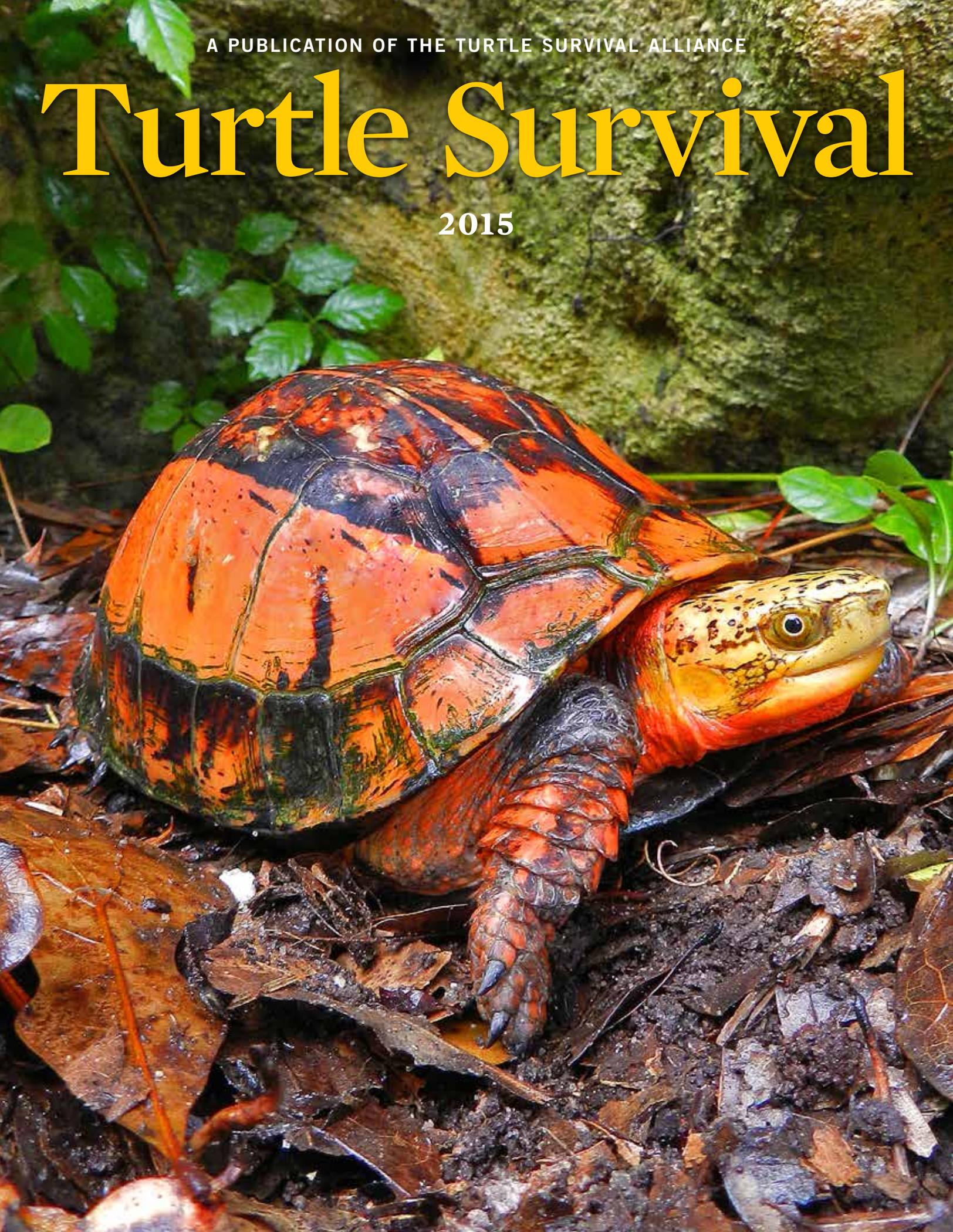


A PUBLICATION OF THE TURTLE SURVIVAL ALLIANCE

Turtle Survival

2015



RICK HUDSON

FROM THE PRESIDENT'S DESK

TSA's Commitment to Zero Turtle Extinctions more than just a slogan



PHOTO CREDIT: KALYAR PLATT

Though an onerous task, this evaluation process is completely necessary if we are to systematically work through the many species that require conservation actions for their survival. Determining TSA's role for each species is important for long-term planning and the budgeting process, and to help us identify areas around the globe where we need to develop new field programs. In Asia for example, Indonesia and Vietnam, with nine targeted species each, both emerged as high priority countries where we should be working. Concurrently, the Animal Management plan identified 32 species for management at the Turtle Survival Center, and the associated space requirements imply a significant investment in new facilities. Both the Field Conservation and Animal Management Plans provide a blueprint for future growth for the TSA, and document our long-term commitment. Failure is not an option for us, and it will require a significant investment in capital and expansion if we are to make good on our mission.

As if to test TSA's resolve to make good on our commitment, on June 17 the turtle conservation community awoke to a nightmare when we learned of the confiscation of 3,800 Palawan Forest Turtles in the Philippines. We dropped everything and swung into action and for weeks to come, this crisis and the coordinated response dominated our agenda. In a show of strength and unity, turtle conservation groups from around the world responded, deploying both staff and resources. In the end working through this crisis became a highly gratifying experience and we were able to turn a grim and chaotic situation into one of hope. As of this writing all but five of the surviving turtles had been treated and released. More than a hundred organizations helped raise funds and for one shining moment the turtle conservation community was able to put aside our differences and unite in a way that I have not witnessed since the Hong Kong confiscation in 2001. May that spirit of cooperation and goodwill remain with us long into the future.

As always, thanks for supporting the TSA, and for all you do to improve the future for turtles and tortoises.

Committed to Zero Turtle Extinctions: these words have become TSA's tagline, our mantra if you will, our overriding mission. It's an easy slogan to toss around, but what does it really mean? How serious is that commitment, and moreover can TSA live up to that promise? We regard our commitment to zero turtle extinctions as our unwritten contract with the turtle conservation community and the turtles themselves. We take this pact very seriously and during this past year, engaged in a rigorous and detailed evaluation process that would put teeth into this commitment.

Starting with a list of 62 species ranked Critically Endangered by the IUCN Red List, or that are proposed for CR listing (including

species that we know to be under imminent threat with dismal futures in the wild) both the Field Conservation and Animal Management Committees began their analysis. Decision trees were developed and eventually the two processes were merged, creating a priority list of 45 species targeted for action and describing what TSA's role would be in each species' survival. This process is preemptive, and is designed to ensure that species don't slip through the cracks. In other words, we want to identify species heading for trouble while there is still time to enact recovery efforts. Too often – in Asia particularly – we find ourselves engaged in crisis management, trying to recover a species that has already slipped dangerously close to extinction.

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TABLE OF CONTENTS



FEATURES

Inside Cover | From the President's Desk
2 | Meet the Staff
3 | Animal Update
6 | Significant Breedings
7 | Outreach
8 | Construction
10 | Veterinary Update
11 | Donated Goods
12 | Capital Campaign
14 | Volunteers
15 | Conservation Notes
40 | eDNA
42 | Bolson's Tortoise Project
44 | Cambodia
46 | Philippines
49 | TSA Blueprint

RANGE COUNTRY UPDATES

16 | Madagascar
21 | India
26 | Bangladesh
28 | Myanmar
33 | Indonesia
34 | China
36 | Belize
38 | Colombia

PARTNER NEWS

52 | Partners
53 | Turtle Conservation Fund
54 | TSA Europe
58 | NAFTRG

EXCLUSIVES, NEWS AND ANNOUNCEMENTS

60 | We are the TSA
62 | Brewery Partnerships
63 | Bern Tryon Memorial
64 | Behler Award
Inside Back Cover | Donor Recognition



Contents of this publication should be cited as: Author. (2015) Article Title. Turtle Survival, pp. xx-xx.

ABOUT THE COVER: This Indochinese box turtle (*Cuora galbinifrons*), was among 95 Asian box turtles received at the Turtle Survival Center (TSC) from Hong Kong in October 2015. The shipment included all three species of Flowerback Box Turtles including *Cuora galbinifrons*, *Cuora boureتي*, and *C. picturata*, and provides important new potential founder lines to the U.S. managed populations. These species can be challenging in captivity, requiring years to acclimate, and reproduction is generally sporadic. Growth of the captive populations has been slow. These turtles were part of a long-term collection, acquired over a decade ago from live markets by a remarkable woman named Vivian Cheung. An architect by trade, Vivian spent countless hours restoring these turtles back to health while keeping them in her apartment – no small feat for even the most experienced turtle keepers. When the genus *Cuora* was elevated to CITES Appendix II, Vivian had the foresight to register them with the Hong Kong government as “Pre Act” to document that they were acquired legally prior to protection from international trade. In early 2015, Vivian contacted the TSA and offered to place her collection at the TSC, an environment that she considered more conducive for conservation management and long-term sustainability. That she offered this rare collection to the TSC is a testament to our growing international reputation, but moreover is a tribute to Vivian's conservation ethic and commitment to the species' ultimate survival. The turtle conservation community, and the turtles that depend on us, and indeed the world, needs more people like Vivian. This issue of Turtle Survival is dedicated to Vivian, and we hope her story will inspire more to follow her example. See cover story on p. 3. PHOTO CREDIT: CRIS HAGEN



<http://instagram.com/turtlesurvival>



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



<http://twitter.com/turtlesurvival>

Meet the Staff



ILZE ASTAD

Ilze Astad joined the Turtle Survival Alliance as Director of Development in November 2014. Her experience in fundraising and nonprofit management spans more than 12 years, working for diverse organizations with causes ranging from hunger to human rights. A native of Latvia where she was raised, Ilze moved to the states in 1997 to pursue her education. She is proud to call Charleston her home. She earned her undergraduate degree in Political Science at the College of Charleston and was later awarded the Masters of Public Administration from a joint program with The Graduate School at College of Charleston and the University of South Carolina. When asked what she likes most about working with the TSA, Ilze said, "It is morally incumbent upon us to preserve endangered turtles and tortoises worldwide as an integral part of ecosystems ... the TSA is at the forefront of that vital work." We are pleased to have Ilze as a part of the TSA team.



CLINTON DOAK

Clinton Doak, the newest member of our team, has been interested in reptiles and amphibians for the majority of his life. Growing up in rural Michigan, his passion for herpetofauna started at an early age where he could be found in the swamps and ponds looking for turtles. After receiving a Bachelor's degree in Zoology, he started a career in zookeeping. Initially a keeper in the education department at the Little Rock Zoo, Clinton's interest drove him towards a more reptile-focused career. This interest led him first into a role as a keeper in the Reptile Department at the Little Rock Zoo, then into a position in the world-class herpetarium, the Museum of Living Art (MOLA) at the Fort Worth Zoo. While working at MOLA he worked with some of the most endangered reptiles in the world, including a variety of Asian species such as Indian Gharial, Painted Terrapin, Southern River Terrapin, and Narrow-headed Softshell Turtle. Clinton's background and experience makes him the perfect addition to the Turtle Survival Center team as the Chelonian Keeper.

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:

zero turtle extinctions.

The TSA is an action-oriented global partnership, focusing on species that are at high risk of extinction in turtle diversity hotspots around the world. We develop culturally sensitive conservation programs that utilize a combination of education outreach, conservation in the wild, assurance colony management in range countries, and *ex situ* (out of range) captive management.

Through our working collaborations with zoos, aquariums, universities, private turtle enthusiasts, veterinarians, government agen-

cies, and conservation organizations, the TSA is widely recognized as a catalyst for turtle conservation with a reputation for swift and decisive action. The TSA has grown into a global force for turtle conservation and currently supports projects or programs in Belize, Colombia, Europe, Madagascar, United States, and throughout Asia. The opening of the Turtle Survival Center in South Carolina in 2013 has greatly enhanced our ability to protect the most vulnerable species through *ex situ* assurance colony management and captive breeding.



With two large acquisitions over the past year, the TSA has significantly increased the managed captive populations of three critically endangered Asian Box Turtle species in the U.S.A. From left to right (*Cuora galbinifrons*, *C. bourreti*, *C. picturata*). PHOTO CREDIT: CRIS HAGEN

Import Bolsters the TSC Collection

CRIS HAGEN

Now in its second year, the TSA's Turtle Survival Center has seen incredible progress since breaking ground in March 2013, thanks to an effective team of dedicated staff, hard working volunteers, the generosity of donors, and steadfast leadership from managers, coordinators, and directors driving the TSA.

A GROWING COLLECTION WITH A PLAN

The TSC's living collection now numbers more than 500 individual chelonians, and as time

and funding allow, outdoor and indoor facilities will be constructed to achieve the long term projected grow out of roughly 2,400 individuals.

Thanks to Hugh Quinn and the TSA's Animal Management Committee, a 100-page Animal Collection Plan has been drafted to manage the living collection. The plan uses a decision tree process to achieve the TSA's goal of zero turtle extinctions by building robust captive populations of critically endangered species that have

little or no chance for survival in the wild and will likely depend on long-term captive management to avoid extinction.

At this time, 32 species have been chosen for captive management at the TSC. Population sizes of founders and their descendants are calculated to maintain 90% gene diversity over 100 years. The Animal Management Committee has also updated documents that define acquisition, disposition, and research guidelines for TSA turtles.



This adult founder female Rote Island Snake-necked Turtle (*Chelodina mccordi*) was kept alone for 17 years by a professor in Anderson, South Carolina before being transferred to a local reptile pet shop for resale in January 2015. After which, the turtle was promptly secured by a private donor for inclusion into a managed captive population at the TSC. PHOTO CREDIT: CRIS HAGEN



Mrs. Vivian Cheung and her husband Jason at home in Hong Kong with their dog Oscar and some of their rescued turtles. PHOTO CREDIT: BEN ANDERS



Each turtle is housed individually at the TSC during their quarantine period.

A Turtle Savior

Cris Hagen and Ben Anders

The remarkable woman who made the October import of 105 turtles possible is Vivian Cheung, a Hong Kong architect, who devoted herself to rescuing and rehabilitating turtles from the food trade during the infamous Asian turtle crisis 10-15 years ago. Mrs. Cheung worked relentlessly to recover the hordes of turtles succumbing to soup pots in Hong Kong markets. Most of her rescued turtles required stabilizing care, including daily tube-feeding, frequent treatments at a veterinary clinic, careful husbandry, and long-term housing arrangements. Her residence has become home to many IUCN Critically Endangered turtles since then, but she finally decided they should get a home more conducive to long-term conservation. The TSA was locally recommended as the best candidate for managing the turtles, and after some correspondence with Cris Hagen, Mrs. Cheung decided that the TSC would be the ideal placement.

After being decimated by commercial collection, Indochinese Box Turtles are now internationally protected. Wild-caught founder turtles are hard to come by and valuable to ex situ conservation programs. Mrs. Cheung's heart-felt concern for turtles was demonstrated by the fine condition of those she donated to TSA. Her level of devotion and selflessness towards global turtle conservation stands as a benchmark for those who support endangered species programs.

Preparing to receive 105 new turtles involved considerable planning and hard work. An area of the central red barn at the TSC was renovated as a temporary quarantine area with new racks and enclosures so that every turtle could be housed individually.

On 14 October 2015 the shipment arrived from Hong Kong in Los Angeles, cleared customs and USFWS, and was transferred to a Delta flight to Charleston. All turtles weathered the trip well, and many began feeding the next day.

The TSA acknowledges the following zoos for their generous support of this importation: Oklahoma City, Knoxville, Woodland Park, National Zoological Park and Tennessee Aquarium. We thank Brian Horne for meeting the shipment in L.A. and getting it safely to the Delta flight east, and Ben Anders for working with Vivian Cheung to ensure the turtles were carefully packed prior to shipping.

KEEPING TRACK OF RESIDENTS AND NEW ACQUISITIONS

Along with an expanding living collection comes more data to record and preserve. In 2015, the TSC consolidated and upgraded all animal records to the *Tracks Software System*, enabling more efficient management. Individuals in the collection were microchipped and/or shell-notched for permanent identification.

In October 2014, the TSC received a very generous donation of 16 adult founder Sulawesi Forest Turtles (*Leucocephalon yuwonoi*), 12 Sulawesi Tortoises (*Indotestudo forstenii*), and 18 Spiny Hill Turtles (*Heosemys spinosa*) from a private collection. All these turtles were rescued from the markets of southern China and elsewhere in the 1990's and early 2000's. The owner decided to disperse the collection to a few qualified individuals and institutions so their genetic lineages could be integrated into captive management efforts. All the turtles acclimated well to the TSC. Most now live in a year round tropical environment in the Sulawesi Greenhouse.

The TSA also acquired several other priority species through breeding loans and donations, including: breeding pairs of Impressed Tortoises



Sheena Koeth unpacks and admires two very large *Cuora galbinifrons*. These new bloodlines will increase the likelihood of successful captive population management for the species.

(*Manouria impressa*) and Arakan Forest Turtles (*Heosemys depressa*), as well as a genetically unrepresented adult female Rote Island Snake-necked Turtle (*Chelodina mccordi*), and Zhou's

Box Turtle (*Cuora zhoui*). A Southern Vietnam Box Turtle (*Cuora picturata*) acquired from a private breeder is one of the first captive bred individuals of this species offered in the U.S.

In 2014, another private collection became available consisting of 10.13 captive and reproducing Bourret's Box Turtles (*Cuora bourreti*). They were all obtained during the 1990's when this species was still imported to the U.S. for the pet trade. The TSA seized the opportunity to secure this genetically important group and significantly bolster the managed captive population.

In October 2015, the TSA received an incredible donation of a long-term captive collection of 105 turtles comprised primarily of Indochinese Box Turtles, the majority of which are Flowerback Box Turtles including *Cuora galbinifrons*, *C. bourreti*, and *C. picturata*. This donation represents important new bloodlines for the AZA studbook for these species. These new founder animals will greatly increase the likelihood that the captive populations of these three species will move closer to long-term sustainability in the U.S.

Contacts: Cris Hagen, Turtle Survival Alliance, P.O. Box 396, Cross, SC 29436, chagen@turtlesurvival.org

Tischler Art for Conservation

Renowned artist Tom Tischler's second sculpture in his Tischler Art for Conservation (T AFC) project is a Galapagos Tortoise dedicated to the Turtle Survival Alliance. The T AFC project was created to provide impact beyond what Tom's life-sized sculptures, seen in more than 100 zoos, museums, and private collections around the world, have had on their viewers. 40% of the purchase price of each sculpture is donated to a conservation organization selected by Tischler, to support programs in the field so that the subjects of his wildlife sculptures can live on for future generations.

The Galapagos Tortoise measures approximately six inches long (tail to nose) by four inches wide and weighs about 4 pounds. The sculpture is cast in bronze with a hand applied and rubbed patina that makes each individual a unique creation. 40% of the purchase price supports TSA conservation programs and includes shipping in the U.S. Shipment confirmation and tracking information will be provided by T AFC. Please visit the online store at www.turtlesurvival.org to purchase your limited edition bronze today.



Significant Breedings

CRIS HAGEN

The most exciting news to emerge from the Turtle Survival Center (TSC) this year was our first successful captive reproduction of Big-headed Turtles (*Platysternon megacephalum*) in October 2015. The species has proved challenging to reproduce in captivity and such breedings are rarely reported.

Continuing the success from 2014, the TSC again welcomed several Yellow-headed Box Turtles (*Cuora aurocapitata*) this year. Other notable cap-

tive reproduction during 2014 and 2015 include our first Bourret's Box Turtle (*Cuora bourreti*), Yellow-margined Box Turtles (*Cuora flavomarginata*), a Spiny Hill Turtle (*Heosemys spinosa*), Vietnamese Pond Turtles (*Mauremys annamensis*), Red-necked Pond Turtles (*Mauremys nigricans*), and Beale's Eyed Turtles (*Sacalia bealei*).

Without doubt, one of the most significant turtle breedings in the U.S., was the successful

2015 hatching of two Zhou's Box Turtles (*Cuora zhoui*). This species currently ranks second or third on the list of the top 25 most endangered chelonians in the world. Only 12 hatchlings are known to have been produced in captivity in the U.S. in the last ten years. This species will only be brought back from the brink of extinction by careful management and an essential collaboration between national and international holdings.



The Yellow-headed Box Turtle (*Cuora aurocapitata*) is a critically endangered species, with TSC among only a few U.S. localities reproducing them. PHOTO CREDIT: CRIS HAGEN



The Yellow-margined Box Turtle (*Cuora flavomarginata*) is a species with a very successful TSA captive management program. PHOTO CREDIT: CRIS HAGEN



The first successful reproduction of the Spiny Hill Turtle (*Heosemys spinosa*) at the Turtle Survival Center occurred in 2014. PHOTO CREDIT: CRIS HAGEN



The TSC hatched its first Bourret's Box Turtle (*Cuora bourreti*) in 2015. PHOTO CREDIT: CRIS HAGEN



Over 20 critically endangered Vietnamese Pond Turtles (*Mauremys annamensis*) were hatched at the TSC in 2015. PHOTO CREDIT: CRIS HAGEN



The TSC achieved its first successful reproduction of Big-headed Turtles (*Platysternon megacephalum*) in 2015. PHOTO CREDIT: CRIS HAGEN



Zhou's Box Turtle (*Cuora zhoui*), one of the world's most endangered vertebrate species, demands essential collaborations if it's to be brought back from the brink of extinction. PHOTO CREDIT: CRIS HAGEN

Making Connections

ILZE ASTAD AND CHRISTINE BOWIE

One of the many benefits of opening the Turtle Survival Center in South Carolina has been our expanded ability to engage with the community through outreach events. Connecting with people face-to-face can have a lasting impact, especially when that connection is made between a tortoise and a child! We hope to continue to expand these efforts in the future and continue to foster ongoing, rewarding relationships with our neighbors in the Charleston area.



Backyard NatureScope provides an annual opportunity for students to learn from local environmental specialists and community businesses about what can be done to protect and enhance their environment. The environmental field day is hosted by Berkeley County Kids Who Care, a local nonprofit aimed at educating children about the environment. PHOTO CREDIT: ILZE ASTAD



Visitors to the Turtle Survival Alliance booth at the Charleston Earth Day Festival are wowed by TSA's rare turtle ambassadors. PHOTO CREDIT: ILZE ASTAD



Carol Armell, TSC Operations Specialist, attends a community outreach event at Cypress Gardens in Berkeley County, South Carolina. A variety of species from the Turtle Survival Center tagged along; front and center is a Burmese Mountain Tortoise. PHOTO CREDIT: NATHAN HAISLIP

ANIMAL MANAGEMENT
TURTLE SURVIVAL CENTER



Two large paddock-style fences were installed circling the perimeter of the Tortoise Barn to provide large yards for groups of Burmese Mountain Tortoises (*Manouria emys phayrei*) and Burmese Star Tortoises (*Geochelone platynota*). PHOTO CREDIT: NATHAN HAISLIP

Expansion Continues at the Turtle Survival Center

NATHAN HAISLIP

The Turtle Survival Center experienced a flurry of construction in the past year with the goals of completing the large, new *Cuora* Complex, finishing the Sulawesi Greenhouse, extensively renovating existing sites, and laying the groundwork for exciting future projects.

THE NEW *CUORA* COMPLEX

One of the most significant projects of last year was the completion of the *Cuora* Complex, a high-security outdoor area for many of our Asian box turtle species. The facilities crew worked tirelessly for months to get the complex ready for the 2015 spring breeding season. Thankfully, Will McGuire Construction Company assisted with the installation.

In total, more than 200 tons of dirt and sand, along with 20 tons of mulch, were added to the above ground enclosures. The secure, aviary-

style frame, consisting of more than 5,000 pounds of steel and 6,000 pounds of heavy-duty wire, took over 100 hours to install. The frame and wire are secured at the base by an extensive, 40,000 pound concrete footer that will prevent any burrowing predators from entering the complex. Beneath the soil and mulch of each enclosure lies an extensive network of water pipes supplying fresh water to all ponds.

The modern and secure complex contains four separate units. There are two units for semi-terrestrial box turtles, and two for fully aquatic species. The units are fully modifiable, with each pair of enclosures having a movable divider that allows keepers to double the size of any enclosure when needed. Within each semi-terrestrial unit are 12 separate enclosures, each equipped with a small concrete pond and a large concrete tunnel. The concrete tunnel serves as an additional winter refuge.

Each fully aquatic unit also contains 12 separate enclosures. These differ from those in the semi-terrestrial units by having larger ponds. Each enclosure also has a nesting area and refugia. The ponds in the fully aquatic unit re-circulate water through a sump system buried underground. This reduces the labor needed to keep the ponds clean by allowing them to cycle through, much as natural ponds would. All the finishing touches, including a network of sprinklers, and a variety of edible plants to provide shade and food for years to come, were added to the complex in April.

THE SULAWESI GREENHOUSE

This year also saw the completion of another significant project, the Sulawesi Greenhouse. This 9m x 29m building currently houses a variety of tropical species, including the world's larg-



The Hatchling Room received a much-needed upgrade this year, greatly increasing the capacity for both aquatic and terrestrial hatchling turtles. PHOTO CREDIT: NATHAN HAISLIP



The Cuora Complex is the latest facility to be completed at the TSC, and has multiple layers of protection and security. Forty-eight individual enclosures, half of them aquatic and half terrestrial, provide optimal breeding conditions for some of the TSC's irreplaceable residents. PHOTO CREDIT: NATHAN HAISLIP

est known, acclimated captive group of Sulawesi Forest Turtles (*Leucocephalon yuwonoi*). The Sulawesi Forest Turtles are housed individually in medium Waterland Tubs to prevent aggression, which is fairly common in this species, especially during the breeding season. This greenhouse is also home to a large population of Forsten's Tortoise (*Indotestudo forsteni*), which are also housed individually.

