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Turtle and Tortoise Newsletter

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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.

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The cover photo, by Chuck Schaffer, is of a *Manouria emys phayrei* female from Vic Morgan's captive collection. She was part of the study described in the first article of this issue and has reproduced successfully every year since 1991.

Behavioral Observations of Captive Juvenile *Manouria emys phayrei* with Notes on Degrees of Intergradation with *Manouria emys emys*

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Manouria emys is the largest tortoise in Indomalaya and the fourth largest in the world. In general, the carapace is flattened on top, but broad, low and slightly wider posteriorly. With the exception of older animals, clear growth annuli surrounding the central areolae are apparent in vertebral and costal scutes. Scutes appear raised excluding very young animals where they exhibit a clear concavity. These turtles have a pronounced lack of derived morphological features (Crumly, 1982; Crumly, 1984). The primitive characteristics include mental glands, similar to batagurids (Winokur & Legler, 1975), arrangement of the carpal bones (Auffenberg, 1966) and early stages of tortoise-like shells evident in interior gular and epiplastral excavation (Highfield, 1990). Its primitive nature is also evident in its mesic habitat preference (Auffenberg, 1971; Pritchard, 1979). These tortoises also exhibit the very unusual nesting behavior of building and defending a raised nest mound.

The distinction between the sexes is not dramatic (Fig. 1) and there is often little difference even in size (Obst, 1988). Males may have longer thicker tails, a more posterior vent and a bulge on the anterior fifth vertebral scute (Morgan and Schaffer, 2001). Old males and some females may have a slightly concave plastron with little size dimorphism. Vocalization, primarily related to mating, occurs in both sexes. Males vocalize during courtship, mounting and copulation. Females limit calls to early stages of mating.

Manouria emys is divided into 2 subspecies: *M. e. phayrei* (Burmese black mountain tortoise) and *M. e. emys* (Burmese brown mountain tortoise). The key difference between the two subspecies is found in the pectoral scutes. In *M. e. phayrei* the pectoral scutes normally meet at or near the midline (Wirot 1979; Ernst & Barbour 1989; Cox et al., 1998), while they are widely separated in *M. e. emys*.

Manouria emys phayrei, the northern subspecies, ranges from central and northern Thailand, Myanmar, Assam, and Bangladesh to India (Pritchard, 1979; Wirot, 1979; Das, 1985; Obst, 1983; Tikader & Sharma, 1985; Ernst & Barbour, 1989; Das, 1991; Iverson, 1992; Cox et al., 1998; Liat & Das, 1999; Iverson et al., 2001) (Fig. 2). In addition to a more northern range, it is larger (60 cm), has larger clutches (51), and is generally darker, with a dark brown, olive or black domed carapace.

Figure 1 a. Female *Manouria emys phayrei*

Figure 1 b. Male *Manouria emys phayrei*

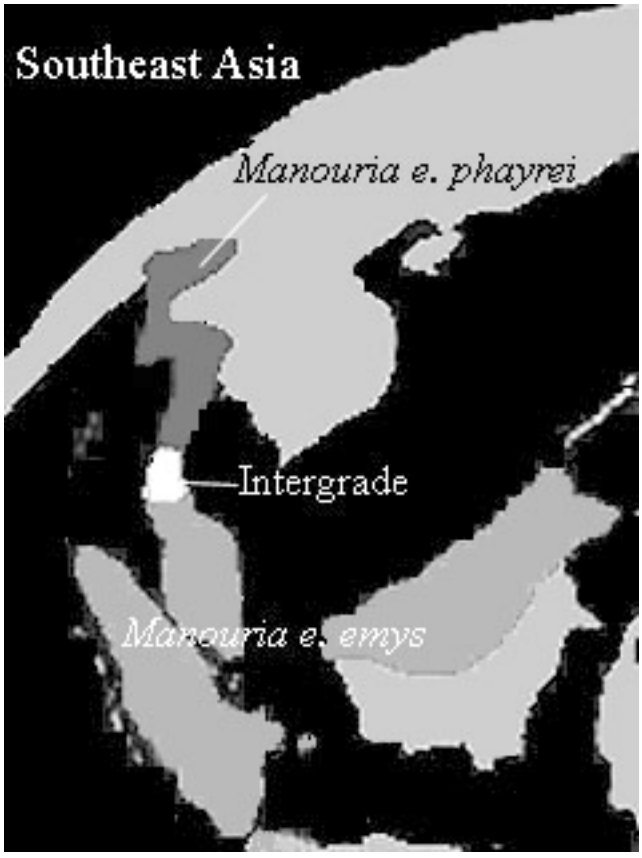

Figure 2. Range map for *Manouria emys phayrei*, *Manouria emys emys*, and the intergrades.

Manouria e. emys has a more southerly range in southern Thailand, Malaysia, Sumatra, Borneo and some of the Indonesian Islands (Fig. 2). It is also (questionably) reported from Australia, China, Cambodia, Lao PDR and Vietnam (Gunther, 1864, Gray, 1870; Bourret 1941; Wu, 1943; Das, 1991; Jenkins 1995). Of these, the Australian "Murray River" specimen (Gunther, 1864) was acquired by the British Museum from Gould "with a series of skins of Kangaroos and other Australian mammalia and reptiles... (Gray, 1870)". It was obviously mislabeled by the Museum or Gould. Wu (1943) described the species from a zooarchaeological specimen from in a Shang Dynasty site, a group that practiced plastromancy (divination by chelonian plastron). Bourret (1941) noted the origin of the specimen was Cholon (Chinatown in the former Saigon). *Manouria e. emys* is smaller (50 cm), has smaller clutches (30), and generally has a lighter yellowish brown flattened carapace. Sometimes the seams may be darker.

Figure 3.a. Hatchling *Manouria emys phayrei*.

Figure 3.c. Plastron of hatchling *Manouria. emys phayrei*.

Hatchlings of both subspecies appear similar, differing primarily in color (Fig. 3 a&b) and pectoral scute arrangement (Fig. 3 c&d). Differences become more pronounced during subsequent years when the carapace of *M. e. phayrei* develops a pronounced scute dimpling (Fig. 3 e), while those of *M. e. emys* remain unchanged. Pectoral scutes remain unchanged from hatching (Fig. 3 f). Examinations of numerous possible intergrade specimens reveal *M. e. phayrei*-like dimpling (Fig. 2 g) with pectoral scute arrangement intermediate to both subspecies but sometimes closer to what would be expected in *M. e. phayrei* (Fig. 3 h). The majority of *M. e. emys* show no dimpling (Fig. 3 i) and have the more typical pectoral scute configuration (Fig. 3 j).

Only one published paper dealing with natural in-situ behavior was found (Lambert & Howes, 1994). During that

Figure 3.b. Hatchling *Manouria emys emys*.

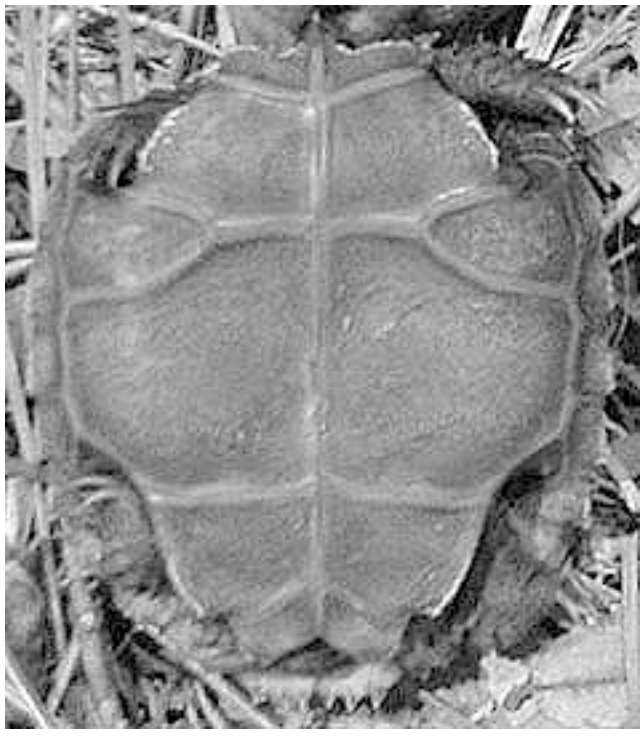

Figure 3.d. Plastron of hatchling *Manouria emys emys*.

Figure 3 e & f. *Manouria emys phayrei* (top two figures).

Figure 3 g & h. Possible intergrades (middle two).

Figure 3. i & j. *Manouria emys emys* (bottom two figures.)

study, the activity period of one female *M. e. phayrei* was examined using radiotelemetry for six months. During this time, she traveled less than 200 m through a series of clustered locations with sporadic longer movements through a 0.6 km^2 area (Lambert & Howes, 1994; Liat & Das, 1999). Very little else has been recorded regarding activity periods and thermoregulation.

Materials and methods

The objective of this ongoing two-year study is to observe a group of juvenile *M. e. phayrei* under near natural conditions to study activity and behavior. Of particular interest was the response in activity level to temperature and humidity. These captive observations, while unable to completely approximate studies in their native range, serve to provide an analogous view until such studies can be conducted. At the study site in Jacksonville, Florida, temperature and precipitation were comparable to areas within the range of *M. e. phayrei*. Study habitat ranged from 1.5 m^2 for hatchlings to 3 m^2 for three year olds with two to three animals in each enclosure. Enclosures were provided with multiple hiding areas/shelters, piles of loose leaf-debris and a shallow drinking/soaking container. Study animals, ranging from one to three years of age, were acquired from captive breeding of wild caught stock. The diet was regularly varied and included a diverse mix of fruits, vegetables and fungi.

Results

Activity levels appear to be directly correlated to time of day, precipitation and temperature. Typical *M. e. phayrei* bimodal activity periods (Fig. 4a) in morning and evening are clear with the morning activity period previously unreported. Cooler temperatures extend and warmer temperatures contract the activity cycles.

Within the temperature range of 13-32°C, maximum activity occurred more often during high humidity or precipitation (Fig. 4b). Below 13° and above 32°C, activity decreased. Low humidity also induced inactivity.

A second very significant discovery was the use of thermostrategy - predetermined thermoregulatory behavior (Morgan & Schaffer, 2001). *Manouria. e. phayrei* spends cold evenings outside and consistently wakes up in a pool of warming sun. The method of location of this spot of early sun must somehow be based on thermoexperience – knowing where the warm area will appear.

Discussion

The primitive nature and morphological traits of *M. e. phayrei* may account for, at least in part, some of the behaviors, particularly those of mesic habitat preference, as well as humidity dependent and bimodal activity patterns. Other problematic characters include complex activities, such as nest building and defense that are anything but primitive.

Although previous in-situ studies of adults have been conducted (McKeown et al., 1982), the published data forms no consensus. Some suggest activity in evening and

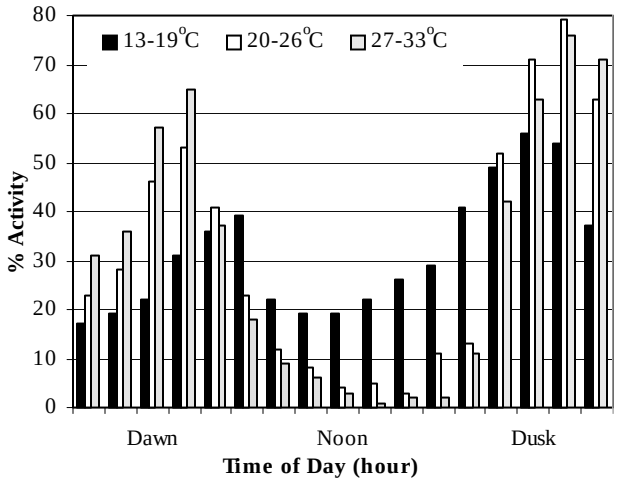

Figure 4 a. *Manouria. e. phayrei* bimodal activity periods.

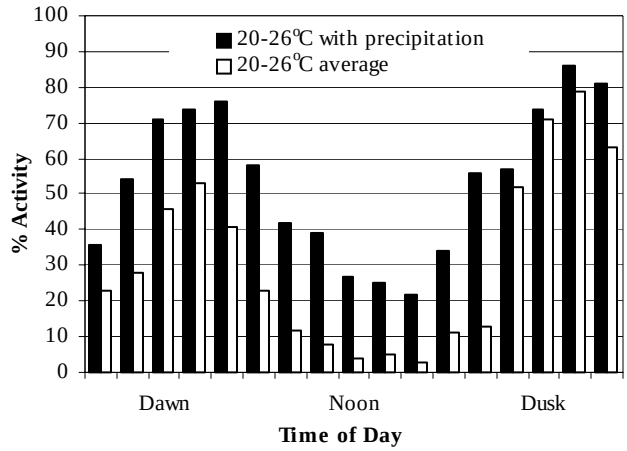

Figure 4 b. The effect of precipitation on *Manouria. e. phayrei* activity periods.

night (Obst, 1988) while others indicate it in early afternoon (Lambert & Howes, 1994). Our observations indicate two activity periods: dawn and dusk.

