

A PUBLICATION OF THE TURTLE SURVIVAL ALLIANCE

Turtle Survival

2013



RICK HUDSON

FROM THE PRESIDENT'S DESK

Strengthening the Culture of Turtle Conservation: TSA's Expanding Global Network



PHOTO CREDIT: SHEENA KOETH

cues from the IUCN Red List process, as well as a prioritized list of turtle diversity hotspot countries, we are always looking for opportunities where we can be both effective and strategic, partnering with other organizations when possible. Given that we often find ourselves in an emergency intervention mode, struggling to save species that have reached critically low numbers, many of our programs involve a captive component such as headstarting or assurance colonies. The sad reality is that we are seeing a growing number of species that, at least for the foreseeable future, have little chance for survival in the wild. As much as we strive to save species in their native country, some species continue to decline. Market driven collecting pressures are simply too intense for them to persist. For this group of species, and in striving to maintain our commitment to zero turtle extinctions, we launched the Turtle Survival Center (TSC) in 2012.

The TSC is rapidly developing into a centerpiece of our network of global assurance colonies and we have finally consolidated much of our collection at the South Carolina facility. Three full time staff are now living on site and construction and renovation work has been moving at a steady pace all summer. New Phase One facilities include a tortoise barn, a quarantine facility, a complex for forest and shade-dwelling species and several greenhouses. These facilities will provide space to hold our core collection, but we will need to expand rapidly as the collection grows. Maintaining well-managed and genetically diverse assurance colonies requires a lot of space, and the SC site is designed for expansion. These are exciting times for the TSA as we work to develop the TSC while maintaining critical support to our field programs. As challenging as these undertakings are, the decision was made easy by one overriding fact: we simply didn't have a choice. We take our commitment to preventing turtle extinctions very seriously, and the TSC will, in time, transform the face of the TSA as well as our ability to impact turtle conservation. To our many members, volunteers and supporters, please realize how much we value your contributions and all that you do to improve the outlook for turtles and tortoises. We look forward to the day when we can host you at the TSC.

Recently Dwight Lawson (TSA Vice President) and I were presented with a question from a reporter about the range and impact of TSA's activities around the world. After some thought, we both arrived at a similar response about what sets TSA apart: Dwight said that TSA has created a global network – I called it a culture – that not only inspires, but catalyzes and facilitates turtle conservation work. Regardless of the terminology, the fact that TSA exists, and is expanding its reach into an increasing number of turtle diversity hotspots, provides opportunities to our many colleagues that are facing turtle conservation challenges. The message is clear: they are not alone and there are resources available to help. We take great pride in the TSA's ability to take swift action and to respond in the face of a crisis. This is especially true with wildlife trade – overwhelmingly the leading threat to the survival of turtles and tortoises worldwide – where the TSA network

has vastly improved the capability to humanely deal with confiscations. Enforcement officials dealing with a seizure of turtles need to know that they have somewhere to turn, and from Burma and India to Madagascar, the TSA is providing that service. Our growing network is often able to provide the needed resources – whether it is veterinary assistance, husbandry training or technical support – and our lines are always open. Are we everywhere we need to be around the globe? No, but we are working to expand our network into new hotspots, with Indonesia on the horizon. We also seek to increase partnerships among grassroots organizations, working locally to protect specific populations, because at the end of the day, that is where the battle to save turtles will be won or lost.

Where TSA works across the globe is influenced by a number of factors, and we have refined our strategy over the years. Taking our

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ABOUT THE COVER: This year's cover photo for Turtle Survival is largely symbolic, combining images of the new Turtle Survival Center (TSC) in South Carolina with an Asian box turtle (*Cuora*), one of the primary targeted species groups. *Cuora* are emblematic of the reason why the TSA must develop such a Center, and represent the most threatened group of turtles in the world: 12 of the 13 recognized species are ranked Critically Endangered by the IUCN Red List. Worse, some of the species are already extinct in the wild, or biologically extinct, meaning that the populations are too small to be viable, consisting mainly of scattered, aging adults. Sadly, the number of turtle species "slipping through the cracks" and edging closer to extinction is growing, victims of chronic and uncontrolled poaching pressures. For these species, the TSC is being developed. When fully operational, the Center will provide a secure future to at least twenty species that have little chance for survival in nature, having essentially become refugees in their native lands. PHOTO CREDIT: CRIS HAGEN



<http://www.facebook.com/TurtleSurvival>



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Changes to the TSA Board of Directors

The Turtle Survival Alliance is pleased to announce the appointment of Dr. Robert Wiese to the TSA Board of Directors. Dr. Wiese serves San Diego Zoo Global as the chief life sciences officer. In this role he is responsible for a variety of administrative, operational and budgetary activities. Prior to taking this position in 2006, Bob worked at the Fort Worth Zoo as director of animal collections. He also served as assistant director of conservation and science for the Association of Zoos and Aquariums (AZA).

Well versed in conservation and animal care projects, Bob has worked with a variety of taxa, helping develop the AZA's Species Survival Plan for numerous species. He has also done extensive field work studying bird species in Southern California and bullfrog populations in the Western U.S., the topic of his doctoral dis-

sertation. A centerpiece of Bob's work with the AZA community is a diverse, extensive body of literature on breeding strategies to maintain genetic diversity in zoo populations and to aid the recovery of endangered and threatened species. He has authored or co-authored dozens of books, articles and papers and has held training courses and made presentations throughout the world to professional and academic organizations.

Board member Raymond A. Saumure recently stepped down from the Board, citing a desire to streamline his professional obligations and spend more time with his family. Ray's keen sense of strategic planning was greatly appreciated and his ideas for short and long term development solutions will continue to influence the TSA. Ray served generously during his time on the Board and is committed to continuing support of the TSA.



About the Turtle Survival Alliance

The Turtle Survival Alliance (TSA) was created in 2001 in response to the rampant and unsustainable harvest of Asian turtles to supply Chinese markets, a situation that came to be known as "The Asian Turtle Crisis." For its first seven years, the TSA worked under the umbrella of the World Conservation Union (IUCN). In 2005, it was registered as an independent 501(c)(3) non-profit, based in Fort Worth, Texas and a dedicated Board of Directors was selected in January 2009. From the day it was founded until today, the TSA has remained focused on a single goal: no turtle extinctions in the 21st century.

The TSA is an action-oriented global partnership, focusing on species that are at high risk of extinction, and working in turtle diversity hotspots around the world. Working in collaboration with zoos, aquariums, universities, private turtle enthusiasts, veterinarians, government agencies, and conservation organizations, the TSA is widely recognized as a catalyst for turtle conservation with a reputation for swift and decisive action. With projects or programs in Belize, Colombia, Europe, Madagascar, Senegal, and throughout Asia, the TSA has grown into a global force for turtle conservation. The opening of the Turtle Survival Center in South Carolina has greatly enhanced our ability to protect the most vulnerable species through ex-situ captive breeding.



Meet the Staff



CHRISTINE BOWIE

As the TSA has grown over the years, the role of Heather Lowe, our long time Program Coordinator, has also grown. With the advent of the Turtle Survival Center, it became clear that it was no longer possible for one person to do all that was required to keep the TSA functioning smoothly. As a result, Heather has been promoted into the position of TSA Program Manager and we are pleased to welcome Christine Bowie aboard as the organization's new Program Coordinator. Christine comes to the TSA after eight years as a manager in the Fort Worth Zoo's animal department. During her time in that role, Christine oversaw a collection that included many rare chelonians, affording her the opportunity to work with the TSA's Animal Management team. Before her time at the Zoo, Christine was in New York City with the Wildlife Conservation Society, where she worked at the New York Aquarium.

Christine will be helping with many of the daily operations of the TSA, including membership management and social media, and will be based at the Fort Worth Zoo.



LUKE WYRWICH

Luke joins the TSA team as the Lead Keeper at the Turtle Survival Center. His passion for turtles started at the age of five, when he began catching box turtles while camping in his native Missouri. Luke began his career by earning a bachelor's degree in Biology at Saint Louis University. While in school, he acquired a wide list of experiences, including water feature construction, field research with the University of South Dakota, and an internship in the Herpetarium at the Saint Louis Zoo.

After graduating, Luke moved to work in the Zoo Atlanta Herpetology Department. There he quickly found a niche as the zoo's turtle expert, having only chelonians under his direct care since 2010. In the last five years he has gained knowledge and skills that include enclosure design and construction, carpentry, and plumbing that will prove invaluable in his new role at the TSC. He also has extensive expertise in chelonian husbandry, having cared for more than 30 species and 150 specimens at Zoo Atlanta, most of which are from Southeast Asia.



SHEENA KOETH

Sheena Koeth joins the TSA team as Veterinary Care Manager at the Turtle Survival Center, and hails from the Cleveland Metroparks Zoo (CMZ), where she worked for 13 years as a Registered Veterinary Technician. With support from CMZ, she has been a field technician for the Gharial Conservation Alliance since 2008, as well as a volunteer consultant for TSA India. Sheena has volunteered with many field projects in the Cleveland area, including surveys for native turtle populations over several years. These opportunities were often used to teach field techniques to select students from Ohio State University's veterinary programs. Sheena has also guest-taught reptile medical techniques at both Cleveland area veterinary technology schools, and mentored many students.

Sheena was a volunteer consultant and exotic animal handler for humane officers during rescue and confiscation operations in Cleveland, as well as a member of the USDA Ohio Veterinary Emergency Responders. Over the past decade, Sheena has raised funds for TSA in many ways and has been a tireless volunteer. She brings to the TSA many years of experience with a special interest in turtles.

Turtle Biology and Conservation Notes

This section is intended to collect and publish scattered field records and observations that would be unlikely to be formally published through scientific journals or other established publications, but are worth recording. Submissions can include new locality records for species, exceptional size records, noteworthy observations of feeding, reproduction, predation or other natural history aspects, as well as items to summarise recent developments regarding the formal and informal conservation of tortoises and freshwater turtles worldwide, including (but not limited to) changes in laws and regulations covering turtles, establishment of protected areas of significance to turtles, changes in the Red List status of turtles, and proposed changes to turtle taxonomy. Text sections should be short, and where possible link to sources of more detailed information. Submissions of items for possible inclusion can be made at any time by emailing hlowe@turtlesurvival.org.



One of the deceased turtles from the Kinabatangan River. PHOTO CREDIT: DGFC/SWD

TURTLE DISTRIBUTION NOTES

Pelochelys cantorii: Two specimens of Asian Giant Softshell Turtle, *Pelochelys cantorii*, were recorded from the Kinabatangan River (5.40N, 118.02E), Sabah, Malaysia, on 23 March and 6 April 2013. The first, a male animal, weighed 26 Kg and with a shell (dorsal disk: bony carapace + cartilaginous margin) of 62.5 cm long and 58.4

cm wide along the curve; the second, a female, weighed 30 Kg with curved shell length of 72.5 cm and width of 61.6 cm and may have been underweight. Both animals were found floating dead in the river; no significant external or internal injuries were found on necropsy, and the animals were thought to have died of natural causes a few

days earlier. These are apparently the first records of *P. cantorii* from the Kinabatangan River.

Submitted by Peter Riger* <priger@houstonzoo.org>, Fernando Nájera** <fernando.najera@danau.com>, Sergio Guerrero Sanchez** and Benoit Goossens** <goossensbr@cardiff.ac.uk>

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RECENT CHANGES IN SCIENTIFIC NAMES OF TURTLES

The IUCN/SSC Tortoise & Freshwater Turtle Specialist Group's Turtle Taxonomy Working Group (TTWG) published its latest annual Checklist of Turtles in December 2012; it can be downloaded from <http://www.iucn-tftsg.org/checklist/>

Compared to the 2011 checklist, the following changes were adopted:

- The subspecies *Mauremys caspica siebenrocki* and *M. c. ventrimaculata* were synonymized, so that *Mauremys caspica* no longer has subspecies.
- *Chelonoidis petersi* was synonymized with *C. chilensis*.
- *Kinixys nogueyi* and *K. zombensis* were recognized as full species; they were previously treated as subspecies of *Kinixys belliana*. The

Madagascar form *domerguei*, previously placed as subspecies of *K. belliana*, was transferred to be a subspecies of *K. zombensis*.

Full details of the justification for these changes, and references to the original literature proposing these taxonomic changes, are given in the Annotations in the 2012 TTWG Checklist.

Opinion 2316 of the International Commission on Zoological Nomenclature (ICZN), published in March 2013, recommended that the name *Chelodina oblonga* Gray, 1841 be used for the northern Australian species currently known as *Chelodina rugosa* Ogilby, 1890, while the name *Chelodina colliei* Gray 1856 should be used for the longnecked turtle of southwestern Australia (traditionally called *C. oblonga*). Further information: <http://iczn.org/node/40312>

Opinion 2316 of the ICZN, also of March 2013, fixed the scientific name for the Aldabra Tortoise to *Testudo gigantea*, suppressing the name *Testudo dussumieri*, so that the current valid name is *Aldabrachelys gigantea*, and the names *Dipsoschelys* (genus) and *dussumieri* (species) should no longer be used. Further information: <http://iczn.org/node/40313>

Two new names for Alligator Snapping Turtles were coined by Raymond Hoser in April 2013. There are significant nomenclatural, technical and biological challenges inherent in these descriptions, and at this time it seems appropriate to treat the names *Macrochelys temminckii muscati* and *Macrochelys maxhoseri* as synonyms of *Macrochelys temminckii*.

Peter Paul van Dijk, p.vandijk@conservation.org

TURTLE TRADE REGULATION CHANGES AT THE 16TH CITES CONFERENCE OF PARTIES

Tortoises and freshwater turtles played a significant supporting role at the 16th CITES Conference of Parties held in Bangkok, Thailand, 3-14 March 2013.

A total of 26 species native to Asian and North America were added to Appendix II, including *Mauremys nigricans*, *Geoemyda spengleri*, *Sacalia bealei* and *S. quadriocellata*, *Palea steindachneri*, *Pelodiscus axenaria*, *P. maackii* and *P. parviformis*, and *Rafetus swinhoei*, which were previously covered by China's Appendix III listing, and *Clemmys guttata*, *Emydoidea blandingii*, *Malaclemys terrapin*, the genus *Cyclemys*, *Geoemyda japonica*, *Hardella thurjii*, *Mauremys japonica*, *Melanochelys trijuga*, *Morenia petersi*, *Vijayachelys silvatica*, *Dogania subplana*, *Nilssonina formosa*, and *N. (Aspideretes) leithii*, which were not covered by CITES previously.

Sixteen species already listed in Appendix II had zero quotas imposed for trade in wild-

collected animals for commercial purposes: *Chelodina mccordi*, *Batagur borneoensis*, *B. trivittata*, all *Cuora* species except *C. amboinensis*, *Heosemys annandali*, *H. depressa*, *Mauremys annamensis*, and *Orlitia borneensis*.

Four species were transferred from Appendix II to App. I: *Platysternon megacephalum* (as Family Platysternidae), *Geocheilone platynota*, *Chitra chitra*, and *C. vandijki*. All these changes came into effect in June.

In parallel, 17 Decisions were adopted, which collectively direct the Parties to improve enforcement of existing laws and regulations, and to improve reporting on legal and illegal turtle trade, on trade in parts and derivatives, and on confiscations; direct the CITES Secretariat to compile and analyze this information, where possible with the assistance of external consultants; direct the Secretariat to engage external consultants to provide guidance to making non-detriment

findings for turtles and develop and distribute identification materials; and direct the Animals and Standing Committees to evaluate this information and act on it, as well as include three turtle species in the Periodic Review as a matter of priority. Over time, these measures should reduce the impact of exploitation on turtle populations and increase their prospects for survival at ecologically meaningful densities.

The original proposals can be accessed at <http://www.cites.org/eng/cop/16/prop/index.php>, results can be found at <http://www.cites.org/eng/notif/2013/E-Notif-2013-012.pdf>, the Decisions regarding turtle trade are in document 58 at <http://www.cites.org/eng/cop/16/doc/index.php>, and detailed records of discussions are at <http://www.cites.org/eng/cop/16/sum/index.php>.

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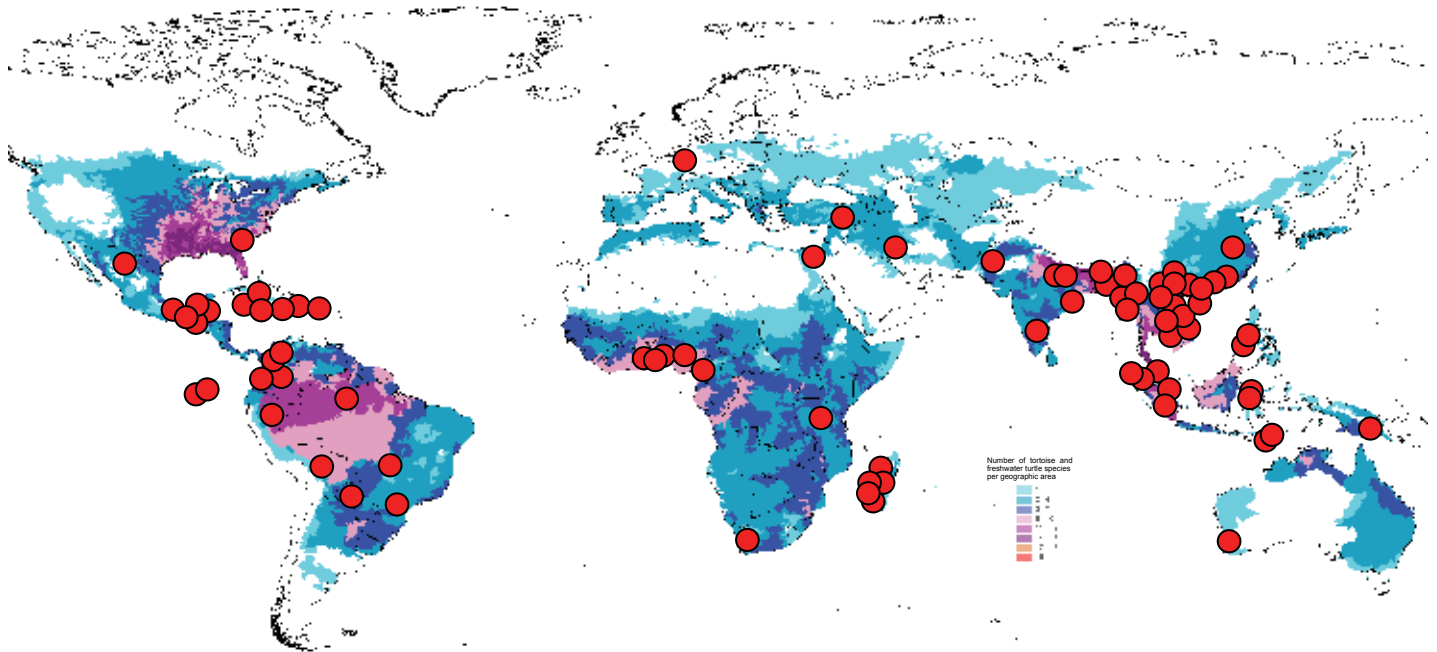
Partners are the Key to Our Success

From our inception, the TSA was intended to be an alliance of partners that shared in a common goal – *zero turtle extinctions*. Since our formation in 2001, partnerships have proven to be the secret to our success. The organizations listed here 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.



TURTLE CONSERVATION FUND



Approximate locations of all TCF projects funded from 2003 to 2013. Each dot represents one or more projects in the same approximate location (multiple projects in China, Myanmar, and Madagascar and elsewhere are represented by only a few dots each).

The Turtle Conservation Fund: 2002–2013 Update

ANDERS G.J. RHODIN AND HUGH R. QUINN

The **Turtle Conservation Fund (TCF)** was founded in 2002, initially as a partnership initiative of Conservation International, the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, and the Turtle Survival Alliance. It has since expanded to also include the Shellshock Campaign of the European Association of Zoos and Aquaria, Humane Society International–Australia, the Turtle Conservancy, and Chelonian Research Foundation. Primary support for the TCF and its grant-making capabilities has come from the Shellshock Campaign, Humane Society International–Australia, the Frankel Family Foundation, and extraordinarily generous private donations from George Meyer and Maria Semple, with logistic and operational support from Conservation International and Chelonian Research Foundation, and welcome venue support for its meetings from the Turtle Conservancy, the Maritime Hotel, the TSA Symposium, and the National Aquarium.

Attesting to its international perspective, the TCF advisory and review board is composed

of 27 turtle experts from ten nations who are globally active in turtle conservation: Hugh R. Quinn and Anders G.J. Rhodin (Co-Chairs), Gary Ades, Chris B. Banks, Kurt A. Buhlmann, Antoine Cadi, Bernard Devaux, Matt Frankel, Eric Goode, Douglas B. Hendrie, Brian D. Horne, Rick Hudson, John Iverson, Gerald Kuchling, Richard Lewis, Luca Luiselli, George Meyer, Russell A. Mittermeier, Vivian Páez, Hans-Dieter Philippen, Colin Poole, Peter C.H. Pritchard, Martina Raffel, Walter C. Sedgwick, Peter Paul van Dijk, Andrew Walde, and Henk Zwartepoorte.

From its first grants awarded in 2003 through its most recent funding cycle in February 2013, the TCF has supported turtle conservation projects in 40 nations around the globe (see map). An impressive total of over \$687,000 in grants has been awarded to 147 projects, directly benefitting 93% of the IUCN Red List's Critically Endangered tortoises and freshwater turtles. Last year alone TCF provided \$71,955 to 17 projects in nine nations, helping more than a dozen highly imperiled

species, as well as providing support for the TSA's new Turtle Survival Center in South Carolina.

A total of 436 grant proposals for a total of \$2,325,642 in requests have been received by TCF to the present, of which 34% have been funded. The average award has been about \$4700, with support ranging from \$1000 to 10,000 per project. Of the Turtle Conservation Coalition's "Turtles in Trouble: The World's Top 25+ Most Endangered Tortoises and Freshwater Turtles – 2011," projects representing all 25 species have been funded. Of TCF's 57 Priority Species (August 2012 list), projects representing 40 (70%) have been supported, and the TCF has also provided support for facilities and projects that impact many additional species.

Through the ongoing efforts of TCF and its partner institutions and individuals, we will ardently and passionately continue to pursue our mission to conserve the world's tortoises and freshwater turtles so that no more species become extinct in our time.



Construction is underway on a new turtle conservation center in Nepal. PHOTO CREDIT: ARCO NEPAL

Nepal's Budo Holy Turtle Rescue and Conservation Center Under Construction

HENK ZWARTEPOORTE AND HERMANN SCHLEICH

Founded in 1997, ARCO-Nepal (Amphibian and Reptile Conservation of Nepal), is a conservation society whose mission includes increased awareness of biology, systematics, and the conservation of amphibians and reptiles in Nepal. The acronym ARCO utilizes an English translation of the Nepali name to emphasize international collaboration. "Arco" in Nepali also means "the bow", or "rainbow", a symbol for nature that spans our efforts, and also serves as ARCO's colorful logo.

ARCO-Nepal actively supports the Turtle Conservation Project (Systematics, Biology and Conservation of the Turtles of Nepal), an endeavor approved by the Nepalese government

in January 1997. We also study the conservation needs and habitats of the amphibian and reptilian fauna of our nation.

THE CHELONIANS OF NEPAL

It is believed that there may be up to 17 turtle species in Nepal, though only 14 have been confirmed at present, with all occurrences in the lower subtropical parts of the country.

