(ISSN 1526-3096)

# TURTLE AND TORTOISE NEWSLETTER

## The Newsletter of Chelonian Conservationists and Biologists

*Issue Number 6* *October 2002*

**Published by**
**Chelonian Research Foundation**

**in association with**
**Conservation International, IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, Chelonian Research Institute, Wildlife Conservation Society, Chelonia Institute, AZA Chelonian Advisory Group, and IUCN (The World Conservation Union) – Species Survival Commission**

# Turtle and Tortoise Newsletter




*Turtle and Tortoise Newsletter* (TTN) is also *available online* at the Chelonian Research Foundation Web Site <http://www.chelonian.org>

***TURTLE AND TORTOISE NEWSLETTER*** (ISSN 1526-3096) is an international newsletter dedicated to providing an open forum for the timely exchange of information on freshwater / terrestrial turtle and tortoise conservation and biology issues. It incorporates and merges the previous publications of the *Newsletter of the IUCN Tortoise and Freshwater Turtle Specialist Group* and the *Box Turtle Research and Conservation Newsletter*.


Submissions are welcome from any source or individual and are in no manner limited to Specialist Group members. Articles may cover any aspects of turtle and tortoise news or research, with a preference for conservation or biology. TTN focuses on freshwater and terrestrial turtles and tortoises; items dealing with sea turtles should be directed to Marine Turtle Newsletter, an independent and separate publication. Of particular interest to TTN are news items and preliminary research or field reports dealing with conservation biology, population status and trends, human exploitation or conservation management issues, community conservation initiatives and projects, legal and trade issues, conservation and development threats, geographic distribution, natural history, ecology, reproduction, morphology, captive propagation, and husbandry. Newsnotes, announcements, commentaries, and reviews of interest to the turtle conservation and research community are also welcome. Submissions will not be peer-reviewed, but minor review and final acceptance for publication is at the discretion of the Editorial Staff. Submit material directly to either H. Kalb or A. Salzberg at the addresses above.


TTN will be published biannually or periodically as the need arises by Chelonian Research Foundation with additional support provided by Conservation International. Institutional association also includes the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, Chelonian Research Institute, Wildlife Conservation Society, Chelonia Institute, AZA Chelonian Advisory Group, and IUCN (The World Conservation Union) - Species Survival Commission. All opinions expressed are explicitly those of the authors and do not necessarily reflect those of the Editorial Staff or any of the Associated Institutions.

*TURTLE AND TORTOISE NEWSLETTER* is available in hardcopy by request from Chelonian Research Foundation, 168 Goodrich Street, Lunenburg, MA 01462 USA (Phone: 978-582-9668; Fax: 978-582-6279; E-mail: RhodinCRF@aol.com) and in electronic form online at the Chelonian Research Foundation Web Site (http://www.chelonian.org). Distribution of the newsletter is free of charge, but donations for financial support are gratefully accepted. A donation form appears on the back inside cover of the newsletter. Chelonian Research Foundation, founded in 1992, is a private, nonprofit tax-exempt organization under section 501(c)(3) of the Internal Revenue Code.
 

# Table of Contents



The cover photo, taken by Jerome Maran, is of an *Emys* (= *"Clemmys"*) *marmorata*, the Pacific pond turtle. You can see the close resemblance to *Emys orbicularis*.

# The Asian Turtle Rescue Operation: Temporary Holding and Placement at Kadoorie Farm and Botanic Garden, Hong Kong

GARY ADES AND PAUL CROW

*Kadoorie Farm & Botanic Garden, Lam Kam Road, Tai Po (NT), Hong Kong SAR; E-mail: fauna@kfbg.org*

A local publication, the *Hong Kong Echo*, reporting on the turtle rescue operation in their spring 2002 issue opened their coverage with the following paragraph;

"Shell Shocked – The Asian turtle crisis exploded on Hong Kong's doorstep last December when customs officials seized an illegal shipment of thousands of endangered turtles – many of them sick and injured – destined for food markets in China. Workers and volunteers toiled around the clock at Kadoorie Farm and Botanic Garden, to providing life support and finding homes for the turtles around the world. It was a massive rescue operation, with governments, international airlines and conservation groups fighting for the survival of these ancient and irreplaceable creatures."

Although this aptly sets the scene for the activities that took place in December 2001, it by no means reflects the underlying logistical complications that followed the seizure or the desperate struggle to provide basic care for over 7000 weakened and dehydrated animals. Always in the background was the depressing sight of KFBG staff disposing of hundreds of dead and dying turtles, some weighing as much as 50 kg.

Some of these events were no doubt to take place later in the States and Europe, but the story began in Southeast Asia and this account provides an overview of the undertakings, which resulted in more than 4000 turtles and tortoises leaving Hong Kong to join assurance colonies overseas.

**Consignment Seized**

It all began around midday on the 11th of December 2001 with a phone call from the Agriculture, Fisheries and Conservation Department (AFCD) of the Hong Kong SAR Government. The Customs and Excise Department and the AFCD had made a larger-than-average, seizure of live turtles and wanted to know if we could assist with identification and possible holding advice. The species and actual numbers were as yet unknown. Our chelonian experts agreed that we could begin assisting with identification if the government could e-mail digital photographs. So began a mammoth task.

Large digital files and an ever-expanding number of unidentified or unconfirmed species emerged as crates were inspected. Pictures continued to download until 5 pm. It began to dawn upon us that this was a significant haul and that it might contain very significant species for conservation.

Initial identifications of the digital images indicated the existence of five species, including the CITES II listed *Manouria emys*. Apart from the lack of legal paper work held by the river barge crew, there was now evidence that they were smuggling protected species. The haul was eventually estimated to be worth over HK $3.2 million. The four men involved in the smuggling, which was apparently destined for the South China food markets, were arrested.

**Holding and Disposal Options**

Knowing that protected and endangered species had been identified, we were asked if KFBG could assist in disposal decisions. After frantically examining our facilities (holding space availability, heating facilities for the tropical species, and water) and assessing our staff and volunteer availability, veterinary resources, and budgetary implications, as well as long-term placement options, we concluded that we could offer temporary placement for the shipment. If all we could do was ensure every animal was viewed and rarities fished out before probable disposal of the remainder of the stock, it would still be a worthwhile effort. All the above variables were considered before we gained approval from the Executive Director Manab Chakraborty to take on what we now coined the Asian Turtle Rescue Operation.

The decision to commence this operation also had to be cleared with the KFBG Board of Directors. Fortunately this aspect of the decision making happened quickly after due consideration had been given to funding options and assessment made of the chances of success. At the least, any commitment would result in the reallocation of manpower with several staff having to put on hold most other projects and dedicate a significant proportion of time just to the turtles. We were approved a period until 16 January 2002 to complete the rescue effort. We considered this a realistic time frame considering the limited resources we had to care for such a large number of animals.

A spate of long distance phone calls to Kurt Buhlmann, Co-Chair of the Turtle Survival Alliance (TSA), and meetings with relevant staff at KFBG now commenced. Gary Ades also started regular communication with Mr. C.S. Cheung, the AFCD contact person. Only one week earlier we had been working closely with Kurt and Mr. Cheung concerning a previous confiscation of 38 Asian turtles and were just finalizing those CITES export permits. Basically we had gone through all of the key steps that we were now to follow, but this time on a much larger scale. The Hong Kong SAR Government had already been provided details regarding the objectives of the TSA and had approved export of the smaller consignment of CITES listed species. Since the number of TSA partners in the United States and Europe was growing, we saw a possible avenue for placement of large numbers of animals. Early investigations indicated that placement in SE Asia for now seemed impractical, and return to Malaysia although investigated was also unrealistic.

Discussion with Kurt Buhlmann now centered on the numbers that the TSA could place. We wanted to know that the animals could be placed before we opened the containers. We were to stay in close contact with Kurt until mid January 2002.

**Turtles Arrive At KFBG**

We were assured by the enthusiastic voices of turtle experts Michael Lau and Bosco Chan that a container load (initially we were informed that this was the extent of the seizure!) was within our ability. Arrangements were made to deliver the animals to KFBG. E-mails were sent to all organizations that might be able to take animals for the longer term should we end up with many live specimens.

The delivery did not happen as scheduled, further phone calls began to expose the bitter truth. The shipment was larger than originally estimated and the government was still unpacking. Ten hours after first being contacted, three 24-ton trucks delivered the shipment. Even with a paid moving crew, unloading took two to three hours and wasn't completed until after midnight. The shipment weighed over four tons. Turtles were being transported in thin plywood, cardboard and polystyrene boxes and synthetic sacks and then placed in four 20-foot containers. The consignment was placed for the evening in our upper piggery building (Figure 1). Over six hundred boxes and sacks stacked almost 2 m high filled the corridor and adjacent vacant pigsties. The scene that greeted us the next morning was quite shocking.

As with most seizures of this type, the exact origin of the chelonians was unknown and tracing the route of the consignment practically impossible. Although the consignment appeared to originate in Malaysia, this may not necessarily have been the only collection region. We noted that many boxes still contained stickers with references to Silk Air, Lufthansa and Singapore Airlines. We also removed shipper and consignee information for Singapore and Macau that was later found to be false.

Figure 1. Boxes of turtles filled the upper piggery building on the first morning.

Nothing could have prepared us for the task that was to follow. While most people were preparing for the Christmas festivities, we were focused on one simple objective - to save as many lives as possible. The weather was against us - temperatures had just dropped to 10°C and were about to hit the lowest temperatures of the year - and with the large logistical task at hand, time was against us. Our goal was to provide basic care and then move them to more suitable facilities in the shortest possible time! For the coordinators of the operation this was going to mean a month of tireless effort directing day-to-day events at many levels, including many dialogues with airline officials, coordination of staff and volunteers, calculating logistics for movement of large numbers of animals, taking animals to the airport, media and radio interviews and decision making about the fate of thousands of animals.

**Consignment Processed**

After brief inspections the first night it was clear that many of the turtles were in extremely bad shape (Figure 2). We desperately wanted to inspect all the animals and give them access to water as quickly as possible.

Multiple stations were established for unpacking and processing the animals. Someone kept notes as each crate or box was opened. Animals were identified, as they were unpacked. Dead and dying turtles were removed from the building, while the living were moved to newly prepared enclosures. Some turtles were able to immediately enter indoor enclosures with standing water and heat to combat the night temperatures, which were to drop as low as 4°C over the next week. Occasionally unpackers gasped as another new

Figure 2. One of many *Orlitia* with obvious fishhooks.

Table 1. Turtle species found during the confiscation.

| Scientific Name | Common Name | IUCN Red List Listing | CITES Listing |
|---|---|---|---|
| *Siebenrockiella crassicollis* | Black marsh turtle | Vulnerable | - |
| *Orlitia borneensis* | Malaysian giant turtle | Endangered | - |
| *Hieremys annandalii* | Yellow-headed temple turtle | Endangered | - |
| *Batagur baska* | River Terrapin | Critically endangered | Appendix I |
| *Heosemys grandis* | Giant Asian pond turtle | Vulnerable | - |
| *Notochelys platynota* | Malayan flat-shelled turtle | Vulnerable | - |
| *Heosemys spinosa* | Spiny turtle | Endangered | - |
| *Manouria emys* | Asian brown tortoise | Endangered | Appendix II |
| *Cuora amboinensis* | Malayan box turtle | Vulnerable | Appendix II |
| *Callagur borneoensis* | Painted terrapin | Endangered | Appendix II |
| *Malayemys subtrijuga* | Malayan snail-eating turtle | Vulnerable | - |
| *Cyclemys dentata* | Asian leaf turtle | - | - |

species was discovered or when a box containing broken animals in a soup of blow fly larvae was opened. Photographic records were made of the proceedings.

We were lucky to have a competent team of around ten people who were able to stop all other work to help. These ten plus a float of 5-6 assistants took more than one and a half days to simply open, inspect and remove contents of all the crates. It was soon clear that there were more species in the consignment than first realized. By the time the last box had been emptied 12 species had been discovered, with only 1 NOT listed as endangered or vulnerable on the IUCN Red Data List (Table 1)! The seizure included even the critically endangered River Terrapin *Batagur baska*, an appendix I listed species. Other CITES listed species found in the seizure were the Asian brown tortoise *Manouria emys*, the Malayan box turtle *Cuora amboinensis* and the painted terrapin *Callagur borneoensis*.

Quick counts indicated that approximately 7,500 turtles and tortoises were alive, while another 2000 were dead or dying. The latter were removed by the AFCD (Figure 3).

Most turtles were cruelly packed, stacked one upon another often 3-5 animals high. Some had been placed in sacks under piles of turtles. Others had been crushed by the weight of the boxes above them (Figure 4). The consignment certainly did not follow any humane standards for transporting live cargo.

At this point the rescue operation became a serious multitasking operation. Labor was divided between unpacking the animals, finding ways to provide water and accommodations for the survivors, finding means to dispose of the dead and dying animals, and seeking assistance for care, shipping, future placement and all other aspects of the rescue effort. The TSA had promised to accept over 3,000 turtles in the States but we still had to determine the fate of those remaining. Exactly how and when the 3,000 would travel was unknown.

Morning, afternoon and evening briefing sessions became normal and it was these gatherings of key staff and volunteers that helped to ensure the whole rescue process ran smoothly over the next few weeks.


Figure 3. After the living animals had been placed in holding areas, the AFCD removed the dead in large trucks.


Figure 4. Many boxes were overfilled and had been crushed from the weight of other boxes.

As the rescue dug into the second, third and fourth days it became evident that despite huge amounts of advice and sympathy from around the globe the scale of this rescue was going to leave us "on our own." Most of the advice and assistance offered simply were not practical on this scale.

We called on previous volunteers including students and friends and asked for assistance from staff from other departments, who helped for periods and then returned to their office work. Well into the operation we had a list of 180 volunteers including several local vets. Workers more used to caring for livestock and dealing with birds of prey were finding themselves handling hundreds of turtles.

**Basic Husbandry Provisions**

Establishing the most basic of holding facilities was complicated by the massive variation in size, from tiny yearling black marsh turtles to huge adult male Malaysian giant turtles. We relied mostly on old vacant pigsties and some existing animal holding enclosures (Figure 5). After the basic facilities were set, we established a daily routine.

All animals were provided water, space and some form of shelter. Heating was provided for 5,000 with modified heaters from chicken farms. The *Manouria*, *Callagur* and *Batagur* were started on medication since their were fewer of these individuals. All turtles with ticks were immediately treated with frontline thanks to the assistance of several volunteer vets and Nimal Fernando, the KFBG vet. *Heosemys grandis,* in particular, suffered high incidence of tick infestation, some measuring 2 cm in diameter!


Figure 5. From top to bottom, *Siebenrockiella,* and *Cuor*a in outdoor facilities (modified pig pens).

Each day the health status of every turtle was checked, the dead removed, and the extremely sick ones marked or removed for later euthanasia (Figure 6). Most enclosures were then flooded for 30-60 minutes; those that could not be flooded had temporary pools built from plastic sheeting and scrap wood. This process was basically a full days work for two to three teams. If volunteer numbers were low, some enclosures had to skip the daily flooding but would receive it the following day. The other main outdoor task each day was a death count and disposal of the new carcasses, which once organized was a grim but routine task.

At this point our e-mail channels were becoming choked by well-meaning people wishing to be updated and offering assistance. We had to request only limited channels of communication from overseas. The help was greatly appreciated but we simply did not have enough ears to listen or hands to carry out the suggested tasks. Many of the suggestions that we did attempt, simply dead-ended when faced with the scale of the problem.

Some of the more notable problems are probably worth mentioning. On the veterinary side we received a lot of advice regarding treatment and preventative measures, but our calculations showed the volume of drugs required to treat this size of shipment were several times larger than the entire stock available in Hong Kong. In addition, even working non-stop 24 hours a day it would probably have taken a week just to inject all of the animals. Daily treatment with our resources was impossible, so we had to be very selective as to which species received medications.


Figure 6. All turtles received daily health checks.

Telephone communications proved essential. In particular, one conversation with Dr. Barbara Bonner provided us with critical veterinary information for the care of some tortoises. Due to government regulations it was not possible for overseas volunteers to simply jump on a plane and come to our assistance, although we appreciated all the offers of help that we did receive.

We unpacked over one thousand *Orlitia* including several weighing over 50kg. This species was the most difficult to care since we had few enclosures with standing water. Staff had to construct shallow pools in open pigsties using wooden frames and plastic sheeting (Figure 7). We could not consider feeding the *Orlitia* at the beginning of the operation, due to the low temperatures and sheer numbers. Even at the start we realized only the healthiest animals would survive the holding period.

**Logistic Arrangements and Transportation**

Reshipment as soon as possible was our ultimate goal. This required flight crates to be constructed to IATA standards. It turned out that normal crate construction or purchase takes weeks or months and we did not know how many turtles would survive or how many would find homes. We were fortunate to find local workers who agreed to make boxes on-site, as we required them.

We were forced to order some crating before placement locations were confirmed, and before airlines were contacted, this posed further problems. Different airlines used different sized palettes. In order to maximize the usability of the crates, they needed to be compatible with both the different sized palettes and turtles, while also conforming to the IATA regulations. When boxes were presented to the air cargo handlers we assisted in securing every inch of space for the consignment! The handlers varied between being flexible or very strict about the box placement on the cargo palettes. On one occasion we had to bring several boxes back to KFBG because we ran out of space and they were refused.

The first shipment of 227 turtles left for the United States, 16 days after arriving at KFBG (Figure 8). During the operation United Airlines, Cathay Pacific, and KLM provided free cargo space, while American Airlines subsidized passage. Freight sizes ranged from 716 kg (672 turtles) to almost 6,000 kg (2,000+ turtles)!

The United States received 3,222 turtles, all of which flew into Miami and were temporarily held by Alvin Weinberg at the Appalatah Flats Turtle Preserve. The TSA then distributed the animals to organizations and individuals with assurance colonies all over the States. We were encouraged to learn that 90% of the turtles in the first three shipments survived the trip to Miami.

Europe received 996 turtles. Henk Zwartepoorte and Gerard Visser at Rotterdam Zoo undertook coordination for distribution to ten countries (Austria, the Czech republic, Denmark, Germany, Netherlands, Poland, Portugal, Spain, Switzerland and UK). Clearly a massive logistical effort was undertaken in the USA and Europe. For the European consignment alone 185 boxes of varying sizes had to be constructed prior to the transportation with funding provided by Rotterdam Zoo.

Details of the placement and survival statistics are presented in Table 2.

**Public Relations – Press Releases and Radio Interviews**

Education Manager Idy Wong coordinated this important aspect of the operation. Many are aware of the wide international coverage received. The press releases and radio interviews were able to sway airlines and local companies into giving charitable assistance and helped to develop awareness and support from the local community. In Hong Kong alone nearly all newspapers covered the story. This resulted in more than thirty articles.

KFBG launched an appeal for help for holding facilities, veterinary supplies, free flight cargo space, funds and volunteer assistance to support the conservation project. The press releases made it clear that support from the wider community was necessary for the success of the project.

It is clear that media exposure was key to raising public concern and no doubt helped us to secure free cargo space for flights to USA and Europe. Some feedback from members of the public included promises that they would not eat turtles again after learning about the plight of those being held at KFBG. Several visitors were visibly distraught


Figure 7. *Orlitia* getting a bath.


Figure 8. Turtles being packed for the trip to Miami, Florida.

Table 2. The following table shows the total number of live turtles unpacked at Kadoorie and their final destination. The majority were sent to the Turtle Survival Alliance in the United States (42.1%) and Europe (13.2%) while 38.6% died.

| Species | KFGB Received | USA | USA | USA | USA | Europe | ZBG | No. Died | Still at KFGB |
|---|---|---|---|---|---|---|---|---|---|
| | 11-Dec | 27-Dec | 29-Dec | 2-Jan | 11-Jan | 17-Jan | | | 16-Feb |
| *Batagur baska* | 5 | | | | 5 100% | | | | |
| *Callagur borneoensis* | 1 | - | - | - | 1 (100%) | - | - | - | - |
| *Cuora amboinensis* | 1,798 | - | - | 181 (10%) | 840 (46.8%) | 285 (15.8%) | - | 400 (22.2%) | 92 (5.2%) |
| *Cyclemys dentata* | 200 | - | - | 123 (61.5%) | 58 (29%) | - | - | 18 (9%) | 1 (0.5%) |
| *Heosemys grandis* | 503 | 41 (8.1%) | 75 (14.9%) | - | 239 (47.5%) | 90 (18%) | 1 (0.2%) | 57 (11.3%) | - |
| *Heosemys spinosa* | 524 | 27 (5.1%) | 26 (4.9%) | 118 (22.5%) | 20 (3.8%) | 283 (54%) | 10 (2.1%) | 40 (7.6%) | - |
| *Hieremys annandalii* | 38 | 36 (94.8%) | - | - | | 1 (2.6%) | - | 1 (2.6%) | - |
| *Malayemys subtrijuga* | 15 | 7 (46.8%) | - | - | - | - | - | 8 (53.3%) | - |
| *Manouria emys* | 73 | 36 (49.3%) | 26 (35.6%) | - | - | 7 (9.6%) | - | 4 (5.5%) | - |
| *Notochelys platynota* | 34 | 33 (97%) | - | 1 (3%) | - | - | - | - | - |
| *Orlitia borneensis* | 1,381 | 47 (3.4%) | 118 (8.5%) | - | 114 (8.3%) | 126 (9.1%) | 1 (0.1%) | 975 (70.6%) | - |
| *Siebenrockiella crassicollis* | 2,972 | - | - | 249 (8.4%) | 753 (25.3%) | 204 (6.9%) | - | 1,409 (47.4%) | 357 (12%) |
| Overall Totals<br>62% Survival rate<br>38% Mortality rate | 7,544 | 227 (3%) | 245 (3.2%) | 672 (8.9%) | 2,067 (27%) | 996 (13.2%) | 12 (0.1) | 2,912 (38.6%) | 450 (6%) |

and wiped tears from their eyes on witnessing the sad spectacle of thousands of helpless turtles that were originally on their way to food markets.