Differing from normal chelonian thermoregulation, and previously unreported in the literature, *M. e. phayrei* utilizes thermostrategies during the colder months. Instead of burrowing or retreating to shelter, *M. e. phayrei* remains outside, and utilizing thermoexperience, awakens in a pool of sunshine. This is an advantageous strategy allowing animals outside to warm up faster and become active far earlier than those in the shelter, thus permitting a much longer period of daily activity.

The Asian turtle crisis has lent urgency to an adequate understanding of this species. With no reliable population density estimates and a drop in abundance, there has been no change in its listed status and conservation, despite growing concern. Failure of current land-use planning, and conservation practices, coupled with inconsistent protective legislation contribute to the decline of this species, to which protection, often simply means limited trade.

Behavioral observations presented here and elsewhere may facilitate understanding of *M. e. phayrei*'s natural

history. This baseline knowledge may supplement conservation programs, arresting the downward trend of this species. Captive observations and breeding alone will not save them, but may provide, not only breeding stock for future repatriation, but the knowledge necessary to keep in-situ populations viable. This study has also revealed new data including: an anterior fifth vertebral scute bulge in males, bimodal activity periods, and thermostrategies/ thermoexperience. In order to ensure the survival of *Manouria emys* in the wild, we need new and more complete in- and ex-situ studies. Land use planning, conservation practices and protective legislation needs to be re-examined more thoroughly in light of last year's Asian Turtle Trade Proceedings (van Dijk et al., 2000).

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Chelonian Notes along the Caura River, Venezuela, 2001

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From April 10-20, 2001, I surveyed the Caura river for chelonians. The Caura is a major river system in Venezuela and a large tributary to the Orinoco river. The source of the Caura is in the southern part of Venezuela near the Brazilian border. It joins with the Orinoco River about 200 km east of Bolivar city. Two Indian Groups, the Yekuana and the Sanema, are found along the river.

I surveyed the river from the town of Maripa where the Caura meets the Orinoco to the Para Falls. A distance of about 150 km. The survey was conducted at the end of the dry season when the Caura is at its lowest level. Observations were made using binoculars from a motorized boat. Turtles were approached slowly for better identification and, when possible, were captured. Sandy beaches along the river were visited to assess the presence of turtle nests. Every Indian village was visited and information associated with turtles was collected. When possible I met with the local Indian chiefs. Finally, two daytime surveys were conducted within the forest near Boca de Ninchare in search of tortoises.

Species Observed and Occurrence

I observed two species of freshwater turtles (*Podocnemis unifilis* and *Chelus fimbriatus*) and one species of tortoise (*Geochelone denticulata*). According to the Yekuana Indians, three more species of freshwater turtles (*Podocnemis expansa*, *Platemys platycephala*, and *Rhinoclemmys punctularia*) and one tortoise (*Geochelone carbonaria*) are also known to occur in and along the Caura. *Podocnemis expansa* is found downstream where habitat appears similar to that of the Orinoco *P. expansa* populations (Pritchard and Trebbau 1984). *Platemys platycephala* is found in the vicinity of Boca de Ninchare, but are believed to be inactive during the dry season explaining the absence of observations (Métrailler and Le Gratiet 1996, Yekuana Indians 2001). The Yekuana Indians say that *Rhinoclemmys punctularia* can be found upstream of Para Falls where the Caura river is smaller.

Vernacular Names

Along the Caura, the Yekuana Indians call *C. fimbriatus* "matamata". *Geochelone carbonaria* and G. *denticulata* are called "wayamu". *Platemys platycephala* is named "Kudamashua". Finally, *Podocnemis unifilis* is called "tadequeya" in the Yekuana language.

Importance of Chelonian in the Indian Communities

Podocnemis unifilis represents an important part of the indigenous diet among fish and wild mammals. The Yekuana Indians fish *P. unifilis* adults year-round. Turtles can be captured by hand in the dry season in the Ninchare river due to the low water level (max. depth: 2 m). Adults are usually captured accidentally in fishing nets or intentionally using a fishhook. Fruits such as papaya, platanos and bananas are the usual baits. The turtle eggs are not eaten as often as the adults. *Geochelone carbonaria* and *G. denticulata* are usually accidentally captured in the forest a few kilometers from the village while hunting for other animals. The meat of *P. unifilis* is preferred to that of both *Geochelone*. During my visit in most of the Yekuana Indian settlements, I observed 1-2 *G. denticulata* kept alive for a few days. They are cruelly immobilized by passing sticks across the front and rear openings of the shell and tying the sticks to the sides. Some families will sell tortoises when going to Maripa, the nearest town, while others will just keep them for their own diet. No *G. carbonaria* were observed, but according to the Yekuana Indians this species lives in sympatry with *G. denticulata*. During the dry season, tortoises are usually found near water bodies.

The status of *G. denticulata* is classified as "insufficiently known" by the IUCN Red Data Book (IUCN, 1982) and indeterminate in Colombia by Castano Mora (1997). The status is unknown along the Caura, but the species appears common according the Yekuana Indians. The status of *G. carbonaria* is unknown in Latin America (IUCN, 1982) and endangered in Colombia (Castano-Mora 1997). Along the Cuara the status is unknown. The Yekuana Indians observe fewer *G. carbonaria* than *G. denticulata*.

For the past three years the Yekuana Indian from Boca de Ninchare have implemented a conservation program for *Podocnemis unifilis* nests along the de Ninchare river. This river is a major tributary to the Caura (30 m wide; max. 10 m deep in winter; max. 5 m deep in summer). A project station is located about 60 km upstream from Boca de Ninchare where three Indians work on-site during the nesting season. Twelve major nesting sites have been protected from predators and poachers with 6,000 hatchlings released in 2000. During the first year, 270 turtles were captured and marked, 370 the second year (3 recaptured), and 670 the last year (7 recaptured). Turtles are captured using fishing nests and SCUBA diving during the dry season. Very few matamata were captured during the *P. unifilis* mark-recapture program. Only one the second year and one the third year. The low capture of *C. fimbriatus* could be attributed to capture methods that are totally inefficient for that species. Additionally, the Ninchare river may not offer a good habitat for the matamata. Even though the matamata is a more cryptic turtle than *P. unifilis*, it appears to be found in lower density along the Caura and tributaries. However their populations are not threatened due to the absence of human consumption or even habitat alteration.

In Latin America, *P. unifilis* is highly exploited. It is classified as vulnerable in the IUCN Red Data Book (IUCN, 1982) and at least vulnerable in Colombia by Castano Mora (1997). The Orinoco populations of Colombia are considered threatened and those in Venezuela are unknown, but probably highly reduced. Based on fishing capture and personal observations, populations of *P. unifilis* in the Rio Caura are also becoming vulnerable (pers. com. Rodriguez 2001). Along Rio Caura, the number of poachers and fishermen has increased over the past few years reducing the number of *P. unifilis*. Through sustainable management of their natural resources, the Yekuana Indians intend to conserve the Rio Ninchare and its turtles. One part of Rio Ninchare has been declared a national monument by the Venezuelan government and the involvement of the Indians living in the vicinity must be encouraged by supporting their conservation-management plan. However, the turtle hatchling program should be implemented only if the techniques they employ are evaluated and information on the biology of the species collected.

If you want to have more information on the *Podocnemis unifilis* program or support the Yekuana Indian community with this project, please contact in Spanish: Alberto Rodriguez, Organizacion Indegena de la Cuenca de Caura Tiuyujani, Apartado Postal 590 C.P. 8001, Ciudad Bolivar, Estado Bolivar, Venezuela.

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Putative Chipmunk Predation of Juvenile Eastern Box Turtles

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Despite the protection of a strong shell, adult box turtles (*Terrapene*) are still sometimes killed by larger predators like raccoons, canids and felids (Zeiller, 1994). Hatchlings and small juvenile turtles, on the other hand, are extremely vulnerable to predation, serving as food for a great variety of small and larger animals, including birds, rodents and reptiles (Harless & Morlock, 1989).

Hatchlings are approximately 25 mm in diameter and the unossified, pliable shell poses no significant deterrent to even small predators. Predation on hatchlings and small juveniles is very high (Madden, 1975). However, Yahner (1974) and Murphy (1976) report that once juvenile box turtles attain a body weight of about 250-300 g, they suffer no greater mortality from predation than do adults (500 g).

In connection with our repatriation studies on eastern box turtles (*T. carolina carolina*) (Belzer, 1996 & 1999), we studied the survivability of yearlings (following an indoor "headstart" of five months' feeding at 75° F and 4 months' hibernation at 40°F). We released the yearlings into a protective 10 m x 6 m nursery (screened top and sides, but not underground, with heavy welded 2.5 cm x 5 cm wire mesh), with an inner fabric liner, for acclimation to natural habitat.

Our first two box turtle yearlings (released June 1997) were evidently eaten by a skunk (*Mephitis mephitis*) in August 1997. Skunk footprints were on the inner lining of the holding pen's walls the day we discovered the yearlings missing. The predator must have squeezed through junctures in the screening, as there were no burrows under the 30 cm deep subterranean walls.

After that predation episode, the enclosure was reinforced with a complete second barrier of heavy wire mesh (top and sides), plus a 3-strand solar powered perimeter of electrified fencing. Once the electrified barrier was in operation, we never again found evidence of larger predators, like skunks, having entered the enclosure, but chipmunks (plus, probably, other small rodents), and moles, frequented the inside of the pen. The added layers of protection enabled subsequent years' juveniles to survive in the nursery through 1998 and 1999.

On April 15, 2000, one of us (S.S.) paid a morning visit to the nursery and found a two year old juvenile (60 mm L x 50 mm W, approximately 30 g) on its back, with 20% of its plastron chewed open (Fig 1). Her approach chased off the predator early in its attack. The hatchling was still alive and kicking even though its peritoneum was breached and intestinal tract and heart exposed. It survived, albeit with deteriorating vitality, through the ensuing 24 hours, till euthanasia was performed.

We did not observe the assault in progress. But of the potential small predators that could enter the enclosure, the chipmunk (*Tamias striatus*) was almost certainly the agent of this attack given daylight onset, size of the plastron wound, and relatively large tooth marks. Shrews, too, are known to chew open the plastron of hatchlings, but their mode of attack involves first chewing off feet, and some degree of paralysis of the victim (Zeiller, 1994).

More attacked young were found following the April 15 episode. For example, on April 17, 2000, another morning assault of a small, just-emerged, four-year-old juvenile (70 mm L x 60 mm W; approximately 45 g) was interrupted.

Figure 1. 20% of the plastron has been chewed open.

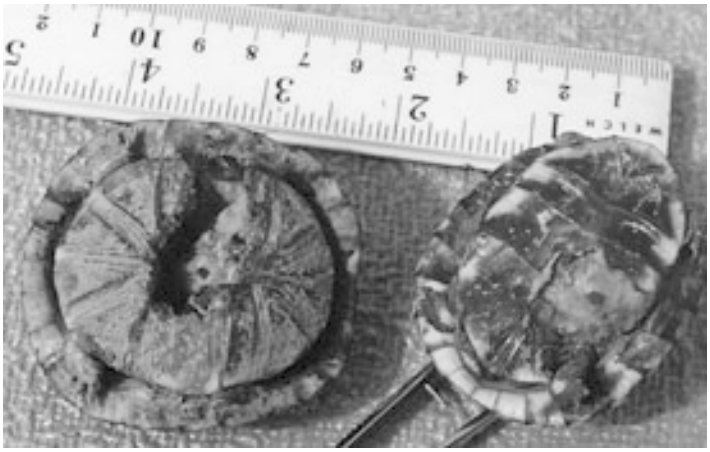

Figure 2. Gnawed on juvenile box turtles.

Again, the juvenile was on its back, with plastron partially gnawed open as in the April 15 case, but some viscera had been eaten and the turtle was already dead. The carapace of a two-year-old was later found with its entire plastron and all viscera gone. Evidently, after a couple of years' residency by juvenile turtles, the nursery was discovered to be a source of novel food by small predator(s) willing to wait for babies emerging from the ground. We saw no evidence that the turtles were excavated from their hibernacula. Evidently, as the juveniles sluggishly climbed out of the ground, they were grasped, turned upside down and their plastrons gnawed open like a nut (Fig 2).

Although popularly regarded as herbivores, chipmunks can be aggressively carnivorous. They are known to attack small birds, field mice, worms, eggs, etc. (Henisch, 1970). Gabriel Sagard described their "swarming" over, and devouring, fish that were left to dry on river banks by 17th century Native North Americans (Henisch, 1970). Predation on small turtles by the chipmunk, therefore, is consistent with its other dietary fare. Almost certainly, all of our 13 juveniles (ten two-year, one three-year, and two four-year-olds) would have been eaten in spring 2000 had we not intervened, excavated the hibernacula and evacuated four surviving individuals (1 four-year-old and 3 two-year-olds).

