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Preliminary Observations of a Large Turtle Farm in Hainan Province, People's Republic of China

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Most of the 90 freshwater turtles and tortoise species of Asia are threatened with extinction (Altherr and Freyer, 2000; van Dijk et al., 2000). While there are many reasons for this decline, the single overriding cause is a massive increase in demand for turtles in China generated by the unfortunate combination of ancient tradition and new found wealth (Behler, 1997). The intense harvesting of wild turtles is fueled by a price for wild-caught *Cuora trifasciata* that can exceed $1000 US/kg. The high value has earned *C. trifasciata* the common name of "coin turtle". Other wild-caught turtles can command a price of $5 to $60 US/kg. In a country, such as Vietnam, where the average annual income is approximately $200 US, this is sufficient to motivate intensive collecting effort.

The massive demand for and high prices attributed to turtles have also spurred the development of captive breeding facilities. As the demand for turtles increases inversely to their diminishing numbers in the wild, the number of turtle farms grows quietly. Although some data on the softshell industry exists (see Chen et al., 2000), data on the farming of hard-shelled chelonians are completely lacking. This is despite the fact that as far back as 1992, Zhou and Zhou claimed that *C. trifasciata* was being bred "everywhere". Furthermore, it is unclear whether the practice of farming turtles is beneficial or deleterious to the future of Asia's wild turtles. Van Dijk (2000) suggests a constant supply of farm-reared turtles might reduce the demand for wild turtles or, alternatively, create a climate in which wild turtles are even more valued by connoisseurs (the current case for *Pelodiscus sinensis*).

In light of the burgeoning business of breeding turtles, especially *Cuora trifasciata*, it is imperative that we understand the size, scope, and practices of Chinese turtle farms. The practices employed by the turtle farms, although primitive compared to standards of most zoos, might provide useful information for captive breeding. The authors (primarily through the efforts of HS) have been able to enter and survey a large breeding facility in Tunchang, Hainan Province P.R.C.. Haitao Shi has visited the Tunchang turtle farm seven times, one time with JFP. Our preliminary observations suggest that the number of captive reared turtles in Asia has been greatly underestimated.

The Tunchang turtle farm

The turtle farm in Tunchang was first established in 1983 based on dozens of *Cuora trifasciata, Mauremys mutica*, and *Ocadia sinensis* collected from the field in Hainan as well as animals from a previously established farm in Guangdong. Today, the owner of the turtle farm claims to have more than 50 species of turtles and 50,000 individuals (30,000 of which are *Pelodiscus sinensis*) in an eight hectare aquatic, outdoor enclosure (Fig. 1) and dozens of breeding pools in an indoor annex (Fig. 2a). Both the outdoor enclosure and indoor annex are under close supervision and guarded by about a dozen ferocious dogs (personal observation).

Figure 1. A view from inside the 8 hectare, heavily guarded, outdoor breeding area. The man in the boat is sterilizing the water with lime, bleaching powder, or potassium permanganate. Photo by HS.

