inc.

Thank you also to KFI, especially President Juan Miguel Zubiri and Vice President Peter Widmann, Indira D. Lacerna Widmann, Ivy Regodos, to the keepers Diverlie Acosta, Angeles Guion and Loreto Alisto, and to the PCCP wildlife wardens, and finally to Engr. Erwin Yadao and his construction team.

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(Above) The new filtration system with settling basin, treatment and filter tanks are shown here. PHOTO CREDIT: KATALA FOUNDATION, INC. (Top right) Philippine Forest Turtle (*S. leytensis*). PHOTO CREDIT: PETER PRASCHAG (Bottom right) The new turtle enclosures are designed to minimize environmental and social stress and feature deeper, cooler water, filtered sunlight and a terrestrial area with retreats. PHOTO CREDIT: KATALA FOUNDATION, INC.

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INDIA



BC Choudhury, Indraneil Das, B.K. Patnaik, Patrick Aust and Rick Hudson (left to right) inaugurating the workshop by lighting a ceremonial lamp. PHOTO CREDIT: TSA INDIA

TSA India Program Expanding to Include Five Turtle Priority Areas

Coverage to Include All Endemic and Endangered Chelonians

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INTRODUCTION

India is a tortoise and freshwater turtle diversity hotspot, ranking at the top in importance for turtle conservation in Asia. With 28 species, India's diversity ranks sixth globally and is tied with Colombia and Vietnam. The threats to India's remarkable turtle fauna are many, but generally can be attributed to a vast, impoverished, and marginalized human population that is increasingly desperate for food resources, placing enormous pressures on the aquatic ecosystems, rivers in particular. Turtle poaching is increasing and largely controlled by external mafia-type organizations with little benefit to local communities; most turtles are shipped to the eastern and north-eastern states of India for consumption and further export to Bangladesh and eventually China. Intensive, and typically illegal, fishing practices trap, ensnare, and unintentionally drown countless thousands of turtles.

BACKGROUND

In 2003, the Turtle Survival Alliance (TSA) began a turtle conservation project in association with the Madras Crocodile Bank Trust (MCBT). To establish species priorities the TSA sponsored a workshop that produced a document entitled "Conservation Action Plan for Endangered Freshwater Turtles and Tortoises of India" in 2005, which provided a blueprint for the next five years. This Plan launched a series of initiatives based in the National Chambal River Sanctuary, and centered on the Red-Crowned Roof Turtle (*Batagur kachuga*), a charismatic and critically endangered species in need of urgent conservation measures. The Chambal Turtle Conservation project also targeted the sympatric Three-striped Roof Turtle (*Batagur dhongoka*). The project has been a success, as thousands of hatchlings are now returned to the river annually from riverside hatcheries. In 2008, San Diego Zoo Institute for Conservation

Research joined the project, broadening the scope of research objectives.

Since 2005, we have expanded our conservation initiatives to cover additional endangered species like the Indian Narrow-headed Softshell Turtle (*Chitra indica*) and the Crowned River Turtle (*Hardella thurjii*) in the Terai (Foothills of the Himalayas).

Our program – now known as the Indian Turtle Conservation Program (ITCP) – represents TSA's longest running program and is widely recognized as one of the most socially integrated of all turtle conservation programs in Asia. The program regularly conducts activities that engage, educate, train, and hire members of the local communities that share the critical habitats with turtles.

With the success of TSA's initial projects in India and given the need to expand to additional regions and species on the subcontinent, we hosted a second national workshop on "Indian Freshwater Turtle and Tortoises Conservation Priority Areas & Initiatives" in Lucknow, Uttar Pradesh, in October 2010. The meeting objectives were to review the progress of the 2005 action plan, and create a new 5-year plan prioritizing important turtle areas for conservation action across India and award prizes to the top turtle conservationists and rangers.

This workshop was conducted by TSA in association with Madras Crocodile Bank Trust (MCBT), Wildlife Institute of India (WII) and IUCN Tortoise and Freshwater Turtle Specialist Group (TFTSG) and co-sponsored by the TSA, WWF-Canada, Cleveland Zoological Society, San Diego Zoo Global, and the Seksaria Sugar Factory. Prof. Indraneil Das, of the University Malaysia, Sarawak, a renowned herpetologist, chaired the workshop. Prof. B.C. Choudhury, Wildlife Institute of India, pioneer of chelonian and crocodilian biology in India was the vice-chair. Mr. B.K. Patnaik, Principal Chief Conservator of Forests, Uttar Pradesh Forest Department and Rick Hudson, TSA President graced the event as Chief Guest and Guest of Honour respectively.

The first goal was to synchronize and capitalize on the efforts of the various organizations and individuals working to conserve chelonians in India. Participants were encouraged to collaborate as regional partners to facilitate future programs in their respective regions. Leading organizations including Zoo Outreach Organization, Wildlife Institute of India, TRAFFIC-India, and Centre for Environmental Education, Central Zoo Authority, and Development Alternatives expressed their strong commitments as national collaborators and advisors to the action plan.

Priority areas were chosen based on species richness, endemism, proportion of endangered turtles, and their potential to host successful conservation programs. The new 5-year conservation plan focuses on the following five Indian turtle priority areas (TPA) that were identified at the workshop.

Turtle Priority Area 1–Chambal and Upper Ganges-Yamuna region (North-central India): This turtle priority area encompasses parts of the states of Uttar Pradesh (UP), Madhya Pradesh (MP), and Rajasthan. The Ganges, Chambal, Yamuna, Ken, Son, and the Ram-Ganga Rivers flow through this area. The middle Ganges River system in north-central India contains over thirteen species of freshwater turtles including *Batagur kachuga* and *Chitra indica* - two endangered species in need of urgent conservation measures. The chelonian diversity and significant amount of freshwater habitats make this a strategic area for turtle conservation.

The conservation partners of this TPA include the National Chambal Sanctuary Project, Deori and Kukrail Gharial Rehab Centres in MP and UP, Centre for Environmental Education, Development Alternatives, Nature Exploration Group, WWF India's dolphin project, Gharial Conservation Alliance, and Jiwaji University.

Recommendations:

Refine the existing headstarting program based on population structure and dynamics possibly through rearing and releasing different size-classes of *Batagur*. Study annual movement patterns of adult *B. kachuga*, *B. dhongoka*, and *C. indica*. Assessment of juvenile survival and dispersal through permanent marking of head-started animals – as well as a comparison of *C. indica* survival with *Nilssonia gangetica*.

Conduct a habitat viability assessment and re-introduction of headstarted *Batagur* yearlings in protected stretches of historical/similar habitats in Ganges basin.

Assess and reduce adult and juvenile mortality through patrols, enforcement, and stakeholder motivation.

Develop more *ex-situ* facilities and establish more assurance colonies of regionally threatened turtles in existing regional zoos, rehabilitation, and rescue centres such as the Kukrail, Deori, and Sarnath crocodile centres.

Lobby government and national NGOs for better enforcement and habitat protection.