In addition to serving as habitat for both of

these species, the greenhouse is home to more than 75 varieties of food-producing plants and gives us the opportunity to grow a large variety of tropical fruits and other plants not normally grown in South Carolina. This capacity allows us to produce food, on-site and year-round, for resident turtles.

RENOVATIONS, UPGRADES, AND THE FUTURE

In addition to new construction, several

existing areas were renovated or upgraded this year, including a new water circulation and filtration system for the Hatchling Room, and remodeling of the Animal Clinic.

Raising hatchling aquatic turtles is made very labor intensive by the frequent need for water changes. To reduce this workload, the Hatchling Room is now equipped with a new re-circulating system that allows us to house numerous aquatic species on the same system. That system sends water to the enclosures through a pump located in a centralized sump that contains various biological and mechanical filtration media and a U.V. sterilizer to ensure our hatchling enclosures always receive fresh, clean water.

A designated incubation area was also incorporated for incubating eggs at varying temperatures, depending on the needs of the particular species. Other changes included the installation of terrestrial turtle tables in front of two large viewing windows to allow guests to view the turtles without entering the room.

The busy construction year also saw the addition of two large paddocks to the Tortoise Barn. These wooden-fenced areas provide a generous amount of outdoor space for larger species such as the Burmese Mountain Tortoise (*Manouria emys phayrei*).

Animal Clinic upgrades included a donated digital x-ray machine, new outdoor runs, and extensive interior remodeling to utilize previously wasted space and to allow for expanded animal holding. We were also able to build a secure fenced area and kennel for the TSC's resident guard dog, with the help of volunteers from the North Carolina Zoo, as well as Jessica and Will McGuire.

Perhaps the most useful, yet hidden improvement came thanks to overall changes in property slope and drainage. In 2013, torrential rains halted construction and flooded much of the property. Now, thanks to a newly installed drainage system, excess water flows off-site quickly and efficiently.

During the installation of this system, Southard Brothers Construction Company also graded, trenched, and prepared a number of additional sites for a planned African Forest Tortoise (*Kinixys*) facility and several Forest Complexes. These preparations should keep the facilities crew and our dedicated corps of volunteers busy with new projects well into the future.

Contact: Nathan Haislip, Turtle Survival Center, PO Box 396, Cross, SC 29436 nhaislip@turtlesurvival.org

Veterinary and Zoo Communities Continue to Support the TSC

SHEENA KOETH

Veterinary staff at the Turtle Survival Center enjoyed another fantastic year with the help and support of many friends. The veterinary clinic remodel started at the end of summer, 2014, as walls were removed to open up space for the laboratory, disinfection area, patient holding, quarantine, and necropsy. Thanks to hard working staff and volunteers, the clinic's transformation, including conversion of an animal holding room into a digital x-ray suite, was complete by early fall.

Installation of a digital radiography unit, generously donated by Midland X-ray, required significant electrical upgrades completed just in time for egg laying season this spring. The unit, installed by Todd Pickler, has proven invaluable. We also recently acquired a portable ultrasound unit for hospital and field use.

The zoo community continued its generous support as Busch Gardens and White Oak Conservation Center sent in veterinary supplies. Peter Miller of Woodland Park Zoo facilitated a grant from the American Association of Zookeepers, Puget Sound chapter, which enabled purchase of a Doppler unit to monitor patient heart rates.

STAFFING SUPPORT

Institutional staffing support has been wonderful. The TSC's consulting veterinarian, Dr. Terry Norton, of the Georgia Sea Turtle Center, sees our patients monthly, often bringing staff and intern volunteers. Dr. Shane Boylan, TSC's volunteer consulting veterinarian from the South Carolina Aquarium has increased involvement; and though we no longer need to borrow the aquarium's X-ray unit, we do rely on Shane's nearby expertise and high quality equipment for diagnostics and supportive care. Dr. Jose Biascochea, of Birds and Exotics Animal Care in Mount Pleasant, South Carolina, has graciously volunteered as a third consulting veterinarian.

In the spring, Zoo Atlanta sent Senior Veterinarian Dr. Sam Rivera to help Dr. Norton endoscopically sex a group of juvenile Northern Spider Tortoises (*Pyxis arachnoides brygooi*). Ma-



Drs. Boylan, Norton, and Biascochea work up a Forest Hinge Back Tortoise (*Kinixys erosa*) with Sheena.

PHOTO CREDIT: NATHAN HAISLIP

rine biologist Christi Huges of the S.C. Aquarium was on hand to observe and assist. Christi had previously spent a week working at the TSC and was a great help.

The National Aquarium in Baltimore kindly lent us veterinary technician Sarah McMillen for a week this year. Sarah exchanged her expertise in *Tracks*, our new animal inventory software, to learn about specialized turtle veterinary care and the basics of reptile hematology. Sarah reached out to help when she heard about the TSA and TSC at the Association of Zoo Veterinarian Technicians Conference in 2014.

REPRODUCTION SUPPORT

In June, our friends at Cleveland Metroparks Zoo (CMZ) dropped everything to help with time-sensitive reproductive concerns with some

of our rarest animals. Zoo Endocrinologist, Dr. Mandi Schook, and Associate Veterinarian, Dr. Mike Selig, traveled to South Carolina to assess the reproductive health of critically endangered Zhou's Box Turtles (*Cuora zhoui*) and Indochinese Box Turtles (*Cuora galbinifrons*). Dr. Boylan hosted the procedures at the South Carolina Aquarium, sharing his time, space, and equipment for these vital assessments. CMZ assisted again in August, flying Sheena to Cleveland with urgent reproductive samples and less than 24 hours notice! We look forward to collaborating with all of our partners on future veterinary projects, and are grateful for their interest and support.

Contact: Sheena Koeth, Turtle Survival Alliance, PO Box 369, Cross, SC 29436, USA, skoeth@turtlesurvival.org

GENEROSITY IN THE LOW COUNTRY

NATHAN HAISLIP

The Charleston, South Carolina region — known locally as the low country — has embraced the Turtle Survival Center as one of its own, with businesses and private individuals supporting the center with frequent donations of goods that include food, equipment, and supplies. The Turtle Survival Alliance would like to thank these generous individuals and organizations for gifts ranging from worms to medical equipment. We genuinely appreciate your support.



Cypress Gardens has provided the Turtle Survival Center with donations of numerous food-producing plants this year — truly a gift that keeps on giving! PHOTO CREDIT: NATHAN HAISLIP



DMF Bait Company in Michigan makes standing donations of Canadian nightcrawlers to the TSC. PHOTO CREDIT: NATHAN HAISLIP

The TSA would like to extend thanks to the following groups and individuals that have donated goods to the Turtle Survival Center this year.

Companies:

Acadian Wholesale Supply
Aquarium Innovations
Berkeley Electric Cooperative
Cambro Manufacturing
Centrex Plastics
Coastal Pet Products
Crescent Gardens
Cypress Gardens
DMF Bait Company
Dogswell
E. L. Mustee & Sons
Ecologic Technologies
Goose Creek Farmers Market
Grizzly Pet Products
Harry Barker
Hills Pet Nutrition
Hyam's Garden Center
ImClone Systems
J.P. Shellfish
Leerburg Training Company
Mempkin Abbey
Midlands Xray Company
North Carolina Botanical Garden
North Carolina Zoological Park
Nylabone
rePotme
Riverbanks Zoo
Saint Augustine Alligator Farm
Seagate
Southard Brothers Construction Company
TyTy Nursery
West Paw Designs
Woodland Park Zoo
ZooMed Laboratories, Inc.

Private Individuals:

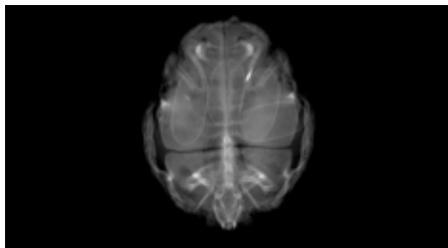
Orlando Alvarez
Kate Butler
Roy Edwards
Maxine Finch
Mary Lou Googe Flanagan
Debra Hane
Roy Herpoisheimer
Jerry Hurd
Clarence and Shirley Mathis
Mike Swingle
Nancy Stewart



The TSC hatching room was remodeled this year to incorporate an incubation area. A large incubator, donated by ImClone Systems in conjunction with St. Augustine Alligator Farm, more than tripled our previous incubation capacity. PHOTO CREDIT: NATHAN HAISLIP



Crescent Gardens donated a large variety of sturdy plastic plant saucers for the turtles at the Center, which make good water dishes. A group of Spider Tortoises is shown having a soak. PHOTO CREDIT: NATHAN HAISLIP



Todd Pickler from Midlands X-rays donated a digital x-ray machine and computer that revolutionized our veterinary capacity at the TSC this year. Turtles are now quickly and easily x-rayed on-site instead of having to be transported off-site, reducing stress and time. Shown is a gravid Yellow-Headed Box Turtle. PHOTO CREDIT: SHEENA KOETH

THE MAKING OF A WORLD CLASS CONSERVATION CENTER

Here are notable moments at the Turtle Survival Center since its inception in 2011.

2011

FEBRUARY

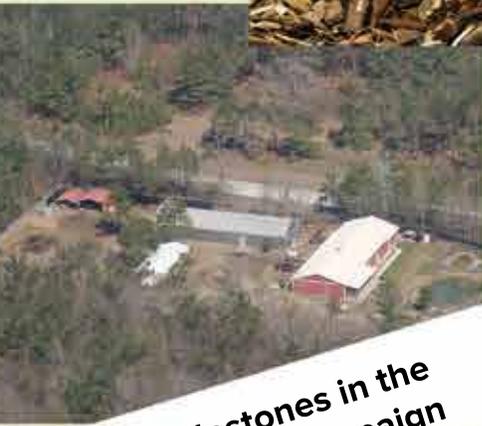
Landmark Decision

The TSA Board of Directors approves the purchase of a 50-acre property in coastal South Carolina to be developed as a Turtle Survival Center.

2012

AUGUST

The TSA announces plans for the Turtle Survival Center and launches capital campaign.



2013

JANUARY

The TSA closes on the Turtle Survival Center property.

FEBRUARY

Massive cleanup conducted & infrastructure improvements including creating drainage fields, installation of electrical wire and plumbing, and placement of secure perimeter fence.



MARCH

Cris Hagen, Director of Animal Management, moves to the Turtle Survival Center.

APRIL

Forest Complex completed. The complex provides habitat for both tortoises & semi-terrestrial forest species that require shady, moist conditions.

MAY

Tortoise Barn completed. This facility houses groups of Burmese Star Tortoises and Burmese Mountain Tortoises and provides warm winter quarters and shaded outdoor yards.

JUNE

Build it, they will come. First individuals of priority turtle species moved to the Turtle Survival Center.

Sheena Koeth, Veterinary Care Manager, joins the Turtle Survival Center team.



AUGUST

Turtle Holding constructed. The facility was originally built to isolate new arrivals, but now provides winter holding for cold-sensitive species including Hingeback Tortoises, Spiny Turtles and Arakan Forest Turtles.



OCTOBER

Carol Armell, Operations Specialist, joins the Turtle Survival Center team.



July 2014
75% Raised \$1.2M

January 2013
50% Raised \$800,000

October 2012
25% Raised \$400,000

**Milestones in the
Capital Campaign**

Thanks to many generous donors,

to date we have raised \$1.44 million of our \$1.6 million campaign goal. Now we need your help to raise the remaining \$160,000 to reach our goal. Please contact us to discuss ways you can support the making of a world class conservation center.

Ilze Astad, Director of Development
(843) 830-4040 or ilze.astad@turtlesurvival.org

= 100 Turtles in Collection at TSC

2013 75 Turtles

2014 250 Turtles

2015 500 Turtles

The Turtle Survival Center (TSC) provides the TSA with the much-needed ability to manage its captive assurance colony programs from a single location and to build healthy, self-sustaining captive populations for many turtle and tortoise species that have little or no chance for survival in the wild.

2014

FEBRUARY

Greenhouse construction completed.



JUNE

Installation of an extensive drainage system to prevent flooding and handle heavy rains.

AUGUST

Nathan Haislip, Facilities Manager and Lead Keeper, arrives at the Turtle Survival Center.

The veterinary clinic undergoes substantial renovations. The updates include increasing functionality for hospitalization and quarantine, converting the exam room into a digital radiography suite, doubling the size of animal holding areas, and adding outdoor enclosures for tortoises.



SEPTEMBER

Electrical upgrades are conducted to incorporate a new generator and allow for future growth.

OCTOBER

Greenhouse build-out completed. This facility serves as the breeding center for two highly endangered Sulawesi (Indonesia) endemic species. It provides tropical conditions due to temperature and humidity control. The plants grown here will provide supplemental food for turtles.



NOVEMBER

Axel joins the security detail at the Turtle Survival Center.



2015

JANUARY

Hatchling Grow-out Room is outfitted with a water recirculation and filtration system for low-maintenance rearing of the many anticipated hatchlings.



FEBRUARY

Gravel added to the driveway to aid with water drainage and aesthetics on the Turtle Survival Center property.

MARCH

Cuora Complex is completed. This complex serves as the breeding center for our collection of rare Asian box turtles, some of which are possibly extinct in the wild. This facility will allow for strict genetic management by maintaining species in pairs. The complex features double layers of security to protect against theft and predation.



JULY

Clinton Doak, Chelonian Keeper, joins the Turtle Survival Center team.

UPCOMING GOALS

African Forest Tortoise Enclosures \$30,000

Cuora Complex 2 \$35,000

Cuora Complex 3 \$35,000

Meadow Ponds \$75,000

Quarantine Building \$100,000

Security System upgrades \$17,500

Tortoise Barn 2 \$50,000

Goal: \$1.6M

June 2015
90% Raised \$1.44M

\$400,000 +

Alan & Patricia Koval Foundation

\$100,000 to \$199,000

San Diego Zoo

\$50,000 to \$99,999

Clarence "Ab" Abercrombie, Detroit Zoo, and Wildlife Conservation Society.

\$25,000 to \$49,999

Columbus Zoo, Bill Denler, Disney's Animal Kingdom, Fagus Foundation, Riverbanks Zoo & Garden, Saint Louis Zoo, Sedgwick County Zoo, David Shapiro, Virginia Zoo, Jacksonville Zoo & Gardens, Oklahoma City Zoo & Botanical Garden, Omaha's Henry Doorly Zoo & Aquarium, San Antonio Zoological Gardens & Aquarium, and Roy Young.

\$10,000 to \$24,999

Jay Allen, Andrew Sabin Family Foundation, Brian Bolton, Cleveland Metroparks Zoo,

\$10,000 to \$24,999 (continued)

Dennis Coules, Dallas Zoo, John Iverson, Moody Gardens, Walter Sedgwick, Brett & Nancy Stearns, Steve Gott Memorial Fund, Turtle Conservation Fund, Walde Research and Environmental Consulting, and Zoo Atlanta.

\$5,000 to \$9,999

A Taste of Thai, BREC's Baton Rouge Zoo, Chelonian Research Foundation, Desert Tortoise Council, Dickerson Park Zoo, Matt Frankel, Houston Zoo, Bob Olsen, Phoenix Zoo, Tennessee Aquarium, Virginia Aquarium & Marine Science Center, and Bruce Weber.

\$1,000 to \$4,999

Akron Zoo, Audubon Zoo, AZFA Clark Waldram Conservation Fund, Beardsley Zoo, Bergen County Zoo, Brevard Zoo, Kurt Buhlmann & Tracey Tuberville, Chevron Matching Funds, Faith Connelly, Ellen Trout Zoo, Fort Worth Zoo, Tim Gregory, Henry Vilas Zoo, Jenkinson's Aquarium, Kansas City Zoo, Jeffrey Lang, Dwight Lawson, Lee Richardson Zoo, Los Angeles Zoo & Botanical Gardens, Hersh Markusfeld, George Meyer, National Aquarium, National Zoological Park, Ed Neil, Noble Creek Biological Consulting, North Carolina Zoological Park, Point Defiance Zoo & Aquarium, Puget Sound AAZK Chapter, David Simon, Frank & Kate Slavens, James Stewart, Ron Tremper, Wildlife World Zoo & Aquarium, and Woodland Park Zoo.

A Special Thanks to our Volunteers

We would like to extend our gratitude to all of the individual volunteers and organizations that have offered their help to the Turtle Survival Center, with special thanks to the following for their ongoing support:

AmeriCorps
 Aquarium Innovations
 Bill Edwards
 Melissa Foote
 Georgia Sea Turtle Center

Tom Hernandez
 Roy Herpoisheimer
 Jerry Hurd
 Steve Ives
 Will and Jessica McGuire

National Aquarium
 North Carolina Zoo
 Riverbanks Zoo
 Smithsonian Zoo
 South Carolina Aquarium



Volunteers from AmeriCorps, Riverbanks Zoo, and the Georgia Sea Turtle Center made concrete hides that are being used for a variety of animals in the *Cuora* Complex and Hatching Room. PHOTO CREDIT: NATHAN HAISLIP



Dynamic duo Will (shown) and Jessica McGuire visited the center to give some much needed construction assistance in 2015. More than 50 tons of concrete was poured for the guard dog kennel area, large trees that could potentially damage buildings were removed, and they assisted with transferring animals from quarantine to the Sulawesi Greenhouse. PHOTO CREDIT: NATHAN HAISLIP



Staff from the North Carolina Zoo pitched in with the guard dog area fence installation, helped move animals, and gathered leaves for overwintering animals.

PHOTO CREDIT: NATHAN HAISLIP



The National Aquarium in Baltimore sent the very talented Sara McMillen to assist with veterinary treatments and help train staff on using the Tracks® animal records program. Here she is helping Veterinary Care Manager Sheena Koeth draw blood from a newly acquired Rote Island Snake-necked Turtle (*Chelodina mccordi*).

PHOTO CREDIT: CRIS HAGEN.



Special thanks to Bill Edwards and Melissa Foote for their continued volunteer support. Melissa's passion for turtles and Bill's experience in the construction industry have been very valuable and helpful. Thanks to them, we also receive regular fruit and vegetable donations from the Goose Creek Farmers Market.

PHOTO CREDIT: NATHAN HAISLIP

Turtle Biology and Conservation Notes

PETER PAUL VAN DIJK

This section summarizes brief updates on turtle biology and conservation from scattered field records and observations that are unlikely to be formally published through other outlets. 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 summarize recent developments regarding conservation of tortoises and freshwater turtles world-wide, 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.

Recently proposed changes of scientific names of turtles

Research into turtle systematics continues to change the scientific names of turtles. Here follows a summary of noteworthy name changes that have been proposed since June 2014. Where possible, a Digital Object Identifier (doi) number is given; the full citation and paper abstract are easily found by entering the doi into any internet search engine.

Alligator Snapping Turtles: Brian Folt and Craig Guyer argued against recognition of *M. apalachicola* as distinct from *M. temminckii*, while supporting continued acceptance of *M. suwanniensis*. — Folt & Guyer, 2015, doi: 10.11646/zootaxa.3947.3.11

Golden Coin Turtles: Taxonomy of the Asian box turtle genus *Cuora* was revised by Ralph Tiedemann and co-workers, who analyzed molecular and morphological data and concluded that *Cuora cyclornata*, with its distinct subspecies *C. c. meieri*, is recognizably different from *C. trifasciata*. — Tiedemann et al., 2014, Salamandra 50(3): 139–146.

South American Tortoises: Storrs Olson and Normand David argued that the linguistic gender of the genus name *Chelonoidis* is masculine, which necessitates changing the endings of some species names, so that they become *carbonarius*, *denticulatus*, *niger*, and *phantasticus*. The name *vicina* remains unchanged. — Olson & David, 2014, Proc. Biol. Soc. Wash. 126(4):393–394.

Asiatic Softshell Turtles: Uwe Fritz and co-workers analyzed molecular systematics, morphology, and biogeography of the *Amyda* softshells, and recognized at least two species, each with two subspecies. *Amyda cartilaginea cartilaginea* occurs in Java and eastern Borneo, while a new subspecies *A. c. maculosa* was described from Sumatra and western Borneo. The name *ornata* was revalidated for the species of continental Southeast Asia, with the typical

subspecies *A. o. ornata* inhabiting the Mekong basin and *A. o. phayrei* occurring in Thailand and Myanmar. — Fritz et al., 2014, Vertebrate Zoology 64(2):229–243.

Asian Giant Softshells and Broad-shelled Snakeneck Turtle: Raymond Hoser named two new *Pelochelys* from India and Kalimantan, as well as a new species and subspecies split out from *Chelodina (Macrochelodina) expansa*, plus a new subgenus for these three. For various reasons it appears prudent not to use these names for now. — Hoser, 2014a, Australasian Journal of Herpetology (AJH) 22:60–64; Hoser, 2014b, AJH 24:3–11.

Seychelles Mud Turtle: After Stuckas, Gemel & Fritz synonymized *Pelusios seychellensis* under *P. castaneus*, Roger Bour carried out further analysis and argued that the Seychelles population merits taxonomic recognition at least at subspecies level, as *Pelusios castaneus seychellensis*. — Stuckas et al, 2013, doi: 10.1371/journal.pone.0057116; Bour, 2013, Chéloniens 29:27–41.

Turtle Extinctions: Anders Rhodin and colleagues published a checklist of turtles known to have existed and gone extinct in the Pleistocene and Holocene. This period, from +/-2.6 million years ago, is when humanity arose and spread across the planet. Of the 84 extinct chelonians, 69 are tortoises, indicating the severe impact that humans had on their survival. Rhodin et al., 2015, doi: 10.3854/crm.5.000e.fossil.checklist.v1.2015

Conservation Notes from the field

Pinzón Tortoise (*Chelonoidis [niger] duncanensis*): A group of juveniles of this species was discovered in the wild on Pinzón Island in the Galapagos, the first in-situ born tortoises in over 100 years. They emerged from natural nests, and survived, right in the first year after a comprehensive rat eradication program in 2012 treated the entire island of Pinzón (1,815 hectares). The Pinzón Tortoise survives on the island with about 100 old residents, as well as over 400 surviving reintroduced headstarted animals from annual egg collection followed by incubation and rearing to rat-proof size at the conservation center on Santa Cruz. <http://www.galapagos.org/blog/pinzon-tortoise-survey-part2/>

LEGISLATIVE UPDATES

The two Madagascar tortoises *Pyxis arachnoides* and *Pyxis planicauda*, and the Pacific Pond Turtle (*Emys (Actinemys) marmorata* and *E. (A.) pallida*), are under consideration by the US Fish and Wildlife Service for possible inclusion in the Endangered Species Act. Docket Nos. FWS–HQ–ES–2014–0012 and FWS–HQ–ES–2014–0013.

The Common Snapping Turtle (*Chelydra serpentina*) and the North American softshell turtles (genus *Apalone*: Florida Softshell *A. ferox*, Smooth Softshell *A. mutica*, and Spiny Softshell *A. spinifera*) are under consideration for inclusion in CITES Appendix III (United States). Docket No. FWS–HQ–ES–2013–0052. for any of these species

In New Jersey, legislation is moving through the New Jersey Congress to permanently close the fishery for Diamondback Terrapins (*Malaclemys terrapin*). New Jersey, 216th Legislature, Senate Bill S2615, House Bill A3932.



Feeding confiscated tortoises at the rescue center at Ambovombe. PHOTO CREDIT: RICK HUDSON

Turning the Tide on Tortoise Poaching Requires Action on Multiple Fronts

RICK HUDSON

There are myriad causes for the drastic decline of Madagascar's tortoises. Overwhelmingly, the most significant impacts come from poaching and illegal trade. Juveniles are collected and shipped out by the thousands to supply Asian pet markets and adults are being poached for food.

Despite well-established laws, in effect since 1960, to protect the Radiated Tortoise (*Astrochel-*

ys radiata), compliance is poor in rural areas and enforcement faces many challenges, particularly in southern Madagascar.

ENACTMENT OF TRADITIONAL 'DINA' BY-LAW BRINGS CHANGES

In 2012, the TSA and our partners began to systematically address the poaching crisis by

launching a media campaign designed to focus both local and global attention on the issue. The results have been very encouraging, but perhaps the most important single event in helping to turn the tide on tortoise poaching is the 2012 adoption of the historic 'Dina' by-law – officially known as "*Lilintane I Androy*." The goal of the Dina law is to empower local communities to be



Andrea Currylow is conducting ecological research on three species of Madagascar tortoises, and oversees TSA's trial reintroduction program.



Some of the 771 tortoises seized at the international airport in Antananarivo, including both Ploughshare and Radiated Tortoises. PHOTO CREDIT: HERILALA RANDRIAMHAZO

directly in charge of any wrongdoing regarding tortoise protection in their villages.

The Dina is a “bottom up” community-based law that reinforces the cultural tradition for protecting tortoises that has existed in this region for centuries. It is valid within the entire Androy Region of Madagascar and allows villagers to tackle tortoise harvesting in a transparent

manner through public participation. With the potential to be a game changer for reducing tortoise poaching, its application needs to be spread more widely throughout the region.