Conservationists using chelonian juveniles need consider chipmunks among the small predators that attack young turtles. Heppell et al (1996) noted that headstarting is wasted effort if juveniles can not be protected from predators till they reach sizes that confer significant defense against attack. Our experience reveals the mistake of omitting a subterranean floor for outdoor nurseries, and of using wire mesh that will not preclude smaller predators.

An alternative to constructing more elaborate nurseries (as developed by Morafka, Berry & Spangenberg, 1997) is to headstart juvenile box turtles until they reach the survivable size of about 275 g (Yahner, 1974; Murphy, 1976). Remarkably, this weight can be attained within two years using a careful, indoor, headstart protocol developed by Michell & Michell (1999). Kathy Michell guided our spring 2000 start-up of their methodology, for our future studies of survivorship among larger juvenile headstarted box turtles. By one year, many of our juveniles are more than 100 g. One has already developed a functional hinge (K. Goodblood, pers. comm.)

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Oh, Those Box Turtles

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This 81 year old man has been observing box turtles since he was three or four years old and thought he had seen everything to be seen about them. He had even written a book about box turtles, "So, You Like Turtles!" One of the things he explained therein was that box turtle shell prints are like fingerprints that, once formed during their juvenile years, remain the same throughout their lives (Fig 1).

But a few weeks ago for the first time, I noticed that two box turtles in my possession have very similar markings. You will see by the next set of pictures (Fig 2) that the markings are not identical but do contain enough characteristics to suggest that these two turtles must have shared at least one parent. Box turtles are not monogamous; a female in my sanctuary could have mated with any of several dozen males.

Over the years I have observed hundreds, if not thousands of box turtles, but have never seen such similarity. The turtle at the top is a female and the picture at the bottom is a male. In checking my records, they were born about 1988, so as of this date they are about 13 years olds.

Figure 1. Turtle L3(2) at 4, 8, and 13 years. Notice the pattern on the indicated costal scute.

Why haven't I seen more turtles with similar markings? That is, so that I could say to myself, "that turtle must be one of Sally's (to use a name) family." There is one very good reason—not many hatchlings survive. The female box turtle lays about seven eggs/year. Is it by design that she lays seven, hoping that one will survive? Think of this, a female box turtle starts laying eggs at about twelve and can lay a clutch of eggs every year through age seventy or more. This is what I believe based upon my records. For example, forty years ago my daughter, Vivian, acquired a box turtle with all the indications of a forty year old turtle. The turtle is now eighty years old and still laying fertile eggs. She is a small individual and perhaps that is why she lays only four eggs per annual clutch, or is it because of her age?

With so much fertility, why are box turtles on the decline? If one female can lay 400-500 eggs in her lifetime, surely there must be turtles all around us. But there aren't. First of all, the female box turtle lays her eggs whether or not they are fertile. As habitats are destroyed, the number of turtles become fewer and there is less chance of mating. Many animals eat turtle eggs, including raccoons, skunks, and opossums. If the eggs survive, many animals eat the hatchlings and the weaker hatchlings die off over winter. Roads and automobiles decimate both young and old turtles.

I guess that is why we don't find many box turtles with similar patterns and can thus say, "this one must be from Sally's family."

Figure 2. Female L-8 above, male L-8 below. Compare the pattern in the circled scute. Both turtles were born in 1988.

Commercial Extinction Exists and Is Often a Conservation Objective

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Salzberg (2001) commented on what "Conservationists have long assumed" about commercial extinction, yet his description of commercial extinction was very limited. A species may go to commercial extinction because it becomes rare, but it is also possible for it to go to commercial extinction without any change in population size.

In the 1980s, *Caiman crocodilus yacare* in the Pantanal was probably the most heavily exploited crocodilian in the world. However, when the bottom fell out of the international market for crocodilian skins in the early 1990's, the subspecies went to commercial extinction even though it remained one of the world's most abundant crocodilians. Economic realists claimed that the industry was subject to unpredictable demands, but many conservationists claimed that the commercial extinction was due to new CITES regulations which made the costs of trafficking too high. Those conservationists do not take credit for the caiman farms that also went to commercial extinction in this period. Whatever the cause, difficulty of hunting at the source was not the cause.

Melanosuchus niger went to commercial extinction in terms of the skin trade in the early 1980's when the populations were extremely reduced. The fact that a heavy trade in meat for local (South American) markets continued, and continues to this day, did not prevent the species from recovering to be the most common crocodilian in many parts of Amazonia (Da Silveira and Thorbjarnarson 1999). Many species of Amazonian turtles are extensively hunted, yet remain relatively common. Therefore, the persistence of hunters in the area does not always keep driving a species down.

Most conservation is about economics and economics depends as much on demand as supply. Conservationists need to think in terms of cost-benefit ratios. The highest costs are often, perhaps usually, not at the source. Conservationists can increase the costs, usually through laws restricting trade, and drive the wild populations to commercial extinction long before they reach biological extinction.

Proposals to farm the species follow the same logic, but their objective is to reduce the benefits of wild harvest by making the price fall. These proposals sometimes backfire, because the highest costs are often at the distribution and processing end. In this case, the farms may keep the industry viable long after it would have gone to commercial extinction if based only on wild populations, especially if the species is used only for food and has an intrinsically low value. As pointed out by Salzberg, when the price is forced up astronomically by rarity, such as when the product is for medicine or the pet trade, the species may reach biological extinction before commercial extinction.

Conservation is not a race between the market and nature. Conservation is about trying to adjust the market in such a way that wild populations of the species will attain commercial extinction before biological extinction. There are many ways to do this, and the best recipe will vary between places. As a generalization, conservation of Asian turtles is difficult because of strong markets, weak laws, widespread poverty close to unimaginable wealth, and the presence of common species that can maintain the market functioning in the area long after the rarer species would have gone to commercial extinction if they were the only species present. However, this generalization hides a multitude of specific cases that will have to be dealt with to obtain effective conservation.

In other places in the world, it may be better to have a wildlife market than convert the area in soybean fields. Again, it is a matter of economics. We will only have success if conservationists use commercial extinction as a tool. The question is almost always the following: How can I manipulate the market so that the species goes to commercial extinction in the wild before it goes to biological extinction? If commercial extinction cannot exist, then neither can conservation.

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IUCN Asian Turtle Workshop: Developing Conservation Strategies through Captive Management and the Turtle Survival Alliance (TSA)

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At this point in time, there are few sectors of the conservation and herpetological communities that are unaware of the extinction crisis facing Asian freshwater turtles and tortoises. The documentation of unsustainable commercial exploitation of chelonians for the food and traditional medicine is convincing and undeniably real. Feelings of hopelessness have at times been nearly overwhelming, as even the combined education and enforcement efforts seem not enough to prevent the extinctions of turtle species in the wild in Asia.

In response to this crisis, a conservation planning workshop for Asian turtles was held in Fort Worth, Texas, from 26 – 28 January 2001 under the auspices of the World Conservation Union (IUCN). The *IUCN Asian Turtle Workshop: Developing Conservation Strategies Through Captive Management* was organized and hosted by the Fort Worth Zoo, and conducted by the Conservation Breeding Specialist Group (CBSG) in conjunction with the Tortoise and Freshwater Turtle Specialist Group (TFWTSG). Major funding support was received from the following organizations: Cleveland Metroparks Zoo, Conservation International, Zoo Atlanta, Chelonian Research Foundation, Fort Worth Zoo, Wildlife Conservation Society, The Tortoise Reserve, and the Chelonian Advisory Group of the American Zoo & Aquarium Association (AZA). This workshop brought together nearly 80 participants from eleven countries representing a wide range of disciplines including wildlife and range country biologists, conservationists, zoo managers, private hobbyists, academics, commercial interests, veterinarians and governmental authorities. The primary goal of this workshop was to develop a global comprehensive captive management strategy for the most endangered Asian chelonians.

Workshop participants divided themselves among nine Working Groups that dealt with the following topics: Captive Holdings, Population Management Plans, Systematics, Veterinary and Husbandry Issues, Facilities, Regulatory Constraints, Information, Linkages with Range Country Programs, and Founder Acquisition. The group dynamics were challenging as would be expected with an assemblage of such diverse and often conflicting goals. However, emerging from this process was a spirit of cooperation that pervaded the workshop and led to an Organizational Working Group composed of representatives from each of the major sectors represented. These sectors included NGOs, commercial breeding operations, American Zoo Association/AZA, European Zoo Association/EAZA, Australian Zoo Association/ARAZPA, IUCN/SSC, legal interests, regulatory agencies in U.S. and China, range country programs, U.S. and European private breeders, veterinary community, university researchers and the public/corporate sector. From this Working Group an alliance was forged, and the Chelonian Captive Survival Alliance (CCSA) was formed. This group (renamed the Turtle Survival Alliance or (TSA) will function as a joint interdisciplinary working group of the IUCN/SSC Tortoise and Freshwater Turtle and Conservation Breeding Specialist Groups, and is defined as a Partnership Network for Sustainable Captive Management of Freshwater Turtles and Tortoises.

The mission of the TSA is: *to develop and maintain an inclusive, broad-based global network of collections of living tortoises and freshwater turtles with the primary goal of maintaining Chelonian species over the long term to provide maximum future options for the recovery of wild populations*.

The TSA Steering Committee represents a diverse range of expertise and interest and is composed of the following:

Steering Committee Co-Chairs:

Kurt A. Buhlmann and Rick Hudson

Representation:

IUCN/SSC

Anders G.J. Rhodin- Chelonian Research Foundation
Rick Hudson- Fort Worth Zoo

NGO

Kurt A. Buhlmann- Conservation International
John Behler- Wildlife Conservation Society

Zoo

Hugh Quinn- Cleveland Metroparks Zoo
Henk Zwartepoorte- Rotterdam Zoo
Matt Vincent- Melbourne Zoo

Corporate

Lonnie McCaskell- Disney's Animal Kingdom

Academic/University

John B. Iverson- Earlham College

Private Hobbyists

James Barzyk- USA
Harald Artner- Austria

Commercial

Al Weinberg- South Florida Reptile Exchange, Inc.

Regional NGO

Dave Lee- The Tortoise Reserve
Doug Hendrie- Turtle Conservation Project, Cuc Phuong N.P., Vietnam

Range States

Peter Paul van Dijk- TRAFFIC Southeast Asia

Veterinary

Barbara Bonner- The Turtle Hospital

Advisors and Consultants:

Legal

Brett Stearns- Institute for Herpetological Research

Regulatory

Wan Zi Ming- CITES China

Records

Annabel Ross- Fort Worth Zoo

Communications

Darrell Senneke- Tortoise Trust USA

Capital Campaign

Walter Sedgwick

Implementing Solutions

Although the initial focus and organizing principal of the TSA was Asian turtle conservation, the TSA is designed to respond to turtle conservation issues worldwide, particularly when captive management becomes a necessary component in a species' overall survival strategy. Recognizing the importance of establishing genetically diverse and viable populations of every species of highly threatened and heavily exploited chelonian in long-term captive or semi-wild conservation programs is the driving force behind the TSA.

Since the founding meeting in January 2001 a significant amount of progress has occurred towards

advancing the mission and goals of the TSA. First, the Steering Committee convened in April in Chattanooga to draft a set of guidelines and procedures under which the TSA could operate. Levels of membership were defined, procurement ethics and importation guidelines written and the basic structure of the TSA was established. Aside from the 16 Steering Committee members, the TSA is composed of Partners that are individuals and institutions that are participating in the conservation breeding programs for the various species and agree to the general mission, goals and code of ethics of the TSA. Partners are those with a vested interest in these species and include private breeders, zoos, geneticists, veterinarians, range country program managers, field biologists and NGO centers. Space is the single most important challenge facing the TSA in establishing conservation-focused captive populations ('Assurance Colonies') of threatened turtles. The facilities needed to support such a massive undertaking far exceed those in zoos. Private and commercial turtle breeders' facilities and government facilities (e.g., fish hatcheries) have much to offer in this respect, and will be major contributors to the success of the TSA. Much of the husbandry expertise is found in the private sector. The tremendous amount of talent, enthusiasm, expertise and energy that exists among private turtle breeders can be applied to international conservation through the TSA. Operating guidelines were drafted to be responsive to the needs of private and commercial breeders, and take into consideration the financial constraints under which many operate.

Half (forty-five) of the ninety species of Asian turtles are ranked by the IUCN Red List as either Endangered or Critically Endangered. Given that so many taxa will likely depend on captive management for their survival, and considering the spatial and thermal conditions that some of the large riverine and softshell species require, the establishment of captive populations becomes a mammoth undertaking. Saving them, in the words of John Behler (1997) will require nothing short of heroic intervention. Recognizing that existing facilities are not adequate to support sustainable populations, the TSA is looking to develop captive colonies in southern locales under semi-wild conditions. Federal and State fish hatcheries offer much potential in this regard, particularly in South Carolina and Georgia. Tropical fish farms in south Florida are also ideally suited for this purpose. Commercial turtle farms in Florida, Louisiana and Alabama also have potential. Thus, creative and unconventional solutions are being sought in order to meet this daunting challenge.