Turtle Priority Area 2–Terai (Foothills of Himalaya) region in Northern India: Indian Foothills of Himalaya, or the Terai region, extends over 6,500 km² in the states of Uttarakhand, UP,



(Left) Suresh Pal Singh, a senior turtle keeper is being presented the 2010 Turtle Conservation Service Award 2010 by Rick Hudson, TSA President. PHOTO CREDIT: TSA INDIA

(Above) Shailendra Singh, TSA India Turtle Conservation Program Director, briefing the workshop participants. PHOTO CREDIT: TSA INDIA

and Bihar near the border of India and Nepal. This area is a highly threatened ecosystem, comprised of the Sal (*Shorea*) forests and mosaic of wetlands, grasslands, swamps, lakes, and snow fed tributaries. This region is so rich in diversity that the World Wildlife Fund (WWF) lists the Terai as one of the top 200 eco-regions in need of conservation globally. The area supports over 50% of the chelonian diversity of India. The main threat to the turtle population in the region is large scale harvesting for local consumption and export.

The workshop identified the Indian Narrow-headed Softshell Turtle (*Chitra indica*) as the flagship species of the region and listed *Hardella thurjii*, *Nilssonia hurum*, *Geoclemys hamiltonii*, *Melanochelys tricarinata*, *Morenia petersi*, and *Indotestudo elongata* as species in need of conservation attention in the area.

The major collaborators identified for this region were Katarniaghat Foundation, Terai Environmental Foundation, Vikramshila Biodiversity Research Centre (VBRC), Corbett Foundation, and Universities in Lucknow and Gorakhpur.

Recommendations:

Conduct surveys to complete a species-habitat inventory including wetland sanctuaries. Survey *Batagur* species in northern snow-fed tributaries to complement surveys in the previous TPA.

Monitor trade, develop an intelligence

network, and continue turtle poacher conversion workshops. Develop alternate livelihood programs for converted poachers.

Enforce/implement sustainable fisheries regulations on major habitats to reduce the accidental drowning of turtles, remove barriers for seasonal migration of turtles for breeding and foraging, through inter-departmental collaboration.

Include turtle species in management plans in regional Protected Areas. Collaborate with Tiger and *Sarus* crane conservation authorities in the Terai ecosystem.

Turtle Priority Area 3–Western Ghats and parts of peninsular region, South India:

This TPA extends over five states including Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, and Goa. The geography of the region is diverse, encompassing two mountain ranges, the Western and Eastern Ghats, and a plateau heartland. The Godavari, Krishna, Tungabhadra, and Kaveri Rivers are important non-perennial sources of water. This TPA encompasses the distribution of three endemic species, including Leith's Softshell Turtle (*Nilssonia leithii*), a poorly known species, and one of our top priorities for conservation action in Asia. This TPA also includes *Pelochelys cantorii*, *Vijayachelys silvatica*, and *Indotestudo travancorica* as other target species in conservation need.

The strategic turtle conservation partners



The flagship species for TPA1, *Batagur kachuga*.
PHOTO CREDIT: SHEENA KOETH



The flagship species for TPA2, *Chitra indica*.
PHOTO CREDIT: ASHUTOSH TRIPATHI



The flagship species for TPA3, *Nilssononia leithii*.
PHOTO CREDIT: V. DEEPAK



The flagship species for TPA4, *Pangshura sylhetensis*.
PHOTO CREDIT: CRIS HAGEN



The flagship species for TPA5, *Batagur baska*.
PHOTO CREDIT: RUPALI GHOSH



identified for this TPA are Madras Crocodile Bank Trust (MCBT), Salim Ali Centre for Ornithology (SaCON), Zoological Survey of India, Wildlife Institute of India, Wildlife Conservation Society's India program based at Bangalore, and Indian Institute of Science.

Recommendations:

Conduct status surveys of all states within this TPA to document occurrence of freshwater turtle populations and key nesting areas. Identify populations of *V. silvatica* and *I. travancorica* outside Protected Areas network

Establish *ex-situ* assurance colonies of *N. leithii* and *P. cantorii* at regional zoos for conservation and research purposes.

Initiate a nest protection program for *N. leithii* and *P. cantorii* in two key habitats (e.g., Netravathi, Kaveri, and Godawari River) and increase patrols during nesting season.

Document and analyse the Star Tortoise (*Geochelone elegans*) harvest and trade and devise methods to halt the export. Devise a plan to repatriate confiscated stocks.

Review (upgrade) listing of *N. leithii* in the Indian Wildlife Protection Act, 1972 and Convention on International Trade in Endangered Species (CITES)

Turtle Priority Area 4-Assam region in

North Eastern India: This northeastern region of India is at the junction of the Himalaya and Indo-Burma biodiversity hotspots, and is regarded as one of the primary centers of turtle diversity in the world. To date, 23 turtle species have been recorded from this region. The state of Assam includes much of the Brahmaputra River basin that, with 17 species, is recognized as the second most important turtle region in the world. This area has several endangered species of turtle and tortoises, notably *Pangshura sylhetensis*, *Nilssononia nigricans*, *Chitra indica*, *Cuora mouhotii*, and *Manouria emys*.

The workshop identified Assam Roofed Turtle, *P. sylhetensis*, as the flagship species for this TPA. This charismatic species is both endangered and elusive and is restricted to a protected area along the Brahmaputra River.

The strategic partners for this TPA are Aran-yank, Turtle Conservation Research Program at Guwahati University, Centre for Environment Education- North East, Assam State Zoo and Botanic Garden, and state forest departments.

Recommendations:

Conduct status surveys and harvest and trade assessments for all seven regional endangered turtles. Survey the Sur Ku foothills in Arunachal Pradesh and Dibroo-saikowa in Assam for threatened regional tortoises.

Study the taxonomy and genetics of *Amyda cartilaginea*, *C. mouhotii*, and *C. amboinensis* in association with the Centre for Cellular and Molecular Biology and Indian Institute of Science.

Survey of zoos and captive centres to document existing chelonian stocks especially *C. mouhotii*, and *M. emys*. Initiate a zoo-based conservation program for species like *P. sylhetensis*, *M. emys*, *I. elongata*, and *C. mouhotii*

Begin planning for turtle-friendly modifications in existing temple ponds containing *N. nigricans* such as diet improvement, removal of aggressive *N. gangetica*, eradication of predatory catfish, and development of basking and nesting areas

Turtle Priority Area 5-Sunderbans and

Orissa region in Eastern India: This TPA includes the lower Gangetic delta (Sunderbans) as well as the lower Mahanadi River basin and parts of the coastal habitats along Bay of Bengal. This encompasses important populations of rare Indian softshell turtles and possibly the last remnants of the Sunderbans River Terrapin (*Batagur baska*) either extinct or nearly so in India, and recognized as the second most endangered large river turtle in Asia.

Simultaneously, the area is known to receive a number of illegal turtle consignments from the entire Gangetic plain (mainly softshell turtles) and Southern India (Star Tortoises and other turtles) for consumption and further export. This TPA should be strategically addressed as a means for controlling the illegal turtle trade.