Future investigations are needed to determine whether species from neighboring countries such as *Geoclemys hamiltoni*, *Morenia petersi*, or the big Batagurs (*B. donghoka*, *B. kachuga*) ever were or might still exist within Nepal's borders. All freshwater turtle species and

tortoises in Nepal currently have some degree of endangered status.

THE BUDO HOLY TURTLE CENTER UNDER CONSTRUCTION

With its launch in 1997, ARCO-Nepal began planning and researching the construction of a turtle rescue and conservation center, along with the establishment of a turtle recovery plan that would benefit the local Nepalese people. The Budo Holy project in southeastern Nepal will be the culmination of this effort, offering a win-win scenario for both endangered turtles and local people.

Once built this rescue and breeding center, will become a home for priority species that will be kept

and bred here in order to establish local assurance colonies. Within the center's protected wetlands, freshwater turtle species will be reintroduced in collaboration with and under the surveillance of the Department of National Parks & Wildlife.

In April 2012, a Memorandum Of Understanding was signed between local Nepali authorities (SUMMEF) and ARCO Nepal, making the turtle conservation center a joint venture. ARCO has agreed with the Nepalese government to contribute \$35,000 for the development of the turtle breeding center. 15,000 is needed to start planning, designing and building. In 2012, the Dutch and Belgium Turtle and Tortoise Society (NBSV) agreed to fund the project from 2012 to 2014, a promising start that should allow us to get construction underway. Other funding sources are being explored.

Important work has already been completed outdoors at the Budo Holy park. The park's large main lake—once empty—has now been filled with water thanks to the repair of its dam, and plantings have been added. A smaller lake and several pools are under construction and will be done soon. All these water bodies have been fenced to keep turtles in and unwanted people out.

At present, turtles found by local people in the vicinity of the Budo Holy park are brought to the already existing SUMMEF park's recreation lake—an unprotected visitors area. These animals will eventually become the founder animals for ARCO's assurance breeding colonies. Breeding and rearing tanks are planned in the future, as are quarantine areas and a small veterinary room for examination, treatment and isolation of sick animals. Plans have been drawn up for the buildings.

Participation by local people is vital to the success of this project. We hope, for example, to get nearby communities involved in breeding food items such as live fish, and growing vegetables, to fulfill the daily dietary needs of turtles kept at the center.

ARCO'S ONGOING EDUCATION INITIATIVES

The Budo Holy project also will include a strong awareness and education component, which is still under development. Booklets and posters have already been created for the program, and are available to local education groups as a free download from our website at www.ARCO-Nepal.de. In summer 2013, a completely new and updated Nepal field guide will be issued by ARCO-Nepal.

Henk Zwartepoorte, TSA Europe chair, NBSV conservation officer and ARCO Nepal Advisory board, h.zwartepoorte@rotterdamzoo.nl; Hermann Schleich, Chair ARCO Nepal and ARCO Spain, schleich.hermann@t-online.de.



Dried "wetland" before damming. PHOTO CREDIT: ARCO NEPAL



Restored main lake. PHOTO CREDIT: ARCO NEPAL



Hatchling of the Indochinese Box Turtle (*Cuora galbinifrons*). PHOTO CREDIT: ROLAND WIRTH

OFFSPRING HATCHED AT IZS IN 2012

No. of hatchlings	English name	Scientific name
16	Red-necked Pond Turtle	<i>Chinemys nigricans</i>
9	Yellow-headed Box Turtle	<i>Cuora aurocapitata</i>
1	Bouret's Box Turtle	<i>Cuora boureti</i>
6	Golden Coin Box Turtle	<i>Cuora cyclornata cyclornata</i>
6	Meier's Golden Coin Box Turtle	<i>Cuora cyclornata meieri</i>
1	Ryukyu Yellow-margined Box Turtle	<i>Cuora flavomarginata evelynae</i>
3	Indochinese Box Turtle	<i>Cuora galbinifrons</i>
14	McCord's Box Turtle	<i>Cuora mccordi</i>
7	Zhou's Box Turtle	<i>Cuora zhoui</i>
3	Arakan Forest Turtle	<i>Heosemys depressa</i>
1	Sulawesi Forest Turtle	<i>Leucocephalon yuwonoi</i>
13	Vietnamese Pond Turtle	<i>Mauremys annamensis</i>



Five hatchlings of Zhou's Box Turtle (*Cuora zhoui*), hatched in 2012. PHOTO CREDIT: ROLAND WIRTH

Best Year Ever at the International Centre for the Conservation of Turtles (IZS) at Muenster Zoo

DR. MARTINA RAFFEL AND ELMAR MEIER

2012, with a total of 80 hatchlings of 12 species/subspecies, has been the most successful year ever for the nearly ten-year old breeding program of the IZS at the Münster Zoo – a joint project of Muenster Zoo, the Zoological Society for the Conservation of Species and Populations (ZGAP), and the German Herpetological Society (DGHT).

Within the species of the genus *Cuora* altogether 46 offspring hatched. A Sulawesi Forest Turtle (*Leucocephalon yuwonoi*) and three Arakan Forest Turtles (*Heosemys depressa*) also hatched. A larger number of the Red-necked Pond Turtle (*Chinemys nigricans*) and the Vietnamese Pond Turtle (*Mauremys annamensis*)

were incubated again in 2012, at the request of other institutions and potential holders. A total of 415 *C. nigricans* specimens were hatched, with more than 400 of them surviving from the start of operations in 2003 up to December 2012. About two-thirds of these have been transferred on breeding loan to zoos, museums, rescue centers, or to experienced private turtle enthusiasts in ten countries.

A major transfer was the import of 21 *Cuora cyclornata* on breeding loan from Kadoorie Farm and Botanic Garden, Hong Kong. Sixteen of these were transferred to four studbook participants of the European Studbook Foundation, while five of them remained within the IZS. The first eggs

have been laid in 2013, and we expect hatching to begin soon.

Another major transfer will hopefully take place very soon: In cooperation with Rotterdam Zoo it is planned that offspring of the Vietnamese Pond Turtle from Münster, Rotterdam and a German private breeder will be transferred to Vietnam. They first will be housed at the "Turtle Conservation Center" at Cuc Phuong National Park. As soon as the proposed turtle station in central Vietnam has been established, they will be moved into their area of origin.

Dr. Martina Raffel, Curator for *in situ* Conservation, Allwetterzoo Muenster, Sentruper Strasse 315, 48161, Muenster, Germany raffel@allwetterzoo.de.



A hatchling Spiny Hill Turtle (*Heosemys spinosa*) at the Prague Zoo. PHOTO CREDIT: PETR VELENSKY

Nine Year Effort to Breed Spiny Hill Turtle (*Heosemys spinosa*) Succeeds at Prague Zoo, Czech Republic

PETR VELENSKY

A group of 30 Spiny Hill Turtles (*Heosemys spinosa*) arrived at the Prague Zoo in January 2002 as part of a TSA rescue operation to save chelonians confiscated in Hong Kong. The Amphibian and Reptile Taxon Advisory Group (ARTAG) of the European Association of Zoos and Aquaria (EAZA) appealed to its members for assistance, and the Prague Zoo accepted five species of turtles, including *H. spinosa*.

We were building an Indonesian jungle house at the time, so immediately adapted a portion of it as an exhibit for endangered Southeast Asian turtles. Two nonpublic rooms behind-the-scenes were converted into a turtle breeding center.

The Hong Kong turtles settled in, and posi-

tive results came quickly. In 2003, we bred *Cuora amboinensis* for the first time. In 2006, we bred *Siebenrockiella crassicolis* and *Heosemys grandis*. In 2007, our first *Orlitia borneensis* hatched.

The only Hong Kong species that didn't breed successfully was *Heosemys spinosa*. Success would require a nine-year effort.

H. spinosa was originally the only species without a public exhibit; we felt exhibition would stress this sensitive species. Instead, in 2003 we set up a non-public breeding enclosure inside our greenhouse for a 1.2 group. The females lived inside a well-planted 4 x 2 meter enclosure. The adjacent male enclosure was placed behind a low wall, which the male could climb if he smelled a

receptive female. Ambient temperatures in the pen varied from 17°C (62.6°F) in winter to 30°C (86°F) in summer. A hotspot under an Osram Ultra Vitalux lamp was available every day. Feeding occurred twice weekly. For the first few years, the animals were fed a 50/50 protein mixture fused in gelatin/fruits (with mineral additives). Nowadays, they are offered 25 proteins/25 fruits/50 herbs.

In these stable quiet conditions, *Heosemys spinosa* made a slow recovery, increasing their breeding tendencies year-to-year. In 2005, the first broken egg was found unburied. In both 2006 and 2007, one egg with bacterial infection was found. In 2008, two eggs appeared, one properly buried, but neither developed. In 2009, two eggs were produced; one was incubated to 1/3 of embryo development then spoiled. In 2010, there were two eggs; one broke and one spoiled perhaps due to an incubation error. In 2011, three eggs spoiled (presumably due to poor quality eggs).

Finally in 2012, the turtles bred successfully. Both females laid twice, four eggs all together. One was infertile, but three juveniles hatched. The eggs were 45,4-57,0 grams in weight with the parameters 61,6x34,1 – 66,6x36,7mm (n=14). The Juveniles weighed 35,5-38,4 g, with a 51,7x51,7-53,1x53,3 mm (n=3) carapace length.

Through the years, we followed the Philadelphia Zoo/Knoxville Zoo protocol for incubation, which though unsuccessful at first, produced positive results with some adjustment. To achieve success, it was necessary to avoid the condensation of water on the eggshell after placing it in the incubator. To achieve this, we placed the eggs for several hours into an absolutely dry incubator and then moved them to slightly humid vermiculite. Temperatures during the 91-116 day incubation period oscillated between 25-27°C (77-80.6°F).

We have since moved the healthy juveniles into the public exhibit. They share space with *Varanus prasinus*, in a super-planted enclosure with a shallow pond at an ambient floor temperature of 25°C (77°F). In this enclosure, they disappear from view and are beyond our control. We see them once weekly. They are growing and thriving.

Heosemys spinosa appears to be a stress and heat sensitive species, requiring a long recovery period after suffering capture, transport and confiscation. Successful breeding at the Prague Zoo required nine years of proper care.

Petr Velensky, Curator of Reptiles, Prague Zoo, Czech Republic, address and email?



Morning catch at Wekiwa Springs State Park. Canoe filled with Peninsular Cooters, Red-bellied Cooters, Loggerhead Musk Turtles, and Common Musk Turtles. PHOTO CREDIT: NAFTRG

The North American Freshwater Turtle Research Group (NAFTRG)

ERIC C. MUNSCHER, EMILY H. KUHN, JESSICA S. MUNSCHER

The roots of the North American Freshwater Turtle Research Group go back fourteen years, to its origin as an undergraduate field class to investigate turtle populations at Wekiwa Springs State Park in Orlando, Florida. The class was offered by Dr. Brian Hauge (then at Pennsylvania State University, now at Peninsula College, Washington) and Dr. Brian Butterfield (Freed-Hardeman University, Tennessee).

Eric Munsch took over as principal investigator in 2004, and the research group's vision extended beyond the original field-class model as it expanded its surveying efforts to seven spring systems in Florida and one in Texas.

Lacking an official university affiliation, Eric recruited research participants among friends and colleagues. Several former undergraduate



Dr. Brian Hauge teaches students how to process turtles. PHOTO CREDIT: NAFTRG

participants (many professionals in their respective fields) now volunteer annually, and they have involved their own students and colleagues.

In 2008, the group renamed itself the Central Florida Freshwater Turtle Research Group. Today CFFTRG has spread across the nation, with over 250 members and volunteers from 14 states. Between 1999 and 2013 more than 200 undergraduate students conducted research through the group. Many have used the skills learned and data collected to further their academic and professional careers.

In 2012, CFFTRG merged with the Turtle Survival Alliance, becoming TSA's official North American working group. It renamed itself the North American Freshwater Turtle Research Group. NAFTRG's mission is to increase awareness and understanding of conservation research efforts concerning turtles through direct involvement of community members in research methods.

SITES AND TURTLE SPECIES STUDIED

NAFTRG research sites include four spring systems in Florida's St. Johns River watershed: Wekiwa Springs, Rock Springs Run, De Leon Springs, and Blue Spring. We also survey at three spring systems in Florida's Suwannee River drainage: Peacock, Fanning, and Manatee Springs. Recently we added Comal Springs, TX. All of the study sites are relatively well protected, but each faces human pressures. Understanding the effects of these pressures on turtles and other aquatic/semi-aquatic organisms is key to conserving natural landscapes.

Within our study sites, we have marked over 5,200 turtles and captured over 9,300 turtles representing 13 species, including the Peninsula Cooter (*Pseudemys floridana peninsularis*), Florida Red-bellied Cooter (*Pseudemys nelsoni*), Texas River Cooter (*Pseudemys texana*), Yellow-Bellied Slider (*Trachemys scripta scripta*), Red-Eared Slider (*Trachemys scripta elegans*), Common Snapping Turtle (*Chelydra serpentina*), Florida Snapping Turtle (*Chelydra serpentina oceloa*), Florida Softshelled Turtle (*Apalone ferox*), Alligator Snapping Turtle (*Macrochelys temminckii*), Florida Chicken Turtle (*Deirochelys reticularia chrysea*), Loggerhead Musk Turtle (*Sternotherus minor*), Common Musk Turtle (*Sternotherus odoratus*), and Striped Mud Turtle (*Kinosternon baurii*).

METHODS

Turtles are captured primarily by hand while snorkeling. All are measured, weighed, sexed,



Wekiwa Springs State Park sampling crew processing turtles: Eric Munscher and Jesse Wayles assisting in tattooing Florida Softshell # 44. PHOTO CREDIT: NAFTRG

observed for physical damage/parasites, and then marked. From 1999 to 2007 turtles were marked using an adaptation of Cagles' (1939) shell notching method. This technique is limited by its inability to mark soft-shelled species, obscuration due to damage, and a finite numbering system. In 2007, Andrew Weber adapted the use of a cordless tattoo wand for marking soft-shelled species (Weber et al. 2011). In 2009 we began using passive integrated transponder (PIT) tags as a redundant marking method.

SUMMARY

We have a wealth of data on the turtles in our research systems, and the possibilities for analysis appear endless. Our original goal was to obtain periodic population parameters for monitoring the health of turtle populations. However, after over a decade of data collection and ecosystem observation, this goal seems too limited. Other areas of basic ecology and conservation research that have captured our interest lately are genetic, dietary, home range and nesting analyses. We welcome collaborations with our efforts and also welcome novel research ideas. Our vision is to continue conducting important

conservation research that involves students and citizen scientists. We feel that the key to conservation is public support. By engaging the community and sharing our methods and findings, we promote scientific literacy and increase the likelihood of public support for conservation policies and funding of conservation research.

To get involved, please contact us. Visit our Facebook page or the Turtle Survival Alliance's website and look for The North American Freshwater Turtle Research Group (NAFTRG).

Eric C. Munscher, SWCA Environmental Consultants, 7255 Langtry, Suite 100, Houston, Texas 77449; Emily H. Kuhns, emilyhkuhns@gmail.com; Jessica S. Munscher, Houston ISD, Dechamues Elementary, 155 Cooper Rd, Houston, Texas 77076.

ACKNOWLEDGEMENTS

This volunteer research program has succeeded due to the dedication of the students and citizen scientists attending sampling sessions. We gratefully acknowledge grant support from: The Friends of the Wekiwa River Foundation, Wekiwa Wild and Scenic Committee, and Disney's Animal Kingdom. Thanks also go to SWCA Environmental Consultants.

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Abnormally high precipitation this year have created abysmal construction conditions. PHOTO CREDIT: CRIS HAGEN

Breaking Ground on the Turtle Survival Center

CRIS HAGEN, RICK HUDSON AND SCOTT DAVIS

In February 2011, the TSA Board of Directors made the boldest move in the organization's eleven-year history when they voted to purchase a 50-acre property in coastal South Carolina to be developed as a Turtle Survival Center (TSC). A former crocodilian and wildlife rehab facility, the site was perfect for maintaining assurance colonies of endangered turtles and tortoises.

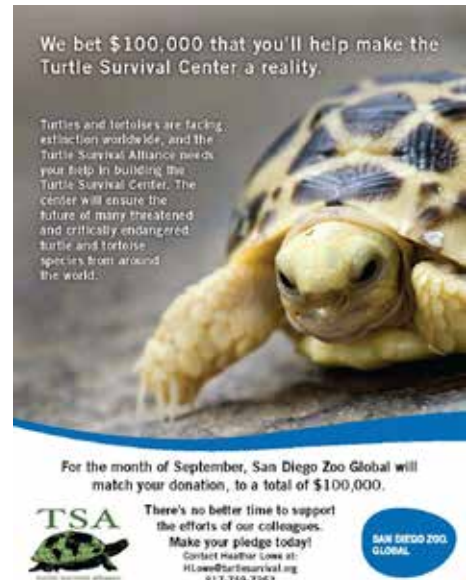
In the end, the decision wasn't difficult: the Board felt it had no other choice if the TSA was to maintain its commitment to zero turtle extinctions. It has become very clear that *in situ* efforts to protect wild populations are inadequate to ensuring the survival of many turtle species. *Ex situ* captive populations are necessary, making the TSC vital to our mission. The decision was made easier by Board Member Pat Koval's commitment

to put up half of the asking price for the land.

From the outset, we chose to base the TSC Collection Plan on the most up-to-date data available on Asian turtles and tortoises, including key workshops held in Singapore and China in 2011. Seven species of tortoises and 20 species of freshwater turtles—primarily Asian—were carefully selected for inclusion, based on the critical need of captive breeding for their survival. Four



The TSA Gratefully Acknowledges These Zoos for Their Generous Support of the Turtle Survival Center



This poster recognizes the 37 AZA zoos that have financially supported the TSC. The top two rows recognize our top donors.



Rick Hudson and Dr. Eric Miller, Director of St. Louis Zoo's WildCare Institute, record their \$10,000 donation to the TSC, pushing the bar closer to the \$100,000 challenge. PHOTO BY HEATHER LOWE

of the tortoise species and 17 of the turtle species are ranked by the IUCN Red List as Critically Endangered. Nine species are identified on the list of *The World's 25+ Most Endangered Tortoises and Freshwater Turtles*, as released by the Turtle Conservation Coalition in 2011. These numbers alone speak convincingly and hopefully to the TSC's eventual impact on the survival of many of the most endangered chelonians in the world.

CAPITAL CAMPAIGN

At our annual conference in Tucson in August 2012, the TSA officially announced its plans for the TSC and embarked upon an ambitious capital

campaign, targeting \$1.6 million over five years. That figure included the \$400,000 purchase price, \$300,000 for construction and renovation, and \$900,000 for facility operations through 2016.

After Pat's generous jump start, the campaign received its second major "shot in the arm" when San Diego Zoo Global put up a \$100,000 challenge, contingent on matches by the zoo community. The TSA set up a booth in the exhibit hall at the American Zoo Association (AZA) meeting in Phoenix, AZ in September 2012 and began seeking matches for San Diego's generous challenge. We not only met but exceeded the San Diego Zoo

San Diego Zoo Global announced their \$100,000 challenge at the AZA conference with this flyer that went to all delegates.

challenge. To date, 38 AZA zoos and aquariums have pledged support for the TSC; that includes some very important multi-year commitments. At the time of this writing we have raised \$935,195 toward our goal of \$1.6 million, with zoos contributing \$406,150 of that total.

TAKING OWNERSHIP

The TSA officially closed on the TSC property on 21 January 2013, bringing to fruition nearly two years of discussion, fundraising, and facilities planning. Work began immediately to prepare the facility for operation. The first steps were to clean up the property, retrofit the existing facilities, and start construction. The first TSC volunteer work weekend was held on 9-10 February, and it was a huge success with enthusiastic support by loyal TSA members. Since then, there have been other volunteer work events, a veterinary team weekend to welcome the first influx of turtles, an AZA directors' open house and dinner, a TSA Board of Directors meeting, various small and large construction projects, as well as the arrival of visitors from around the globe.

Cris Hagen, TSA's Director of Animal Management, was the first person to permanently move to the TSC on 26 March, leaving a position that he had held for the past 11 years at the Savannah River Ecology Lab (SREL). Next in line to relocate to the TSC were 300 individuals of priority turtle species maintained at SREL—a move of 120 miles across the state. But before this



The TSA Board of Directors held their first of many meetings at the TSC in April 2013. The meeting was highlighted by Pat Koval kicking in another \$100,000 donation toward construction at the Center. PHOTO CREDIT: RICK HUDSON



Thomas Rainwater and Cris Hagen cooking "Low Country Boil" for the TSA Board Dinner while Zuli looks on. PHOTO CREDIT: SHEENA KOETH

mass chelonian relocation could take place, facility renovations and construction had to be completed to provide the highest quality husbandry and security. Although the TSC is still a work in progress, we moved 91 turtles of 17 species from SREL to the TSC by the end of June.

CONSTRUCTION

The TSC property operated as a wildlife center under the direction of Dr. Sam Seashole for

many years prior to the TSA purchase. Therefore, we spent most of the first two months cleaning and reorganizing the center. Trips to the county waste disposal facility were frequent as we removed bird and mammal holding facilities and renovated barn stalls to become turtle holding areas.

In spite of extremely rainy weather throughout the first six months of construction, we have made significant progress since

our start on March 27th. Construction of an outdoor complex for forest and semi-aquatic species was initiated by Dave Manser (Ponds and Plants) and is nearing completion as of this writing. A 20' x 40' tortoise building and a 20' x 50' quarantine building have been erected. New ponds have been dug to accommodate F1 groups that are produced at the Center over the coming years. Drainage fields have been created to handle water usage, and hundreds of feet of plumbing and electrical wire have been buried. An 11-acre area was encircled by an eight foot high, electrified perimeter security fence.

During the remainder of 2013, we plan to complete two forested habitat complexes, finish out the interiors of the tortoise and quarantine buildings, erect several greenhouses, renovate one of the barn stalls into a kitchen and food preparation area, and install additional layers of security.

As facilities have been completed, turtles have begun being relocated to the TSC. As turtles arrive at the Center, they receive health assessments; blood is drawn and banked for DNA testing; animals are given transponders; swabs and fecals are taken to conduct disease testing; and the animals are placed in quarantine. This work is made easier by the fact that the TSC facility came with a full clinic, including gas anesthesia, a portable x-ray unit, a blood chemistry analyzer, and a full surgical suite. The veterinary work is overseen by the TSC's veterinary advisory group, which includes Dr. Bonnie Raphael (WCS-Bronx), Dr. Keith Benson (Riverbanks Zoo), Dr. Sam Rivera (Zoo Atlanta), Dr. Charles Innis (New England Aquarium), Dr. Joseph Flanagan (Houston Zoo), and Dr. Shane Boylan (South Carolina Aquarium). Thanks to their help, we are well on our way to developing a complete set of husbandry and veterinary protocols and to ensuring the highest standard of care for TSC animals.

TSC STAFF

By mid-June we had a full staff at the TSC. Luke Wyrwich is our Lead Keeper and came to us from Zoo Atlanta where he managed their chelonian collection for the past five years. He brings a strong background in construction and maintenance, as well as first-hand husbandry experience with a number of the target species at the Center. Luke is currently tackling the numerous construction projects that are underway.