However, and perhaps foremost, the TSA will endeavor to foster, support and develop captive programs in range countries wherever possible. Establishing *in situ* captive colonies and headstarting programs will become visible reminders to citizens of these countries that turtles are part of their natural heritage and this becomes critical for garnering support and implementing future reintroduction plans. Perhaps such programs can provide benefit to the local communities through jobs and tourism. The Turtle Conservation Project at Cuc Phong National Park in Vietnam is exemplary in this regard and is a model program. Efforts to provide education to Asian student scholars through internship programs such as that undertaken by the Wetlands Institute in Stone Harbor NJ and New York Turtle and Tortoise Society (NYTTS) are vital to this mission and should be expanded.

Field survey and research is also needed. Several Asian turtle species are known only from food markets. How are we to plan for the return of populations to the wild if we know little about their natural history and distributions? Where are protected areas being established? Thus, building partnerships between the TSA and conservation organizations (e.g., CI and WCS) is critical. Likewise, observations and experimental studies of semi-wild and captive turtles are needed to refine TMGs (described below). The eventual repatriation of species to native ranges will require university research on relocation techniques that maximize survival and ensure site fidelity.

Taxon Management Groups (TMGs)

The functional units of the Turtle Survival Alliance are the Taxon Management Groups (TMGs). The primary goal for each specific TMG plan is to insure the long-term survival of that species in captivity and preserves future options for reintroduction. Each TMG is organized by a designated 'point person' who assumes responsibility for bringing together the participating TSA Partners who then draft a management plan for their particular species. At present, there are TMG point persons in both Europe and North America.

Each TMG plan establishes the target size of the population and the number of founders needed, states how many offspring will be set aside for conservation, identifies the genetic, husbandry, and veterinary concerns, determines who will maintain the turtles and where, and proposes an acquisition and disposition plan. Range country partners are identified. The Steering Committee then reviews each plan.

To facilitate the process, cross continent networks have been established and a ListServe provides a forum for gathering and sharing natural history and captive husbandry information. An extensive database of worldwide turtle holdings has been compiled by Annabel Ross of the Fort Worth Zoo and is available to TMG point persons as they develop their TMG plans. The database is growing with the TSA and is becoming a valuable tool.

Further, to help insure that these captive populations are representative of their wild counterparts, a team of geneticists from the University of California-Davis is working to screen some of the problematic forms in order to identify cryptic taxa and resolve taxonomic issues. This genetic component will be critically important to "ground truth" these captive colonies, particularly those founded with stock from unknown or disparate localities.

Currently TMGs are being organized for 17 taxa including 14 of the 18 Critically Endangered species plus the genus *Manouria* (3 taxa). The others are *Batagur baska, Callagur borneoensis, Chelodina mccordi, Chitra chitra,*

Cuora aurocapitata, C. galbinifrons, C. mccordi, C. pani, C. trifasciata, C. zhoui, Geochelone platynota, Heosemys depressa, Leucocephalon yuwonoi, and *Mauremys annamensis.* TMGs for additional taxa will be designated in January 2002 when the TSA Steering Committee meets again in Austria. TMGs document the existence of captive populations as well as establish a cooperative management team to insure their survival. Working together under an IUCN umbrella is important as we work to attract the necessary resources to implement TMG plans. Fund-raising efforts by Kurt Buhlmann have paid off recently and financial commitments have been made to help TMGs develop some of the infrastructure needed.

Confiscations

The Assurance Colonies for many species will be stocked primarily through the confiscations of turtles that were destined for food markets in Asia. Confiscated turtles will be made available to TSA partners provided that those turtles become part of Assurance Colonies and are not subsequently sold or traded. Subsequently, some offspring may be sold or traded provided that the conservation goals of the TMG for that species are being met. In order to facilitate this process Kurt Buhlmann has been working with U.S. Fish and Wildlife Service to establish procedures and guidelines for directing confiscations to TSA Partners. Kurt is also working with CITES authorities in Hong Kong to develop a mechanism for directing seized shipments of turtles to the TSA. To handle such confiscations an extensive network of TSA veterinarians with specialized facilities and training in turtle medicine has been established that will serve as our 'front line' in these situations.

Getting an international project of this magnitude and complexity off the ground has been a challenging undertaking and progress at times has *seemed* slow. Much time and effort has gone into promoting the TSA on a number of fronts and to a variety of audiences. Since April 2001 Buhlmann and Hudson have given presentations about the TSA at the following meetings: Conservation International (Washington DC, May), AZA Chelonian Advisory Group (Detroit, June), International Herpetological Symposium (Detroit, June), SSAR/HL (Indianapolis, July), U.S. Fish and Wildlife Service (Washington DC, August), International Reptile Breeder's Expo (Daytona, August), Gopher Tortoise Council (Gainesville, October), NYTTS/AMNH (New York, October), and Savannah River Ecology Lab (Aiken SC, November). An eight-page color brochure was published in August that describes the TSA and its mission and contains frequently asked questions about the organization and its operating guidelines. This includes a form that requests information from new applicants. In short, there has been an almost frenetic amount of energy devoted toward the promotion of the TSA and in trying to establish the network connections that will be essential to our long-term success.

The strength of the TSA lies in the diversity of its Partners. The TSA is an action based conservation alliance that seeks proactive solutions to the threats facing the world's turtles and tortoises. A tremendous effort will be required to sustain this initiative and a genuine spirit of altruism based on a shared conservation ethic must develop if we are to be successful. We invite anyone that shares this spirit and passion for turtles to join our efforts. Contact either Kurt or Rick for more details.

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Editors' Comments on Recent Hong Kong Confiscations

On December 11, 2001 an illegal shipment of approximately 7,500 Asian freshwater turtles and tortoises was seized in Hong Kong en route from Singapore to China. Kadoorie Farm and Botanical Garden (KFBG) in Hong Kong received all the turtles for placement and enlisted the help of the recently launched IUCN Turtle Survival Alliance (TSA) (see previous article). Working together, KFBG and TSA swung into action to save as many of these animals as possible. This was the first opportunity for TSA to help save confiscated turtles, and it happened to be one of the largest confiscations in history.

As of mid-January, four shipments have arrived in the United States, bringing approximately 3,200 animals; another 1000 animals have gone to Europe. All animals have been placed into Assurance colonies under the umbrella of TSA.

Those turtles brought to the United States were first processed and medically treated in Port St. Lucie, Florida at South Florida Reptile Exchange. Veterinarians, students, researchers, corporate employees, and many others rallied to spend their holidays trying to save these turtles. From Florida, the animals have been shipped all over the United States to join already established assurance colonies.

The next issue of TTN will have several articles on this topic. You may also visit www.turtlesurvival.org for further information.

For those of you who were directly involved, individuals and corporations — the editors and readers of TTN would like to extend our sincerest congratulations and deepest appreciation for your work on behalf of these turtles.

Recent Actions by the People's Republic of China to Better Control International Trade of Turtles

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The People's Republic of China is the largest consumer country of freshwater turtles and tortoises (hereafter "turtles") in the world (Lau and Shi, 2000). The demand for turtles in China for food and medicinal purposes has fueled an enormous export of turtles from countries throughout Asia. This international trade has been implicated as the major conservation threat for most species of Asian turtles (van Dijk et al. 2000). As China is the largest consumer country of turtles, its demands ultimately determine the size and dynamics of this trade.

In 1981, China became Party to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), and since 1988, some species of turtles have been afforded protection under national and provincial legislation in China (reviewed by Lau and Shi 2000). We optimistically report here that the Chinese government has become aware of the consequences of Chinese trade demands on wild turtle populations in Asia, and as a result has recently implemented new legislation and enforcement actions to improve control measures on the trade of turtles in China.

In 1998, the CITES Management Authority of China and the Customs Agency cooperatively implemented a new piece of legislation called the "Commodity Code of Wild Fauna and Flora for Import and Export," which required that all imported and exported turtles in China be accompanied by permits and be inspected by customs officials.

For three weeks in January 2000, national and provincial government authorities in the provinces of Guangdong, Fujian, Guangxi, and Yunnan carried out a special enforcement action called "No.2 Action." Under this action, 51,664 policing officials investigated illegal trade and transportation of wildlife at international airports, key roads, wildlife trading companies, large wildlife restaurants, and at least 8,370 markets. While this action dealt with wildlife trade in general, a special emphasis was placed on turtles and tortoises in Guangdong Province. As a result of the No. 2 Action, 264 cases of illegal wildlife trade were found, a number of illegal traders were fined or arrested, and 40,748 animals (of which many were turtles) were confiscated. As a precedent, the No. 1 Action was an enforcement action carried out in April 1999. It focused on the illegal trade of Tibetan antelope in the provinces of Xinjiang, Qinghai, and Tibet Autonomous Region.

In June 2000, the CITES Management Authority of China implemented the "Notice of Strengthening the Live Reptile Import and Export Management," which prohibited the export and re-export of all species of turtles from China, except the two farmed species Chinese softshell *Pelodiscus sinensis* and Reeves' turtle *Chinemys reevesii*.

In June 2001, the CITES Management Authority of China implemented the "Notice of Strengthening the Trade Management on Turtle and Tortoise." This notice suspended the import of CITES-listed turtles from countries without export quotas, required each separate piece of cargo in a turtle shipment to carry a permit, and limited the number of ports that could import turtles. The notice also prohibited the import of all species of turtles from Cambodia, Indonesia, and Thailand. The CITES Management Authority of China recently sent several letters to range and transit countries in Southeast Asia requesting information on management regulations, laws, and trade control measures concerning turtles in those countries. Turtle imports were banned from Cambodia because the Cambodian Management Authority did not respond to these inquiries, from Thailand because Thailand has banned the export of all wildlife, and from Indonesia owing to confusion as to whether the Indonesian CITES Management Authority or a newly constructed aquatic resources department maintains jurisdiction over issuing export permits for turtles. Under this notice, the CITES Management Authority of China also affirmed a renewed commitment to verify the legitimacy of foreign permits that accompany imported shipments of turtles.

In April 2001 at Zhangjiajie Nature Reserve in Hunan Province, the CITES Management Authority of China and the General Administration of Customs cosponsored a training and consultation course for port officials to improve their inspection and enforcement abilities concerning wildlife, including turtles.

Presently, the CITES Management Authority of China is preparing an identification manual to approximately 80 of the most frequently traded species of turtles in Asia. The manual introduces the taxonomy, identifying characteristics, biological habits, conservation status, and trade status of these species using simple language and photographs. The manual will be distributed in China to wildlife management authorities and enforcement, port, and customs officials for assisting with on-site inspection and identification of shipments containing turtles. It is hoped that this manual will assist with the conservation and management of turtles in China and elsewhere in Asia.

Clearly, problems concerning the overexploitation of Asian turtles in China are not all solved. However, these recent actions are important first steps toward curbing the international trade of turtles in China. It is expected that China's role in combating the conservation crisis of Asian turtles will continue to strengthen.

Acknowledgments

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Pu Mat Turtle Hunter Interview

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While in Vietnam's Nghe An Province the authors interviewed individuals involved in turtle trade. Rangers from Pu Mat Nature Reserve, motorcycle drivers (a sort of taxi service), and local police authorities assisted us in finding people involved in the illegal turtle trade. Everyone we interviewed lived along Highway 7 in Nghe An province bordering Pu Mat Nature Reserve.

On 20 January 2001, we were introduced to a retired turtle hunter. Mr. Quang (not his real name) hunted turtles from 1983 to 2000, but retired when one son accidentally shot and killed another, mistaking him for game in the bushes. Mr. Quang took this as a sign that his family's career as turtle hunters was over and began farming instead. This is the first time that Mr. Quang has been interviewed about his turtle collecting activities.

The hunting period for all turtles was April to September and local hunters, like Mr. Quang, used dogs to hunt terrestrial species. The dogs, never formally trained, learned how to hunt turtles from their mother. They appeared to use primarily visual cues since they rarely found turtles buried in the leaf litter or wood duff nor did they ever find turtle nests. Often the dogs would find one turtle partially exposed under a log, but additional searches in the same locale by the hunters would find additional hidden turtles.

The information Mr. Quang has on eggs is from captured females who dropped their eggs in captivity or from dead females. When a turtle died, it was eaten. While cleaning the turtles for cooking, information was obtained by the hunters on the number of eggs present and the type of items in the digestive tract.

Specific Species Caught by Mr. Quang

The first turtle we discussed was a terrestrial species with an oblong round shell and a hinge that could close up tightly. It was dark with light patches along each side of the carapace and a thin light strip right down the middle. The plastron was usually all black. Males had a red throat color and females yellow. We believe this turtle to be *Cuora galbinifrons*.

These turtles were found along the hillsides, usually alongside fallen logs. The easiest time to find them was immediately after rain. Often there would be a small group of two males and one female.

Mr. Quang never observed these turtles dropping eggs, but examination of dead females usually revealed two eggs. Based on the contents of the digestive tract, they appeared to eat worms, mushrooms and rotten wood.