The workshop identified the Northern River or Sunderbans Terrapin (*B. baska*) as the flagship species for this TPA, whereas *Pelochelys cantorii*, *Nilssonia nigricans* and *Pangshura sylhetensis* as species in need of conservation attention. The workshop suggested developing a practical action plan to curb the trade of all freshwater chelonians in the area.

The strategic partners identified from this region are Nature Conservation and Wildlife Society, Wildlife Society of Orissa, Nandankan Zoo of the Orissa Forest Department, *Sajnekhali* Conservation Centre of the West Bengal Forest Department, and local universities in both states.

Recommendations:

Initiate exhaustive status surveys along Indian Sunderbans, West Bengal, and Orissa particularly the Mahanadi River.

Improve the facility holding surviving *B. baska* individuals at *Sajnekhali* in Sunderbans to add basking areas, nesting banks, private fencing, and to improve turtle diet. Link this facility with the existing TSA Northern River Terrapin conservation project in Bangladesh, probably using the South Asian Regional Co-operation (SARC) platform. Set up an additional breeding program by transferring two male *B. baska* from Sunderbans to MCBT to pair with the two adult females there.

Set up temporary transit rescue facilities to handle the rehabilitation of confiscated turtles and build capacity for better enforcement and management.

Develop an information network among former turtle poachers/sellers to locate remnant turtle populations and monitor trade. Develop an action plan to deal with poaching and monitoring in collaboration with the Ministry of Environment and Forest's Special Crime Control Bureau and TRAFFIC- India.

OUTSTANDING SERVICE AWARDS GIVEN AT WORKSHOP

During the workshop, two annual awards were established to encourage frontline turtle conservationists and rangers: the "Turtle Conservation Service Award" and "Turtle Field Conservation Award." Congratulations to the 2010 award winners, Suresh Pal Singh (UPFD) for his 25 years of outstanding service for captive



PHOTO CREDIT: TSA INDIA

Meet the Staff: Linthoi Naorem

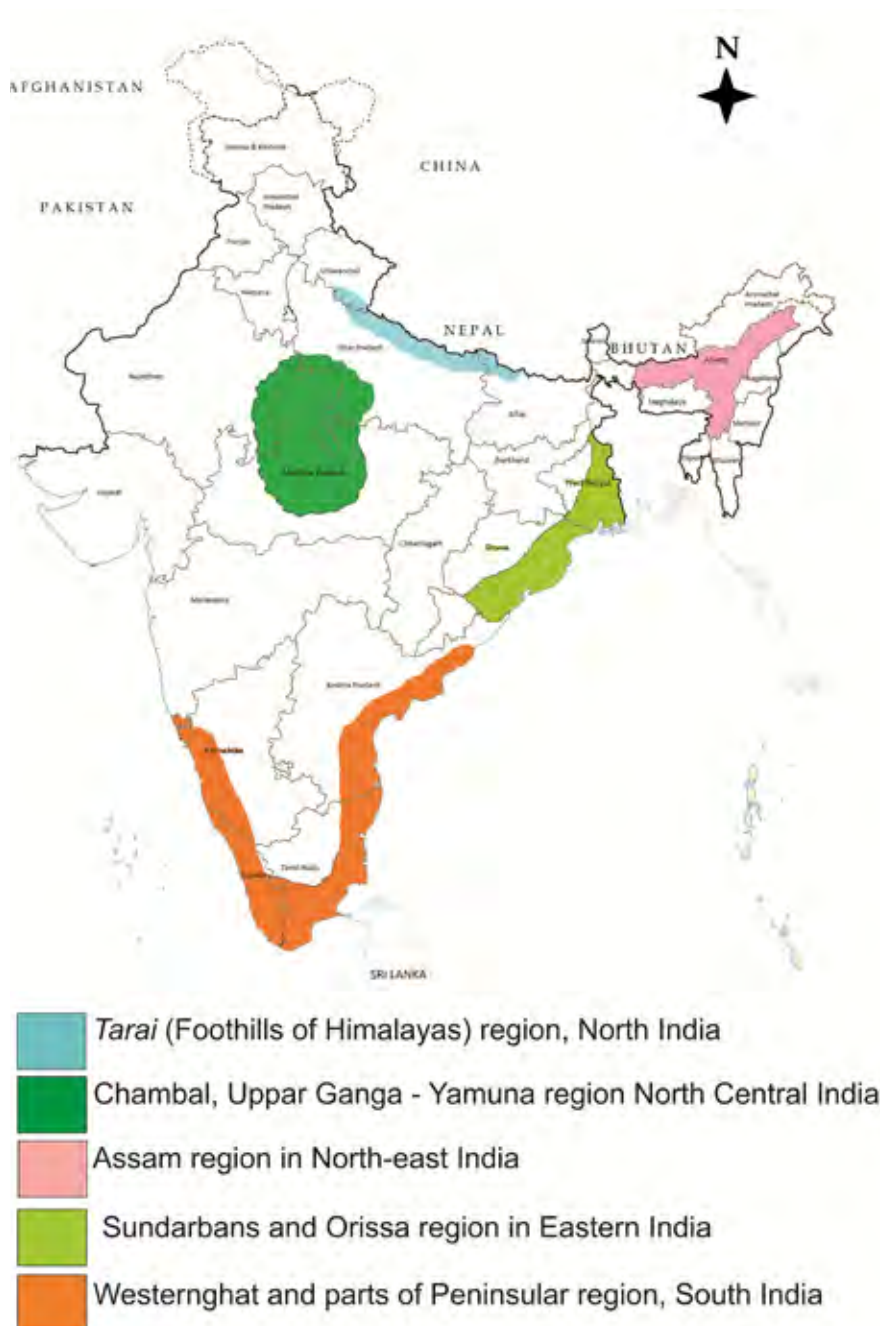
SHAILENDRA SINGH

Linthoi Naorem, "Lin," has recently joined the TSA India staff as Program Executive and is rapidly "getting up to speed" by learning about the program's many activities and past achievements.

Lin was recruited as per TSA's planned expansion to include all Turtle Priority Areas (TPA) throughout the country, and given the responsibility of facilitating the coordination of all projects as well as overseeing the TSA program's office.

Lin hails from Imphal town of Manipur in North-eastern India. She is a molecular biologist by training and initiated her research work on freshwater turtles and tortoises in 2008 for her PhD dissertation at the University of Gauhati in Assam, which she is still pursuing. Her love and passion for freshwater turtles and tortoises inspired her to take action in whatever small ways possible to help their conservation. She has also been involved in helping to raise awareness at the grassroots level in the state of Manipur, along the Indian and Myanmar border. Her work is mainly concentrated on Loktak Lake - a Ramsar site of international significance - and adjoining areas, potential habitat for a few threatened turtles including the Malayan Box Turtle (*Cuora amboinensis*). Lin maintains a colony of *Cuora* at her home, rescued from the turtle trade, that breeds every year!