Sheena Koeth is our Veterinary Care Manager and comes to us from the Cleveland Metroparks Zoo with thirteen years of experience working as a veterinary technician. She will be the primary point person for all veterinary



Jeff McKenzie and Luke Wyrwich are having a hard time using this Ditch Witch in muddy terrain, Construction progress has been hampered due to abnormally wet weather leading to frustrations. PHOTO CREDIT: RICK HUDSON

The first of two tortoise barns under construction. Groups of Burmese Mountain, Burmese Star and Forsten's Tortoises will be managed here PHOTO CREDIT: CRIS HAGEN



Jay Allen and Theresa Stratmann cutting PVC pipe for the drains to the Forest Complex PHOTO CREDIT: RICK HUDSON



The walls of the Forest Complex being formed and poured during one of the few sunny days during the project. PHOTO CREDIT: CRIS HAGEN



More than 20 tons of gravel were removed from former crocodile pools by dedicated volunteers. PHOTO CREDIT: CRIS HAGEN



Filling this large dumpster with debris from around the property took only about 2 hours on the first volunteer work weekend in February. PHOTO CREDIT: RICK HUDSON

needs under the guidance of the TSC's veterinary advisory group. She is also responsible for implementing our record keeping system.

Theresa Stratmann began a two-month internship in late May and spent eight weeks with us this summer before starting her graduate degree at Clemson University. Theresa is a recent graduate of the University of Georgia's Odum School of Ecology and has several years

experience caring for TSC target species while volunteering at the Riverbanks Zoo.

The TSC staff quickly adapted to working well together in a rural area under difficult weather conditions. The team faces the enormous challenge of bringing the TSC on line while preparing to accommodate a diverse collection of highly endangered chelonians. The pressures are daunting and every day brings new and

unexpected trials. Recordkeeping systems must be developed, protocols written, and routines and schedules established. Fortunately, the team brings a diverse set of knowledge and skills to the TSC, and their backgrounds have prepared them well for meeting the challenges of developing and operating a professional turtle center.

VOLUNTEER WORK WEEKENDS

Two TSC work weekends in February and March were organized for TSA members to come out and volunteer their time and energy to clean up the site in preparation for construction. The hard work and dedication of TSA members has always been a key to our success and we were delighted by the great group of volunteers who showed up to help. Dumpsters were filled and hauled off, trees removed, trenches dug, and more than 20 tons of gravel removed from existing ponds during two days of back-breaking work. Hardware cloth was installed at the base of chain link fences surrounding existing ponds, and old pasture fencing was torn down. We are very appreciative of all the hard work volunteers contributed to the development of the Center.

Jay Allen (Aquarium Innovations), Kathy Vause (Riverbanks Zoo and Garden), and Roman Fletcher deserve special thanks for repeat visits and sustained commitment to the project. Kurt Buhlmann, Whit Gibbons, Judy Greene, Tracey Tuberville, Brian Metts, and Sean Poppy all contributed time and energy to transitioning turtles from SREL to the TSC.

On 6 April the TSC veterinary advisory group, along with veterinary technician Sheena Koeth, arrived for a hectic fun-filled weekend with Cris Hagen processing the first wave of



Cris Hagen and Theresa Stratmann collecting accession data on an Arakan Forest Turtle. PHOTO CREDIT: SHEENA KOETH



A veterinary team arrived at the TSC in early April to volunteer their time in processing the first wave of turtles arriving at the center from SREL. From left to right Dr. Charles Innis, Sheena Koeth, Dr. Joseph Flanagan, Dr. Bonnie Raphael, Dr. Keith Benson, Dr. Sam Rivera. PHOTO CREDIT: CRIS HAGEN



Cris Hagen ceremoniously releases the first turtle into one of the existing ponds following health screening during the big veterinary roundup in April. PHOTO CREDIT: SHEENA KOETH

arriving turtles. The vet team spent the weekend collecting quarantine samples and conducting health assessments on the first 47 turtles transferred from the SREL collection. These collaborative efforts are very important for the development of the TSC, and represent the first steps in establishing effective quarantine and disease prevention protocols for the Center.

The TSA is grateful for the expert care provided by the vet team. However, their dedication was not limited to veterinary medicine. Dr. Innis was the first to arrive and within minutes was mired in mud, shoveling wet cement to build walls for a forest enclosure. Dr. Flanagan baked home-made bread for the group every morning. The camaraderie was a true pleasure, and the seven people present shared in a significant occasion: the release of the first turtles into the outdoor ponds: 1.1 *Batagur borneoensis*, 1.3 *Orlitia borneoensis*, 11.14 *Mauremys annamensis*, 5.3 *Mauremys nigricans*, and 1.1 *Geoclemys hamiltoni*. On a poignant note, some of the first arrivals to the TSC were a group of three Burmese Mountain Tortoises and a pair of Sulawesi Forest Turtles, brought there as a result of the untimely passing of Dr. Greg Fleming, who had also planned to be a part of the vet team.

No sooner had the vet team departed the TSC than we began preparations for another arrival. On Thursday evening, 11 April, the TSC hosted over 40 delegates from the American Zoo Association mid-year conference in Charleston, SC. The group, which included directors, curators and AZA staff, spent two hours touring the facility and learning about our vision for the Center. That was followed by a southern BBQ dinner. The next night the TSA Board of Directors arrived for their annual board meeting, and they were treated to a traditional Low Country Boil prepared by Thomas Rainwater and Cris Hagen.

VISITORS

Despite the chaos, ongoing clean up and construction, we still found time to host a few turtle biologists. Maurice Rodrigues from the Turtle Conservancy stopped by in early April. Dick Vogt was conducting research in Charleston, SC, and came to the Center in late April. Nguyen Thu Thuy, Turtle Program Coordinator for the Asian Turtle Program, based in Hanoi, Vietnam, spent 2 days at the Center at the end of May. Bernard Devaux and Franck Bonin from SOPTOM in France, as well as Uzma Noureen from WWF Pakistan, spent an afternoon with us in early June.

As much as we enjoyed showing off the TSC, we are discouraging further visits until heavy construction is complete and the bulk of the TSA



Rick Hudson conducts a tour of the TSC for AZA Zoo Directors and Curators that came over from the AZA Mid-Year Conference in Charleston. Center PHOTO CREDIT: SHEENA KOETH

collection has been settled in to their new homes. We look forward to the day when the Center no longer looks like a muddy construction site!

SIGNIFICANT ACQUISITIONS

If there is a single group of turtles that stands to benefit most from the TSC, and which should be considered emblematic of the Center, it is the Asian Box Turtles (genus *Cuora*). The most imperiled group of turtles in the world, 12 of the 13 recognized *Cuora* species are considered critically endangered. Several are extinct in the wild, and others are biologically extinct, meaning their populations have reached such low numbers that they are no longer viable. Collecting pressures on the remaining wild stocks are so intense that their future rests solely on captive populations. The TSC was founded specifically for species in such dire straits.

Over the past year the TSC has acquired several groups of priority *Cuora* species through breeding loan agreements and donations. We were incredibly fortunate to be able to acquire founder adult specimens of *C. aurocapitata*, *C. bouretti*, *C. mccordi*, *C. pani*, *C. picturata*, and *C. zhoui*—most of which are presently unrepresented in the global captive population. These turtles will form the nucleus of important breeding programs at the TSC, and we expect these groups to thrive and reproduce well here in the moderate coastal climate of South Carolina. Although the low country climate and topography has presented challenges to our construction projects, it

is an excellent match to the climate of southern China where many of these species occur. Building highly secure and functional habitats for these species is our leading priority.

SUMMARY

The decision to acquire and develop the Turtle Survival Center was a bold move, and certainly one with risks. The successful launch of the Center certainly bodes well. But our overwhelming challenge over the next five years will be to continue the momentum behind the TSC, while simultaneously sustaining consistent funding for our many field programs—both efforts are vital to our mission. We have full time staff in Madagascar (2), Burma (2), India (6) and Colombia (1) that we cannot afford to lose if we are to meet growing threats and obligations.

The TSA Board and our core donors have proven their dedication to our mission time and again, and have always come through. They have now made a leap of faith, and shown vision in their simultaneous commitment to maintaining our field programs while also constructing the TSC. We trust that one day soon—when the TSC is firmly established and a handful of critical species have gained a foothold on a secure future—that our current financial travails will be but a distant memory. Then we will look back with pride and know that our bold gamble paid off.

Until that day, please join the TSA in helping make the TSC and our field programs thrive, for the betterment of chelonians around the planet.

ANIMAL MANAGEMENT
TURTLE SURVIVAL CENTER



Staff and volunteers work on new enclosures that will house shade-loving forest turtles and tortoises. PHOTO CREDIT: TSA



92 percent of Asian box turtles face extinction in the wild. The TSC will help ensure that these species, and others like them, do not vanish forever. PHOTO CREDIT: HENK ZWARTEPOORTE



This new Quarantine Building will initially house the large influx of tortoises coming over from SREL, but eventually be used for winter holding and juvenile rearing. PHOTO CREDIT: CRIS HAGEN

Opportunities for Support

Assurance colonies are a critical component of the TSA's mission to secure the future of the world's most endangered chelonians. In early 2013, we purchased a property in South Carolina that is ideally suited for this purpose. The facility is now known as the Turtle Survival Center (TSC), where we have plans to develop assurance colonies for critically endangered turtles and

tortoises that depend on captive management for their survival. Work is now being done to expand the infrastructure and facilities of this property to turn it into a truly world-class facility.

By becoming a supporter of the TSC, you have an opportunity to partner with a program that will directly impact nine of the Top 25 Most Endangered Turtles in the world (Turtle Conser-

vation Coalition, 2011). Your legacy will be that you were integral in founding the TSA's Turtle Survival Center. Your support helps to guarantee the survival of not one, but many, species that are nearing extinction.

To learn more about giving opportunities, please visit <http://www.turtlesurvival.org> or contact Heather Lowe at (817) 759-7262.

Spotlight: Patricia Koval



Patricia Koval (left) with Kalyar Platt (TSA Turtle Conservation Coordinator) in Myanmar in 2011

Patricia Koval serves on the Board of Directors of the Turtle Survival Alliance and is a staunch ally in the fight against turtle extinction. A generous donor, Pat's contributions have supported the TSA's field programs for many years and most re-

cently have helped to make possible the purchase and renovation of the Turtle Survival Center. In this interview, she tells us a little more about herself and what draws her to turtle and tortoise conservation.

Pat, tell us a little about your background.

I'm a business lawyer, by profession, specializing in corporate finance, mergers and acquisitions. My academic background is in law, business and economics. While I really enjoy my

work, my passion has always been wildlife conservation, and I've spent many years volunteering for and supporting organizations, large and small, focused on conservation of diverse species.

How did you first become interested in conservation work?

I think that I was born with my interest in conservation. It's always been there, since as early as I can remember, coupled with a love for animals and interest in animal welfare. While I didn't get much of an opportunity to indulge this interest as a child, I started looking for ways to promote conservation and the preservation of biodiversity when I was beginning my career. I actively looked for organizations that were doing the kind of work that I was interested in and began looking for ways to help them.

We know that you had a turtle named Tinker. Tell us about him and how he impacted your thinking about turtle conservation.

Like many of us who support TSA, my interest in turtles began when my parents bought me a turtle as a pet. As youngsters, we lived near a very busy road, and my parents were concerned at the prospect of having pets who might venture out onto it. So, they answered my nagging for a pet by getting three little turtles (for me, my brother and sister) complete with a plastic dish with its green plastic palm tree – I'm sure many of us remember those! We absolutely loved them – and I couldn't get enough of books, magazines, anything that I could get my hands on to learn more about turtles. It was really a consuming interest, and I found myself becoming quite a self-taught expert on turtle behavior! Years later, after finishing University, I decided that I wanted another pet turtle. It was quite difficult to find a pet store which sold turtles – the import of sliders into Canada had just been banned due to salmonella. But I persevered with the pet store listings in the Yellow Pages until, finally, one pet store said they had a turtle – and, in fact, that he had been recently returned to the store by the young family who originally bought him because “he wasn't a fun pet”. On my visit to the shop, my decision to buy my shy little Tinker was almost instantaneous – the store thought he was a tortoise and had forced him to live in a small box, with only a tiny vesicle for drinking water. I determined his species myself from my turtle books – a Malayan Box Turtle, a then-common pet store turtle, probably from a private breeder somewhere in Ontario. When he became ill after 26 too-short years with me, I did online research



Pat with Tinker, the Malayan Box Turtle that inspired her passion for turtle conservation.

on his condition (in conjunction with frequent veterinarian visits) and was shocked to learn that his species had become highly endangered. In fact, I found myself reading about the Asian turtle crisis with increasing horror. That's what made me determined to do something significant to conserve Asian freshwater turtles and tortoises – a memorial to Tinker, if you will.

You have been a generous supporter of the TSA's field programs, particularly our flagship India program. What is it about these programs that first attracted your interest? How do you feel about the progress made after five years of your support?

I've been fascinated, from the start, with TSA's work in the Asian range countries. I became interested in India, initially, because I liked what I saw of our work there – our website painted a very compelling picture. I also had a personal connection to India, through a client, which meant that I was travelling to India several times a year. I was lucky enough to spend time with Shailendra Singh (Director, TSA India) several years ago – the Chambal River in May – a great experience! I think our work there has been very valuable, and I would love others to join me in supporting the great things we are doing

there! I'm also a keen supporter of our work in Burma – and had a great opportunity to see it in person several years ago, thanks to Kalyar Platt (TSA Turtle Conservation Coordinator, Myanmar) and our partners at WCS. I'm tremendously encouraged by the depth and scope of our Burma work – including our far-reaching plans for release sites.

In 2011 you made a substantial pledge to the TSA that enabled us to purchase the property in South Carolina that became the Turtle Survival Center. Tell us about what inspired this gift and your vision for the future.

My commitment to conserving Asian freshwater turtles and tortoises led me to decide, very quickly, that the establishment of assurance colonies at the Turtle Survival Center could make a real difference to this cause. The decision to make a major donation was easy – it's something that I passionately wanted to do – and my husband, Alan, and I had just created our own family foundation to support conservation. We want to make a difference now, while there is still time to do that. It was a natural for a first major gift from us. Alan and I share TSA's vision for the Center – we can't wait to see it fully constructed with our assurance colonies thriving!

Sulawesi Forest Turtle Sees Significant Increase in Captive Breeding



A hatchling Sulawesi Forest Turtle (*Leucocephalon yuwonoi*). PHOTO CREDIT: CHARLES INNIS

CHARLES INNIS, RICK HAEFFNER, AND SUE KRAUSS

The Sulawesi Forest Turtle (*Leucocephalon yuwonoi*) is endemic to Sulawesi, Indonesia, and is relatively new to science, being formally described in 1995. Ranked Critically Endangered by the IUCN Red List, major threats include rapid habitat loss and collection for the international live animal trade.

Over the past two decades, many individuals have been seen in Southeast Asian animal markets and the international pet trade. Despite “zero export” quotas in recent years, specimens continue to be traded. Collection of wild specimens continues, and large numbers of clearly wild-caught specimens were recently seen at a purported *L. yuwonoi* “farm” in Sulawesi. Its future in the wild is tenuous, and *ex situ* captive breeding is a priority for the TSA.

Wild caught *Leucocephalon* have been difficult to acclimate to captivity, and the mortality rate among some imported groups has been very high. Over time, specimens have been stabilized in several private collections and zoological institutions, and modest numbers of eggs produced. We remain concerned about the sporadic, unexpected mortalities of apparently healthy founders. Although occasional two egg clutches have been documented, this species generally lays one large egg per clutch, though several clutches can be produced annually. Attempts to hatch captive-produced eggs were unsuccessful for several years. The first known successful captive breeding occurred in a private collection in 2003.

A Taxon Management Plan (TMP) for this



A pair of *Leucocephalon yuwonoi* mating in captivity. PHOTO CREDIT: CHARLES INNIS

species in captivity was established by the TSA in 2005, with the goals of maintaining a census of known captive individuals; documenting successful breeding methods; and tracking the lineage of F1 offspring to ensure genetic diversity for future breeding. Currently, the TMP is aware of approximately 120 founder specimens in roughly 25 collections worldwide, many of which are TSA partners. It is likely that more specimens are held in other collections. We are aware of successful captive breeding in at least six private collections, and three zoological institutions, including Altweitzoo Münster, Zoo Atlanta, the Denver Zoo, and the private collection of our late colleague and friend, Dr. Greg Fleming.

To date, we know of 29 F1 *L. yuwonoi* offspring produced since 2003, but several have died. Notably, the Denver Zoo has significantly increased its F1 population with the successful hatching of nine individuals in the past eighteen months. Additional fertile eggs are under incubation at this time at the Denver Zoo and in at least one private collection.

In many instances, successful breeding has not occurred until the adults have been acclimated for five to six years. At the Denver Zoo, the 2012 breeding involved adults acquired in 2007. In 2011, the 1.3 wild-caught adults at Denver were introduced into a new off-exhibit enclosure, measuring approximately 5 x 5 x 1 meters, including an approximately 5 x 3 x 0.2 meter pool, and



One of nine *L. yuwonoi* hatched at the Denver Zoo in the past 18 months. PHOTO CREDIT: RICK HAEFFNER

the first fertile egg was produced eight months later. It is strongly believed that the added space contributed to this breeding success.

Denver Zoo adults are fed three times weekly on a diet of mixed greens, a commercial tortoise diet, and other vegetables and fruits. Giant mealworms, earthworms, and pinkie mice are offered once weekly. One to two hour simulated rain periods are offered three times weekly, and ambient temperatures are maintained at 25°C (78°F) for water, and 28°C (82°F) for air.

L. yuwonoi usually do not dig extensive nest cavities. The Denver Zoo's females dug shallow nests and mostly laid eggs against the base of plants. Fertile eggs at the Denver Zoo were incubated in vermiculite (1:1 ratio of vermiculite to water by mass) at 25-27°C (78-80°F). Eggs develop a transverse white band within several weeks. Blood vessel development is seen within two months, and average incubation time at the Denver Zoo was 137 days, with a range of 126 to 152 days. Incubation times as long as 176 days are seen in other collections. Hatchlings are quite large, often weighing 30-40g.

Successful rearing of hatchlings has occurred at several facilities, and the oldest known F1 individuals are currently five years old. Hatchlings appear comfortable in wet sphagnum moss with several centimeters of water and temperatures similar to those of adults. Observations at two facilities indicate that *Pothos* is often the first accepted food, with a more diverse diet accepted over time.

The TSA's Turtle Survival Center (TSC) will soon include a greenhouse facility dedicated to the captive breeding of this species. A group of adult founders maintained at the Savannah



A four-year old captive bred *L. yuwonoi*. The tail size and extent of yellow coloration of the head has been increasing over the past year, likely indicating that this is an immature male in the process of developing the sexually dimorphic characteristics that are typical of this species. PHOTO CREDIT: CHARLES INNIS



It is strongly believed that the added space provided in this off-exhibit enclosure at the Denver Zoo contributed to breeding success. PHOTO CREDIT: RICK HAEFFNER

River Ecology Lab will form the nucleus of the TSC population, supplemented with adults from several other collections. At least two lineages of F1 individuals will be maintained at the TSC.

We look forward to continued successful breeding of this species in captivity, with thoughtful relocation of founders to establish

new breeding groups, and careful tracking of F1 pedigrees for future captive breeding. In the absence of a clear *in situ* conservation plan, *ex situ* captive breeding remains an important component for the future of this species.

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A captive male *Kinixys erosa*. PHOTO CREDIT: CRIS HAGEN



Kinixys nogueyi hatching in captivity under artificial incubation. PHOTO CREDIT: VICTOR LOEHR OF HOMOPUS.ORG



Kinixys natalensis photographed in its natural habitat during a research trip. PHOTO CREDIT: VICTOR LOEHR OF HOMOPUS.ORG

The Future of the *Kinixys* Genus Hinges on our Present Actions

BY DAVID MIFSUD AND MICHAEL W. HANCE, PH.D.

Presently, there are eight recognized species of the genus *Kinixys*, commonly referred to as “Hinged Tortoises”, distributed across Africa and Madagascar (1). *Kinixys erosa* and *K. homeana*, are largely found in the rain forests of western and central Africa (2). *Kinixys belliana*, *K. lobatsiana*, *K. natalensis*, *K. nogueyi*, *K. speki*, and *K. zombensis* (with two subspecies, *K. z. zombensis* and *K. z. domerguei*) are primarily found in savannah regions of central to coastal forests of southeastern Africa and Madagascar (1, 2).

Kinixys are unique among the family Testudinidae, possessing a carapacial hinge that provides additional protection to the rear legs and tail (2, 3). The hinge is absent in juveniles and is poorly developed in the adults in some species (2). Hinged tortoises are variable in coloration, and patterns contrast even between members of

the same species (3). All members of the genus are medium-sized tortoises with the largest being *K. erosa* (measuring up to 400 mm.) and have five claws on the forelimbs with the exception of *K. nogueyi* which has four (2). The sexes are easily identified by the male’s longer and thicker tails. With the exception of *K. erosa*, females are larger than males (2, 3).

In captivity, *Kinixys* has developed a reputation of being difficult to keep and reproduce in the long term. The majority of the tortoises currently offered for sale are field collected animals that usually arrive dehydrated, stressed and with little to no background information. As a result, a thorough veterinary examination of new animals is recommended to address any potential health issues. In general, these tortoises are fairly omnivorous and will readily eat most of the

common produce offered to tortoises including greens, squashes, root vegetables, various fruits and a variety of mushrooms, as well as animal or insect protein (2, 3). Habitat design is one of the most challenging aspects of keeping this genus, primarily due to the fact that its natural range is a diverse conglomerate of microhabitats (3). Unfortunately, field collected animals usually have sparse accompanying locale information, thus requiring keepers to use some creativity to design appropriate habitats (3).

Captive reproduction of *Kinixys* is uncommon though it does happen sporadically. Initiating courtship appears to be straightforward in captivity and cued by environmental triggers such as increased rainfall and increased temperatures. The duration of egg incubation ranges from 90 to 200 days for most species but incubation for *K. erosa* can range from 150 to 300 days (2). Additionally, egg incubation in some species may require a diapause or an environmental trigger to initiate development; *K. speki* eggs for example,



A captive male *Kinixys spekii* in a naturalized environment in central Texas. PHOTO CREDIT: SCOTT DAVIS



A captive male *Kinixys homeana*. PHOTO CREDIT: CHRIS HANSEN

delay development until sprayed, which initiates vascularization shortly after (Hance, pers. obs.). Fortunately, the rare captive-produced progeny appear to do much better in captivity than imported animals. Dedicated institutions and keepers will be essential to expand our current husbandry and breeding protocols to ensure viable assurance colonies.

Efforts are being made globally to protect and conserve these poorly understood chelonians. These species are in decline in many parts of their range due to bushmeat consumption, habitat loss, improper land use, and collection for the pet trade (4, 5, 6). Currently, over 75% of *Kinixys* species are Not Evaluated (NE) or Data Deficient (DD) by The International Union for Conservation of Nature (IUCN) Red List (7). The Tortoise and Freshwater Specialist Group of the IUCN will meet in Lome, Togo this year for a status assessment review and evaluation of the current threats. To date, no comprehensive effort has been made to compile and synthesize



A nice pair of captive *Kinixys lobatsiana* PHOTO CREDIT: WILL AHRENS

available research and resources on the *Kinixys* complex. In an effort to guide the status review of Hingeback Tortoises, the *Kinixys* Conservation Blueprint (Misfud, In prep) is a document drafted to assess the distribution of currently recognized species, habitat and ecology, global and regional status, potential threats, conservation and management, and husbandry and captive breeding.