**Conclusion**

Although some of our carefully planned efforts went astray, we feel the undertaking was a great success. In rescuing this single confiscation, pathways to assist future confiscations were forged. Government departments, airlines, conservation organizations and the public were all brought together to work on a critical issue. In addition to the successes achieved in the development of assurance colonies and the education message regarding the suffering of individual animals, the rescue has increased the world's awareness of the plight of Asian turtles.

During this entire exercise, we were frequently impressed by the human ability to work relentlessly toward a common goal against great odds. We heard of many similar feats and great efforts in the United States and later Europe. We also witnessed the remarkable ability of individuals with no previous relevant experience, to adapt and work tirelessly toward the objectives of the rescue mission.

We would like to acknowledge the support of Mr. Andrew McAulay, the KFBG Board of Directors and the Kadoorie Foundation Trustees, who supported the decision to accept this challenge. We would also like to thank all those who assisted in this operation and sacrificed their free time to ensure that some of these wonderful creatures had the best possible chance of survival.

We received support in the form of material donations from Oxbow Hay Company, USA, Lam Soon Food Industries Ltd, HK, Jean-Marie Pharmacal Company Ltd., HK, and Alfamedic Ltd., HK. Financial donations were received from Conservation International, USA and the Nando Peretti Foundation, Italy. We also received generous donations from members of the public in Hong Kong.

# The Miami Experience

**CHUCK SCHAFFER**

*Co-Chair Manouria group*

*[1]University of North Florida, 13811 Tortuga Point Drive, Jacksonville, FL 32225 USA; E-mail: chelonian1@aol.com*

On December 11, 2001, in what was likely a routine inspection at the Yau Ma Tei Public Cargo Working Area, four and a half tons of live turtles were confiscated from four 20-foot cargo containers on an incoming river trade vessel from Macau. The shipment was destined for the illegal food trade in China. The agents of the airlines and shippers involved have transgressed in both simple animal welfare, and in international conservation and trade agreements. The four men arrested for this incident (facing maximum penalties of one-year imprisonment and a HK$500,000 fine) did not act alone and hopefully will not stand trial alone. By their efforts devoted to this seizure, Hong Kong has confirmed a firm commitment conservation.

The demand for turtles in the food markets represents possibly the single largest threat to wild Asian turtle populations and will ultimately mean extinction for many species. While this is the largest individual turtle smuggling incident to date in Hong Kong, it is estimated that perhaps twice this amount are smuggled in each month.

Early on the morning of Friday, December 28 a shipment of about 300 turtles and tortoises (sent according to conservation priority) arrived in Miami, Florida.

Being primarily involved with *Manouria emys*, I documented their temporary indoor holding pens where they were initially housed and received preliminary examinations (Figure 1). The animals' conditions varied and it was apparent that many had been subjected to extreme conditions long periods. Some showed evidence of past trauma, including an old tiger bite. Although the shipment was expected to include *Manouria emys phayrei*, only *M. e. emys* were present.

People began to arrive in force around 9:00 AM. After a short organizational meeting we embarked upon the business of the day. First animals were cataloged and assigned identification numbers by Annabael Ross, the TSA registrar. Next they were moved to a morphometric station for weighing and measuring (Figure 2). Finally, the animals were transported to the vets and medical triage area which resembled a chelonian MASH unit (Figures 3 and 4).

Figure 1. The author holding a *Manouria emys*.

Figure 2. Joe Mitchell weighing a *Manouria emys*.

After triage, the animal's physical characteristics were recorded. At this point, measurements, examination, sexing, additional assessments, blood samples for genetics and the inevitable load of paperwork began. Several universities, including Southwest Texas State University and University of Miami, will be embarking on extensive genetic work that may serve to establish baselines by which geographic localities of captive animals may be determined in the future. This is essential to determine where captive animals may be repatriated when the time is right. It will also provide guidance for captive breeding of founder stock. Drilling of the marginals was then done to provide for permanent identification of TSA animals. Processed animals were then found outdoor accommodations. The satisfaction of the initial task now completed was apparent on the faces of the participants.

Sometime during the day, the media arrived and most of us were called away for interviews, questions and comments. This was time well spent and yielded favorable newspaper and TV coverage during the next two days.

Figures 3 and 4. Turtle M.A.S.H. units at work.

**Second Shipment Arrives**

Then it was time for the next trip to Miami International Airport for the second shipment of turtles. There, we had encounters with shipping agents (armed with reams of paper and incomprehensible rhetoric) and a U.S. Fish and Wildlife Agent (armed with Pritchard's Encyclopedia of Turtles and Ernst & Barbour's Turtles of the World) (Figure 5). It was a long and frustrating process, but apparently not uncommon in the trade.

Saturday was a repeat of the previous day with smoother operations but fewer supplies. Most of us were thoroughly sunburned. All available shade was reserved for the turtles. Thank God, it didn't rain – that would have seriously limited our options.

For me, the end of a few very long days came far too quickly. With my available time exhausted, I left for home Saturday evening, tired, but satisfied and with three large *Manouria emys emys* (and the smaller tiger bite victim who will be an excellent education animal) available for my behavioral studies.

My time there was comparatively short. There were those who came before me and were still there a week later. Many folks worked longer hours and at more difficult tasks. Some drove from as far as Texas, brought family members and packed equipment and tortoises even into the occupant's seats on the long drive home to save the stress (and money) of shipping animals already so strained. The owner of the property in Port St. Lucie had his family's life and business disrupted – with this to continue for a considerable time. It was amazing that so many gave such an incredible amount of time, effort, supplies and support for this project on such short notice.

To those of you who would have liked to help, but couldn't make it to Florida; there are many other critical forms of participation. Write letters to the sponsors listed on page 14 of this newsletter. Buy their products and let them know why you are doing this. We will need them again and if we make it worth their while (read that "Public Relations and Advertising" dollars), they will come through again. At least let them know that they are appreciated simply for their initial effort. We couldn't have done it without them.

Figure 5. A US Fish & Wildlife inspector checking the turtles.

# Medical Triage in Miami, Florida

**Chris Tabaka**

*Staff Veterinarian, Memphis Zoo, Memphis, Tennessee, USA; E-mail: tortvet@yahoo.com*

Well before the break of dawn on December 28th, the first shipment from Kadoorie arrived in Miami and was driven up to Port St. Lucie, Florida. Jim Barzyk and Lonnie McCaskill worked steadily through the night to unpack the chilled animals and place them in Al Weinberg's spacious indoor pens to allow them to soak and stretch their legs. As daylight arrived, the morphometric and medical triage teams, as well as numerous volunteers arrived. Medical field stations were rapidly established and stocked with supplies. The morphometric teams set up just outside the heated warehouse while the medical teams set up under some palm trees in a field about 50 yards from the morphometric folks.

The medical triage area consisted of four individual exam tables staffed by a veterinarian, a record keeper (generally a vet student), an experienced animal handler, and someone to draw up the various fluids and medications that were in constant demand as the animals flowed through each station.

The initial assessments were rapid but thorough. The animals were checked for external parasites, shell condition including shell rot and petechiation, hydration status, skin lesions, oral exams for such problems as anemia and fish hooks, muscle tone/strength, and alertness. The primary goal for the initial treatment was to get them rehydrated using warmed fluids intracoelomically, subcutaneously, orally, and/or cloacally depending on the species. Each animal was also started on antibiotics via individually dosed regimens depending on the condition, size, and species. Various other medications, including everything from antifungals to antiprotozoals to anthelminthics in severely parasitized animals/species, were also used. Sedatives were also used in a number of animals to remove fishhooks or to allow pharyngostomy tube placement and IV fluids.

After the animals were initially assessed and treated by the medical teams, runners then carried the animals to either the intensive care area/holding pens or into a new area where the turtles could continue to thermoregulate and rehydrate. This process continued throughout the day as we proceeded through one species at a time. The species from the first two shipments included subadult to adult *Malayemys subtrijuga*, *Manouria emys emys*, *Notochelys platynota*, *Hieremys annandalii*, *Heosemys grandis*, *Heosemys spinosa*, to the sleek black *Orlitia borneensis*.

Animals that died were set-aside for potential egg removal and complete necropsies to ascertain the cause of death. Due to the incredible efforts of all of the volunteers, the total number of dead in the first three days was only about 20 animals out of the almost 500 that were brought in. All carcasses were sent to the Texas Cooperative Wildlife Collection at Texas A&M University.

The author in Miami, Florida this past December.

A binful of adult *Heosemys spinosa*, spiny turtle.

There are innumerous people to thank for their work but in particular, I would like to thank the tireless efforts of fellow veterinarians Dr. Barb Bonner of the Turtle Hospital, Dr. Barb Mangold of the Wildlife Conservation Society, and Dr. Terry Norton of St. Catherine's Island-Wildlife Conservation Society. The efforts of these dedicated clinicians in conjunction with their highly skilled teams made a tremendous difference not only to the future breeding efforts of TSA but also to each and every one of the animals that went through their skilled hands. Numerous other veterinarians including Dr. Charlie Innis, Dr. Joe Flanagan, Dr. Bonnie Raphael and many, many other zoo and private veterinarians also deserve endless thanks for the two larger shipments that followed in early January. Thanks also to Dr. Nimal Fernando, the staff, and volunteers at Kadoorie Farm and Botanic Garden for all of their hard work. Last and far from least, thanks to all of the volunteers who spent countless hours not only working on the animals as they arrived in Florida but also working with them in their own homes and facilities. The amalgam of TSA is an inspiration and will hopefully serve as a model for other taxa in the near future

Andy Snider, reptile curator at the Detroit Zoo, and Dr. Barb Mangold, Wildlife Conservation Society.

*Hieremys annandalii*, the yellow-headed temple turtle.

Dr. Terry Norton and staff fromSt. Catherine's Island, WCS.

Barbara Bonner from the Turtle Hospital discussing turtle care.

*Manouria emys*, Asian brown turtle, with Dwight Lawson (left).

# Turtle Rescue - Turtle Survival Alliance Executive Summary

**Rick Hudson and Kurt Buhlmann**

*Fort Worth Zoo, 1989 Colonial Parkway, Fort Worth, TX 76110; phone: 817-759-7177; E-mail: iguanhudso@aol.com*
*Conservation International, 1919 M Street, Suite 600, Washington, DC;*
*phone 202-912-1352 and 803-725-5293; E-mail: k.buhlmann@conservation.org*

With the Turtle Survival Alliance (TSA) not even a year old and still struggling to establish its international network, the young organization was handed a daunting responsibility. On December 11 Hong Kong authorities seized a shipment of 10,000 Asian turtles heading for markets in China. Most likely Malaysian in origin, the shipment contained 12 species, many of them classified as threatened or endangered. The enormous task of unpacking the shipment fell on Kadoorie Farm & Botanic Garden (KFBG) Wild Animal Rescue Center in Hong Kong, a TSA partner organization. Despite overwhelming numbers of sick and injured turtles their staff handled the crisis as effectively as could be expected until arrangements could be made to transport them. Rather than destroy the shipment, the turtles were offered to the TSA. For an excellent summary of the events leading up to the turtles coming to the U.S., see the extensive article by Gary Ades and Paul Crow. For co-chairs Kurt Buhlmann and Rick Hudson, life was turned completely upside down. Over the next two chaotic and frenetic weeks the complications and logistics of bringing these turtles to the US were dealt with. On 27 December 2001 the first shipment of 300 turtles arrived. By 12 January 2002 four shipments totaling 3,200 animals had been received in Miami through airfreight space donated by United, Cathay Pacific, and American Airlines. The turtles were moved to Al Weinberg's Allapattah Flats Turtle Preserve in Port St. Lucie, Florida, which served as the staging area for evaluation and treatment. Such a massive rescue effort would not have been possible without this facility. The TSA owes a great deal to both Al and Jacquie Weinberg who opened their home and facilities to allow this process to occur. For their perseverance, dedication and genuine hospitality shown to hundreds of strangers and visitors during this tumultuous period, the TSA extends its gratitude.

Such a sustained effort presented an enormous logistical challenge and required a large and dedicated volunteer force. Every turtle that was processed received a permanent shell-notched individual ID number and was measured, weighed, and sexed. Three sets of paperwork for each animal included biological attributes, veterinary treatment data, and disposition to TSA Partners necessitated extensive record keeping (see Chris Tabaka's summary). The organization and maintenance of this process fell on the shoulders of TSA records keeper Annabel Ross of the Fort Worth Zoo who performed a remarkable job of bringing some system of order to a potentially chaotic situation. This process was accomplished with a host of volunteers representing the private sector and over 20 zoos, universities, and non-profit conservation organizations. Important contributions from nearly 20 corporate donors and organizations helped make it all possible. Over 30 of the best zoo, wildlife, and private veterinarians in the U.S. were on hand to attend to a multitude of medical problems. In fact the enormous outpouring of donor support, in terms of donated time, funds, services and supplies, was remarkable (see the following tables).

**Where they went**

All totaled, 3,202 turtles and tortoises were processed during the Florida rescue effort. They were distributed in the following manner:

- 49 private individuals & organizations received 1,397
- 11 zoos received 325
- 3 veterinarians received 154
- 1 Vet School received 38
- 2 tropical fish farms received 641

Another 996 turtles were consigned to the Rotterdam Zoo and distributed throughout the European zoo community, an event coordinated by Gerard Visser and Henk Zwartepoorte.

Overall mortality figures for the U.S. rescue effort have not been disappointing given the extremely poor and debilitated condition in which many of the turtles arrived. In particular, the last shipment consisting primarily of *Cuora amboinensis* and *Siebenrockiella crassicollis* were severely compromised and many stood little chance for survival. As of 14 August 2002, eight months post rescue, mortality stands at 44% (1,408 deaths out of 3,209 turtles processed) according to the ongoing database maintained by Annabel Ross - TSA Records Keeper. However if these two species are not factored into the analysis, then overall mortality figures drop to 25%, which is remarkable.

In addition to monitoring the 12 species seized during the Hong Kong confiscation the TSA is tracking four other species that KFBG sent along with the last shipment. These include *Cuora galbinifrons* (3), *Indotestudo elongata* (20), *Lissemys punctata* (8), and *Morenia petersi* (3). For some of the 16 species being tracked, the results are predictable while others are pleasantly surprising. The *Cuora* and *Siebenrockiella* suffered 54% and 56% mortality, which is not surprising, nor is 86% for the exceedingly difficult to maintain snail-eating turtle *Malayemys subtrijuga.* Disappointing is the 44% mortality for the mountain tortoises *Manouria emys* which arrived, for the most part, in what *appeared* to be fairly good condition. However closer assessments, revealed a myriad of problems on the inside including severe parasitism from a highly invasive hookworm as well as starvation. In fact the specimens that did survive required a massive and dedicated veterinary effort and a huge time commitment on behalf of those

involved. In the words of TSA vet Chris Tabaka "we haven't had a battle like that here in a long time". A pleasant surprise is the 3% mortality seen in the yellow-headed temple turtles *Hieremys annandalii (*1 out of 40) and the 33% for the Malayan flat-shelled turtle *Notochelys platynota (*11 out of 33) which has a reputation as a problematic captive. Equally impressive is the low mortality on the two species of *Heosemys*: 21% for *H. spinosa* (40 out of 191) most of which were large adults that generally acclimate poorly, and 12% for *H. grandis (*42 out of 355*)* which were certainly one of the hardier species that we dealt with. Our success with the giant Bornean river turtle *Orlitia borneensis* is one of which we are quite proud. Though many of these giants, some over 50 kg, succumbed before they could be shipped from Hong Kong, the Florida rescue team processed 260. Besides arriving extremely dehydrated and with enormous parasite burdens, almost all had hooks caught in their mouths or esophagus and required surgery. The husbandry challenges that this species presented were formidable due to their large size, aggressive nature and debilitated condition. But thanks to the tremendous dedication of a team of veterinarians (Dr. Chriss Miller of Miami Metrozoo deserves special commendation as she and her staff accepted over 50 *Orlitia* at the Zoo hospital and lost only two animals; most are still under her care) only 89 have perished for a mortality rate of 34%. It must be pointed out that an enormous amount of time and resources, both financial and human, have gone into trying to save these turtles.

Individuals and institutions both have absorbed huge costs in terms of drugs, personnel overtime, lab work and diagnostics, vet bills and shipping charges. During the rescue many of the medical expenses were covered through donations from several humane organizations (HSUS, WSPA, IFAW) channeled through Barb Bonner's Turtle Hospital of New England. But once the turtles went home many individuals bore the personal burden of paying for veterinary care. To this group of dedicated turtle keepers we owe a special debt of gratitude.

While tracking mortality figures is necessary in order to document our efforts and maintain accountability, one of the more pleasant tasks is tracking hatchlings. Lots of eggs were laid during and subsequent to the rescue effort, and TSA communications manager Darrell Senneke reports the following hatching success:

37 *Heosemys grandis* and 1 *H. spinosa*
7 *Hieremys annandalii*
2 *Indotestudo elongata*
1 *Malayemys subtrijuga***
2 *Siebenrockiella crassicollis**
*Orlitia borneensis* (at KFBG )

* The first hatchling born from the overall confiscation was a *Siebenrockiella* that hatched at KFBG.

** The first U.S. hatching was a *Malayemys* on 11 April 2002 from eggs laid on New Years Eve 2001 at Shawn Learmont's facility in Illinois. Shawn's emerged only one hour prior to a *H. grandis* at Paul vander Schouw's.

All total, 50 hatchlings had emerged by 6 August 2002. These turtles are alive today because of TSA and KFBG rescue efforts.

Many specimens from the Hong Kong rescue are being integrated into existing TSA programs known as Taxon Management Groups (TMG). One of the more important acquisitions was the five mangrove terrapins *Batagur baska*, which were incorporated into a captive gene pool with very low genetic diversity, i.e. most specimens were descended from one female. These new animals have integrated into captive groups at Bronx NY, Cleveland Metroparks and San Diego. The receipt of these five *Batagur* is significant for other reasons as well. Listed as CITES I and Endangered by USFWS, the process of obtaining import and export permits for such specimens could normally take up to a year. The TSA received an import permit on an emergency basis in five days, heralded by many as an extraordinary achievement. However a number of events had occurred previously that paved the way for this permit. In 2001 a remnant population of *Batagur* was discovered by biologists from the Wildlife Conservation Society (WCS) along the Sre Ambel River in Cambodia where they were believed extinct. Funding requests went out to develop a community based nest beach protection program that resulted in support from Cleveland Metroparks, Disney's Wildlife Conservation Fund and Conservation International CABS, all TSA Partner institutions. Cleveland Metroparks Zoo had also compiled a studbook and written a management plan for *Batagur*. All of this was factored in to FWS's decision to issue an import permit.

The lone male painted terrapin *Callagur borneoensis* was sent to a facility holding four captive hatched females approaching adult size and is now part of a TMG program for that species. For other taxa TMGs were organized in response to the confiscation. One of the more active of these has been *Heosemys spinosa* under the coordination of Chris Tabaka, DVM. His extensive communications concerning the medical management of this species have no doubt resulted in the surprising low mortality being seen.

When the TSA was established we envisioned that more manageable numbers would be seized, probably not exceeding 500 specimens, and these would be distributed throughout our network of veterinarians for initial triage and treatment, and eventual placement after they were stabilized. This is how the system is supposed to work. The 11 December seizure in Hong Kong shattered that illusion and brought the harsh realities of the massive volume of the Asian turtle trade into our personal lives. The TSA was dealt a very bad hand but had no choice but to play it. Though the KFBG staff exerted heroic efforts to save these turtles, limited space, winter weather and time worked against them. Clearly many of the turtles that were shipped to the U.S. should have been euthanized in Hong Kong, as they never stood a chance. However given the circumstances the TSA did the best it possibly could under such conditions. We simply ran out of facilities to house and care for so many sick and dying turtles and compromises had to

be made. With the last group of *Cuora* and *Siebenrockiella*, the decision often came down to who had a warm water pond to put them in. Extensive medical intervention was simply not an option. However we are confidant we did as well as we could. There have been numerous discussions as to how to deal with a similar situation the next time and most of the TSA steering committee is in agreement that we should send triage teams to deal with the confiscation initially in the range country, and only ship back the specimens needed to develop assurance colonies for threatened species. It must be pointed out that the TSA's primary mission is conservation. The confiscations and market rescues are a means to achieving our broader goal of saving endangered turtle species through the development of sustainable captive populations. This is reflected in the TSA's definition as *An IUCN Partnership Network for Sustainable Captive Management of Freshwater Turtles and Tortoises* and in our primary goal of *Preserving Options for the Recovery of Wild Populations.* TSA is not a rescue organization, and we do not intend to replicate the efforts of existing rescue groups. We will likely find ourselves working with these groups in the future as confiscations become more prevalent.

The impact of this single rescue event towards bonding the TSA partners and their support network, and establishing the organization's reputation as a successful conservation group, cannot be understated. During the process huge debts were incurred, but much of this has been offset by direct contributions and grants from Conservation International ($9000), Disney's Wildlife Conservation Fund ($5000), and the Columbus Zoo ($3000). Thousands more in contributions were made by a wide range of private hobbyists and turtle enthusiasts. All in all, the Hong Kong turtle rescue brought together the turtle community for a unified cause, and a spirit of purpose and unity truly prevailed. And though chaos seemed evident at times, and mistakes were certainly made along the way, a process emerged that we can all be proud of. For those of us that endured this ordeal in its entirety, it is an experience that will remain with us for the rest of our lives.