The price of these turtles ranged from 60,000 to 150,000 Dong/kg. The exchange rate at the time of this interview was 14,500 Vietnam Dong to $1.00 US. They could get 20 kg on a good day with a total of about 300 kg for the total hunting season**.** At about 1,200 gms per turtle this is approximately equivalent to 250 captures.

The second species caught was a large, terrestrial turtle. The maximum size observed for this turtle was 30 cm (length) and 4 kg. It was dark brown to black with lighter areas on its carapace and had large scales on its front legs, sharp pointed scales on its buttocks, and no hinge. This turtle was very strong and could go over a month without being fed. We believe that this turtle is *Manouria impressa*.

Called the Mountain Ridge turtle by the locals, they were usually found on hilltops where it was cool and usually foggy. When it was very hot they could sometimes be found in small pools along the ridges. They hid in root buttress hollows and small rock caves. The diet included mushrooms and rotten wood.

When the dogs find one, another turtle of the opposite sex was often directly in front of or behind the first turtle. Males have an Adam's apple and follow females, making a "chet chet chet" sound. During May to July, captured females might drop 10-12 eggs. These were also observed in dead females.

These turtles were found throughout the hunting season from April to September. During a typical hunting trip of 10 days to two weeks, Mr. Quang and his family might collect 50 individuals of varying sizes. These turtles have a low value, only 25,000 Dong/kg, but due to the turtle's ability to survive long periods of time with minimal care, they are worth collecting despite the buyers not actively seeking them.

One additional question for the hunter regarding this type of turtle was about its nesting habits. Based on the nesting ecology of *Manouria emys phayrei* reported by McKeown et.al. 1990 (Eds. note see article on pg. 2), we asked if they had ever found this kind of turtle around piles of leaf litter, similar to what is locally thought of as a pig pile? No, they had not.

The third type of turtle that we discussed was a small dark turtle, locally called the Serrated turtle. We believe that this species is *Geoemyda spengleri*. The maximum size that Mr. Quang recalled seeing was 10 (l) by 6 (w) cm and 300 grams. Males had very long thick tails. These turtles were rare, with only 2-3 being found per trip during July and August. They were usually found in streambeds that no longer have a flow, but still had moisture. Eggs were never seen. Examination of the digestive tract revealed mushrooms and rotten wood. Traders don't seek them since they are only worth 25,000 Dong/kg. The dogs usually ate them.

Type four was an aquatic turtle that went by the name Parrot Beak. They usually weighed 600-800 grams and were 20-22 cm long and about 13 cm wide. They had very long tails and could bite very hard. Males had chin glands. When held together in holding tanks, mating was observed. Eggs were never found. This was the most valuable type of turtle worth about 400,000 Dong/kg. We believe this species is *Platysternon megacephalum*.

Dogs can't find these, so the hunters use hooks in a circle with bait in the middle. They live in streams where there are deep pools near fast moving murky water. Usually only one, maybe two, will be caught per pool. Occasionally they are observed hiding in shady, shallow, cool water with their body down in a crevice, head poking out. Crab shells are found in their intestines.

Type five was a rare, aquatic turtle that the locals named Bad Smell turtle. We believe this was *Sacalia quadriocellata*. They were approximately 20 (l) by 12 (w) cm and weighed 400-500 grams each. Their shells were reddish-brown, domed, had keels and lacked hinges and they had stripes on their heads. They were found in both deep and shallow water pools in June and July. Normally they were caught in basket fish traps, only twice did Mr. Quang catch them on Parrot Beak turtle hooks. Mr. Quang never observed any of their eggs nor did he have any knowledge of what they might eat. They had a low value of only 25,000 dong/kg.

Mr. Quang had no trophy shells or other artifacts from his turtle-hunting career around his home, but his son said that an uncle had a shell found locally in Quang Phuc hamlet. The shell was that of *Cuora galbinifrons galbinifrons*. We will describe it in another publication.

Additional Interviews

Next we went to the home of a turtle broker, the middleman between people who have incidentally acquired turtles and traders bound for China, but he wasn't home. We spoke to his wife for only a few minutes, but she was paranoid that we were investigating her husband's illegal trade. She had one Big-headed turtle, *Platysternon megacephalum*, that she indicated she would use as a remedy for an ailment. When asked for exactly what ailment the turtle was useful, she said that her knee hurt and eating the turtle would help. The turtle trader's wife was very anxious about speaking with us, and quickly a large crowd of curious onlookers developed, even following us into the backyard and storeroom/garage of the house. The overall feeling was uneasy, so this interview ended without much information gained.

Our motorcycle driver brought us to another location, this time a traditional medicine shop. The shop owner had only a *Cuora* carapace used as a scoop for bins of dried plant products. We asked why the carapace was only worth being used as a scoop, while plastrons were so valuable. We were told that the carapace could only protect the turtle from mechanical damage from above, while the plastron kept away disease that came from the ground. When asked for more details, we were told that it cured lung problems.

The rest of our efforts at interviews proved fruitless. Mr. Quang, had been the most outspoken, but as he no longer participated in this illegal commerce he had nothing to loose by speaking with us.

Acknowledgements

We would like to thank Hoang Hoa Que, Director of the Pu Mat Management Authority for facilitating the required permissions from Provincial, District and Commune authorities. Doug Hendrie and Vu Thi Quyen for facilitating the appropriate visa for entering Vietnam, Roger Wood, PhD, and Cindy O'Connor, both of The Wetlands Institute for their effective introduction of William Espenshade to the authorities in Vietnam. Many local individuals along Hyway seven helped us both including Hoang Hoa Que's son Ky, Rangers from Pu Mat Nature Reserve and local Con Cuong Commune police.

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Madagascar Tortoise Crisis
Letter To CITES Animal Committee and Concerned Parties, 9 January 2002

JOHN BEHLER,
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At the close of 2001, the four endemic tortoises of Madagascar continue to be victimized by smugglers, the exotic pet trade, rampant habitat alteration and fragmentation, and unbridled collection for food. During my late November-early December 2001 trip to southern Madagascar, my party and I discovered new threats to radiated (*Geochelone radiata*) and spider tortoises (*Pyxis arachnoides*), which further cloud the picture and forecast dire straits for remaining chelonian stocks. Neither CITES and its signatories and their collective wildlife regulations, nor the Malagasy agency charged with tortoise protection and the enforcement of that country's wildlife laws, nor local fady (taboos) have significantly been able to reduce the traffic.

The following summarizes Dr. Herilala Randriamahazo's and my observations during our recent visit to southern Madagascar.

29 November. Beheloka. A 75 km west-east dirt road beginning ~8 km south of Ambatry from Highway 10 to the coastal village of Beheloka was traversed by 4x4 vehicle during late afternoon at the peak of the tortoise activity. In 1990 this area supported a robust tortoise population and 37 radiated tortoises, of all age classes, were observed and photographed during a similar drive across this road. No tortoises were observed in a 1999 survey along the same route under optimal afternoon observation conditions. Our Nov. 2001 trip was equally unproductive. Three sets of tracks were observed and no live tortoises were seen. Of additional note, extensive areas of forest had recently been cleared for agricultural purposes and little tortoise habitat remains.

30 November. Beheloka. The dunes immediately south of the fishing village supported large populations of both spider and radiated tortoises in 1990.

In 1999 Bill Holmstrom, WCS Herpetology Collection Manager, and I found that radiated tortoises had been extirpated here and the spider tortoise population had been significantly reduced in number. Today the landscape is a badly degraded grazing land (goats) and large areas have been cleared for tombs. Tortoise bones and shells remain as remnants of former days.

30 November. Tsimanampetsotsa National Park. We visited ANGAP staff in Efoetse and hiked with them into good tortoise habitat east of the lake. During former times this site supported a remarkably large radiated tortoise population (pers. com. Q. Bloxam). The population has been plundered in recent years by collectors from Tulear who harvested the tortoises for holiday feasts. No tortoises (one set of tracks) were observed during the one-hour hike. This observation is consistent with those made by Thomas Leuteritz (George Mason University Ph.D. scholar) in 1999.

ANGAP staff informed us that seven large pirogues (each capable of holding 500 tortoises) had arrived from Tulear on 1 November 2001 to collect tortoises for the upcoming holiday feasts. They complained that they have no authority to stop these "dangerous men." That authority rests with Eaux et Forets.

30 November. "Killing fields of Anandriana." During late afternoon and optimal conditions for observing tortoises, we visited an area several kilometers south of Androka and the Linta River (GPS/WGS 84 = 0416280, 7236092) to check on the subspecific status of the resident spider tortoise and the health of the local radiated tortoise population. The site has generally been considered to be beyond the zone of collection for food and the radiated tortoise population was believed to be one of the highest densities.

What we discovered was a degraded landscape that was littered with the skeletons of hundreds (very likely many thousands) of radiated and spider tortoises. The tortoises appeared to have been killed in their tracks. The shells of all age classes (from ~4 years old to ancient adults) were seen. Over the course of one hour (1550-1650 hr.), and along a narrow transect (~50 m wide, <1 km long), we recorded 39 dead radiated tortoises (11 juv., 28 adults) and 20 living radiated tortoises (16 juv., 3 sub -adults, 1 young adult). We also saw 1 dead and 3 living spider tortoises. Adults had a large hole punched through their plastra, while juveniles had the top of their carapaces crushed.

These observations were especially disturbing as it is the first report of harvest of virtually all age classes and the first observation of killing of spider tortoises. The killing appears to have taken place within a span of six months with the most recent events occurring within the month as dried flesh remained on some of the shells. Equally disturbing is that the tortoises appeared to just have been killed where they were encountered.

Subsequently we learned from scattered sources that a group of Asians (speculated to be the same as those

Dr. Randriamahazo surrounded by dead turtles at Anandriana.

involved in the sapphire smuggling business) were killing the tortoises for their livers which were made into pate' and smuggled to Japan.

We were informed that the men had been in Tulear several weeks prior to our visit.

2 December. Lavanono. We overnighted at Sorona hotel (built in 1997 by villagers; now a non-profit organization to help the economy of this remote coastal village through eco-tourism). An interview with the hotel staff revealed that they had sent a letter last June, signed by the community, to the government asking that they stop the collection of tortoises on their lands.

They said that the 4x4 vehicles came from Ft. Dauphin and belonged to members of Parliament. On 1 October, Rajaonimanana, from Eaux et Forets, supposedly responsible for CITES data (the hotel had his business card and hotel registration) visited Lavanono and heard the community complaints.

The community said nothing had been done and the vehicles returned and recent collection had taken place. This village, as all others, is not empowered to stop any trafficking in wildlife.

Flat-tailed Tortoises. While in Antananarivo, and prior to our southern Madagascar travels, I'd heard (pers. com. J. Durbin) that the flat-tailed tortoise (*Pyxis planicauda*) collection had resumed in the Kirindy area. As previously reported at an Animal Committee meeting, the collection of this species has exceeded the CITES quotas. This was verified by USFWS. At the CBSG/CAMP meeting in Madagascar last May, the status of this species was evaluated and judged to be critically endangered. This tortoise is a dry deciduous forest species that is sympatric with the giant jumping rat. This vanishing species was fully evaluated through a PHVA and the results predicted an extinction time of <30 years. The forest habitat is disappearing at 4-5% per annum. Ignoring all other factors, that statistic in and of itself provides a snapshot of the bleak future these species face. Further collection of this species of flat-tailed tortoises must stop. Arguments that animal dealers in Madagascar will play a role in this species' conservation have no biological foundation.

The CAMP evaluation by Malagasy and expatriate reviewers was clear on this subject.

Plowshare Tortoise. Shortly after my return to the United States from Madagascar, I received a communication from a ranking IUCN/TFTSG member that a Malagasy dealer and two Germans were involved in a plan to illegally export wild-caught plowshare tortoises (*Geochelone yniphora*) to the United States.

Those involved claimed to have bought the responsible Minister and timed the event to take place before the presidential elections last month. From subsequent messages that I've received, I understand that the names of the individuals involved are known to Malagasy, German, and USA wildlife authorities.

In closing, I want to reiterate that all Madagascar tortoises face a very serious set of problems. There is no internal effort to monitor the trade and only the most blatant and exposed smuggling episodes are prosecuted. Confiscated animals are quickly given to dealers. The tortoise trade in Madagascar has been facilitated by the highest government officials in the country. I implore CITES to be very thorough in its review of the Madagascar reptile and amphibian trade in 2002.

BOOK REVIEWS

North American Box Turtles: A Natural History, by C. Kenneth Dodd, Jr. 2001. University of Oklahoma Press, 10.25 x 7.125 in., xviii + 231 pp. Hardcover/DJ, Price $59.95 and

Turtles, Tortoises and Terrapins: Survivors in Armor, by Ronald Orenstein. 2001. Firefly Books, Inc., 11 x 8.5 in., xii + 308 pp. Hardcover/DJ, Price: $45.00

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Those old enough to remember the Beatles invading New York back in 1964 (R.I.P., George), probably also recall a time when quality new books covering freshwater turtles were few and far between. In fact, until the 1967 release of Living Turtles of the World by Peter Pritchard, most well stocked chelonian libraries in the United States contained exactly two titles, Clifford Pope's by then antique Turtles of the United States & Canada (1939) and Carr's Handbook of Turtles (1952).