The Dina cannot be applied without a traditional ceremony that enables it to be implemented in each of the four districts that form the Androy Region. TSA has already conducted

Dina workshops in two districts: Tsihombe in November 2014, and in Beloha during April 2015. Aimed at community leaders and those with enforcement authority, the workshops have proved successful in instilling local resolve not to “turn a blind eye” to poachers.

Workshop participants agreed to collaboratively implement the Dina without exception, and an action plan, valid for one year, was written and signed by all present – a plan that is being implemented. In Tsihombe, for example, participants decided to set up a checkpoint just outside the town to control cars. TSA and partnering organizations supported the construction of this first-of-its-kind road barrier built to address tortoise trafficking in southern Madagascar.

ENFORCEMENT FINALLY TAKING HOLD

Sylvain Mahazotahy, TSA's Law Enforcement Instructor, is the key person charged with administering Dina implementation. He is considered far more effective than any other law enforcement officers within the region due to his strong will and direct involvement. As a result of his activities and influence, TSA has produced 40 applications of the Dina.

Most of these actions were possible because of the exemplary leadership by the head of the district in Beloha. In partnership with TSA, the Beloha District agreed to create a volunteer group – The Tortoise Patrol – to champion the Dina implementation. Over a three-week period, and armed with an official letter from the District, Sylvain and his 33 volunteers visited every village to organize the *Lilintane* and relevant practices.

His group used shell remains from recently killed tortoises, found nearby, as incriminating evidence of Dina violations. In August 2014, following the largest mass slaughter of tortoises on record – 5,000 near Tranavaho – they chased down and arrested the 42 poachers involved and sent them to jail in Ambovombe, where they remained for nearly ten months.

These are historic events. Previously, poachers were rarely arrested for killing tortoises, and the arrests strongly indicate that the tide is turning. Visitors in the south now encounter a heightened sense of awareness amongst the local peoples regarding the tortoise poaching crisis along with a strengthened resolve to tackle the issue.

TORTOISE CONFISCATIONS IN 2015

As predicted, increased training and awareness, coupled with improved enforcement and Dina application, have resulted in an increased number of confiscated tortoises. To address this



Unpacking tortoises in a pre-release enclosure where they will spend six months prior to being released. This research is designed to test the effectiveness of pre-release penning on site fidelity following release.



Grad student Soary Randrianjafizana collects data on released Radiated Tortoises in the field with members of the Ampotaka community

issue, the TSA built four rescue centers in the main cities of southern Madagascar: Ambovombe, Ampanihy, Betioky and Beloha.

The Beloha facility was recently built with generous support from our partner, Utah's Hogle Zoo, and is the best built and most secure of the four centers. TSA currently employs eight per-

manent staff, four caretakers and four security guards, at the facilities to manage and secure the four triage centers.

At present, of the 825 tortoises under the care of TSA, 88% are Radiated Tortoises, while the remaining 12% are Spider Tortoises (*Pyxis arachnoides*). Custom officers at Ivato International

Airport in Antananarivo seized 67% of these tortoises and the remaining 33% are the result of increased local enforcement.

Confiscation frequency at the airport has been reduced significantly, with two cases this year compared to the year before, when we saw an average of one confiscation per month during the first six months of 2014. With a total of 1,489 tortoises seized, May and June of 2014 were the worst months in confiscation throughout the history of TSA's involvement.

But then, on 28 September, Malagasy Customs officials scanning luggage discovered a staggering 771 wild native tortoises concealed in two wooden boxes at Antananarivo's Ivato International Airport. TSA was called upon to receive the tortoises, among them eight Ploughshare tortoises, *Astrochelys yniphora*. Of the 763 Radiated Tortoises, 23 were already dead and many others were very weak. The shipment had been destined for Malaysia using the cargo service of Air Mauritius. Its seizure was described by Customs as the largest ever of its kind at either the airport or in the country.

PREPARING FOR REPATRIATION

The large number of Radiated Tortoises recovered from the illegal trade began to overwhelm our rescue facilities and hastened the need for a quick, sound repatriation strategy. We began engaging local villages and community members to establish a good working partnership with the ultimate goal of creating a safe haven for the reintroduction of the tortoises. We found willing collaborators in the village of Ampotaka, in southern Madagascar. Ampotaka now plays a key role in our science-based reintroduction strategy.

The strategy includes the testing of two approaches: a soft versus hard release. The soft release strategy includes animals that are held for either six or 12 months in temporary enclosures, within suitable habitat, prior to release. The hard release strategy includes tortoises that are immediately released without prior penning. Monitoring the movements and habits of tortoises will help us understand the importance of soft releasing in order to encourage site fidelity.

Site fidelity is the tendency to remain in the general vicinity where released. From past experience, we know that hard released tortoises usually wander away from unfamiliar territories. Our challenge is to encourage them to remain nearby within the ecologically optimal, community-protected, sacred forest.

Soary Randrianjafizana, a graduate stu-



Confiscations of illegally collected Radiated Tortoises surged toward the end of 2015, and all four of the TSA's rescue centers — a fifth facility is underway soon — are at full capacity, with another ~2,000 tortoises being cared for in Antananarivo. Ultimately the completion of the Tortoise Conservation Center will ease this burden and allow for improved long-term care and options for the future. PHOTO CREDIT: HERILALA RANDRIAMHAZO

dent at the University of Tulear, is conducting surveys at the reintroduction site to determine the density of the resident tortoise population. Soary also acts as a community liaison for the TSA by communicating project goals and conducting conservation education. In 2013, she supervised the construction of the required temporary enclosures and participated in a traditional ceremony signifying community support for the project.

READY FOR REINTRODUCTION

In January 2014, the first group of 45 soft release tortoises was transferred to the site. A second group of 45 arrived later, in July, representing the 12-month and 6-month groups. Both groups had been long-term captives from the Village des Tortues in Ifaty. Twelve resident tortoises were fitted with radio-transmitters and monitoring was initiated by local village assistants. Monitoring of all the animals is currently being conducted by community members, Soary, and the TSA staff.

In January 2015, we brought the final group of 39 tortoises to the site as the hard-release group. These animals had been housed in two of TSA's rescue centers in Ampanihy and Betioky. The Ampotaka community welcomed the arrival and, in preparation for the release, held a formal meeting to brief locals from the village and surrounding communities.

Despite a cultural taboo against disturbing the tortoises, many local people are inter-

Winning Hearts – and Respect for Radiated Tortoises – One Community and Soccer Match At a Time

In November 2014, TSA launched a unique campaign in southern Madagascar to utilize this island nation's love of soccer to support the Radiated Tortoise Conservation Awareness Program. The initiative, called Soccer for Sokake (the local word for Radiated Tortoise), used the sport to facilitate learning about the conservation of local wildlife in the village of Lavanono – a community that is key to the conservation of this species, and where local stewardship is essential to its survival. Thirty donated Ultra-durable, One World Footballs were essential to the program and to the games initiated in the community.

Soccer for Sokake was a partnership between Utah's Hogle Zoo, Turtle Survival Alliance, and One World Play Project, and part of a continuing community awareness program to support our reintroduction strategy for Radiated Tortoises. Its goal was to strengthen community capacity for tortoise conservation education and action through a culturally relevant activity – soccer.

The program's core messages included: "Wildlife conservation requires teamwork; Become a defender of wildlife by not supporting illegal collection; and Radiated Tortoises occur nowhere else, and it's everyone's job to protect them!" The messages were shared through an adult mentorship program called Conservation Coaches, and were featured prominently at field stations and in classroom activities that gave children opportunities to improve their soccer skills while learning about conservation, tortoises and local wildlife.

Before arrival in Lavanono, twenty Conservation Coaches led the community in a three-month long project to create a soccer field in the village. Coaches and kids selected animal mascots for the ten soccer teams participating in the program, including: lemurs, wild turkey, guinea fowl, snakes, freshwater turtles, and of course, tortoises.

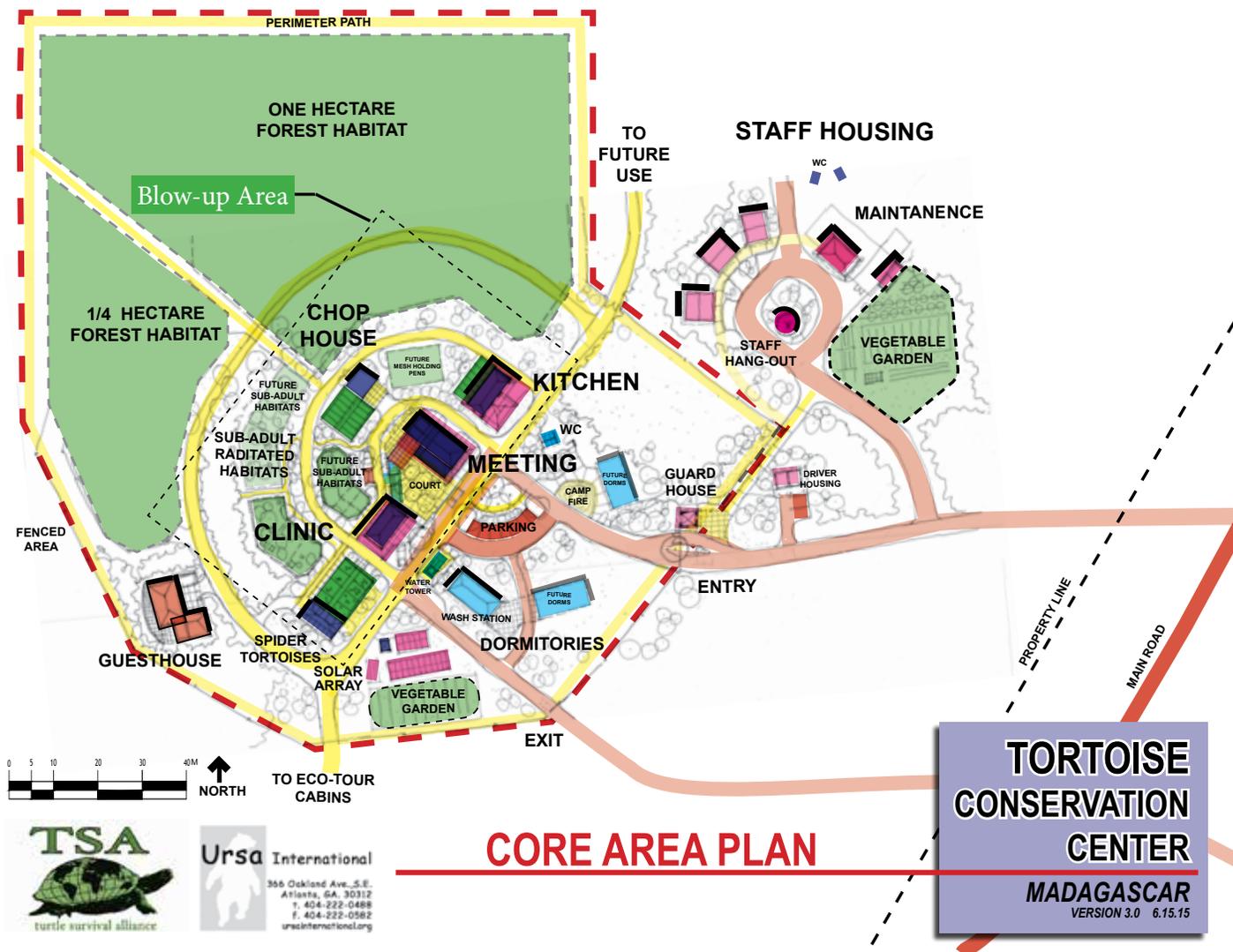
Soccer for Sokake participants crafted wearable animal masks and costumes to learn about wildlife and connect to conservation through fun and creative play. Both kids and coaches learned more about wildlife in the spiny forest by writing and performing poems and songs about their animal mascots, and by illustrating team banners. In the afternoon, kids played in a weeklong soccer tournament, which benefited from more than 200 new uniforms, cleats, socks, and the One World Footballs we provided.

The program culminated with the raucous, high-stakes final game of the soccer tournament. The game was preceded by an uplifting animal parade that wove through the village with song, dance, and speeches of goodwill for the partnership and commitment to tortoise conservation. Following a pinning and certificate ceremony, where every participant was acknowledged for their contribution, the village hosted a traditional celebration shared by several hundred people. It was a wonderfully festive event that clearly enhanced local tortoise knowledge and goodwill.

ested in why international organizations are investing in their communities. They want to learn more and participate; so additional local volunteers were selected to join the tracking team, allowing us to monitor the tortoises more closely.

One hundred and eight tortoises were fitted with radio-transmitters so their movements

and habitat use can be monitored for at least two years. We removed the enclosure fences to release the animals to freely wander the forests. It was gratifying to see tortoises that had gone through so much – once destined to become food – rescued, and then held in captivity for months or years, to survive to this point and be released into good forest habitat.



TORTOISE CONSERVATION CENTER THE FINAL PIECE IN CONSERVATION STRATEGY

As the various pieces of TSA's *Confiscation to Reintroduction Strategy* begin to coalesce, there was one very important component still missing. The TSA needs a centralized base of operations in the south, where we can bring the growing number of confiscated tortoises for long-term holding and proper health and genetic evaluations prior to release. We need a counterpart facility to the Village des Tortues Center at Ifaty on the west coast, where most confiscated tortoises now end up. This Center is currently holding many, many tortoises, and to avoid the risk of catastrophic loss by having all our tortoises in just one basket, we must build a second facility.

To that end, the Tortoise Confiscation Center (TCC) will ultimately become the lynchpin

in TSA's tortoise reintroduction program, and give us the ability to carefully plan future releases. Detailed site plans were recently developed in consultation with zoo and wildlife facility designer, Nevin Lash of Ursa International. The TCC received start-up funding through a three-year grant from the Leona M. and Harry B. Helmsley Charitable Trust. Utah's Hogle Zoo has committed \$15,000 to Year 1 construction, while other groups are organizing to help raise funds.

Along with requisite tortoise management areas, the TCC will include a vet clinic and isolation area, dormitory space for visiting biologists, kitchen and food prep areas for people and tortoises, meeting and conference space, an outdoor classroom, staff housing, and vegetable gardens. The TCC plans are ambitious and will require a minimum of five years to complete given the pace

of construction work in the south.

In summary, TSA's long term commitment to protecting the Radiated Tortoise (*Astrochelys radiata*) has achieved extraordinary milestones, with the future continuing to improve for this Critically Endangered species.

Contact: Rick Hudson, 1989 Colonial Parkway, Fort Worth, TX 76110 rhudson@fortworthzoo.org

Acknowledgements: TSA extends its gratitude to the following organizations and donors for their support to the Madagascar Tortoise Conservation Program: Leona M. and Harry B. Helmsley Charitable Trust, Utah's Hogle Zoo, Conservation International, Los Angeles Zoo, Zoo Miami, Turtle Conservation Fund, and Owen Griffiths/Francois Leguat Ltd. TSA also salutes Andrea Currylow for her energy, perseverance and commitment to the tortoise reintroduction-research component of this program. Soccer for Sokake was made possible by the Andrew Sabin Family Foundation, Radiated Tortoise Species Survival Plan, Toronto Zoo, and Boy Scouts of America.

INDIA



A long term turtle assemblage study has been initiated to collect baseline demographic data to improve conservation management practices in Tarai, one of five Turtle Priority Areas. PHOTO CREDIT: BHASKER DIXIT

TSA India: Another Successful Year for Indian Turtle Conservation

SHAILENDRA SINGH, PHD, LONNIE MCCASKILL, AND DAREN R RIEDLE, PHD

India is renowned as the land of the tiger and the elephant; many Indian gods are depicted riding peacocks or tigers. But sadly, the revered relationship that existed between people and wildlife centuries ago has largely vanished, and the protected areas, which comprise just 4% of India's landscape, are now mere islands amidst a sea of people. Protecting and recovering India's wildlife presents a monumental task.

With 28 species of tortoises and freshwater turtles, India has one of the most diverse chelonian faunas in the world and ranks among the top

five Asian countries in regards to the importance of its turtle conservation efforts. Over 40% of Indian turtles are listed as either Endangered or Critically Endangered on the IUCN Red List. A rapidly expanding human population, coupled with increasing exploitation of the area's watersheds, poses a significant threat to all riverine species, including turtles.

Despite numerous challenges, TSA India is steadily becoming a prominent turtle conservation force throughout the region. In addition to maintaining key species conservation projects

throughout the country, TSA India continued further advocacy over the past year by influencing government policies, facilitating turtle repatriation, setting up key facilities, and building new community partnerships – all notable achievements that will continue going forward. Here is a summary of those accomplishments.

THE KUKRAIL GHARIAL AND TURTLE REHABILITATION CENTER

Located in Lucknow, Northern India, the Kukrail Center was established in 1978 by the Uttar Pradesh Forest Department (UPFD) to help recover wild populations of the Gharial (*Gavialis gangeticus*). In fruition of the Ganga Action Plan in the 1980's, freshwater turtle species were added to the Center's collection. TSA India later developed a Memorandum of Understanding (MoU) with the UPFD to strengthen ongoing programs, and with the long-term objective of developing a broad based, living collection of threatened Indian chelonians.

Three hundred and ninety turtles of 12 North Indian species currently reside at the Kukrail Center. Four species of turtles, including the Crowned River Turtle (*Hardella thurjii*) and Peacock Softshell Turtle (*Nilssonina hurum*), were recently added to the collection for captive conservation and research.

To mark the beginning of a captive breeding project at the center, one hundred and sixty one turtles of two different species were headstarted this year and released in Hakimpur Lake near the Narora Atomic Power Station.

NEW ARRIVALS PROMPT CONSTRUCTION

Twenty sub-adult Red-crowned Roofed Turtles (*Batagur kachuga*) were relocated to the Kukrail Center from TSA's Garhaita Turtle Conservation Center on the Chambal River. The turtles were raised at Garhaita in an effort to create assurance colonies of the species.

Their arrival prompted refurbishment to supporting structures that had become dated, including: the conversion of an old building into a functional Laboratory for Aquatic Biology (L.A.B.); the building of an isolation enclosure for rescued turtles, along with a series of pens to hold animals during education events; the construction of a modest tortoise enclosure; and, finally, the creation of a larger enclosure built especially for big river turtles and featuring a series of seven deep pools.

We've continued our very popular Kukrail Guided Nature Tour (KGNT), which educated over 1,800 children about turtles and crocodiles



TSA's Chambal conservation project mainly focuses on the recovery Red Crowned Roofed Turtle. Established in 2006, the Garhaita Turtle center has been instrumental in head-starting hundred of hatchlings of the species and teaching communities about aquatic wildlife conservation. PHOTO CREDIT: DAREN R RIEDLE



Former crocodile facilities at Kukrail Gharial Centre in Lucknow have been renovated for developing assurance colonies of endangered turtles, such as these juvenile Narrow-headed softshell turtles that Shailendra Singh is moving. PHOTO CREDIT: ARUNIMA SINGH

over a series of 46 events held at the center.

Finally, with the Kukrail Center now serving as the TSA India base office for all research and veterinary activities, signage was renovated and new graphics installed.

A WAY STATION FOR CONFISCATED CHELONIANS

Along with the many other key activities happening at the Kukrail Center, it also serves as the main transit point for large-scale confiscations of

illegally traded and hunted chelonians throughout the region. Over the last few months, Kukrail Center successfully handled four large confiscations involving 1,200 turtles representing four different north Indian species. On the occasion of World Turtle Day, we were able to assist with the first-ever repatriation of 335 Spotted Pond Turtles (*Geoclemys hamiltoni*) from Maharashtra to Lucknow.

Kukrail Center has also developed a mobile

rescue and rapid response unit. Besides rescuing turtles, the TSA team aided in rescuing individuals from several other species, including Gangetic dolphin (*Platanista gangetica*), Gharial (*Gavialis gangeticus*), and Mugger (*Crocodylus palustris*).

THE TERAI CONSERVATION PROGRAM

The Indian foothills of the Himalayas, also known as the Terai region, is a turtle diversity hotspot with 13 species of aquatic and semi-aquatic turtles and one species of tortoise known to occur there. TSA recognizes the Terai as one of five Turtle Priority Areas (TPA) across the country. This year, with support from the Disney Worldwide Conservation Fund and the Mohamed Bin Zayed Species Conservation Fund, we were able to construct a community education center and field research station along the Ghaghra River in Bahraich district. This community center marks the culmination of long-term efforts in the region to demonstrate the linkage between conservation and sustainable livelihoods for local communities. Education efforts also included a series of outreach programs in 35 riverside schools to raise awareness of the need for freshwater vertebrate conservation.

RESEARCH AT TERAI

Field trials to test hoop nets with turtle friendly modifications were concluded recently and have yielded seminal information on mitigating incidental mortality (see sidebar for details). Further, we also began sampling exercises to establish baseline abundances and diversity of turtles on the Sarju River. Preliminary data on trade-offs between body size and reproductive output on the Crowned River Turtle (*Hardella thurjii*) was gathered, and twenty gravid females were sampled and x-rayed during late August and early September. Two *H. thurjii* females were relocated to the Kukrail Center to induce ovi-position. Of the two nests, one nest hatched in late May and 9 hatchlings of *H. thurjii* are currently being maintained at the center.

To better aid the recovery and management of diverse turtle communities in the Terai, we instituted an assemblage level sampling protocol on the Sarju and Ghaghra Rivers. Protocols include collecting basic demographic information on all species, assessing the variation in species richness and abundance at both up and downstream sites, and the collection of environmental variables to identify habitat requirements for each species. To date, we've sampled an upstream (Katra Ghat) and downstream (Paska) site on



Adult male Northern River Terrapins basking at the Sanjekhali Centre. TSA and West Bengal Forest Department initiated a recovery program for this critically endangered species in 2012. PHOTO CREDIT: JAYANTA BASU

the Sarju River. Five species of aquatic turtles were captured at each site, but only four species were common to both sites. The Indian Softshell Turtle (*Nilssonina gangetica*) was only captured at Katra Ghat, while the Indian Flapshell Turtle (*Lissemys punctata*) was only captured downstream, near Paska. The Crowned River Turtle (*H. thurjii*) comprised 82% of all captures at Khatra Ghat, and this site most likely represents the largest population of the species in the world.

We've made some headway in mitigating threats in the Terai region through awareness and outreach events, and unearthed some baseline information on the status and reproductive biology of *H. thurjii*. We aim to systematically reform those involved in unsustainable activities; such as the clandestine trapping of large *Hardella* females, the use of illegal fishing gear, and riverside agriculture, by providing local residents with the necessary infrastructure and know-how towards adopting sustainable alternatives.

BATAGUR CONSERVATION PROGRAM IN CHAMBAL AND UPPER GANGA

The Batagur Conservation Program maintains a continuing nest protection program for the Red-crowned Roofed Turtle (*Batagur kachuga*) and Three Striped Roofed Turtle, (*B. dhongoka*). This year, three makeshift riverside



These juvenile Northern River Terrapins have been fitted with sonic transmitters and will be released in winter 2016 as part of a pilot reintroduction program. PHOTO CREDIT: SHAILENDRA SINGH

hatcheries, set up along the upper, middle, and lower stretches of the Chambal River at Baroli, Raipur Khurd, and at Garha, faced the challenge of an unexpected flood.

During late March there was an erratic release of water – possibly due to untimely rain – from an upstream dam. The release resulted in the inunda-

tion of key nesting sites along our three hatcheries. Fortunately, our team rescued all 81 nests near Baroli. Thirty-one nests near Raipur Khurd, which have been shifted to higher points on the same sandbar, were also saved. A remaining 187 nests were moved into plastic containers as there was no dry sand left on the Garha sand bar.

Reducing Freshwater Turtle Bycatch by Developing Alternative Fishing Nets

Shailendra Singh, Elly Pepper, Jake Li, Anna Harris, Peter Lalampaa, Gabriella Skollar

As part of the Emerging Wildlife Conservation Leaders Program, we partnered with TSA India to reduce freshwater turtle bycatch—the third biggest threat to India’s freshwater turtles. Because the gill nets India’s local fishermen use to catch fish for subsistence also capture and drown turtles, we developed alternative nets that reduce turtle bycatch while still catching fish.

We designed four modifications for hoop nets: 1) excluding turtles from entering the nets by adding vertical bars at the net entrance, 2) enabling turtles to escape through a “chimney” at the top of the net, 3) enabling turtles to escape through an opening in the top of the net covered with loose rubber or string, and 4) enabling captured turtles to survive until the net is checked by building air chambers in the nets. The modifications have been tested in the U.S., but not in Asia.

Thus far, TSA India has conducted testing on the Sarju, Ghagra, and Yamuna rivers. At first, several turtles drowned – possibly because the modifications were not appropriately sized for turtles in the area – and fish catch was low. However, as we adjusted the modifications, turtle mortality decreased considerably. Fish catch



The TSA India team, with help from local fishermen, prepare to test an alternative fishing net – a hoop net modified with a chimney escape device – in India’s Sarju River with the aim of reducing freshwater turtle bycatch. PHOTO CREDIT: SAURAV GAWAN

continues to present a challenge, although we alleviated the problem by using strongly-scented baits.