Table 1. The following Institutional Sponsors provided staff, supplies and facilities.

| | |
|---|---|
| Conservation International | staff, media and PR |
| Central Florida Zoo | staff, volunteers |
| Cleveland Metroparks Zoo | staff, logistical support |
| Detroit Zoological Institute | staff, supplies |
| Disney's Animal Kingdom | volunteers, vet, pathologist; logistical support |
| Florida Aquarium | vet staff, supplies |
| Florida Atlantic University | geneticists |
| Fort Worth Zoo | vet staff, registrar, media, PR, & supplies; logistical support |
| Houston Zoo | vet staff, supplies |
| Kadoorie Farms Botanic Gardens | massive rescue effort |
| Lowry Park Zoo | vet staff, facilities |
| Memphis Zoo | vet staff, supplies |
| Miami Metrozoo | vet staff, facilities |
| North Carolina State Vet School | vet staff, facilities |
| Roger Williams Park Zoo | staff |
| Turtle Hospital of New England | staff, supplies |
| Savannah River Ecology Lab | staff |
| Southwest Texas State University | geneticists |
| University of Florida | vet staff, facilities |
| University of Richmond | staff |
| Wildlife Conservation Society | staff, supplies |
| Zoo Atlanta | staff |
| **Funding and Grants** | |
| Turtle Hospital of New England | (see next article) |
| Columbus Zoo | |
| Conservation International | |
| Disney's Animal Kingdom | |

Table 2. Sponsors and supporters of this operation.

| |
|---|
| American Airlines |
| Austin's Turtle Page |
| California Turtle & Tortoise Club |
| Cathay Pacific Airlines |
| Conservation International |
| Disney's Animal Kingdom |
| European Aquarium and Zoo Association |
| Humane Society of the United States / Humane Society International |
| Nutrition Support Services Inc. |
| Purina Mills |
| South Florida Reptile Exchange, Inc. |
| St. Catherines Island Foundation |
| The International Fund for Animal Welfare |
| The World Society for the Protection of Animals |
| Tortoise Reserve |
| Turtle Homes |
| United Airlines |
| Wildlife Conservation Society |
| World Chelonian Trust |

## A Word of Thanks from Barbara Bonner and the Turtle Hospital

**BARBARA BONNER**

*The Turtle Hospital of New England, Tufts University School of Veterinary Medicine*

The Turtle Hospital would like to thank The World Society for the Protection of Animals, The International Fund for Animal Welfare, and the International Humane Society/The Humane Society of the United States, and private donors for their prompt and lifesaving response to the Kadoorie Rescue effort. Because of their gift of funds for the purchase of supplies, every single animal who arrived in Miami alive had access to veterinary care with state-of-the-art medications and techniques. Without the medical supplies their funding enabled us to purchase for the very ill animals arriving into Miami, the death toll could have been as high as 95%. The generous and prompt gift of funds to purchase subcutaneous fluids, parasiticides, antibiotics, treatment utensils and all accessory equipment needed was absolutely lifesaving.

The Turtle Hospital also would like to ensure that the generosity of Dr. Sue Donaghue of Walkabout Farms and Mazuri are acknowledged, as, again, their timely and very needed donations were lifesaving.

A large percentage of veterinarians, veterinary students, institutions, rehabbers and private caring individuals were able to grow in knowledge and experience thanks to the benevolence of these donors. All of us involved in the rescue effort are enormously grateful for the timely and generous outpouring of assistance. Each turtle who died while receiving care contributed towards improved survival and enhanced knowledge for the next confiscation. Each living turtle stands as a representative of his/her species in a global call for conservation of the one third of the world's turtles threatened with extinction in the next decade. Each hatchling from a gravid mother who was part of the confiscation stands as a living symbol of hope for the future.

To all our donors, we who care for the world's turtles are profoundly grateful.

## Results of Turtle Market Surveys in Chengdu and Kunming

**SHI HAITAO**

*Department of Biology, Hainan Normal University, Haikou, 571158, China*
*Fax: 0898-65890520; E-mail: haitao-shi@263.net; Tel: 0898-66752479*

Trade is currently the largest threat to turtles and China is one of the largest consumers of turtles in the world (van Dijk *et al*., 2000). Unfortunately, relevant data on trade, captive breeding, population number and life history of Asian turtles are lacking. This seriously hinders conservation measures. Published market surveys (e.g., Artner and Hofer, 2001) are valuable additions to our knowledge of turtle trade. This note reports on trade at two markets in China.

In March 2002, I surveyed the species and number of turtles at the Qingshiqiao market in Chengdu, Sichuan Province and Huaniao market in Kunming, Yunnan Province during late March.

**Qingshiqiao market**- There were 6 stands selling 11 species of turtles (740 individuals) at the Qingshiqiao Market. The majority (95%) were *Trachemys scripta elegans* with 91% of these hatchlings. The remaining 5% were *Indotestudo elongata* (3 adults), *Cuora amboinensis* (4 adults), *Cuora galbinifrons* (1 adult), *Chinemys reevesii* (2 adults) *Hieremys annandalii* (1 adult), *Sacalia quadriocellata* (1 adult), *Carettochelys insculpta* (1 subadult), Chelydra *serpentina* (1 subadult), and *Pelodiscus sinensis* (17 hatchlings).

**Huaniao market-** There were 10 stands selling 7 species of turtles (529 individuals) at the Huaniao market in Kunming. Once again, the majority (98%) were *T. scripta elegans* hatchlings (only 3% were adults). The other 2% include *Manouria impressa* (2 adults), *I. elongata* (1 adult), *C. galbinifrons* (1 subadult), *Melanochelys trijuga* (1 subadult and 2 adults), *Ocadia sinensis* (1 adult) and *S. quadriocellata* (5 adults).

Of the 14 species of turtles observed in these two market surveys, 5 do not occur naturally in China. Almost all of the turtle dealers claimed that *T. scripta elegans* came from local turtle farms, but they refused to reveal the exact location of these farms. The number of species and individuals observed in these two markets is much less than before. This may reflect increases in enforcement, education and limitations on imports. The following issues require additional attention:

1. Many turtle dealers illegally buy and sell CITES listed species, such as *I. elongata* and *M. impressa*. This indicates that markets, as well as customs, need to have increased enforcement for turtle smuggling and illegal trade.

2. Some of the trading is now done behind closed doors. Therefore, it is not possible to see all the species traded. Most turtle dealers know what species are legal to sell and hide the others far from their stands. This is true of *S. quadriocellata, C. galbinifrons, M. trijuga* and other species observed in this survey. In one case, the turtle dealer kept his turtles in a room behind the market. There were three doors leading into the room and I was only allowed to go into the first door. I was not allowed to take pictures. This illustrates that surveys and enforcement based on "surface counts" underestimate the trade, especially of putatively protected species.

3. Many of the turtles had serious injuries and infections and suffered from starvation and dehydration. One turtle dealer explained that the price of the turtle was the same if it was dead or alive because they would sell either the shell or the meat.

**References**

Artner, H. and A. Hofer. 2001. Observations in the Qing Ping Free Market, Guangzhou, China, November 2000. Turtle and Tortoise Newsletter, Issue 3:14.

van Dijk, P. P., B. L. Stuart and A. G. J. Rhodin. 2000. Asian Turtle Trade: Proc. Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia. Chelonian Research Monographs, No. 2.

# The Beleaguered Chelonians of Northeastern India

**ABHIK GUPTA**

*Department of Ecology, Assam University, Silchar 788 011, India; E-mail: abhikgupta@hotmail.com*

The Northeastern region of India is home to one of two biodiversity hotspots in India (Myers *et al.,* 2000). This region abounds in different types of freshwater ecosystems including torrential mountain streams of both groundwater and glacial origins, large meandering rivers in the valleys with relict channels, oxbows and seasonally inundated floodplain lakes, and swamps, marshes, ponds, pools and others. The floral diversity is also extremely high with tropical wet evergreen, montane wet temperate, tropical semi-evergreen, tropical moist deciduous, sub-tropical pine, and swamp forests, as well as dense bamboo and cane brakes (FSI, 2000). Such rich diversity is accompanied by a correspondingly high diversity of turtles and tortoises. Of the 26 species of non-marine chelonians reported from India, 19 are found in northeastern India (Das, 1996; Pawar and Choudhury, 2000), thus making it an important repository of chelonian diversity. However, a plethora of anthropogenic stresses are now exerting severe pressure on this interesting group of reptiles.

**Habitat destruction**

The forest cover is rapidly disappearing from the entire region, especially the state of Assam. Several paper and pulp mills are exerting unsustainable pressure on the bamboo forests. Cutting and burning of forests for slash-and-burn cultivation poses a threat to the hill tortoises. The quality of the forest is also deteriorating, with the dense forests (canopy closure of 40% or more) becoming degraded into open forest or scrub. This forest destruction is resulting in a food shortage, as bamboo sprouts have been reported to be the favorite food item of some species. Deforestation and the resultant loss of soil, especially in the hill areas, are leading to increased siltation of rivers and streams. The deep pools that are the favored habitats of many species, are rapidly becoming shallow and choked with silt, leading to a decline in habitat. At the same time, swamps, marshes, and other wetlands are increasingly being reclaimed for urban and agricultural expansion. These changes are reflected in a sharp decline of chelonian density.

**Hunting / trapping for flesh**

A vast majority of the indigenous inhabitants of this region are carnivorous in their food habits and crave turtle meat and eggs. Many communities have expert hunters, trappers and fishermen. In the past, the hunting/trapping was done with considerable prudence with many taboos and restrictions. The Ningthouja clan of the Meiteis of Manipur, for example, considered it a taboo to consume turtle or tortoise meat (Gupta and Guha, 2002). Unfortunately, a rapid incursion of consumerist culture and the lure of easy money are fast making this market unsustainable.

Collecting is often done with mindless cruelty. For instance, many turtle hunters use spears to gore the hapless creatures in shallow water, refusing to spare even juveniles. Another common practice is to lay rows of hooked lines in shallow water near sandbanks. As the turtles move into this area, their paddles get caught in the hooks. A male and a female *Kachuga sylhetensis* – a rare species endemic to this region – recently rescued had their front paddles badly mauled by hooks. In addition to nets, various traps made of bamboo and cane are also used.

**Use in traditional / alternative medicine**

Both the flesh and eggs are believed to have several medicinal properties. The blood, believed to be a cure for piles and fistula, is also in great demand. The flesh is supposed to be a remedy for gout and arthritis, while the carapace of the soft shell turtles is also used as medicine. Live animals as well as gunny sacks full of carapaces – probably *Aspidaretes hurum* and *Lissemys punctata andersoni* - used to be exported out of this region to the other parts of India, until at least the mid-eighties. That practice has now stopped because the numbers have dwindled drastically, but because of the decline, traders now offer very lucrative prices for flesh and carapace to the tribal hunters and fishermen.

**Superstitious beliefs**

There are many superstitious beliefs that lead to the killing of turtles. Hanging a carapace in the cattle-shed is believed to be a good luck charm and to keep snakes away from the premises; hanging a carapace on the door or wall of a house is believed by some to keep away burglars.

A recent survey conducted in Assam has identified certain areas rich in freshwater chelonian diversity. These include the floodplain area of Dibru-Saikhowa Biosphere Reserve in the Northeastern corner of Assam where eight species have been recorded with unconfirmed reports for an additional three. However, progressive siltation of the lakes and pools, as well as poaching, are proving to be hazardous for the turtles. Other diversity-rich areas include the Hajong Lake and marsh in the Langting-Mupa Forest Reserve in North Cachar Hills district of Assam, inhabited by seven or eight species, several floodplain lakes in Nagaon, Kamrup and Cachar districts of Assam, the Rukni river that flows out

of Mizoram into the plains of Cachar, Assam, and the Jiri river and its tributaries in the Assam-Manipur border. These areas need to be declared as chelonian sanctuaries, and widespread awareness campaigns need to be undertaken to wean potential consumers away from eating turtle meat and eggs and to remove the superstitious beliefs from their minds.

Although poaching is a problem, turtles have historically received community-sanctioned religious protection in many temple tanks in this region. Examples include softshell turtles protected in the Kamakhya temple at Guwahati, Assam and *Aspidaretes gangeticus* in the Tripureshwari temple at Udaipur, Tripura. More recently, the Shiva temple at Tinsukia, Assam has started offering turtles sanctuary. Thus ex-situ conservation of chelonians in community and temple tanks and in public gardens could also constitute a useful mechanism for conservation.

**References**

Das, I. 1996. Biogeography of the Reptiles of South Asia. Florida: Krieger Publishing Company, 87 pp.

F.S.I. 2000. State of Forest Report 1999. Dehra Dun: Forest Survey of India (Ministry of Environment and Forests), 113 pp.

Gupta, A. and Guha, K. 2002. Tradition and conservation in Northeastern India: an ethical analysis. Eubios Journal of Asian and International Bioethics 12: 15-18.

Myers, N., Mittermeier, R.A., Mittermeier, C.A., Da Fonseca, G.A.B., and Kent, J. 2000. Biodiversity hotspots for conservation priorities. Nature, London 403: 853-858.

Pawar, S.S. and Choudhury, B.C. 2000. An inventory of Chelonians from Mizoram, North-East India: new records and some observations on threats. Hamadryad 25(2): 144-158.

## A Nine Year Study of Eastern Box Turtle Courtship with Implications for Reproductive Success and Conservation in a Translocated Population

**BILL BELZER**

*Biology Department, Clarion University/Venango Campus, 1801 West First St, Oil City, PA 16301*

The eastern box turtle, *Terrapene carolina carolina*, has low reproductive success (Madden, 1975; Doroff & Keith, 1990; Klemens, 1989; Zeiller, 1994; Klemens, 2000; Dodd, 2001). Integration of the evidence presented here, and from my previous field studies in northwestern Pennsylvania (Belzer, 1999a, 1999b, 1999c), with that found in discussions of declining *Terrapene* populations (e.g. Murphy, 1976; Stickel, 1978; Halgren-Scaffidi, 1986; Williams and Parker, 1987; Doroff and Keith, 1990; Dodd and Franz, 1993; Lieberman, 1994a and 1994b; Tyning, 1997; Hall *et al*. 1999; Miller, 2000; Niederriter, 2000; Dodd, 2001), suggests that perpetuation of this species' populations requires high reproductive activity; and that a high adult population density is critical for that required level of sexual interaction.

**Courtship Encounters**

Over the last nine years, we have regularly monitored 43 eastern box turtles with radio telemetry (Belzer, 1999a). These turtles were released into the McKeever and Buttermilk Hill Nature Sanctuaries, in Pennsylvania's Mercer and Venango counties (respectively). This has provided exceptional opportunities to observe reproductive behavior. Neither courtship nor mating was observed during the initial years of the_repatriation studies (Belzer, 1999b). At that time, the first 10 turtles were kept within a 12 ha core of the 80 ha McKeever habitat (Belzer, 1999c).

My initial hypothesis (that pheromonal or other distant cues would bring distant box turtles together for mating) failed to reconcile the lack of observed mating activity with the fact that box turtle copulation lasts for hours. It would be difficult to miss all mating activity, even in a small population, when all the animals are located many times a week. Moreover, my naive notion that box turtles would probably detect distant potential mates, and move to them, failed to accommodate Stickel's (1989) report that she saw mating only among adults whose home ranges overlapped, not among ones with separated home ranges.

In the earliest years of my studies, I sometimes found individuals near one another (e.g. 5-20 m), but never together. Later, as more turtles were added to the site, we found more interacting turtles. A male's recognition of a female often starts with a series of brief, energetic, erratic head and body jerks or lunges toward the female, after which he approaches her. Males would walk within one meter of a female obscured by vegetation, and pass by her location as if oblivious to her presence. I discovered that if I removed the object obstructing the male's view, the male generally turned sharply toward her as soon as he noticed her. He would then close in on her, court and often copulate.

I also observed males walk past females who were not hidden, but who were motionless and withdrawn into their closed shells. The males appeared oblivious to the proximity of such potential mates even though the females were in plain view. If the female moved or was moved by me with a branch, the male would suddenly turn around, close in and begin courtship.

In short, our male eastern box turtles seemed to approach females only when they actually saw and recognized them.

**Experiment 1: Effect of visibility on mate finding**

My revised hypothesis became that visual cues are critical for finding potential mates in an eastern box turtle population. In 1997, I initiated several field tests to assess male responses to hidden and visible females.

In each trial, a test male was placed 10-40 cm from a hidden female. Females were obscured from the male by either hiding the female under a thin layer of dead grass or

leaves (n=21), by creating a straight wall of either bark, cardboard or twigs and leaves (n=32), or by employing a collapsible, I-shaped barrier (n=22) (Figure 1).

Figure 1. I-shaped visual barrier; 12cm high; 36cm long.

Between 1997 and 2001, 75 trials were run using 23 males and 20 females. The tests were conducted between 6am and 7pm and between May and October to minimize daily or seasonal effects on male's behavior.

Observations and videotaping were done by either remote control or by a single individual (1) standing, unhidden about 3 m from turtles, (2) hiding on the ground behind shrubbery with binoculars; or (3) in a tree blind 7 m from the turtles recording behavior through a peep hole with a video camera.

In only one trial did a male ever walk to the visual barrier and climb over it to find the concealed female. In this case the female had been rummaging in the dried leaves comprising the barrier. This rustling sound, just 10 cm from the male's face, appeared to attract the male's attention. His approach to the barrier was not the typical erratic, energized movement pattern seen when a male recognizes the presence of a female; only after climbing over the leaves and seeing the female did he display the characteristic movements. In the other 74 trials, the males sat in place, generally four to ten min (maximum 25 min.) before walking away.

As soon as the male started to walk away, the barrier was removed and the male's reaction to the visible female recorded (Table 1). When the females remained motionless (n=35), the males approached and courted 62.9 % of the time. When the females were already moving when the barriers were removed (n=16), the males approached and courted the females in 75 % of the cases. In two of the cases where the male did not court the female, the male looked at the female and took a step or two toward her, but then veered off and departed; in the other two cases, the male simply ignored the females and left. In 24 of the trials, the female initially remained motionless, but then started to move around. In 87.5 % of those cases, the males approached and courted the female after she started to move. In the 3 cases where the males did not approach, the males had already walked over a meter away from the female before she started to move. At such a distance, the line-of-sight for the departing males was partially obscured by grass or other ground cover.

Most courting males seemed uninhibited by our presence, but some of the more timid would cease courtship and depart the area if we approached. The tests introduced unknown variables that might disturb some animals more than others. For example: Does handling a male to set up the trial cause stress which overrides the male's normal detection of, and response to, females? Does handling a female cause stress that might inhibit release of pheromonal or other attractants?

Non-handled males, observed incidentally in their habitat, showed the same generalized behavioral pattern as experimental males (namely, males walking past motionless or hidden females, but then moving to the females after a visual barrier is eliminated). Experimental handling, therefore, did not seem to greatly distort behavior.

To assess the possibility that moving a female to the test site might have inhibited the release of some signal needed to attract males, or that moving a male to the test site might override his ability to detect a sex attractant or other signal from a hidden female, I varied which subject was moved the short distance to the trial site. Courtship occurred (after the visual barrier was removed) in 73% of 22 trials where only the female was relocated; in 71% of 31 trials where only the male was relocated; and in 77% of the 22 trials where both subjects were relocated. Therefore, relocation had no effect on the outcome.

To assess whether, by chance, I might be setting males on a side of the barrier away from which they happened to have an innate (or acquired) inclination to turn, I ran retrials of 12 males wherein, once the male turned away from the barrier but then returned and approached (and courted) the female after she became visible, the barrier was reestablished on the opposite side of the female, the male replaced on the opposite side of the barrier, and then retested. As usual, regardless of the side of the barrier, the males did not approach females when they were out of view, but generally did approach them when the visual barrier was lifted.

Table 1. Most males approached and courted the females after removal of the visual barrier.

| Female's Behavior after Removal of Barrier | Male's Behavior toward Female after Barrier is Removed | | Total |
|---|---|---|---|
| | Approach & Court | Did Not Approach | |
| Motionless | 22 | 13 | 35 |
| Moving | 12 | 4 | 16 |
| Initially Still, then Moving | 21 | 3 | 24 |
| Total | 55 | 20 | 75 |

**Movement v. Sex in Attracting Males**

During our early years of fieldwork I observed a male chase down and court a moving male that had just been carried to the area. The courting male failed to notice or approach a nearby motionless female even after he gave up courting the closed male. It appeared that movement was an important factor in attracting the suitor. Male-male courtship has been reported among box turtles (e.g., Ewing, 1935; Boice, 1970; Ernst and Barbour, 1989). We often find that when a male courts another male, the male being courted closes up, and the suitor eventually leaves when he gets no response. However, if the male being courted fails to close up, and turns to confront the suitor, the courtship often turns into a fight (e.g. see Belzer 1999d). I conducted various experiments to begin to evaluate the importance of movement versus sexual cues in attracting a male and eliciting courtship behavior.

**Experiment 2: Choice between a Hidden Male and Female**

I conducted 18 trials to see whom a test male would approach when he had a choice between a hidden male and a hidden female. For these trials, a male and female were each carried to the test male's location, and placed anterior to, and equidistant from, the untouched test male. Small piles of leaves and dried grass were placed atop the introduced males and females to obscure them from the test male's view. The arrangement formed an equilateral triangle (sides of approximately 40 cm) of three turtles, all facing the same compass bearing, with the test male at the posterior vertex facing forward along a midline between the two anterior, hidden animals. Movement and visibility proved to be important in attracting a test male.

When the concealed male moved and became visible, the test male approached and began to court him (n=6). When the female moved, she was courted (n=4). When neither concealed turtle moved, the test male departed the area (n=8) walking either between the two hidden animals (n=3) or angling off and walking by the hidden female (n=2) or the hidden male (n=3) with no apparent notice of the hidden animals. When a turtle did move and emerge from cover, one always emerged before the other, thus the test male had a clear choice of one moving animal.

**Possible Close-Range Signals In Courtship**

Courtship of a male was often abandoned much sooner than courtship of a female. This fact, plus the observation that "sniffing" along the marginals (particularly posterior marginals) is often a prelude to courtship (Ernst, 1981; Belzer, unpublished), may suggest that at close range, some olfactory (or tactile) cues might promote continued courtship. But such hypothesized cues do not appear necessary to initiate courtship, because we have often seen males (particularly the more aggressive ones) immediately climb atop a female's (or male's) carapace and begin advanced phases of courtship (snapping at the anterior marginal scutes while balancing atop the carapace) without ever probing the tail or marginals.

**Experiment 3: Courting a Moving Bone Fragment**

Relevant to the suggestion of possible olfactory cues extending courtship once it has begun, I tested males' reactions to "decoy" females. I conducted 18 trials where I tested different males responses to a nearly complete skeletal carapace (n=6), a wooden decoy (n=6) and a plastic decoy (n=6) (Figure 2).

Figure 2. Wood, skeletal, and plastic decoys used to attract males.