Says Lin, "my dreams came true when TSA called to me to assist with it's nationally and internationally renowned Indian Turtle Conservation Program and I look forward to learning the dynamics of the program quickly and helping the turtle conservation activities expand in all possible ways."



Prof B.C. Choudhury speaks during the inaugural session of the workshop. PHOTO CREDIT: TSA INDIA

ACKNOWLEDGEMENTS

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The TSA would also like to give special thanks to Nature's Own for their challenge grant in 2010, which helped to raise a total of \$60,000 for the TSA's India Program.

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conservation and management of Indian turtles at the state-run Kukrail facility, and Bhasker M. Dixit (Terai Environmental Foundation NGO), for his contribution to the turtle poacher conversion and rehabilitation programs in the Terai.

PROGRESS SINCE THE WORKSHOP

The workshop outcomes have been very well received. A significant step in seeing the recommendations of the workshop implemented is that the Wildlife Division of the Ministry of Environment and Forests has endorsed the workshop through an official press release and deemed the workshop recommendations worthy of inclusion into their national agenda to achieve the goals set forth in the "International Year of Biodiversity 2010. Furthermore, TSA is

already facilitating expansion of its resources to implement the new 5-year plan. The following actions have occurred: 1) Recruited a biologist to carry out the preliminary surveys on the status of *N. leithii* and *P. cantorii* in TPA #3; 2) Hired a program executive to facilitate the conservation work in all five regions; 3) Awarded four TSA seed grants, totalling \$10,000, that targeted five threatened species spread across four different TPAs; 4) Organized a four-day veterinary training program at MCBT in which Dr. Shannon Ferrell (Fort Worth Zoo) and Dr. Gowri Mallapur trained twenty-five veterinarians from all five TPAs, on turtle veterinary management and rehabilitation techniques. The TSA and its partners in India will soon address other recommendations of the workshop.

INDIA



Dr. Ferrell demonstrates the correct method to restrain a chelonian for oral gavage of either medications or alimentary feeding using a juvenile Red-crowned Roofed Turtle (*Batagur kachuga*). PHOTO CREDIT: L. NAOREM, TSA INDIA

Chelonian Health Management And Rehabilitation Training Workshop For Indian Veterinarians

LINTHOI NAOREM, SHASHWAT SIRSI & SHAILENDRA SINGH
INDIA TURTLE CONSERVATION PROGRAM

As recommended during the Turtle Priority Areas and Initiative Workshop in Lucknow in October 2010, the Madras Crocodile Bank Trust (MCBT) and Turtle Survival Alliance (TSA) jointly sponsored and organized a veterinary workshop to train veterinarians of Turtle Priority Areas (TPAs) of India. Twenty wildlife vets, associated with reptile care and rescue, participated in the training. The workshop was held from June 26-30, 2011 at the MCBT facility and focused primarily on the basics of chelonian husbandry and health care in captivity as well as the handling and rehabilitation of turtle confiscations. The MCBT houses 17 species of Indian chelonians

and provided ample opportunity for hands-on experience to the participants. Dr. Shannon Ferrell (Fort Worth Zoo) was the main instructor to the workshop, whereas Dr. Gowri Mallapur, resident vet of the MCBT, was the co-instructor and one of the lead organizers. Participants represented the states of Assam, Gujarat, Uttar Pradesh, Karnataka, Tamilnadu, Andhra Pradesh and Maharashtra.

The workshop was divided into two separate sessions due to the number of interested invited participants. Veterinarians who manage chelonians for the forestry departments and NGOs comprised the bulk of the first session. The second

session consisted primarily of private practice veterinarians, particularly those associated with wildlife rescue within India. The inaugural address was given by Mr. Colin Stevenson, Director of the MCBT, who emphasized the need for active collaboration among the participating Indian agencies/institutions in furthering chelonian conservation. The invited veterinarians were then asked to introduce themselves and express what they hoped to learn during the training. Dr. Ferrell provided a brief overview of TSA's role in turtle conservation around the globe with special mention on the India program.

The workshop involved a combination of didactic sessions supplemented with hands-on practical exercises such as physical exam, phlebotomy, assist feeding techniques, anesthesia, and gross necropsy. An additional separate session was organized on the identification and handling of turtles by Nik Whitaker, Curator of the MCBT. During the didactic sessions, existing husbandry and medical protocols were discussed in detail for the improvement of chelonian health in both private and governmental facilities. At the end of the sessions, participants felt the physical training significantly improved their confidence and comfort level in the application of more aggressive diagnostic and supportive care techniques for chelonians. Certificates of participation were distributed, and the veterinarians were keen to continue collaborating and communicating for the advancement of turtle conservation throughout the country under the leadership of the TSA/MCBT's India Turtle Conservation Program.

The major goal of this workshop was to train veterinarians in advanced chelonian health management techniques that can assist with both the captive and field components of TSA's India conservation program. It is critical that we are able to mobilize a network of trained veterinarians to assist the government when confiscated chelonians are in need of triage, treatment, and rehabilitation. To further the agenda, TSA is talking with a few NGOs and forestry departments to develop a mobile "Rapid Response Veterinary Unit" to immediately assist turtle confiscations throughout country.

ACKNOWLEDGMENTS

We wish to thank both the Fort Worth Zoo for sparing one of their staff veterinarians and Dr. Shannon Ferrell for conducting the training workshop. We acknowledge MCBT Trustees and Staff for helping to organize this workshop. Mr. Ashutosh Tripathi, TSA India is also thanked for designing the certificate and banners.

INDIA



Leith's softshell turtle (*Nilssonia leithii*) is a poorly known species endemic to south India that has been proposed for critically endangered status by the IUCN Red List. Intense fishing pressures are the primary threats. This is a juvenile, evidenced by the intense orange flashes on the head. PHOTO CREDIT: B.H.C. MURTHY

Preliminary observations on Occurrence of Softshell Turtles in Karnataka, Southern India

SHASHWAT SIRSI¹ | SHASHWATSIRSI@GMAIL.COM

Freshwater turtles and tortoises of India are in an unenviable position, with 60% of the 28 native species in danger of extinction. In response to this grim scenario, in 2005, the Madras Crocodile Bank Trust, the Turtle Survival Alliance with support from Conservation International developed the “*Conservation Action Plan for Endangered Indian Freshwater Turtles and Tortoises*”. This action plan identified ten most threatened freshwater turtle species and outlined necessary actions to address specific threats. Subsequently in 2010, the Turtle Survival Alliance, Madras Crocodile Bank Trust and San Diego Zoo Global in association with Wildlife

Institute of India (WII) and IUCN/SSC Tortoises and Freshwater Turtle Specialist Group, convened the “*Indian Freshwater Turtle and Tortoises Conservation Priority Areas & Initiatives*” at Lucknow, Uttar Pradesh. The workshop largely aimed to review the action plan devised in 2005 along with the prioritization of areas for turtle conservation action. Priority areas were identified on the basis of species richness, endemism, relative number of endangered turtles as well as the feasibility to initiate conservation initiatives.