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A batch of recently hatched Indian Narrow-head Soft-shell Turtles at the Kukrail Gharial Centre. PHOTO CREDIT: ARUNIMA SINGH

We evaluated flood damage using a motor-boat along known nesting areas on the river to determine losses. Our survey indicated the flooding of over 300 wild turtle nests in a 150+ kilometer stretch of river – essentially from Rajghat to Barahi. Despite this calamity, we protected 88 nests of *B. kachuga* and 321 nests of *B. dhongoka* at our three riverside hatcheries, and released over 1,400 hatchlings of *B. kachuga* near their original nesting sites.

HATCHLINGS AND DATA WILL TRAVEL

We recently deployed temperature recorders in a few wild nests, and also at relocated hatchery nests, to compare incubation temperatures. Four clutches, consisting of 59 hatchlings of *B. kachuga* along with accompanying temperature data, were transferred to TSA’s Garhaita Turtle Survival Center for sex determination and head-starting. We have yet to perform laparoscopic investigations on these hatchlings. Another 100 hatchlings of *B. kachuga* were transferred to the Deori Eco-centre along the middle Chambal. After a comprehensive health assessment, we PIT tagged and “soft” released 191 *B. kachuga* and 63 *B. dhongoka* from the Garhaita facility. During the winter, the released cohort was caged for five months in a backwater along the river. This strategy helped reduce winter mortalities in the field-based facility.

Previously headstarted *B. kachuga* sub-adults with sonic transmitters were monitored during post-monsoon and winters. We were able to locate 7 individuals out of a total of

10 released. The preliminary result suggests movement over 200 to 250 kilometers downstream. While monitoring these turtles, we also eliminated over 20 clandestine sets of fishing gear from the water and rescued 19 net-entangled turtles representing five different species.

A THRIVING HEAD START

The Batagur Conservation Program, in association with the Narora Atomic Power Station, was able to build a headstart facility for *Batagur* species near Narora on the Upper Ganga River. This particular section of the river was identified as a Ramsar Site – a Wetland of International Importance – in 2009.

During this field season we protected seven nests of *B. dhongoka* in this important area, and incubated them at our headstarting facility. One hundred and thirty-two hatchlings emerged during late May and are currently being maintained at the facility. Additionally, 24 hatchlings of *B. dhongoka*, started last year at this facility,

were marked and released at the precise location of nest collection. This project has served as a unique model of a well-coordinated government and NGO partnership for turtle conservation in the region.

Another regional target species is the Indian Narrow Headed Turtle (*Chitra indica*). *C. indica* is a highly elusive and large softshell turtle species found in the fast flowing river waters of Northern India. The species is extensively sought after for illegal trade. We surveyed a 100 kilometer stretch of the Yamuna River, from Bateshwar to the confluence of the Chambal and Yamuna Rivers, and identified 3 new nesting sites. We protected 4 nests, a total of 382 eggs, by moving them to a riverside hatchery along a stretch of the Yamuna River. One hundred and forty-five hatchlings were released at the precise location of nesting. Two additional nests were protected along the Ganga River near Narora, with 110 turtles kept throughout the winter at the Narora facility and released in March.

NORTHERN RIVER TERRAPIN CONSERVATION PROJECT

There are now less than 50 Northern River Terrapin (*Batagur baska*) adults left in the entire world. TSA, in close association with the West Bengal Forest Department, is working with 12 (7.5) of these remaining adults to recover the species. In mid-January, 2015, Dr Gerald Kuchling supervised the laparoscopic sexing of captive juveniles hatched between 2012 and 2014. The majority of the 145 juveniles held at the Sajnekhali Forest Station within the Sunderban Tiger Reserve were found to be female. The laparoscopic exams identified 25 males and 120 females. Information regarding gender-ratio may be extremely helpful in adjusting reintroduction, translocation, and captive breeding initiatives in the future. All the juveniles were tagged with Passive Integrated Transponders (PIT) tags for further identification and data collection concerning development of secondary sexual characteristics over time.

Finishing up a busy year, we fixed sonic-transmitters on two juvenile females from the 2012 batch to check the efficacy of our equipment and observe its impact on the animal's behavior. Renovations to the nesting enclosure this year included a new sand lining and predator-proof fencing. All four females transferred to this enclosure during late February nested during early March. All four nests have yet to hatch.



TSA researchers collect data on turtles in Tarai. Such studies are instrumental in monitoring key surviving populations of threatened species and allow for improved conservation management and planning. PHOTO CREDIT: FRACK BONIN

ASSAM TURTLE CONSERVATION PROGRAM

This year saw the conversion of the old mon-goose enclosure at the Assam Zoo into the Assam Roofed Turtle (*Pangshura sylhetensis*) Conservation Facility. The new facility will house up to 50 animals for display and conservation breeding purposes. To inaugurate the new facility, Mr. Atuwa Munda, Forest Minister for the State of Assam, released six Assam Roofed Turtles in celebration of World Turtle Day on 23 May. The facility has running water, a modest physical filter, a large sand bank covering over 40% of the total area, and lots of natural cover essential for this small, hard-shell turtle of the Brahmaputra's River system. Preliminary surveys for the occurrence and nesting of the species in upper Brahmaputra are currently underway.

PROTECTING BLACK SOFTSHELL TURTLES

We've continued to maintain our Black Softshell Turtle (*Nilssonina nigricans*) captive conservation project in the Nagshankar Temple along the Brahmaputra River in the state of Assam. The project's objective is to protect nests, headstart the hatchlings, and supplement decimated wild populations.

We hope to meet these objectives through husbandry improvement and increased awareness among the temple committees and devotees. We also continue to document additional temples and village ponds that contain *N. nigricans* so

we can network colonies and use them to help recover wild populations. This year we protected 8 nests with a total of 198 eggs of *N. nigricans* currently under incubation at our facility.

CAPACITY BUILDING PROGRAMS

Along with everything else TSA India has accomplished this year, we've continued to expand our capacity building programs for various target groups such as children, teachers, frontline forest department staff, riverside community members, and reformed turtle poachers.

Programs have been held at various project locations and on significant occasions such as: National Wildlife Week, World Wetland Day, International Biodiversity Day, and World Turtle Day. Resource materials, such as posters, handouts, badges, and bands for participants have been developed and augmented by resource materials inaugurated by government ministers and top government officials.

In total, we've conducted over 46 turtle conservation awareness events while educating and training over 20,000 stakeholders in vital matters of chelonian conservation.

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Acknowledgements: We thank the Forest Department of Uttar Pradesh, Madhya Pradesh, West Bengal, Assam, and Maharashtra for logistic support and necessary authorisations. We would also like to thank particular Forest Department officers: SK Upadhyay, Ravi Srivastava, Pradeep Shukla, Pradeep Vyas, SP Royal, Soumitra Dasgupta, Sanjay Srivastava, Vincent Rahim, Anil Kumar Patel, Chandan Bora, Gurmeet Singh, MP Singh, Suresh Chandra Rajput, Biplab Bhaumik, Suresh Pal Singh. We also thank the TSA Board, especially Rick Hudson and Andrew Walde, for their continued guidance and support. Patricia Koval and Walter Sedgwick are profusely thanked for supporting the Kukrail Project. Heather Lowe and Christine Bowie have provided outstanding administrative support to the project. Dr Gerald Kuchling is appreciated for volunteering his time for the sexing of *B. baska*. We would also like to thank the Madras Crocodile Bank Trust Centre for Herpetology, Assam State Zoo and Botanic Garden, National Power Corporation Limited, Nagaland Zoological Garden, Emerging Wildlife Conservation Leaders, and Air India for supporting our ongoing conservation efforts. The Disney Conservation Fund, Mohamad Bin Zayed Species Conservation Fund, Turtle Conservation Fund, Turtle Limited, MP Biodiversity Board, People's Trust for Endangered Species, British Chelonia Group, IUCN- Save our Species (SOS), Auckland Zoo, Woodland Park Zoo, and the Phoenix Zoo are sincerely thanked for financially supporting various projects and initiatives. The TSA India crew included Aradhna Singh, Akash Singh, Arunima Singh, Ashutosh Tripathi, Bhasker Dixit, Chaitra Baliga, Disha Sharma, Raja Mandal, Satish Kumar, Saurav Gawan, Shailendra Singh, Shashwat Sirsi, and Rishikesh Sharma. Special thanks go to our numerous field assistants for supporting the projects.

BANGLADESH

Release of four adult male *Batagur baska* in the new facility in Karamjal is overseen by our collaborators from the Forest Department Bangladesh and IUCN Bangladesh.

PHOTO CREDIT: ANTON WEISSENBACHER & RUPALI GHOSH

Northern River Terrapins Head South to New Karamjal Breeding Facility

DORIS PREININGER, ANTON WEISSENBACHER, RUPALI GHOSH AND PETER PRASCHAG

A new, more southerly breeding facility has been established for relocation of part of an *in situ* bred population of the Northern River Terrapin (*Batagur baska*). The facility is at the Karamjal Eco-Tourism Center – a Forest Station of the Bangladesh Forest Department in the Sundarbans – a region considered to be the former historic distribution range of this species.

The new facility marks an important starting

point for future release projects. Additionally, it will serve as security backup to continue *B. baska* breeding efforts by increasing and providing sufficient space. The move was made possible with support from the Zoological Society for the Conservation of Species and Populations (ZGAP), Deutsche Gesellschaft für Herpetologie und Terrarienkunde (DGHT) and the European Union of Aquarium Curators (EUAC).

The colony at Bhawal National Park currently includes eight females, 14 males and 132 juveniles. As reported in the 2014 issue of *Turtle Survival*, the breeding pond at Bhawal was renovated and partitioned to include isolated sections. After receiving genetic information on relatedness for all the terrapins, five unrelated pairs were introduced into the new pond divisions before this year's breeding season. So far, three nests are documented, with a total of 47 undamaged eggs.

Unlike the successful construction work relationships established in Bhawal, negotiations with contractors in Karamjal proved challenging. Fear of tiger attacks and biting fleas, along with transportation problems, caused a termination of arrangements with contractors from the town of Mongla. Eventually, local labor was arranged and contracted workers from the nearby village were signed on. The first round of materials, for area demarcation and pond construction, was finally ordered in November



The large pond in the foreground was constructed for adult individuals. Those in the back will be used as a hatchery for juveniles. PHOTO CREDIT: ANTON WEISSENBACHER & RUPALI GHOSH



One of the released juveniles seems to have settled quickly into its new home. PHOTO CREDIT: ANTON WEISSENBACHER & RUPALI GHOSH

2014. Meanwhile, newly hired workers began clearing the area of shrubs and bushes, and additional workers from the nearby villages of Bhajonkhali, Dangmari, and the house Smith from Pabna, arrived to begin construction of a breeding pond (13m x 40m) with a sand beach for nesting (13m x 5m). There were often as many as 70 workers on site at the same time.

TSA'S Rupali Ghosh visited Karamjal at

just the right moment, arriving the same time as a new sand shipment. She was able to make recommendations on slope steepness, and approve pond depths as the beach was filled with sand. By the end of November, workers were able to focus on the next tasks: constructing two juvenile ponds (10m x 5m each), the hatchling rearing tank, and new fencing.

Our combined efforts, aided by local support,

made for fast progress. Work continued on cement pillars, wall construction, and the installation of barbed-wire fencing. By mid-December, the project was nearly complete. Only the finishing touches, such as a water change in the ponds, and tiger fern planting, remained to finalize the new *B. baska* conservation and breeding facility.

We hoped to transfer individuals to the new site as soon as possible. Unfortunately, a labor strike, paralyzing the country since the beginning of 2015, made travel to and from Karamjal nearly impossible. Co-workers had a difficult time reaching Bhawal National Park, located only 29 miles / 47 km., from Dhaka, and transport of the terrapins to Karamjal had to be postponed several times. The situation finally resolved and Anton Weissenbacher, Peter Prashag and Rupali Ghosh finally visited Bhawal National Park in May 2015.

The team measured all individual terrapins, took blood samples, and tagged recently acquired females and the hatchlings from 2014. We were then able to arrange transportation for relocation of the terrapins to the new facility, and all reached the breeding center in Karamjal after an arduous seven hour car ride to the town of Mongla followed by a two hour boat trip through the mangrove forests of the Sundarbans.

Partners and collaborators from the Forest Department Bangladesh (Dr. Sunil Kumar Kundu and Mr. Jahidul Kabir), along with two IUCN Bangladesh members (Mr. Ishtiq Uddin Ahmad, and Mr. Dipu A.B.M. Sarowar Alam) joined us when we released the first four males and ten juveniles from 2012 into the new Karamjal ponds. We were also delighted to welcome crocodile conservationist Rom Whittaker who was there for the event.

Two additional adult terrapins joined the new Karamjal group a week later, providing us with the successful foundation for a second breeding project in Bangladesh.

A sustainable reintroduction of *B. baska* will still require the finding of suitable habitat and nesting beaches for a wild population. However, future field surveys and continued tracking of terrapins will help yield more habitat information and bring us closer to that goal.

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MYANMAR



A headstarted Burmese Roofed Turtle basks at the new grow-out pond at the TSA/WCS Base camp in Limpha Village along the upper Chindwin River. PHOTO CREDIT: STEVEN G. PLATT

Notable Victories in the Fight to Save Myanmar's Critically Endangered Turtles

STEVEN G. PLATT, KALYAR PLATT, ME ME SOE, WIN KO KO, KHIN MYO MYO, TINT LWIN, AND MYO MINH WIN

The **Turtle Survival Alliance** and Wildlife Conservation Society (TSA/WCS) Team scored several significant victories this year in the fight to save the critically endangered turtles of Myanmar. As in past years, we continued to focus on those species endemic, or nearly so, to Myanmar, namely the Burmese Star Tortoise (*Geochelone platynota*), Burmese Roofed Turtle (*Batagur trivittata*), Arakan Forest Turtle (*Heosemys depressa*), and the Burmese Peacock Softshell Turtle (*Nilssonina formosa*).

All of these species have received significant conservation effort and are classified as Endan-

gered or Critically Endangered by the IUCN after being decimated by decades of relentless over-harvesting to supply food, medicine, and pet markets just across Myanmar's northern border, in China.

BURMESE STAR TORTOISE REINTRODUCTION

The centerpiece of our success continues to be the reintroduction of captive bred, headstarted Burmese Star Tortoises into protected areas within the dry zone of central Myanmar.

Once common in this desert-like region – mean annual precipitation in the dry zone is

comparable to that of western Texas – unremitting demand from foreign pet markets drove the Star Tortoise to near-extinction in the late 1990s. By the mid-2000s, viable wild populations were a thing of the past and the Star Tortoise survived only in three TSA/WCS-funded assurance colonies in Myanmar. Fortunately, Star Tortoises reproduce readily in captivity and thousands of offspring are now hatching every year. About 2,000 have hatched in 2015 alone.

Because the ultimate goal of any *in situ* breeding program should be to reestablish viable wild populations rather than simply stockpile animals

in captivity, we initiated an experimental program in 2013 to reintroduce captive bred Star Tortoises at Minzontaung Wildlife Sanctuary (MWS) – where local animist beliefs held that spirits dwelling in a nearby mountain would protect them from harm.

Three pens, each encompassing 1 hectare of natural grassland and scrub habitat, were constructed in the sanctuary and stocked with 150 subadult (5-7 year old) tortoises in November 2013. This ‘soft release’ approach allows tortoises

to become acquainted with their new surroundings before groups of 50 are released at intervals of 6, 12, and 18 months. The idea behind this approach is that on-site penning makes the tortoises less likely to wander from the release area. This is of especial concern to us because MWS is surrounded by farmland and the safety of any tortoise that might venture onto these lands cannot be guaranteed.

Even more importantly, the illicit wildlife trade continues to pose a serious threat to the

future of Star Tortoises in Myanmar and constant vigil must be maintained to guard against poachers.

To this end, sanctuary rangers are stationed at the holding pens 24 hours a day, seven days a week and they conduct regular, aggressive patrols throughout the sanctuary. Shallow pits filled with sharpened bamboo *punji* stakes are concealed along likely avenues of approach to deal with any poacher who might slip past the rangers in hopes of purloining a tortoise from the pens.

A WILDLY SUCCESSFUL RELEASE

We released the first group of 50 tortoises in May 2014, the second in November 2014, and the third in May 2015. We expanded the program in late 2014, with the construction of three, 2 hectare holding pens in a different area of the sanctuary. Next, 300 subadult tortoises, in approximately equal sex ratio, were selected from the assurance colonies, and after all were individually examined and given a clean bill of health by a team of visiting Bronx Zoo veterinarians, were transferred into the pens to be liberated within the coming year.

Per standard operating procedure, each tortoise is affixed with a radio transmitter so that it can be tracked after being liberated. Each one is also permanently tattooed with an individual identification number and Buddhist iconography to deter poachers. So far, results are promising: 150 tortoises now roam free and another 300 in the holding pens await release.

Encouragingly, survival has proven much higher than we expected with only 11 tortoises lost. Several fell victim to feral dogs or jackals, others died after being mauled by large rats, and some simply turned up dead with no clue as to their demise. Much like natural selection, reintroduction can be viewed as a winnowing process and perhaps these individuals simply failed to pack the Darwinian gear necessary for survival in the wild.

Balanced against these losses, several females have been observed laying eggs, both before and after release from the holding pens. What's more, biweekly telemetry monitoring by teams of sanctuary rangers and TSA/WCS staff revealed that most tortoises remain within 1.0 km of the holding pens, even months after being liberated. This finding suggests the soft release approach has imbued the tortoises with some degree of site fidelity and ultimately keeps them within the confines of the sanctuary where they can be effectively protected.



Villagers prepare to release headstarted Burmese Roofed Turtles into Nam Thalet Chaung, a tributary of the Chindwin River. Note the radio transmitters attached to the carapace of many of the turtles. PHOTO CREDIT: BY STEVEN G. PLATT



Before being released, the carapace of each headstarted Burmese Star Tortoise is permanently tattooed with a unique identification and Buddhist icons in hopes of deterring poachers. PHOTO CREDIT: STEVEN G. PLATT



Headstarted Burmese Star Tortoise found constructing a nest and laying eggs in a pre-release holding pen at Minzontaung Wildlife Sanctuary. PHOTO CREDIT: ME ME SOE

PROGRAM CHALLENGES AT SHWE SETTAW WILDLIFE SANCTUARY

Hoping to reinforce our success by using what was learned at MWS to replicate efforts at a second protected area, we recently initiated another reintroduction program at Shwe Settaw Wildlife Sanctuary (SSWS). Comprising over 44,000 hectares of deciduous forest habitat, and home to the largest surviving herd of Endangered Eld's Deer in Myanmar, SSWS could host a Star Tortoise population numbering in the tens of thousands. Achieving this objective will no doubt prove far more challenging than returning tortoises to MWS.

Local animist beliefs that might provide an umbrella of protection for Star Tortoises are nonexistent at SSWS. Additionally, although the SSWS is officially a 'protected area', enforcement of regulations protecting wildlife has been



TSA/WCS Turtle Team members Myo Minh Win (left) and Zaw Zaw (right) search for released Burmese Roofed Turtles from a promontory on Pagoda Island in the Chindwin River near Limpha Village. PHOTO CREDIT: STEVEN G. PLATT

lax to non-existent for many years. To address these issues, TSA and WCS staff are conducting a sustained conservation education program in the many villages that ring the sanctuary, along with carrying out an intensive training course for SWS rangers.

Soft release holding pens are currently being built deep within the sanctuary and well away from its borders. Once completed, 300 captive bred Star Tortoises will be ensconced behind the high bamboo fences to become familiar with their surroundings before being liberated. Additional groups of tortoises are slated to join them in the coming years with the ultimate goal of restoring the Star Tortoise as a functional member of the biota at SWS.

BURMESE ROOFED TURTLE CONSERVATION AND REINTRODUCTION

Great strides were also made this year in Burmese Roofed Turtle conservation. Considered one of the most critically endangered turtles in the world, wild Burmese Roofed Turtles are now confined to a remote stretch of the upper Chindwin River where less than 10 adult females and an unknown number of males cling precariously to survival.

There is no doubt the species would have gone the way of the Dodo had not an integrated *in situ* and *ex situ* conservation program been implemented by TSA and WCS in 2006. Combining an assurance colony at the Mandalay Zoo with an egg collection and headstarting program along the upper Chindwin River slowly brought the number of surviving Roofed Turtles up to almost 700 by 2015.

Given this numerical buffer against biological extinction, we felt the time had come to return headstarted Roofed Turtles into the wild. From 2012 into 2014, we conducted a wide-ranging assessment of potential release areas and ultimately identified two areas where the reintroduction of Roofed Turtles is likely to succeed. The first is a stretch of the upper Chindwin River near Limpha Village, already inhabited by several nesting females. The second is along the Nam Thalet Chaung, a relatively pristine tributary of the Chindwin that merges into the main river near Htamanthi.

Once the release areas were identified, the first task was to move 160 headstarted Roofed Turtles from the Mandalay Zoo to our remote basecamp in Limpha Village. Sixty of these turtles would be returned to the wild, while the remaining 100 were destined for an assurance colony being established at the headquarters of



Forest Department rangers and TSA/WCS field staff release headstarted Burmese Star Tortoises into a holding pen at Minzontaung Wildlife Sanctuary. Tortoises are provided with food – succulent vegetation – for the first few weeks after being placed in the pen, but quickly learn to forage for themselves. PHOTO CREDIT: ME ME SOE

Htamanthi Wildlife Sanctuary.

Getting the turtles to Limpha Village was a weeklong ordeal involving an overland truck journey along rutted jungle tracks awash in mud, followed by a 160 km boat trip up the Chindwin River.

Upon arriving at Limpha, the turtles were immediately released into two large concrete grow-out ponds and given a month to recuperate from their arduous journey. In the meantime, we constructed soft release holding pens on beaches along the Chindwin River and Nam Thalet Chaung.

Given that few reintroductions of river turtles have ever been attempted and there was virtually nothing in the scientific literature to guide our efforts, we designed a simple experiment to test the efficacy of penning to diminish post-release dispersal – two groups of 30 turtles would be released at each site; 15 would be released immediately without being penned, while the remaining 15 would be held for 30 days in a riverside pen and then set free. VHF radio transmitters were attached to 15 turtles, with seven or eight of those within two groups destined to be liberated in each river, giving us the ability to track their post-release movements.

COMMUNITY CELEBRATES THE RETURN OF 'AIKE' OCCUPANTS

The release of Burmese Roofed Turtle came first at the village of Limpha, and later at a beach along the Nam Thalet Chaung. Release ceremonies at both sites were well attended by government officials and crowds of villagers. Following talks by TSA/WCS team members, the turtles were ceremonially 'donated' to attending Buddhist monks who then blessed them before being either being released into the river or placed in a holding pen.

Thirty days later, the pens were opened and within hours the turtles began to disperse. On the Chindwin River, most turtles moved only 1-2 km up- or downstream from the release site, many taking up residence in deep holes, called *aikes* in Burmese, that according to local lore, once harbored resident Roofed Turtles. On the Nam Thalet Chaung, one turtle swam over 30 km to the confluence with the Chindwin River before it disappeared. This turtle was the exception, as the others simply found the nearest *aike* and took up residence. As on the Chindwin River, local fishermen assured us that these same *aikes* were home to Roofed Turtles in the not so distant past.

Although it is still too early to judge the

success or failure of this reintroduction, early observations bode well for the future of the Roofed Turtle. The acid test will come later this year as the wet season commences. Floodwaters surging down the rivers may sweep the turtles downstream into heavily fished stretches laced with deadly monofilament nets, or they may remain in the relative safety of the release areas. Only time, and continued monitoring by our dedicated field staff, will tell.

OTHER CONSERVATION ACTION

The TSA/WCS Turtle Team continues to oversee the *in situ* propagation of endangered chelonians in Myanmar as an adjunct to field programs. In addition to the spectacularly successful Star Tortoise breeding program that is producing 1,500 to 2,000 hatchlings every year, two assurance colonies of Asian Brown Tortoises (*Manouria emys phayrei*) are now established.

First attempts to incubate Brown Tortoise eggs under natural conditions last year ended in failure when ants ate through the eggshells and devoured the developing embryos. To remedy the situation, this year we collected the eggs shortly after laying and the clutches are being incubated in Styrofoam boxes.

Notable success was achieved in breeding Roofed Turtles at the Mandalay Zoo; 51 eggs hatched successfully, with others still incubating at the time of this writing.

ENDANGERED TURTLE BREEDS FOR THE FIRST TIME IN CAPTIVITY

A significant 'first' occurred at the Mandalay Zoo when a Burmese Peacock Softshell Turtle (*Nilssonina formosa*) deposited a clutch of eggs, 12 of which later hatched. To our knowledge, this event marks the first successful breeding of this endangered species in captivity.

In another notable achievement this year, three Arakan Forest Turtle (*Heosemys depressa*) hatchlings emerged from eggs deposited at the assurance colony in Gwa. Unlike in past years when egg laying went unnoticed by keepers because these turtles are extremely secretive, even in captivity, this year's nesting was not only observed but also filmed by Hein Htet, a Yangon University doctoral student conducting field research on Arakan Forest Turtles for his dissertation.

Finally, a survey of pagodas throughout coastal regions of Myanmar bore fruit when Win Ko Ko discovered two Estuarine Terrapins (*Batagur baska*) languishing in a pond near Moulmein. One turtle was hauled from the pond



More than 1,500 Burmese Star Tortoises are being hatched every year at three assurance colonies in Myanmar. These tortoises will be headstarted and eventually released at wildlife sanctuaries throughout their former distribution in the dry zone of central Myanmar. PHOTO CREDIT: STEVEN G. PLATT

and found to be a female, while the sex of the second remains undetermined. Negotiations are currently underway to secure what may be the only two surviving Estuarine Terrapins in Myanmar for an incipient assurance colony.