In two cases I lured more aggressive males to chase after and court the empty carapace being maneuvered from above by a line and pole. The bony fragment was mounted on a piece of Plexiglas with leaves attached to its perimeter to substitute for the missing plastron. In each case, the male would pursue and climb upon the shell as long as I continued to keep it moving. When I stopped moving the shell, the male would pause, shift down to the side of the carapace, probe the marginals with his nose, and then begin to walk away. If I immediately started to move the shell again, the departing male would turn, chase after and climb back atop it, but then abandon the carapace once again as soon as I stopped moving it.

The carapace used in my tests was a nearly complete (pieces of marginal bones chewed off, and holes chewed through two pleural) skeletal assemblage that I had collected in 1958 at a 400 ha, southeastern Pennsylvanian summer camp that (then, but not now) had a dense box turtle population. I found its anterior end slightly protruding from the soil. Most of the carapacial bones were deeply weathered and soil-stained. This still-articulated assemblage had long been completely devoid of scutes, ligaments or tissue before I found it, and no other parts of the skeleton remained nearby. During the four decades after being removed from the soil, this specimen sat on bureaus in my various residences. It is highly unlikely that it contains any olfactory sex attractants (and plastic or wood models would not likely emit any sex attractants), yet movement of such decoys did initiate the first steps of courtship by some males.

I was able to stimulate five of the 18 males to pursue (for 15 minutes) the plastic and wood decoys being moved in circles around a rock or log by fish line. However, none of the males ever climbed atop these decoys. In general the

males would pursue the decoys with their neck fully extended and close to the ground, as if to sniff at its rear. In one of the decoy trials, another male happened to walk past the test male; the test male immediately turned his attention to the real turtle, pursued him, and began to probe at his marginals and sniff, and then climb atop his carapace and began to court. Thus, although decoys might elicit some prelude to courtship, test males could obviously distinguish a decoy from a real turtle.

In contrast to their behavior with the empty carapace, males do not immediately abandon courtship of a living female when she closes up in her shell. They may continue the courtship for over an hour, even if the female remains closed and motionless, but eventually the males abandon a closed up female. If the male sees the female open up again and move, he will often return to pursue and court again (Belzer unpublished). This same behavior pattern was observed among males in a native Delaware population (H. Niederriter, pers. comm.)

Thus, while vision and movement seem very important for getting mates together, other very close range, (olfactory?) cues seem to play some final role in promoting courtship in this species once individuals have found one another.

**Olfaction**

While there is evidence for close-range chemosensory behavioral cues in some chelonians (e.g. Rose, 1969; Owens *et al.*, 1982; Halpern, 1992; Halpern and Holtzman, 1993), there is little evidence to suggest much role in longer range behaviors (Lutz & Musick, 1997; Halpern, 1992). Describing eastern box turtle behavior, Allard (1948) remarked: "The writer has never been able to demonstrate with satisfactory conclusiveness that the box turtle possesses a sense of smell which will advise it of distant objects, although there is some evidence that particular individuals may appreciate odors when in near contact with a substance."

Even at close range, Auffenberg (1965) reported that in some species of G*eochelone* (where olfaction demonstrably initiates copulatory attempts) the first phase of sex discrimination is entirely visual (with sexually active males challenging any tortoise-sized moving object).

My evidence argues that visual cues are critical in getting *Terrapene* mates together. This view is similar to that for *Chrysemys picta* by Vogt (1979) and Halpern (1992) where "...in the absence of visual and tactile cues, traps with males are equally likely to attract males as are traps with females. These results have been interpreted to suggest that female pheromone, if present, is not capable of attracting males at a distance but requires direct contact".

**Experiment 4: Pairs (and even Large Aggregations) of Concealed Females Fail to Attract Males**

To further assess the possibility that olfaction might play some role in getting mates together, we conducted five trials in which two females (to intensify any olfactory cues) were placed inside a cylindrical, 60 cm diameter corral made of thick, opaque, blue cotton cloth fastened to a circular wire frame 60 cm tall. A thin nylon cord was fastened to the frame and threaded through a pulley on an overhanging tree limb, so that an observer hidden in a blind in a different tree could pull the line to tilt the corral up and expose the interior. In each test, a male was placed outside the corral, his behavior observed, and then the corral lifted before he abandoned the area. This was done first with the corral empty and then repeated with two females placed in the corral.

In all five cases, the males eventually walked away from the corral when it was empty. When it was lifted to reveal the empty interior, one male looked back when attracted by the motion, but then continued to walk away from the area; a second male took no note of the movement and proceeded to walk away; a third male was frightened by the movement and closed his shell before eventually resuming his exodus; and the other two males interrupted their exodus and returned to explore the apparatus when it was lifted, before proceeding to abandon the site.

When two females were inside the opaque corral, the males behaved in the same way. They displayed no attraction to it; none approached or probed its edges, nor remained near it for an extended time. In one case, as the male was departing, one of the enclosed females climbed up and over the rim before the corral was raised. The thump she made when falling to the ground outside the corral attracted the departing male's attention. He turned back, returned, chased her down and began to court. In the other four cases, at least one female walked out of the corral when it was raised. This attracted the departing male's attention and he returned to court. In one of those cases, when the male was courting the first female to emerge, he abandoned her tightly closed shell to chase after the second one when she emerged.

Thus, even when two females are close at hand, males seem unaware of them unless the females are visible. These observations help explain why if I took a female from a courting male, and hid her in a box 2.5 m away, the male would continue rummaging for up to 20 minutes where he had last seen her, in a seemingly confused pattern (intermittently pausing, looking around, walking in tight circles, probing the soil, walking away a few steps and then doubling back, etc). In only one case did the male home in on the box and that was when the female was vigorously scratching to get out. In that case, he walked completely around the box once and then returned to where he had last seen the female and resumed his rummaging in the leaves and soil.

Even stronger evidence for the importance of close range visual, and the lack of distant, cues in enabling males to find females comes from seven consecutive years (1995 - 2001) when most or all females in the habitat were confined (6-8 weeks) to a pen located in the core of the 80 ha McKeever Environmental Center preserve. The pen is a 900 $m^2$ area enclosed by a one-meter tall opaque black silt-fence fabric constructed on a south-facing slope. A stream passes by 25 m to the south (lower end) of the fence, and a wetland encompasses the southern end of the pen and adjacent

habitat. The pen was used for studies of nesting behavior and nest-site selection for six to eight weeks each June and July. A defacto test of male behavior occurred each year because all males remained at-large in the surrounding habitat, so their movements before, during, and after females were concentrated in the pen could be compared. Even when ALL females from the habitat are in the pen, the males do not converge on the area nor change their movement patterns. These data are now being prepared for future publication. We also had the opportunity to telemeter the one native male turtle found in the region (in contiguous woods about 1400 m from our research population) and follow his movements for one year. During that year, he too failed to gravitate toward the females inside the McKeever preserve.

Certainly, if free-ranging males could detect females at distances, they would have been attracted to the females' pen. That these males, who appeared oblivious of such large concentrations of females, had a strong mating proclivity was demonstrated by periodically carrying one to the pen and placing him inside, at which point he promptly moved to, courted, and often copulated with, the first female he saw (Belzer 1999d).

**Discussion on Finding Mates**

Courtship behavior can vary among male eastern box turtles. For example, males often prod and "sniff" another turtle before mounting to begin courtship, but some do not. A few of our males pursue a female in a lock-step pattern (taking steps only when she steps, and halting when she halts). One male climbed atop and began to court a male who had already mounted a female and was courting her (Sue Seibert - pers. comm.). Some males refuse to court when a human observer is nearby, but have been discovered copulating and so obviously do court females when not under observation. Some males will court an unresponsive female for over an hour whereas others will abandon the effort after 15 minutes. Despite behavioral idiosyncrasies in the hundreds of courtships we observed, and despite variations in our method of observing and testing the turtles' responses to each other, a common behavioral denominator emerged: males don't move to concealed females, even when close to them. It was only when females became visible that males moved to them and began to court. In many cases, not only visibility, but also movement by the female, was required to elicit approach by the male.

The generality of this finding among our males is remarkable in that the displaced males were donated from many different parts of Pennsylvania (Belzer, 1999b). The behavior can therefore not be dismissed as the genetic peculiarity of a particular deem. And it can't be dismissed as a behavioral artifact caused by lack of a home range because some of these males had reestablished stable home ranges in their new habitat years previously (see Belzer 1999b). Moreover, the same behavioral requirement (for a male to see a female before approaching to court) was seen when I repeated several tests with the one native male who resides near our research site. Tests similar to ours are being planned for native box turtle populations in Delaware (Jacob Bowman, pers. comm.).

Our findings show that male eastern box turtles cannot find females who are not close enough to be seen or heard. In self-sustaining populations, the close contacts needed to initiate a male's recognition of a female's presence (and consequent courtship) are probably matters of chance encounters, the likelihood of which is improved by knowledge of where females had been found in the past within his home range. This view of box turtle behavior is consistent with Stickel's (1989) failure to observe mating between box turtles that did not share overlapping home ranges within their habitat.

Such a basis for reproductive behavior has an important conservation implication: if pet collecting, vehicular traffic, etc. thin native populations, then reproductive activity diminishes. Dense adult populations must be conserved wherever they still remain since chelonian population losses are not compensated by increased reproduction or faster maturation (Brooks, 1997).

**Population Density and Recruitment**

Although female box turtles may retain viable sperm for years (Gist and Jones, 1987), the proportion of infertile eggs increases as access to males declines (Halgren-Scaffidi, 1986; Dodd, 2001). That observation on egg fertility is consistent with the evidence that while turtle sperm may deteriorate little over periods of weeks or months during their storage in male or female ducts (Gist, *et al*., 2001), their fertilizing ability may deteriorate over longer periods during retention in the female reproductive tract (Hildebrand, 1929; Gist and Congdon, 1998; Gist *et al*., 2000; Gist, 2002 pers. comm.). Some box turtle clutches are completely infertile (Ernst *et al.*, 1994). Even when females have frequent encounters with males, 20% or more of their eggs may be infertile (Allard, 1935; Ernst *et al*., 1994). That incidence of infertile eggs among females with continuous access to males matches our observations at the Buttermilk Hill Nature Sanctuary during 1999 and 2000. A group of six females had been confined with nine males in a 1.2 ha area. They produced 18 eggs with four showing no signs of development.

Besides improving fertility, high adult population density fosters multiple copulation and multiple paternity, important for sustaining a deem's adaptability (Halgren-Scafidi, 1986; Mrosovsky *et al.*, 1995; Lovich, 1996; Rovero *et al*., 1999).

**Embryonic Development and Recruitment**

Juvenile recruitment is precarious because of the small clutch size (mean=4 eggs) (e.g. Harless and Morlock, 1979; Ernst *et al*., 1994; Dodd, 2001). Compounding the contribution of small clutches to poor recruitment is the frequent failure of eggs to survive or develop in the field (Zeiller, 1994). Predation destroys many (e.g., Madden, 1975; Ernst *et al*., 1994; Dodd, 2001) and sometimes all nests (Karen Kovalchick, pers. comm.; Belzer *et al*., unpublished). When

clutches escape predation, embryonic development is often terminated by climatic stresses (Halgren-Scaffidi, 1986; Zeiller, 1994; Tucker *et al*., 1997; Tucker and Packard, 1998).

In our experience with 42 clutches (mean clutch=4 eggs; range = 1-7 eggs), at the McKeever Environmental Learning Preserve between 1995 and 2001, only six of 30 eggs left in-situ and successfully protected against predation by screen barriers, initiated embryonic development. The actual development among those nests would doubtless have been less because during the extended droughts of some seasons, we watered selected nests to assess the developmental toll from soil desiccation. Only 8% of eggs among the in-situ nests that were not watered during droughts showed embryonic development. This lower figure agrees with Don Zeiller's (1994) assessment of the dismal prospects for in-situ box turtle nests.

In contrast, 91 eggs developed among 123 eggs that were moved to incubators at either 75°F or 85°F, and 96-98%rh, in a medium of 1.7:1 (wt:wt) water:vermiculite.

This picture of the poor prospects for in-situ eggs was reflected in another small study (Belzer, Seibert, Atkinson, unpublished), in which eggs from each of six clutches were divided between artificial and in-situ incubation to serve as matched pairs. Development among eggs left in the soil was 17% (but zero if we exclude the eggs from nests artificially watered during droughts). Development occurred in 70% of the artificially incubated eggs.

**Hatchling Survival and Recruitment**

When eggs escape predation, and are fortunate enough to encounter environmental conditions that enable their development, the resulting juveniles have a poor prospect of surviving the eight to 10 years needed to develop shells durable enough to withstand predator attacks (Madden, 1975; Ernst *et al*., 1994; Dodd, 2001; Belzer *et al*., 2002). Our findings on the poor prospects for box turtle eggs and juveniles are in agreement with the low recruitment found in studies of native populations (e.g., Doroff & Keith, 1990; Klemens, 1989 & 2000). Survivorship does not reach that of adults till juveniles reach about 250-300g (Yahner, 1974; Murphy, 1976)

**Concluding Remarks**

A species with the low recruitment capacity of the eastern box turtle cannot easily rebound from population losses. Study of a relatively dense Maryland box turtle population (25/ha during the 1940's) in the vast Patuxent Wildlife Refuge (Hall *et al*., 1999), has seen a continuous decline in density (down to 6/ha by the 1990's) and, so far, an inability to recover from its mid-century population losses to floods. In contrast to this well buffered population in Patuxent's 4,800 ha preserve, consider the condition of most contemporary box turtle populations whose densities are much lower and are annually decimated by the consequences of habitat fragmentation and human intrusion. If a population's density is already diminished, rebounds from even small losses can become impossible (Williams & Parker, 1987). In a 10-year study of recruitment in the Dunlap Hollow box turtle population of Wisconsin, after its historically high density had fallen to 3/ha, the population was found to be unable to sustain loss of even one adult per year for the deem to avoid extinction (Doroff & Keith, 1990; Klemens, 2000). With annual population losses (to winter kill and other natural events) of 7% to 20% (Yahner, 1974; Williams & Parker, 1987; Grobman, 1990), let alone added losses to legal or illegal pet collection, many destabilized contemporary populations of box turtles have undoubtedly already passed their threshold to gradual extinction (cf. Holly Niederriter, 2000). Similarly, studies of alligator snapping turtle population dynamics indicate that 98% adult survivorship is needed to avoid eventual (if gradual) extirpation (Reed *et al*., 2002). This high survivorship requirement for the alligator snapping turtle is virtually identical to that for the Dunlop Hollow, WI box turtle population. Very small losses (just one or two extra adults each year) can result in a gradual (but inexorable) decline toward extirpation (Doroff & Keith, 1990; Reed *et al*., 2002), which is imperceptible in the short term.

The literature on declining box turtle populations suggests to me that a self-sustaining population may need adult densities of more than 25/ha in order to achieve sufficient reproductive activity to rebound from events that thin the population (e.g., Carpenter, 1957; Williams, 1961; Adler, 1970; Murphy, 1976; Stickel, 1978; Davis, 1981; Schwartz *et al*., 1984; Halgren-Scaffidi, 1986; Williams & Parker, 1987; Doroff & Keith, 1990; McCollough, 1997; Tyning, 1997; Hall *et al*., 1999; Niederriter, 2000; Julie Miller, 2000). Many existing box turtle populations lack such densities, and their critical instability, and gradual declines, generally go unnoticed (e.g., Williams, 1961; Murphy, 1976; Stickel, 1978 & 1989; Davis, 1981; Schwartz *et al*., 1984; Halgren-Scaffidi, 1986; Williams & Parker, 1987; Doroff & Keith, 1990; McCollough, 1997; Tyning, 1997; Hall *et al*., 1999; Quinlan *et al*., 1999; Niederriter, 2000; Julie Miller, 2000).

The centenarian longevity of adult box turtles (Graham & Hutchison, 1969; Murphy, 1976; Stickel 1978; Miller, 2001) enables geriatric remnants of a doomed population to persist for many decades and thereby mask a critical insufficiency of juvenile recruitment (Klemens 1989, 1997, and 2000). Reviewing 25 years of study of a native box turtle population at the University of Delaware, Holly Niederriter (pers. comm., 1999) remarked: "The perception during the 1970's and even during the early 1980's was that this population was a healthy one. Surely, finding 30 turtles on a 14.8 ha site would not cause most biologists to be alarmed, but now it is clear that this population was declining even when many turtles were still being found." At the American Fisheries Society 1999 Symposium on the conservation of long-lived species, D. Crouse (1999) noted critical management lapses for species like this: "Long lived species are particularly vulnerable because the very longevity of older individuals introduces a delay in management response... this matter of perception (makes)

this a serious problem... persistent older stages mask declines in (juvenile) recruitment until the problem is well advanced making recovery even more difficult."

Remarkably, when box turtle populations have been studied long enough, previously unnoticed declines have become apparent. What we often regarded as "good numbers" in box turtle density, and indicative of population stability, were revealed as deficient only after generations of study. Inferences from the densities of most contemporary box turtle populations may make the notion of normal densities of over 25/ha seem incredible, but such densities were commonplace a century ago, and in some places regarded a "nuisance", but they have largely disappeared today (e.g. Murphy, 1976; cf. Breisch, 1997 and McCullough, 1997). In insular regions, dense populations can still be found (e.g., Dodd *et al*., 1994). I have personally known only two populations with densities over 25/ha (one in a 400 ha summer camp in SE PA, which was surrounded by thousands of hectares of woodland and farms during the 1960's, and one on a 15 ha knoll in SW MO bounded by hundreds of hectares of woodland, golf course and farmland during the 1970's). Although those populations still persist some three and four decades later, the present densities are nothing like they once were and their former undeveloped habitat buffers are much smaller or gone.

The published studies on native populations noted in this paper reveal that densities which many would regard as normal and adequate for long term population stability, have turned out (in hind sight) to be too low to enable rebound from losses, and the time for intervention (to try to slow the population's inevitable demise) was passed decades before. This emerging insight from studies of living populations is confirmed by archaeological findings. The Iroquois in western New York used box turtles for a variety of purposes. Box turtle numbers were eventually depleted, so the Iroquois had to switch to snapping turtles instead (Adler, 1970). Now, with more than 200 yrs to recover in the persistent (and remote, extensive) habitat of those western NY locales, box turtle populations have not returned.

With box turtle populations becoming even more fragmented, and recruitment declining, measures are needed to save extant deems. We have completed the first nine years of tests on the feasibility of using donated, homeless adult eastern box turtles to establish a self-sustaining, resident population inside preserves where ancestral populations had been completely extirpated (e.g. Belzer 1999b, 1999c, and unpublished data). These turtles included wild caught pets and otherwise displaced individuals whose natal Pennsylvania homes were unknown (Belzer, 1996 and 1999b). We now know that despite many consecutive years of intensive day-to-day monitoring, and retrieval when animals move out of the preserve, well over 60% of the displaced turtles failed to establish new home ranges within the confines of the 80 ha McKeever preserve. A complete picture from our initiation of similar studies at the much larger Buttermilk Hill Nature Sanctuary will not be known for many years but in our first year of work we already found that translocated box turtles will abandon even this 200 ha preserve. This reflects Bob Cook's (1996) finding of high emigration from a 400 ha preserve at New York's Gateway National Recreation area. It is clear that the costs for this approach to repatriation is prohibitive and fails to create a population density that would enable long-term survival of any established population. My pessimistic conclusion concerning the futility of using adult animals to rebuild declining or lost box turtle populations was echoed by a repatriation study in the Albany Pine Bush Preserve of NY (Kallaji, 1998; 1999 pers. comm.). Repatriation often fails and is widely regarded as a dubious conservation tool for many species (Reinert, 1991; Dodd and Siegel, 1991; Reinert and Rupert, 1999). Existing knowledge on density decline and ineffective remedial options already warns that the immediate lesson we need to learn is that populations need strong protection while their densities are high; this species is poor at recovering from losses.

Even as we continue to study the behavior of our relatively few adults who seem to have developed home ranges following relocation, we are initiating an assessment of the possible utility of headstarted juveniles as a repatriation tool that might at least slow population declines (Belzer, et al 2002). Although a strategy with poor prospects (Taubes, 1992; Heppell *et al*., 1996; Morafka *et al*., 1997), headstarting sometimes is productive (Shaver, 1996) and needs to be evaluated for box turtles since no alternative may remain for trying to reverse this species' declining numbers.

The growing understanding of the peculiar and precarious population dynamics of long lived species with low reproductive potential, like *Terrapene*, should serve as notice to management agencies for the need to launch immediate, aggressive, proactive conservation policies to protect adults. Trying to increase numbers of eggs and hatchlings (to compensate for losses of adults) will not work since the younger stages are almost all lost.

"Many species replace their population losses by producing numerous offspring who mature early to offset low survivorship; others produce a few offspring invested with high survival prospects. Box (and many other) turtles are different: maturity isn't reached till age 10 or so; a female lays few if any eggs each year; eggs & hatchlings rarely survive. How can adults sustain a population?... By staying in the habitat a long time (e.g.70-80 yrs) … Removing adults strikes at the heart of this population mechanism... (Belzer, 2000)." A female box turtle can produce eggs as long as she lives (Miller, 2001); and probably needs those eight or more decades of egg production to leave an adult replacement in her population.

The traditional management approach of waiting till adult population declines are obvious before exercising aggressive conservation measures for a species is a dead end strategy for eastern box turtles and species like it; by the time adult population declines are significant, it is too late. Barry Yoeman (2002) recently highlighted the common disconnect in chelonian management: "There's a reason wildlife managers haven't thought in those terms: Most of

the animals we try to protect such as deer, rabbits, and quail, are relatively short-lived (and produce numerous viable young)". His remarks echo insights published by Congdon *et al*. (1993), and the alert issued to wildlife managers (quoted above in these concluding comments) by Deborah Crouse (1999). In long-lived species like *Terrapene*, the key to population stability is retaining aged adults in the habitat for their full, long lives (e.g., Congdon *et al*., 1993; Crouse, 1999; Musick, 1999; Miller, 2001; Yeoman, 2002). As summarized by Ron Nussbaum (in Yeoman, 2002): "... what would a conservationist do with this information? Well, you would make sure the adults survive..."

