

A large Zhejiang Province turtle farm.
Photo: T. Zhou

Captive Breeding of Hard-Shelled Chelonians in China

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Large-scale captive breeding of turtles has become noticeably popular over the past two decades, and increasingly lucrative for the farmers, but reports on the growing industry prior to 2005 were few (LUO, et al., 1999; SHI and PARHAM, 2000; SHI and FEN, 2002; SHI, 2004; YAO, et al., 2004). Little was known domestically or internationally about farm size, species being bred commercially, or levels of production. From 2003 to 2006, as part of an investigation of the turtle farms of China supported by the State Forestry Administration of the People's Republic of China, we investigated more than 150 turtle farms in sixteen provinces, and gained a better understanding of the turtle farming going on in China. Further information has been gathered since that time.

Most of the data presented here was obtained first hand from the farmers themselves, with additional information supplied by the Forestry and



Chelydra serpentina in
a Chinese turtle farm.
Hainan Province.
Photo: T. Zhou



A Hunan Province turtle farm. Photo: T. Zhou



A Hainan Province turtle farm. Photo: T. Zhou



A turtle farm in Hubei Province. Photo: T. Zhou



A turtle farm in Guangxi Province. Photo: T. Zhou



A turtle farm in Fujian Province. Photo: T. Zhou

Fishery Administrations of the respective provinces. We personally visited the facilities of most farms we investigated, and followed up with correspondence by telephone and mail. The species and numbers given in this report do not include turtles in nature reserves, zoos, aquariums, or museums; those being kept for conservation or education; or private collections — except *Cuora (Pyxiclemmys) yunnanensis* (see VETTER and VAN DIJK, 2006).

Turtle farming in China is most extensive in Guangdong, Guangxi, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, and Zhejiang provinces — with the largest individual farms being in Guangdong, Hainan, Hunan, and Zhejiang. There are very few people breeding turtles in the rest of China; no turtle farms are known in Jilin, Inner Mongolia, Qinghai, and Xinjiang.

Based on data obtained in this investigation, we estimate that the total land area (property) actively being used by known turtle farms is approximately 10,000 hectares (1 hectare = 2.47 acres). We found Zhejiang Province to have the greatest number of large farms — eight of the facilities visited had more than 66.7 hectares, and twenty had between 33.3 and 66.7 hectares. The greatest number of small farms of about 6.67 hectares are in Hainan and Zhejiang provinces.

The farms in Guangdong, Guangxi, Jiangsu, and Zhejiang were found to be concentrated in clusters that play important roles in the local economies. In Donglin

of Huzhou, Tonglu of Hangzhou, Xiu Town of Jiaxing, Yiwu of Jinhua, and Yuyao of Ningbo (Ningpo), farmers have formed government-recognized turtle breeding organizations that have become well known throughout China (ZHOU, 2006a). There are fewer than twenty farms in Guangdong Province using relatively large areas of up to 33.3 hectares. Most farms in the province consist of buildings on lots of only 0.5–1 hectare. However, these small-area farms keep large numbers of turtles in high densities, and are located very close to each other. As a result, many places — such as Chen Village, Daliang in Shunde, and Shalang Town in Dianbai County (ZHOU and GU, 2005), Guangdong Province, and Nanning and Qinzhou city of Guangxi Province — have become known as “turtle towns,” and are the dominant economic forces in their areas. In Jiangsu Province, Badu Town is the center of a turtle-breeding industry that expands from there to many physically small farms concentrated in other cities like Baoying, Jiaxing, and Suqian.

As of June 2008, twenty-two species of hard-shelled turtles are known to be farm-bred in China on a commercial scale (with repeated large numbers of offspring sold). Of these species, twenty are of the suborder Cryptodira and two are of the suborder Pleurodira (side-necked turtles). Also observed on Chinese turtle farms were thirteen other species that were being bred with minimal success (fewer than 100 offspring per year) and twenty-eight species that have not yet been successfully bred in captivity. Of these species, thirty-five are cryptodires and six are pleurodires.