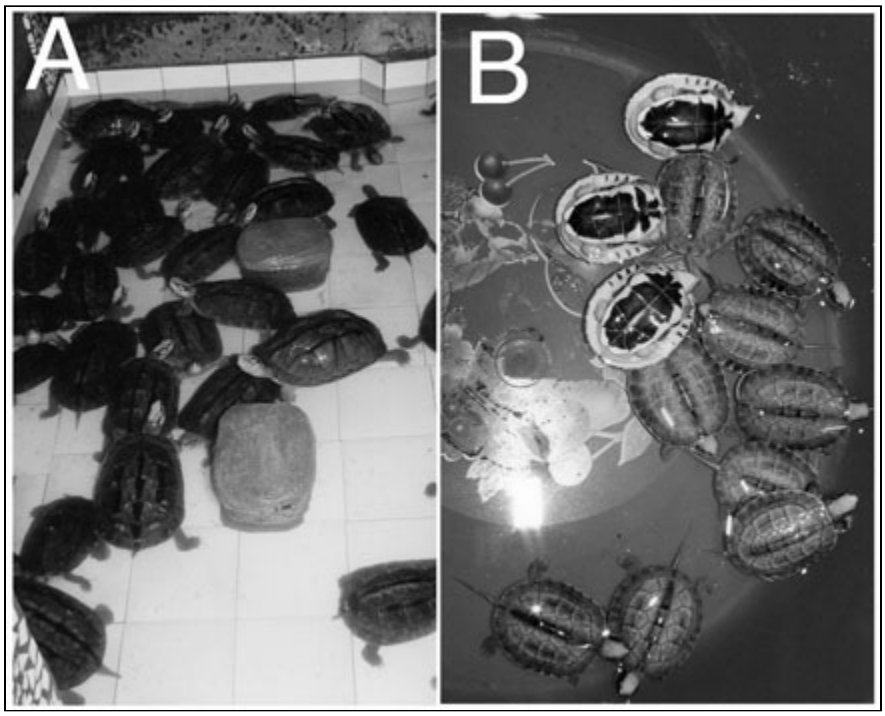

Figure 2. A) A small indoor breeding pond for *Cuora trifasciata*. B) *C. trifasciata* hatchlings. Photo by HS.

In the outdoor enclosure, the nesting sites are restricted to a raised dry area covered by a small cement building. In the indoor annex, small, cement breeding "ponds" are connected to sand-filled nesting rooms through a series of cement planks. Eggs are vigilantly harvested from the provided nesting areas, placed in a separate indoor hatching area, and incubated at the ambient temperature. Hatchlings are raised in plastic tubs (Fig. 2b). At roughly 8-12 cm CL, they are placed into raising ponds (Fig. 3). At no time are the turtles from the indoor annex exposed to natural light or even special lamps. In fact, most are kept in near darkness. The turtles are reared on a diet of fresh food (market fish and shrimp) and "coin turtle" brand commercial turtle food. We are told that the valuable *C. trifasciata* are given a higher quality diet than *M. mutica* (i.e., less commercial food and more fresh food). The turtles in the indoor raising ponds are raised to a sufficient selling size or eventually placed in a breeding pond. Most of the indoor breeding ponds are dominated by one species; however, all but the smallest *C. trifasciata* breeding ponds (e.g., Fig. 2) have multiple species. One indoor breeding pond with *C. trifasciata, M. mutica*, and *Chelydra serpentina* was observed while the large outdoor enclosure (Fig. 1) includes a hodgepodge of most species. Some information about some of these taxa is provided below.

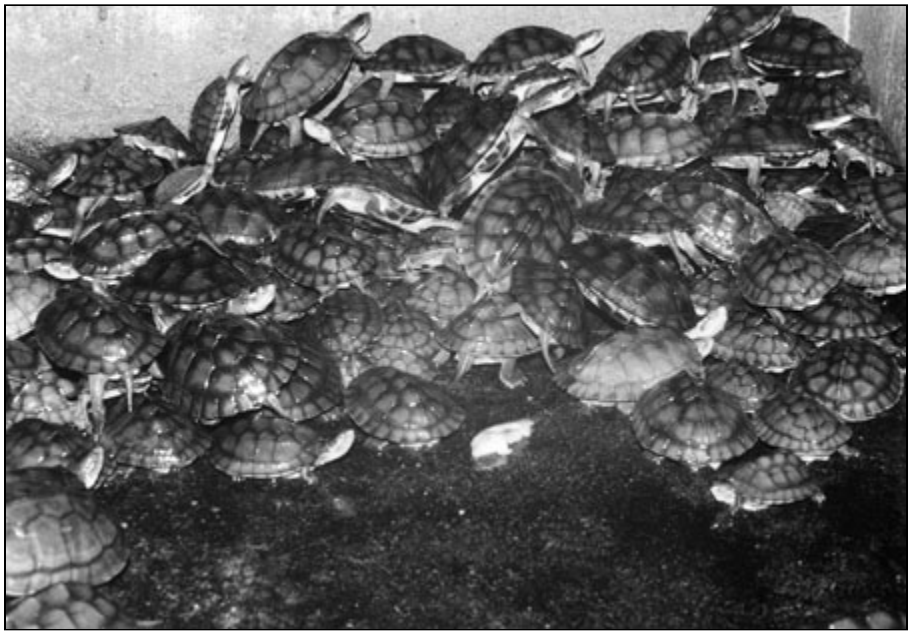

Figure 3. *Mauremys mutica* juveniles in an indoor raising pond. Photo by HS.

Cuora trifasciata

The owner has had some of his *C. trifasciata* stolen in the past. Consequently, he was reluctant to discuss exact details of this species in his farm. Eventually, under the condition that we do not report our findings in Chinese, he volunteered that he has a population of at least 1,000 individuals (300 adults, 600 subadults, and 100 hatchlings). However, we suspect that he might have more. He keeps these turtles at extremely high densities in the indoor annex (3/m^2 for adults, 15-20/m^2 for subadults, and 50-100/m^2 for hatchlings; Fig 2).