My findings on *Terrapene* behavior illustrate that failing to protect adult densities undermines even the very first steps (mating encounters) needed for any hope of progressing to that rare event of a new adult's recruitment into an aging population.

**Acknowledgements**

The magnitude of these studies would have been impossible without the help and advice of many people. I am deeply grateful to them all. Some major benefactors were: Susan Seibert, Ben Atkinson, Maggie Byrne, Ann Davis, Peter Jenkins, Kathie Goodblood, and Monica Held for grueling nighttime vigils to determine which females are nesting and to mark or protect nest sites; Mimi Halpern for leads into the literature on chelonian chemoreception; Julie Miller for leads into the literature on the population dynamics of long-lived species; Robert Cook and Howard Reinert for advice on the ecological issues associated with repatriation studies; Kelly Seibert & Shawn Wigle for remote videotaping; The McKeever Environmental Learning Center and Jerry Stanley & Kathie Goodblood of the Buttermilk Hill Nature Sanctuary for permission to conduct our field studies within their preserves; Mike Kallaji for sharing unpublished data; Ed Belzer for advice on experimental controls; and Heather Kalb for editorial improvements in the submitted manuscript. Some of the funding for this work came from a Clarion University Foundation Projects Grant and from two summer sabbatical awards granted by Clarion University of Pennsylvania.

**Literature Cited**

Ackerman, L. 1997. The Biology, Husbandry and Health Care of Reptiles Volume I: The Biology of Reptiles. T.F.H. Publications, Neptune City, NJ. 382 pp.

Adler, K. 1970. The influence of prehistoric man on the distribution of the box turtle. Ann Carnegie Mus 41(9):263-280.

Allard, H.A. 1935. The natural history of the box turtle. The Scientific Monthly 41:325-338.

Allard, H.A. 1948. The eastern box turtle and its behavior. J. Tenn Acad Sci. 23:307-321.

Auffenberg, W. 1965. Sex and species discrimination in two sympatric South American tortoises. Copeia 1965(3): 335-342.

Belzer, B. 1996. Box turtle repatriation in Northwestern Pennsylvania. Box Turtle Research & Conservation Newsletter 4:12-13.

Belzer, B. 1999a. Survival among translocated eastern box turtles. Box Turtle Research & Conservation Newsletter 8:7-8.

Belzer, B. 1999b. Home range establishment by translocated eastern box turtles. Box Turtle Research & Conservation Newsletter 8:3-7.

Belzer, B. 1999c. Repatriation criteria. Box Turtle Research & Conservation Newsletter 8:2-3.

Belzer, B. 1999d. Eastern box turtle aggression. Box Turtle Research & Conservation Newsletter 8:13-14.

Belzer, B, and M.B. Steisslinger. 1999. The box turtle: Room with a view on species decline. The Amer Biol Teacher 61(7):510-513.

Belzer, W. 2000. Comments by Dr. W. Belzer commending a ban on box turtle collecting submitted to PA Fish and Boat Commission Herpetology Advisory Committee Meeting, May 15, 2000.

Belzer, W.R., S.Seibert, and B. Atkinson. 2002. Putative chipmunk predation of juvenile eastern box turtles. Turtle and Tortoise Newsletter. 5:8-9.

Boice, R. 1970. Competitive feeding behaviors in captive *Terrapene c. carolina*. Animal Behav 18:703-710.

Boiko, V. 1984. The participation of chemoreception in the organization of reproductive behavior in *Emys orbicularis* (Testudines, Emydidae). Zool Zh 63:584-589.

Breich,A. 1997. The status and management of turtles in New York. (editor) T.F. Tyning , Status and Conservation of Turtles in the Northeastern United States. Mass Audubon Society. Serpent's Tale publishing Lanesboro, MN. p.11-14.

Brooks,R.J. 1997. Dynamics of a northern population of snapping turtles: How can long-lived species be conserved?" (editor) T.F.Tyning, Status and Conservation of Turtles in the Northeastern United States. Mass Audubon Society. Serpent's Tale publishing Lanesboro, MN. p.31-33

Carpenter, C.C. 1957. Hibernation, hibernacula and associated behavior of the three-toed box turtle (*Terrapene carolina triunguis*). Copeia 1957:278-282.

Cook, R.P. 1996. Movement and ecology of Eastern box turtles repatriated to human habitat" Box Turtle Research & Conservation Newsletter 5:8.

Congdon, J.P., A.E. Dunham, and R.C. Van Loben Sels. 1993. Delayed sexual maturity and demographics of Blanding's turtles (*Emydoidea blandingii*): Implications for conservation and management of long-lived organisms. Conservation Biology 7(4):826-833.

Crouse. D.T. 1999. The consequences of delayed maturity in a human-dominated world. (ed) A. Musick, Life in the Slow Lane: Ecology and Conservation of Long-lived Marine Animals. Amer. Fish. Soc. Symposium #23, American Fisheries Society, Bethesda, MD. p.195-202.

Davis, M. 1981. Aspects of social and spatial experience of eastern box turtles, *Terrapene carolina carolina*." Ph.D. diss. University of Tennessee, Knoxville.

Dodd, C.K., Jr. 2001. North American Box Turtles: A Natural History. Univ of Oklahoma Press, Norman, OK. 1231 pp.

Dodd, C.K., Jr and R. Siegel. 1991. Relocation, repatriation, and translocation of amphibians and reptiles: Are they conservation strategies that work? Herpetologica 47:336-350.

Dodd, C.K., Jr., and R. Franz. 1993. The need for status information on common herpetofaunal species. Herp Rev 24:47-50.

Dodd, C.K., Jr, R. Franz, and L.L. Smith. 1994. Activity patterns and habitat use of box turtles (*Terrapene carolina bauri*) on a Florida island, with recommendations for management. Chel Conservn Biol 1(2):97-106.

Doroff, A.M. & L.B. Keith. 1990. Demography and ecology of an ornate box turtle (*T. ornata*) population in south-central Wisconsin." Copeia 1990: 387-399.

Ernst, C.H. 1981. Courtship behavior of male *Terrapene carolina major* (Reptilia, Testudines, Emydidae) Herp Rev 12(1):7-8.

Ernst, C.H. and R.W. Barbour. 1989. Turtles of the World. Smithsonian Inst Press, Wash, D.C. 313 pp.

Ernst. C.H., J.E. Lovich, and R.W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Inst Press, Wash DC.

Ewing, H.E. 1935. Further notes on the reproduction of the eastern box turtle, *Terrapene carolina* (Linne). Copeia 1935:102.

Gist, D.H. and J.M. Jones. 1987. Storage of sperm in the reptilian oviduct. Scanning Microscopy 1:1839-1849.

Gist, D.H. and J.D. Congdon. 1998. Oviductal sperm storage as a reproductive tactic of turtles. J Exp Zool 282:526-534.

Gist, D.H., T.W. Turner, and J.D. Congdon. 2000. Chemical and thermal effects on the viability and motility of spermatozoa from the turtle epididymis. J. Reproduction and Fertility 119:271-277.

Gist, D.H., S.M. Dawes, T.W. Turner, S. Sheldon, and J.D. Congdon. 2000. Sperm storage in turtles: a male perspective. J. Exp Zool 292:180-186.

Graham, T.E. and V.H. Hutchison. 1969. Centenarian box turtles. International Turtle and Tortoise Society Journal 3:25-29.

Grobman, A.B. 1990. The effect of soil temperature on emergence from hibernation of Terrapene carolina carolina. Amer Midland Naturalist 124:366-371.

Halgren-Scaffidi, L. 1986. Habitat, home range and population study of the eastern box turtle (*Terrapene carolina*). MS thesis, Univ Maryland, College Park, MD.

Hall, R.J., P.F.P. Henry, and C.M. Bunck. 1999. Fifty-year trends in a box turtle population in Maryland. Biol Conserv 88:165-172.

Halpern, M. 1992. Nasal chemical senses in reptiles: Structure and function. (editors) C. Gans and D. Crews, Biology of Reptilia. Univ of Chicago Press, Chicago, IL. p.423-523.

Halpern, M. and D. Holtzman. 1993. Chemosensing and Chemosignaling in Reptiles: Proceedings of a satellite conference on 'Reptilian Chemical Senses and Signals'. Brain, Behavior and Evolution Vol 41(no's 3-5). Karger, Basel, Switzerland.

Harless, M. and H. Morlock. 1989. Turtles: Perspectives and Research. Robert E. Krieger Publishing Co. Malbar, Florida. 695 pp.

Heppell, S.S., L.B. Crowder, and D.T. Crouse. 1996. Models to evaluate headstarting as a management tool for long-lived turtles. Ecol. Appl. 6(2):556-565.

Hildebrand, S.F. 1929. Review of experiments on artificial culture of diamond back terrapins. Bull U.S.Bureau of Fisheries 45:25-70.

Kallaji, M. 1998. Albany pine bush eastern box turtle experimental release project - Interim Report. New York State Department of Environmental Conservation, Endangered Species Unit. Delmar, New York. 11 pp.

Klemens, M.W. 1989. The methodology of conservation. (editors) R. Swingland and M.W. Klemens, The Conservation Biology of Tortoises. IUCN Species Survival Commission, no.5. Gland, Switzerland. p.1-4.

Klemens, M.W. 1997. Conserving *Clemmys*. (editor) T.F. Tyning, Status and Conservation of Turtles in the Northeastern United States. Mass Audubon Society. Serpent's Tale publishing Lanesboro, MN. p.23-24.

Klemens, M.W. 2000. Turtle Conservation. 334 pp. Smithsonian Inst Press, Wash, DC. p.20-21.

Lieberman, S. 1994a. Biological Data submitted in support of USFW proposal to add *Terrapene* spp. to Appendix II of the Convention on the International Trade in Endangered Species. S. Lieberman. Chief of the Branch of Operations, Office of CITES Management Authority, U.S. Fish & Wildlife Service 4401 N. Fairfax Drive Room 432 Arlington, VA 22203.

Lieberman, S. 1994b. Can CITES save the box turtle? Endangered Species Tech Bull 19(5):16-17.

Lovich, J.E. 1996. Possible demographic and ecologic consequences of sex ratio manipulation in turtles. Chelonian Conservn & Biol 2:114-117.

Lutz, P.L., and J.A. Musick (eds). 1997. The Biology of Sea Turtles. CRC Marine Sci Series. CRC Press Boca Raton, Florida. 448 pp.

Madden, R.C. 1975. Home range, movements, and orientation in the eastern box turtle *Terrapene carolina carolina*. Ph.D. diss. City Univ of NY.

McCollough, M. 1997. Status and conservation of turtles in Maine. (editor) T.F. Tyning, Status and Conservation of Turtles in the Northeastern United States.. Mass Audubon Society. Serpent's Tale publishing Lanesboro, MN. p.7-11.

Miller, J.K. 2000. Suburban sprawl and the three-toed crawl: A demographic population study of the three-toed box turtle across 35 years of land-use change. M.S. thesis, U of Idaho. Moscow Idaho. 95 pp.

Miller, J.K. 2001. Escaping senescence: Demographic data from the three-toed box turtle (*Terrapene carolina triunguis*). Exp Gerentol 36(4-6):829-32.

Morafka, D.J., K.H. Berry and K. Spangenberg. 1997. Predator-proof field enclosures for enhancing hatching success and survivorship of juvenile tortoises: a critical evaluation. (editor) J.V. Abbema, Proceedings, Con-

servation, Restoration, and Management of Tortoises and Turtles, An International Conference. A Joint Publication of the New York Turtle and Tortoise Society and the WCS Turtle Recovery Program, NY, p.147-165.

Murphy, J. (1976) The natural history of the box turtle. Bulletin Chicago Herp Soc 11:2-47

Musick, A. 1999. Ecology and conservation of long-lived marina animals. (ed) A. Musick, Life in the Slow Lane: Ecology and Conservation of long-lived Marine Animals. American Fisheries Society Symposium #23, American Fisheries Society, Bethesda, MD. p.1-10.

Niederriter, H. 2000. Ecology of eastern box turtles (*Terrapene carolina carolina*) in an isolated forest fragment in Northern Delaware. M.S. thesis. Univ of Delaware.

Owens, D., M. Grassman, and J. Hendrickson. 1982. The imprinting hypothesis and sea turtle reproduction. Herpetologica 38:124-135.

Quinian, M., C. Swarth, and M. Marchand. 1999. Characteristics of a high-density eastern box turtle population on Maryland's costal plain. Symposium on Conservation and Ecology of Turtles of the Mid-Atlantic Region, held Oct 30 & 31, 1999 at the National Wildlife Visitor Center of the Patuxent Research Refuge, Laurel Maryland.

Reed, R.N., J. Congdon and J.W. Gibbons. 2002. The Alligator Snapping Turtle [*Macrochleys (Macroclemys) temminckii*]: A review of ecology, life history, and conservation, with demographic analyses of the sustainability to take from wild populations. A report to the Division of Scientific Authority, United States Fish and Wildlife Service. Univ of Georgia, Savannah River Ecology Lab. 17pp.

Reinert, H.K. 1991. Translocation as a conservation strategy for amphibians and reptiles: Some comments, concerns, and observations. Herpetologica 47(3):357-363.

Reinert, H.K., and R.R. Rupert, Jr. 1999. Impacts of translocation on behavior and survival of timber rattlesnakes, *Crotalus horridus*. J of Herpetology 33(1):45-61.

Rose, F.L. 1969. Tortoise chin glands fatty acid composition: behavioral significance. Comp. Biochem. Physiol. 32:577-580.

Rovero, F., M. Lebboroni, and G. Chelazzi. 1999. Aggressive interactions and mating in wild populations of the European pond turtle *Emys orbicularis*. J of Herpetology 33(2):258-263.

Schwartz, E.R., C.W. Schwartz, and A.R. Kiester. 1984. The three-toed box turtle in Central Missouri, Part II: A nineteen-year study of home range, movements and population. Missouri Dept of Conservation Terrestrial Series #12, Jefferson City, MO. 30pp.

Shaver, D,J. 1996. Head-started Kemp's ridley turtles nest in Texas. Marine Turtle Newsletter 74:5-7.

Stickel, L.F. 1978. Changes in a box turtle population during three decades. Copeia 1978:221-225.

Stickel, L. F. 1989. Home range behavior among box turtles (*Terrapene c. carolina*) of a bottomland forest in Maryland. J. Herpetol. 23:40-44.

Taubes, G. 1992. A dubious battle to save the Kemp's ridley sea turtle. Science:256:614-616.

Tucker, J.K., F.J. Janzen, and G.L. Paukstis. 1997. Response of embryos of the red-eared turtle (*Trachemys scripta elegans*) to experimental exposure to water-saturated substrates. Chelonian Conservation and Biology 2(3):345-351.

Tucker, J.K., and G.C. Packard. 1998. Overwinter survival by hatchling sliders (*Trachemys scripta*) in west-central Illinois. J of Herpetology 32(3):431-434.

Tyning, T. 1997. The quick decline of slow turtles." (ed) T.F.Tyning (ed), Status and Conservation of Turtles in the Northeastern United States. Mass Audubon Society. Serpent's Tale publishing Lanesboro, MN. p. X.

Vogt, R. 1979. Spring aggregating behavior of painted turtles, *Chrysemys picta* (Reptilia, Testudines, Testudinidae). J. Herpetology 13: 363-365.

Williams, E.C., Jr. 1961. A study of the box turtle, *Terrapene carolina carolina* (L), population in Allee Memorial Woods, Indiana. Indiana Acad Sci 71:399-406.

Williams, E.C., Jr and W.S. Parker. 1987. A long-term study of a box turtle (*Terrapene carolina carolina*) population at Allee Memorial Woods, Indiana, with emphasis on survivorship." Herpetologica 43:328-335.

Yahner, R.H. 1974. Weight change, survival rate and home range change in the box turtle, *Terrapene carolina*. Copeia 1974:546-548.

Yoeman. B. 2002. Can turtles live forever? Discover, June 2002:61-66.

Zeiller, D. 1994. So You Like Turtles, 88 Norman Place, Tenafly NJ 05670.

## A Note on Box Turtle Reproduction

**DAVID S. LEE**

*Tortoise Reserve, Inc., P.O. Box 7082, White Lake, NC 28337; E-mail: TorResInc@aol.com*

Robert B. Lyons of Purellville, Virginia, provided photographs and a brief written report on the following activity of a female eastern box turtle.

On the morning of 28 June 1994, Bob Lyon found a female box turtle digging a nest in his garden. She was missing her right hind leg from the knee down, yet she laid three eggs and refilled the hole. All the digging and filling was done with the left hind leg, with no apparent movements of what remained of the right leg. Two of the three eggs dropped directly into the nest hole, one egg, which could not be positioned because of the missing leg, was hung up and remained above and to the right of the nest chamber as the hole was backfilled. The entire process lasted about an hour and a half (11:00 to 12:30 AM). Once nesting was complete the female turtle walked back into the woods. She appeared to "...walk as straight as any other box turtle".

On the morning of 24 September 1994 the family dog discovered an empty egg at the surface of the ground where this turtle had nested. Bob scratched loose the dirt and an "inch or two" down found empty shells of the other two eggs. Apparently this nest was successful.

From the photos it is obvious that this turtle was old. The anterior marginals are missing and the shell damage extends into the costal and marginals. Vertebral scutes and several marginals appear to be flaking off and in a number of place the carapace bone is exposed (coastals, vertebrals and marginals). The right side of the shell is quite damaged with scutes absent from nearly 50% of the carapace. The shell appears to be long healed (shell descriptions from photos). This damage is consistent with a turtle being hit by a car. Lyon's niece recalls placing a band-aid on the right hind leg of a box turtle she had discovered in the same yard about 35 years previously. The shell was broken and the leg was nearly severed as a result of it being run over by an automobile. Could this be the same turtle? I wouldn't rule it out.

I submit this note not because of any academic merit, but because I have seen several published articles addressing concerns about egg laying in female turtles with missing limbs. In sea turtles artificial hind limbs have even been placed on females so that they could nest. The resilience of turtles and their ability to continue to contribute to the population even when severely handicapped is one of the factors that makes them so endearing.

## Gopher Tortoise Die-Off at Rock Springs Run State Reserve, Lake County, Florida

**ALI RABATSKY[1] AND BOYD BLIHOVDE[2]**

[1] *Department of Biology, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL 32816*

[2] *Wekiva Basin GEOPark, 1800 Wekiwa Circle, Apopka, Florida 32712*

The gopher tortoise, *Gopherus polyphemus*, is a prominent member of Florida's herpetofauna and plays an important role in sandhill communities. Tortoises dig extensive burrows several meters in length that are home to hundreds of commensal species such as snakes, frogs, turtles, small mammals and insects (Speake, 1981).

Upper Respiratory Tract Disease (URTD) caused by the bacteria *Mycoplasma agassizii* (Brown *et al*., 1995), has been reported in many tortoise populations and is the suspected cause of some recent large-scale die-offs in Florida. Outbreaks of URTD have been documented in captive and wild populations of the desert tortoise, *Gopherus agassizii*, and in the gopher tortoise, *Gopherus polyphemus* (Deimer-Berish *et al*., 2000). Two hypotheses may explain the presence of URTD in a tortoise population (Deimer-Berish *et al*., 2000). (1) *M. agassizii* may be a naturally occurring bacterium found in tortoises but can become pathogenic when a tortoise is stressed (caused by habitat fragmentation, diminished food resources, relocation, drought, captivity, etc.). (2) URTD may be introduced into a population when an already infected tortoise is moved to a new site (Deimer-Berish *et al*., 2000).

Symptoms of URTD include nasal and ocular discharge, conjunctivitis, palpebral edema (swollen eyelids), chitinous scarring of the shell, labored breathing, lethargy, anorexia and death (McLaughlin, 1997). An infected tortoise may show no outward symptoms and can spread the bacteria whenever it comes in contact with another tortoise. A tortoise may become re-infected once it has had the disease (McLaughlin, 1997).

In June of 2001 a project was initiated to assess the prevalence of URTD in the Wekiva Basin GEOpark in Orange, Seminole, Volusia, and Lake Counties. Included in the GEOpark are Wekiwa Springs State Park, Lower Wekiva River State Preserve, and Rock Springs Run State Reserve (RSRSR). Rock Springs (where the die-off occurred) is a 13, 710 acre Type I Wildlife Management Area. It is composed of a mixture of habitat types including sandhill, scrub, flatwood, hydric, mesic and xeric hammock, swamp and small, marshy ponds. However, the die-off occurred in well-maintained sandhill. Prescribed burning is used to maintain the quality of the habitat, although drought conditions have limited this activity since 1998.

Upon visual survey of approximately 150 acres of sandhill at RSRSR, approximately 125 dead tortoises were found between August and December 2001. Three marked tortoises were among the dead. Dead tortoises were concentrated in a central area of approximately 100 acres. Most tortoises were found plastron side up and within 5 meters of their possible burrow. A large majority were intact and bleach white, suggesting that they had been there for some time (Dodd, 1995). This population was surveyed in May of 2000 and showed no signs of mortality at that time.

Visual surveys continued from August to November 2001 in an attempt to collect tortoises to be tested for URTD. Because few tortoises were found, it was necessary to switch to bucket trapping to obtain a sufficient sample size. After collection, standard morphometric data was recorded as well as any visually obvious symptoms of URTD. Samples were sent to the University of Florida to be tested using ELISA for exposure to *M. agassizii*. Of the 22 tortoises tested, 14 (64%) tested positive for exposure to URTD and two tortoises (9%) were suspected of having been exposed to URTD.

Although the exact cause of the die-off has not been determined, many factors are being considered. Local Florida Fish and Wildlife Conservation Commission staff has reported tortoises being dropped-off at RSRSR. This could introduce individuals with URTD and infect the existing population. Strain virulence, burn history and burrow humidity may also be factors.

The occurrence of large-scale die-offs and their association with URTD has become more common in Florida in recent years (Cindy Gates, pers. comm.). Loss of suitable habitat, illegal development practices, drought conditions and a well-intending but under-informed public may be contributing factors to its prevalence. Determining the factors affecting the distribution of URTD within and among populations, its virulence and possible solutions warrant future investigation.