Peninsular India was among the priority areas identified based on the degree of endemism

and the proportion of endangered turtles. Among the priority recommendations for this region that emerged from the workshop was to gather information regarding recent and accurate distribution, status and level of exploitation of the insufficiently known and endangered Leith's Softshell turtle (*Nilssonia leithii*) and the Asian Giant Softshell turtle (*Pelochelys cantorii*). Such information is vital in developing and implementing an effective species recovery plan. *N. leithii* is understood to be endemic to peninsular India, inhabiting large rivers and reservoirs while *P. cantorii* is generally considered as a freshwater form having a widespread distribution, in isolated localities, from the west coast of India eastwards to Bangladesh. *P. cantorii* has also been observed to migrate from freshwater to nest on ocean beaches. These large sized softshell species are a valued source of protein for local communities as well as a luxury food item for epicures. In addition, products derived from the species may also be used in traditional medicines and health products. Intensive illegal harvesting for local consumption and export as well as human-induced habitat changes has severely depleted populations of both *N. leithii* and *P. cantorii*.

Rapid surveys to collect information on the occurrence of *N. leithii* and *P. cantorii* began in September, 2010 across the states of Karnataka and Andhra Pradesh in southern India. The surveys were funded through a seed grant provided by the Turtle Survival Alliance. Intensive status surveys were begun in the state of Karnataka since March 2011 under the aegis of the Indian Turtle Conservation Program, to garner relevant information for species conservation objectives.

Sites were selected for sampling on the basis of previous species distribution records, information from local community members and personal communications with biologists, that have worked in the area. Sampling for specimens was largely carried out using hoop traps (a specialised turtle trap) and fishing nets. Identification of species occurring at a site was also carried out through conversations with local community members using visual aids such as field guides and by distributing postcards with color photographs of *N. leithii* and *P. cantorii* among local residents. Questionnaires were also used in interviews of local fishermen to arrive at indications of population status, trends, level of exploitation, and their perception towards turtles in general.

These survey efforts have been a step forward in enhancing our knowledge of these poorly

known species. The occurrence of *P. cantorii* was confirmed during rapid surveys through the observation of a single female and two male specimens from three different locations on River Netravati, a west flowing river in Dakshin Kannada district, southwestern Karnataka. Additionally, skeletal remnants of two adults were also observed at a private museum in Bantwal town of the same district. The two male *P. cantorii* are currently being maintained at the Dr. Shivram Karanth Biological Park at Pilikula, Dakshin Kannada district.

There are four hydrological projects on the river in this ecologically sensitive region, which have affected habitat stability and possibly block migration of *P. cantorii* toward estuarine areas. All records of species occurrence obtained during the survey were from locations proximate to hydrological projects. Regradation of the river bed was being undertaken during a visit to one such hydroelectric project at Shamboor, near Bantwal. The impact of such a change in habitat on *P. cantorii* would be understood through later visits to this site. A large number of itinerant labourers at the site have been reported to consume adults and eggs of *P. cantorii*, which coupled with habitat changes, exerts considerable pressure on this population. At another hydrological project, near Bantwal, the height of the dam is being raised to twice the current height of 4 m, in order to enhance storage capacity for water supply. This is likely to inundate valuable nesting habitat upstream. Further, mortality caused during operation of power generation and water supply equipment has also been reported by project personnel. Sampling in the near future on Netravati River is planned at additional locations to further ascertain the presence of *P. cantorii* and possibly *N. leithii*.

Sampling was carried out at the Cauvery River in southern Karnataka primarily at locations that were within a designated protected area. Valuable information regarding the habitat of this little known species was gathered through discussions with local community members. *N. leithii* was reported to occur in areas of considerable depth, relatively slow water flow and soft riverbed stratum. Individuals from local communities also mentioned that nesting by *N. leithii* typically occurred during April and May. Mid-river islands were also visited to search for nests of the species where evidence of nesting trials was observed. People of the Soliga tribe reside in this region and carry out fishing, hunting and collection of non-timber forest products in a clandestine manner to supplement their

meager income from manual labour. Members of this tribe mentioned that they incidentally and infrequently capture *N. leithii* using baited hooks, while fishing, as well as harvest eggs of the species. The Soligas possess considerable traditional knowledge and are particularly skilled at locating nests of *N. leithii*. Participation of these local individuals in potential nest/egg protection programs planned for the species would improve effectiveness while providing them with an alternate source of income.

A settlement of Bangladeshi expatriates in Sindanoor town, Raichur district of northern Karnataka, was also visited. As reported by local fishermen, intensive harvest of *N. leithii* has been carried out by camp residents over an extended period since the establishment of five camps in 1970. During my first visit, camp residents feared that I was part of an elaborate ruse to have them arrested for poaching turtles and only after a few hours of convincing the village headman were these fears allayed. A series of unbaited hooks- also known as “Boshior Hazaara,” that are particularly effective in snagging softshell turtles are used by the Bangla poachers in capturing *N. leithii*. Local consumption of meat and commercial trade in calipee has been reported by some of the camp residents- the calipee of *N. leithii* is apparently of high quality and fetches a current price of up to Rs. 3000 (ca. \$65 US) per kg. An agent allegedly visits this camp every fortnight in order to transport consignments of calipee to Calcutta, West Bengal. The relatively common Indian Flapshell Turtle (*Lissemys punctata punctata*) was also observed to be sold for consumption at evening bazaars at this camp. A conservation

education program was carried out on May 23, ‘World Turtle Day’ in order to sensitise members of this high pressure group towards the need for chelonian conservation. Participants mentioned that while poaching of freshwater turtles involved risks such as imprisonment and heavy fines, the money earned through this illegal enterprise offsets the risk. It was also mentioned during this interaction that several poachers have moved to exploit softshell turtle populations in large rivers of other states such as Gujarat and Maharashtra.

A set net was also used on the Tungabhadra River, northern Karnataka at locations where incidental capture of *N. leithii* had been observed previously by local fishermen. As recommended by local fishermen, the set net was made less conspicuous by dyeing it with an extract from the tree species *Terminalia tomentosa*. However, commercial and subsistence harvest seems to have severely depleted this population with no specimens being captured in the set net deployed over a sampling period of ten days.

During visits made to the Krishna River in Bagalkot district of north-western Karnataka, local fishermen confirmed the incidence of *N. leithii* and reported a relatively high frequency of capture and accidental drowning of the species in set nets. Local residents also stated that incidentally captured adults were sold for consumption. In addition, it was also reported that Bangladeshi poachers used to frequently and intensively harvest *N. leithii* until a few years ago, when increased vigilance by forest authorities made them shift their base of operations. In concluding, while a positive start has been made towards conserving this scantily known species,



Setting bait in hoop traps at Cauvery River, Karnataka. PHOTO CREDIT: SHASHWAT SIRSI, TSA INDIA

we do have a lot of work ahead of us in order to secure the future of these endangered softshells.