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Acknowledgements: For their steadfast and generous support of the TSA/WCS Myanmar Turtle Conservation Program, we wish to recognize the following donors: Andrew Sabin and the Sabin Family Foundation, Andrew Walde, Critical Ecosystem Partnership Fund, Helmsley Charitable Trust, Holohil Systems, Ltd., Panaphil Foundation, Patricia Koval and WWF Canada, Turtle Conservation Fund, and the Wildlife Conservation Society.

INDONESIA



Painted Terrapins occasionally bask on sandy riverbanks to regulate body temperature. This image was captured on the Tamiang River at sunset. PHOTO CREDIT: JOKO GUNTURO

Painted River Terrapin Conservation Underway in Aceh, Sumatra

JOKO GUNTURO

With its vast size, and a varied geography ranging over 17,500 different islands, Indonesia is surpassed only by Brazil in its rich biodiversity. With a tropical climate and equatorial location, Indonesia also ranks fifth in the world regarding diversity of turtle species; equal to both China and Brazil.

Among the 31 turtle species found here, three are endemic. Five Indonesian turtle species are currently listed among the *World's 25 Most Endangered Turtles and Freshwater Turtles* as determined by the Turtle Conservation Coalition. These include the Rote Island Snake-necked Turtle (*Chelodina mccordi*), the Asian Narrow-headed Softshell Turtle (*Chitra chitra*), the Southern River Terrapin (*Batagur affinis*), the Sulawesi Forest Turtle (*Leucocephalon yuwonii*), and the Painted River Terrapin (*Batagur borneoensis*).

Indonesian turtle and tortoise species have endured high levels of egg harvesting as villagers collect them to eat or sell at local markets. These animals also face nest predation by wild pigs and monitor lizards and increasing habitat destruction as mangrove forests are destroyed and lost.

More conservation efforts are clearly needed to help overcome these challenges.

SATUCITA FOUNDATION BOOSTS CONSERVATION OF *B. BORNEOENSIS*

Currently, the Painted River Terrapin (*B. borneoensis*) is the only Indonesian chelonian on which field conservation activities are focused. *B. borneoensis* is dependent on the mangrove ecosystem for food and habitat. The loss of riverine vegetation has played a large role in the species' decline as mangrove swamps are rapidly converted for agriculture, charcoal production, and oil palm plantations.

To help overcome these threats, the Satucita Foundation has organized annual nesting patrols and tree planting to secure eggs from poaching and provide needed forage and habitat. The Satucita Foundation has also engaged in community education with over 5,000 villagers learning about the conservation needs of the Painted River Terrapin in Aceh Province, Sumatra.

The educational program has led to the formation of two community groups who planted

more than 10,000 Mangrove Apple trees (*Sonneratia sp.*), a favorite food of the Painted River Terrapin. The turtles often congregate under these trees within the flooded mangroves to wait for the ripened fruit to fall.

HELP NEEDED TO EXPAND CONSERVATION EFFORTS

After the protected eggs hatch, *B. borneoensis* juveniles are kept for headstarting at the Foundation's headstarting and education center. As of 2015, 167 Painted River Terrapin hatchlings have been released back into the wild. In 2016, we'll begin monitoring released turtles thanks to a generous donation of equipment from Walde Research and Environmental Consulting.

Illegal egg harvesting and destruction of riverine vegetation continue, while many ecological and biological aspects of this species are not adequately understood and haven't been studied. Conservation planning is compromised while these threats continue to impact the Painted River Terrapin, as well as all other endangered freshwater turtles and tortoises throughout Indonesia. A TSA Indonesia Program is seriously needed to play an important role in helping to ensure their continued survival in the future.

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Acknowledgements: Thank yous go to BKSDA Aceh and Aceh Tamiang Local Government for their collaboration. Supporting organizations include: Turtle Survival Alliance, Turtle Conservation Fund, Pertamina EP Field Rantau, Chester Zoo, Mohammed bin Zayed Species Conservation Fund, and the Phoenix Zoo.



Joko Guntoro records GPS coordinates of traps deployed during field surveys to monitor Painted Terrapin populations in the Tamiang River. PHOTO CREDIT: YUSRIONO



Electroejaculation and semen collection of *Rafetus swinhoei*, 06 May 2015. PHOTO CREDIT: PAUL CALLE

Rafetus swinhoei in China – still on the brink despite eight years of captive breeding attempts

GERALD KUCHLING AND LU SHUNQING

The Yangtze Giant Softshell Turtle (*Rafetus swinhoei*) is not only one of the largest freshwater turtles in the world, but also the most critically endangered. The species is on the brink of extinction, with only two individuals known to survive in China – an old male in the Suzhou Zoo and a female in the Changsha Zoo. Chelonian experts from China, the USA, and Thailand – along with support from the Turtle Survival Alliance (TSA) and others – are racing to acquire the breeding and fertility knowledge

necessary to save them.

AN EMERGENCY BREEDING PROGRAM

A breeding program initiated by TSA in 2008 led to the female laying between 180 and 220 eggs annually, in the late spring or early summer. Sadly, the eggs turned out to be infertile, with no hatchlings produced and no embryonic development demonstrated. Semen evaluation and an attempt at artificial insemination had been planned as early as four years ago, but at the last moment,

the male's owner, the Suzhou Zoo, declined permission for the procedure to go ahead.

Unable to test their method of sperm collection with the *Rafetus* male, Dr. Wachira Kitimasak of the Kanchanaburi Inland Fisheries Development Center, Thailand, and a veterinary team headed by Dr. Nantarika Chansue of the Aquatic Animal Disease Research Center, Chulalongkorn University, Thailand, successfully trialed semen collection with the species *Amyda cartilaginea*.

Despite the earlier setback, the team estab-



Artificial insemination of *Rafetus swinhoei*, 06 May 2015. PHOTO CREDIT: PAUL CALLE

lished a protocol using the method of electroejaculation to collect the semen of large softshell turtles, and provided important preliminary information on semen quality (Kuchling, G., Shunqing, L., and King, E. 2011: The fourth year of *Rafetus swinhoei* breeding attempts in China. *Turtle Survival* 2011:78-79).

Further investigation occurred in July 2014, as Kaitlin Croyle of the San Diego Zoo Institute for Conservation Research, examined the vitelline membrane of some of the *Rafetus* eggs. Her tests failed to detect any sperm heads, suggesting that no fertilization had occurred. Questions regarding the viability of the male turtle's sperm and whether he was able to successfully copulate and inseminate the female now had to be answered.

AGREEMENT TO MOVE FORWARD FACES A SETBACK

In order to provide urgently needed answers to these questions and move the breeding program forward, the Changsha Zoo, Suzhou Zoo, China Zoo Society, TSA, and WCS-China signed a memorandum of understanding to perform semen collection and evaluation in the spring of 2015. The agreement specifically assured that if motile sperm could be demonstrated during the evaluation, the team was to perform immediate artificial insemination of the *Rafetus* female.

Artificial insemination has not been demonstrated to be successful in any turtle species. Planned trials to establish how to best perform artificial insemination with a similarly large, female *Amyda*, in early 2015, were cancelled due to unfortunate, last minute obstacles. The team was faced with the possibility of postponing the

scheduled attempt at artificial insemination with the *Rafetus* female and the subsequent loss of another breeding season. The delay also threatened to terminate the *Rafetus* breeding program in China as the female was supposed to move back to the Changsha Zoo later this year.

WORKING AGAINST TIME

Despite reduced chances for success, we went ahead with the challenging procedure on 06 May 2015 – the world's first AI attempt with the only known female of a species is obviously a problematic endeavor without prior trials in a more common species.

The team included Chinese scientists and veterinarians from the Changsha Zoo, Suzhou Zoo, China Zoo Society, Chengdu Giant Panda Breeding Centre, Dr. Barbara Durrant of the San Diego Zoo Institute for Conservation Research, and Dr. Paul Calle of the Wildlife Conservation Society - Bronx Zoo.

Electroejaculation was successfully performed following the *Amyda* protocol. The good news was that the male is still producing sperm despite his old age. The relatively small volume of collected semen contained motile sperm, although in low density and with many damaged spermatozoa (e.g. broken tails). The bad news was that his penis is heavily scarred, relatively thin, and the complex structures of the glans penis of softshell turtles, including seminal grooves, are missing.

Due to his severely damaged and scarred penis, the male appears unable to either copulate successfully with the female or to transfer semen into the area of the female cloaca where it is

needed to facilitate egg fertilization. Given this predicament, artificial insemination is now the only chance to produce offspring. Knowing this, we placed all collected semen into the urodeum in the cloaca of the female.

NEW INFORMATION MAY BREED SUCCESS

Frustratingly, the eggs of three subsequent clutches in 2015 were again infertile. We knew from the beginning that low semen quantity and sperm quality reduced chances for success, but now it appears that specific sperm placement may also be important. Further study of the penis morphology of big softshell turtles suggests that semen may have to be deposited directly into both oviducts, which open independently into the cloaca.

We speculate that low semen quality may have been related to the fact that semen collection took place toward the end of the mating season, which commences in late September and October, and ends in May. We plan to repeat semen collection and artificial insemination in October 2015 to take advantage of the natural mating cycle and hope for better semen quantity and quality.

Prior to the October semen collection, we plan trials with females of other species of large softshell turtles to find out how best to locate the oviduct openings into the cloaca for semen placement. We're confident the female *Rafetus*, once correctly inseminated, can then store sperm until the next breeding season in the spring of 2016.

ANOTHER RAFETUS IN THE RED RIVER?

A large softshell turtle, observed by local people in the Chinese part of the Red River, was spotted again in April 2015. Presumed to be a *Rafetus*, it has not been captured despite intensive trapping. The effort to locate another breeding individual is critical as global turtle experts work against time to save this highly endangered species.

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Acknowledgement: For technical assistance on 06 May 2015 we thank: Barbara Durrant (San Diego Zoo), Paul Calle (WCS), Emily King (TSA), Steve Platt (WCS); Chen Daqing, Di Min, Sun Aiguo, Tang Enen, Tang Deqi, Chen Jing Han Shichang, Liu Xing Feng Qi, Lu Fang (Suzhou Zoo); Yan Xiahui, Lu Qingtao, Yang Junlong (Changsha Zoo); Liu Nonglin (China Zoo Society); and Liu Hong, Liu Jlawen, Wang Juan (Chengdu Giant Panda Breeding Centre). In addition we thank Peter Praschag and Thomas Hildebrandt for the opportunity to explore the penis morphology of some softshell turtles. We acknowledge financial support by Kadoorie Farm and Botanic Garden and the Turtle Conservation Fund (TCF).

BELIZE

A Hicatee hatchling pictured at one week old. PHOTO CREDIT: HEATHER BARRETT

Hicatee Conservation and Research Center Produces Its First Hatchlings

HEATHER BARRETT

The Hicatee Conservation and Research Center (HCRC) has seen a lot of activity over the past year, with expanded infrastructure, the hiring of a full-time staff member, and the addition of 22 Central American River Turtles (*Dermatemys mawii*). The center's primary mission is to protect and restore *D. mawii*, locally known as the Hicatee, the lone surviving representative of the family *Dermatemydidae*.

Based out of the Belize Foundation for Research and Environmental Education (BFREE) field station in southern Belize, the HCRC facility is designed for the captive breeding of the spe-

cies, and has already experienced spectacular and surprising success with the arrival of seven healthy new Hicatee hatchlings!

NEW RESIDENTS, NEW MANAGEMENT

After the introduction of 22 Hicatee into one of the breeding ponds during the spring of 2014, it was clear that a full-time staff member was needed to oversee the new residents. HCRC's new Facility Manager, Thomas Pop, was hired based on extensive, firsthand experience with the Hicatee while working with Dr. Thomas Rainwater on TSA's countrywide survey in 2010.

Tom has also worked on various BFREE research projects, including Harpy eagles, jaguars, and sedges. Under the guidance of BFREE Executive Director Jacob Marlin, he quickly adapted to the vital role of Hicatee turtle feedings and observations, while also expertly maintaining the facility, grounds and equipment.

Soon after assuming his new role at HCRC, Tom raised the water level of the breeding pond in an attempt to replicate natural river conditions during flooding in order to stimulate egg laying. A few days later, on 5 December 2014, eight eggs were found buried in the soil at the pond's edge. The unanticipated clutch, so quickly following the turtles' placement in captivity, now required an equally quick plan of action.

After consultation with experts, the eggs were removed from the nest and placed in artificial incubation chambers in a stable and secure indoor environment. The clutch was divided into two groups with different humidity levels. Because no incubator was available, the ambient temperature determined the incubation temperature. Of the eight eggs, one was infertile, while the other seven quickly banded and then stopped. We had no idea if they were in diapause or if they had died, so were both thrilled and relieved on 14 June when the first of seven Hicatee turtles pipped and hatched.

Growing quickly and eating voraciously, the hatchlings have more than doubled their birth weight in the first three months of life. They are currently in the process of being moved from temporary setups to a custom-made 6'x4'x18" enclosure at the HCRC, where they will spend the next year under close observation.

FACILITY IMPROVEMENTS

The HCRC, with the help of Belize Aquaculture Limited (BAL Shrimp), has undergone additional facility improvements to better support its residents and associated research. Leaks in the second pond were identified and repaired, ultimately allowing for the opening of two fully functioning turtle ponds. Nesting areas were created and continue to be modified based on information learned from local sources and derived from the deposit location of the first clutch. Additionally, a new processing station was built in order to collect routine data and perform regular health checks on the Hicatee. The repair and introduction of the second pond allowed the turtles to be divided into two groups – one consisting of two adult males and ten reproductive size females, and the other consisting of one adult male and nine sub-adult females of varying sizes.



Dr. Shane Boylan (South Carolina Aquarium) performs ultrasound exams on female Hicatee to assess reproductive status. PHOTO CREDIT: MALLORY CLARK



HCRC manager Tom Pop retrieves turtles from the capture net so they can undergo health assessments and reproductive evaluations. PHOTO CREDIT: RICK HUDSON

TSA VISIT PROVIDES EXPERT ASSISTANCE

A TSA team including Dr. Shane Boylan, Rick Hudson, Dr. Thomas Rainwater, and Mallory Clark visited BFREE in February, 2015 to work alongside Tom Pop and Jacob Marlin conducting evaluations of the turtles' health and reproductive status.

The team created husbandry and management protocols, tested water quality, discussed nesting habitat based on the current nest, developed incubation techniques based on group knowledge of the embryonic diapause that eggs of this species undergo, and began preparations for a film that would document the goals of the

project. Dr. Boylan and Rick Hudson returned in August for a second time to conduct another round of health checks on both adults and hatchlings.

During each visit, Shane Boylan, DVM, an outstanding chelonian clinician with a broad knowledge of water quality and testing, brought a portable ultrasound to evaluate the females' reproductive status. An ultrasound conducted during the August visit concluded that the largest female (weight – 10 kg, carapace length – 43.4 cm) had large follicles and was reproductively active.

HCRC continues to monitor the turtles, paying special attention to the reproductive female,

Announcing the 2nd Hicatee Conservation Forum and Workshop, including the IUCN Red List Meeting for *Dermatemys mawii*

When: February 25-26, 2016

Where: BFREE Field Station, Toledo District, Belize

For info, contact: Heather Barrett, hbarrett@bfreebz.org



with three motion sensing cameras and video surveillance installed to capture nesting behavior – something that has never been observed in the wild or captivity. The collected observations on feeding and nesting behaviors will help to establish a reliable management plan for successful breeding of *D. mawii* in captivity. Our hope is that these actions will eventually lead to a sustainable and larger-scale effort intended to reduce the various pressures plaguing wild populations of Hicatee.

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Acknowledgements We would like to thank the Association of Zoos and Aquariums and Disney Worldwide Conservation Fund for their financial support for research occurring at the HCRC. Additionally we would like to acknowledge the support of the following organizations and individuals: Belize Aquaculture Limited, Jacksonville Zoo, Dr. Thomas Rainwater (USFWS), Shane Boylan, DVM (South Carolina Aquarium), Mallory Clark (Ms Mallory Adventures), Nichole Bishop (UF PhD student), as well as BFREE Staff members: Sipriano Canti, Marcelino Pop, Elmer Tzalam, Fernandes Sho, and Marlyn Cruz, and BFREE/HCRC Volunteers: Mark Mummaw, Lindsey Gordon and Jordyn Mulder.

COLOMBIA



Dahl's Toad Headed Turtle (*Mesoclemmys dahlí*) from the tropical dry forest of Colombia. Genetic studies performed by the TSA/WCS team will help provide conservation recommendations for the species. PHOTO CREDIT: LUIS EDUARDO ROJAS

TSA Colombia Expands Research and Conservation Initiatives for Imperiled Species

GERMAN FORERO-MEDINA, NATALIA GALLEGO, AND MARIO VARGAS

The Turtle Survival Alliance (TSA) and Wildlife Conservation Society (WCS) joint turtle conservation program continues to work for Colombia's most imperiled chelonian species. Ongoing projects by this active partnership include efforts to conserve the Magdalena River Turtle (*Podocnemis lewyana*) and Dahl's Toad Headed Turtle (*Mesoclemmys dahlí*). We have also implemented research and concrete action to conserve two other threatened species: the Giant South American River Turtle (*Podocnemis expansa*), and the Red-footed Tortoise (*Chelonoidis carbonaria*).

CONSERVING IMPORTANT HABITAT FOR THE GIANT SOUTH AMERICAN RIVER TURTLE

Podocnemis expansa inhabits the Amazon and Orinoco river basins. It is one of the most heavily exploited species in the region, and has experienced a generalized decline in numbers. There are very few studied or protected *P. expansa* populations in Colombia, so there is an urgent need to evaluate additional conservation sites.

In response, Fundación Omacha, in collaboration with the TSA/WCS program, launched a conservation initiative for the species on a

section of the Meta River running through the Orinoquia region on the eastern plains of Colombia. This effort is part of a larger initiative led by WCS and Ecopetrol (Colombia's largest oil company), which is trying to conserve ten landscape species in Colombia. Previous work by Fundación Omacha identified the Meta River site as having potential as a conservation area that already includes a population of nesting females.

In 2014, the project began working in cooperation with the local communities of La Virgen and La Culebra in the states of Arauca and Vichada. We established conservation agreements to set aside protected nesting beaches; conduct surveillance of the protected beaches to reduce mortality of reproducing females and their eggs; monitor reproductive parameters during the nesting season; and to evaluate the effectiveness of the various conservation efforts.

SUCCESS ON THE META RIVER

From January to May 2015, the team working in cooperation with community members, conducted surveillance of the beaches and monitored for reproductive parameters. Results so far are outstanding: 975 nests were recorded, making this the second largest known population and reproductive site for the Giant South American River Turtle in Colombia. Nest survival and hatching success on the naturally protected beaches was very high, with nest extraction lower in protected beaches than on non-protected ones.

Extraction of adult females during nesting was also low. Apparently, consumption of *P. expansa* in the nearby town was reduced as a consequence of the local people's awareness of and participation in the work.

The project will be funded for at least two more years as part of a larger initiative with Proyecto Vida Silvestre, led by Ecopetrol and the Wildlife Conservation Society. Research begins next year with a mark-recapture study that will gather data to estimate the size of the resident population at this promising river site for continued conservation of the species.

GENETICS AND OCCUPANCY STUDIES ON COLOMBIA'S TROPICAL DRY FOREST CHELONIAN

The tropical dry forest is one of the most threatened ecosystems in Colombia, with less than 10 percent of original forest cover remaining. Ecopetrol has launched an initiative to increase understanding of this fading ecosystem's biodiversity by funding projects focused



The team from WCS, TSA, Fundación Omacha, La Virgen and El Control communities at one of the protected beaches for *Podocnemis expansa* on the Meta River. PHOTO CREDIT: TSA/WCS



Naturally emerged *Podocnemis expansa* hatchlings at the protected and monitored beaches. The net is used to count the number of live hatchlings without manipulating the nest. PHOTO CREDIT: GERMAN FORERO

on developing urgently needed conservation strategies.

A WCS/TSA program received support under the initiative to study two dry forest chelonian species: Dahl's Toad Headed Turtle (*Mesoclemmys dahl*), and the Red-footed Tortoise (*Chelonoidis carbonaria*). Both species are considered endangered, primarily due to the transformation of dry forest habitat. The Red-footed Tortoise (*Chelonoidis carbonaria*) is also being pressured due to the pet trade. The project seeks to address conservation genetics, and to evaluate remaining populations in the field to identify opportuni-

ties for initiation of conservation programs at particular sites.

The conservation genetics study for *Mesoclemmys dahl* assessed genetic diversity and structure throughout the species' range, and established whether there are different management units based upon identified genetic structure and major demographic parameters. We obtained more than 120 blood and tissue samples from *M. dahl* wild populations, and developed a microsatellite library consisting of 23 polymorphic loci. The genotyping of all individuals is underway.

Additionally, a survey determined occurrences of the Red-footed Tortoise (*C. carbonaria*) in remaining patches of dry forest, and found wild populations in the states of Atlántico, Bolívar, Cesar, and Guajira. This study, coupled with results from genetics research being done for this species, will generate recommendations for protection sites across its range.

CONSERVATION OF THE MAGDALENA RIVER TURTLE ON THE SINÚ RIVER

The Magdalena River Turtle (*Podocnemis lewyana*) is a Critically Endangered species endemic to the Magdalena and Sinú rivers in Colombia. The two rivers are considered separate management units, so require different conservation actions. A community-based conservation project, led by the towns of Caño Viejo and Cotocá Arriba, was launched in 2005 to address the needs of the Sinú River population.

In 2013, the program gained the support of TSA and WCS with the goal of strengthening its management, research and monitoring capabilities. One of the main achievements of the partnership was the creation of the first management plan on the Sinú River. The plan details specific conservation actions the program must follow in order to reduce species threats.

This year, the local team continued with traditional *in situ* and *ex situ* management actions to reduce egg mortality due to flooding. Five artificial nesting banks were built to increase nesting site availability during times when natural beach sites are submerged. Natural beaches were also constantly patrolled to avoid poaching and to rescue clutches prone to inundation.

The Caño Viejo community team patrolled six beaches located between Lorica and San Nicolas de Bari throughout the nesting season, while collecting and incubating 101 clutches *ex situ*. The Cotocá Arriba community team patrolled six nesting beaches, three more than last year, and collected 24 clutches. As in previous years, about 2000 *P. lewyana* hatchlings were successfully released back into the river.

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Acknowledgements: We kindly thank Fundación Omacha, Ecopetrol, Fundación Mario Santo Domingo, Wildlife Conservation Society, Universidad de Los Andes and Senckenberg Museum for program funding and support.

In Search of Ancient Beasts with Modern Technology: Aquatic Turtles and Environmental DNA

JIM GODWIN, LESLEY DE SOUZA, AND TOM AKRE



Flattened Musk Turtle (*Sternotherus depressus*) adult. PHOTO CREDIT: JIM GODWIN

Rare, threatened, or endangered species occupying a complex environment, which are also cryptic, or shy, are often difficult and expensive to survey. Various types of survey techniques and statistical analyses have been developed to help compensate, and better detect elusive species, but at the end of the day, absence of evidence is not necessarily evidence of absence!

It's now common to hear biologists talk of

using environmental DNA (eDNA) to locate some invasive or rare aquatic animal. The technology has gained popularity in recent years as an increasingly effective tool for sampling difficult to collect aquatic organisms, particularly some aquatic turtles.

Environmental DNA refers to the DNA collected from the general surrounding environment, used as a means of determining the

presence of an organism that is particularly challenging to sample by other means. As organisms move about their habitat and perform biological functions, they shed cells and DNA. These DNA fragments can be collected, isolated, and identified as to species.

Much of the public became familiar with this technology by watching crime scene investigation TV programs. Unlike a crime scene, an



In the field, water filtration using hand operated vacuum pumps. PHOTO CREDIT: JIM GODWIN

aquatic environment does not require a forensic specialist to find and collect samples; only a pump to filter water samples is needed. The filter must have pores that are smaller than the sought after DNA fragments. Many studies over the last decade have relied on this simple principle, with eDNA sampling done on both native and exotic species, including invertebrates, fish, amphibians and mammals; in marine and freshwater environments that include rivers, streams and ponds.

An eDNA study takes place in both the field and lab. The first step is to collect water samples. We use decontaminated Nalgene bottles for sample collection, taking precautions to avoid contamination. Once a sample is collected, the water is filtered to capture the DNA by placing a filter on top of a vacuum flask. Vacuum pressure is applied, pulling water through the filter. When the process is complete, the filter is placed in a vial with a buffer. DNA captured by the filter is extracted by using species-specific primers, and the DNA mix is tested for the specific DNA of the target species using quantitative polymerase chain reaction (qPCR).

Although the general technology and application are not new, eDNA is increasingly being considered as a valuable tool by wildlife biologists because capture of a genetic marker from a water sample can substitute for capture of an individual. Factors such as low population density, cryptic behavior, or a challenging environment, contribute to the difficulty of sampling with stan-



Nalgene bottle used for collection of water in an eDNA study. PHOTO CREDIT: JIM GODWIN

dard survey methods such as visual encounter surveys, basking point counts, or trapping.