**Literature Cited**

Brown, D.R., Crenshaw, B.C., McLaughlin, G.S., Schumacher, I.M., McKenna, C.E., Klein, P.A., Jacobson, E.R., Brown, M.B. 1995. Taxonomy of the tortoise mycoplasmas *Mycoplasma agassizii* and *Mycoplasma testudinis* by 16S rRNA gene sequence comparisons. Intl. J. of Syst. Bacteriol. 45:348-350.

Deimer-Berish, J.E., Wendland, L.D., and Gates, C.A. 2000. Distribution and Prevalence of Upper Respiratory Tract Disease in Gopher Tortoises in Florida. J. Herpetol. 34(1):5-12.

Dodd, C.K., Jr. 1995. Disarticulation of turtle shells in north-central Florida: how long does a shell remain in the woods? Amer. Midl. Natur. 134:378-387.

McLaughlin, G.S. 1997. Upper respiratory tract disease in gopher tortoises, *Gopherus polyphemus*: pathology, immune responses, transmission, and implications for conservation and management. Unpubl. Ph.D. Dissertation, Univ. of Fla., Gainesville. 110pp.

Speake, D.W. 1981. The gopher tortoise burrow community. Pp. 44-47. *In:* Proceedings of the 2nd Annual Meeting of the Gopher Tortoise Council. Florida State Museum, Gainesville, FL.

## Generic Revisions of Emydine Turtles

**JAMES FORD PARHAM[1,2] AND CHRIS R. FELDMAN[3]**

*[1]Department of Integrative Biology, 3060 Valley Life Sciences Building,*
*University of California, Berkeley, California 94720-3140, USA; E-mail: parham@socrates.berkeley.edu*
*[2] University of California Museum of Paleontology, 1101 Valley Life Sciences Building,*
*University of California, Berkeley, California 94720, USA*
*[3]Department of Biology, Utah State University, Logan, Utah 84322-5305, USA; E-mail: elgaria@biology.usu.edu*

Emydine turtles (sister to Deirochelyinae within Emydidae) are represented by ten extant species, nine of which are restricted to North America. This charismatic and ecologically diverse group of turtles is relatively well studied (as turtles go) and is familiar to both amateur and professional chelonologists. Recent phylogenetic studies (Bickham *et al*., 1996; Burke *et al*., 1996; Lenk *et al*., 1999; Feldman and Parham, 2001, 2002), combined with the discovery of important new fossils (e.g., Hutchison, 1981; Holman, 1987, Holman and Fritz, 2001), have contributed to an emerging consensus on the major aspects of emydine evolutionary history. Based on this combined evidence, two independent studies (Holman and Fritz, 2001; Feldman and Parham, 2002) proposed contrasting generic revisions of emydine turtles. The purpose of this note is to briefly review these taxonomic changes and point out areas of agreement and disagreement.

Presently, the emydine species can be divided into four well-supported, monophyletic groups (Figure 1); listed in order of their date of authorship these are:

***Emys* Dumeril 1806**- The type species of *Emys* is the European pond turtle, *Emys orbicularis* (Linnaeus 1758). Using mtDNA data, Bickham *at el*. (1996) were the first to

suggest that the western pond turtle, *Emys marmorata* Baird and Girard 1852, Blanding's pond turtle, *Emys blandingii* (Holbrook 1838), and *E. orbicularis* form a monophyletic group. Given this arrangement, Bickham *et al*. (1996) suggested that all three species could be placed in the genus *Emys*, pending further support. Since that time, a monophyletic *Emys* has been strongly supported by two additional molecular-based studies (Lenk *et al*., 1999; Feldman and Parham, 2002) and an expanded *Emys* was adopted by Feldman and Parham (2002). However, Holman and Fritz (2001), based on the results of Lenk *et al.* (1999), suggested the *Emys* clade be divided into three separate genera: *Emys*, *Actinemys* Agassiz, 1857 (for *E. marmorata*) and *Emydoidea* Gray 1870 (for *E. blandingii*). They specifically avoided placing a species without shell kinesis (*E. marmorata*) into the same genus as taxa with shell kinesis (*E. orbicularis* and *E. blandingii*). We disagree with this typological approach, and provide the following arguments in support of a more inclusive *Emys*.

First, there are multiple examples of turtle genera that display varying degrees of shell kinesis. Two notable examples are mud turtles (*Kinosternon*) and Palearctic tortoises (*Testudo*). In fact, shell kinesis can be polymorphic within a single species. For example, the spider tortoise, *Pyxis arachnoides*, can have a plastron with a well developed hinge or an akinetic plastron (Siebenrock, 1906; Bour, 1981). Additionally, Harding (pers. comm. to JFP) has recorded *E. blandingii* with akinetic plastra in Michigan. Because shell kinesis is a character that can vary at several taxonomic levels, even within emydine species, we feel it should not be used to split *Emys* into separate genera.

Second, Feldman and Parham (2002) found that the amount of uncorrected sequence divergence among the three *Emys* species (5.66-6.33%) overlaps with the genetic distances seen between other congeneric emydines (4.22-6.09%), but is less than that observed between emydine genera (7.01-9.26%). Although useful as a comparative example, we emphasize that genetic distance alone (i.e, without a phylogenetic justification) should not be an arbiter of taxonomy.

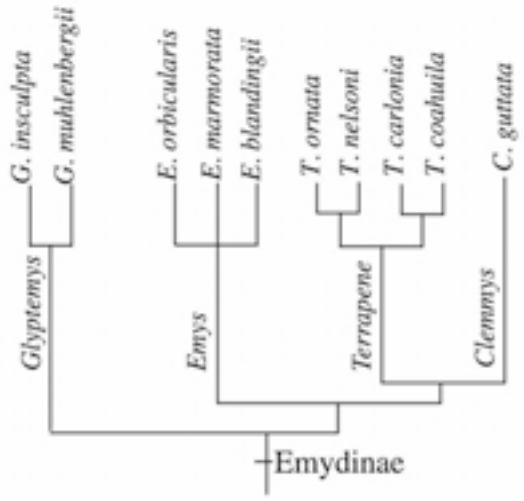


Figure 1. A phylogenetic tree of emydine species based on Feldman and Parham (2002), similar to Bickham *et al.* (1996) and Lenk *et al*. (1999). The four species groups are well supported, but the basal relationships (e.g., the relationships of *Clemmys* sensu stricto) are more ambiguous."

Third, the taxonomy suggested by Holman and Fritz (2001) results in three closely related genera, each with a single living species. This would obscure the undeniably close relationships of *E. marmorata, E. blandingii* and *E. orbicularis*. Separate generic names are redundant because *Emys* species are already distinguished by their specific epithets. Extinct relatives of *Emys* species exist, but the bulk of *Emys* research and interest is focused on living taxa. To make the scientific names informative to the majority of workers, we suggest *Actinemys* and *Emydoidea* be reserved as subgeneric names for groups that include a living species and its close fossil relatives.

***Terrapene* Merrem 1820**- No taxonomic revision is required for the well-known genus *Terrapene*. All analyses support the hypothesis that the species of *Terrapene* represent a natural group with a shared history that is independent of the other emydines.

***Clemmys* Ritgen 1828**- The only species in the genus *Clemmys* is the type species, *Clemmys guttata* (Schneider 1792). Although monotypic genera are generally undesirable, it is necessary here because the phylogenetic affinities of *C. guttata* to other emydine genera are uncertain (Bickham *et al*., 1996; Burke *et al*., 1996; Feldman and Parham, 2002). None of the analyses suggest a close affinity to *Emys marmorata* or *Glyptemys*.

***Glyptemys* Agassiz 1857**- All analyses agree that the wood turtle, *Glyptemys insculpta* (LeConte 1829), and bog turtle, *Glyptemys muhlenbergii* (Schoepff 1801), are each other's closest relative and are not closely related to *Clemmys*. Two groups working in parallel (Holman and Fritz, 2001; Feldman and Parham 2002) revised the taxonomy of these species. Unbeknownst to one another, they chose different names for this clade. Feldman and Parham (2002) chose *Calemys* Agassiz 1857 while Holman and Fritz (2001) chose *Glyptemys*. The generic revision of Holman and Fritz (2001) was published three months before Feldman and Parham (2002) so *Glyptemys* is the appropriate, valid name.

We would like to thank James Harding, Phillip Spinks and Patricia Holroyd for providing helpful suggestions.

**Literature Cited**

Agassiz, L. 1857. Contributions to the Natural History of the United States of America. Boston: Little, Brown and Co., 452 pp.

Baird, S.F. and Girard, C. 1852. Descriptions of new species of reptiles collected by the U.S. exploring expedition under the command of Capt. Charles Wilkes, U.S.N. Proc. Acad. Nat. Sci. Philadelphia 6:174-177.

Bickham, J.W., Lamb, T., Minx, P. and Patton, J.C. 1996. Molecular systematics of the genus *Clemmys* and the intergeneric relationships of emydid turtles. Herpetologica 52:89-97.

Bour, R. 1981. Étude systématique du genre endémique Malagache *Pyxis* Bell, 1827 (Reptilia, Chelonii). Bulletin Mensuel de la Société Linnéenne de Lyon 50(4):132-176.

Burke, R.L., Leuteritz, T.E. and Wolf, A.J. 1996. Phylogenetic relationships of emydine turtles. Herpetologica 52:572-584.

Duméril, A.M.C. 1806. Zoologie analytique ou Méthode naturelle de classification des animaux, rendue plus facile à l'aide de tableaux synoptiques. Paris: Allais, 344 pp.

Feldman, C.R. and Parham, J.F. 2001. Molecular systematics of emydine turtles. Chelonian Conservation and Biology 4(1):194-198

Feldman, C.R. and Parham, J.F. 2002. A molecular phylogeny for emydine turtles: taxonomic revision and the evolution of shell kinesis. Molecular Phylogenetics and Evolution 22(3):388-398.

Gray, J.E. 1870. Supplement to the catalogue of Shield Reptiles in the collection of the British Museum. Part 1. Testudinata (Tortoises). London: Taylor and Francis, 120 pp.

Holbrook, J.E. 1838. North American Herpetology; or a description of the reptiles inhabiting the United States. Ed. 1 Vol. 3. Philadelphia: J. Dobson and Son, 122 pp.

Holman, J.A. 1987. Herpetofauna of the Egelhoff site (Miocene: Barstovian) of north-central Nebraska. J. Vert. Paleo. 7:109-120.

Holman, J.A. 1995. A new species of *Emydoidea* (Reptilia: Testudines) from the late Barstovian (medial Miocene) of Cherry County, Nebraska. J. Herp. 29:548-553.

Holman, J.A. and Fritz, U. 2001. A new emydine species from the Middle Miocene (Barstovian) of Nebraska, USA with a new generic arrangement for the species of *Clemmys* sensu McDowell (1964) (Reptilia: Testudines: Emydidae). Zoologische Abhandlungen Staatliches Museum für Tierkunde Dresden 51:331-354.

Hutchison, J.H. 1981. *Emydoidea* (Emydidae, Testudines) from the Barstovian (Miocene) of Nebraska. PaleoBios. 37:1-6.

LeConte, J. 1829. Descriptions of the species of North American tortoises. Ann. Lyceum Natur. Hist. New York 3:91-131.

Lenk, P., Fritz, U., Joger, U. and Winks, M. 1999. Mitochondrial phylogeography of the European pond turtle, *Emys orbicularis* (Linnaeus 1758). Mol. Ecol. 8:1911-1922.

Linnaeus, C. 1758. Systema naturae per regna tria naturae secundum classes, ordines, genera, species cum characteribus diferentiis, synonymis, locis. 10th ed. Vol. 1. Stockholm: Salvii, 824 pp.

Merrem, B. 1820. Versuch eines Systems der Amphibien. Tentamen Systematic Amphiborum. Marburg: Kreiger 199 pp.

Ritgen, F.A. 1828. Versuch einer natürlichen eintheilung der Amphibien. Nova Acta Physico-Medica Acad. Caes. Leopold.-Carol. Natur. Curio. 14:246-284.

Schoepff, J.D. 1801. Historium Testudinum iconibus Illustrata. Erlangen: Palmii 160 pp.

Siebenrock, F. 1906. Schildkröten von Ostafrika und Madagaskar. In: Voletkow, A. (Ed.). Reise in Ostafrika 2. Stuttgart: E. Schweizerbart'sche Verlagsbuchhandlung, Nägele & Dr. Sproesser, pp. 1-40.

## Adapting the Namaqualand Speckled Padloper, *Homopus signatus signatus*, to Captive Conditions

**Mark Klerks**

*Mr.Ruys De Beerenbrouckstr. 24, 5142TJ Waalwijk, Netherlands: E-mail: cuora@xs4all.nl*

*Homopus s. signatus* is the world's smallest terrestrial tortoise (max. male, 87.5 mm carapace length, 96 g; female, 106 mm and 163 g) (Boycott, R.C. and Bourquin, O., 1988) and is endemic to Namaqualand, South Africa. The species is listed in Appendix II of CITES, but is not listed in the South African Red Data Book. In South Africa the species is also called "klipskilpadjie" which means little rock tortoise. This tortoise is found in a region with relatively low rainfall and can be found on rocky outcrops.

In October 2001 two male and two female wild-caught *Homopus signatus signatus* (specimen studbook numbers 0035-0038) where imported from South Africa into the Netherlands (export permit EB2001/432, import permit 33145) to consolidate the studbook for this species within the Homopus Research Foundation. These specimens were from the same area (Springbok, Namaqualand) as previously imported specimens. After capture, during flight and customer transfer a data logger (HOBO temp, Onset computer corporation, Pocasset, USA) was placed in the transport box. While temperatures dropped briefly to less than 5°C during transport, these temperatures are also encountered in the wild at this time of year.

Figure 1. Male *Homopus* exploring his new cage.

Upon arrival, the animals were released into their new enclosures as quickly as possible. One pair (specimens 0035-0036) was placed at my location (Figure 1).

Since the vast majority of wild specimens are found to carry nematodes (Loehr, 2002a), both animals were immediately treated with fenbendazole (Panacur, Hoechst, Frankfurt) at a dosage of 50 mg/kg body weight. The same dosage was repeated two weeks later.

Their indoor enclosure measured 150 x 80 x 80 cm (l x w x h). Flat pieces of rock where positioned to create multiple crevices with soil on the bottom, mimicking natural hiding places (Loehr, 2002a). This is in contrast to another rock-dwelling species, the pancake tortoise (*Malacochersus tornieri*), which prefers rock-rock crevices (Moll and Klemens, 1995). The enclosure was decorated with mopani wood and artificial succulents. The substrate was 8-10 cm deep and consisted of course gravel (diameter 2-3mm). An 80 W spotlight (Philips PAR Flood) and a 150 W halogen spotlight were placed in the enclosure 40 cm above the soil to achieve an initial temperature of approximately 25-30°C. and adjusted to mimic a southern photoperiod, but there were light influences through a blinded window in the room.

Water was sprayed 3-4 times a week to stimulate feeding. Water was always present, but no drinking was observed.

The front wall of the enclosure is only 18 cm tall. This design was chosen to better mimic natural conditions by allowing temperatures to decrease at night and to facilitate dehydration of the enclosure after spraying water. The enclosure was initially divided in two to separate the male and female.

Upon arrival, the female weighed 176 g, the male 86 g. On November 6, 2001, the female produced one egg, weighing 12 g. The egg was deposited in a crevice and was not buried.

**General behavior**

Upon arrival both animals showed stress including standing in the corners of the enclosure, digging next to the cage divider, and ignoring food items. The female was less active than the male and spent more time in the retreats. This could have been related to the fact the female was gravid. After two weeks the separation was removed to allow the tortoises to interact and to provide more space, retreats and microclimates for each of them. The high activity level remained the same and the food was still refused, but the male stopped digging. The male and female also switched retreats. No aggression or mating activity was observed.

Spraying of water to stimulate feeding resulted in increased activity. The high activity and non-feeding resulted in a rapid weight loss. Between October and late January, the male lost 12 g dropping to only 74 g; the female lost 15 g (though 12 g of this can be accounted for by the egg).

**Drinking, the syringe method**

After three weeks without observed feeding or drinking, I started offering them lukewarm tap water from a needleless syringe (Figure 2). I simply let the water drip down onto their nostrils and into their mouth. The first time I tried this with the female she drank over 20 ml of water within 10 minutes. She even pushed her nostrils to a rock where water from the syringe had dripped. This might reflect natural drinking behavior. Within 3 days the male also accepted water. Syringe water was provided daily but it was only accepted about twice a week.

On advise of another studbook member, electrolyte was added to the water bowl, and irregularly to the water in the syringe (T. Licitra, pers. comm.). Also an estimated 5% Nutrilon Soya solution (milk formula for babies that contains soy protein, vegetable fat and is lactose free) was accepted without problems. Using the syringe to provide fluids had several advantages since it was not necessary to handle the animals and the scale on the syringe allowed estimation of the volume of water that the tortoises drank. A weight increase of 10-12 g after drinking was not unusual for either turtle. After starting to drink water, the animals appeared to stabilize and displayed calmer behavior.

**Feeding**

Various food items were offered, including dandelion, clover, endive, chicory, banana, grape, pear, *Plantago*, and tomato. Following Loehr (1999a) some flowers (*Taraxacum officinale*, *Calendula officinalis* and *Trifolium repens*) were also provided. However, both tortoises refused all food items. In an attempt to provoke feeding and to prevent further loss of weight, the animals were force-fed Nutrilon Soya with a needless syringe. If the animals did not cooperate instantly, they where placed back in the enclosure. Handling of the animals appeared to cause a lot of stress, especially the female, so I stopped force-feeding after only a few attempts.

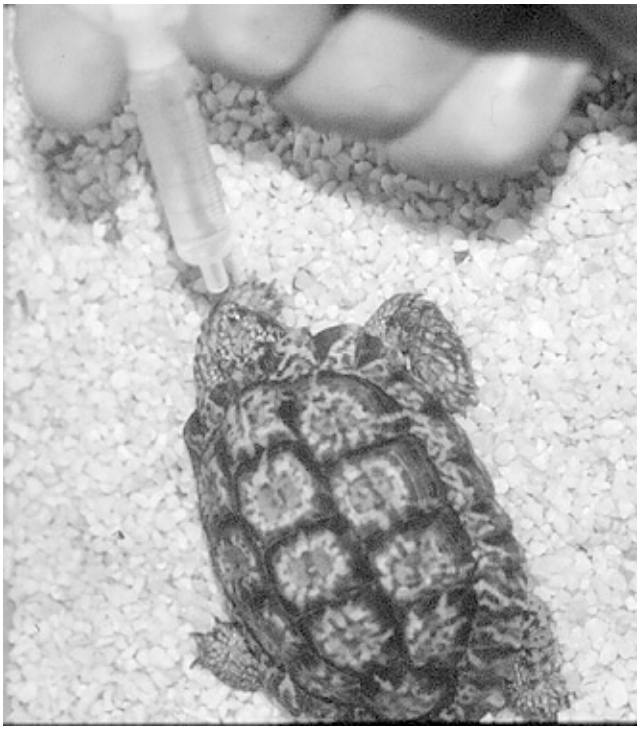

Figure 2. The male drinking from a syringe. Note the size in contrast to the author's hand.

To stimulate their metabolism and to mimic natural temperature changes, the lights were moved closer to the substrate and the 80 W bulb was replaced with a 120 W bulb.

On January 26, about two weeks after adjusting the temperature, some endive was eaten. At the same time, two succulent plants (*Kalanchoe* sp. and *Crassula* sp.) were placed in the enclosure. Selection of succulents should be done carefully to avoid plants treated with pesticides. Within a day they were feeding on the *Kalanchoe* sp. The succulents, about 15 cm tall, were completely eaten in a week. Within two days of the initial feeding they started accepting other greens like endive, chicory, alfalfa, and seedlings germinated from clover and katjang idjoe (taugé) seeds.

With the exception of one *Alöe dichotoma* that was not eaten, no additional succulents were placed in the enclosure, but a sedum spp. is offered in the diet. The first feces were found a few days after they started eating.

**Discussion**

Survival rates of *H. signatus* in captivity have been reported to be low, due to its presumably highly specialized habitat and diet requirements (Barzyk, 1994). Yet, neither Boycott and Bourquin (1988) or Loehr (1999b) found them to require a specialized diet. Almost a year after my pair was imported, it is hard to imagine that they were ever difficult to feed. The food items that they initially refused are accepted now. Fruits like banana and pear were not included in the diet since I don't consider these appropriate for Padlopers.

My results confirm that *H. s. signatus* can be adjusted to a captive diet, but that adaptation to captive conditions can be delicate and time-consuming. Barzyk's conclusions (1994) may have been based on turtles that were collected commercially or illegally imported. In both cases there can be a long time-span between initial capture and release into stable captive conditions. Furthermore, there may be several housing locations before the tortoises arrive at their final destination. Considering the brief initial time-span during which the condition of my specimens rapidly became worse, it is easy to imagine the negative consequences of long time-spans between capture and release at the final captive location or housing at multiple locations (with different husbandry and climatic regimes) for short periods of time. Therefore I would recommend transferring specimens directly and without delay to new locations.

*Homopus. s. signatus* lives in the Succulent Karoo biome and feeds partially on succulents (Loehr, 2002). It might be useful to include pesticide free succulents in the captive diet of *Homopus signatus*. With dehydrated tortoises it could be beneficial to prevent further dehydration. Captive hatchling *H. s. signatus* have been reported to be vulnerable for dehydration (Loehr, 1999a). For non-feeding animals, the succulents might be a trigger to start them feeding.

Sufficient heat and lighting appear important for *H. signatus* to thrive under captive conditions. The increased light intensity and photoperiod might have contributed to the start of feeding.

The syringe method worked well to provide fluids and was low stress since the specimens were not handled. This is in contrast to a widely used method like soaking. I assume this method might work for all *Homopus* species and even others tortoises. This method could also be of use for rehabilitation programs where *Homopus* may be encountered. There is a single observation of a wild *H. signatus* drinking from a shallow stream of water on a rock slab after rainfall (V. Loehr, pers. comm.).

**Literature Cited**

Palmer, M. 1994. The speckled tortoise, *Homopus signatus*, in captivity. Tortuga Gazette 30:1-5.