An effort to mobilize and unite those working with *Kinixys* both in the field and in captivity is underway. The *Kinixys* Conservation Task Force is a newly developed partnership through which TSA and other interested organizations are collaborating to address the conservation and captive management of this genus. A primary objective of this group is to assess the current captive holdings of *Kinixys* in both private and public collections to assess potential founder stock for

assurance colonies. As part of this effort, data on husbandry and breeding success will be collected and shared with members to improve future breeding success.

Kinixys are amazing and often overlooked tortoises that are an important part of sub-Saharan African and Malagasy landscapes. Comprehensive knowledge regarding their ecological needs, population status, and threats to survival is necessary for successful conservation of these unique tortoises. To learn more about the *Kinixys* Conservation Blueprint or to get involved with the *Kinixys* Conservation Task Force please contact David Misfud.

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MADAGASCAR



Groups of confiscated Radiated Tortoises are initially cared for at TSA's Office in Antananarivo until they can be moved south. PHOTO CREDIT: HERILALA RANDRIAMHAZO



Radiated Tortoises are loaded into multiple level boxes in preparation for their drive from Durrell's tortoise center in Ampijoroa to Antananarivo. These tortoises were seized in Mahajanga on a boat headed for the Comores. PHOTO CREDIT: HERILALA RANDRIAMHAZO

Rise in Tortoise Confiscations Underscores Need for New TSA Triage Centers

HERILALA RANDRIAMHAZO, RICK HUDSON AND CHRISTINA CASTELLANO

A key to the success of our Madagascar tortoise conservation program is facilitating tortoise confiscations through increased awareness among local law makers and by giving support to enforcement agencies—especially by providing temporary homes, proper husbandry, and veterinary care to confiscated animals.

2013 saw a significant rise in confiscations, with the TSA's Antananarivo office handling at least one confiscation monthly over a seven month period. A major cause of the increase is better surveillance at Ivato International Airport in Antananarivo—a combined result of greater awareness by the international conservation

community, and the signing of a community anti-poaching pact known as a DINA.

CONFISCATION CASE STUDIES

The DINA was launched in southern Madagascar's Androy region in June 2012. By November three confiscations totaling 350 tortoises were made, the most notable being the September arrest of poachers in Ampanihy carrying 272 juvenile Radiated Tortoises. The poachers were from Tsihombe, a community known for illegal tortoise trafficking and their arrest shook the town. Within a day, the mayor and other officials launched an awareness campaign. The mayor made a speech

informing people about the DINA, and asking for their support against poachers. Local people welcomed his words. After years of silence, they want authorities to protect Tandroy traditions. This unprecedented event was broadcast on national television and will likely have lasting positive consequences. Since then, tortoise confiscations have occurred in every month of the first half of 2013.

In January 2013, two men were arrested for selling 11 adult Spider Tortoises on an Antananarivo roadside. The animals were concealed in a basket and passersby were urged to buy them. The men were reported to police, the tortoises confiscated, and the TSA took on their care.

In February 2013, two smugglers were arrested and 493 juvenile Radiated Tortoises—stuffed into three suitcases—were seized at Ivato Airport. Three University of Antananarivo veterinary students stepped in to care for the animals, and also volunteered to treat confiscated tortoises turned over to TSA in future. After observation, care and quarantine at the Madagascar Biodiversity Partnership (MBP) facility in Antananarivo, the tortoises were transferred to the Village des Tortues in Ifaty.

In March 2013, a Malagasy man from Antananarivo was arrested at Ivato Airport before boarding a flight to Bangkok via Nairobi, Kenya. He had two suitcases holding 293 juvenile Radiated Tortoises—his second attempt to get the animals out of the country. The man claimed he was allowed to leave Madagascar with a suitcase

full of tortoises in December 2012. Léon Razafindrakoto of Salamandra Nature and MBP worked with TSA to transport the tortoises free of charge via Air Madagascar to the Village des Tortues.

In April 2013, A Malagasy woman tried to smuggle a suitcase full of baby chameleons and 40-hatchling Radiated Tortoises through Ivato Airport. She registered her luggage at check-in, but when customs found the animals in her suitcase, she vanished. The forestry officer turned the confiscated animals over to the TSA for care.

In May 2013, a dhow setting sail to the Comoros Islands was seized in Mahajanga with 168 juvenile Radiated Tortoises aboard. They were moved to Durrell's tortoise conservation center in Ampijoroa. A week later, TSA received a Forestry permit to take charge of the tortoises.

In June 2013, police confiscated 39 adult Spider Tortoises in an Antananarivo overnight bus parking lot. Fortunately, Parc Tsimbazaza (the National Zoo and Botanic Garden in Antananarivo) was able to receive them because all available TSA tortoise space was full.

REINTRODUCING CONFISCATED TORTOISES

Given the increasing volume of confiscated tortoises, our next challenge is to implement an effective system to transition them back to the wild. This requires that we identify good habitat where depleted populations can be restored, as well as adjacent communities supportive of tortoise protection. We've identified two such areas, and plan to release tortoises at both sites: Sirempo, the sacred forests in Ampotaka and Tragnovaho in southern Madagascar's Androy region. Ms. Soary Andrianjafizana, a University of Toliara graduate student, will test various

release strategies for Radiated Tortoises at both sites as part of her PhD program. We will involve local communities during both the pre-release period—to build soft release enclosures—and to aid in follow-up monitoring.

A preliminary study will involve 54 sub-adult tortoises, 42 of which will be radio-tracked following a soft release. All will be held in one-hectare pre-release pens for six-month/one-year periods to acclimate them to local conditions and native food sources. Mr. Sylvain Mahazotahy, a TSA staffer from Ambovombe, is leading the project. A launch ceremony at the sacred forest of Sirempo in Ampotaka is scheduled for July 2013.

TORTOISE TRIAGE

A cornerstone of our confiscation/reintroduction strategy is the creation of tortoise triage facilities in key southern Madagascar towns where the animals are most often illegally traded. These centers will give law enforcement agencies a place to temporarily house confiscated tortoises, facilities where we can give the best possible care.

The TSA, assisted by Zoo Boise Conservation Fund, is building three triage centers, with two more planned. The first is in Ambovombe, with Betioky and Ampanihy to follow soon, and Tsiombe and Beloha coming later. Each highly secure facility, with its trained staff, will be a safe haven to which tortoises can be moved immediately after confiscation—a place to settle in, rehydrate, be fed, and treated for injuries and illnesses.

The tortoises will be moved from the triage centers to a larger regional rescue center for longer term management and pre-release planning.

This regional center is planned for the town of Marovato, a centralized location with a very supportive mayor, located in the eastern part of the tortoise's range. The World Bank has tentatively approved the center's funding. The regional center will relieve overcrowding at the Village des Tortues in Ifaty, where most Radiated and Spider Tortoise confiscations are now placed. To prevent "putting all our eggs in one basket," and to avoid mixing genetic stock, we plan a second regional center east of the Menarandra River, closer to the heart of the species' range. There is good evidence of genetic structure in Radiated Tortoises and large rivers represent barriers to gene flow that are responsible for this structure.

The rise in confiscations and construction of triage centers both show that TSA's conservation program is working, offering hope to Madagascar's endangered tortoises.

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ACKNOWLEDGEMENTS

The TSA's *Confiscation to Reintroduction Strategy* is largely supported by a \$29,000 grant from the Zoo Boise Conservation Fund; it pays for construction and operation of the triage centers. Generous support has also come from: AZA Radiated Tortoise SSP, Charles Landrey, Columbus Zoo, Conservation International, Dennis Coules, Fort Worth Zoo, Herpetofauna Foundation, Idea Wild, Knoxville Zoo, Mohamed Bin Zayed Species Conservation Fund, Natural Encounters Conservation Fund, Owen Griffiths, WWF Education for Nature program, Phoenix Zoo, Robert Krause, San Diego Zoo, Seneca Park Zoo Society, Toronto Zoo, Turtle and Tortoise Preservation Group, Turtle Conservation Fund, Madagascar Biodiversity Partnership, Direction Générale des Forêts, Air Madagascar, Utah's Hogle Zoo, the Andrew Sabin Family Foundation, Leicester Tortoise Society, and the Devon and Cornwall Tortoise Group. We also recognize our Radiated Tortoise conservation field team: Sylvain Mahazotahy, Riana Rakotonrainy, and Soary Randrianjafizana, as well as, Ryan Walker and Andrea Currylow. Partnering organizations in spider tortoise monitoring include: Ho Avy, Blue Ventures, University of Southern California's Department for Human and Evolutionary Biology, Université d'Antananarivo Département de Biologie Animale, Madagascar Biodiversity Partnership, The Open University's



Veterinary students from the University of Antananarivo helping to treat a group of 292 Radiated Tortoises seized at the Ivato Airport. They are Ny Aina, Anjara and Ranto PHOTO CREDIT: HERILALA RANDRIAMAHAZO

MADAGASCAR



Sylvain with school kids in Tsiombe during environmental education questionnaires. PHOTO CREDIT: RYAN WALKER



The iconic lighthouse at Cap St Marie, a special reserve on Madagascar's southernmost tip, which supports the densest population of Radiated Tortoises in the country. Protecting this important population through community stewardship is the core of our project and the highest conservation priority for this species. PHOTO CREDIT: AARON GEKOSKI

On the Road Again: Radiated Tortoise Conservation in Southern Madagascar

CHRISTINA CASTELLANO AND RICK HUDSON

On this year's field expedition to southern Madagascar, we travelled from the east coast, across the Spiny Forest, to Lac Tsimanampetsotsa National Park—known for Radiated Tortoises and our final western destination. The trip met three goals: to advance our Radiated Tortoise public awareness campaign; to assess that campaign's impact so far on conservation; and to lay groundwork for a network of triage centers for confiscated tortoises dotting the species' range. We also shared new campaign materials and hatched plans for the program's future.

CONTINUING EDUCATION

In 2012, we developed new, more sophisticated education materials with our program partner, the Emerging Wildlife Conservation Leaders (EWCL). A fun, hands-on activity book was designed to teach local children about Radi-

ated Tortoise natural history, survival threats, and ways they can ensure a bright future for one of their society's most beloved animals. We distributed hundreds of the books, along with pencils, crayons, pencil sharpeners, and candy bags to schoolchildren in 10 targeted communities—all key regional tortoise stewards.

We also implemented a study to see if the campaign's first two-years had achieved the hoped for impact: tortoise conservation through community stewardship. We surveyed men, women, and children in each village to determine if: 1) campaign materials were appropriate and used, 2) the messaging was acceptable and understood; and 3) the campaign inspired people to protect tortoises. We also conducted focus groups, seeking ideas for program improvements. Early results suggest the campaign has been successful, empowering people to express

their convictions that poaching is wrong, and that tortoises should be protected. Of course, law enforcement is needed to back-up the education effort, since poachers are armed. Consequently, we need to continue supporting law enforcement by giving them the tools necessary to apprehend poachers and care for confiscated tortoises.

TRIAGE FOR TORTOISES

During our Madagascar trip, we visited five strategically located towns where TSA plans to build its triage centers to receive confiscated tortoises. We identified construction sites, discussed outreach opportunities, and considered center design. Located near the heart of each town, the centers will include conservation education kiosks and graphic panels to facilitate school programs and tourist visits. The triage centers, with their accessibility to law enforcement and wildlife agents, will encourage police confiscation of illegally collected tortoises, and provide care for the animals, preparing them for reintroduction to the wild.

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The president of the community of Lamboara is involved in the monitoring project within the north of the species range. PHOTO CREDIT: BLUE VENTURES

Community Based Spider Tortoise Monitoring in Southern Madagascar

RYAN WALKER, ANDREA CURRYLOW, TSILAVO RAFELIARISOA, EDWARD LOUIS, FRAN HUMBER, CHARLOTTE GOUGH, AND ANTHONY ARNOLD

Several priority conservation sites were identified in southwest and coastal Madagascar by the TSA/TCF-funded spatial population and distribution analysis of remaining wild populations of (Walker et al., 2012; Walker and Rafeliasoa, 2012). To protect at these sites, NGOs and other partners have launched community-based incentivised conservation monitoring initiatives

in the towns of Lamboara, Anakao, Ranobe and Lavaolo.

The NGO Blue Ventures Conservation (BV) has developed a basic monitoring program for a significant population of in partnership with the community of Lamboara within the Velondriake Community Managed Marine Protected Area. Backed by funding from TCF and TSA, BV

appointed a Malagasy tortoise monitoring coordinator who works with Lamboara residents in a regular mark and recapture program for . BV also initiated an awareness and education program, holding tortoise festivals and doing local radio programs to promote species conservation and sustainable management of the tortoise's dry forest habitat. This spider tortoise population has also been included in Velondriake Protected Area management plans. Further south, the local sustainable agriculture group is monitoring a small population of in the forests of the Ranobe region.

In the coastal fishing community of Anakao, south of Toliara the regional capital, a long-term mark and recapture program has been running for ten years. The program, maintained by U.K., U.S. and Madagascar researchers, has hired a fulltime local forest guardian to collect data, and more importantly, be a permanent presence in the forest. Maurice Rodrigues from the village of Anakao has worked seasonally with the research group for four years. His growing knowledge of tortoise biology has now allowed him to be employed collecting radio telemetry data and to earn added sustainable income by leading guided forest walks.

Further south in the village of Lavaolo, U.S. and local biologists, in collaboration with the Madagascar Biodiversity Partnership, have launched a radio telemetry project for a population of , using a para-biologist from the local community. This same community member has been monitoring for a few years.

This incentivised form of conservation—paying stipends for basic data collection, or for small-scale tourism ventures—gives communities a vested financial interest in preserving spider tortoise populations. Such incentives are likely our best hope for tortoise conservation in Madagascar's most impoverished regions.

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BANGLADESH

Rupali Ghosh, AGJ Morshed and Noorul transfer a nest inside the hatchery. PHOTO CREDIT: PETER PRASCHAG

Another Successful Year for Project *Batagur baska*

PETER PRASCHAG, ANTON WEISSENBACHER, AND RUPALI GHOSH

The World Association of Zoos and Aquariums (WAZA) launched Project *Batagur baska* with the acquisition of five (3.2) Northern River Terrapin (*Batagur baska*) in July 2010. The goal was to

build a breeding group of one of the rarest turtle species in the world within Bangladesh.

In 2011 and early spring 2012, we furthered that endeavor by acquiring three additional

females and several more males. We found these *B. baska* in rudimentary fish breeding ponds in rural Bangladesh (where local communities keep turtles for good luck), and transferred them to a facility where they could be optimally bred and protected. The Bangladesh Forest Department provided two large earthen ponds inside Bhawal National Park—enclosures previously used for crocodile conservation.

In 2012, during the first breeding season, all five females nested and 26 hatchlings emerged. After this quick unexpected success, steps were taken to link *ex-* and *in situ* measures to ensure the long time survival of *B. baska*. A new collaboration with a strong local partner, IUCN Bangladesh, was established, and a memorandum of understanding was signed between TSA, Zoo Vienna, the Bangladesh Forest Department, and IUCN Bangladesh. IUCN Bangladesh now functions as the umbrella organization, working closely with local groups, including CARINAM as a scientific adviser, Prokriti O Jibon (Nature and Life) as media partner, and the Bangladesh Environment and Development Society (BEDS) an active NGO for south Bangladesh.

We continue to improve our Bhawal facility. We've renovated a second hatchery to hold additional juvenile turtles, and have improved adult turtle health. Many adults are advanced in age and have suffered years of malnutrition. Turtles are now offered green leafy vegetables, such as water spinach (*Ipomoea aquatica*), as well as bananas and shrimp on alternating days. The staff supplements this diet with water hyacinths (*Eichornia sp.*), water lettuce (*Pistia stratiotes*), and river snails (*Viviparus sp.*). The turtles are now well-adjusted and even take bananas by hand.

All five females nested again this season though no female laid multiple clutches. Clutches were deposited between 23 and 26 March. An additional clutch laid earlier but overlooked was found on 14 April. Eggs from the first four clutches were transferred to a hatchery protected by metal mesh to prevent mongoose or monitor lizard predation. The fifth clutch remained in place, but was caged with metal mesh.

Past experience indicated to us that we needed to raise incubation temperatures. In the previous year, we determined the sex of a small subset of hatchlings using endoscopy. The results led us to strongly suspect that previous incubation temperatures were maintained too low, producing only males. In response, we raised the average temperature of the nesting beach this year by trimming surrounding trees and placing glass panels atop clutches to inten-



Basking hatchlings of 2013. PHOTO CREDIT: A.G.J. MORSHED



An adult pair of *B. baska*; the female is feeding on water hyacinth. PHOTO CREDIT: PETER PRASCHAG

sify solar radiation. Nest temperatures were also controlled daily by the staff who installed and removed the glass panels depending on the weather. These efforts increased average incubation temperature from 27°C (80.6°F) to 29-30°C (84.2-86°F).

The five females produced 99 eggs (compared to 92 in 2012) out of which 61 hatched. The hatch-

ling success rate rose from 26 percent in 2012, to 61 percent in 2013, a laudable achievement in a single year. Only 3 eggs were presumed to be infertile, suggesting adequate sperm production by the males. Interestingly no eggs out of the last group—the ones not transferred (n=20) hatched. The incubation period was 62 to 66 days.

We have an ambitious plan for 2014, thanks

to a generous grant from SOS - Save Our Species, that will fund the construction of at least five new breeding ponds. This will allow us to shift from our current random breeding to known - parentage pairings, with a studbook and defined bloodlines. The CITES export permit for tissue samples of all known *B. baska* in Bangladesh passed the advisory board of the Ministry of Forests and will soon be issued. Based on microsatellite analyses, an Austrian student will look into the genetic constitution of the species, allowing us to know the parentage of all hatchlings and to create the studbook. Fortunately, the Wildlife Conservation Society (WCS) and Wildlife Reserves Singapore (WRS) recently developed a microsatellite library for the genus *Batagur*. Defined breeding pairs, or trios of 2:1, will be separated for breeding.

In June 2013 a BEDS led team located two wild caught *B. baska* hatchlings, provided by local fishermen. This exciting discovery is the first evidence of a reproducing wild population in the Sundarbans. More good news: the different size and morphology of the two hatchlings allows us to confidently conclude that they are not full siblings but rather emerged from two different clutches. This finding encourages us to launch extensive field surveys to locate nesting beaches and build an *in situ* conservation program. Because so little is known about the biology and ecology of the species, satellite telemetry should be used to study movement patterns and habitat selection of any adults found in the wild. All nesting sites discovered should be protected and nests monitored to assure they are not destroyed by predators.

The amazing achievement of 61 hatchlings in the 2013 breeding season offers reason for optimism. We are currently acquiring an additional female to enlarge the breeding group. To minimize the risk of setbacks due to devastating disease, the *B. baska* breeding group should be split, with half the stock transferred to Karamjal, a forest station of the Bangladesh Forest Department in the middle of the natural habitat of the Northern River Terrapin in the Sundarbans.

Project *Batagur Baska* has turned out to be a small but very successful international conservation partnership.

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ACKNOWLEDGEMENTS

This project was generously supported by the Toronto Zoo, Columbus Zoo, SOS - Save Our Species and Walter Sedgwick.

INDIA



Leith's Softshell Turtle (*Nilssonia leithii*) are enigmatic softshell turtles of peninsular India. The TSA has been conducting surveys to determine their current status, while also developing assurance colonies in regional zoos using juveniles of the species such as this one. PHOTO CREDIT: SHAILENDRA SINGH

TSA India: Committed to Securing the Future of Indian Turtles

SHAILENDRA SINGH, PHD

India is a hot spot of chelonian diversity, with 28 species of freshwater turtles and land tortoises. It is home to such enigmatic species as *Chitra indica*, and charismatic endemics like the Forest Cane Turtle (*Vijayachelys silvatica*), Travancore Tortoise (*Indotestudo travancorica*), and the Red-crowned Roofed Turtle (*Batagur kachuga*).

India's booming human population, topping 1.24 billion, is impacting those species. The intensive use of resources, such as water and sand for construction, for example, has put key chelonian habitat squarely in the crosshairs of destruction. Twelve of India's 28 chelonian species are now Endangered or Critically Endangered according to the IUCN Red-List; the rest are being pushed to the brink.

Despite this disheartening news, TSA's India Program is making real headway saving endan-

gered chelonians with an integrated conservation strategy that includes education, local community involvement, staff recruitment, and NGO partnering. TSA's India Program, in association with the Madras Crocodile Bank Trust and other conservation partners, is working effectively in five Turtle Priority Areas (TPAs)—regional zones that focus on chelonian species at greatest risk. Here we present some notable successes from the last field season:

INDIAN NARROW-HEADED SOFTSHELL TURTLE (*CHITRA INDICA*) INITIATIVE:

Conservation of *C. Indica* has met with successes and setbacks. A robust nest protection program has included surveys of nesting habitat and protection of known nests in North India, but the initiative has achieved only marginal suc-

cesses in the raising of endangered softshells in captivity over the past five years—a failure likely due to harsh winter weather.

During this past year's survey of the Upper Ganges, mid Chambal and lower Yamuna river systems, we found ten nests on the largely unprotected Yamuna-Chambal confluence. Two nests (271 eggs) were translocated to the Kukrail Gharial and Turtle Centre in Lucknow for incubation. Of 187 hatchlings that emerged in November, we released 137 at the collection site; 50 were retained for headstarting.

Modifications to a gharial hatchling pen at the Kukrail Center and improved husbandry there have increased winter survivability. The enclosure was equipped with clear plastic sheets and a solar water heater to protect against the cold. New ultraviolet and infrared lamps maintain appropriate water temperatures and allow for synthesis of vitamin D. Regular water changes helped maintain water levels, while sand for burrowing was replaced every 2 weeks. The hatchling diet included fish fingerlings, earthworms and snails.

Unfortunately, the cohort suffered bouts of mortalities in January and April 2013, when more than 30 hatchlings died, due to temperature extremes. Husbandry parameters were adjusted to stem the deaths. The remaining 20 hatchlings are growing rapidly (ca. 75+ grams) and will hopefully survive, establishing the first species breeding program at Kukrail.

Five additional nests (754 eggs) were moved to the Garhaita Turtle Centre on the Chambal and 563 hatchlings were released at natal sites. Unfortunately, human pressures and erratic weather over recent years have caused deterioration of the once prime nesting habitat on the upper Ganges.

RED-CROWNED ROOFED TURTLE (*BATAGUR KACHUGA*) INITIATIVE:

TSA's *Batagur* headstarting project—in operation for nine years in the National Chambal Sanctuary (NCS)—aims to enhance recruitment of this endangered species. Over the past year, we initiated an NCS sonic telemetry project to test basic assumptions about our headstarting program. Brian D. Horne helped us design the project and choose the equipment. Receivers, transmitters, and an inflatable boat were purchased with funds from his postdoctoral fellowship at the San Diego Zoo Institute for Conservation Research.

Ten sub-adult individuals (4 males and 6 females) aged 10 years were selected from the TSA supported *Batagur* headstarting facility at

Meet the Staff: Chaitra Baliga

Shashwat Sirsi

Chaitra Baliga, or “Chatri”, is one of the newest TSA-India program members. A science graduate, she joined the Western Ghats and Peninsular India Project as a research intern, and became a full-time Assistant Project Officer in April 2013. Chatri will be conducting surveys and helping set up assurance colonies of threatened softshells and tortoises in South India.