Environmental DNA is expected to improve detection of many aquatic turtle species and further reduce survey costs by replacing the need for standard survey methods. Adding to the savings realized from advances in processing technology and computing power over the last decade, the approach promises to grow in use. As with any

other sampling method, it requires further use and validation to understand rate and causes.

Environmental DNA survey advantages include reduced field time; allowing more samples to be collected, or a larger geographical area to be sampled within a given time period. Field equipment is minimal, and there is no need to return to a sampled site, as compared to the multiple disturbances required when setting and retrieving traps. Also, a smaller field crew is required, since intense searches are not necessary, and no traps must be managed. Additionally, detecting a species with eDNA is often more sensitive over conventional techniques.

Initial eDNA studies should be conducted alongside standard survey methods so that detection of eDNA can be validated by capture of individuals. All studies should be conducted in a standard scientific framework, as in the use of replicates and controls.

In our research on the distribution of the Flattened Musk Turtle (*Sternotherus depressus*) in Alabama, the goal was to use this method to resample historic sites and survey for new localities based simply on detection of eDNA. We confirmed five historic localities, extended the range in known occupied streams, and added four new localities.

We successfully used eDNA with both the Wood Turtle (*Glyptemys insculpta*) in Virginia, and the Flattened Musk Turtle (*Sternotherus depressus*) to confirm the presence of the two species in streams and rivers. We entered into this two-year study as skeptical field biologists, but we've become optimistic concerning the potential use of eDNA in surveys.

Understanding the natural history and biology of the turtle species being investigated remains an important consideration when using eDNA. While it can be a powerful tool for surveying aquatic turtles, the outcome may be flawed without inclusion of a knowledgeable turtle biologist in the work. If the need is only to detect the presence of a freshwater turtle, and field conditions or other factors inhibit use of other accepted methods, then employment of eDNA may be appropriate.

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Acknowledgement We thank the Alabama Department of Conservation and Natural Resources, the U.S. Forest Service, and U.S. Fish & Wildlife Service for funding this work, and the Lodge Lab at the University of Notre Dame for lab access and support.

Testing the Waters in the Desert: Establishing a Bolson Tortoise Colony Where Bolson Tortoises Haven't Tread in over 10,000 Years



Adult male Bolson tortoises like the one shown here are generally smaller than the adult females (by ~15%). The largest of the males in our colony have shell lengths of ~325 mm, the largest females reach ~390 mm.

PHOTO CREDIT: SCOTT HILLARD

CHRISTIANE WIESE AND SCOTT HILLARD

In 2006, the Turner Endangered Species Fund (TESF) accepted responsibility for a group of tortoises collected and bred since the early 1970s by the late Ariel Appleton. In the summer and fall of 2006, TESF staff and volunteers rounded up Ariel's tortoises near Elgin, Arizona, and transferred them to their new home on the Armendaris Ranch in southern New Mexico. The Armendaris, owned by media mogul and

conservationist Ted Turner, lies at the northern tip of the tortoise's prehistoric range in the Chihuahuan Desert.

Largest of the five North American tortoise species, the Bolson Tortoise (*Gopherus flavomarginatus*) is believed to have once roamed throughout most of the Chihuahuan Desert. The tortoises' current range is now restricted to the small "Bolson de Mapimi" area in north central Mexico.

Their scientific name, *flavomarginatus*, meaning "yellow-margined", describes how Bolson Tortoises have yellow marginal scutes with most individuals also displaying yellow toenails. Known as the "Tortuga Grande" and the "Running Tortoise", their propensity for a running take off to the nearest burrow distinguishes them from other tortoises who are more likely to stay put and retreat into their shells.

BREEDING PROGRAM SUCCESS

We've developed a robust breeding program on the Armendaris Ranch over the last 9 years; resulting in over 500 new Bolson Tortoises. Young tortoises are housed in outdoor holding pens to protect them from predators until they are large enough to fend for themselves. What it precisely means scientifically for them to be "large enough" is a research question still under investigation.

In the fall of 2012, we began outfitting larger juveniles (>100 mm shell length; between four and seven years old) with transmitters and moving them from the protected pens to large (7.5 hectare) unprotected, predator-accessible enclosures fenced to comply with current permit requirements, but not covered. Because of such releases, over 100 captive born tortoises experience life as wild animals with minimal human interference. We weigh, measure, and assess health twice a year. Beyond that, the tortoises are on their own.

Survivorship is an astounding 85 percent. Predators known to eat tortoises, such as ravens, roadrunners, hawks, ground squirrels, ringtails, raccoons, coyotes, mountain lions, bobcats, bears, and snakes are present on the Turner Ranches, but may pass up the Bolson Tortoise 'tortellinis' for more accessible prey. Bolsons spend upwards of 90 percent of the time in their burrows, and generally emerge only for basking sessions close



Dr. Jim Jarchow watches as a juvenile tortoise with transmitter slowly advances to check out the burrow the tortoise team has chosen for its release in the large unprotected pen. This Bolson Tortoise juvenile was the 100th tortoise released to live as a wild tortoise in the northern portion of its species' prehistoric range with minimal human support or interference. PHOTO CREDIT: CHRISTIANE WIESE



Coaxing an adult tortoise out of its burrow requires getting up close (or down close, as the case may be) and personal. Here, one of the authors is patiently taking advantage of the tortoise's natural behavior to defend its burrow by pretending to be an intruder. In most cases, the tortoise's efforts to evade the intruder will eventually bring it close enough to the burrow entrance to be captured. PHOTO CREDIT: SCOTT HILLARD

to the security of the burrow opening. They're out for relatively brief foraging bouts, so unless it rains, young tortoises are rarely encountered away from their burrows.

WILD POPULATION STATUS UNKNOWN

Little is known about the current status of the Bolson Tortoise in the wild. The last

official population count was conducted in the early 1980s. Even then, the wild population was thought to comprise a mere 8,000 to 10,000 animals existing in six separate colonies. One of these colonies was protected inside the Mapimi Biosphere Reserve, but the continued threats of habitat degradation and human consumption are likely to have signifi-

cantly reduced the number of wild Bolson Tortoises. Fewer than 2,000 adults are estimated to remain in the wild today.

There is good news from other quarters. Given the current rates of reproduction of our semi-captive colony on the Turner Ranches, the U.S. population of Bolson Tortoises may soon rival the size of the wild population.

MOVING BEYOND ASSURANCE COLONIES

TESF's ultimate goal is to move beyond maintaining captive assurance colonies, and establish free-ranging populations in what was the Bolson habitat before early humans greatly reduced their range, and modern humans brought them close to the brink of extinction.

Monitoring the growth and fecundity of our colony has convinced us that Bolson Tortoises not only survive, but actually *thrive* in the northern Chihuahuan desert grasslands. About half of our 13 females routinely triple clutch, and clutch size is similar to wild counterparts. Moreover, released juvenile tortoises find enough high quality, native forage to manage normal growth rates. What remains to be established is whether nests and hatchlings in unmanaged or minimally managed populations can survive at rates high enough to maintain and increase the population.

Concerns about future landscapes, in the face of inevitable climate change, prompt careful consideration of potential reintroduction sites. In addition to establishing free ranging, minimally managed Bolson Tortoise populations on Turner lands, we envision them once again roaming the desert shrublands of places like Big Bend National Park.

Many thoughtful conversations will need to take place to fully address lingering concerns about reintroducing a species not present in a region since before the time of Christopher Columbus. But hopes are that truly wild Bolson Tortoises will once again tread on northern, public Chihuahuan Desert lands.

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Acknowledgements: We thank our partners for their support: Living Desert Zoo and Gardens State Park (Carlsbad, NM), El Paso Zoo (El Paso, TX), and San Antonio Zoo (San Antonio, TX). We are grateful to the many volunteers who have helped over the years, especially our trusted provider of veterinary care, Dr. James Jarchow, DVM (Tucson, AZ).

Restoring Cambodia's Wild Populations of Southern River Terrapin

SITHA SOM, SARAH BROOK, AND SOVANNARA HENG



A female Southern River Terrapin with attached transmitter, allowing the released individuals to be monitored.
PHOTO CREDIT: THIDA LEIPER/WCS

the headstarting facility until ready for release. Currently there are 225 hatchlings, juveniles and sub-adults at the facility.

A NEW FACILITY

The successful headstarting program has outgrown its current facility, so a new center is under development. The new site is adjacent to a wildlife sanctuary within the species' natural range and will enable the project to increase the number of terrapins raised. The sanctuary's newly expanded location will also allow for the housing of rescued Siamese crocodiles, a species inhabiting the same river system. Captive breeding programs at the center will help restore wild populations of both species. The first phase of construction and relocation of the terrapins began in September 2015.

PREPARATION FOR RELEASE

In late 2014, a threat assessment was conducted within the wider Sre Ambel River system to determine the spatial distribution and frequency of various threats to *B. affinis*. Appropriate threat mitigation strategies were developed and put into place prior to the first release of terrapins back into the system. Five rivers were surveyed, and

The last 12 months have been notable for the Southern River Terrapin (*Batagur affinis*) in Southwestern Cambodia. The Wildlife Conservation Society (WCS) continues to work with the nation's Fisheries Administration (FiA) to conserve this endangered species. Known locally as "The Royal Turtle", *B. affinis* conservation efforts achieved a significant milestone with the July 2015 release of 21 sub-adult terrapins into the wild.

A BRIEF HISTORY

In 2001, WCS and government agencies re-discovered a remnant population of the Southern River Terrapin in southwestern Cambodia. WCS and the FiA have since worked with local communities to prevent egg collection and protect the species in the wild. With an average of 2-3 nests located and protected each year on the Kaong

River, the effort is critical — there are perhaps as few as 2-3 breeding females remaining within the entire Kaong river system. From 2002 to 2014, a total of 35 nests have been protected by the project, resulting in 326 hatchlings. A small headstarting facility was constructed in 2006 where more than 200 hatchlings have been raised since then to increase chances of survival before being released back into the wild. Surveys of other rivers in southern Cambodia have been conducted during the nesting seasons, but have not yet detected any other breeding populations.

MORE WILD NESTS

Four clutches from at least two females were located in the Sre Ambel River system in February 2015 and achieved a hatching success rate of 89%, as 59 *B. affinis* hatchlings emerged in May. The hatchlings will be closely monitored at

although very low levels of illegal fishing practices – such as spear fishing and the use of long line hooks – were detected, the amount of land clearance and illegal logging were found to be of great concern to terrapin conservation efforts.

MONITORING THREAT LEVELS WITH TECHNOLOGY AND LOCAL SUPPORT

To facilitate improved monitoring of threats and adaptive site management, the Spatial Monitoring and Reporting Tool (SMART) management system was introduced in late 2014. Refresher training in patrol strategies and data collection for both SMART and GPS use was provided to project staff. A SMART report is now generated at the end of each month and patrol data is carefully analyzed to determine next

month's patrol objectives. The patrol team will be expanded, later this year, to include an additional law enforcement officer. The additional personnel enables the project to deal more effectively with illegal logging and land clearance.

In early 2015, three villages close to the release site on the Kaong River were visited to inform locals of the project's plans to release a number of the headstarted terrapins. Project leaders asked the villagers for cooperation in reporting to project personnel of any sightings or accidental captures. More than a third of community members from all three villages joined these meetings and were very supportive of the release.

HEALTH MONITORING

In June 2015, the WCS Veterinary team, led

by Dr. Paul Calle, screened all of the terrapins for release. A population level health assessment was conducted to enable long term health monitoring. At the same time, all the terrapins to be released were fitted with acoustic transmitters to enable post release monitoring,

CELEBRATION OF THE FIRST TERRAPIN RELEASE

In July 2015 the project released 21 healthy sub-adult Southern River Terrapins to supplement the wild population. Given the significance of the species, the release of “The Royal Turtle” was marked with a large ceremony and celebration attended by senior government officials along with more than 150 school children and community members.

Surrounded by celebrants and well-wishers, the 21 terrapins were released into a large semi-natural, soft release enclosure within a lake on the Kaong River. They remained in the enclosure for 3 to 4 weeks to become accustomed to their new environment and to potentially engender site fidelity. The released terrapins are currently being monitored twice monthly to estimate survival, movements, and habitat use. After the first two months of monitoring, approximately 30% of released animals are still within the soft release enclosure (which is no longer enclosed), and more than 20% have travelled downstream towards coastal areas. The collected monitoring data allows the release program to be evaluated and adapted to further enhance our understanding of this species.

A NEW ADDITION TO THE TEAM

The project team was strengthened in 2015 by the recruitment and addition of Cambodian biologist, Sitha Som. Mr Som recently completed his Master's degree in Environmental Management in New Zealand, and has been working with freshwater turtles and tortoises since 2004. He is a member of the IUCN Tortoise and Freshwater Turtle Species Group and will be responsible for implementing post-release monitoring and providing general technical support to all project activities.

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Acknowledgements: This conservation program is made possible with support from the Turtle Survival Alliance, SOS - Save Our Species, Critical Ecosystem Partnership Fund, Wildlife Reserves Singapore, US Fish & Wildlife Service, Turtle Conservation Fund, Pat Koval and an anonymous donor.



Local religious leaders bless the terrapins in a ceremony to mark the release of the “Royal Turtles” back into the wild. PHOTO CREDIT: THIDA LEIPER/WCS



Construction of the soft-release enclosure on a 1 hectare oxbow lake on the Kaong River begins. PHOTO CREDIT: WCS/SARAH BROOK

The Palawan Turtle Rescue

NELSON DEVANADERA, VERONICA DE GUZMAN AND SABINE SCHOPPE

On 17 June 2015, Katala Foundation Inc. (KFI) received a phone call from the Palawan wildlife authorities (PCSDS) with the shocking news that its Enforcement Group confiscated from an identified illegal trader in Southern Palawan 4,312 live, and 90 dead, freshwater turtles. Worse still, the majority of the turtles were Palawan Forest Turtles (*Siebenrockiella leytensis*) – a species carefully conserved in a joint effort by KFI and PCSDS over the last nine years.

Prior confiscations of *S. leytensis* had never numbered more than 80 individuals. Now, with a warehouse full of turtles at numbers almost exceeding the total estimated wild population, it was clear that an extraordinary effort would be needed to save them.

REDISCOVERY INCREASED CONSERVATION EFFORTS

The Palawan Forest Turtle had originally been described as *Heosemys leytensis*. For 69 years, two types, allegedly collected in Leyte, were the only known specimens. Then Buskirk (1989) described a neotype based on a third specimen allegedly from Leyte, found in the collection of the California Academy of Science. At about the same time, Timmerman and Auth (1988) bought a specimen in the Municipality of Taytay in northern Palawan. The search for the species in the wild began again, but it took another 12 years until Palawan was confirmed as its place of origin.

With a new description published in 2004, the countdown to tragedy began. Hunted down to supply collectors, hobbyists, and the East Asian food and Traditional Chinese Medicine markets, populations were reduced faster than they could be assessed. Recognizing the unfolding peril, KFI urgently adopted the Palawan Forest Turtle as a key species in its Philippine Freshwater Turtle Conservation Program (PFTCP) jointly implemented with the Department of Environment and Natural Resources – Biodiversity Management Bureau (DENR-BMB), focusing on both *in-situ* and *ex-situ* conservation



Images such as this struck an emotional chord and galvanized the global turtle conservation community to action.

PHOTO CREDIT: SABINE SCHOPPE



Turtles were stacked 3-feet-deep in the truck that carried the confiscated animals from the office of PCSDS to PWRCC. The night before they had arrived from the warehouse in Southern Palawan on a smaller truck on which they had been stacked 6-feet-deep. PHOTO CREDIT: KATALA FOUNDATION INC.

measures since 2006.

In 2007, KFI's *ex-situ* facilities were built in collaboration with the Zoological Society for the Conservation of Species and Populations (ZGAP), with research activities supported by the Turtle Conservation Fund (TCF). Further, TCF partnered with TSA and the Turtle Conservancy (TC) to assist KFI in enhancing husbandry facilities for an assurance colony.

Both ZGAP-DGHT and Wildlife Reserves Singapore (WRS) supported this critical assurance colony. Education campaigns were begun with the support of the US Fish and Wildlife Service (USFWS) and were later enhanced by the Ocean Park Conservation Foundation Hong Kong. Additional *ex-situ* conservation measures are supported by the Chester Zoo.

Based on both long and short term population surveys, KFI estimated the wild population of the Palawan Forest Turtle at some 6,000 individuals; all restricted to five municipalities in northern Palawan.

CONSERVATION CHALLENGES AND OPPORTUNITIES

On 18 June 2015, a truck from Rio Tuba arrived at the Palawan Wildlife Rescue and Conservation Center (PWRCC). PWRCC reacted fast and made it possible to accommodate the thousands of confiscated turtles for the first critical days. A first inspection revealed a conservation nightmare become reality. Most of the turtles were indeed Palawan Forest Turtles, and they were in terrible shape – dehydrated, smashed, injured, dying, with many already dead. Based on their dreadful condition, it was clear these animals had been collected and kept for over six months.

KFI accounted a total of 4,090 individuals excluding the fatalities that had incurred between confiscation and arrival at PWRCC. Turtles were composed of 3,831 Palawan Forest Turtles, 168 Asian Leaf Turtles (*Cyclemys dentata*), 25 Southeast Asian Box Turtles (*Cuora amboinensis*), and 69 dead individuals (63 *S. leytensis* and 6 *C. dentata*). The count confirmed that we were facing a crisis of unprecedented proportions; almost the entire estimated wild population of Palawan Forest Turtles had been confiscated.

We requested some 40 students from Western Philippines University (WPU) be excused from class to help PWRCC personnel and KFI staff with unloading. WPU is an active partner of PCSDS and KFI in wildlife conservation. The turtles were moved into the only available enclosures: two huge crocodile pens which were



With a mandate to release turtles as quickly as possible to reduce captive stress, the rate at which the medical teams were able to triage turtles and get them back into native streams was impressive. Cris Hagen (TSA) and Paul Gibbons (right, TC) are shown with the team returning turtles to the wild. PHOTO CREDIT: KATALA FOUNDATION

under repair that time and had not been used by PWRCC for months, thus with no running water and full exposure to the sun. Freshwater had to be trucked in to fill the pens so that they could be used temporarily for the turtles. We had to resort to this because there were no pens available large enough to hold the huge number of turtles.

HELP ARRIVES FROM EVERYWHERE

That same night, KFI informed the IUCN/SSC TFTSG and appealed for assistance. Nothing prepared us for the overwhelming response from turtle conservation groups from all over the world. In less than 12 hours, Asian, American, and European organizations had all committed financial support, technical assistance, and supplies.

In the meantime, KFI and PWRCC discussed moving the turtles to smaller crocodile pens with less exposure to sunlight and not so deep for better management of the turtles. We were so lucky that these pens were vacant. This new pens had to be renovated and transformed from crocodile pens to turtle ponds to better meet the needs of the turtles. KFI staff – assisted by students, PWRCC personnel, volunteers, and hired laborers – repaired the pens, installed adequate shade over the ponds and work areas, and started transferring the turtles to the new areas on 19 June.

On 21 June 2015, the IUCN/SSC TFTSG made the recommendation on next steps, stating: “We believe it is important to release back into the wild as many apparently healthy animals as possible at the first available moment. We recommend that animals that do not clearly need extensive rehabili-

tative care should be released into the wild swiftly, ideally into areas that were previously inhabited by these turtles.”

We held the same view, considering *S. leytensis* shows intraspecific aggression and fares poorly when maintained in large groups. The confiscated number was so large that the species was in danger of becoming functionally extinct in the wild unless many of them were quickly returned. Thus, KFI staff began surveying possible release sites that would meet tough criteria: that turtle release occur within the species' natural range, not within a pristine wild population, not be readily accessible, be away from people, and that the release team be unseen by locals.

Four days after the arrival of the confiscated turtles at the rescue center, the first veterinarians, Dr. Sonja Luz from WRS, Dr. Paolo Martelli from OPHK, Dr. Paul Gibbons from TC, and Dr. Charles Innis from the New England Aquarium, started triage of thousands of turtles and treated those immediately in need of veterinary aid. They were soon joined by Dr. Karthi Martelli of Kadoorie Farm and Botanic Garden, TSA's Director of Animal Management Cris Hagen, and a Wildlife Conservation Society team composed of Dr. John Sykes, Dr. Kenneth Conley, vet techs Nga Nguyen Thi Thanh and Ihsaan Sebro, and Assistant Director of Zoological Health, Lisa Eidlin.

The team primarily dealt with necrotic shell lesions secondary to trauma and septicemia, dehydration, distal limb edema, severe eye lesions, and claw loss from extended contact with concrete. The number of turtle deaths decreased rapidly as the animals responded to aggressive

antibiotic and fluid therapy and began to eat voluntarily.

FREE AND BACK HOME AT LAST!

As early as 22 June, we started releasing turtles that were judged sufficiently healthy. By the end of the month, 2,773 individuals had been released back to the wild, giving the turtles a better chance for survival, and greatly reducing crowding at the rescue center for a species highly prone to stress in groups. All released turtles received a cohort notch as recommended by TFTSG-TSA-TC-CRF.

The first three weeks of taking care and working hard to save the turtles were the most challenging in the professional lives of those directly involved in the rescue. Managing the different situations, the needs of both turtles and foreigners, giving interviews, and still smiling into cameras would have depleted all energy if not for the assistance of TSA Executive Director Andrew Walde, who handled communication with the international turtle community.

A local team of about 30 KFI volunteers helped in every possible way, notching the turtles for release; pumping dirty water out, and clean water into, ponds; moving countless bins of turtles around as needed; acting as veterinary assistants; and helping to keep everything organized.

Cris Hagen, the first member of the TSA staff to arrive in Palawan, reported after a week on site that “things are finally calming down and I think the general madness is over.” At this point, we started putting together teams of veterinarians, vet techs, and experienced turtle keepers who could provide treatment and rehabilitation until the rest of the animals were healthy enough for release. At the same time we trained KFI staff to take over once treatment was manageable.

Turtles were treated in two groups, every 48 hours, leaving every third day without treatment. Days without treatment were dedicated to morphology, blood work, necropsy, and laboratory work. Necropsy was spearheaded by WCS Head Pathologist Ken Conley.

By the end of June, the TSA team had been reinforced by Veterinary Care Manager Sheena Koeth and vet tech Allyson Lee, a volunteer supported by TSA, and PWRCC resident veterinarian Dr. Glenn Rebong. Vet tech Olivia Vandersanden volunteered, and Dr. Csaba Geczy worked with the group during the first week of July. After Dr. Geczy's departure, the technician team, KFI staff and vet student Mariah Lan-



Turtles ready for release were marked with a white spot and received a shell notch. They were then carried in crates to the vehicle for transport to the release site.

PHOTO CREDIT: KATALA FOUNDATION INC.

caster of Tufts University managed the turtles for more than a week without a veterinarian. The group was then joined by San Diego keeper Tommy Owens.

The remaining 254 turtles were moved to KFI's facilities at the Katala Institute for Ecology and Biodiversity Conservation (KIEBC) in Narra, Palawan which has facilities that are specifically designed for turtles and were it was possible to provide individual care to the remaining turtles. Prior to the move, we released another 439 turtles at four sites.

This amazing turnaround, from chaos to a manageable situation, is a tribute to the perseverance and dedication of an amazing team of veterinary staff and volunteers. In addition to KFI's resident keeper Angel Satioquia, we hired three new keepers, Kyle, Jovie and Archiel. The new keepers were trained by the experts in the first month of the crisis, and were temporarily assisted by Wrocław Zoo Keeper Karolina Mol and her husband Maciej.

FINALLY DONE WITH THE MISSION

9 July was the first day without mortality. On 13 July, all the turtles were reassessed when Drs. Alex Grioni and Sandra Schneider from Kadoorie, and Columbus Zoo Resident Dr. Matt O'Connor, arrived. Special emphasis was given to animals in critical condition and with severe eye lesions. With the need for veterinary attention

decreased, the San Diego Zoo team of Dr. Ben Nevitt and Jill Kuntz were the last to assist. They left after witnessing one of the last releases on 28 July, leaving only 57 turtles still requiring care.

Having received training from 20 different veterinarians and various technicians and keepers, we felt prepared to manage the remaining turtles. As of late September, after one more release, we are left with just six turtles. Our activities are now concentrated on monitoring the turtles at the release sites. We also collected some 130 eggs, with seven proving to be viable.

Overall mortality was 11.5%, surprisingly low compared to other large confiscations. This success rate would have in no way been possible, had it not been for the prompt and swift action by a truly global team wholeheartedly united in the goal of saving the Palawan Forest Turtle from extinction. We hope to never have such a large confiscation again, but we are confident that if it ever does happen, we will join hands again and with the full support of the wonderful, worldwide turtle community we will be able to rescue them

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Acknowledgement: On behalf of the Palawan Forest Turtle, we would like to thank the main players for without their generous financial support and/or technical assistance this crisis could have never been resolved: Action Campaign for Endangered Species, Csaba Geczy, NEZS Chester Zoo, Columbus Zoo, DENR-BMB, Dutch/Belgium Turtle & Tortoise Society, Friends of Wuppertal, Kadoorie Farm and Botanic, Karthi Martelli, KFI, Laffer, Los Angeles Zoo and Botanical Garden, Monterey Bay Aquarium, New England Aquarium Ocean Park Hong Kong, Oxbow Animal Health, Olivia Vandersanden, San Diego Zoo, PCSDS, PWRCC, Q-Mark, Turtle Conservancy, TFTSG/TCF/CRF, Turtle Survival Alliance, Stichting Turtle Survival/TSA-Europe, Sponsor of Mariah Lancaster, Wildlife Conservation Society, Western Philippines University, Wrocław Zoo, Wildlife Reserves Singapore, Zoological Society for the Conservation of Species and Populations, Zoo Halle, Zoo Landan, Zoo Leipzig, Zoo Med Supplies, Zoo Parc Beauval, and Zoo Schönbrunn Vienna.