Barzyk, J.E. 1994. Husbandry and captive breeding of the parrot-beaked tortoise (*Homopus areolatus*). Chelonian Conservation and Biology 1:138-141.

Boycott, R.C. and Bourquin, O. 1988. The South African tortoise book, a guide to South African tortoises, terrapins and turtles. Johannesburg: Southern Book Publishers, 148 pp.

Klemens, M.W. and Moll, D. 1995. An assessment of the effects of commercial exploitation on the pancake tortoise, *Malacochersus tornieri*, in Tanzania. Chelonian Conservation and Biology 1:197-206.

Loehr, V.J.T. 1997. *Homopus s. signatus*, Namaqualand speckled padloper, captive breeding. African Herp News 26: 23-24.

Loehr, V.J.T. 1999a. Dietary requirements of captive hatchling Namaqualand speckled padlopers (*Homopus s. signatus*). African Herp News 28:23-26.

Loehr, V.J.T. 1999b. Husbandry, behavior and captive breeding of the Namaqualand speckled padloper (*Homopus s. signatus*). Chelonian Conservation and Biology 3(3): 468-473.

Loehr, V.J.T. 2002a. Diet of the Namaqualand speckled padloper, *Homopus signatus signatus*, in early spring. African Journal of Herpetology

Loehr, V.J.T. 2002b. Male aggression in captive Namaqualand speckled padlopers (*Homopus s. signatus*). Bulletin of the Chicago Herpetological Society 37: 1.

# ORGANIZATIONAL PROFILES

## Northern Virginia Reptile Rescue

**DENNIS DESMOND**

*7011A Manchester Blvd., # 302 , Alexandria VA 22310; E-mail: herptech@bigfoot.com*
*Phone regular hours: (703) 971-1109, Emergencies: 629.2425*

Our Mission is to rescue, rehabilitate, and relocate reptiles and amphibians. Whether they are victims of abuse, neglect, abandonment, or are merely unwanted or displaced, we will do our utmost to render whatever aid is necessary and then find a suitable new site for release. If we determine the animal is non releasable, we will endeavor to find a suitable home where the animal can live out its remaining years.

As licensed Virginia state rehabilitators, we undergo several hours of rescue and rehabilitative training by professionals in the field of herp medicine.

We also attend numerous conferences to learn the best techniques of triage, shell repair, and emergency care for injured and displaced wildlife.

If you find a displaced or injured reptile or amphibian, please feel to contact us and we will assist you in caring for or placing the animal. For further information contact the author or visit our website at www.boxturtle.org.

## World Chelonian Trust Overview

**DARRELL SENNEKE**

*Director – World Chelonian Trust, 4N710 Sawmill Trail, Saint Charles, Illinois 60174; E-mail: rednine@earthlink.net*

The World Chelonian Trust (WCT) sees its path as promoting the conservation and assuring the survival of all tortoises and freshwater turtles. We do this by actively supporting *in-situ* conservation efforts, field research and veterinary research. In addition to this we provide information and guidance to individuals and organizations to further the successful maintenance and propagation of captive populations, particularly from our web site at www.chelonia.org and through our quarterly Newsletter. We firmly believe that only by supporting both wild populations and captive propagation can we provide the maximum options for the survival of all chelonian species.

In addition to receiving the quarterly newsletter and access to detailed husbandry information, we strive to give our members the opportunity to have an impact in world chelonian survival through the actions of the organization. We intend to offer our members the opportunity to participate in field trips, seminars and workshops. The generous support from members enables us to further impact the future of Chelonians far beyond what any individual can accomplish.

We are actively pursuing partnerships with herpetological societies and turtle organizations across the globe, offering our expertise and support in the ongoing effort to protect and succor chelonians. We will continue to forge alliances in the area of turtle and tortoise rehabilitation; actively seeking qualified groups and individuals in the interest of joint effort. The WCT intends to work with these people as a networking facilitator, knowledge resource, and, in some circumstances, sponsor.

In the area of education we will offer our experience and materials to further the care of chelonia in captivity and the preservation of wild populations in all aspects. This educational effort manifests itself in the free distribution of care sheets, presentations before groups, the aforementioned web site and cooperation with concerned groups and individuals. This educational mission is a broad effort, encompassing things as varied as our comprehensive "Overview of the Animal Markets of China" on our web site to the handing out of a single care sheet to a child.

We see a bright future of cooperation ahead and wish to encourage contacts from all interested parties.

## Cooperative Agreement Between the Tortoise Reserve and World Chelonian Trust

The Tortoise Reserve, Inc., a non-profit chelonian conservation organization and the World Chelonian Trust, a non-profit membership-based turtle and tortoise society, have entered into an informal cooperative agreement. This agreement will provide a framework for us to work together on various activities where we have a shared mutual interest. We believe that the combined expertise and assets of the two organizations can be of long-range benefit to many aspects of turtle and tortoise conservation. This arrangement will encourage both organizations to focus resources on specific issues where we have shared interest and it will complement our existing programs.

Since freshwater turtle and tortoise conservation efforts have expanded into issues regarding the pet trade and captive breeding, the newly formed agreement seems appropriate and timely. The Tortoise Reserve is already working with a number of organizations and institutions on specific programs; the World Chelonian Trust is also working in some of these same programs as well as others through the efforts of its board and membership. This agreement is open and will provide a greater opportunity for the two organizations to work together on any number of key issues. In the coming months the directors and boards of the two groups will develop several trial programs which

should be of mutual importance and will directly address the conservation needs of turtles.

Marine turtles are outside the primary scope of both organizations.

Members of the World Chelonian Trust may wish to visit the web site of the Tortoise Reserve to learn of their current activities (www.tortoisereserve.org). The visual image resources and the turtle sanctuary program may be of particular interest. The World Chelonian Trust also maintains a conservation and care educational web site at www.chelonia.org .

Any World Chelonian Trust members wishing to work in the development of specific aspects of this cooperative agreement, or ones having ideas of issues to address, should contact Darrell Senneke (rednine@earthlink.net). We are excited about the potential of our combined efforts.

# BOOK REVIEW

## The Turtles of Russia and Other Ex-Soviet Republics (Former Soviet Union), by Serguis L. Kuzmin. 2002. Edition Chimaira, Frankfurt am Main. 8.5 x 6 in., 159 pp. Hardcover, Price: US $44.50, Euros 34.80 (approx. $35.00 U.S)

**Reviewed by John P. Levell**

*NorthStar Herpetological; P.O. Box 389; Lanesboro, MN 55949-0389; USA;*
*E-mail: emys@turtlebookshop.com.*

Since beginning to produce books in English, publisher Edition Chimaira of Frankfurt am Main, Germany has released a number of volumes on regional herpetofaunas that are poorly known to many American and British readers. These include titles on the amphibians and/or reptiles of Europe (Neèas, *et al.*, 1997; Corti and Lo Cascio, 2002), the Middle East (Disi, *et al*., 2001), Africa (Schiøtz, 1999; Rödel, 2000), and Southeast Asia (David and Vogel, 1996). Each of these volumes, in its own way, has done much to bridge the often-conspicuous geographic gaps evident among more readily available English language herpetological publications.

The recent release of Turtles of Russia and Other Ex-Soviet Republics continues this now firmly established Edition Chimaira tradition. In fact this slim volume, perhaps even more so than its predecessors, provides coverage of an area that has been largely ignored in the herpetological literature accessible to those only capable of reading English. At the same time, this well illustrated little book represents the first comprehensive English review of the seven chelonian species known to inhabit Russia and the other Republics of the former Soviet Union.

While possibly viewed as a detraction by some, the small number of species covered is in reality (in this reviewer's opinion anyway) among the book's strongest assets. This allows room for the development of relatively extensive species accounts, an advantage that author Serguis Kuzmin of the Russian Academy of Sciences has exploited quite fully. For example, his review of the Central Asian Tortoise, *Agrionemys* (= *Testudo*) *horsfieldii*, includes 14 pages of text and overall occupies 27 of the book's 159 pages.

Individual accounts for the region's other terrestrial and freshwater chelonians are similarly lengthy as well. These include 17 pages devoted to the Mediterranean Spur-thighed Tortoise, *Testudo graeca*, 15 pages on the Chinese Softshell, *Pelodiscus sinensis*, and an almost unbelievable 29 pages on the European Pond Turtle, *Emys orbicularis*. The extensiveness of this latter species account is also largely responsible for the comparative brevity of Kuzmin's 8-page review of the Caspian Turtle, *Mauremys caspica*, as much relevant information on this species is included in his examination of *Emys orbicularis*. An additional 5 pages on the Loggerhead Sea Turtle, *Caretta caretta*, and 4 pages on the Leatherback, *Dermochelys coriacea*, complete the species reviews.

All told, Kuzmin's seven species accounts occupy exactly 105 of his book's pages. Considering Freiberg's well-respected review of South American turtles covered more than 40 species in a total of a mere 125 pages (Freiberg, 1981), the amount of space Kuzmin has allocated to each of his species reviews becomes even more astounding.

Focusing primarily on data relevant to the territories encompassed within the former Soviet Union, Kuzmin's species accounts, not surprisingly, provide a wealth of information on the distribution, subspecific and/or geographic variation, habitats, habits, natural enemies, and parasites of each of the region's seven turtles and tortoises. In doing so, Kuzmin has concisely synthesized the vast body of data collected by previous Russian researchers, virtually none of which has been available in English before. This data is further supplemented by Kuzmin's research and personal observations.

Accounts also include general species descriptions, distribution maps, and a multitude of color photographs of both the animals and their habitats. Totaling 68 in number, these color photos are invariably of good to excellent quality. Additional illustrations in the form of nine b/w photographs, four text figures, and three tables are scattered throughout the text as well.

Rounding out the text are the almost obligatory opening comments on turtle morphology, evolution, and biogeography, and brief closing chapters on captive care and regional chelonian conservation. This latter chapter should prove of particular value, as it provides numerical data and other relevant comments and recommendations on the commercial exploitation and conservation of Soviet turtles and tortoises. Naturally, a complete bibliographic listing of all literature cited has been included as well.

Overall the text is very neatly laid-out and is surprisingly free of typographic or factual errors, although the problems with English syntax and translation so common in most publications produced in countries where English is not the primary language still crop up on occasion. Luckily, this is only problematic in the chapter on captive care (what exactly "force-meat" is, for example, is impossible to determine) and should provide few difficulties for careful readers elsewhere in the book. Paper quality is quite good as well, while the binding certainly meets or exceeds that of most other titles bound within illustrated boards.

All things considered, Turtles of Russia and Other Ex-Soviet Republics is clearly a very worthy edition for the bookshelves of anyone with an interest in Eurasian turtles and tortoises. In particular those working with *Emys orbicularis*, *Agrionemys horsfieldii*, and/or *Testudo graeca*, whether in captivity or in the wild, should find Kuzmin's book exceedingly valuable and will undoubtedly want a copy for their libraries.

**Literature Cited**

Corti, Claudia and Lo Cascio, Pietro. 2002. The Lizards of Italy and Adjacent Areas. Edition Chimaira. Frankfurt am Main, Germany.

David, Patrick and Vogel, Gernot. 1996. The Snakes of Sumatra: Annotated Checklist, Key and Biological Notes. Edition Chimaira. Frankfurt am Main, Germany.

Disi, Ahmad M., Modrý, David, Neèas, Petr, and Rafai, Lina. 2001. Amphibians and Reptiles of the Hashemite Kingdom of Jordan: An Atlas and Field Guide. Edition Chimaira. Frankfurt am Main, Germany.

Freiberg, Marcos. 1981. Turtles of South America. T.F.H. Publications, Inc. Neptune, NJ.

Neèas, Petr, Modrý, David, and Zavadil, Vit. 1997. Czech Recent and Fossil Amphibians and Reptiles. Edition Chimaira. Frankfurt am Main, Germany.

Schiøtz, Arne. 1999. Treefrogs of Africa. Edition Chimaira. Frankfurt am Main, Germany.

Rödel, Mark-Oliver. 2000. Herpetofauna of West Africa, Vol. 1: Amphibians of the West African Savanna. Edition Chimaira. Frankfurt am Main, Germany.

# LEGAL UPDATES

## New Turtles to be Proposed for CITES Listing in November

**ALLEN SALZBERG**

*67-87 Booth St. #5b, Forest Hills, NY 11375 USA*

*E-mail: asalzberg@nyc.rr.com*

At the upcoming meeting of The Parties To The Convention On International Trade In Endangered Species Of Wild Fauna And Flora (CITES), this November, in Santiago, Chile, freshwater turtles and tortoises for once have the potential to play a very large role in the meeting. The speed, three years, in which the problem with international trade was first introduced for consideration by CITES, to CITES actually acting, is considered a record. This is, probably, partially because of the unfortunate size of the turtle import trade in China, and the quick delivery of the reports on the trade of several of these animals: *Pyxis panicauda, Lissemys punctata* and three species of *Cuora: galbinifrons, flavomarginata* and *amboinensis*.

The number of turtle species and subspecies proposed for listing is the highest (24) since the first CITES meeting. The chances that these proposals will be accepted are also high, since China, the cosponsor of many of the proposals, is home to many of the species and the largest source of problems with the international trade.

The turtles being considered are:

*Lissemys punctata,*
*Orlitia borneensis,*
*Pelochelys* spp.
*Chitra* spp.
*Kachuga* spp. (excluding *K. tecta* already on Appendix I)
*Siebenrockiella crassicollis,*
*Mauremys mutica,*
*Pyxidea mouhotii,*
*Hieremys annandalii,*
*Heosemys* spp.,
*Platysternon megacephalum,*
*Mauremys annamensis,*
*Leucocephalon yuwonoi*
*Pyxis planicauda*

For PDF copies of the CITES proposals contact the author.

**NOTE:** CITES has just approved all proposals for the turtles listed above. Any laws or regulations that are effected by this ruling go into effect February 15, 2003.

## Spotted Turtles Receive Increased Protection in South Carolina

**STEVE BENNETT**

*South Carolina Department of Natural Resources; 803-734-3930; sbennett@scdnr.state.sc.us*

July 1, 2002 the spotted turtle (*Clemmys guttata*) was officially listed as a "Species in Need of Management in South Carolina". The addition of the spotted turtle to this list and the subsequent drafting of regulations was undertaken by the South Carolina Department of Natural Resources (SCDNR) to afford protection for spotted turtles. The intent of the listing is to regulate the take of these animals and to eliminate the sale of wild-caught animals. Included in this notice you will find the justification for listing the spotted turtle. This is provided as an explanation for SCDNR's actions concerning the spotted turtle.

Anyone possessing spotted turtles in South Carolina must apply for a free permit to possess these animals. The limit for wild-caught spotted turtles for a permitted individual is 9. There is no limit on the number of captive born spotted turtles an individual may possess, but all births must be reported as part of the annual permit renewal process. SCDNR will allow persons who possess more than 9 wild-caught spotted turtles to apply for a one-time designation exemption for these animals. Persons who possess more than 9 animals must apply for this exemption prior to September 30, 2002. The exemption will be granted upon the condition that every individual spotted turtle in the applicant's possession is made available for a photograph to document the animal. These photographs will be kept on file, in digital format, by SCDNR and may be used in the future to identify these specimens. Applicants for this exemption will not be allowed to collect 9 additional wild-caught adult spotted turtles, and they will not be permitted to replace exempt animals with wild caught animals if any exempt animals are lost due to mortality unless the total number of spotted turtles in their possession falls below 9. SCDNR reserves the right to verify spotted turtle mortality by requiring the carcass or shell of the dead spotted turtle to match against the file photo.

The SCDNR is developing a spotted turtle permit application and should have that completed sometime this summer. The basic information required for a permit is included within the regulation, however additional information deemed important to this program may be required. Please see the Spotted Turtle regulations document and the Endangered Species classification request for the Spotted Turtle.

For more information and/or to request the designation exemption please contact the author.

## Commercial Herp Trade Ends in Nebraska / Commercial Snapping Turtle Trade ends in Maine

On January 15, the Nebraska Game and Parks Commission voted 5-2 to ban commercial exploitation of the state's 62 species of reptiles and amphibians. The one exception is leopard frogs and tiger salamanders, which can still be collected and sold as bait. Ornate box turtles, western painted turtles and milk snakes can still be kept as pets, but they can't be sold or exported. The agency has also set limits on the number of creatures people can have in their possession. Wyoming and South Dakota are the only two surrounding states with less-restrictive regulations on the trade. For more information on the new regulations, call the commission at 471-0641. Source: LINCOLN JOURNAL-STAR (Nebraska) 16 January 02

In July, Maine officially banned the commercial hunting of snapping turtles based on scientific data and public outcry. Many of these animals had been headed to the Asian turtle food markets.

## United States Fish and Wildlife Service Lifts May 9th Ban on the Importation of CITES Listed Wildlife and Products from Madagascar

**U.S. FISH & WILDLIFE SERVICE**

*Office of Law Enforcement, 4401 N. Fairfax Dr., MS-LE3000, Arlington VA, 22203; USA*
*703-358-1949(Telephone) or 703-358-2271 (FAX)*

**Background:** On May 9, the U.S. Fish & Wildlife Service announced a ban on the importation of CITES-listed live wildlife and wildlife parts and products from Madagascar due to the lack of an official government. The U.S. has now officially recognized the government of President Ravalomanana.

**Action:** Effective immediately (September 20, 2002), the U.S. Fish and Wildlife Service will allow the import of CITES-listed live wildlife or wildlife parts and products from Madagascar with valid CITES documentation issued by the government of President Ravalomanana. Importers should be aware that all CITES documents will be verified before clearance is granted and shipments may be detained pending investigation into the legality of CITES documents. This notice supersedes and cancels the May 9, 2002 public bulletin on Madagascar.

# NEWSNOTES

**SUMMARIZED BY BRIGID RANSON**
*2193 Hendricks Rd., Pennsburg, PA 18073 USA; E-mail: ttnnewsnotes@aol.com*

## ASIA and AUSTRALIA

### Mary River Turtle Survival

Greening Australia, a volunteer group based in Queensland, is working to save the Mary River Turtle. The group conducted a pilot study investigating the nesting habits of this endangered species. The study revealed enough new information to warrant applying for more federal aid to continue the research on a larger scale. The group hopes to learn enough about the little known species to begin protecting them and educating the public to do the same. Source: Australian Broadcasting Company, September 10, 2002

### New Licensing Regulations in Western Australia

Under the Wildlife Conservation Act of 1950, new regulations are being introduced in Western Australia that prohibit taking amphibians and reptiles from the wild as pets. Previously, WA was the only state in the country without a licensing system. Strong controls to "ensure responsible ownership" will be implemented by the Department of Conservation and Land Management. Violators will be prosecuted. Source: Press Release September 21, 2002

### Repatriation of Indian Star Tortoises

CITES officials in Singapore confiscated more than 1,800 illegally traded Indian Star Tortoises. They have been returned to India and will eventually be released into their natural habitat. The Singapore Zoo cared for the tortoises until their return to India, which was funded by the International Fund for Animal Welfare and the Wildlife Trust of India. Upon arrival in India, the tortoises were taken to the Hyderabad Zoo Rescue Centre where officials of the Hyderabad-based Centre for Cellular and Molecular Biology will test the DNA of the tortoises to determine their geographic origins. The tortoises will then be released in the appropriate locations. The Indian Star Tortoise is classified as "vulnerable" by the IUCN and is listed on Appendix II of CITES. The Indian Wildlife Protection Act of 1972 grants them Schedule IV status – the least level of protection. Source: asalzberg@nyc.rr.com August 23, 2002

### Protected Turtles Seized in Thailand

On September 9, forestry officials in the Nakhon Pathom's Bang Len district of Bangkok confiscated an estimated 6,000 turtles. The turtles are protected under the Wildlife Preservation and Protection Act and were believed to be in route to restaurants in Songkhla, which serve Chinese and Malaysian clientele. The turtles are now going to be released in Khao Laem and Sri Nakharin national parks in Kanchanaburi province. An additional 300 turtles, as well as other animals, were seized in Onnuj district the same day. Source: Bangkok Post, September 10, 2002

### Thai Authorities Confiscate Illegal Turtle Cargo

Authorities in Thailand have seized over four tons of turtles bound for China at the Chiang Rai airport in Thailand. The turtles were seen through a crack in one of the boxes. Upon opening the boxes, 1,160 tightly packed turtles were found, ten of which were dead. Some of the turtles were endangered and charges have been filed against the consignee, SSukasem Company, for trafficking and smuggling endangered species. Source: Morning Herald (Australia), August 7, 2002

## NORTH AMERICA

### Canadian Turtle Disappearance

Connie Browne, a Lakehead University researcher, has been conducting a two-year study of the turtle populations in Point Pelee National Park, Canada. She found no spiny softshell turtles, which had never been abundant, or spotted turtles, which had been common. Another concern was the lack of juvenile Blanding's and snapping turtles, which are vital for the continued success of those populations. The painted and map turtle populations appeared to be doing fine. Browne also studied some of the 175 nests found in the park. The nests along the roads were eaten, presumably by raccoons and only 45 % of the nests in the other parts of the park hatched. Browne recommends keeping raccoon populations within the park in check. She may have further suggestions when she completes her analysis of DDT presence in any eggs and examines data collected over the past 16 years on turtle roadkills within park boundaries. Source: Windsor Star (Ontario), September 3, 2002

### Pennsylvania's Bog Turtle

In Pennsylvania, sightings of bog turtles, a federally listed endangered species, have delayed a $12 million state road project and three residential housing developments, all located in close proximity to the Bushkill Creek. It took over a year, to negotiate acceptable revisions to one development (two houses were removed which allowed space for a wetlands area and buffer zone within the development's boundaries). The Bushkill Township Zoning Officer has said that the other two development projects and Route 33 will have no affect on turtle habitat, but clearance to begin the projects has yet to be given. In a previous case after an 18-month delay, Pennsylvania's Department of Transportation was forced to make $2 million

worth of changes for a construction plan through bog turtle habitat. Transportation officials and constructors in Pennsylvania now consider the bog turtle a major threat to development. Source: The Morning Call, August 27, 2002