Putting things into perspective, five years would pass between the appearance of Pritchard's Living Turtles and the release of the next in-depth review of semi-aquatic chelonians, Turtles of the United States by Ernst and Barbour, in 1972. We then had to wait until 1979 for the next major works to appear, although that year did mark the release of two separate volumes, Turtles: Perspectives and Research edited by Harless and Morlock and Pritchard's greatly expanded Encyclopedia of Turtles.

These two volumes were then followed by an unprecedented burst of activity, in which new titles appeared every couple of years; Freiberg's little Turtles of South America (1981), Turtles of Venezuela by Pritchard and Trebbeau (1984), the English translation of Obst's exceptional Turtles, Tortoises and Terrapins (1986), Alderton's Turtles & Tortoises of the World (1988), the far superior Turtles of the World by Ernst and Barbour (1989), and Gibbons' Life History and Ecology of the Slider Turtle (1990).

While a similar rate of new releases continued throughout most of 1990s, the number of titles covering semi-aquatic and terrestrial turtles available to American readers has increased significantly over the past three to four years. In this time period volumes examining Asian (at least 3 major monographs), Australasian (1 monograph and at least 3 smaller publications), and African species, as well as worldwide overviews of turtle reproduction (Kuchling, 1999) and conservation (Klemens, 2000) have all been widely distributed within the United States. In fact, the amount of quality new turtle publications makes it difficult to single out any one for review.

With these thoughts in mind, it was therefore thought best to briefly comment on two of the most exciting turtle volumes to be released during 2001. The first of these of course, if for no other reason than appearing earlier, is C. Kenneth Dodd's long awaited review of North American box turtles. In producing this volume, Dodd has successfully synthesized the wealth of existing information on turtles of the genus *Terrapene* into one neatly compact, researcher friendly and highly readable tome.

At the same time, the pages of North American Box Turtles: A Natural History are liberally sprinkled with a plethora of Ken's personal observations and research findings. Chapters reviewing the evolution, habitats, activity and movements, behavior, reproduction, feeding, population structure, predators and diseases, and conservation of box turtles overall are followed by relatively extensive standardized accounts for each of the four currently recognized species. These species accounts incorporate data on the type specimens, distribution, and appearance of all recognized subspecies and include range maps, etymologies, and complete synonymies of changes in nomenclature.

As expected, Dodd freely cites relevant literature whenever appropriate and the resultant bibliography spanning nearly 19 pages is quite impressive indeed. This, of course, only further enhances the book's overall research value. Those with a more casual interest in *Terrapene*, however, will nevertheless find Dodd's informative prose an easy and pleasurable read. Typographical errors and other mistakes are remarkably scarce throughout the text as well, despite Ken's humble claims to the contrary. About the only conceivable criticism that can be directed at the book at all concerns the 8 pages of color photographic plates, which have been reproduced at a size some may find too small. This admittedly poor editorial decision aside, North American Box Turtles is simply one of those classic natural history monographs that will serve as a standard reference for decades to come.

Turtles, Tortoises, and Terrapins: Survivors in Armor by Ronald Orenstein, unlike Dodd's genus specific review, provides a more "popular" overview of chelonians on a worldwide basis. As such, the text includes coverage of the sea turtles as well as the diverse assortment of semi-aquatic and terrestrial chelonian species. While similar broad-based reviews have been the target of previously released volumes, the most recent of these, Ernst and Barbour's Turtles of the World, is now nearly 13 years old. Considering the significant advances made in turtle research over the past decade or so, a newer synthesis of relevant information is certainly a most worthwhile goal.

Although by his own admission primarily an ornithologist, Orenstein has nevertheless produced an accurate, obviously thoroughly researched, and highly informative text. Unlike most worldwide overviews, which concentrate mainly on species diversity and identification, Ron has instead opted to focus more attention on what turtles are and why they do what they do. While superficially resembling the general approach utilized by Obst in his similarly titled Turtles, Tortoises and Terrapins, the more forcible emphasis on chelonian conservation issues by Orenstein sets his volume yet further apart.

Wrapped in a dust jacket featuring a beautiful shot of the Wood Turtle, *Clemmys insculpta*, and profusely illustrated with over 300 color photographs, the book is quite attractive to look at as well. Contributed by some of the world's leading wildlife photographers, interior color photos are invariably of excellent quality. Unfortunately, these photos also constitute the book's only significant flaw, as the captions of a select few obviously misidentify the species depicted. The "nostril ridges" of the turtle illustrated on page 70, for example, clearly identify it as a Spiny Softshell, *Apalone spinifera*, not the Smooth, *A. mutica*, as claimed in the caption. The "basking chicken turtle (*Deirochelys reticularia*)" of page 115, as well as the sliders "(*Trachemys scripta*)" of page 179, are likewise almost certainly some kind of *Pseudemys*. Of course, it is equally possible that these mistakes in identification rest with the original photographer, as here Ron has been left largely at their mercy.

This comparatively minor flaw, however, fails to overshadow the extent of Orenstein's accomplishment. His accurate and fact-filled text, while easily readable by even the most casual of turtle observers, will almost certainly provide some unknown tidbit of useful information to just about everyone regardless of expertise. Although this alone seems destined to insure Turtles, Tortoises, and Terrapins: Survivors in Armor a prominent place in the annals of chelonian literature, the volume's strong and clear stand on the side of turtle conservation, at the same time, cannot be more highly commended or have come at a moment too soon. Hey Ron, all in all, not bad for an ornithologist!

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Clark, Patricia J. 2000. Reproductive strategies of turtles: Population, latitudinal, and phylogenetic comparisons. Ph.D. 235 pg. Indiana University.

Abstract: A key hypothesis in the study of life history strategies predicts a trade-off between offspring size and number. Previous studies of turtle reproductive strategies and investment focused on variability of egg wet mass (size) and clutch size, generally within one site. This study compared not only the size of eggs and hatchlings but also the more fundamental energetic content of eggs and hatchlings and efficiency of conversion of egg to hatchling material at a variety of levels: within a species among local sites, within two species at widely geographically separated sites, and among a broadly distributed variety of species. Bomb calorimetry was used for energetic determinations. Analyses indicated some significant differences in size and energy content at all levels of comparison. For example, *Chelydra serpentina* and *Trachemys scripta* from the southern sites produced significantly larger eggs and hatchlings (both mass and energy) than those from the northern sites. Similarly, tropical cryptodire species with temperature dependent sex determination produced signifi-

cantly larger eggs and hatchlings (both mass and energy) than did the other groups compared. There were also significant differences in energy density among sites for *Sternotherus odoratus* and *C. serpentina*. Additionally, energetic analyses in this study indicated that use of wet mass as a measure of reproductive investment underestimated the differences at all levels of comparison.

This study also addressed the issue of optimal egg size and the constraint on egg size due to the physical morphology of the female *S. odoratus* shell. Egg width increased with both pelvic girdle opening and caudal aperture. However, comparisons of egg width and pelvic girdle opening and caudal aperture indicated that in this species, the caudal aperture was more constraining than the pelvic opening. This limited eggs to sizes smaller than would otherwise have been optimal save in the largest females.

Duggan, Annemarie E. 2000. Seasonal and Hormonal Regulation of Lipid Homeostasis in the Freshwater Turtle, *Chrysemys picta.* Ph.D. 165 pg. Boston University.

Abstract: The hypothesis that gonadal steroid hormones have a primary role in the regulation of significant lipid shifts associated with seasonal vitellogenesis and ovarian growth in oviparous species such as the freshwater turtle, *Chrysemys picta*, was tested. Analysis of the control mechanisms involved may provide insight into sex differences in cardiovascular disease and the cardioprotective role of estrogen in the human. We have described changes in plasma lipid and protein components during the turtle annual ovarian cycle. The distribution of lipids in total plasma and the lipoprotein fractions Very Low Density Lipoprotein, Low Density Lipoprotein, High Density Lipoprotein, and Very High Density Lipoprotein and of the lipid-transporting proteins, apoA-I, apoB, and apoE was assessed. Elevations of plasma triglyceride were associated with spring and fall periods of ovarian growth. Vitellogenin, but not cholesterol was also increased during these periods. ApoA-I, associated with reverse cholesterol transport, was significantly elevated after ovulation. Estradiol administration increased triglyceride and apoA-I levels in females and males, and hypophysectomized females with or without growth hormone. Progesterone followed by estradiol in females, also significantly increased apoA-I and triglyceride levels. Cholesterol levels were not altered. The physiologically relevant receptor for apoA-I, SR-BI (Scavenger Receptor Class B Type I), demonstrated here in non-mammals for the first time, was expressed in turtle tissues (liver, heart, and gonads). A second protein (34 kDa), putative apoE in turtle HDL/VHDL fractions, presumed absent in non-mammalian vertebrates, was also found. A comparative study of other non-mammals demonstrated widespread distribution of a putative apoE in vertebrates, which was reported to be present in the plasma of the lamprey (an agnathan), shark and skate (elasmobranchs), and alligator (another reptile).

These studies suggested that the lipid-transporting proteins, apolipoproteins (A-I and E, were associated with the plasma HDL fractions in the turtle, and that apoE was widely present in vertebrates, as was SR-BI, the receptor for apoA-I. Further, the synthesis/secretion of these lipid-transporting proteins, as well as vitellogenin, may be under endocrine regulation. In this way lipid homeostasis may be maintained despite the massive shifts in lipid reserves associated with seasonal ovarian growth. These studies may provide insight into the cardioprotective role of estrogen in the human female.

Rie, Melanie Tuthill. 2000. Assessment of the Effects of Groundwater Pollution on a Sentinel Species, *Chrysemys picta*, on Cape Cod, Massachusetts: Tissue Contaminant Levels and Hepatic and Reproductive Bioindicators. Ph.D. 200 pg. Boston Univ.

Abstract: In this study we sought evidence that groundwater pollution containing a low-level mixture of environmental contaminants might negatively impact reproductive processes in the freshwater turtle, *Chrysemys picta*. The specific geographic focus of the study was the Massachusetts Military Reservation (MMR), a Superfund site on Cape Cod, Massachusetts. We selected several bioindicators of exposure (hepatic cytochrome P4501A [CYP1A], glutathione-S-transferase [GST], metallothionein measurement and plasma vitellogenin) and effect (plasma estrogen and testosterone, sexual maturity, ovarian follicular kinetics (females), sperm counts (males) and testicular histology) to assess responses to groundwater pollution. In addition, the tissue levels of heavy metals were measured in animals trapped seasonally from potentially impacted and non-impacted sites over a period of 4 years. Since cadmium is known to have negative effect on reproduction, we chose to investigate the tissue distribution of an injected dose of radioactive cadmium, and the effect of exposure to non-isotopic cadmium on tissue metallothionein induction in a laboratory study.

Significant seasonal and site related changes were seen in the activity of two hepatic biotransformation enzymes CYP1A/GST, indicative of exposure of animals to organic pollutants. In addition, significant elevations in hepatic metallothionein and tissue heavy metal levels were detected in animals from the impacted site. Assessment of reproductive/endocrine biomarkers of effect indicated significant differences between animals from the contaminant impacted site and the control site. At the impacted site, females appear to be slower to reach sexual maturity and have reduced oocyte numbers. In addition lower plasma levels of estradiol were seen, which correlated with the reduced levels of the estrogen dependent yolk protein precursor vitellogenin and lower reproductive tract weights. Plasma testosterone levels and testis weights were somewhat lower in males from the impacted site. Sperm counts were lower in all Cape Cod nudes than in control males from Wisconsin. Although the primary site of pollutant action in the hypothalamic-pituitary-gonadal axis cannot be determined from these observations, the liver may be related to these responses in as much as hepatic metabolism of gonadal steroids and synthesis of vitellogenin may be altered in animals exposed to xenobiotics.

Rubin, Cory Stuart. 2000. Ecology and Genetics of Blanding's Turtles in an Urban Landscape. Ph.D. 113 pg. University of Illinois at Urbana-Champaign.

Abstract: The Blanding's turtle (*Emydoidea blandingii*) inhabits shallow freshwater habitats in North America and is undergoing population declines throughout its range. The loss of habitat is largely responsible for the demise of this semi-aquatic turtle. Moreover, the subdivision and insularization of remaining habitats through urban development are expected to become major threats to the species' persistence. Most knowledge to date has been generated in areas where habitats are relatively undisturbed by urban development. Consequently, the potential effects of urbanization on Blanding's turtles are not well established. To develop a better understanding of how Blanding's turtles respond to urban development, I initiated an investigation of the ecology and genetics of Blanding's turtles in the intensely developed Greater Chicago metropolitan area (GCMA) in northeastern Illinois. My findings indicated that populations in the GCMA are small and isolated and have juvenile recruitment problems, though do not appear to be suffering genetically. As expected, Blanding's turtles relied extensively on wetlands, but during dry periods turtles were often found on land and in permanent residential ponds located on private property adjacent to preserve boundaries. Based on these findings, primary efforts toward the conservation of Blanding's turtles in the GCMA should aim to increase population sizes and provide permanent wetlands within preserve boundaries and protect those used by turtles on private property. Because adult survival was high in the populations studied, low juvenile recruitment appears to be the major factor resulting in small population sizes. Thus, management interventions need to focus on increasing juvenile recruitment rates to increase the size of Blanding's turtle populations in the GCMA. Potential strategies to increase juvenile recruitment include "headstarting" or the captive propagation of young turtles that are subsequently released back into the wild and the protection of nesting areas of Blanding's turtles from predators and human disturbances. Ultimately, however, the fate of Blanding's turtles in the GCMA will depend upon the protection and proper management of habitat for Blanding's turtles at all life-stages. Thus, conservation strategies that combine a holistic approach to habitat management with those that increase juvenile recruitment will be the most successful.