Chatri first showed her affinity for turtles at age nine, when she rescued an Indian Black Turtle after it was hit by a car, releasing it safely back into the wild once recovered. Her efforts to convince neighbors to release “pet” turtles earned her the nickname “turtle girl”. Chatri’s dream is to restock depleted endangered Cochin Forest Cane Turtle populations, while helping local communities understand their vital role in conserving the Western Ghats landscape. Her hobbies include football and listening to heavy metal music.



Chaitra Baliga holding a female *N. leithii* along the Kali River. PHOTO CREDIT: SHASHWAT SIRSI



TSA India has set up riverside hatcheries on the Chambal River to protect the nests of sympatric *Batagur* species every year since 2006. Freshly encountered nests from vulnerable locations, like this one, are relocated to protected hatcheries to ensure their survival. PHOTO CREDIT: LONNIE MCCASKILL

the Deori Eco-Centre in Morena on the middle Chambal. Ultrasonic Coded Temperature Telemetry (Sonotronics® CTT) transmitters were mounted on captive sub-adult *B. kachuga*, allowing us to obtain baseline values on post release survival, dispersal and microclimatic selection among the headstarted turtles.

Transmitted individuals were “soft” released on the mid Chambal into a 75-meter-long river leg enclosed with bamboo frames. Turtles were observed during the penning period foraging on aquatic vegetation and became increasingly shy of humans. After two weeks, the enclosure was dismantled and the animals dispersed to the main river channel. We are currently tracking eight tagged individuals in deeper channel pools within five kilometers of the release site. This procedure could potentially be extended to wild specimens to observe comparative behaviors.

This year, *Batagur* nest protection efforts occurred at two hatcheries on the lower and middle Chambal. In February, we also initiated an *in-situ* nest protection effort along the lower Chambal at Garhaita village, for comparative purposes. The new hatcheries used wire mesh, but this didn’t prevent jackals and other animals from depredating all 70 protected nests.

This high predation rate inspired the establishment of a new hatchery at Garhaita in March. A total of 120 nests (2,195 eggs) and 166 nests (3,243 eggs) of two *Batagur* species were protected

on the lower and mid Chambal. Hatching in the river’s middle and lower sections are complete with 90 and 89 percent average emergence. Emergent hatchlings were tagged prior to release at natal sites. 110 *B. kachuga* hatchlings were transported from the mid-Chambal hatchery to the Deori Eco-centre to supplement our headstarting project. Unfortunately, 78 nests were depredated, poached or destroyed at nesting sites along the entire river segment (ca.75 km) surveyed.

COMMUNITY EDUCATION, AWARENESS, AND TRAINING (CEAT)

Chelonian educational materials were developed for urban and river communities as part of a yearlong Freshwater Biodiversity Conservation Awareness Campaign. Table calendars, a book of nature poems, and posters highlighting species diversity, ecology, and conservation were distributed to local communities and schools. These materials were officially released in March 2013 by the Honorable Minister of Uttar Pradesh, Sri Raja Anand Pratap Singh at a function in Lucknow attended by 300 dignitaries.

Seventy-eight CEAT events were conducted addressing over 18,560 participants. Events included Village Level Conservation Meetings (*Sanrakschan Panchayat*), Camel Rallies and Road Shows, Turtle Poacher Conversion Workshops, Ranger Training Workshops, River-side Education Camps and Photo Exhibitions. We also



TSA India conducts outreach to educate school children about riverine turtles and other vertebrates. Such programs involve skits, painting and model competitions, wildlife games and demonstrations. PHOTO CREDIT: SHAILENDRA SINGH



Divisional Forest Officer of Chambal, Vincent Rahim, listens to the sonic telemetered Batagur kachuga sub-adults released on the Chambal River. San Diego Zoo Global generously funded the purchase of this equipment. All individuals will be tracked throughout the year to study the survival and migration of headstarted turtles. PHOTO CREDIT: SHAILENDRA SINGH

designed and installed signage on turtle diversity, threats, and conservation measures at key locales, including the Kukrail Centre; on North and South Indian rivers such as the Chambal, Ghaghra, Sarju and Kali; and at Northeast Indian temple ponds. Moreover we trained two graduate students of wildlife science and corporate communication in the turtle conservation biology and conservation communication, respectively.

NORTHERN RIVER TERRAPIN (*BATAGUR BASKA*) INITIATIVE:

In March we worked with staff at the Sunderban Tiger Reserve (West Bengal Forest Department, WBFD) to facilitate the nesting of *B. baska*, one of the world's most endangered turtles. Just before nesting, females at the *Sajnekhali* facility were captured from their earthen pond enclosure and examined. Three adult females were palpated



Turtle Limited, a popular menswear company in India, announces a three year deal to promote TSA's India turtle conservation program as part of their Corporate Social Responsibility initiative. TSA representative Dr. Shailendra Singh presents a souvenir to Turtle Limited representative, Mr. Samaresh Shah during an event to formally launch this collaboration. PHOTO CREDIT: BHASKER M DIXIT

and determined to be gravid and transferred to the nesting pond. In March, another adult female from a village pond at Mollakali was handed over to the WBFD. She too was introduced to the *Sajnekhali* nesting pond. All four females nested and 56 hatchlings emerged on the nights of 25 and 26 May. All were transferred to the nursery.

We marked, weighed, measured and photographed 33 yearlings that hatched in 2012. They were then moved to a permanent nursery enclosure, a revamp of a former Olive Ridley pen. All yearlings have taken well to their new home and are growing rapidly.

BLACK SOFTSHELL TURTLE (*NILSSONIA NIGRICANS*) INITIATIVE:

The Black Softshell Turtle is restricted to a few temple ponds in India and Bangladesh, with the exception of remnant individuals in the Brahmaputra River. Early this year, we monitored four Assam temple ponds, finding that all needed modifications to address husbandry deficiencies and to encourage nesting. We met with temple committees, and community and political leaders repeatedly to build confidence and consensus on achieving these goals, while taking care not to upset religious beliefs. Since then, we have made changes to two temple ponds at *Nagshankar* and *Sarbhog* in the Brahmaputra River system. We incorporated regular health examinations, established basking and nesting platforms, and developed an on-site hatchery and nursery facility. Other measures culled predatory fish and discouraged the release of semi-aquatic turtles and tortoises. We also installed signage asking visitors to refrain from littering in the ponds



Improvements at the Kukrail Gharial Center have improved husbandry practices. Donated equipment has included a solar water heater and an electric refrigerator. PHOTO CREDIT: SHAILENDRA SINGH

or feeding turtles. A temple register was installed to record new pond entries. In April, we found a *N. nigricans* nest at Nagshankar pond and set up an temporary onsite hatchery. Another nest of *N. nigricans* was given to TSA team members by local villagers and is currently incubating. A permanent facility, capable of incubating at least ten nests and rearing 75 hatchling *N. nigricans* for six months, has been completed and on 30 June, the first clutch hatched, producing 15 turtles.

LEITH'S SOFTSHELL TURTLE (*NILSSONIA LEITHII*) INITIATIVE:

During this field season, Rajkumar, TSA's veteran nest finder, traveled from North to South India to teach local assistants how to locate the nests of *N. leithii*. We set out to Dandeli in North-west Karnataka and celebrated World Turtle Day upon our arrival. The celebration included a workshop for 30 school children at the Bison River Resorts on the River Kali.

Subsequent surveys and sampling yielded no nest, though implications are that two clutches were deposited by this enigmatic species during



A status assessment of the enigmatic Leith's softshell Turtle, *Nilssonina leithii* is ongoing on the Kali River in Karnataka state of South India. Here is our south India project co-ordinator, Shashwat Sirsi (left) along with project field assistant Santosh holding two freshly sampled leithii specimens. Such animals are sampled using traditional fishing gears with the help of local fishermen and after processing released back at the precise location of capture. PHOTO CREDIT: CHAITRA BALIGA/TSA INDIA



San Diego Zoo Global donated an inflatable boat to TSA India that has been instrumental in implementing crucial turtle conservation projects across Northern India. PHOTO CREDIT: SHAILENDRA SINGH



Newly hatched Black Softshell Turtles (*N. nigricans*) await release at the new facility at Nagshankar. Hatchlings like these will be reared and restocked in historic and protected habitats along Brahampatura river system in Assam. PHOTO CREDIT: AKASH SINGH

Emerging Wildlife Conservation Leaders (EWCL) is a joint program, facilitated by the Disney Worldwide Conservation Fund and Conservation International. This program helps jump-start the careers of conservation professionals through skills training and networking opportunities with peers and established practitioners. EWCL chose the India Turtle Conservation Program as a partner to help strengthen community outreach, advocacy, networking, communication and capacity building over the next two years.

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TSA India, under guidance from the Endangered Species Project, Uttar Pradesh Forest Department, renovated the species graphics and developed a river reptile knowledge park at the Kukrail Gharial Center. PHOTO CREDIT: LONNIE MCCASKILL

the post-monsoon and early summer season. We did come across a dead adult female, drowned in a fisherman's net. The specimen was 63 cm. in length and 22 kg. in weight. Our lack of knowledge regarding *N. leithii* in the wild, underscores the need for an assurance colony where this species' reproductive biology can be studied. Efforts continue to establish a captive breeding program in South India.

NEW CONSERVATION PARTNERS:

TSA India is proud to announce Turtle

Limited and Emerging Wildlife Conservation Leaders as new conservation partners

Turtle Limited was established in 1993 and today is one of India's fastest growing menswear companies. Turtle Limited has committed itself to supporting TSA India's Turtle Conservation Program for three years as part of its "Corporate Social Responsibility" project. Turtle Limited is displaying the TSA logo on its apparel at its 300 stores across India, along with an appeal for turtle conservation.

ACKNOWLEDGEMENTS

TSA India extends heartfelt gratitude to the following organizations and individuals:

Financial support: Andrew Sabin Family Foundation, San Diego Zoo Global, Mohamed bin Zayed Species Conservation Fund, Patricia Koval/WWF Canada, Cleveland Metroparks Zoo, Cleveland Zoological Society, Sedgwick County Zoo, Turtle Conservation Fund, Phoenix Zoo, SOS - Save our Species, Toronto Zoo, Turtle Limited, Ministry of Environment and Forests, Gharial Conservation Alliance and Centre for Environmental Education.

Permits, logistic support and guidance: Rupak De, Narendra Kumar, Suresh Chand, NC Bahuguna, Dipak Sarmah, B.K. Singh, Suhas Kumar, Ajai Mishra, Saumitra Dasgupta, Puneet Pathak, Shailesh Prashad, Sanjay Srivastava, Eva Sharma, Neeraj Kumar, Sujoy Banerjee, Vincent Rahim, Brij Kishore Gupta, Manoj Kumar Shukla, V.B. Srivastava, Gurmeet Singh, Suresh Rajput, Ayodhya Prasad, SC Bhaduria, Renu Singh, Jayanto Basu, Bahumik, Andy Leeman, Apal Singh, and Samaresh Shah, Ministry of Environment and Forests, Forest Departments of Uttar Pradesh, Madhya Pradesh, West Bengal, Assam and Karnataka, Zoological Survey of India, National Fisheries Development Board, TRAFFIC-India, RIB Expedition, and White Canvas Limited.

Critical feedback, guidance and support: Rick Hudson, Lonnie McCaskill (India advisor), Scott Davis, Patricia Koval, Andrew Walde, Brian D Horne, Hugh Quinn, Heather Lowe, Colin Stevenson, Ravi Chellam and Romulus Whitaker.

TSA India team Members: Shailendra Singh, Shashwat Sirsi, Ashutosh Tripathi, Bhasker M Dixit, Raja Mandal, Gowri Mallapur, Dr. RK Sharma Bishwajeet Baruah, Chaitra Baliga Suresh Pal Singh, , Aurnima Singh, Shadab Ahmad, Rinku Kumar, Surendra Kumar, Santram Bhagwatiand Om Prakash.

MYANMAR



A group of Asian Brown Tortoises eagerly devour a tray of food after being transferred to the new assurance colony in Gwa. The discolored carapace of the tortoise at the far left is likely the long-healed result of injuries sustained in a past brush fire. PHOTO CREDIT: STEVEN G. PLATT

TSA and WSC Join Forces to Save Myanmar's Imperiled Turtles

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

The Turtle Survival Alliance/Wildlife Conservation Society (TSA/WCS) Team logged another extremely productive year in Myanmar, scoring impressive victories in our continuing effort to save the country's beleaguered turtle fauna.

THE TSA/WCS TEAM TO THE RESCUE: TURTLE RESCUE CENTER OPENED

For starters, the long awaited and much needed Turtle Rescue Center (TRC) opened

in late 2012. The newly constructed facility is ideally located in a forest reserve near Maymyo, astride the Mandalay-Lashio Highway, a major conduit for illegally trafficked turtles destined for southern China's markets and butcher shops. Until now, Myanmar had no designated facility for turtles confiscated by police and Forest Department officials. Consequently these animals often were dumped at the Mandalay Zoo, which had neither personnel nor resources to care for

sudden influxes of large numbers of turtles, many needing urgent medical care.

The TRC opened on 6 December in a formal ceremony attended by Rick Hudson, U Than Myint (WCS Myanmar Program Coordinator), the TSA/WCS Turtle Team, and a host of government officials. The TRC is a state-of-the-art facility designed for immediate care of confiscated turtles. The spacious interior contains examination tables and holding tanks. Outdoor pens and tanks house rehabilitating turtles.

After appropriate quarantine periods, rehabilitated turtles will either be repatriated to suitable protected habitat, or in the case of threatened and endangered species, moved into existing assurance colonies. The TSA/WCS team trained two Forest Department staff to run the facility. Dr. U Tint Lwin, a Mandalay Zoo veterinarian and Myanmar's foremost authority on reptile medicine, is on stand-by to offer emergency medical care.

The facility quickly proved its worth when 85 turtles, including three Arakan Forest Turtles (*Heosemys depressa*) and four Impressed Tortoises (*Manouria impressa*), were confiscated in June at a border checkpoint. Regrettably, one Impressed Tortoise died of unknown causes (these delicate tortoises are notoriously difficult to maintain in captivity), but the Arakan Forest Turtles are in good health and will join the assurance colony in Gwa (see below).

ASSURANCE COLONIES AT MAYMYO AND GWA

An assurance colony of Asian Brown Tortoises (*Manouria emys phayrei*) was also recently established at the Maymyo TRC. The tortoises were originally part of a larger group confiscated from wildlife traffickers in 2007 and formerly housed at the Mandalay Zoo and Lawkanandar Wildlife Sanctuary (LWS). Both facilities are located in the arid dry zone of central Myanmar where summer temperatures exceed 110°F (43°C). This hot, dry climate was not to the liking of these deep forest denizens, who spent their time trying to keep cool and failed to reproduce. In response, we dispersed the tortoises to new assurance colonies in cooler climates.

Maymyo, given its location in the mountains overlooking Mandalay, was an obvious first choice for one of the assurance colonies. A large enclosure with multiple internal pens was constructed in a wooded area adjacent to the TRC. In mid-May we moved 30 tortoises into the facility. Here, they'll benefit from the same cool weather enjoyed by British civil servants in the Colonial period when they founded Maymyo to escape the



The recently opened Turtle Rescue Center near Maymyo. The building at center houses examination and treatment areas for confiscated turtles, while outdoor pens (in foreground) are available to maintain turtles during the rehabilitation process. PHOTO CREDIT: WIN KO KO



The exam and treatment area at the new Turtle Rescue Center near Maymyo. This Center was dedicated in December 2012. PHOTO CREDIT: RICK HUDSON.



Khin Myo Myo (left) and Me Me Soe (right) distribute educational material to village schoolchildren adjacent to Minzontaung Wildlife Sanctuary. Educational programs are being conducted prior to the release of captive-bred Burmese Star Tortoises in the sanctuary. PHOTO CREDIT: KALYAR PLATT



Unloading Burmese Mountain Tortoises into the new assurance colony facility at Maymyo. Located across the stream from the new Turtle Rescue Center, this facility will accommodate ~30 adult tortoises in multiple groups. PHOTO CREDIT: WIN KO KO

blast-furnace summer heat of Mandalay.

We established a second assurance colony at the Rakhine Yoma Elephant Sanctuary headquarters in Gwa, a coastal town nestled against the base of the Rakhine (Arakan) Hills in southwest Myanmar. The facility boasts four large, heavily vegetated, and well-shaded paddocks, each with a deep pool where tortoises can soak in hot weather. The colony was stocked with 21

tortoises from the Mandalay Zoo and LWS.

Transporting the animals to Gwa proved more difficult than expected. The combined weight of 21 tortoises far exceeded our Toyota hatchback's carrying capacity. It blew a tire less than an hour into the nine-hour journey. After some hurried negotiations with the driver of a bus on which the Team was traveling, we loaded half the tortoises into the cargo bay. Tortoises,

Team, and Toyota hatchback arrived safely in Yangon that evening. We temporarily lodged the tortoises in our garage and quickly learned first-hand how much feces an adult Brown Tortoise generates in a single day! Over the weekend, two more tortoises from the Yangon Zoo joined the group. Five days and a small mountain of feces later, the entire group arrived at their new quarters in Gwa.

ARAKAN FOREST TURTLE SUCCESSES

Gwa is also home to our nascent assurance colony of Arakan Forest Turtles, a poorly known and critically endangered species endemic to the Rakhine Hills. The colony was founded several years ago when a handful of turtles were seized from wildlife traffickers by the Forest Department. In 2012, its ramshackle enclosure was replaced in a major TSA/WCS sponsored facility renovation. We also provided training on the care of these rare and seldom-kept turtles. Since then the staff has witnessed numerous matings, but no

eggs appeared to have been laid. Then in late May, as the dry season waned and the monsoon began, five tiny just-hatched Arakan Forest Turtles were found exploring the enclosure! These were the first ever Arakan Forest Turtles successfully propagated in Myanmar, and one of only a handful of successful breeding attempts worldwide.

In November the Team ventured into the southern Chin Hills of western Myanmar in search of wild populations of Arakan Forest Turtles. The Chin and Rakhine hills are part of a contiguous mountain chain edging Myanmar's western border. Because no obvious barriers to dispersal exist, we long suspected *H. depressa* distribution extended north into the Chin Hills, but we lacked specimens to prove it. We especially wanted to know if the species occurred in Kyauk Pan Taung National Park, a recently protected area. Despite escalating regional ethnic tensions, the Team was granted permission to enter Chin State and the "Long Walk" began. A nearly month-long trek across steep terrain and rain-swollen rivers was required to reach Kyauk Pan Taung and return. It was worth it. Within the first week our exertions were rewarded when we obtained locally collected shells of *H. depressa* at a remote Chin Village. These specimens extend the distribution of *H. depressa* almost 150 miles (250 km) north from the nearest known populations in central Rakhine State. More importantly, we later verified *H. depressa* within Kyauk Pan Taung National Park, one of only two Myanmar protected areas known to harbor

the species. The Arakan Forest Turtle appears relatively secure in the region for now. Extensive tracts of forest and bamboo remain, and while the indigenous Chin collect and eat turtles they rarely hunt them, focusing instead on larger prey such as wild pigs and deer.

BURMESE STAR TORTOISES PLANNED REINTRODUCTION

Another exciting development this year concerns our planned reintroduction of Burmese Star Tortoises (*Geochelone platynota*) to Minzontaung Wildlife Sanctuary (MWS). Once common in arid central Myanmar, *G. platynota* is considered "ecologically extinct" in the wild due to rampant over-collecting in the late 1990s. A Team assessment conducted in 2011 identified MWS as the most promising of several proposed release sites for captive-bred tortoises. MWS is especially appealing because of the widely held belief among area villagers that tortoises are under the divine protection of *Nats* (Earth Spirits) dwelling within the sanctuary. Anyone harming a tortoise risks *Nats* retribution via sickness, misfortune, or even death. These powerful beliefs provide an umbrella of protection under which reintroduction is more likely to succeed.

We plan to select captive-bred subadult tortoises from the assurance colonies, place them in holding pens for varied periods of time to familiarize them with their surroundings, then gradually release them over 18 months. Tortoises selected for release will be "donated" to local

Buddhist monks—and blessed before being placed in holding pens—a move that we see as vital to protecting tortoises from poachers after release.

As a prelude to reintroduction, we convened a National Star Tortoise Workshop at LWS in September 2012. It was attended by Forest Department staff from every protected area within the geographic distribution of the Star Tortoise; by veterinarians from Myanmar (Dr. U Tint Lwin) and Thailand (Drs. Nantarika Chansue, and Kwanta Charapum); by Mandalay and Yangon zoo's curatorial personnel; and by the managers of assurance colonies at Lawkanandar, Shwe Set-taw, and Minzontaung wildlife sanctuaries. Both *ex-and in-situ* conservation issues were addressed, including an assessment of potentially surviving wild populations, improving husbandry and veterinary care in assurance colonies, and protocols for reintroducing captive-bred tortoises into protected areas. A workshop proceedings was compiled and is being translated into Burmese for distribution to participants and government officials.

In October 2012, the Team met with villagers and community leaders in the rural hamlets surrounding MWS to pave the way for the reintroduction. Shortly thereafter, the WCS Conservation Education Team made follow-up visits to each village and delivered presentations to schoolchildren and adults. In February 2013, the Team returned to the area, constructed "Star Tortoise Education Centers" in village schools, and distributed educational materials. A cadre of Community Conservation Volunteers (CCV) was established to monitor the reintroduction and report on poachers. CCV are paid a nominal fee, report to MWS staff, and submit monthly reports. Work has temporarily ceased with the monsoon's onset, but holding pens are slated for construction in September, followed by health screens in October for tortoises selected for release. This fall, after the "donation" ceremony by local monks, the tortoises will be moved into the holding pens.

BURMESE ROOFED TURTLE BACK FROM THE BRINK

The endemic Burmese Roofed Turtle (*Batagur trivittata*), another critically endangered species, continues to get much of our attention. Once, when asked about his victory at the Battle of Waterloo, the Duke of Wellington is said to have replied, "it was a damned close run thing!" The same can be said about our fight to save the Burmese Roofed Turtle. With less than 20 females left in the wild, it continues to be, "a damned close run thing". When the Burmese Roofed Turtle was "rediscovered" by Gerald



Young Burmese Star Tortoises feeding at an assurance colony in Lawkanandar Wildlife Sanctuary. These animals are destined for release as part of a project to restore wild populations of Star Tortoises at Minzontaung Wildlife Sanctuary. PHOTO CREDIT: KALYAR PLATT

Kuchling in 2002, it was tottering on the brink of extinction. However, prospects for long-term survival of this large river turtle get brighter with every passing year owing to our on-going conservation programs.

The first step taken to insure *B. trivittata* survival was to found an assurance colony at the Mandalay Zoo with eight adult turtles rescued from pagoda ponds and fishermen. Next, a beach monitoring and egg collection program was initiated along the upper Chindwin River, the last wild redoubt of this species. Under the direction of project leader U Kyaw Moe, local fishermen are hired yearly to monitor the few known-nesting beaches for signs of activity. Eggs deposited by females are collected and reburied at a secure incubation area on a sandbank beside the tiny riverside village of Limpha. Hatchlings emerging about two months later are placed in headstarting facilities at the Mandalay Zoo, LWS, and Limpha Village, where they're reared to a suitable release size. This program has been highly successful, with *B. trivittata* numbers steadily increasing each year. During the 2012-13 breeding season 74 eggs collected from the upper Chindwin River successfully hatched, bringing the number of Roofed Turtles in captivity to over 600. Without these programs, the Burmese Roofed Turtle would undoubtedly have followed the dinosaurs into extinction.