According to the owner, female *C. trifasciata* begins reproduction at about 0.75-1.0 kg weight. The largest weight of a female is about 5 kg. Courtship occurs between August and October. When a female is ready to nest she selects a site that is soft and easily excavated. She digs a nest of about 10-12 cm depth. Nesting usually occurs in the evening hours of May through August. Only one clutch of five or six eggs is laid each year and they hatch in about 80-85 days. It only takes three years for them to reach 1 kg, and five years to reach 2 kg. The owner claims that the survival rate at each stage (incubation, hatchling, juvenile) is at least 95%.

Other turtles

The present captive population of *M. mutica* at the farm is approximately 7,000-8,000 (3,000 adults, 2,000 sub-adults, 2,000-3,000 hatchlings). *Mauremys mutica* is apparently much easier to keep and breed than *C. trifasciata*. The current estimate for *O. sinensis* is only 150, 50 of which are adults. *Ocadia sinensis* fetches a much lower price than either *M. mutica* or *C. trifasciata*. Therefore, for any given species, the number of turtles at the farm is not only correlated to its adaptability to captivity, but also its market value.

When the farm was first established, the owner acquired approximately 10 *Palea steindachneri* from the field in Hainan. The present population at the Tunchang turtle farm includes approximately 500 individuals (300 adults, 200 juveniles and hatchlings; Fig. 4). In 1996 this species was considered “near threatened”, however, *P. steindachneri* is now considered endangered (van Dijk et al., 2000). Other species bred at the Tunchang turtle farm include the terrestrial *Pyxidea mouhotii* and *Cuora galbinifrons* as well as *Platysternon megacephalum, Chinemys reevesii, Sacalia quadriocellata, Macroclemmys temminkii* and *Chelydra serpentina* (multiple subspecies), and probably many others.

Figure 4. *P. steindachneri* hatchlings and eggs. Photo by HS.

Hybrids

Finally, we address the matter of hybrid turtles. Van Dijk (2000) raises the possibility that many of the unusual turtles that appeared in the pet trade during the past twenty years, and then described as full species, might be turtle farm hybrids. Our observations of the Tunchang turtle farm suggest that this is probably the case for some of the taxa. The history of the Tunchang turtle farm has been one of progressive organization through trial and error. In the early years, the segregation of turtles was never practiced and all species of turtles were kept together. Even today, many species are kept together. We fully suspect that the conditions of the Tunchang turtle farm are representative of other turtle farms in China. Given the propensity of distantly related turtles to hybridize (Fritz and Baur, 1994; Fritz, 1995) combined with the high prices that new turtles fetch from hobbyists, the sudden appearance of turtles with unusual characters in the pet trade is to be expected. We agree with van Dijk (2000) that the status of the new species should be determined quickly because their conservation value is either
extremely high or else zero.

According to the owner, in some cases the hybridization is infrequent and accidental, such as the crosses between *C. reevesii, M. mutica*, and *O. sinensis*. This could explain the small sample size for the new *Ocadia* species (*Ocadia philippeni* McCord and Iverson 1992, *Ocadia glyphistoma* McCord and Iverson 1994). Also, it is worth noting that *Mauremys pritchardi* McCord 1997 has been implicated as a possible hybrid between *C. reevesii* and *M. mutica* (Artner et al., 1998). In at least one instance, however, the hybridization is intentional. In November of 1999, the authors discovered *Mauremys iversoni*-like animals that turned out to be intentionally produced hybrids of *C. trifasciata* and *M. mutica* (Shi and Parham, in prep.). The owner of the turtle farm sells these hybrids as *C. trifasciata* to unsuspecting buyers (counterfeit "coin turtles"). He claims this is a common trick used by many Chinese turtle farmers.

Conclusions

Clearly the role and impact of Chinese turtle farms to the Asian turtle trade is greater than previously thought. However, the exact nature of its effect remains to be determined. In addition to being a possible source for the new and unusual pet trade "species", the turtle farms have inadvertently preserved large numbers of chelonians of valid species that are now extremely rare. How, or if, these turtles can be used for conservation purposes remains to be determined. Additional surveys of Tunchang and other Chinese turtle farms are being planned.

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