Simon, M. Suzanne. 2000. Endocrine Controls and Functional Morphology of the Oviduct of the Slider Turtle, *Trachemys scripta*. Ph.D. 298 pg. Ohio University.

Abstract: This research sought to elucidate the roles of steroid hormones in the control of the oviduct in turtles by examining the natural hormone cycle, the functional morphology of the oviduct and the effects of specific steroid hormones on the oviduct in the slider turtle, *Trachemys scripta*. Plasma levels of steroid hormones were measured over a reproductive cycle in a wild population of sliders and their oviducts analyzed histologically. In the laboratory, turtles were treated with specific steroid hormones and the oviducts analyzed histologically.

Wild-caught turtles displayed relatively low levels of estradiol-17beta throughout the reproductive year with no apparent cycle. Testosterone levels, although slightly higher than estrogen, also did not exhibit an annual cycle. Progesterone levels were low and static during most of the year but displayed a distinct peak, possibly representing a spike, around ovulation. Oviductal epithelium, mucosal glands and lamina propria showed no morphometric changes throughout the cycle. However, staining for secretory products in the epithelium and mucosal glands of the tubal and uterine portion of the oviduct was more intense before gravidity and nearly absent in many areas following gravidity.

Estradiol-17beta induced the formation of mucosal glands and had pronounced hypertrophic effects on epithelium, mucosal glands and lamina propria in both tubal and uterine regions of the oviducts of prereproductive female *Trachemys*. Estradiol also induced the synthesis of secretory products; glycosaminoglycans in secretory epithelium and proteins in mucosal glands. Progesterone enhanced hypertrophic effects in the epithelium but not in other oviductal areas. Progesterone-treated tissues also showed less staining for glycosaminoglycans and proteins. Testosterone induced epithelial hypertrophy and production of glycosaminoglycans, as did dihydrotestosterone to a lesser degree.

Estradiol-17beta appears to have a minor role in control of reproduction in adult Trachemys. It may be responsible for oviductal maturation at puberty and low level maintenance in adults. Testosterone may act as a more primitive and redundant controller of oviductal epithelium. Progesterone is the apparent stimulator for release of secretory products. The periovulatory release of high levels of progesterone suggests that preovulatory follicles are the primary source of progesterone and corpora lutea are a secondary, less important source.

Wilgenbusch, James Charles. 2000. The Influence of Incubation Conditions and Hatchling Body Size on Growth and Survivorship of the Common Snapping Turtle (*Chelydra serpentina* L.). Ph.D. 144 pg. George Mason University.

Abstract: A comprehensive understanding of how maternal and environmental effects influence offspring phenotype and in-turn how offspring phenotype influences characters directly or indirectly related to fitness is necessary to evaluate current life-history theory. This dissertation represents an examination of the factors affecting hatchling body size and the way that these factors and body size affect post-hatching growth and survival. Specifically, the following hypotheses were tested; (1) clutch identity influences hatchling growth and survivorship independent of body size and incubation condition, (2) incubation of eggs on a wet substrate increase post-hatching growth and survivorship independent of body size and clutch identity, (3) larger hatchlings grow faster and experience lower mortality than smaller hatchlings, and (4)

increased body size will be favored when there is greater intraspecific competition. To test these hypotheses 253 eggs from 26 common snapping turtles (*Chelydra serpentina*) were incubated in the laboratory under wet (-150) and dry (-950 kPa) conditions and the hatchlings from these eggs were reared under variable laboratory conditions to simulate a range of selective pressures.

Clutch identity was a significant source of initial egg size and hatchling body size differences, but did not represent a significant source of variation in models describing post-hatching growth. Post-hatching survivorship in the communal tank was affected by clutch identity, although the effect did not appear to be independent of body size at hatching. Turtles from eggs incubated on wet substrate were significantly larger at hatching than turtles from eggs incubated on a dry substrate. Moisture availability during incubation affected post-hatching growth and survivorship only in as much as moisture affected relative hatchling body size. Size at hatching also affected survivorship regardless of the initial size difference between the paired hatchlings or the condition under which eggs were incubated. Among turtles reared in social isolation, egg size and size at hatching were inversely related to post-hatching growth rates. This finding suggests a possible mechanism that could offset the trade-off typically associated with optimal egg size models in environments where intraspecific competition is low. This study demonstrates that "bigger is better" only under specific post-hatchling rearing conditions.

Feinberg, J.A. 2001. Nesting ecology of diamondback terrapins (*Malaclemys terrapin*) at Gateway National Recreation Area. Masters Thesis, Hofstra University, Hempstead, NY 116 pp.

Abstract: The nesting ecology of diamondback terrapins (*Malaclemys terrapin*) was studied in 1998 and 1999 at Gateway National Recreation Area. I found populations of nesting terrapins at three different locations. Most of my research was conducted at the Jamaica Bay Wildlife Refuge. Female terrapins nested from early June through late July, and laid up to two clutches per season, depositing an average of 10.9 eggs per nest. Nesting activity increased with daily high temperature and high tide. The majority of females were captured when there was 25-75% cloud cover. The majority of nests were counted in shrub-land, mixed-grassland, and dune habitats, but nest density was highest on a man-made, sandy trail and also on beaches. Raccoons depredated 92.2% of terrapin nests. Only 5.2% of terrapin nests survived to produce hatchlings. I counted 1,319 and 1,840 depredated nests in 1998 and 1999, respectively, at the Refuge. I also found the carcasses of 23 female terrapins that were apparently killed by raccoons as they came on land to nest. Contact information: J. Feinberg, 348 St. Marks Ave., Apt. 4B, Brooklyn, NY 11238, E-mail: jerfein@aol.com

NEWSNOTES

Please send newsarticles and press releases with sources and dates to

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AFRICA

Tortoise Poachers Convicted in South Africa: The new green crime unit of the Cape Nature Conservation organization was key in the conviction of two Slovak men for the collection, possession and transportation without required permits of 113 angulate tortoises. The men were apprehended November 14th and were convicted in early December under the Nature Conservation Ordinance. The tortoises are listed by the Convention on International Trade in Endangered Species as Appendix II, strictly limiting the trade of the tortoises and their parts. In the opinion of Fanie Bekker, Cape Nature Conservation's director of operational services, "The huge success that we have recently enjoyed is substantial proof of the necessity of a strategic rather than an adhoc approach to environmental crime". The men have been sentenced in Clanwilliam South Africa, to either two years in prison or a fine of approximately US $33,600.

Czech Poachers Convicted: Two Czech poachers were convicted of the illegal possession and hunting of fauna and flora native to the western cape of South Africa. Among the fauna collected were geometric tortoises, common padloper tortoises and angulate tortoises. The poachers were found guilty of all counts brought against them and fined according to the Cape Nature Conservation Ordinance and the South African National Parks Act. Source: Issued by Carol Hurd, Public Relations, Cape Nature Conservation, E-mail: churd@pawc.wcape.gov.za

ASIA

Three Problems Recognized with Turtle Raising in Thailand: Chairman of the Rayong Aquatic Animal Breeders' Co-operatives, Phairat Arunvessaset, recognized several problems relating to the falling export price of turtle meat from Thailand. One problem is excessive turtle farming in several areas of Thailand. Mr. Phairat also reported that farmers need to improve hygiene standards in order to meet the requirements of importers. Finally, the export of young turtles to supply China's increasing number of turtle farms must stop. Source: Herpdigest Vol 2 Issue 10

Importation of Red-Eared Sliders Banned in Korea: The Ministry of the Environment in Seoul, Korea has announced a ban on the importation of red-eared sliders. These turtles have become popular as pets and often are used in Buddhist rituals for freeing animals. However, this Mississippi River (U.S.A.) native is responsible for consuming freshwater fish, aquatic insects, frogs and snakes. This ban is in response to complaints about the volume of animals being consumed by the sliders.

Indonesia Reopens Flight Route To China: The shipping of cargo between China and Indonesia has increased. In response, Indonesia's National carrier, Garuda, has reopened its route between Jakarta and Guangzhou. The majority of the cargo being trafficked is live turtles, perishable goods and marine products. Source: Garuda airline's press release

Protected Species of Turtles Confiscated at Bangkok International Airport: Almost 2,000 turtles were intercepted at Bangkok International Airport November 26, 2001. Officials received a tip that the shipment of turtles that were declared as Red Ear Sliders were actually species restricted from trade. The Red Ear Slider is not protected and can be shipped in and out of Thailand freely. The shipment only contained two sliders and the rest were protected species native to Malaysia such as *Heosemys grandis*, *Heosemys spinosa* and *Cuora amboinensis*. The shipment was headed for Yunnan, China for use in seasonal medicinal purposes. Illegal trading of protected species is punishable by a maximum fine of Bt 40,000 and or imprisonment of up to four years. Source: The Nation, 11/27/01

NORTH AMERICA

The Vanishing marshes of Jamaica Bay: Jamaica Bay includes 10,000 acres of beaches, wetlands and woods in the New York metropolitan area and is home to a large and varied collection of flora and fauna, including possibly the largest urban population of diamondback terrapins. Despite the great development around the bay of highways, sewage treatment plants and the like, Jamaica Bay is in a great state of health. However, many acres of the bay are disappearing very quickly and the cause remains unknown. Scientists have speculated that several reasons for the problem such as dredging, run-off and massive mussel mortality. The National Park Service has budgeted $150,00 to spend trying to repair the area, but before an adequate solution can be begun, the cause of the disappearing land must be found. Source: The New York Times 7/6/01

Keeping Blanding's Turtles from Being Roadkill: To stop Blanding's turtles from attempting to cross highway 83 in Valentine National Wildlife Refuge, the Nebraska Department of Roads erected 5,360 feet of three foot high fence to herd the turtles through under the road culverts. Blanding's turtles are nationally listed as a species of special concern. By erecting the fence near the wetlands that the turtles call home, it is hoped that this precautionary measure will help to keep Blanding's turtles from heading towards threatened or endangered status. Source: Omaha World-Herald 9/11/01

Turtles Added to Species of Special Concern List: The Department of Environmental Protection's endangered and non game species program has created a new list for species in New Jersey that could benefit from further study. The species on the special concerns list have no legal protection but are in need of further study before they reach the population point at which they would need to be listed as threatened or endangered. The spotted turtle, eastern box turtle and diamondback terrapin are among the species listed. Source: Press of Atlantic City, 12/11/01

Blanding's Turtles Lose Nesting Grounds: A community of rare Blanding's turtles may lose their nesting grounds to a strip mall in McHenry County, Illinois. The Illinois Department of Natural Resources said that the colony of turtles in that particular area is about 70 and is the largest in the county, if not the entire state. Conservationists in the area are concerned that the turtles, already listed by the state as threatened, will be in even greater danger once the mall is established and nesting grounds destroyed. The developers who are building the group of stores have said that they do not believe they are disrupting the area where the turtles nest and will work with the state to find a compromise for developing the site. Although the state can create laws to protect species, the decision on how to develop land is made by local authorities. To combat some of the negative effects of the development, the state would like the builders to establish barriers between the turtles' marsh and to create areas similar to those in which the turtles prefer to nest. Source: Beacon News, 12/28/01

Ranchers vs. Desert Tortoises: Early in 2001, an agreement was reached between the Bureau of Land Management and several environmental groups to protect millions of acres of land between the eastern Sierra and the Mexican Border. Most of the land is inside the borders of the California Desert Conservation Area. The agreement restricted activity on the land that would threaten the fragile desert habitat or any of its 24 endangered or threatened species. Part of the settlement required ranchers using public land to graze their cattle to remove the livestock from the protected area during the periods that the desert tortoise is most active – March 1st to June 15th and Sept. 7th to Nov. 7th. Cattle are detrimental to desert tortoise health because they out-compete the tortoise for food, collapse tortoise burrows and import nonnative plant species on their fur and hooves. Several ranchers appealed the order by Bureau of Land Management in July, claiming that this will mean an end to their livelihood. On August 24th, an administrative law judge with the Department of the Interior decided that the cattle should be removed from the land by September 7th. The Bureau of Land Management argued that to coordinate the removal with the ranchers by the designated deadline was unrealistic. However, the order remains that the cattle must be removed from

the protected land. Sources: Los Angeles Times 9/6/01 and 7/25/01, The Press-Enterprise, Barstow, 7/25/01