RECOMMENDED FUTURE CONSERVATION ACTION

- Investigate genetic variance in *P. cantorii* and *N. leithii* across the river systems that where the species occur.
- Set up of an *in-situ* hatchery program for *P. cantorii* near Netravati River at Bantwal
- Upgrade existing enclosures and begin breeding program for *P. cantorii* at Dr. Shivram Karanth Biological Park at Pilikula
- Assess trade and exploitation patterns of *N. leithii*, particularly through discussions with Bangladeshi expatriates at Raichur District
- Conduct a status survey of zoological gardens in the range states of *P. cantorii* and *N. leithii* in order to facilitate the establishment of captive assurance colonies
- Develop a conservation strategy for all four endangered turtles of the area through involving all range biologists and other stakeholders through organising a regional workshop as recommended in Lucknow Turtle Workshop, 2010.

ACKNOWLEDGEMENTS

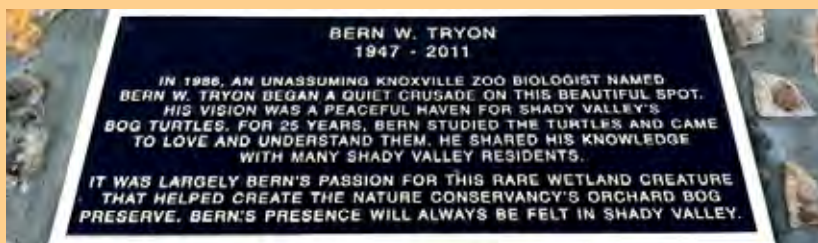
Heartfelt gratitude is extended to Rick Hudson (President, Turtle Survival Alliance), Dr. Shailendra Singh (Director, TSA India Program), Prof. B.C. Choudhury (Wildlife Institute of India), Dr. (Vet) Gowri Mallapur and Mr Nikhil Whitaker (Curator, Madras Crocodile Bank Trust), as well as Dr. B.H.C.K. Murthy (Senior Scientist, Zoological Survey of India) for their support and guidance. I sincerely acknowledge the support from the Principal Chief Conservator of Forests (PCCF), Wildlife Mr BK Singh, Mr Hitesh Malhotra (in the state of Karnataka) and Andhra Pradesh respectively for granting the necessary permissions. Additionally, PCCF Dr. MS Swaminath and PK Sharma, of the state of Karnataka and Andhra Pradesh respectively, are being acknowledged for their help in procuring the necessary permission and needed guidance. The Divisional Forest Officers Mr AK Singh, Cauveri Division, Mr Vikjayakumar Manglore Division, Mr Panchalinge Gowda, Raichoor Division in Karnataka and Mr K. Thulsi Rao, Head, biodiversity Research Centre, Srilelam, Andhra Pradesh are thanked for suggestions and logistic support. Thanks are also due to my field assistants who are too many in number to be named specifically but without whom the surveys could never have been conducted.



Female *Pelochelys cantorii*, Netravati River, Karnataka. PHOTO CREDIT: SHASHWAT SIRSI, TSA INDIA



A group of hatchling narrow-headed softshell turtles (*Chitra indica*) being headstarted at the Deori Turtle Rearing Center in Madhya Pradesh (MP). In August 2010, four nests from the National Chambal Sanctuary and two from the Son Gharial Sanctuary – totaling 701 eggs (116 eggs per clutch) were located and left in situ, covered with iron mesh for protection against predators such as jackals and monitor lizards. In October, 637 *Chitra* hatched with an overall hatching success rate of over 90%. Conservation measures such as this are necessary to try and offset the rapid decline of this species due to hunting for its cartilage (or calipee) that is dried and shipped to China. The calipee trade is an emerging threat that is having serious impacts on softshell turtle populations throughout India, Pakistan and Bangladesh. We thank Dr. R. K. Sharma and the MP Forest Department for this photograph and data.



The plaque was placed by The Nature Conservancy at the Shady Valley bog site where Bern spent much of the last 25 years of his life, working to save Bog Turtles in Tennessee.



Bern Tryon Bequeaths Library to TSA

Proceeds to Benefit Southern Bog Turtles

The turtle conservation community lost one of its staunchest allies when Bern Tryon passed away on May 6, 2011 after battling cancer. He is best known for his pioneering work with the southern Bog Turtle, especially in Tennessee where he wrote and helped implement a conservation and recovery plan for the species. He created new subpopulations using turtles headstarted in captivity, and developed a model program merging field and captive management techniques. Bern's 25 year field commitment to the southern bog turtle will continue long after his death as he bequeathed his significant herpetological library – valued at \$185,000 – to the TSA to create an endowment to fund research and conservation on bog turtles in the south.

At the time of his death he was employed by the Knoxville Zoo as Director of Animal Collections / Herpetology. He initiated a highly successful captive tortoise propagation program there (spider tortoises, in particular) and from that directed financial support to the TSA. At the 2010 turtle symposium in Orlando, Bern was awarded a Lifetime Achievement Award for Significant Contributions to the Conservation of the Southern Bog Turtle, presented jointly by the TSA and the IUCN Tortoise and Freshwater Turtle Specialist Group. Bern will forever be remembered for his dedication and passion for herpetology and uncompromising commitment to turtle conservation.

We're serious about saving turtles—join us!

Visit www.turtlesurvival.org to become a TSA member. Or, complete this form and send, with a check (payable to TSA) to: TSA, 1989 Colonial Parkway, Fort Worth, Texas 76110, USA

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Thanks for your support!

TSA members are eligible for discounts on registration at our annual conference and other items throughout the year. In addition, members receive our annual full-color publication, along with a bi-weekly e-newsletter featuring the latest in turtle conservation news. Membership funds allow the TSA to do work around the world including:

- Awarding small grants to expand conservation work with endangered tortoises and freshwater turtles globally
- Hosting our annual symposium and providing support to speakers and special guests
- Providing training opportunities to young biologists in range countries that are eager to pursue turtle conservation work
- Supporting conservation work and recovery programs for critically endangered chelonians around the world

Thank you for your support!

The TSA gratefully acknowledges the following donors and organizations for their generous support over the past year (July 2010-July 2011):

Supporters donating \$200 to \$499

Bruce Weber, Chuck Schaffer, Dave Manser, Dickerson Park Zoo, Donnel Davis, Emily Rhine, Erica Forhan, Han Qi, Hersh Markusfeld, James and Lee Glassco, Kurt Buhlmann, Lisa Weiss, Mazuri, Patricia Koval, Peter Reed, Robert Olsen, Robin de Bled, Steven Fielke

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Supporters donating \$2500 to \$7,499

AAZK - Omaha's Henry Doorly Zoo, Brian Bolton, British Chelonia Group, Chelonian Research Foundation, Cleveland Metroparks Zoo, David Shapiro, Detroit Zoo, Disney's Animal Kingdom,

Fagus Foundation, Fort Worth Zoo, Frank and Kate Slavens, Oregon Zoo, Scott Davis, Taipei Forestry Bureau, Taipei Zoo, The Orianne Society, Toronto Zoo, Turtle Conservancy, William Dennler

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2011 Behler Turtle Conservation Award Sponsors

Chelonian Research Foundation, Turtle Conservancy, Deborah Behler, Chelonian Research Institute, World Chelonian Trust, Conservation

International, Wildlife Conservation Society, Brett and Nancy Stearns

The TSA would also like to extend special thanks to the following members who have found unique ways to support turtle conservation:

Sheena Koeth sold merchandise on the behalf of the TSA throughout the year, raising more than \$800.