**Restoration to Terrapin Habitat**

In the past, relatively inexpensive rocks and bulkheads have been used to stabilize shorelines. Unfortunately, this prevents diamondback terrapins from nesting in those areas and affects a variety of other organisms as well. The Chesapeake Bay Foundation, the Department of Natural Resources and other organizations decided to do something about this problem. In Prospect Bay, Maryland, they have replaced the bulkhead with 7,000 cubic yards of sand and native vegetation, stretching the previous 500 feet of beach to approximately 2,500 feet. Since the shoreline's close proximity to open water does require some form of stabilization, watershed restoration scientist, Rob Schnabel of the Chesapeake Bay Foundation, chose to use a limited number of rocks and biodegradable "biologs" instead of the bulkheads. The vegetation chosen for the project includes smooth cordgrass, wax myrtle, marsh hibiscus and other plants. As these plants take root and spread, they will also help to prevent the shoreline from eroding. The project is expected to be completed by late September at which time an offshore oyster bar was to be created. However, since the beginning of the restoration project, the water quality in the area has already improved, about 50 terrapin nests where counted early this summer, more shorebirds are feeding in the bay and crab populations have increased. Maryland announced a new initiative to save diamondback terrapins this summer and it is hoped that despite its more expensive nature, the benefits of projects like Prospect Bay will be recognized and become the norm in this and other states. Source: The Annapolis Gazette, September 9, 2002

**Plea to Install Road Barriers and Culverts**

In Tallahassee, Florida U.S. Route 27 cuts Lake Jackson into two parts. The road has become a migration route for resident turtles and other herps of the lake looking for mates, nesting areas or foraging sites. Matthew Aresco, a Florida State University student has been investing a lot of time, energy and money into saving the wildlife from the passing cars on Route 27. He claims that "this area has the highest number of documented [turtle] crossings in North America." In an attempt to decrease this number he has installed a black nylon silt fence to funnel the wildlife towards the lone culvert under the highway. The fence's effectiveness has been limited however because larger species such as mature softshells and snapping turtles simply go through or over the barrier. For this reason, Aresco has requested that the Florida Department of Transportation install concrete barriers and culverts along Route 27 similar to the ones installed on Route 441 in Paynes Prairie State Preserve. Jim Weimer of Paynes Prairie said that the barriers are "shockingly effective" and "the mortality has almost evaporated." In order for the construction on Route 27 to occur, Aresco has to follow legal procedures that include getting the county to propose the work for federal aid and the local city planning organization to prioritize the plan. For more information, visit www.lakejacksonturtles.org. Source: Tampa Tribune, October 7, 2002

**Arrests Made at Reptile Show in Illinois**

Law enforcement officials from the Illinois Department of Natural Resources, the Food and Drug Administration, the Illinois Department of Agriculture and the U.S. Fish and Wildlife Service had been conducting a yearlong investigation into illegal reptile trade that climaxed at a "reptile swap" in mid September. Despite the raid, Lee Watson's farm in Streamwood, the site of the swap for 12 years, has not been shut down. Some of the vendors were conducting legal trade, however, many were buying and selling protected species, unlicensed animals and undersized turtles. Illinois Conservation Police Investigator Michael Lyne said one man had more than 600 undersized turtles and was charged with "not having a license, not keeping records, commercialization of the resources and being over the limit. He was the worst in the number of turtles – but there were many others." Lyne said that there is a 400 percent mark-up on baby turtles, which makes them a profitable venture. Fourteen vendors at the show were arrested, at least three more arrests are pending and 37 misdemeanor citations were issued. Source: Daily Herald, September 17, 2002

**Desert Tortoise Conflict Continues**

The implementation of grazing regulations on cattle in parts of the Mojave Desert is a victory for desert tortoise populations. However, the Center for Biological Diversity, the Sierra Club and Public Employees for Environmental Responsibility are questioning how well the Bureau of Land Management is monitoring the pastures in the California Desert Conservation Area, especially during the present period of drought. The Center for Biological Diversity and the Sierra Club are planning to send monitors to the area and "vow to seek contempt charges against the BLM if monitoring teams report violations." Source: San Bernando County Sun, September 18, 2002

**Legal Victory for California Desert Tortoises**

In late August, a California couple pleaded guilty to illegally possessing 50 desert tortoises. Nine of the tortoises had been surrendered to TortoiseAid International in September of 2001, but further investigations by California Department of Fish and Game Warden Gary Densford disclosed 41 additional tortoises that were in desperate need of veterinary care. The couple was prosecuted and forced to pay restitution for the care of the tortoises and are prohibited from possessing any wildlife. TortoiseAid said about the case, "we hope this legal victory sends the message that crimes involving California's protected wildlife will not be tolerated." Source: TortoiseAid International Press Release, August 30, 2002

**Zoo-bred Turtles Mate in the Wild**

The Seattle Zoo in Washington State has been trying to revive the population of endangered western pond turtles (*Emys marmorata* - see cover photo) by releasing individuals from the zoo's captive bred population. Recently, a Department of Fish and Wildlife biologist unearthed a nest of eight eggs laid by Turtle 218, a zoo-bred participant in the program who was released into the wild to mate. The eggs will be incubated until they hatch and then raised at the zoo for about one year before being returned to the wild. This was Turtle 218's second time laying a nest, however none of the eggs from last year's clutch hatched. The protected site of Steilacoom where the efforts are being concentrated is the only natural site in Western Washington where it is believed that the western pond turtle is breeding. Source: Associated Press – Seattle, September 17, 2002

**An Endangered Species Re-Surfaces in Missouri**

This summer, two yellow mud turtles were found along a highway near Purdy, Missouri. On the states endangered species list, they were last seen in Missouri in 1964 along the same highway. One of the turtles had been hit by a car and is being rehabilitated at Springfield's Dickerson Park Zoo. In the spring, Missouri's chief herpetologist will begin trapping in the area in hopes of locating more for research purposes. Source: News Leader, August 25, 2002

# ANNOUNCEMENTS

**3rd Annual Symposium on Sea Turtle Biology and Conservation** to be held in Kuala Lumpur, Malaysia on March 17-21 2003 at the Legend Hotel (www.legendhotels.com). This meeting will be hosted by the Community Conservation Network, WWF-Malaysia and the Department of Fisheries, Malaysia. The meeting aims to bring together the world's foremost sea turtle biologists and conservationists, government, fisheries and indigenous community representatives, and people who just love to love turtles, in a geographical setting that befits the migratory nature of marine turtles.

To learn more about the symposium, to register and to submit abstracts please visit http://www.seaturtle.org/symposium. Oral and poster presentations will be accepted until 15 November 2002. We urge you to submit posters where possible and use the website for abstract submission.

**The All Florida Herpetology Conference** (organized by the Florida Museum of Natural History) will be held on April 5-6 at the Sheraton in Gainesville, Florida.

**"Conserving Amphibians and Reptiles through Education,"** a PARC National Conference, organized by Southeast Partners in Amphibian and Reptile Conservation (SE PARC), will be held 6-8 April at the Sheraton in Gainesville, Florida. This conference will discuss the need for increased educational efforts on behalf of our native herpetofauna and will highlight a broad range of successful conservation education programs. It is sure to be a unique and interesting educational experience for both naturalists and educators. The conference will also serve as an organizational meeting for the PARC Education/Outreach Working Group, with the last day reserved for that purpose. Contact George L. Heinrich at highpine3@aol.com for more information, or visit the PARC website at www.parcplace.org.

**2003 Joint Meeting of Ichthyologists and Herpetologists** to be held in Manaus, Brazil from June 26 to July 1, 2003. Deadlines for abstract submission and preregistration are Feb 23. For more information, visit http://www.aiha.org.br.

**2 workshops on Planning Assurance Colonies**, sponsored by Ashton Biodiversity Research & Preservation Institute, Inc. The Tortoise Reserve, Inc. and The Asian Turtle Consortium, are to be held on Jan. 10-11 and Feb. 7-8 at the Ashton Biological Preserve in Archer, Florida. All are invited, but class size is limited to 12. The workshop will be taught by Ray and Patricia Ashton. Funding is being sought to bring in other experts. The deadline for registration is 30 days prior to your specific workshop. The cost is $75.00. Ashton Biodiversity Research & Preservation Institute, Inc., 14260 W. Newberry Rd. #331, Newberry, FL 32669; Phone: (352) 495-7449 / Fax: (352) 495-7433; E-mail: Tortfarm@aol.com.

**The National Military Fish & Wildlife Association (NMFWA) Herpetology Working Group** has developed a database of herpetology projects on military installations. This database can be accessed by NMFWA members, other military natural resources managers, and others interested in herps. The database can be found on the NMFWA web site at: http://www.nmfwa.org/Herp/dblist.html.

**A pair of radiated tortoise were stolen** in Sonoma County, California this summer. Anyone with information about the theft, sale, or trade of the pair should contact Melissa Kaplan at melissk@sonic.net.

**The Gopher Tortoise Council is selling copies of past proceedings.** Go to www.gophertortoisecouncil.org/index.htm and navigate to "Meeting Proceedings" via the home page for complete descriptions, prices, and quantities. The bibliographies alone are worth the price. All monies collected go directly to Gopher Tortoise Council projects.

**A Working Guide to the Literature on Box Turtles** (*Terrapene*) has moved to http://www.fcsc.usgs.gov/Center_Publications/box_turtle_bib1/box_turtle_bib1..html. Compiled by: C. Kenneth Dodd, Jr., Florida Caribbean Science Center, U.S. Geological Survey, 7920 N.W. 71st St., Gainesville, Florida 32653.

# REQUESTS FOR SAMPLES AND SPECIMENS

**Request for eastern box turtle shells with both plastron and scutes in place for use in Pueblo Indian religious ceremonies**. I am from the Pueblo of Laguna, one of the 19 Pueblo tribes in New Mexico. Along with the Pueblos of Acoma, Santa Ana, Zia, Cochiti, Santo Domingo and San Felipe we speak the Keres dialect. Our ceremonies involve ceremonial dances and prayer that are focused on the land, people, and all life. As an agrarian society, rain and the prayer for rain and moisture is a big part of our ceremonial cycle. Because the turtle is often found near or in water, they represent a connection to the moisture and rain spirits. The turtle is looked to for its power to communicate with the rain spirits and is respected for this reason. This is why the turtle is used in our religious ceremonies. We are in need of intact box turtle shells with both plastron and scutes still attached to the carapace. I can be contacted at Richard Luarkie, P.O. Box 468, Casa Blanca, NM 87007; E-mail: rbluarkie@yahoo.com

**Request for tissue or blood samples from spotted turtles.** Dr. Tim King's lab at the USGS-Leetown Science Center in eastern West Virginia is conducting a rangewide survey of genetic population structure of the spotted turtle (*Clemmys guttata*) using 24 polymorphic microsatellite markers. This is a request for tissue samples taken from throughout the species' range, i.e. Maine south to Florida (including both eastern and western PA), Ohio, Indiana, Illinois, Michigan, and from where they occur in Ontario and Quebec. Ideally, we'd like 30 samples from each geographic area. Our lab will supply vials (with ethanol) and/or FTA cards for the samples, and we will pay shipping costs. If you are able to assist with the request please contact me: Colleen Callahan, U.S. Geological Survey/Johnson Controls Inc., Leetown Science Center, 11700 Leetown Rd., Kearneysville, WV 2543; (304)724-8340, ext. 2181; E-mail: ccallahan@usgs.gov

**Request for information on contaminants in turtle bodies.** In certain areas of the United States, local traditions include eating turtle meat and eggs by the local population. I am seeking information documenting the chemical contaminants and contaminant levels in commonly consumed species. Of particular interest is information on snapping turtles (*Chelydra serpentina*) and the American softshell turtles (*Apalone*). Any information on this subject or any information concerning human health problems due to consumption of turtles would be greatly appreciated. Alan J. Bartels, P.O. Box 102, Farwell, NE 68838; E-mail: Bartels@cornhusker.net

**Request for ideas on tagging water turtles** for individual identification. I do not wish to use shell notching, large holes in scutes, paints or anything affixed to the shell. I need something recognizable by general public that will not present a snagging hazard. I have used floy tags threaded through a tiny hole in a marginal scute and a Monel tag on the scutes similar to flipper tags. The turtle will have passive id for confirmation. Marguerite Whilden, Dept. of Natural Resources, Fisheries Service Conservation and Stewardship Program, Tawes State Office Building, 580 Taylor Ave., Annapolis, Maryland 21401; Phone (410) 260-8269; FAX (410) 260-8278; E-mail: mwhilden@dnr.state.md.us; Website: www.dnr.state.md.us/terrapin.

# DONORS

We would like to thank all of the following donors: Jae P. Abel, Kraig Adler, Baltimore Zoo, William Belzer, Marvin H. Bennett, Neil P. Bernstein, Madeline L. Bonanno, Marc Bossert, Robert E. Brechtel, British Chelonia Group, Nicholas A. Chew, G. Elaine Chow, Joseph T. Collins, Mary Anne Compton, Anne F. Darlington, C. Kenneth Dodd, Jr., Philip W. Drajeske, Peggy J. Drake, Alain Dupré, Barry D. Durst, Jeremy Feinberg, Janet Feutz, Wayne Frair, Matthew G. Frankel, Terrell G. Heaton-Jones, Jean R. Held, Dan C. Holland, Eugene W. Holmes, Jennifer Homcy, Island Foundation, Louisa M. Jaskulski, David T. Kirkpatrick, Jennifer Kureen, Richard L. Lardie, David S. Lee, Robert C. Lee, John M. Legler, Lisa Lowell, Justin C. McCann, Sam E. McCuen, Philip A. Medica, Martha Ann Messinger, Albert C. Molnar, Kenneth A. Nagy, David H. Nelson, Frank J. Passamonte, Charles Scott Pfaff, Mason M. Phelps, F. Harvey Pough, Michael B. Pugh, James H. Rea, Donald N. Riemer, Robert M. Rioux, John Jake Ryan, Norman J. Scott, Jack W. Sites, Jr., Brett C. Stearns, Paul-Heinrich Stettler, Bern W. Tryon, Ken Vellin, Herbert Von Kluge, Harold Wahlquist, Joseph P. Ward, Bruce J. Weissgold, Jeanette Wyneken, Yuichirou Yasukawa, Colleen M. Young, Donald Zeiller, and George R. Zug.

# INSTRUCTIONS FOR CONTRIBUTORS

Submissions will NOT be peer-reviewed, but may be edited. Submissions should be sent to the editors and NOT the editorial board.

**Text:** To ensure a swift turnaround of articles, we ask that, where possible, all submissions be in electronic format either as an attached E-mail file or on disc. If compatible computer facilities are not available, hard copies of the article can be sent to the editors by mail or fax. Scientific names should be italicized and given in full in their first appearance. Citations in the text should take the form of (Kuchling, 1989), (Martin and Bateson, 1986), (Ernst *et al*., 1994). All articles need to be accompanied by the name of the author and a complete hard copy mailing address. If you wish your E-mail address, phone or fax number included please include them in your address.

**Table/Figures/Illustrations:** Each figure should be stored as a separate document in Word, Wordperfect, Excel, .bmp, .tif or .jpeg file. The editors will scan figures, slides or photos for authors who do not have access to such facilities. Tables and Figures should be given in Arabic numerals. Photographs will be considered for inclusion.

**References:** Citation format for different styles of references should be as follows:
*a. For an article in a journal:* Gaffney, E.S. 1979. Comparative cranial morphology of recent and fossil turtles. Bull. Amer. Mus. Nat. Hist. 164:65-376.
*b. For a book:* Cogger, H.G. 1975. Reptiles and Amphibians of Australia. Sydney: A.H. and A.W. Reed, 660 pp.
*c. For an article in an edited volume:* Pritchard, P.C.H. 1979. Taxonomy, evolution, and zoogeography. In: Harless, M., and Morlock, H. (Eds.). Turtles: Perspectives and Research. New York: John Wiley and Sons, pp. 1-42.
*d. Citations with two or more authors have all authors listed last name first and separated by commas:* Dodd, C.K., Jr., Franz, R., and Smith, L.L. 1994. Title. Reference.

# SUBSCRIPTIONS AND DONATIONS

For a hard copy subscription to this newsletter, please send your name and address to TTN at the address below. If you wish to review the newsletter on the web or download a PDF version, please visit our website http://www.chelonian.org.

In order to maintain our policy of free distribution to colleagues throughout the world, this newsletter must receive donations. We appeal to all of you, our readers and contributors, for financial support to maintain this venture. All donations are greatly appreciated and will be acknowledged in future issues of the TTN. Please give what you can. Donations to the TTN are handled under the auspices of the Chelonian Research Foundation and are fully tax deductible under US laws governing 501(c)(3) non-profit organizations. Donations are accepted in US dollars as either a Personal Check drawn on a US bank, an International Banker's Check drawn on a US bank, a US Money Order, an International Postal Money Order, or as a Credit Card payment (Mastercard and Visa only). Please do not send non-US currency checks.

Name_____

Address _____

Signature _____ Date _____

Amount $ _____ Payment method: Check or Money Order _____ Mastercard _____ Visa ____

Credit Card Account No. _____ Expiration Date _____

Please make checks or money orders payable to the Turtle and Tortoise Newsletter and send to
Turtle and Tortoise Newsletter
c/o Chelonian Research Foundation,
168 Goodrich St, Lunenburg, Massachusetts 01462, U.S.A.
Email: RhodinCRF@aol.com, Fax: +1( 978) 582-6279

## TURTLE AND TORTOISE PUBLICATIONS AVAILABLE FROM

# CHELONIAN RESEARCH FOUNDATION

The following turtle and tortoise publications are produced and published by Chelonian Research Foundation. The comprehensive breadth of our publications on turtle research is unparalleled and we hope that the quality and scope of our materials entice you to subscribe and/or purchase. This information, including full detailed tables of contents of all our publications, is also available on our website at **www.chelonian.org** — which we urge you to visit.


• ***Chelonian Conservation and Biology – International Journal of Turtle and Tortoise Research***. ***CCB*** is the only international professional scientific peer-reviewed journal of broad-based coverage of all aspects of conservation and biology of all chelonians, including freshwater turtles, marine turtles, and tortoises. Inaugurated in 1993, Volumes 1 through 3 have been completed and we are now producing Volume 4, with four issues per volume, averaging about 200 pages per issue. It is edited by Anders G.J. Rhodin and Peter C.H. Pritchard, and backed by an editorial board of 30 of the world's leading turtle authorities. Our worldwide distribution is over 1000 to more than 60 nations. Included in the contents are the formal descriptions of several new genera and new species of turtles, as well as articles on ecology, conservation, systematics, reproduction, sex determination, breeding and husbandry, pathology, physiology, morphology, and wildlife management. We publish one to two issues a year. Our subscription price is a very modest $50 per volume of four issues (over about two years) for individuals, $35 for students, $100 for institutions, and $100 for contributing members (tax-deductible and acknowledged in the journal). Every journal depends on its contributing authors, subscribing readers, and institutional libraries for its support. May we count on yours? Please consider subscribing for yourself, or encourage your institutional library to subscribe. We also invite all turtle workers to consider publishing their turtle research with us.


• ***Turtle and Tortoise Newsletter – The Newsletter of Chelonian Conservationists and Biologists. TTN*** is an informal high-quality biannual publication inaugurated in 2000 with time-sensitive notes, news, and announcements of interest to the world of turtle conservation and biology. Edited by Heather Kalb and Allen Salzberg it merges two previous publications: *Box Turtle Research and Conservation Newsletter* and *IUCN Tortoise and Freshwater Turtle Specialist Group Newsletter*. It is available free of charge with a paid subscription to ***CCB***.



• ***Chelonian Research Monographs – Contributions in Turtle and Tortoise Research***. Two issues in the ***CRM*** series are available: CRM 1 (1996): *The Galápagos Tortoises: Nomenclatural and Survival Status*, by Peter C.H. Pritchard (85 pp.), and CRM 2 (2000): *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*, edited by Peter Paul van Dijk, Bryan L. Stuart, and Anders G.J. Rhodin (164 pp.). Both are filled with numerous photos in full color.

**CCB Subscription (Volume 4, set of 4 issues, 2001-2002)**
Individual Subscriber ..... $50____
Student Subscriber (Institution:_____) $35____
Institutional Subscriber ..... $100____
Contributing Member ..... $100____
Air Mail surcharge to foreign addresses (optional) .. $40____

**CCB Back Volumes (4 issues in each volume)**
Vols. 1-3: Indiv. ($60 per vol.) (v. 1:__, 2:__, 3:__) .... $____
Vols. 1-3: Inst. ($100 per vol.) (v. 1:__, 2:__, 3:__) .... $____
Vols. 1-3: Air Mail surch. to for. addr. ($40 per vol.) .. $____

**CCB Single Issues (Current or Back Volumes)**
Vols. 1-4: Single issues only ($17 each:_____) $____

**CRM 1 (*Galapagos Tortoises*)**
Hard Cover Edition (ISBN 0-9653540-0-8): ..... $ 29____
Soft Cover Edition (ISBN 0-9653540-1-6): ..... $ 19____
*Postage USA or International Surface Mail* ..... $ 3____
*International Air Mail* ..... $ 10____

**CRM 2 (*Asian Turtle Trade*)**
Hard Cover Edition (ISBN 0-9653540-2-4): ..... $ 35____
Soft Cover Edition (ISBN 0-9653540-3-2): ..... $ 25____
*Postage USA* ..... $ 3____
*International Surface Mail* ..... $ 6____
*International Air Mail* ..... $ 13____

***Total:*** _____

**Name**
_____

**Address**
_____
_____
_____ **Zip Code** _____

Payment : ❑ CHECK OR MONEY ORDER ❑ MASTERCARD ❑ VISA
Acct. No._____ Exp. Date_____
Signature_____

Payment only in US dollars by either a check drawn on a US bank, a US money order, an International Postal Money Order, or by Credit Card (MasterCard or Visa only). Make checks or money orders payable to **Chelonian Research Foundation** and remit to: Anders G.J. Rhodin, Chelonian Research Foundation, 168 Goodrich Street, Lunenburg, MA 01462 USA, *Phone:* 978-582-9668, *Fax:* 978-582-6279, *E-mail:* RhodinCRF@aol.com, *Website:* www.chelonian.org