Motor Vehicles vs. Desert Tortoises: In October of 2001, the Bureau of Land Management issued a decision record that temporarily closed approximately 3,200 acres of public land to motorized vehicle use in the California Desert Conservation Area. This decision was part of a settlement agreement in response to a lawsuit filed by the Center for Biological Diversity, the Sierra Club and the Public Employees for Environmental Responsibility regarding the Endangered Species Act. By closing this area to traffic, the state and federally protected desert tortoise will be provided with more protection, as will its habitat. The duration of the closing was from the time the record of decision was issued until the signing of the West Mojave Plan, which is expected to be June of 2003. Authority for the closure is found in 43 Code of Federal Regulations 8341.2(a). Source: Bureau of Land Management Press Release, 10/19/01, CA-610-02-06, CA-610-02-07, CA-610-02-08

The United States Army vs. Desert Tortoise: Public lands and critical desert tortoise habitat are now going to be used as an area for tank training by the U.S. Army. An amendment was approved on August 1 of 2001 that allows the U.S. Army to expand Fort Irwin National Training Center in the Mojave Desert in southern California by 110,000 acres. The legislation does not make the Army accountable for the cost of the additional land or restoration projects that will need to be implemented to combat the effects of the expansion. The augmentation of the center will severely compromise the existence of the desert tortoise and the endangered Lane Mountain milkvtech, both of which are listed under the Endangered Species Act. The land acquired by the army also includes part or all of two Wilderness Study Areas in the Avawatz Mountains. Source: Press Release 8/2/01, San Bernardino Sun 7/17/01, Desert Dispatch 7/17/01

Search for the Cause of Gopher Tortoise Die-Off: Staffs at Rock Springs Run State Reserve near Orlando, Florida have found a large number of dead gopher tortoises in the area of their park. In August, it was estimated that 120 to 140 dead tortoises were found in a 200 acre area. The cause of death from animals of humans has been ruled out and biologists are looking for any leads. Please respond to the address below if you know of any locations were the gopher tortoise population has decreased by 25% or more. Ray Ashton, Ashton Biodiversity Research and Preservation institute, Inc., 14260 W. Newberry Rd. #331, Newberry FL. 32669; Phone: 352-495-7449; E-mail: Tortfarm2@aol.com

Protecting Alligator Snappers in Louisiana: Alligator snappers face numerous threats such as pollution, dredging, dams, development and the palate of human consumers. Twelve of the 13 states that have alligator snappers have laws to protect them. The IUCN lists them as vulnerable and the American Zoological Association declared them as one of three turtles in need of help. The alligator snapper is not protected in Louisiana. The Louisiana Department of Wildlife & Fisheries claim the snappers are not in need of protection because they believe their are numerous amounts of turtles present in the wild. Some biologists agree with the fact that alligator snappers are not in immediate danger of becoming endangered. However, the overall consensus is that the odds of the alligator snapper remaining at a healthy population level are slim if regulations against the collection and possession of the snappers are not created. Source: Bangor Daily News 9/03/01

Assault Against a Galapagos Tortoise: Pedro, a Galapagos tortoise living at the Cypress Garden in Charleston, south Carolina was assaulted and a $1500 reward is being offered for an arrest of the culprit(s). The attack occurred an evening that the park was open for a wedding reception. Rocks and bricks were thrown into Pedro's pen causing some superficial injuries and also breaking some bones. His enclosure is being remodeled and a guard has been posted for Pedro's protection. Source: Associated Press-Charleston 9/15/01

18 Acre Purchase Made by the Nature Conservancy: The towns of Sandwich and Barnstable in Massachusetts have protected parcels of land that were recently connected by a purchase made by the Nature Conservancy. The 18 acre area of land on Sandy Neck that was purchased for $1.25 million is a nesting and feeding ground for many animals including diamondback terrapins. By connecting the larger parcels of land, the Nature Conservancy's purchase has helped to create a safe passageway for species from one area to the other and also ensure the protection of the land for years to come. Source: asalzberg@nyc.rr.com 10/23/01

Nebraska Wildlife Regulations Updated: The Nebraska Game and Parks Commission banned commercial exploitation of 62 of Nebraska's reptile and amphibian species during a mid-January public hearing. Tens of thousands of ornate box turtles, western painted turtles, yellow mud turtles, red ear sliders and many other herpetofauna will now be protected from capture and sale by dealers. There are several exceptions to the regulations. Scientists may apply for collection permits for research purposes, two species of leopard frogs and tiger salamanders may be collected for fishing bait, and hobbyists may still collect a limited number of designated reptiles and amphibians as pets. Source: Lincoln Journal Star, 1/16/02

Soft-Shell Turtle Safety in Lake Champlain: Debate over the true effects of a bridge on the population of threatened Spiny Soft-Shell turtles in Lake Champlain has residents of the area arguing over what is best for the turtle. The Agency of Transportation (AOT) says that the bridge now in place over Missisquoui Bay in Vermont is dangerous to travel and needs to be replaced. However, biologists say that the mud at the base of the bridge offers protection for hibernating turtles and when the bridge is not in use, the turtles will use it as an artificial beach to sun themselves. Under state law, the threatened species must be protected. The Fish & Wildlife Department has required the AOT to leave the bridge in place. Resi-

dents of the area argue that leaving the bridge in place will hurt the turtles more than removing it would. They say that the gravel causeways that will also remain in place are choking the bay and may hurt the turtles in the end. Others say that the bridge structures block water circulation in the bay and removing the bridge would enable more pollutants and sediment to be flushed from the bay. As of now, the compromise between the AOT and the state is that a new bridge will be constructed near the one currently in place and part of the older bridge will not be demolished. Bridge construction will also only occur at times that will not interfere with turtle safety. Source: The Associated Press, Alburg, 1/27/02; Channel 3 News Website Rutland, Vermont, 1/30/02

Questionable Intent of Cape Coral Developers: Grosse Point Development Company of Fort Myers, Florida are trying to reassure concerned citizens of the Cape Coral area that resident gopher tortoises of land they intend to develop will not be harmed by the planned construction. The gopher tortoise is listed as a species of special concern by the Florida Fish and Wildlife Conservation Commission. This title requires that builders must follow strict regulations when developing land where the tortoises live. Grosse Point Development Company has said that they intend to move the tortoises to an area of land adjacent to the property being developed. However, the company applied for an "incidental take permit" from the state, which would allow the company to bulldoze the area without concern for the tortoises. The take permit would cost Grosse Point Developers $50,000 to $60,000 and the money would go to establishing gopher tortoise habitat elsewhere in the state. This is the most cost-effective way to deal with the gopher tortoises however, Grosse Point Developers had told citizens that they would not injure the special residents of the property. At the time of press, the intent of the developing company was still unclear. Source: News-Press.com, 1/26/02.

Bahamas' Cat Island Turtles in Trouble: The Cat Island turtle, *Trachemys terrapin* has had a problematic history that does not seem to be getting any better. It is not certain that this turtle is endemic to the Bahamas. Even so, Cat Island is the stronghold for the population of less than 200 turtles. The turtles' 50 hectare distribution area is the interface between people and freshwater making the turtles compete for habitat with humans. After last summer's shooting of the Cat Island turtle, more attention was drawn to the species. When attempting to find the culprit, it was discovered that although the cat island turtle is listed as endangered by the United States Fish and Wildlife Service, there is no protection for the turtle. People can legally hunt, kill, eat and capture the turtle without penalty. In response to the turtles' situation, conservation leaders in the area, particularly Dave Lee of the Tortoise Reserve, are focusing more attention on education. They are making the situation high profile in the area using such techniques as a conservation poster contest with awards from several other conservation groups such as the Mid Atlantic Turtle Society. Source: Personal Interview with Dave Lee

ANNOUNCEMENTS AND CONFERENCES

Joint Meeting of Ichthyologists and Herpetologists will be held July 3-8, 2002 at the Westin Crown Center in Kansas City, Missouri. It is being hosted by the Univ. of Kansas. The deadline for preregistration is May 3. For further information, please visit www.dce.ksu.edu/dce/cl/2002jointmeeting.

2002 meeting of the Society for Conservation Biology will be held July 14 - 19, at the Durrell Institute of Conservation and Ecology at the University of Kent at Canterbury in UK. It is the Society's 16th annual meeting, and will be co-hosted by the British Ecological Society. For more details, see the 2002 meeting website: http://www.ukc.ac.uk/anthropology/dice/scb2002/

2nd International Congress on Chelonian Conservation will be held June 18 - 22, 2003 in Senegal. Abstracts are requested as soon as possible, but the deadline is September 31, 2002. The conference will be held in English with French translations. Regular registration is $180 US while students are $90 US. For further information visit www.tortues.com, E-mail: soptom@soptom.com, call (33) 04 94 78 36 41 or fax (33) 04 94 78 24 27.

Herpetological key for Long Island and the surrounding islands, developed by Russell Burke and Jeremy Feinberg, can be found at http://people.hofstra.edu/faculty/russell_l_burke/HerpKey/MainHerpPage.html.

Two scholarships for a 10-week course (May-Aug) at the Wetlands Institute in Stone Harbour, New Jersey are being offered to Southeast Asian undergraduates by the New York Turtle and Tortoise Society. Applicants must have completed their 1st year of tertiary education in biology or zoology. To complete an on-line application form, go to www.nytts.org.

The Turtle Ecology Program will expose interns to basic field techniques, data collection and analyses. The program is aimed at developing the capability of the individuals to establish conservation, education and awareness program in Southeast Asia. Program participants will be encouraged to form an organizational network that will assist them in protecting Asian turtles. The foreign students will join 12 local undergraduates on a field trip to the Chelonian Research Institute in Oviedo, Florida, which has the most extensive collection of turtle specimens in the world. They will also visit the Wildlife Conservation Society's Bronx Zoo and the American Museum of Natural History.

Upcoming Workshops from the Gopher Tortoise Conservation Initiative: GTCI is a program of the Ashton Biodiversity Research & Preservation Institute, Inc. and is involved with creating cooperative, mutually beneficial, and economically reasonable solutions to gopher tortoise problems. We are located near Archer, Florida.

Mitigation and Management Techniques Workshop is designed to provide professionals with an intense, 3 day experience working hands-on with gopher tortoises. The workshop will include burrow identification tips, a demonstration of proper excavation, and . *April 17-19, May 8-10, and June 5-7, 2002. 9am-6pm.*

Land Managers Workshop is designed for private landowners, land managers, county/govt. personnel involved with mitigation, and/or park, state, and federal employees involved in land management. This will provide them with new information on gopher tortoise natural history and will also give them the opportunity to review or develop management plans using techniques to conserve gopher tortoises. This will also promote the Gopher Tortoise Reserve Program created to further conserve and manage for gopher tortoise survival. *July 13, 2002. 10am-4pm.*

Gopher Tortoise Mitigation and Management Techniques Workshop - designed for environmental consultants, land managers involved with tortoise management, county/state personnel responsible for establishing policy, and other professionals involved with gopher tortoises. This intense, three-day workshop involves hands-on experience with field methods concerning gopher tortoises and other species present in their burrows. It also includes burrow identification techniques and a proper excavation demonstration. *April 17-19, May 8-10, and June 5-7, 2002*.

The registration deadline is 3 weeks prior to each workshop. We can be contacted by phone 352-495-7449; Fax 352-495-7433; and E-mail: Tortfarm2@aol.com. Our website is http://www.geocities.com/ashtonbiodiversity.

Box Turtle State Reptile Bill: House Resolution 73, introduced to Pennsylvania's House State Government Committee on March 2001, makes the Eastern Box Turtle (*Terrapene carolina carolina)* Pennsylvania's official state reptile. Committee chairman, Paul J. Clymer, has said that the resolution will not be voted on unless there is sufficient public interest and support.

It is hoped that by making the box turtle the state reptile, more emphasis will be placed on this species survival by creating and enforcing more restrictive legislation to protect the turtles. Pennsylvania's neighboring states of New York, New Jersey, and Ohio have already banned the collection of box turtles. Presently, Pennsylvania's possession and collection limits are two box turtles / person / day. Buying, selling, trading or bartering turtles taken from the wild is prohibited.

It is believed that the Pennsylvania box turtle population is declining and that removing even a small number of turtles from the wild could be detrimental. These concerns stem from the turtles' limited home ranges, extensive habitat destruction, chance meetings of mates and low reproductive rates.

Please encourage Pennsylvania's government to pass HR 73 promptly by showing your support of the legislation and writing to Hon. Paul Clymer at the address below.

Suite 101, Room 110
Ryan Office Building
Harrisburg, Pa 17120-2020
Phone: 717-783-3154; Fax: 717-705-1849

Sources: Coffman, Adam. PA Sierra Club Newsl., Winter 2002. Summary by Brigid Ranson.

This snapping turtle was found dead floating in a river in Holland by Robert & Angelique Stappers. It measured approximately 75 cm nose to tail and weighed 10+ kg. Notice the heavy fishing line extending from its mouth. They speculate that it may have survived there for several years due to the mild winters.

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