Given the small number of founder individuals, the genetic diversity of the Burmese Roofed Turtle assurance colony remains a major concern. If the genetic make-up of the animals in the colony were known, we could pair turtles for breeding in such a way that heterozygosity (genetic diversity) would be maximized in future generations. Determining the paternity and maternity of headstarted turtles would also provide greater insight into the number of males and females remaining in the Chindwin River. Unfortunately, genetic analysis funding has been unavailable. However, in an exciting new development, Dr. David Bickford, a conservation geneticist at Singapore National University (SNU), agreed to conduct the analyses if we provide the samples. The Team went quickly into action, traveling up the Chindwin River to Limpha Village in February, and collecting turtle tissue samples at the headstarting facility. In May the Team was joined by Natalia Huang and Samuel Tay of the Singapore Zoo, and Fatma Gözde Cilingir, a graduate student from SNU. Tissue samples were collected from every turtle in the Mandalay Zoo and LWS. At the same time we collected morphometric data to determine growth rates and to



Collecting tissue samples for genetic analyses from critically endangered Burmese Roofed Turtles at the Mandalay Zoo. From left to right: Kyaw Moe (WCS), Kalyar Platt (TSA), Samuel Tay (Singapore Zoo), Dr. U Tint Lwin (Mandalay Zoo), and Steven G. Platt (WCS). PHOTO CREDIT: WIN KO KO



Four of the five Arakan Forest Turtles recently hatched at an assurance colony in Gwa emerge from a water bowl after a lengthy soaking. Numbers painted on the shell permit identification of individuals for monitoring purposes. PHOTO CREDIT: S.G. PLATT.

verify that each turtle contained a microchip for individual identification. Study results will allow us to more effectively manage the existing captive population and craft conservation plans to better protect the few remaining wild turtles.

Kalyar Platt, Turtle Survival Alliance, Building C-1, Aye Yeik Mon 1st Street, Hlaing Township, Yangon, Union of Myanmar.

ACKNOWLEDGEMENTS

We wish to recognize the following donors

for their steadfast and generous support of the TSA/WCS Myanmar Turtle Conservation Program: Andrew Sabin and the Sabin Family Foundation, Andrew Walde, Batchelor Foundation, Beneficia Foundation, British Chelonia Group, Brookfield Zoo, Detroit Zoological Institute, Disney Worldwide Conservation Fund, Edith McBean, Fagus Foundation, Los Angeles Zoo, Natural Encounters, Patricia Koval and WWF Canada, Toronto Zoo, Turtle Conservation Fund, Wildlife Conservation Society, Woodland Park Zoo, and Zoo Miami.

CAMBODIA



Gregory Duplant (top), David Manser (right), and Brian D. Horne (left) pose for a picture as the installation is nearing completion. Behind the group is the deep-water reservoir, from which water flows over the faux rock waterfall. The waterfall was created to add aeration to the system, important in maintaining water quality.

PHOTO CREDIT: DR. MARCO GASPAROTTO

relinquished to the WCS Cambodia turtle team. This gave us the beginnings of the first breeding group of *B. affinis* within Cambodia.

On 18 February 2013, David Manser from Ponds & Plants and I travelled to Cambodia to begin work on the new breeding pond. WCS Cambodia's Greg Duplant, Dr. Marco Gasparotto and David Ware of ACCB helped us with the pond's construction, as well as a team of local Khmer from the surrounding community.

The pond was designed with the eco-physiology of the species in mind. It has three depths (1, 2, & 3m) to allow for the turtles to thermo-regulate as well as a shallow water biological filtration system and deep water reservoir that will help maintain cool water temperatures during the hot dry season.

Because the soil at ACCB is mostly sand that rapidly drains, we imported a pond liner from the US. This was another first for the region as pond liners are not readily available.

We then capped the ponds edges to secure the liner with plastic mesh and cement reinforced with fine plastic fibers. The cement was applied so that it would give an appearance of a muddy riverbank. The water from the deep-water reservoir was made to flow over a faux finished rock waterfall, which David Manser hand carved leaving a more natural appearance.

This breeding pond is a significant step in the conservation of *B. affinis* within Cambodia. As the last population in Indochina, it is hanging on by a mere thread. Only 2-3 nests are found each year within the Sre Ambel River System. We hope that this pair of turtles will produce an additional 1-2 clutches per year and that their offspring can be released into the wild in the coming years.

Brian Horne, Wildlife Conservation Society, 2300 Southern Blvd., Bronx, NY, 10460. bhorne@wcs.org

Dr. Marco Gasparotto of ACCB is shown here releasing the female *Batagur affinis* into the new breeding pond. The male and female *B. affinis* were released into the pond before increasing the water level as it was thought this would lessen the stress of the transfer and prevent the turtles from trying to escape the pond during the initial release. Since this photograph was taken, the water level has been increased and the turtles appear to be stress free. Evidence of mating attempts (shallow claw marks on the female's shell) indicates a high probability of nesting next year. In the background, the rainwater storage containers are visible. PHOTO CREDIT: DAVID WARE

A new breeding facility for the Southern River Terrapin in Cambodia

BRIAN D. HORNE, WCS

The Wildlife Conservation Society (WCS) and the Wildlife Reserves Singapore (WRS) jointly built the first pond specifically designed for breeding the Southern River Terrapin (*Batagur affinis*) in Cambodia at the Angkor Centre for Biodiversity (ACCB). WCS has been actively engaged in the conservation of *B. affinis*, for over ten years but has never had the opportunity to breed the turtles in captivity. This situation changed in late 2012 when an adult female *B. affinis* was returned to Cambodia from Vietnam due to the efforts of Doug Hendrie at Education for Nature Vietnam and Sovannara Heng of the Fisheries Administration of Cambodia.

WCS Cambodia had no suitable space for such a large turtle. Fortunately, the ACCB (a project of the Munster Zoo) made space available at their facility. In a further stroke of luck a male *B. affinis* was incidentally captured by a local fisherman and



David Manser (left) and Brian D. Horne (right) examining the female Southern River Terrapin (*Batagur affinis*) recently returned from Vietnam. PHOTO CREDIT: DR. MARCO GASPAROTTO

CHINA



Collapsible cathedral trap with a truck tire inner tube as a float at the Red River. The floating inner tube helps keep the net funnel straight and at the water's surface, always providing captured turtles with access to air. PHOTO CREDIT: GERALD KUCHLING

In Search of China's Last Giant Softshell Turtles (*Rafetus swinhoei*)

GERALD KUCHLING, RAO DINGQI, AND LU SHUNQING

Past reports of Giant Red River or Yangtze Softshell Turtles (*Rafetus swinhoei*) still roaming a small stretch of China's Red River prompted us to continue our efforts to catch and rescue the last specimens for captive breeding in 2013.

The formerly turtle-friendly riverine habitat of this area has been largely transformed into a series of huge hydroelectric reservoirs managed for electricity needs, with little environmental consideration. As a result, water levels often fluctuate dramatically, by several meters, within days or even hours.

Rafetus and other softshell turtles typically bury themselves in sand or mud, so can be trapped on drying sand banks or in shallow pools when water levels drop. Local people are aware

of the turtles' predicament, and swarm to these suddenly dry areas to search for buried animals to eat. This is precisely how three or four years ago a group of locals caught a 54kg *Rafetus* and shared its meat.

Fluctuating water levels create challenges for the trapping of remaining *R. swinhoei*. Traps must be large and strong to capture big turtles, making them difficult to transport and deploy. Also, if water levels suddenly rise, it is imperative that the traps float so turtles don't drown. To meet these requirements, we designed and constructed collapsible cathedral traps with metal frames and strong netting which can be lowered to a depth of 3-4 meters.

Unfortunately, bureaucratic hurdles have

so far prevented us from deploying the traps. Although the Chinese Forestry Department is responsible for turtle conservation, permission to set traps must be granted by the Fishery Department, part of the Agricultural Department. There are national, provincial, prefecture and county levels of the respective departments, all involved in regulation.

However, local people aren't breaking any law or regulation when they catch, slaughter, and eat *R. swinhoei*. The species isn't protected in China due to longstanding confusion regarding the identities of *R. swinhoei* and *Pelochelys cantorii*. In contrast to *Pelochelys cantorii* however, *Rafetus swinhoei* is still not listed on Schedule 1 of the China Key List of protected animals.

Though progress is slow, we continue working with the bureaucracy to get our traps placed.

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ACKNOWLEDGEMENTS

Program financial support came from the Turtle Conservation Fund (TCF) and Kadoorie Farm and Botanic Garden.



A fisherwoman identifies a turtle, of which she ate a leg, three to four years ago, as *Rafetus swinhoei*. She reported that the turtle provided as much meat as a pig and tasted even better. She runs a fishing business together with her younger brother and explained that most people who occasionally see the remaining *Rafetus* try to catch it. PHOTO CREDIT: GERALD KUCHLING

AFRICA



A close up head shot of the rarely seen Aubry's Flapshell Turtle (*Cycloderma aubryi*). PHOTO CREDIT: JOHN HART

Turtle and Tortoise Surveys in the Democratic Republic of the Congo

TOMAS DIAGNE, FIDELE BANDELE ENGALEENZIBO
AND MAMBA MBUSA KALISYA

Translation by Lucy Keith Diagne



The Democratic Republic of Congo (DRC) covers 2,345,000 km² and is the largest nation in central Africa. The DRC lies on the equator and has three climate zones: equatorial, tropical and mountain. The north includes part of the world's second largest rainforest, shared with six other countries. To the west, the DRC borders the Great East African Rift, with its mountains, hills, great lakes and volcanoes. The southern and central DRC is a savanna atop a plateau. In the far west, at the mouth of the Congo River, is a 40 km coast on the Atlantic Ocean.

Deforestation for timber and mining for mineral exports, largely by foreign companies, are both causing serious ecological damage, with

a loss of biodiversity—losses exacerbated by an escalating local bushmeat trade. In view of this situation, several field trips were made between April and August 2011 to the Salonga National Park complex by a team directed by Tomas Diagne of TSA Africa. This park lies entirely within the Central Congo Basin, between 1°00' and 3°30' south latitude, and 2°00' and 23°00' east longitude, and covers the provinces of Equateur, Bandundu, Kasai Oriental and Kasai Occidental. The surveys were made to observe, measure and describe tortoises and freshwater turtles in their natural habitat, and to determine their status and identify threats.

The Salonga National Park, a UNESCO World Heritage Site, covers 36,000 km² and is the largest rainforest reserve in the world. The

climate is equatorial, hot and humid, with an average annual temperature of 25.5°C (77.9°F), and 2000 mm of rain each year. Altitude varies between 350 m and 530 m and the fauna consists of diverse rainforest species, including many that are endangered (Krunkelsven *et al.* 2000).

FIELD SURVEY RESULTS

The field survey covered portions of the Salonga-Lukenie-Sankuru drainages (Figure 1) in two transects, from latitude 0 13 23 longitude 19 31 33, to latitude 1 03 16 longitude 20 56 35; and from latitude 1 14 25 longitude 20 21 50, to latitude 2 06 58 longitude 21 05 44. The headwaters of the Salonga River are in the Equator province north of the Park. Tributaries flow into the main Salonga River near the Watsikengo Station of the Congolese Institute for Nature Conservation in Boende Territory. Fishing activities are prohibited in the river, but still occur, as authorities do not control access. The team travelled 45 km along the Yenge River and 655 km along the Salonga-Lukenie-Sankuru drainages.



Flooded forest habitat is the preferred foraging habitat of *Cycloderma aubryi*. At Salonga National Park, DRC. PHOTO CREDIT: TOMAS DIAGNE

The Salonga and Luilaka rivers are similar, with murky brown waters, an average width of 45-60 m and depth of 3 to 11 m, depending on location and season. Water flow is powerful, even during the dry season, and the bottom is mud and detritus. The banks are lined with forest, bushes and grasses. Occasional sandbars appear during the dry season. Water temperature ranges from 23-25°C (73.4-75°F) and the pH ranges from 4.1 to 5.5. This acidity is caused by heat-dissolved humic substances, which also tint the water brown. These humic acid waters (given their pH) are less oxygen, 2.7 mg/l, which confirms the allegations of Doumenge, C., 1990. It seems, according to Matthes, the percentage of humic substances (acids) in water makes it extremely reductive release of iron



Close head view of Aubry's Flapshell Turtle (*Cycloderma aubryi*) in natural habitat at Salonga River. This species inhabits waters with high tannin content from decaying vegetation. PHOTO CREDIT: TOMAS DIAGNE

Table 1. Turtle species found during the study.

SPECIES	NUMBER & AREA WHERE FOUND
1. Serrated Hinge-back Tortoise, <i>Kinixys erosa</i>	22 specimens found in two bush meat markets; plus empty shells in several villages near Goma
2. Aubry's Flapshell Turtle, <i>Cycloderma aubryi</i>	145 specimens found in several surveys trips of the Luilaka River; 6 specimens in a bushmeat market near Goma
3. Nile Softshell Turtle, <i>Trionyx triunguis</i>	42 specimens found in several trips on the Yenge River
4. African Dwarf Mud Turtle, <i>Pelusios nanus</i> *	turtle species not captured but described by fishermen on the Salonga River
5. West African Black Turtle, <i>Pelusios niger</i>	99 specimens in the Salonga and Luilaka Rivers
6. West African Mud Turtle, <i>Pelusios castaneus</i>	102 specimens in the Salonga and Luilaka Rivers; 11 specimens in a bushmeat market at Kinshasa
7. African Forest Mud Turtle, <i>Pelusios gabonensis</i>	52 specimens in the Salonga and Luilaka Rivers
8. Central African Mud Turtle, <i>Pelusios chapini</i> *	turtle species not captured but described by fishermen on the Salonga River

oxides that absorb a significant portion of the dissolved oxygen.

The Yenge River is smaller than the Salonga and Luilaka, but similar. The major difference is width: the larger rivers rarely exceed a 200 m width, but the Yenge flood zone can extend to 400 m in places.

Turtle Species Identified

A total of 479 individuals from eight species of turtles (seven freshwater species and one tortoise species), were identified in the study areas (Table 1). Of these, two species (*Pelusios nanus* and *P. chapini*) were not seen by the investigators, but were accurately described by fishermen during interviews. Of these specimens, 440 were found in the field and 39 were found in markets. Most of the species were relatively common in the study area, except for the two species noted only in fishermen's accounts.

CONCLUSION

This inventory of chelonians in the Congo Basin is preliminary and survey work should be continued in this vast country. However, studies of turtles in this fragile ecological complex are rare, and we hope that this survey will provide a baseline for future researchers. Irresponsible hunting and fishing were very common in our study areas and the overexploitation of wildlife for bushmeat is of great concern. Enforcement of currently lax park regulations would help guarantee responsible fishing and hunting to preserve this ecosystem.

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Local Community Supports Conservation at Lac de Guiers, Senegal

TSA Africa announces good news for the Adanson's Mud Terrapin (*Pelusios adan-soni*) conservation program at the Tocc Tocc Community Nature Reserve on Lac de Guiers in north Senegal. The project—run by the African Chelonian Institute with help from the TSA and other partners—tried but failed to engage local people in turtle conservation at the Reserve for ten years. Now the four largest villages in the local community have reached a collective agreement prohibiting turtle consumption. The villages—including major stakeholders such as farmers, fishermen, and cattle ranchers—met and pledged to obey Reserve conservation rules. The July meeting was also attended by local officials and representatives from Senegal's National Parks Service and Water and Forestry Department. A local Eco-guards team has been trained and outfitted with surveillance equipment, to ensure enforcement. Local turtle consumption has already fallen to almost zero. The Tocc Tocc Community Nature Reserve was created to protect key foraging and nesting habitats for *P. adan-soni* and other wildlife.

Contact: Tomas Diagne, African Chelonian Institute & TSA Africa, africanci@gmail.com or fondsdev@yahoo.fr

ACKNOWLEDGEMENTS

Special thanks go to His Excellency Jose EB Endundo, Congolese Minister of the Environment, Nature Conservation and Tourism who allowed this work, and to the Turtle Survival Alliance, and Nature and Discoveries Foundation (France) for funding this study.

BELIZE

One of the two breeding ponds is now holding water, thanks to the artificial liners. Note the 4-inch PVC vertical pond drain which can be swung manually to adjust pond levels to the desired depth. Cohune thatch palm leaves have been placed around the perimeter of the ponds to mitigate any erosion that might take place during the coming rainy season and until natural vegetation takes hold. PHOTO CREDIT: WILLIAM GARCIA

Local Belize Businesses Step Up To Support Hicatee Conservation

JACOB MARLIN

The Central American River Turtle (*Dermatemys mawii*) is a large river dwelling species historically found in the coastal lowlands of southern Mexico, northern Guatemala and Belize. Known locally as the Hicatee, it has been intensely harvested for its meat and eliminated from much of its former range in southern Mexico. Its status in Guatemala remains unclear.

The lone surviving representative of the family Dermatemydidae, *D. mawii* is a unique

evolutionary lineage. Classified as Critically Endangered by the IUCN Red List, it was ranked 15th in the 2011 Turtle Conservation Coalition report *Turtles in Trouble: The World's 25 Most Endangered Turtles and Freshwater Turtles*.

Urgent conservation measures are needed to restore depleted wild populations. Captive management has been recommended, but Hicatee have proven difficult to reproduce due to their secretive nesting habits and because eggs undergo

embryonic diapause and delayed development.

To save the species, these reproductive challenges must be met in a controlled setting and through a local initiative. With that goal in mind, the Turtle Survival Alliance partnered more than two years ago with the Belize Foundation for Research and Environmental Education (BFREE), a biological field station in southern Belize. In 2011, the partnership began building the Hicatee Conservation and Research Center (HCRC). Initial work focused on constructing clay-lined ponds fed by a freshwater well and a solar powered pumping system. Breeding ponds were designed to permit manipulation of environmental variables to help determine egg-laying cues.

The project utilized heavy machinery, wheelbarrows and sweat equity to move large amounts of clay onsite. The clay lining process often takes time to seal and stabilize. Unfortunately, a year and a half after installation, the ponds still leaked and failed to hold sufficient water, stalling the HCRC effort.



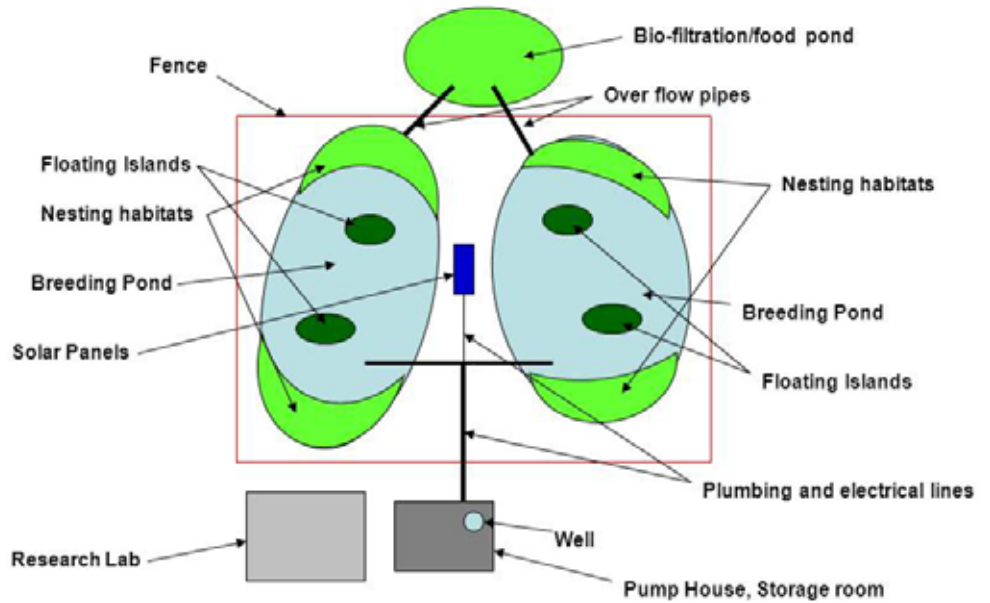
One of the breeding ponds just after liner installation and before being filled with water. Note the uprights of the perimeter fencing under construction in the back.
PHOTO CREDIT: JACOB MARLIN

In March 2013 as the dry season began, TSA and BFREE agreed that the clay pond lining was not viable and that artificial pond liners were the solution. The effort to procure, transport and install these liners was conducted with some urgency: the work had to be complete before the rainy season began. From mid-May to February, a time when 140 inches of rain can fall, the six-mile-long dirt HCRC access road that fords the Bladen River is mostly impassable, making movement of supplies and equipment impossible.

With only a two-month dry weather window still available in 2013, BFREE staff set to work. Jacob Marlin sought out heavy-duty liners. U.S. purchasing and shipping proved cost-prohibitive, so staff searched for in-country options. BFREE cacao farm manager Elmer Tzalam recommended Belize Aquaculture Limited (BAL), a local shrimp farm, as a possible source.

BAL representatives were enthusiastic about helping with the project. “BAL believes in sustainable and responsible shrimp farming, and we are devoted to positively impacting our surrounding social and natural environment,” said Isabelle Gayot, BAL’s Environmental and Human Resources Manager. “We are proud to contribute to Belize natural resource preservation and to assist the Hicatee Conservation and

Hicatee Conservation and Research Center at BFREE



The layout of the HCRC includes two breeding ponds, one biofiltration/food rearing pond, solar panels, pumphouse, and a perimeter fence. DIAGRAM BY: JACOB MARLIN

Research Center.”

BAL quickly identified a shrimp pond where plastic liners weren’t necessary. They put a crew to work removing the liners and repurposing them for the HCRC ponds. BAL also volunteered staff and tools to do the installation. However, they didn’t have a transport vehicle. Maya King Ltd., one of the largest agricultural businesses in Belize and a long-time BFREE friend, stepped forward with a truck.

Two BAL workmen arrived at BFREE with installation equipment and tools, including a hot air welding gun to join the pieces of plastic liner. The installation took just five days and five staff—three from BFREE and two from BAL.

Liner installation preparation included removal of the Morelet’s Crocodile (*Crocodylus moreletii*), four Bocatora Turtles (*Trachemys scripta*), and two Furrowed Wood Turtles (*Rhinoclemys areolata*), from the ponds. These reptiles were moved to other parts of the field station.

The existing ponds were drained and bulldozed deeper and wider by staff from Thomas Gomez and Sons Sawmill—another local BFREE supporter. BFREE staff led by Marcelino Pop smoothed the pond bottoms and dug pond drains with hand tools. Staff also installed a ten-foot-tall fence to keep natural predators—such as jaguars

and ocelots—out, and turtles in.

With the arrival of this year’s rainy season work continued, including completion of the electrified perimeter fence, and the building of artificial nesting areas and small floating islands to provide shade for thermal regulation.

Early in 2014 when the rainy season subsides, stock will be acquired, likely making the HCRC fully operational by summer. This will allow the facility to study the Hicatee under semi-natural conditions, hopefully unlocking the reproductive mysteries that have prevented past captive production.