Of the twenty-two species of hard-shelled turtles being commercially farm-bred in China as of June 2008 (Table 1), seven species are native to China (ZHOU and ZHOU, 1992; ZHOU, 2004; ZHOU, et al., 2004) — of these, only *Cuora (Pyxiclemmys) trifasciata* is endemic. Fifteen of the twenty-two species are exotic or non-native (see distributions in IVERSON, 1992). Nineteen of the twenty-two species are aquatic, and three are semi-aquatic. Sea turtles are not farm-bred in China and are thus not discussed in this report, although YAO et al. (2004) reports that three species are kept in captivity. No tortoises have been bred. Soft-shelled turtles (*Apalone*, *Palea*, and *Pelodiscus*) are farmed in large numbers in China, and will be dealt with in a separate report.

Of the twenty-two hard-shelled species, nine belong to the family Geoemydidae, nine to the family Emydidae, one to the family Chelydridae, one to the family Kinosternidae, and two (the side-necked species) to the family Chelidae.

Of the twenty-two species of hard-shells commercially bred in China, one is listed in CITES (2007) Appendix I, five in Appendix II, and six in



Incubation buildings in Hubei Province. Photo: T. Zhou



Large turtle greenhouses in Zhejiang Province. Photo: T. Zhou



Feeding shrimp to the turtles in Hainan Province. Photo: T. Zhou



Malaclemys terrapin in a Chinese turtle farm, Hainan Province. Photo: T. Zhou

Appendix III. One of the twenty-two is in Class II of China's list of National Protected Animals; two others are listed in China's list of fifty-four species of captive wild animals being bred for commercial trade using advanced techniques.

The native Reeves' pond turtle, *Chinemys (Mauremys) reevesii* is the most widely captive-bred hard-shelled turtle species in China, being farmed in all sixteen provinces surveyed. The non-native red-eared slider, *Trachemys scripta elegans*, is a close second, being farmed in fifteen of the surveyed provinces. In descending order, *Mauremys mutica*, *Ocadia (Mauremys) sinensis*, *Chelydra serpentina*, *Cuora (Cistoclemmys) flavomarginata*, *Cuora (Pyxiclemmys) cyclornata* (Blanck, et al., 2006), and *Cuora (Pyxiclemmys) trifasciata* are all farmed in at least eight of the sixteen provinces surveyed.

Of the sixteen provinces involved with turtle breeding, eight (Guangdong, Guangxi, Hainan, Hubei, Hunan, Jiangsu, Jiangxi and Zhejiang,) commercially produce more than ten species simultaneously. Hainan Province has the most, with twenty-one species being successfully farm-bred at present, followed by Guangdong Province with twenty species, and Zhejiang Province with nineteen species. Hainan Province also has the most species being "kept" in captivity (see Table 2).

A total of approximately 4 million hard-shelled turtles are currently being used as active breeding stock in Chinese turtle farms. We found the following eight species being kept in the greatest numbers (figures are approximate): *Trachemys scripta elegans*, 2.5 million; *Chinemys (M.) reevesii*, eight hundred thousand; *Ocadia (M.) sinensis*, four hundred thousand; *Mauremys mutica*, sixty thousand; *Chelydra serpentina*, thirty thousand; *Cuora (Cistoclemmys) flavomarginata*, 8.5 thousand; *Cuora (P.) cyclornata*, 7.5 thousand; and *Cuora (P.) trifasciata*, 5.2 thousand (Zhou, 2006b). The thirteen species in Table 1 with no asterisk (*) have totals of only five to one hundred breeding animals, and current breeding success of less than one hundred offspring annually. The twenty-eight species in Table 2 have not yet reproduced on the turtle farms of China.

Captive populations include all age groups of the six presently recognized Asian box turtle species endemic to China: *Cuora (Pyxiclemmys) aurocapitata*, *Cuora (Cistoclemmys) mccordi*, *Cuora (Pyxiclemmys) pani*, *Cuora (P.) trifasciata*, *Cuora (P.) yunnanensis*, and *Cuora (Pyxiclemmys) zhoui* (suspected range partially or primarily Vietnam). *Cuora (P.) trifasciata* is kept in high numbers, as reported above. Only three adult *Cuora (P.) yunnanensis* are kept in private (non-farm) hands. The numbers of breeders of each of the other *Cuora* species ranges from five to one hundred on all farms. All endemic Chinese turtle species are in a desperate



A pond full of *Macrochelodina siebenrocki* on a Chinese turtle farm, Hainan Province. Photo: T. Zhou



Chinemys reevesii laying eggs at night, Hainan Province. Photo: T. Zhou



Workers selecting fertile eggs, Hainan Province. Photo: T. Zhou



Gathering hatchlings in Hainan Province. Photo: T. Zhou



Turtle farm in Guangdong Province. Photo: T. Blanck



Turtle farm in Guangxi Province. Photo: T. Blanck



Turtle farm in Guangdong Province. Photo: T. Blanck



Turtle farm in Guangdong Province. Photo: T. Blanck



Turtle farm in Guangxi Province. Photo: T. Blanck

struggle for survival. Commercial-scale production of F2-generation offspring has been reached with seven species; of F3-generation offspring, with two species.