The TSA thanks all donors for their generous support during this critical period. Special thank you to the following supporters donating at the \$1,000 and above level:

Audubon Nature Institute, Columbus Zoo & Aquarium, Disney's Conservation Fund – Rapid Response Fund, Fagus Foundation, Owen Griffiths, Houston Zoo, Moody Gardens & Aquarium, George Meyer, Ed Neil, James Neil, Sea World Emergency Fund, Ty Park, Turtle & Tortoise Preservation Group, Woodland Park Zoo, and Zoos Victoria

TSA Develops Blueprint for Future Turtle Conservation

RICK HUDSON AND HUGH QUINN



The Painted Terrapin (*Batagur borneoensis*) would benefit from TSA program expansion in Indonesia and Malaysia. PHOTO CREDIT: ANDREW BRINKER

When TSA proclaims we are “Committed to Zero Turtle Extinctions” what exactly does that mean, and what steps have been undertaken to make good on this promise? Is this just a mission statement, or does it have real teeth? We decided that if we’re going to continue to use this mantra, then we better see how it actually looks on paper. It was time to make a roadmap to the future.

CONSERVATION STRATEGY PUTS TURTLES IN A TREE

In the Opening Letter for this year’s TSA Journal (see inside front cover), I reflected a bit

on the extensive evaluation process involved in defining TSA’s turtle conservation strategy. Starting with the challenging task of agreeing on priority species, we devised a list of 62 species for conservation focus. We selected those ranked CR, or proposed for CR listing, by the IUCN Red List – along with a mix of some Endangered taxa we felt were facing imminent threat. From this list, Hugh Quinn, Animal Management Committee Chair, began designing a decision tree designed to determine what actions, if any, were needed for each species in captivity, and more specifically, those at the Turtle Survival Center.

TOP PRIORITY COUNTRIES FOR FIELD CONSERVATION WORK	NUMBER OF SPECIES
1. Indonesia	9
2. Vietnam	9
3. Myanmar	8
4. Malaysia	7
5. Bangladesh	5
6. India	5
7. Madagascar	5
8. China	3
9. “Africa” (country not yet identified)	3



The Striped Narrow-headed Softshell Turtle (*Chitra chitra*) would be a high priority species for a TSA Indonesia program. PHOTO CREDIT: DOUG HENDRIE



The Home's Hingeback (*Kinixys homeana*) was recently elevated to critically endangered status (IUCN Red List), and has been targeted for management at the TSC. PHOTO CREDIT: CRIS HAGEN

Once each species had been run through the decision tree, 32 were selected for TSC management based on a number of criteria, including these five critical factors: 1) species currently without effective range country protection and management programs in place, 2) those species that do not have a well-managed, long term *ex situ* population, 3) species able to thrive outdoors,

year-round at the TSC for at least 8 months; or have climate controlled, existing, specialized facilities available for them, 4) are available for acquisition, and 5) currently have, or have planned, facilities for them at the TSC.

From this rigorous analysis, a comprehensive 105-page Animal Management (AM) Plan emerged presenting an estimation of the number

of animals needed to maintain sustainable captive populations over several generations, and describes breeding strategies to be employed in maintaining long term, viable turtle populations at the TSC. The final section outlines the enclosures currently available to maintain the collection and evaluates operational needs to meet the demands of the future collection and effectively plan annual budgets.

GROWING IN-RANGE PARTNERSHIPS

Though the AM plan primarily defines the TSC collection, it also identifies species recommended for in-range captive management that would not be appropriate or feasible for TSC holding. For example, river terrapins (*Batagur*) and large, softshell turtles (*Chitra*, *Nilssonia*, *Pelochelys*) are best managed in the tropics where they live rather than in temperate South Carolina. When a species is eliminated from AM consideration, they move over to the Field Conservation (FC) decision tree for assessment.

From the original list of 65 species, Colin Poole, Chairman of the FC Committee, highlighted 45 for continued or future investment by the TSA with three criteria: 1) Large riverine or wetland species, 2) Forest species for which sufficient habitat still exists, and 3) Lesser known African species. The process specifically recommended strengthening existing programs in India, Myanmar, Bangladesh and Madagascar, while developing partnerships to launch new initiatives in Indonesia, China, Vietnam, Malaysia and Cambodia. Africa, with a variety of emerging, market-driven threats, demands our attention, as well. The FC Plan's success will center on our ability to build new partnerships along with the funding to support them.

THE PLAN TO AVOID EXTINCTION

Merging the species evaluation process for Animal Management and Field Conservation has resulted in a sound, pre-emptive strategy that ensures no species will slip through the cracks. For each CR ranked species, there are objective, transparent, and defensible recommendations for specific conservation actions.

For some species, such as the Nubian softshell (*Cyclanorbis elegans*), we don't have enough information and survey work is needed. For others, such as the endemic Chinese *Cuora*, collecting pressures are simply too intense for management of wild populations exclusively, and we must depend on *ex situ* captive breeding, both in and out of range. Twenty-two species will require both *in situ* and *ex situ* actions.

Table 1. Species chosen by the TSA decision tree process for *in situ* (in-range programs) and ex situ (TSC management) programs. Where “A” indicates there is an adequate TSA field (*in situ*) conservation investment in a given species (successful program); “B” indicates there is a field conservation investment in a given species, but it is not yet adequate; “C” indicates there is no TSA field conservation investment in a given species, but initiating one is feasible; “D” indicates a captive (*ex situ*) conservation investment is needed at the TSC, and facilities are available; and “E” indicates a TSC program is needed and feasible, but facilities are currently not available.

SPECIES	TSA PROGRAM		
	IN SITU	COUNTRY	EX SITU
1. <i>Astrochelys radiata</i> (Radiated tortoise)	A	Madagascar	
2. <i>Astrochelys yniphora</i> (Ploughshare tortoise, angonoka)	C	Madagascar	E
3. <i>Batagur affinis</i> (Southern river terrapin)	C	Indonesia, Malaysia	
4. <i>Batagur baska</i> (Northern river terrapin)	B	Bangladesh, India	
5. <i>Batagur borneoensis</i> (Painted terrapin)	C	Indonesia, Malaysia	
6. <i>Batagur kachuga</i> (Red-crowned roofed turtle)	B	India	
7. <i>Batagur trivittata</i> (Burmese roofed turtle)	A	Myanmar	
8. <i>Chelodina mccordi</i> (Rote Island snake-necked turtle)	C	Indonesia	D
9. <i>Chitra chitra</i> (Asian narrow-headed softshell turtle)	C	Indonesia, Malaysia	
10. <i>Chitra vandijki</i> (Burmese narrow-headed softshell turtle)	C	Myanmar	
11. <i>Cuora amboinensis</i> (Southeast Asian box turtle)	C?	Currently unknown	D
12. <i>Cuora aurocapitata</i> (Yellow-headed box turtle)			D
13. <i>Coura bourreti</i> (Bourret's box turtle)	C	Vietnam	D
14. <i>Cuora cyclornata</i> (Vietnamese three-striped box turtle)			D
15. <i>Cuora flavomarginata</i> (Yellow-margined box turtle)			D
16. <i>Cuora galbinifrons</i> (Indochinese box turtle)	C	Vietnam	D
17. <i>Cuora mccordi</i> (McCord's box turtle)			D
18. <i>Cuora mouhotii</i> (Keeled box turtle)	C	Vietnam, Myanmar, Bangladesh	D
19. <i>Coura pani</i> (Pan's box turtle)			D
20. <i>Cuora picturata</i> (Southern Vietnam box turtle)	C	Vietnam	D
21. <i>Cuora trifasciata</i> (Chinese three-striped box turtle, golden coin turtle)			D
22. <i>Cuora zhoui</i> (Zhou's box turtle)			D
23. <i>Cyclanorbis elegans</i> (Nubian flapshell turtle)	C	Sudan	
24. <i>Dermatemys mawii</i> (Central American river turtle)	B	Belize	
25. <i>Erymnochelys madagascariensis</i> (Madagascar big-headed turtle, rere)	C	Madagascar	E
26. <i>Geochelone platynota</i> (Burmese star tortoise)	A	Myanmar	D
27. <i>Gopherus falvomarginatus</i> (Bolson tortoise)	C?	Mexico	
28. <i>Heosemys annandalii</i> (Yellow-headed temple turtle)	C	Cambodia, Thailand	
29. <i>Heosemys depressa</i> (Arakan Forest turtle)	A?	Myanmar, Bangladesh	D
30. <i>Heosemys spinosa</i> (Spiny turtle)			D
31. <i>Indolestudo forstenii</i> (Forsten's tortoise, east Indian tortoise)	C	Indonesia	D
32. <i>Kinixys erosa</i> (Forest hinge-back tortoise, serrated hinge-back tortoise)	C	Currently unknown	E
33. <i>Kinixys homeana</i> (Home's hinge-back tortoise)	C	Currently unknown	E
34. <i>Leucocephalin yuwonoi</i> (Sulawesi forest turtle)	C	Indonesia	D
35. <i>Malacochersus tornieri</i> (Pancake tortoise)	?	Currently unknown	
36. <i>Manouria emys</i> (Asian giant tortoise)	B	Myanmar, Bangladesh, India, Malaysia, Indonesia	D
37. <i>Manouria impressa</i> (Impressed tortoise)	C	Vietnam, Myanmar, Malaysia	D
38. <i>Mauremys annamensis</i> (Vietnamese pond turtle, Annam pond turtle)	C	Vietnam	E
39. <i>Mauremys mutica</i> (Yellow pond turtle)			E
40. <i>Mauremys nigricans</i> (Chinese red-necked turtle, Red-necked pond turtle)			E
41. <i>Mesoclemmys hogei</i> (Hoge's side-necked turtle)	C	Brazil	
42. <i>Nilssonina formosa</i> (Burmese peacock softshell turtle)	B	Myanmar	
43. <i>Nilssonina leithii</i> (Leith's softshell turtle)	C	India	
44. <i>Nilssonina nigricans</i> (Black softshell turtle, Bostami softshell turtle)	B	Bangladesh, India	
45. <i>Orlitia borneensis</i> (Malaysian giant turtle)	C	Malaysia, Indonesia	
46. <i>Pelochelys cantorii</i> (Asian giant softshell turtle)	C	Cambodia, Indonesia, Malaysia, India	
47. <i>Platysternon megacephalum</i> (Big-headed turtle)	C	Vietnam, Myanmar	D
48. <i>Podocnemis lewyana</i> (Magdalena River turtle)	B	Colombia	
49. <i>Psammobates geometricus</i> (Geometric tortoise)	C	South Africa	
50. <i>Pyxis arachnoides</i> (Spider tortoise)	C	Madagascar	E
51. <i>Pyxis planicauda</i> (Flat-tailed tortoise, flat-shelled spider tortoise)	C	Madagascar	E
52. <i>Rafetus swinhoei</i> (Red River giant softshell turtle, Yangtze giant softshell turtle, Swinhoe's softshell turtle)	B	Vietnam, China	
53. <i>Sacalia bealei</i> (Beale's eyed turtle)	C	China	D
54. <i>Sacalia quadriocellata</i> (Four-eyed turtle)	C	Vietnam, China	D
55. <i>Stenotherous depressus</i> (Flattened musk turtle)	C?	USA	

TURTLE CONSERVATION FUND

Highlighting Support for the Madagascar Big-headed Turtle Integrated Conservation Program

HUGH QUINN AND ANDERS RHODIN, TURTLE CONSERVATION FUND CO-CHAIRS

Once ranging across most of Madagascar's west-flowing rivers and lakes, the Critically Endangered Madagascar Big-headed Turtle (*Erymnochelys madagascariensis*), or "Rere," is now restricted to eight watersheds, with only 7.6% of the species' historical range currently supporting stable populations. Populations have declined precipitously due to loss of wetlands and consumption of the turtle's meat and eggs by local communities. Rising to the challenge of preventing this species from slipping over the brink, Jersey Wildlife Preservation Trust (now Durrell Wildlife Conservation Trust), in collaboration with Conservation International and Madagascar National Parks, began a conservation initiative in 1998. The ultimate goal of this recovery effort was to ensure that at least one healthy population survived within each of the eight watersheds. Conservation activities have focused on four key sites, with four priority activities at each site: 1) research on the species' distribution, biology, ecology, genetics, and major threats; 2) intensive population management, including captive breeding, population restoration through release and post-release survival monitoring of headstarted juveniles and translocated hatchlings, and protection of wild nests; 3) education and capacity building of local communities to improve awareness of the species' importance and to facilitate the legal transfer of resource management to these communities so that they can protect and manage *Rere* wetlands; and 4) promotion of official national protection of important wetlands.

Highly positive results of these activities have been achieved at all four sites. For example, three official New Protected Areas (NPAs) that support important populations have been established, including an NPA at Lake Ambondrobe, which is the most important site for *Rere* in Madagascar. The captive-breeding program has produced 114 hatchlings to date that have been released at



Field team leader Juliette Velosoa (center) with Tsibangoe (left) and Namotoa Charles (right), proudly display *Rere* hatchlings from protected nests at Lake Ambondrobe. PHOTO CREDIT: PETER CRANSWICK.

various ages in Lake Ravelobe in Ankarafantsika National Park, with similar releases also occurring for headstarted young collected from wild nests. Hatchlings from wild nests are also being translocated to areas where populations need reinforcement, and all groups are being regularly monitored to determine the best possible release strategy. Survival of all age groups has been high, and the populations at Lakes Ankomakoma and Ambondrobe have increased significantly. Additionally, local people at two lakes have protected nests that have produced more than five thousand hatchlings. Community Associations have been created at four sites to protect turtles and habitat, with the long-term goal of having communities sustainably manage viable

turtle populations within each of the eight main watersheds.

This program provides an excellent global model for a successful *in situ* program that integrates captive breeding, wild population management and restoration, and most importantly, community-led conservation and resource management. The Turtle Conservation Fund (TCF) has been a proud and integral partner in this endeavor by providing regular support in the form of eight grants since 2008, totaling nearly \$40,000. This project is just an example of the many conservation successes that the TCF has been integral in supporting since 2003. For more information about the TCF and grant application procedures, visit: www.TurtleConservationFund.org.

Captive Breeding Critical to Saving the Highly Endangered Vietnamese Pond Turtle (*Mauremys annamensis*)

HENK ZWARTEPOORTE, HERBERT BECKER, ELMAR MEIER, MARTINA RAFFEL & TIM MCCORMACK

The Vietnamese Pond Turtle is not a particularly attractive or colorful species, so they were not very popular with private owners and zoos. Believed extinct as recently as 2006, their fortunate survival now depends on captive breeding efforts to increase their numbers in the wild.

Serious scientific inquiry was initiated after it was discovered that individual specimens of *M. annamensis* were occasionally offered for sale in Asian animal markets. Field research and local interviews revealed that the species was not extinct, and eventually discovered the origin of the market turtles. A wild, residential population was discovered in Central Vietnam within a distant and isolated area of the Quang Nam Province.

Shortly afterwards, Vietnamese authorities began conservation efforts to protect the species with enthusiastic support from leading European zoos. A plan was developed whereby Vietnamese Pond Turtles hatched in Europe would be made available for a reintroduction project in Vietnam. The project's plan requires finding out how many animals are left in the wild, where they live, and how these areas can be protected. The plan also includes the important goal of gaining local community support for reintroduction of *M. annamensis*.

BREEDING IN CAPTIVITY

Captive breeding to save the endangered turtle began when the Rotterdam Zoo first reported successful breeding of *M. annamensis* in 2002. Both Herbert Becker and the Internationales Zentrum für Schildkrötenschutz (IZS) in Muenster Zoo announced successful breeding results in 2006. Since then, and within the past nine years, Herbert Becker oversaw the birth of 171 animals from one male and two females. In Rotterdam Zoo, 43 animals were born between 2003 and 2014 from three breeding pairs; while at the IZS, 67 animals were born between 2006 and 2014.

In 2003, the year of the 'Shellshock Campaign', a discussion within the European



A juvenile *M. annamensis* in the wild – still a rarity.

Association for Zoos and Aquariums (EAZA) discussed how the breeding of the Vietnamese Pond Turtle in zoos might support an *in situ* conservation project. Experience with this species showed that they were not hard to breed, and so good results could be expected. Reported breeding results supported this conclusion as the species had already been bred into the second generation.

With all evidence showing that the establishment of an assurance colony was possible, an EAZA breeding program was developed to ensure a genetically sound and healthy population to breed from, and from which to reintroduce offspring into the wild. Within the framework of this breeding program, DNA research – coordinated by the Prague Zoo – was done on samples of *M. annamensis* bred by Herbert Becker, and on animals from zoos in Muenster and Rotterdam. Results showed that the breeding groups were genetically pure *Mauremys annamensis*.

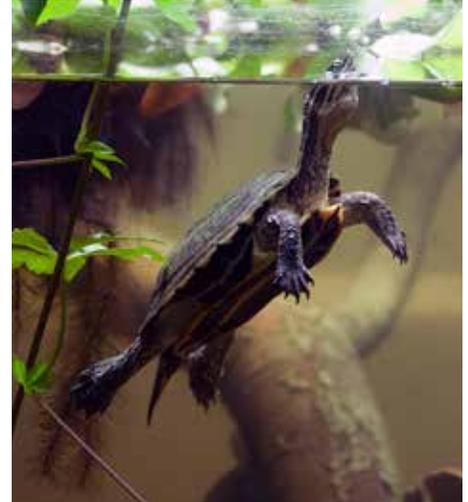
The implementation of the EAZA studbook took longer than expected, so there was overcrowding in the groups from Becker, Muenster and Rotterdam in 2011 and 2012.

THE HOMECOMING OF THE FRESHWATER TURTLE

Initial preparation for the transfer of the turtles to Vietnam was challenging, despite our good relationship with Vietnamese officials which helped pave the way. Application and handover of CITES and veterinary medical documents took longer than expected, but finally, in August 2013, we were ready to transfer the offspring to the Turtle Breeding Center at Cuc Phuong National Park in North Vietnam (TCC). Seventy-one *M. annamensis* offspring, originating from the breeding program that included Becker, the Rotterdam Zoo, and Muenster, were flown to Vietnam as part of the *Mauremys annamensis* Project (MAP) of the Asian Turtle Program (ATP).



Cuc Phong National Parks Director Truong Quang Bich and TCC Manager Bui Dang Phuong meet the turtles at the National Park and explain the important status of these turtles to the press. PHOTO CREDIT: TIM MCCORMACK/ATP



Captive bred *M. annamensis* at the Turtle Conservation Center (TCC) in the Cuc Phong National Park, Vietnam. PHOTO CREDIT: TIM MCGORMACK/ATP

The Vietnamese press came out in force to greet the turtles and their breeders, though the news was mostly ignored in Europe and the United States. In Hanoi, more than 40 journalists, representing seven television stations and 30 newspapers, reported what the Vietnamese press called ‘The Homecoming of the Freshwater Turtle’.

“Today is an important step towards the preservation of this rare species in Vietnam,” declared Mr. Bui Dang Phong, leader of the TCC in 2013. “Poaching, agriculture and loss of habitat are a great danger to the Vietnamese Pond Turtle in the wild. It is the duty of Vietnam to actively protect these animals from illegal hunting and trade, so that we will not lose another valuable endemic species.”

“We’re proud that we have contributed to the preservation of these rare turtles and were able to bring them back to Vietnam,” stated Henk Zwartepoorte, curator of reptiles at the Rotterdam Zoo. “We’re positive that Vietnamese initiatives like these and ongoing international efforts will help these species to survive in the wild. The goal of these efforts is to reintroduce the turtles in their habitat in Quang Ngai Province in Central Vietnam.”

Timothy McCormack, Program Coordinator of ATP and MAP, noted, “This event has contributed to placing the Vietnamese Pond Turtles all over the world in the focus of nature conservation. Although these turtles survive in captivity, we must take urgent measures to protect this species in the wild, so they will have the chance to survive in Vietnam.”

DNA ANALYSIS, RECENT DEVELOPMENTS

Recent DNA research in Vietnam on *M. annamensis* from the wild has shown that there are two DNA lineages within their habitat in Central Vietnam. Only genetically and medically healthy animals are suitable for reintroduction, so it’s important to establish which of the available animals are suitable for reestablishment and in which habitat they can be released.

Since 2000, a large group of confiscated *M. annamensis* and their offspring have resided in the turtle rescue center in Cuc Phong. The origin of these animals is unknown. As mentioned above, from 2007 on, some animals caught in the wild have occasionally been found in markets. Whether these animals are suitable for captive breeding or not remains to be determined by further DNA sampling.

Rotterdam Zoo contributed funds in 2015 for further DNA research, while the Muenster, Rotterdam, and London Zoos, along with Herbert Becker, made donations to build theft proof enclosures in the Cuc Phong National Park.

The coordination of the conservation project is now the responsibility of Vietnam, as suitable lands for reintroduction need to be assessed and purchased from local people. These areas must also be secured and guarded – offering job opportunities in the community. Though this process develops slowly, support of the local people is vital. They need to be convinced that they are important partners in species protection and conservation, if our efforts are to have hope of success.

THE FUTURE OF EUROPEAN EFFORTS

In July 2014, during a meeting at the London Zoo, involved parties discussed the necessity and feasibility of a continued *M. annamensis* captive breeding program in Europe. Representatives from the London, Chester, and Rotterdam Zoos brainstormed a variety of issues, and made plans related to DNA and veterinary medical research on Vietnamese Pond Turtles in Europe, with protocols and timetables to be developed. The possibility of an EAZA studbook and further cooperation between EAZA Zoos and private keepers within the European Studbook Foundation (ESF) was also addressed.

The experience gained from developing a first Vietnam initiative to protect *M. annamensis* habitat and reintroduce this threatened species was very important. This was the first time ever that such a large group of turtles from a European breeding program was transferred to their country of origin.

Repatriating these animals demonstrated that *ex situ* breeding by zoos or private keepers can play a decisive part in the preservation of species.

The cooperation between zoos, private keepers and local conservationists worked exceedingly well in this first major effort, and played an important part in the continuing preservation of *Mauremys annamensis*. Clearly, international cooperation and the establishment of a strong link between *in situ* and *ex situ* partners, is a key to success.

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Hybridization can be a serious threat for small populations. This photo shows *Mauremys annamensis*, *Mauremys sinensis* and *Cyclanorbis pulchrirostrata* in the local trade in central Vietnam PHOTO CREDIT: TIM MCCORMACK/ATP



Juvenile of *Mauremys annamensis* at the turtle breeding center (IZS) in Münster. PHOTO CREDIT: HEIKO WERNING

groups: One group consists of pure animals, the second is formed by hybrids of *M. annamensis* and some closely related species. These particular hybrids look physically like *M. mutica*, according to external morphology and coloration, so it is not possible to confuse them with pure *M. annamensis*.

According to mitochondrial genes (genes inherited only in the female lineage) there are two closely related groups of pure *M. annamensis*. These results suggest that in the ancient history of this species, there were either two isolated populations, or perhaps nearly related species, which formed *M. annamensis* as we know it today. Genetic distance between these two groups is small and there is no reason for distinguishing them as separate taxonomical units at the moment. It is advisable to keep them separated in the case of repatriation as there may be possible reclassification in the future.

Recent genetic research conducted on the captive European population shows that all specimens classified as *M. annamensis* – according to the size, shell shape, and coloration – are most probably not hybrids. Repatriation to the original distribution areas of this species is possible and without risk of contaminating native populations with hybrids.

Our research of shell shape variability using the method of geometric morphometrics within *M. annamensis* shows that there are differences between two mitochondrial groups in the shell shape of carapace and plastron. Our work further supports distinction of these two groups and importance of their separation in breeding facilities. It is possible to determine turtle species using this fast, cheap, and non-invasive method of shell shape identification and differentiation rather than through the use of genetic testing.

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Genetic and Shell Shape Variability in *Mauremys annamensis*

TOMÁŠ PROTIVA

Many turtle species, especially within the genus *Geoemydidae*, are endangered or almost extinct due to habitat destruction and a phenomenon known as the “Asian Turtle Crisis” – the often illegal trafficking in turtles to satisfy the high demand by Chinese markets for turtle meat for consumption and the use of turtle parts in traditional Chinese medicine.

The situation is further complicated by frequent hybridization within this family. Hybrids among species, and even among genera, are known both from captivity and in nature. Several hybrids had been wrongly described as new species.

The Vietnamese Pond Turtle (*Mauremys annamensis*), a species almost extinct in the

wild and with a small population in captivity, is extremely threatened by possible hybridization. Hybridization among *Mauremys annamensis*, *M. mutica*, *M. sinensis*, *M. nigricans*, *Cuora amboinensis* and *C. trifasciata* has been reported both from captivity and in the wild.