Ultimately, the Hicatee’s survival depends on local cooperation. The tremendous outpouring of local support in 2013 in the creation of the HCRC ponds bodes well for this critically endangered river turtle.

Jacob A. Marlin, Executive Director, Belize Foundation for Research and Environmental Education, U.S. Mailing address: 4320 W University Ave Gainesville, Florida 32607, jmarlin@bfreebz.org

ACKNOWLEDGEMENTS

We wish to thank Belize Aquaculture LTD, Maya King LTD, Mohamed Bin Zayed Species Conservation Fund, Thomas Gomez and Sons LTD, the Chesapeake AAZK Chapter, Bill Denner, and the hardworking staff of BFREE.

INDONESIA



The offspring of *B. borneoensis* just emerged from eggs into a sand box. PHOTO CREDIT: JOKO GUNTORO



Joko Guntoro collects morphometric data (measuring carapace, plastron, etc.). He is helped by Agung Perdana Putra, a young volunteer who logs the data into a computer. PHOTO CREDIT: YUSRIONO

Conserving Indonesia's Painted Terrapin

JOKO GUNTORO

The Painted Terrapin (*Batagur borneoensis*) is ranked Critically Endangered by the IUCN Red List, and listed in *The World's 25 Most Endangered Freshwater Turtles and Tortoises* (Turtle Conservation Coalition, 2011). It has suffered sharp declines in Indonesia and is in serious need of management actions and local awareness efforts to protect this species.

In 2009 and 2010, the TSA supported surveys in the Aceh Tamiang District, where the species faces intensive threats. Villagers, unaware that

B. borneoensis is critically endangered or that its conservation is a national priority, harvested thousands of eggs in the 1990s. Between the 1990s and early 2000s, thousands of adult terrapins were collected as food and pets for local markets, and hundreds of hectares of mangrove forest—prime *B. borneoensis* habitat—were converted to palm oil production.

There are three main *B. borneoensis* nesting beaches in the Aceh Tamiang District: Pusong Cium, Kuala Genting, and Ujung Tamiang—lo-

cated in the Seruway Mangrove Reserves of the sub-districts of Seruway and Bendahara. All three beaches are remote, hours away by motorboat from the nearest villages. We collect eggs on one beach, but rely on egg purchases from fishermen at the other two. Fishermen are trained to excavate nests and to move the eggs into foam boxes filled with sand for transfer to our rearing facility.

In 2010, we hatched 59 *B. borneoensis* and released them after two weeks. The hatchlings were not headstarted because a facility was then lacking. This was remedied in 2011 when TSA established a headstarting pond. The 2011 nesting season was a disappointment. All eggs failed to hatch due to infertility and egg-handling errors by fishermen.

In the last nesting season—December 2012 to January 2013—we secured and reared 190 eggs, of which 81 hatched between 15 March and 2 April 2013 (with an 85 to 108 day incubation period). Offspring were kept in sand boxes for a week then moved to rearing ponds. Release of marked terrapins is planned after six months growth and shell hardening to minimize predation. Offspring were fed on *Kangkung* (*Ipomoea aquatica*), shrimp, and *Berembang* (*Sonneratiasp*) fruits. After the first month, average growth increase was 16 percent. On 4 May, average measurements were: 49 gram weight; 6,2 cm length; 5,8 cm width. Previous average measurements on 30 March were: 41 gram weight; 5,4 cm length; 5,1 cm width. We are steadily improving the rearing facility, adding a small building to house visiting students studying the Painted Terrapin and other species. We trained more than 600 students between 2011 and 2012. Our goal is to increase awareness of Painted Terrapin conservation among students and local villagers. We are promoting habitat reforestation where *B. borneoensis* is abundant through replanting of mangroves such as *Rhizophora sp.*, *Sonneratia sp.*, and *Avicennia sp.* Nesting patrols and captive breeding continue. We hope to rear and release at least 600 hatchlings into the wild between 2013 and 2017.

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ACKNOWLEDGEMENTS

We gratefully thank the Turtle Survival Alliance, PT Pertamina, EP Field Rantau, and the Turtle Conservation Fund who supported the 2012 survey, and the Keidanren Nature Conservation Fund who supported the campaign for students in 2011-2012.

COLOMBIA



Armando and Alberto Viga, leaders of the Caño Viejo community, with the new boat presented by TSA. The boat will greatly expand the range of nest protection and monitoring activities of the project. PHOTO CREDIT: RICK HUDSON

TSA/WCS Colombia Program Focuses on Endemic Species Protection

GERMAN FORERO-MEDINA AND RICK HUDSON

The TSA/WCS Turtle Conservation Program in Colombia was quite productive in its first year. The program—while still seeking financial support—made fast progress in capacity building, endangered/rare species monitoring, and development of turtle conservation partnerships. It also offered support to the conservation program of the Magdalena River Turtle (*Podocnemis lewyana*) in the Sinú River. Most importantly, the program is working to elevate turtle conservation to being a Colombian national priority.

CONSERVATION OF THE MAGDALENA RIVER TURTLE

The IUCN red list ranks *P. lewyana* as

critically endangered, and it is included in *The World's 25 Most Endangered Tortoises and Freshwater Turtles – 2011*. That's why the greatest achievement in the first year of the TSA/WCS Colombia program was the signing of an agreement between Urrá Electric Industry (UEI) and the Regional Environmental Authority of the Sinú River (CVS) to collaborate in a recovery program for the Magdalena River Turtle in the Sinú River.

The species experiences very high egg mortality in this river basin due to hydroelectric dam water releases, which flood nesting beaches. To reduce this loss, biologist Natalia Gallego, with support from Conservation International and the

CVS, created a community-based conservation program some years ago to rescue nests from flood-prone beaches and provide artificial nesting banks. This remarkable project won Natalia the student award for best presentation at the 9th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles in Orlando. The new Urrá/ CVS agreement helps continue this important species preservation effort by offering logistic and financial support, while strengthening the technical research and monitoring component.

First off, a workshop was conducted to develop a species management plan, identify and prioritize threats, determine required conservation actions, and design rigorous project evaluation methods. The workshop “A Management and Conservation Plan for the River Turtle in the Sinú River” was held 16 – 18 July 2013, and was sponsored by the institutions involved in the agreement, plus Conservation International. Participants included local universities and NGO's and the communities of Caño Viejo and Cotocá Arriba—both involved in the nest protection program. A major workshop outcome was a consensus agreement that nesting beach flooding is the primary threat to Sinú river turtles. Urrá has made significant efforts to reduce extreme water level fluctuations during nesting season, but it was agreed that management actions are still needed to increase nest survivorship. Goals include expanding nesting beach protection, and extension of the nest rescue program to other beaches. Improved communication between the dam and the nest rescue team will result in better timing and coordinated actions. Other proposed measures include protection of nesting beaches from cattle, environmental education programs, and alternative productive activities for consumer communities. Although there is still much to do, the willingness of Urrá to compensate for their impact, and to commit to the conservation program, bodes well for the recovery of this species in the Sinu River.

A highlight of the workshop came on day three when TSA President Rick Hudson presented a new fiberglass boat and outboard motor to the project during a celebration in the community of Caño Viejo. This boat will allow nest protection and monitoring to expand over a much larger area, and replaces the dugout canoe that has been used by the project for years.

CAPACITY BUILDING AND EDUCATION

A major program goal is to expand the capacity for turtle conservation work in Colombia. To help meet that objective, TSA/WCS supported a gradu-

ate course in natural history and the conservation of freshwater turtles and tortoises offered by the *Universidad del Valle*, in Cali, from 29 September to 8 October 2013. Eighteen students from Colombia and one from Ecuador participated in the course, which hosted a field trip to Isla Palma in the Pacific to practice field techniques and develop small research projects with the island's turtle species. Course faculty included professors Dr. Alan Giraldo (*Universidad del Valle*), Dr. John L. Carr (*University of Louisiana*), Dr. Vivian Paez (*Universidad de Antioquia*), Carlos Galvis (*Cali Zoo*), Mario F. Garcés (*Universidad del Valle*), and TSA/WCS Colombia Program Coordinator Dr. German Forero-Medina. This was an outstanding opportunity to teach students about turtle conservation, and laid the groundwork for a student communication network for future research.

TSA/WCS, along with the *Asociación Colombiana de Herpetología* and the *Cali Zoo*, also organized a workshop to share turtle conservation education success stories in Colombia. More than 30 researchers and conservationists involved in turtle work shared their projects, methods, and developed a set of recommendations for implementing turtle conservation environmental education programs. These recommendations and the network created during the workshop will be most useful for practitioners.

Additionally, the TSA/WCS Colombia program is supporting undergraduate students working with turtles and local communities to improve knowledge of rare species and their uses. In Chocó department, students are evaluating the use of turtle species by local and indigenous communities, while conducting workshops to discuss turtle diversity and conservation with local leaders and schoolchildren.

ENDANGERED AND RARE SPECIES MONITORING

Colombia harbors some of South America's most threatened and rare chelonians, including the Magdalena River Turtle, South American Giant River Turtle (*P. expansa*), Dahl's Toad-Headed Turtle (*Mesoclemmys dahl*), and Dunn's Mud Turtle (*Kinosternon dunn*). The TSA/WCS team is supporting population monitoring of Dahl's Toad-Headed Turtle in Cesar state, in collaboration with the Instituto de Ciencias Naturales from the Universidad Nacional de Colombia. This year the project received a \$27,000 grant from the People's Trust for Endangered Species to estimate population abundance throughout the species range and to begin implementing habitat restoration.

Dunn's Mud Turtle is one of the least known mud turtle species worldwide, and one of three



Magdalena River Turtle (*Podocnemis lewyana*). PHOTO CREDIT: NATALIA GALLEGO



Participants of the course "Natural History and Conservation of Freshwater Turtles and Tortoises" held in Cali, Colombia, September-October 2012. PHOTO CREDIT: TSA COLOMBIA

endemic species in Colombia. TSA/WCS is supporting Dunn's Mud Turtle baseline research to understand its distribution, ecology, threats, and conservation needs. This project involves students and researchers from the local university, Universidad Tecnológica del Chocó.

The TSA/WCS program is also conducting research to aid in future conservation decisions. We are mapping the ranges of the nation's 27 turtle species and conducting gap analysis to identify species currently protected/unprotected by the National Parks System. Partial funding

has also been secured for a management practices workshop for the South American Giant River Turtle, which will bring together practitioners working with the species to develop a regional monitoring program.

ACKNOWLEDGEMENTS

We thank the Wildlife Conservation Society, Natural Encounters, Fagus Foundation, People's Trust for Endangered Species, British Chelonia Group, Mohammed bin Zayed Species Conservation Fund and Bill Dennler for program support.

SOS Batagur: Help is on the Way!

RICK HUDSON



Some of the 2012 hatched *B. baska*, showing exceptional growth rates. PHOTO CREDIT: AGJ MORSHED

In October 2012 the TSA, in collaboration with the Wildlife Conservation Society (WCS), was awarded a major SOS - Save Our Species grant for conserving Asian River Turtles. The grant of \$151,866, spread over two years, will implement a regional model to conserve large River Terrapins of the genus *Batagur* in South and Southeast Asia.

It represents the largest single grant in the eleven year history of the TSA, and provides funding at a critical time to three programs: TSA's Chambal River program for Painted Roof



Terrapins (*B. kachuga*) in India; the TSA/Zoo Vienna program for the Northern River Terrapin (*B. baska*) in Bangladesh; and WCS's recovery

program for Southern River Terrapins (*Batagur affinis*) in Cambodia.

SOS is a global coalition initiated by three founding partners—IUCN, Global Environment Facility and World Bank—with the goal of building the largest species conservation fund to support on-the-ground field conservation projects worldwide.

RIVER TERRAPINS AT RISK

River Terrapins were once abundant in the



The Painted Roof Turtle, *B. kachuga*, is one of three *Batagur* species that will benefit from SOS funding. This is a male in full breeding color. PHOTO CREDIT: SHEENA KOETH

major river systems of South and Southeast Asia, from the Mekong to the Ganges, but human activities now threaten the survival of these large turtles. Five of the six species in the genus *Batagur* are ranked Critically Endangered by the IUCN Red List and face imminent extinction unless threats are reduced.

Batagur eggs are widely gathered for domestic consumption, a harvest made easier because females congregate yearly at about the same time to deposit eggs at known beaches and sandbars. Large adults are also harvested for food, with nesting females—critical for sustaining populations—making up most of the catch. Females are easy prey when emerging to lay eggs. *Batagur* are also harvested as a fishing by-product or accidentally drown in fishing nets. Rampant commercial harvest of adult and juvenile turtles for food markets in Asia has decimated some populations. These threats, some chronic, resulted in inclusion of five species in the 2011 report *Turtles in Trouble: The World's 25+ Most Endangered Tortoises and Freshwater Turtles*, by the Turtle Conservation Coalition.

WCS and TSA: A Model Partnership



Future issues of Turtle Survival will champion the TSA's partnerships worldwide.

This year we start by paying tribute to our most important strategic partner: WCS.

The remote upper reaches of the Chindwin River in Myanmar may seem like an unlikely scene for a marriage, but it was here that the vital turtle conservation partnership between the TSA and Wildlife Conservation Society (WCS) began. In 2005, with the discovery of a remnant wild population of the Burmese Roofed Turtle, a species long thought extinct, TSA and WCS together launched what many now consider a model conservation program for large river turtles.

Today the working relationship and strategic alliance between TSA and WCS has grown beyond Myanmar to include turtle conservation projects in China and Colombia. Over the years, the WCS/TSA alliance has responded effectively to critical conservation challenges by utilizing the collective strengths of both organizations. WCS has an extensive network of program offices in key turtle diversity hotspots around the globe, staffed with experts ranging from field and conservation biologists to GIS mapping gurus and accountants. Partnering with WCS allows the TSA to utilize existing national agreements and long-standing relationships with governments in host countries, and provides a mechanism for administering funding. Over the years WCS's range country staff have been instrumental in facilitating TSA's goals, whether it be facility construction or organizing workshops. For its part, the TSA brought expertise in turtle captive management and handling trade seizures to the equation, along with fundraising ability.

Other partnership benefits include the drafting of Memorandums of Understandings (MOUs); making mutual travel and visa arrangements; sharing office space, accounting and translation services; getting permission to travel in restricted areas; and making introductions to key government personnel.

Nowhere is this partnership better exemplified than in the Myanmar Turtle Conservation Program. Considered a model for systematically addressing the conservation priorities of a country's chelonian fauna, the program owes much of its success to the dynamic husband and wife team of Steven and Kalyar Platt, working jointly for WCS and TSA respectively. In what is recognized as one of the world's most successful ongoing turtle recovery programs, the TSA/WCS partnership has brought the Burmese Roof Turtle back from the brink of extinction to a captive population that now exceeds 600 turtles.

Working with the Myanmar Department of Forestry, multiple assurance colonies have also been established for endemics like the Arakan Forest Turtle and Burmese Star Tortoise. The Burmese Star Tortoise breeding programs have been so successful that preparations are underway to reintroduce tortoises to a protected area in 2014.

One of the most memorable moments of the partnership came in 2007 when a joint TSA/WCS team handled the rescue of 76 Burmese Mountain Tortoises in Mandalay. Today those sturdy tortoises survive and are distributed among four assurance colonies in Myanmar.

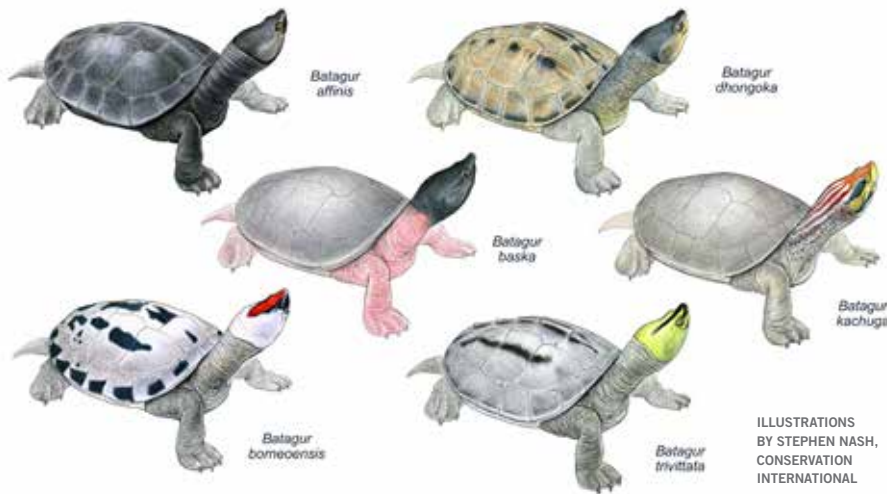
Other examples of mutual success include Gerald Kuchling's TSA-supported effort to breed *Rafetus* at the Suzhou Zoo, facilitated by Lu Shunqing and WCS's China Program office in Beijing. Starting in 2008, the WCS provided critical logistical support to these ground-breaking attempts to save the world's most endangered turtle.

Finally, in 2012, the TSA joined with WCS's Colombia Program to initiate a comprehensive turtle conservation program there, hiring German Forero to spearhead the new initiative.

Partnerships have always been one of TSA's core strengths; in fact, we were founded as a partnership initiative. We highly value our many allies worldwide with whom we work side-by-side to save turtles.



Rupali Ghosh happily displays the two wild-caught hatchling *B. baska* from June 2013, conclusive evidence this species is still reproducing in the wild. PHOTO CREDIT: AGJ MORSHED



ILLUSTRATIONS BY STEPHEN NASH, CONSERVATION INTERNATIONAL

The TSA and WCS have spearheaded *Batagur* conservation in South and Southeast Asia since 2003, and together have developed a highly effective model for conservation that utilizes *in-situ* and *ex-situ* methodologies to arrest declines and increase populations. Without our conservation actions, it is highly probable that the Burmese Roof Turtle (*B. trivittata*) would already be extinct and numbers for other species would be significantly lower than at present. SOS funding provides a means to reverse the downward population trajectories of *Batagur* by allowing us to continue developing and implementing our already highly effective conservation project

models. Without continued aggressive conservation intervention, there is no doubt that many *Batagur* populations would face extinction within the next ten years.

SOS PROJECT ACTIVITIES

The best “points of access” to helping *Batagur* populations are the nesting beaches critical to sustaining populations and ensuring the next generation. The annual emergence of females to lay eggs on well-known and often historic nesting beaches is the most vulnerable stage of their annual life cycle, and it is here where protective conservation measures have proven most

effective. Our SOS program will focus on nesting beaches, using tried and tested conservation techniques—guarding females, protecting eggs and often moving them to safe incubation areas, and collecting hatchlings as they emerge. In the National Chambal River Sanctuary in India, thousands of *Batagur kachuga* and *Batagur dhongoka* nests are saved annually by moving them to protected hatcheries where eggs are safe from jackal predation. An estimated 80 percent of those nests would be lost without this program. Instead, tens of thousands of healthy hatchling *Batagur* are released into the river each year.

Raising hatchlings in captivity until they are large enough to avoid predation—known as headstarting—is used successfully in *Batagur* conservation programs in India, Myanmar, and Cambodia. However, in the case of the Sunderbans River Terrapin (*Batagur baska*) no active nesting beaches are known in India or Bangladesh, so we rely instead on captive breeding within assurance colonies to restore populations. Assurance colonies guarantee a species’ survival until protected habitat can be identified for reintroduction. Most *Batagur* species are considered conservation dependent, meaning their populations will not persist without these intensive recovery efforts. By ensuring survival of both eggs and hatchlings, and protecting nesting females at this extremely vulnerable stage of their life cycle, the SOS project will assure the next generation of river terrapins.

Project activities covered by this grant in Bangladesh include the construction of new *B. baska* breeding facilities to maximize genetic management and potential of the small founder groups; acquisition of new specimens for the captive program; field surveys to locate active nesting beaches and extant wild populations; and searches for potential release sites. In India the *B. baska* breeding facility will be improved; the riverside hatchery and headstarting program for *B. kachuga* will be expanded; and turtles will be released and monitored for survival. Field surveys to verify new wild populations of *B. kachuga* outside the Chambal will get underway; and a second population will hopefully be established using headstarted turtles. In Cambodia, the remnant wild population of *B. affinis* on the Sre Ambel River will be supplemented with headstarted offspring; efforts to improve protection of known nesting sites will be ramped up; and new breeding and headstarting facilities will be completed.

Rick Hudson, TSA President, rhudson@fortworthzoo.org

Communication in Aquatic Turtles: An Interview with Dick Vogt and Camila Ferrara



Camila Ferrara recording hatchlings on the beach and in the river. PHOTO CREDIT: CEQUA-RICHARD C. VOGT

You are involved in some innovative research; can you describe what you are working on?

We're studying acoustic communication in aquatic turtles. Using hydrophones, we've demonstrated that late term embryos of *Podocnemis expansa* are communicating to stimulate simultaneous hatching and communal digging out of the nest. Furthermore, we've found that females are communicating underwater to hatchlings, presumably to aid in long distance migration. So far, we've documented acoustic communication in ten aquatic turtle species. Most likely, all turtle species emit sounds to some extent to communicate with conspecifics. This phenomenon has been overlooked because the sounds are at the low end of the frequency of human hearing, short in duration, and low in volume. It's very exciting to know that turtles have been exchanging information in our presence all along; only now are we documenting what they're saying.

These findings are transforming the way we look at turtles; can you elaborate on the possibilities here?

Acoustic social behavior in turtles is the most



Podocnemis expansa being released with satellite and vhf transmitters. PHOTO CREDIT: CEQUA-RICHARD C. VOGT

exciting development in turtle biology since the discovery of temperature controlled sex determination in the 1970s, which changed the way people thought about turtle population biology and conservation programs. The fact that turtles are now shown to be far more social than anyone

dreamed, will change the way people study turtles and the way conservation and management programs are developed. Sound pollution is an obvious example of an important new factor that must be considered in future turtle conservation programs. We don't know how motorboat or dredging operation sound interference may affect turtles' abilities to communicate. Is it possible that sounds produced by ATVs driven across nesting beaches may cause premature hatching? Or perhaps even loud Cumbia music played on the beach may effect a hatching.

Turtles must find mates; until now we thought they merely bumped into each other, or maybe that pheromones played a role, as evidenced by a tortoise attempting to copulate with a head of lettuce walked over by a female. Clearly, acoustic and olfactory senses develop differently amongst turtle species. We know that *P. expansa* are very social, emitting sounds to group together for migration, to come out of the water and bask communally, and to leave the water and nest in groups. They might also be emitting sounds continually as they migrate to maintain pod structure, as ducks do when they fly in V formation or as red-winged blackbirds do in their massive spring and fall migrations. Do turtles give warning calls? Are there group leaders? Is there vigilance on beaches while their sisters nest? Turtles must no longer be considered animated rocks with legs; they have an intricate social life that we are just beginning to unravel.

This field is ripe for further research. What are some areas you would like to see investigated?

It's unlikely that individual females identify their young or vice versa, but it is rather a genetic group bonding effort. We need to know the genetic nature of these pods, are these family groups? Are the females that migrate with hatchlings from the nesting beaches sisters? Are these relationships maintained through the year? Do turtles go in and out of groups?