Stephen Ecrement and **Mariammar Gutierrez** hit the Appalachian Trail in April 2011 for their "Hiking for Hicatee" fundraiser. Their week-long hike resulted in \$830 for *Dermatemys* conservation in Belize.

Eric Goode and **the Maritime Hotel** provided special assistance to the TSA again this year by hosting the annual Board of Directors meeting. His hospitality and generosity is very much appreciated.

Brian Horne and **Adina Ripin** harnessed the power of the internet to raise funds for the TSA. Brian used Facebook Causes to raises more than \$400 for turtle conservation to celebrate his birthday. Adina Ripin celebrated her bat mitzvah by asking for donations via First Giving. She nearly tripled her fundraising goal and in the end, and at the time of this publication, raised more than \$1,000 for TSA with the help of her family and friends.

Carel Brest van Kempen, renowned wildlife artist, donated an original painting of a Radiated Tortoise for the 2010 auction. The original painting generated \$6,000 for Malagasy tortoise conservation and sales from the limited edition prints continue to raise funds for Madagascar.

HOW CAN YOU HELP?



There are many ways that YOU can contribute to turtle conservation and support the TSA's mission of *zero turtle extinctions*. Visit the TSA website to learn about how you can:

- **Make a Donation** Donations can be dedicated to a specific project or program, just let us know what you'd like to support!
- **Purchase Equipment** Check out the TSA's "wish list" to purchase equipment that is needed by our staff in the field.
- **Adopt a Turtle** By symbolically adopted an endangered species for yourself or as a gift, you can support turtle conservation globally.
- **Join the TSA** Become a member of the TSA, or buy a gift membership for a friend!
- **Support the TSA at No Cost to You!** There are several programs available in which you can support the TSA's mission by doing what you do every day - shopping, banking or selling items on eBay.
- **Do Some Shopping for a Cause** Visit the TSA's online store to purchase t-shirts, art, publications or other merchandise that supports conservation projects around the world.

www.turtlesurvival.org



2011 Behler Turtle Conservation Award: John B. Iverson

ROSS KIESTER, TURTLE CONSERVANCY | ROSS@TURTLECONSERVANCY.ORG
ANDERS RHODIN, RICK HUDSON

The IUCN Tortoise and Freshwater Turtle Specialist Group and the Turtle Survival Alliance are delighted to announce that the 2011 Behler Turtle Conservation Award will be presented to John Iverson.

Almost everyone who works in turtle conservation knows John. He has produced a body of basic biology that critically underpins any turtle conservation efforts and he has shared information and maintained fruitful contact with turtle people all over the world in a way that no one else has done.

John has contributed extensively and significantly to at least three aspects of the biology of turtles that have important conservation impli-

cations: taxonomy and phylogeny, zoogeography, and ecology and demography. To do conservation work, we must know what turtles there are, where they live, and whether their populations are increasing or decreasing and why.

In the realm of taxonomy and phylogeny, John has worked for more than 35 years on his beloved genus *Kinosternon*, the Mud Turtles. When he began working on this group, it was, simply stated, the biggest taxonomic mess in North American turtles. Building on the work of Norman Hartweg and collaborating extensively with Jim Berry, John has, through careful work and extreme attention to detail, achieved a clear understanding of this once confused group.

John has also spent his career wrestling with perhaps the hardest problem in turtle taxonomy - the Asian Geoemydids. Along the way, he participated in describing one of the most remarkable new turtles ever, the Sulawesi Forest Turtle (*Leucocephalon yuwonoi*). Other work describing new species that turned out to be hybrids was less immediately successful, but led to important advances. A defining character of science according to Francis Bacon, one of modern science's founders, is that "Truth arises more readily from error than confusion." It takes a very good scientist to make an important mistake. It takes an even better person to build on those mistakes, if we can even call them that. John's unpublished "Synopsis of Problematic Geoemydid Taxa" set the research program for that group of turtles for many years.

Although John has worked on his own checklist of turtles since his graduate school days, he is also a key member of the IUCN Turtle Taxonomy Working Group. Here, in the company of others, he brings his unparalleled knowledge to work that directly affects turtle conservation.

In 1986, John published the first edition of his monumental *A Checklist with Distribution Maps of the Turtles of the World*. Here he summarized turtle taxonomy and presented literally every known locality of every species of turtle of the world. To do this he had to read all of the literature and extract all of the museum data that were available anywhere. He then had to look up each locality, find it on a map and determine its latitude and longitude. The process of georeferencing these localities was about two decades ahead of its time. In 1992, he published *A Revised Checklist with Distribution Maps of the Turtles of the World* and immediately began collaborating with Ross Kiemer to make these data available as a computer database. As this process continued, the Worldwide Web evolved to the point where the data could be presented to all via the EmySystem website. Once the data were in a database, we could finally get a handle on just how much work John had done. At present there are 41,704 localities in the EmySystem representing 66,939 museum specimens and 24,713 localities from 2,263 literature citations.

In 1981, John began working at Gimlet Lake in the Nebraska Sandhills. Using drift fences on an unprecedented scale, he began studies of the life history and demography of the Yellow Mud Turtle and the Ornate Box Turtle. Workers in turtle conservation constantly plead for more long-term studies of turtle demography. Because most turtles live so long, a study cannot even

begin to be considered as long-term until it is conducted for more than 30 years. There are simply too few studies of this duration and John has built two of them.

John's passion for turtles is equaled by his passion for connecting to the turtle community. Throughout his career, by post and then by email, he has maintained a correspondence second to none. The number of emails he answers in a week would cause most of us to weep. His commitment to sharing data came long before that was the expected practice of scientists and is a key aspect of his contribution to turtle conservation.

John received his Ph.D. from the University of Florida in 1977 where he was a student of both Archie Carr and Walter Auffenberg. But in reality, John went his own direction establishing a pattern of independence throughout his life. In 1978 he took a position at Earlham College in Richmond, Indiana, and remained there until his retirement this June. Earlham is a small, well-respected liberal arts college, but has neither the institutional culture nor the infrastructure to support research careers. So John's productivity as a research scientist is all the more remarkable. However, this institution's relative indifference to research made it possible for John to do exactly the kind of work he felt was important. In contrast, it is hard for research career oriented professors at major universities to continue long-term studies year after year with publications coming only every several years.

What John did receive from Earlham was a constant stream of talented undergraduates. He made the most of these and they, in return, got the benefit of a truly dedicated mentor. Field studies are often labor intensive and John's reputation was such that he never lacked for help.

From 1982 until his retirement this year, John was the Director of Earlham's small but surprisingly superb Joseph Moore Museum of Natural History.