The species which is genetically closest, ecologically similar, and thus most probable as a partner for hybridization is *M. mutica*, which also inhabits the distribution area of *M. annamensis*. It's crucial to focus protection and repatriation efforts only on pure specimens of *M. annamensis* and not on hybrids.

Genetic studies carried out in the United States with samples of captive specimens found that specimens of *M. annamensis* form two

Successful Breeding Efforts at International Center for the Conservation of Turtles (IZS) at Muenster Zoo Result in Rare Hatchings



An adult *Cuora cyclornata* at the Muenster Zoo. PHOTO CREDIT: HENK ZWARTEPOORTE

DR. MARTINA RAFFEL AND ELMAR MEIER

Focused breeding efforts at the International Center for the Conservation of Turtles (IZS) resulted in a record fourteen hatchlings of the Yellow-headed Box Turtle (*Cuora aurocapitata*). Additionally, the first-ever two hatchlings of the Central Vietnamese Three-striped Box Turtle (*Cuora cyclornata cyclornata*) outside of their native Southeast Asia were also produced.

In regard to the total number of hatchlings, 2014 has been rather an average year for the IZS at the Muenster Zoo – with 38 offspring in 11 species hatched (see table below). Furthermore, for the first time, female offspring in *Cuora aurocapitata* and McCord's Box Turtle (*Cuora mccordi*) produced hatchlings; making these the first ever reported halfway F2-generation in these species.

The female Zhou's Box Turtle (*Cuora zhoui*)

offspring, as reported in 2013, produced another clutch in 2014, and was even joined by a second female hatched in captivity.

The strategy to establish and build assurance colonies by transferring various turtles to places such as the Rotterdam Zoo, Nordens Ark, and with several private turtle keepers, has seen remarkable success and progress as the breeding loan turtles quickly started to reproduce. Additional institutions and private persons have been included in the ESF studbooks and will hopefully add up to more overall success in the future.

Contacts: Dr. Martina Raffel, curator for *in situ* Conservation, Allwetterzoo Muenster; and Elmar Meier, Volunteer Project Manager IZS; Email: raffel@allwetterzoo.de Allwetterzoo Muenster, Sentruper Strasse 315, 48161 Muenster, Germany

TABLE 1:
OFFSPRING HATCHED AT IZS IN 2014

No. of surviving hatchlings	English name	Scientific name
14	Yellow-headed Box Turtle	<i>Cuora aurocapitata</i>
7	Golden Coin Box Turtle	<i>Cuora cf. cyclornata</i>
2	Central Vietnamese three-striped Box Turtle	<i>Cuora cyclornata cyclornata</i>
2	Meier's Golden Coin Box Turtle	<i>Cuora cyclornata meieri</i>
4	McCord's Box Turtle	<i>Cuora mccordi</i>
6	Zhou's Box Turtle	<i>Cuora zhoui</i>
2	Sulawesi Forest Turtle	<i>Leucocephalon yuwonoi</i>
1	Vietnamese Pond Turtle	<i>Mauremys annamensis</i>

NORTH AMERICAN FRESHWATER TURTLE RESEARCH GROUP



Longtime volunteer Ben Williams with his haul of turtles at the first ever NAFTRG sample of Weeki Wachee Springs State Park (Florida) in March 2015. PHOTO CREDIT: NICOLE SALVATICO

The Multi-faceted Effects of Research with the NAFTRG

ERIC AND JESSICA MUNSCHER

Participation in a research project can have profound effects on the lives of those who volunteer their time, money, and resources. Since partnering with the Turtle Survival Alliance (TSA), the North American Freshwater Turtle Research Group (NAFTRG) volunteer opportunities have become more accessible to the public, scientists, and other professionals that are passionate about turtle conservation. These opportunities have a lasting impact on their lives.

We have had the privilege of sitting down with two individuals that have shown their devotion to turtle conservation by volunteering with NAFTRG on many occasions. In speaking

with these individuals, one can get a better sense of the positive impact that our research has, not only for the turtles, but also in the lives of those who dedicate their time and efforts to the group. Christopher Havel is currently employed as a Senior Aquarist at Sea World San Antonio in Texas. Dr. Beth Walton is currently an Instructor of Geospatial Technologies, Spatial Analysis and Modeling at the University of South Florida.

Question: How do you, personally, assist in research with the NAFTRG?

Havel: The main thing I do is help with the collection of the turtles, donning a mask and snorkel

and gathering up every turtle I can find. It makes for some friendly competition to see who will come up with the most. Along with collecting turtles, I also assist in processing and releasing the turtles, which includes everything from separating them by species, inserting PIT tags, marking shells for identification, or taking weights and measurements of each individual. Sea World, where I work, has donated supplies in the form of PIT tags and is always willing to loan out a kayak to the group.

Question: What have you learned from participating in field studies that you have passed on to others?



Girl Scout Troop 1187 provided some great volunteer help during the June sampling in Comal Springs (Texas).
PHOTO CREDIT: CRYSTAL ALLGOOD



Dr. Beth Walton holding two large female Suwannee River Cooters (*Pseudemys concinna suwanniensis*) captured and processed at Manatee Springs State Park in March 2015. PHOTO CREDIT: NICOLE SALVATICO

Walton: I've found that working in the field with a group of like-minded people who share the same passion and enthusiasm for turtles provides a sense of community that is quite unlike any other I have experienced. I wasn't sure what I could contribute to the overall survey effort or if I would get that community feel with the NAFTRG. Yet, I was warmly greeted by the entire group, and they truly made me feel welcome. Within an hour, I was PIT tagging and tattooing turtles with someone more experienced in these

processes right by my side to guide me along. This is a group in which you can fit right in, and made to feel like you belong; you make meaningful contributions in collecting and processing the turtles and thus your contribution of time, past experiences and new techniques acquired are valued and encouraged.

Question: What makes you a 'return volunteer'?

Walton: I am attracted to successful people

and groups – especially if I feel I can make a meaningful contribution to that success by lending a hand or providing professional expertise. I found that I could actively assist with the surveys and help with writing manuscripts. This is “food for my soul,” a form of sustenance that goes well beyond the repeated daily meals. This type of nourishment allows me to connect with a group of people dedicated to a common cause, a cause that holds no promise of lining our financial pockets and there's no prospect of praise or gratitude from the subjects we serve. And yet the sense of purpose, camaraderie, and peace sustain me until I can once again participate in the next field excursion or meeting with these people of kindred spirits.

Question: What type of opportunities has NAFTRG opened up to you, outside of the coordinated group research?

Havel: Connections! While volunteering, I have been introduced to many people who share my interest in conservation. This has led to other potential projects Sea World can get involved in to benefit other species.

Question: What do you think of NAFTRG partnering with TSA?

Walton: I think it's a great opportunity for TSA to champion the long-term research efforts of NAFTRG and to promote turtle conservation on a local basis in addition to their global efforts. Even though many freshwater turtles are ubiquitous, long-term studies are few, yet critically important to our overall understanding of freshwater turtle species. This also provides unique opportunities for TSA members to participate in fieldwork and conservation efforts, especially for members who cannot volunteer in other countries.

Volunteer experiences enrich the lives of those who choose to give their time and talent. Research efforts, like these conducted by the NAFTRG, through the TSA, would not succeed without the generosity of those who care deeply about turtle conservation. Christopher and Beth show us that the only prerequisite for volunteering is having a passion for turtles. We invite you to participate in upcoming field experiences to contribute to the success of our group and continue in our efforts to help keep common turtles *common*.

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We Are the TSA

CHRISTINE BOWIE

The foundation of the Turtle Survival Alliance (TSA) is our partnerships, including those with our individual members. With that in mind, 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.



the years. In this way, we can test the long-term safety of our methods.

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

I enjoy the annual symposium the most. I can sit down next to a complete stranger and we can be “talking turtle” within seconds.

How would you describe your personal conservation philosophy?

No farmed animal ever went extinct. I strongly support using turtle farms to satisfy the worldwide pet market. In the wild, the chance of an egg surviving to produce a hatchling is less than 5%. On a farm it's 85% - a big advantage. Of course, turtle farming must be accompanied by strong laws protecting wild populations.

Tell us anything about yourself that makes you, “you.”

I was gifted with a wonderful education. My skills in physiology, medicine and biochemistry have all come together to make our research possible. I have also been gifted with a wife that not only puts up with me but is eager to participate in the work in the stifling heat of a Louisiana summer. What more could a man ask for?

KATHY VAUSE

Hometown: Hopkins, South Carolina

Occupation: Reptile Keeper at Riverbanks Zoo in Columbia, South Carolina

What first sparked your interest in turtles and tortoises?

I started working with turtles and tortoises in 1990, when I began working in the reptile department at Riverbanks Zoo.

Tell us about your job.

Most of my interactions with turtles and tortoises are at the zoo, where I happily feed, clean, observe, and as my co-workers say, “mollycoddle” the zoo's collection of chelonians in the hopes of making things right for them to thrive and reproduce in their captive setting.

How did you first learn about the TSA?

MARK FELDMAN

Hometown: Kerikeri, New Zealand

Occupation: Emergency room physician

What first sparked your interest in doing research with turtles?

Around 1975, I walked into John Legler's lab at the University of Utah. While I was there, I met a young graduate student named Jim Berry. When I complained to Jim how difficult it was to catch hatchling turtles for pets he suggested I

“make them.” He described and demonstrated a method of using oxytocin to induce adult females to lay their eggs. This led to a lifelong interest in developing better methods than using oxytocin to induce egg laying in turtles.

Do you keep turtles at your home?

We have a collection of 15 Red-eared Sliders that we keep at our home in New Zealand. We've had most of them for 20-30 years. They are both pets and research animals since the females have had every clutch of eggs induced artificially over



ahead and bring it!” As it turned out, I won the TSA student poster contest! Chuck always said it was because of the enormous poster size.

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

That first TSA meeting turned out to be one of the best and most influential conferences I’ve ever attended. I can’t tell you how wonderful it was to become part of the TSA “family” of fellow chelonian researchers that shared my passion for turtle conservation. Over the years I’ve had the pleasure of meeting some remarkable people and I’ve seen phenomenal research, amazing strides made in conservation planning, and I’ve had opportunities to collaborate with fellow researchers. I leave the conference each year filled with new ideas, my spirit fed, and my soul invigorated with new possibilities.

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

As a professor of geoscience technologies, I take advantage of every opportunity to create teaching moments to demonstrate the plight of turtle species on a global, regional, and local basis. I’ve been able to introduce my students to spatial analysis using turtles as subjects for tracking, home range analyses, ecological niche modeling, field studies, density analyses, and habitat preferences. These students have presented at a number of academic and professional conferences and will be lifelong ambassadors for turtle conservation.

What are some of your hobbies?

When I’m not teaching, I enjoy reading, kayaking, and fishing and anyone who knows me, knows I love geocaching (a high-tech scavenger hunt using GPS units). I live in Tampa with my husband, Al, and our two Pomeranians, Mistee and Sandee.



I heard about TSA from Scott Pfaff, the reptile curator at Riverbanks Zoo and Theresa Stratmann, a reptile department volunteer. We were very excited when we learned of the Turtle Survival Center being built so close to Columbia! I started making trips to the Center to volunteer whenever I could and I want to continue helping. It has been gratifying to watch it grow! I attended my first TSA conference just a couple of years ago, but I plan on making it a habit.

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

My most memorable encounter with wild turtles was helping Theresa with her bog turtle surveys in the mountains of Georgia. I tagged along on a few occasions to help check traps and got to experience the fun of finding turtles and being immersed in their habitat (sometimes immersed to the point of being stuck!). I also helped with the collection and transport of traps at the end of the survey and gained huge respect for the rigors of field work.

BETH WALTON

Hometown: Tampa, Florida

Occupation: University of South Florida, School of Geosciences as an Instructor of Geospatial Technologies, Spatial Analysis and Ecological Niche Modeling

How did you first learn about the TSA?

My affiliation with the TSA began in 2006 when I contacted Chuck Schaffer about presenting at the Annual Conference. While all of the speaker slots were already filled, he said I could present a poster of my master’s research. I happened to attend another conference early that summer and bumped into Chuck. We were both presenting posters, but as this was the first time I had ever presented, I took it literally when the guidelines said I would have an 8 x 4 foot poster board to hang my poster on and had a poster made that was large enough to cover it from end to end. I told Chuck I would get a smaller poster printed for the TSA meeting, and he said, “No, go

Raising a Glass for Turtles

HEATHER LOWE

The Turtle Survival Alliance teamed up with Holy City Brewing Company (Charleston, South Carolina) this September to “Drink Beer. Save Turtles.” The benefit, held during Charleston Beer Week, was a tremendous success, bringing awareness to the plight of turtles worldwide. The team from the Turtle Survival Center escorted tortoise “ambassadors” throughout the brewery, providing the opportunity to mingle and “talk turtle” with the many guests of all ages.

In honor of the occasion, Holy City launched its limited edition beer, Gimme Shell-ter, an American Blonde Ale brewed with an all-time turtle favorite, blackberries. Proceeds from the sale of the special release beer directly benefitted the TSA’s global turtle conservation programs.

The event in Charleston was inspired by the TSA’s collaboration with Martin House Brewery (Fort Worth, Texas) in 2014, in which they debuted their limited edition blackberry Altier, Turtle Power. The beer was such a hit last year



that Martin House brought it back in 2015 as their October seasonal brew. The brewery once again sponsored a series of Turtle Power tasting events in the Dallas/Fort Worth Metroplex throughout the month of October, raising both awareness and funds for the TSA.



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, PO Box 12074, Fort Worth, Texas 76110

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Membership Levels (figures represent annual dues):

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

Thanks for your support!



TSA members enjoy a **10% discount** every day on most items in the TSA’s online store. Log into your membership account at turtlesurvival.org and select “Member Benefits” from the dropdown menu to learn about additional offers and rewards throughout the year.

Tryon Bog Turtle Grants Awarded

MICHAEL OGLE AND HEATHER LOWE

Bern Tryon, who is best known for his pioneering work with the Southern Bog Turtle (*Glyptemys muhlenbergii*), passed away on May 6, 2011. However, 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. Bern will forever be remembered for his dedication and passion for herpetology and uncompromising commitment to turtle conservation.

We are pleased to announce two projects have been funded by the Bern W. Tryon Bog Turtle Conservation Fund this year. These projects will help to further our knowledge of this critically endangered species in the southern portion of its range, which was of vital importance to Bern and his vision for the long-term conservation of the bog turtle.

The first funded proposal was from Davidson College (Emma Rose Parker, Annalee Tutterow, Shannon Pittman, and Michael Dorcas) titled "Risk-analysis and Mitigation for a Critically-endangered Population of Bog Turtles in North Carolina." Although habitat degradation, loss, and fragmentation are considered the primary causes of Bog Turtle population declines, less attention has been paid to other potential sources of Bog Turtle mortality, such as trampling by cows and predation. The lack of knowledge concerning the severity and nature of these alternative mortality risks limits the development of effective management strategies. The researchers will monitor potential predator and cow activity using numerous game cameras set up within and around the study site located in the western Piedmont of North Carolina. Their approach takes into consideration the sensitivity of small, critically endangered populations to mortality events and involves strategies to minimize mortality risk.

The second funded proposal was submitted by Carola Haas (Virginia Tech) for her project entitled, "Recovering Information on Southwest Virginia's Bog Turtles: A Need for Data Management Especially to Document Movement History". This grant will cover the cost of an experienced technician to enter all the data collected since 2009 into the Virginia Department



Bern Tryon preparing to go afield.

of Game and Inland Fisheries Bog Turtle database. Once the database has been updated and amended, it will be possible to report the capture history for each individual turtle known in the area. This information is essential for being able to calculate survival estimates through mark-recapture analyses and to determine patterns of movement between wetlands. Dispersal of over 2.5 km has already been reported for bog turtles in SW Virginia, and a restored database should allow more focused analyses to better understand the frequency and distance of movement among wetlands.

Thus far, Bern's library has generated an en-

dowment of more than \$150,000 for Bog Turtle conservation. However, there are still a number of wonderful books available for sale, 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>.

If you are interested in submitting a proposal for funding in 2016, information on applying will be distributed via the TSA, IUCN Tortoise and Freshwater Turtle Specialist Group, Project Bog Turtle, and the Herp Digest. The TSA would like to thank the Knoxville Zoo for their efforts in managing the grant process.



Kalyar Platt holds an exceptionally large Burmese Star Tortoise at the Lawkananda Wildlife Sanctuary in Bagan. PHOTO CREDIT: ME ME SOE

Kalyar Platt – Saving Imperiled Turtles in Myanmar

STEVEN G. PLATT, PH.D.

I well remember the first time I met Kalyar. It was January 1999, and I was with John Thorbjarnarson on my maiden trip to Myanmar, surveying crocodiles in the Ayeyarwady Delta. It was a beautiful day – dry, sunny, and surprisingly cool for Myanmar – when Kalyar, along with professor U Win Maung from Yangon University, arrived by boat at our island camp to spend a few days gaining research experience. Unbeknownst to either of us at the time, this chance

meeting would irrevocably alter the course of our lives. Over the next three years we worked together in Wildlife Conservation Society’s (WCS) Myanmar Program. With John Behler, we searched for Burmese Star Tortoises at Shwe Settaw Wildlife Sanctuary, advised on a nascent captive-breeding program, and then watched helplessly as poachers stripped the sanctuary of its tortoises. That this disheartening experience brought us closer together was but small consolation

for the frustration we felt at being unable to alter the course of events. In early 2000, we trekked through the western mountains to study Arakan Forest Turtles. Later that same year, we learned of large turtles that laid eggs the “size of duck eggs”, information that ultimately led to the “rediscovery” of Burmese Roofed Turtles in the Dokthawady River and set in motion a train of events culminating in today’s successful conservation program for this critically endangered

species. Somewhere along the way we decided to get married, and in 2004 I was betrothed to this amazing woman who Rick Hudson has called a “Force of Nature”.

Kalyar was born in 1972 to Daw San San and U Nyunt Thein in what was then Rangoon, Burma. As a young girl, Kalyar often accompanied her father, a government engineer engaged in building hydropower dams to his work sites, and her earliest memories of turtles are of those collected by construction workers being thrown into large pits, destined to be eaten. Fascinated by the variety of species to be seen, she later recoiled in horror as her new friends were hauled from the pit and butchered alive by the camp cook. Kalyar muses that perhaps it was this early exposure to needless cruelty, which she was unable to reconcile with Buddhist teachings regarding the sanctity of life, that steered her into a life of conservation.

Kalyar grew up in Yangon and attended Yangon University where she earned a BSc. with Honors in 1995, and her MSc. in 2000. Knowing the universities in Myanmar were apt to be closed at any moment by the ruling military junta, and hoping to pursue intellectual opportunities abroad, Kalyar moved to Bangkok in 2001 and began working for WCS-Thailand. Shortly thereafter she was admitted into the graduate program at Chulalongkorn University where in 2007, she earned a Ph.D. studying the ecology of *Batagur affinis* under the noted Thai biologist, Dr. Kumthorn Thirakhupt. Degree in hand, she moved to the United States where in the meantime I had taken an academic position at Sul Ross State University in the tiny hamlet of Alpine, Texas. Employment opportunities in Alpine being almost non-existent, Kalyar moved to New York to live with her sisters, taking a lucrative job at an orchid farm that catered to the rich and famous, and we spent the next four years shuttling back-and-forth on academic holidays. But something was missing. Although our jobs were satisfying and financially rewarding, our passions lay elsewhere - we dreamed of one day returning to Myanmar and devoting our energies to turtle conservation. In 2010, Rick Hudson and Colin Poole made that dream a reality. The TSA hired Kalyar as Director of the TSA Myanmar Program and a few months later I came aboard as the WCS Herpetologist for Southeast Asia.

Kalyar’s accomplishments over the past four years bespeak of her abilities. She is one of those rare individuals who can not only hob knob with wealthy donors and government officials, but also do effective boots-on-the-ground turtle



The Burmese Star Tortoise is one of two endemic chelonian species that are making strong recoveries under Kalyar’s leadership. PHOTO CREDIT: ME ME SOE

conservation. Her first achievement was reenergizing the moribund Burmese Star Tortoise conservation program. To this end, Kalyar organized a national conservation workshop, and together with the participants developed an action plan outlining how and where to restore this iconic species. Not content to merely develop the plan, she next set out to execute it. The upshot is that almost 250 headstarted Star Tortoises now roam freely at Minzontaung Wildlife Sanctuary, with more soon to follow. Building on success, Kalyar has put in motion a second reintroduction in Shwe Settaw Wildlife Sanctuary, a large protected area that could ultimately be home to thousands of tortoises. Kalyar has also worked tirelessly to pull the Burmese Roofed Turtle

back from the edge by overseeing the collection of eggs from the Chindwin River, conducting the first release of headstarted turtles (2015), establishing a third assurance colony, and boosting production of hatchlings at the Mandalay Zoo. Kalyar’s achievements have not gone unnoticed in Myanmar where turtles are now at the forefront of the budding conservation movement. Indeed, in a recent Facebook post, the Assistant Director General of the Myanmar Forest Department wrote that TSA/WCS efforts on behalf of turtles is without exception the most effective conservation program in the country, and much of this success was due to the unceasing labors of one person, the *Leik Saya Magyi*, Indomitable Turtle Lady, of Myanmar, Kalyar Platt.

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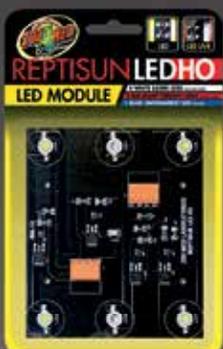


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You can provide for the future needs of our mission by naming the Turtle Survival Alliance as beneficiary in your estate plans. A Legacy gift will insure that the Turtle Survival Alliance keeps its promise of zero turtle extinctions for years to come. Thank you for taking the time to explore the benefits of gift planning, including life income gifts, gift annuities, mutual funds, real estate, life insurance and other plans.

You can also support the Turtle Survival Alliance by donating to the Operating Endowment Fund. Your gift allows you to have a significant impact on the Turtle Survival Alliance's future by helping to provide an ongoing income.

For additional information, please contact Ilze Astad, Director of Development, at 843/830-4040 or ilze.astad@turtlesurvival.org.



Help us conserve turtles and tortoises for future generations. PHOTO CREDIT: BRIAN HORNE

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** Your support moves us closer to a goal of zero turtle extinctions.
- **Purchase Equipment** Check out the TSA's Wish List on amazon.com to purchase equipment that is needed by our staff at the Turtle Survival Center and in the field.
- **Join the TSA** Become a member of the TSA or buy a gift membership for a friend.
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 - » **Amazon.com** – Access amazon.com via the TSA link (http://bit.ly/tsa_amazon) and a portion of your purchase will be donated to turtle conservation!
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- **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. A number of 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.

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

Thank you for your support!

The TSA gratefully acknowledges the following individuals and organizations for their generous support from July 2014 through October 2015.

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The TSA would also like to extend special thanks to the following members and supporters for their continued commitment and support:

Lonnie McCaskill continued to go above and beyond as the TSA India Advisor, putting in many valuable hours to support this critical conservation program.

Daniel Gaillard, Peter Miller, Nancy Reinert, Rose Tremblay, and Robert Villa, returned as our faithful volunteers for the 2015 symposium. **Randy Babb, Rene Clark, Cecina Morrow, and Jason Myrand** joined them for the first time, providing A/V and workshop support.

Andrea Currylow, Lonnie McCaskill, Daren Riedel, Andrew Walde, and Beth Walton put in countless hours of work behind-the-scenes to make the annual symposium a reality, catalyzing turtle conservation globally by bringing together the leaders in the field.

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

Drs. **Shane Boylan** and **Terry Norton** demonstrated outstanding commitment and dedication to building a contemporary and comprehensive veterinary program at the Turtle Survival Center.

We pay special recognition to **Jay Allen** (Aquarium Innovations) for his commitment to improving the operations of the TSC and for other courtesies extended during the past year.

On 18 June 2015 the turtle conservation community awoke to a nightmare – more than 4,000 turtles confiscated in a warehouse in Palawan, destined for China markets. Shockingly, over 3,800 of these were Palawan Forest Turtles (*Siebenrockiella leytensis*), a recently (2004) rediscovered endemic ranked critically endangered by the IUCN Red List. Though this species has been appearing in the pet trade with increasing frequency, this magnitude of this seizure was appalling and rapidly mobilized the global conservation community to action. The responsibility to manage this awful crisis fell on the able shoulders of Sabine Schoppe of the Katala Foundation, who persevered with fortitude and tenacity throughout, dealing with huge logistical, political and human challenges. Sabine's wrap-up report was optimistic: only six turtles remain in care, and overall mortality was surprisingly low given the deplorable condition that many of these turtles were in. The vast majority were released back into streams in natural habitat that are being monitored. These results are remarkable in light of the tragic and dismal situation that Sabine inherited and is a testament to the swift and effective response by the veterinary community. In all more than 40 organizations globally contributed funds or medical supplies, or sent staff to assist, and hundreds of individuals made financial donations. The initial response team in particular is to be commended for quickly restoring order from chaos. If there is a silver lining to be found in this tragedy, it is this: that the global turtle community can come together, united behind a single cause, and bring it to closure. This shining moment provides a glimmer of hope for the future if we can remain united. PHOTO CREDIT: CRIS HAGEN



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