Dick Vogt and Virginia Bernardes recording underwater vocalizations of *Podocnemis expansa* with a hydrophone.
 PHOTO CREDIT: CEQUA-RICHARD C. VOGT



P. expansa adult female and hatchlings with sonic transmitters. PHOTO CREDIT: CEQUA-RICHARD C. VOGT

What happens when you release a turtle of the same species from a different river system near the group? Does it join the group or try to find its way home? We need to conduct underwater playback experiments to understand the

function of emitted sounds. Can we call turtles in to nest on the nesting beach of our choice? Can we use surrogate mothers when releasing headstarted turtles so that these naïve turtles can get to foraging grounds? What do the

structures of these sounds look like in mixed species assemblages of turtles, where we may have 10 or more species in the same river? Can we use hydrophones to census turtles in streams, rivers, and lakes? On the Mississippi River in Wisconsin, three species of *Graptemys* hibernate together behind specific wing dams; why these wing dams and not others? These same species migrate 8-12 km to nest on the same beaches together year after year; is there interspecies communication? We need to collect data over a broad taxonomic scale to understand the level of communication among diverse taxonomic groups and the diversity of the acoustic repertoire. Are there universal sounds of similar wavelength and structure used by all turtles?

The fact that female and hatchling South American Giant River Turtles are vocalizing, and that there is strong evidence that female turtles wait offshore for hatchlings to enter the water, has enormous implications for how we plan and execute headstart and release programs. Can you elaborate on the potential impact of your research on these conservation strategies?

There is more than strong evidence. We have over 20 years of research demonstrating that female *Podocnemis expansa* do indeed wait for hatchlings. To date, we know hatchlings migrate with the females in the deep channel of the river for up to 62 km. This year, we predict we'll be able to document hatchling turtles reaching the flooded forest feeding grounds with the females. The practice of holding hatchling *Podocnemis expansa* in captivity for weeks or months before release, and the practice of releasing hatchlings at beaches different than their natal ones, may actually be harmful to the natural process of migration. There is recent documentation of young mature *P. expansa* nesting alone in inadequate beaches in shallow, fine sand in the lower Amazon River. These turtles may have lost their pod, or never were members of one; this could be the result of released or escaped turtles. It would be interesting to see if we could induce these turtles to follow the sounds of migrating turtles played from underwater speakers, bringing them to a migrating pod or up to the nesting beaches in the Trombetas River. Remembering that pre TSD conservation efforts by some sea turtle biologists produced all male turtles because of nest manipulations, it may be best to revisit the conservation strategies for *P. expansa* and consider a more hands off approach.

Dick Vogt, dickturtlevogt@gmail.com
 Camila Ferrara, ferrara@terra.com.br

FURTHER READING

- Ferrara, C.R., Vogt, R.C., and Sousa-Lima, R.S. 2012. Turtle vocalizations as the first evidence of post-hatching parental care in chelonians. *Journal of Comparative Psychology* 127:24-32
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We Are the TSA

HEATHER LOWE

The foundation of the Turtle Survival Alliance (TSA) is our partnerships, including those with our individual members. With that in mind, we are pleased to announce that our membership has continued to grow in 2013. Funds generated by membership dues help to offset TSA operating costs and provide available funds for unexpected costs of conservation projects around the world. In short, your support is critical to our success.

We firmly believe that anyone can contribute to turtle conservation in some way, regardless of background or experience. These are three exceptional members who do just that. We hope that you enjoy getting to know them.

MILENA OLIVA MÉNDEZ

Hometown: Guatemala City, Guatemala

Occupation: Biologist

What first sparked your interest in turtles and tortoises?

I had pet turtles as a girl, but my scientific interest in turtles began in 2008. I was in my second year of biology course work and on a field trip with an invertebrates course. We were looking for insect larva in a pond, and then suddenly I saw the most beautiful creature I've ever seen: a wood turtle (*Rhinoclemmys pulcherrima*). I had found animals in the wild before, but I'd never felt what I felt at that moment. From that day, my interest grew.

Tell us about your job.

I did my thesis research on the distribution, natural history and habitat characterization of the Central American River Turtle (*Dermatemys mawii*) at Sarstún River, Guatemala. Through this experience, I realized that the only way to do something effective was through community involvement. The wonderful people that live along the Sarstún River have an impressive cultural wealth. But, they also live in poverty and their education is very limited. How can we ask these fishermen not to feed their families when they accidentally capture a turtle in their cast nets? How can we demonstrate to them that the ecosystem in which they live is much more valuable than money, when they live in poverty?

To continue my research, I designed a conservation project where local people benefit from sustainable development projects. The project will promote improvement in people's education



and general welfare while preparing them to study and protect *Dermatemys*.

How did you first learn about the TSA?

I did an internship at Zoo Atlanta in 2011. Knowing my interest in turtles, the staff there encouraged me to go to the Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles in Orlando. I was surprised by the passion that I saw in everybody. It was a true inspiration to hear all the presentations and that was where my thesis project was born.

How would you describe your personal conservation philosophy?

I think that we have to reunite humans with nature, but in the process we cannot neglect one or the other. For me it is important to

strengthen that union through environmentally friendly activities that are also welcomed by the community.

MICHAEL W. HANCE

Hometown: Centereach, NY

Occupation: Biomedical researcher/postdoc

Tell us about your family.

My wife, Emily, and I just had our first child, Isla, in March 2013. We live in rural coastal South Carolina with our dogs and various turtles and tortoises.

What first sparked your interest in turtles and tortoises?

At the age of four, my first reptile pet was an



tional outreach should be a part of every scientist's job. Even if they are not directly working in conservation, we need to end this distrust of scientists and educate people about science so that it is not clouded in mystery. Then, maybe, the science we do can become something they understand, even something that fascinates them. My hope is for people to begin to trust us, and even care about the harsh realities that we need to face, like extinctions and climate change.

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

When I became interested in herpetology, I noticed how many people vilified the animals I loved. I realized that I could pursue a career in conservation and do all the research I wanted, but it would not matter if the general public was not interested in keeping these animals alive. While at the University of Georgia, I started doing educational outreach with their Herpetological Society. For the past four years we have been taking native reptiles and amphibians to schools and local events, teaching people of all ages and walks of life about them.

Tell us about your job.

I just graduated from the University of Georgia and will be starting graduate school at Clemson University in the fall. In the summer of 2010 I was hired by the Georgia Department of Natural Resources as a wildlife technician to help monitor known bog turtle populations and locate new ones. I have been helping them with their efforts to conserve bog turtles ever since. I'll be continuing this research in graduate school, focusing on bog turtles in South Carolina, but this summer I have taken a break to do an internship with the TSA, helping them set up the new Turtle Survival Center.



Eastern Box Turtle (*T. c. carolina*). That turtle ignited a passion that will likely persist the rest of my life. To this day, I still keep a pair as pets and get a sense of euphoria when I find one in the wild.

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

I really like the diversity of the membership of the TSA. There are academic researchers, veterinarians, zoo workers, and private hobbyists that all share a passion for turtle and tortoise conservation. This broad knowledge base provides the opportunity to constantly learn, whether at the annual conference or while volunteering at the Turtle Survival Center.

How did you first learn about the TSA?

I first learned of the Turtle Survival Alliance while working at the Knoxville Zoo. I officially joined in 2006 and have been a member ever since.

Tell us about your job.

I am an American Cancer Society postdoctoral fellow at the Medical University of South Carolina's Hollings Cancer Center. My current work involves investigating the molecular mechanisms of early metastatic behavior in prostate cancer such as cellular plasticity and the ability of cancer to exploit the genetic programs regulating tissue organization and cellular polarity. We hope that our group may be able to identify biomarkers focused specifically on these early events, thus providing clinicians with additional tools to differentiate men at the greatest risk of metastatic disease. The ability to do so will improve the quality of life of men with less aggressive cancers by reducing unneeded treatment and hopefully provide strategies to limit metastasis by therapeutically targeting the earlier events in the process.

HERESA STRATMANN

Hometown: Irmo, SC

Occupation: Graduate Student, Clemson University

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

In 2000, I moved from Washington to South Carolina. One day Mama came running into the house, asking us to come out. She showed us a bright orange and black turtle sauntering through the yard. For German immigrants new to the Southeast, the only thing we could conclude was that someone had lost their pet. Our neighbor kindly pointed out that it was a wild turtle. You might as well have told us that we had lions in our backyard - that was how exotic the experience seemed to us. For me, it was the first time I realized that you do not have to go to the Amazon to see spectacular wildlife. If you take the time to look, there are treasures right in your own backyard.

How would you describe your personal conservation philosophy?

"In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught." – Baba Dioum

This quote, from a Senegalese conservationist, best sums up my conservation philosophy. And as a scientist-in-training, I believe this message needs to be taken to heart by scientists. Like the quote says, people only conserve what they love and will only trust what they understand. If the public does not love nature, conservationists cannot save it. If the public is not literate in science, skepticism of problems, like climate change, will continue to run rampant. To be effective, a scientist must therefore be more than a researcher. A scientist must be an educator and leader, opening the public's eyes to our backyard treasures. Educa-

A Lasting Legacy

The turtle conservation community lost one of its staunchest allies when Bern Tryon passed away on May 6, 2011. He is best known for his pioneering work with the Southern Bog Turtle (*Glyptemys muhlenbergii*); particularly in Tennessee where he wrote and helped implement a conservation and recovery plan for the species that merged field and captive management techniques. Bern's 25 year commitment to the Southern Bog Turtle is being sustained as he bequeathed his significant herpetological library to the TSA to create an endowment to fund bog turtle research and conservation.

At the time of his death, Bern was the Director of Animal Collections/Herpetology at the Knoxville Zoo. At the 8th Annual Symposium on the Conservation and Biology of Turtles and Freshwater Turtles, he was awarded a Lifetime Achievement Award, 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.

Thus far, the library has generated more than \$50,000 for Bog Turtle conservation. However, there are still a number of wonderful books and reprints available, many of which are out of print. All proceeds from library sales directly benefit the fund. To view the full catalog online, please visit <http://pondturtle.com/btlMain.html>.

As a special offer to TSA members, all books are now available for 20% off of the listed price through December 31, 2013. Your membership in the TSA will be verified at the time of purchase.



Bern holding the last Bog Turtle he would ever collect, September 2009 in North Carolina. PHOTO CREDIT: DENNIS HERMAN

We're serious about saving turtles—join us!

Visit 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

NAME

COMPANY / ORGANIZATION

ADDRESS

CITY, STATE, ZIP, COUNTRY (IF OUTSIDE U.S.)

E-MAIL

PHONE NUMBER

How did you hear about the TSA? _____

Membership Levels (figures represent annual dues):

Student (\$25) Individual (\$50)

Would you like to make your membership "green?" Green members will not receive a hard copy of the TSA's annual publication in the mail. Instead, they are invited to read it online. Yes No

Please visit turtlesurvival.org to learn more about options for Organizational Memberships.

Thanks for your support!



TSA members are eligible for discounts on registration at our annual conference and other specials 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 and conducting training opportunities to expand conservation work with endangered tortoises and freshwater turtles globally
- Hosting our annual symposium and providing support to speakers and special guests
- Supporting conservation work and recovery programs for critically endangered chelonians around the world



Inspecting the growth rate on a Burmese roof turtle at the Yadanabon Zoo in Mandalay, Burma in 2010. Rick was instrumental in building the breeding and headstart facility here in 2006 that helped spur the recovery of this near extinct turtle. PHOTO CREDIT: KALYAR PLATT

Rick Hudson Receives 8th Annual Behler Turtle Conservation Award

JOHN IVERSON, PHD, ANDERS RHODIN, MD,
AND BRIAN D. HORNE, PHD

Raised in the small, rural mountain town of Stuart, Virginia, just off the Blue Ridge Parkway, Rick Hudson, spent his formative years plying the local streams and springs for salamanders, snakes, and turtles and his Herp affliction became apparent at an early age. His fascination with all things herpetological was indulged by his parents despite

the fact that his long-suffering mother had a true snake phobia. However, she gladly took him for rides following summer rains to search of box turtles, while his father was called on to build homes for his son's growing menagerie. Rick became known locally as the "guy to call when you found a reptile" and by the age of 12 had established a

backyard zoo that attracted local media attention. In 1966 the hometown newspaper ran an article that quoted Rick as saying that when he grew up he wanted to be a naturalist and work in a real zoo. Few people can say that they are doing now what they said they aspired to do as a child. Destined to be a zoo man, his earliest childhood memory was at the National Zoo at the age of four.

Herpetological opportunities were sparse in rural Virginia but that improved when Rick moved to Richmond in 1972 where he found like-minded people that enjoyed collecting and keeping herps. He earned a BS degree in Biology from the University of Richmond in 1977 and began seeking employment in zoo reptile departments. With few job prospects he decided to improve his marketability by enrolling in a veterinary technology program under the direction of a former zoo veterinarian, Dr. Stuart Porter. Porter helped open the door to the zoo world for Rick that ultimately led him to his first and last job in 1980, at the Fort Worth Zoo where he has spent his entire 33-year professional career. He served as Assistant Curator in the zoo's world-renowned Herp Department for twenty years, moving to the new Conservation and Science Department in 2000.

Prior to his involvement in the turtle world, Rick established a reputation for organizing zoo-based conservation programs, most notably through his efforts to save several highly threatened Caribbean iguana species. He organized and chaired the Lizard Advisory Group for the American Zoo Association (AZA), becoming involved in West Indian Rock Iguana (*Cyclura*) conservation following the rediscovery of the Jamaican Iguana. Rick organized the 1993 workshop in Kingston that laid the foundation for the recovery of the Jamaican Iguana – now regarded as one of the world's premiere conservation success stories – a program with which he maintains close ties today. The Kingston workshop ultimately led to the formation of the IUCN West Indian Iguana Specialist Group (now the Iguana Specialist Group) which Rick co-chaired for ten years. Today Rick remains active in iguana conservation, and is the Executive Director of the International Iguana Foundation that raises and administers funds to support research and recovery programs for critically endangered iguanas throughout the Caribbean, Central America, and Fiji.

In response to the Asian turtle crisis in the mid-1990s, Rick began taking an active role in the AZA Chelonian Advisory Group, and helped guide the restructuring of the AZA's collection plans to make them more conservation-based. The Fort Worth Zoo's herp collection responded as well,

establishing successful breeding groups of many endangered Asian species, including Painted Terrapins, Golden Coin Box Turtles, Pan's Box Turtles, Annam Leaf Turtles, McCord's Snakeneck Turtles, and initiating some of the first zoo-based work with captive Impressed Tortoises.

In 2000 Rick joined Kurt Buhlmann, at the Savannah River Ecology Lab in South Carolina, with John Behler, Dwight Lawson, Dave Collins, and Whit Gibbons. Concerned with the Asian turtle crisis, they discussed how best to utilize their facilities for endangered Asian turtles. It was there that the idea was born to hold a workshop to address the Asian turtle crisis. Rick convinced the Fort Worth Zoo to host the workshop and plans got underway with a January 2001 target date. As the international invitation list began to take shape and key players were identified, word began to circulate "Why is an iguana guy holding a turtle workshop?" - a fair question given Rick's well-known iguana background. During this time he took comfort, and inspiration, in knowing that his long-standing colleague from the iguana world, John Iverson, was able to successfully work with both chelonians and iguanas. In fact, Rick's first turtle-related publication was co-authored with John, a feeding note on Alligator Snapping Turtles in *Herp Review*.

The Fort Worth Zoo workshop was an arduous three-day affair that brought together 80 turtle experts from around the world, with representatives from all of the various sectors that had a stake in Asian turtle conservation, including groups that traditionally shared little in common and rarely communicated. As expected, the workshop, facilitated by the Captive Breeding Specialist Group and its Chair, Ulie Seal, was fraught with challenges, and it was not until the eleventh hour that a new sub-group came together, with representatives from all constituent sectors, and committed to working together to save Asia's rapidly declining turtle fauna. Thus, the Chelonian Captive Survival Alliance was born as an IUCN Task Force, co-chaired initially by Rick Hudson and Kurt Buhlmann. The name was soon changed to the Turtle Survival Alliance (TSA) and Rick has continued to lead this organization's development from that eclectic workshop in 2001 to a global turtle conservation enterprise with an annual budget of over a million dollars. Rick has charted an ambitious path for the TSA with active field programs in not only Asia but around the globe. He maintains direct involvement in the planning and implementation of these programs, and has a keen eye for recognizing talented and motivated people to lead



Rick holding an adult male Grand Cayman Blue Iguana in Grand Cayman in 2001. PHOTO CREDIT: JOHN BINNS

them. Furthermore, Rick has been the driving force behind finding a new home for the TSA, the Turtle Survival Center, in South Carolina. This facility allows TSA to address its founding mandate of protecting species in captivity that have little success of surviving in the wild.

Rick embodies the true spirit for which this award was created: to honor leadership and excellence in the field of tortoise and freshwater turtle conservation. Rick's recognition in the turtle conservation community is largely tied to the extraordinary success of the TSA and his leadership role in that organization's rise to prominence. He does not have an advanced academic degree, nor has he written books or published major scientific works. However, he has led the development of an incredibly effective turtle conservation organization, and he has worked on the front lines in efforts to help prevent the extinction of several Asian turtle species. Rick's direct and indirect contributions to global turtle conservation easily match those of the previously honored recipients, and his career path has closely followed that of the late John Behler for whom this prestigious award is named. He is emblematic of the growing corps of conservation specialists whose background has been primarily in zoo management and herpetoculture, as those disciplines become ever more important in our global struggle to help prevent turtle and tortoise extinctions in our time. His award is highly deserved and reflective of his important standing as a true and prominent leader in the global turtle conservation community.

In Rick's own words: *Being selected by my*

peers to receive this award is certainly the greatest accolade of my professional career and I am honored to join this select fraternity of prominent turtle biologists. Inasmuch as my success in turtle conservation is linked with that of the TSA, I feel it appropriate to mention those that have been at the core of that success: Kurt Buhlmann, Scott Davis, Brian Horne, Dwight Lawson, Heather Lowe, Lonnie McCaskill, and Andrew Walde. I also want to mention Pat Koval, Walter Sedgwick and the rest of the TSA Board of Directors: your trust in me is humbling and my commitment to you is that I will never let you down. Fort Worth Zoo Director Mike Fouraker deserves special recognition for his unwavering support of my conservation work, for sticking with me during the hard times, and for providing a home base for the TSA. I pay tribute to Ulie Seal and John Behler: both exerted major influences on my conservation ethic but moreover on how I attack problems and deal with difficult challenges. I was privileged to spend a month with John in Madagascar in 1991 on our first trip when the addiction began. It was a magical and unforgettable experience, and changed us both forever. But if there is one person that was my greatest example, it was my father, Dick Hudson, who instilled in me his work ethic. Finally if there is one compliment that I have received over the years that sticks with me, it is this gem from my colleague in Madagascar, Christina Castellano: when asked to describe Rick Hudson by someone that didn't know me she replied, "All I can tell you is, the guy knows how to get s____ done." If this is my epitaph, then I will consider my career a success.

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

Veterinarians **Keith Benson, Charlie Innis, Sam Rivera, Joe Flanagan, Bonnie Raphael** visited the Turtle Survival Center in April to welcome

the first turtles to the facility, conduct quarantine exams and make recommendations on protocol.

Lonnie McCaskill has taken on the new role of TSA India Advisor, putting in many valuable hours to support this important conservation program.

Robert Villa, Michael Hance, Rose Tremblay and **Nancy Reinert** all returned as our faithful volunteers for the 2013 symposium. **Brian Bower** and **Daniel Gaillard** joined them for the first time, providing photography and A/V support.

Kathy Vause, Michael and **Emily Hance, Roman Fletcher, Andrew Blaser, Emily Turnbull, Scott Pfaff, Jay Allen, Melody King, Connor Par-ton, Theresa Stratmann, Stephen Nelson, Brad Moxley, Ed Neil, Sheryl Brandt, Berkeley Boone, Ann Hao, Sam Seashole, Dave Manser, and Chris Spees** all pitched in and got their hands dirty as volunteers at the Turtle Survival Center.

Thomas Rainwater donated and prepared a delicious "low country boil" for the TSA Board of Directors during their meeting at the Turtle Survival Center in April.

Shannon Livingston assisted with grant writing for the India program, helping to secure funds for several key projects.

Glenn Scherer provided editorial services for Turtle Survival, with **Matt Welneck** coordinating design and layout.

Ben Anders, Stephen Nash and **Ann Hirschfeld** shared their artistic skills and provided us with t-shirt designs again this year.

Jennifer Poindexter and the St Louis Zoo have once again been wonderful local partners for the annual conference, providing generous and friendly event planning support.

Jay Allen has devoted multiple hours of his time and expertise in helping to build the Turtle Survival Center.

Omaha's Henry Doorly Zoo and the **Fort Worth Zoo** sold merchandise on behalf of the TSA, raising funds for our conservation programs.

Steve Gott represented the TSA at an event hosted by the Florida Museum of Natural History, sharing information about the Rafetus breeding program in China.

Harold "Wally" Wahlquist generously donated a pick-up truck for use at the Turtle Survival Center.



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 more!

- **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 Turtle Survival Alliance Wish List on Amazon.com to purchase equipment that is needed by our staff at the Turtle Survival Center and in the field.
- **Adopt a Turtle** By symbolically adopting 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 Extra Cost to You** There are several programs available in which you can support the TSA's mission by doing what you do every day!
 - » **Amazon.com** – Access amazon.com via the TSA link and a portion of your purchase will be donated to turtle conservation!
 - » **Capital One Card Lab** - Share your passion and donate to our cause with your everyday purchases. We've partnered with Capital One® Card Lab Connect on a fundraising program, which helps us earn money effortlessly every day! Just carry our custom credit card (choose from three designs), and valuable cash donations for every purchase you make with the card will be donated to our organization.
 - » **eBay** - Turtle Survival Alliance is part of the eBay Giving Works program. So, you can support our mission when you buy and sell on eBay.
 - » **Good Search** – What if the TSA earned a donation every time you searched the Internet? Or how about if a percentage of every purchase you made online went to support our cause? It can, with Good Search!
- » **Shop for the Cause** Visit the TSA's online store to purchase t-shirts, art, publications or other merchandise to support conservation projects around the world. Retired designs are available on a wide variety of merchandise in the TSA's Café Press store.
- » **Volunteer** Pitch in and get your hands dirty! Volunteer opportunities are posted on the TSA website when available.

<http://www.turtlesurvival.org/get-involved/support-the-tsa>

The Black Softshell Turtle (*Nilssonina nigricans*), is a critically endangered turtle species endemic to Northeastern India and Bangladesh, long thought to exist in only one temple pond. Wild populations have recently been discovered, but the species is extensively hunted for the food and calipee trade and population numbers are low. Confined primarily to a few religious sites and temple ponds of northeast India, where they are protected, these temple ponds are usually overcrowded and the water conditions are poor with no basking areas. Turtles are fed puffed rice and other human food as religious offerings, and often show signs of skin disease, infighting, and poor nutrition. Due to a lack of suitable nesting substrate for digging, females deposit their eggs in places where they have little chance of hatching. To improve some of these situations, the TSA has initiated projects with some selected ponds in Assam to improve husbandry and reproduction of these turtles. The eventual goal is to produce hatchlings that can be headstarted and released as a means of supplementing depleted wild populations. A modest softshell nursery and hatchery was built along the Brahmaputra River at Nagshankar Temple and the first clutch of 15 hatched on 30 June. The facility will help protect ten nests and 50 hatchlings annually for the first two years and will be expanded as funding allows.

PHOTO CREDIT: SHAIKENDRA SINGH/TSA INDIA



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