We found some hybrids in several Guangdong and Guangxi turtle farms. Very small numbers (one to five individuals) of the following were seen: *Chinemys (M.) reevesii* X *Chinemys (M.) nigricans*, *Chinemys (M.) reevesii* X *Ocadia (M.) sinensis*, *Chinemys (M.) nigricans* X *Cuora (P.) trifasciata* and/or *Cuora (P.) cyclornata*, *Chinemys (M.) reevesii* X *Mauremys mutica* (i.e., *Mauremys pritchardi*), *Ocadia (M.) sinensis* X *Mauremys (Cathaiemys) annamensis* (i.e. *Ocadia (M.) glyphistoma*, many wild caught), *Ocadia (M.) sinensis* X *Mauremys mutica*, *Cuora amboinensis* X *Mauremys (C.) annamensis*, *Cuora amboinensis* X *Cuora (P.) trifasciata* and/or *Cuora (P.) cyclornata* (mostly wild caught), *Pyxidea (Cuora) mouhotii* X *Cuora (P.) trifasciata* and/or *Cuora (P.) cyclornata* (i.e., *Cuora (Cistoclemmys) serrata*, all wild caught), *Cuora (Cistoclemmys) galbinifrons* X *Cuora (P.) trifasciata* and/or *Cuora (P.) cyclornata* (all wild caught), *Cuora (P.) trifasciata* and/or *Cuora (P.) cyclornata* X *Mauremys mutica* (i.e., *Mauremys iversoni*), *Cuora (P.) trifasciata* or *Cuora (P.) cyclornata* X *Cuora (P.) pani*, *Cuora (P.) cyclornata* X *Cuora (P.) trifasciata*, *Cuora (P.) pani* X *Cuora (P.) aurocapitata*, and *Cuora (P.) cyclornata* X *Cyclemys pulchristriata*. Considerably more common (about 200 individuals each) were *Cuora (P.) trifasciata* and/or *Cuora (P.) cyclornata* X *Mauremys mutica* and *Chinemys (M.) reevesii* X *Chinemys (M.) nigricans*. The farmers reported that most of these hybrid forms are more vigorous than the parent species — with faster growth rates, better overall survival, and larger clutch sizes. Therefore, several hybrids, such as *Mauremys mutica* X *Cuora (P.) trifasciata*, are produced intentionally, although most happen by chance.

At this time a total of 30 to 40 million hard-shelled turtle hatchlings are being produced on farms in China every year — more than 15 million *Trachemys scripta elegans*, about 9 million *Chinemys reevesii*,



Turtle farm in Guangxi Province. Photo: T. Blanck



Ocadia (M) sinensis in a Chinese turtle farm, Guangdong Province. Photo: T. Zhou

about 7 million *Ocadia (M.) sinensis*, about three hundred thousand *Mauremys mutica*, about 150 thousand *Chelydra serpentina*, about 5,500 *Cuora (C.) flavomarginata*, 5,500 *Cuora (P.) cyclornata*, and 4,000 *Cuora (P.) trifasciata* (see ZHOU et al., 2007). With continued breeding success, higher numbers of offspring will be produced in the future.

In China, there is a long history of using turtles for human consumption and medicine, and only more recently for a burgeoning pet trade. Captive breeding will hopefully satisfy the desire for turtles as food, medicine, pets, or research animals, and will reduce the demands on wild turtle populations. However, until turtle farms stop replenishing losses of breeding stock with wild-caught replacements,

they will have a negative impact on remaining wild turtle populations. ■

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Gathering subadult *Ocadia (M) sinensis*, Hainan Province. Photo: T. Zhou

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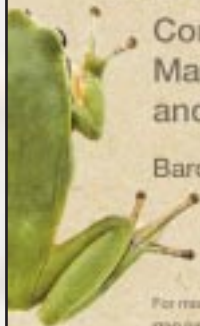
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