John's passion and indefatigable capacity for work have secured him a place in the hearts and minds of turtle conservation people around the world. We look forward to even more inspiration from him now that he is retired from academia. The turtle community is proud to have John as a member, but we do have to share him with the iguana community where he has done, if anything, more direct conservation work than he has with turtles. So John is about twice as remarkable as most of us think. That's truly remarkable.

The IUCN/SSC Tortoise and Freshwater Turtle Specialist Group and Turtle Survival Alliance established the Behler Turtle Conservation Award in 2006, a major annual award presented

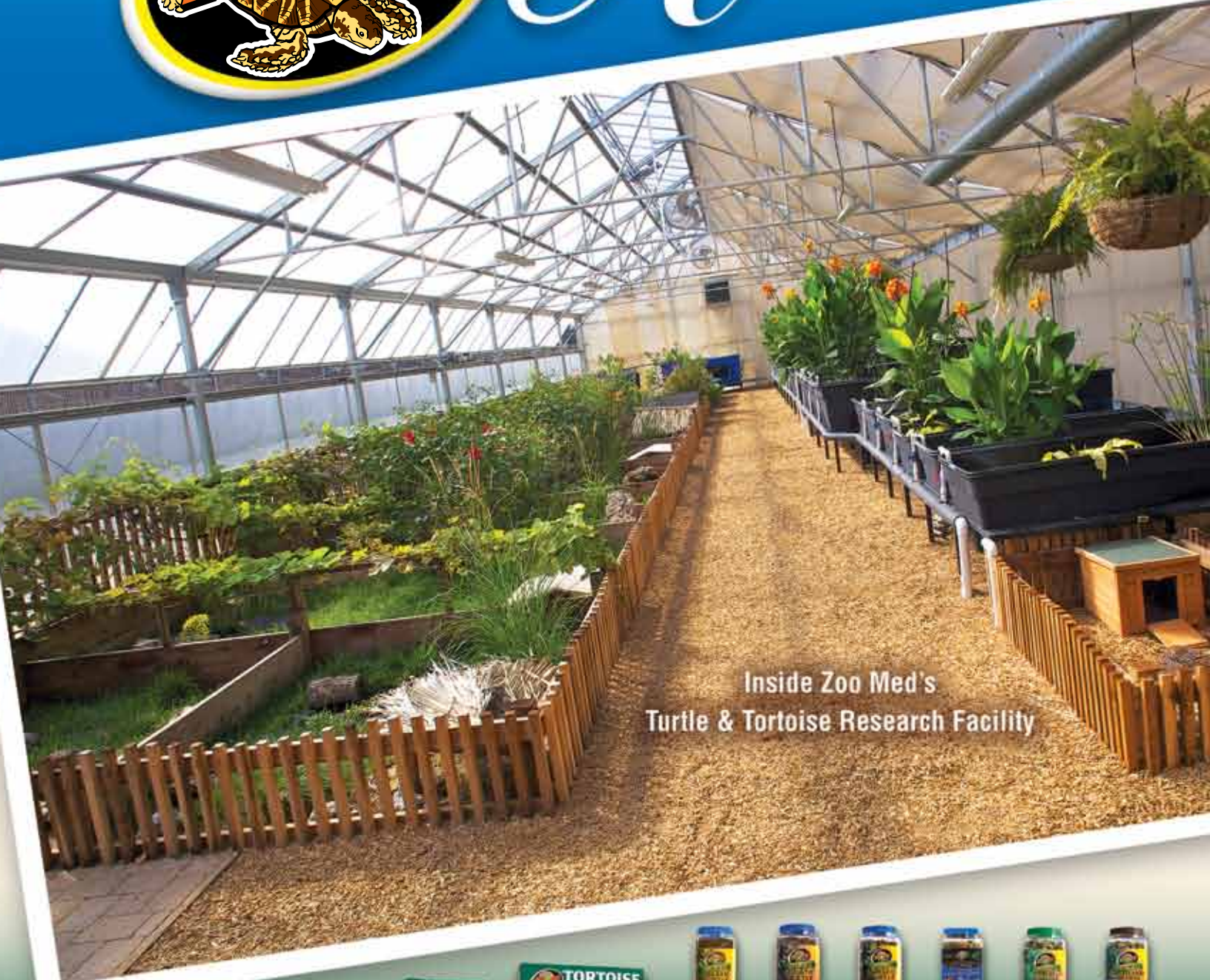


jointly by these groups to honor leadership and excellence in the field of tortoise and freshwater turtle conservation. The award honors the memory of John L. Behler, previous Chair of the Tortoise and Freshwater Turtle Specialist Group and Curator of Herpetology at the Bronx Zoo, Wildlife Conservation Society. The Award includes an honorarium of \$3,000, and co-sponsors this year are Chelonian Research Foundation, Conservation International, Chelonian Research Institute, Behler Chelonian Center, World Chelonian Trust, Wildlife Conservation Society, Deborah Behler, and Brett and Nancy Stearns.

Previous Behler Award honorees are Ed Moll, Whit Gibbons, Peter Pritchard, Gerald Kuchling and Bernard Devaux. In addition to honoring the life-time achievements of senior turtle and tortoise conservationists, the Award also honors conservation efforts by younger individuals who make major contributions to the field. Recognizing and valuing the often tireless and dedicated efforts made by all these individuals is important, and the Behler Award hopes to provide some inspiration and reward for those who have demonstrated excellence and leadership on the front lines of global turtle conservation efforts.



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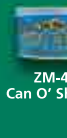
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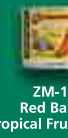
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Papaya
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ZM-154
Papaya &
Red Banana
Tropical Fruit
Mix-ins



ZM-45
Can O' Shrimp



ZM-152
Red Banana
Tropical Fruit
Mix-ins



ZM-153
Mango & Papaya
Tropical Fruit
Mix-ins

Turtle NIRVANA

We Don't Just Understand Turtles...We Breed Them

**Black-Knobbed
Sawback
Turtle**



**Gulf Coast
Box Turtle**



***Turtles
hatched
and raised
at Zoo Med***

**Pink Belly
Side Necked
Turtle**



Eastern Painted Turtle



NEW

RH-20
ReptiTherm®
Habitat Heater



EE-8 Eco Earth®
Loose Coconut
Fiber Substrate



RH-10 Reptibator
Digital Egg Incubator



FS-24 Reptisun 5.0 UVB Fluorescent Bulb



OS-24 Reptisun 10.0 High
Output UVB Fluorescent Bulb



TD-20 Turtle Dock



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Publication
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The bushmeat trade in Africa continues to severely threaten many species of turtle and tortoise, including the Serrated Hinge-backed Tortoise (*Kinixys erosa*). This enigmatic species is being so heavily utilized as a protein source by isolated impoverished villages across Central Africa that many localized tortoise populations may have already gone extinct. Thus, in early 2011, TSA and their partners proactively began developing *ex-situ* assurance colonies for this species as a means to safe guard its continued existence.