

Rediscovery and First Breeding of the Yunnan Box Turtle

Mottled throat
pattern of a male
Cuora yunnanensis

Cuora yunnanensis

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PHOTOS BY TING ZHOU



Close-up of the head of a female *Cuora yunnanensis*



The extremely rare Yunnan box turtle, *Cuora yunnanensis*, was first described by George Albert Boulenger in 1906. The species is thought to occur only in Yunnan Province, China, and is possibly the rarest turtle in the world. Internationally, *Cuora yunnanensis* has been listed by CITES in Appendix II (passed in 1999, in effect since 2000), and as “extinct” in the IUCN Red List since 2000 (ATTWG, 2007). Domestically, the species is listed as Class II of China’s National Protected Animals (1988), as “extinct in the wild (EW)” in the China Red Data Book of Endangered Animals (ZHAO, 1998), and as “extinct (EX)” in the China Species Red List (2004).

Since the original description of the Yunnan box turtle, data on its still-uncertain distribution, morphology, phenotypy, and genetics have been reported by BLANCK, 2005; BLANCK et al., 2006; BOUR, 2005; ERNST, 1988; HE et al., 2007; PARHAM et al., 2004; ZHANG et al.,

1946; ZHOU et al., 1992; ZHOU and ZHAO, 2004; ZHOU et al., 2004; and ZHOU, 2005. These studies clearly demonstrate that the species is valid and that the presently known live adult specimens (one male and two females) are genetically true *Cuora yunnanensis*, so although its exact status in the wild remains unknown, the species is not entirely extinct!

With funds provided to us in 2004 by the State Forestry Administration of the People’s Republic of China, we successfully reproduced the Yunnan box turtle in captivity in 2006 for the first time on record.

We have maintained an adult pair of Yunnan box turtles (*Cuora yunnanensis*), since 2004. The male measures 148.9 millimeters in straight carapace length, and weighs 375 grams; the female measures 175.2 millimeters, and weighs 850 grams. The carapace has a monochromatic olive-gray or dark brown ground color with orangeish-brown longitudinal stripes along the weak keels.



Female, right; male, left

Captive housing

We house our Yunnan box turtles individually in aquariums measuring 940 x 520 x 400 millimeters (LxWxH), with a water depth of 12–15 centimeters. There are submerged rocks and a basking site in each aquarium. We use a filter to clean the water. A 5.0 pet-trade UVB fluorescent tube is lit every day for 8–10 hours to simulate sunlight and enable the process that regulates calcium metabolism, and a UV lamp is added for 3–5 hours once a week for increased UVB radiation plus some UVA and a little UVC. In warm weather, the turtles are kept outdoors in round plastic pools. As winter approaches, the turtles are moved indoors. A separate nesting area of sand 25 centimeters deep is also provided for the female when she is known to be gravid, determined by digital palpation.

Adult husbandry

The Yunnan box turtle is highly aquatic, so water temperature and quality are important. Over the course of the year, our water temperature ranges from 8°C to 32°C (46.4–89.6°F). When the water temperature drops below 10°C (50°F) the turtles become very sluggish and do not eat, but they do not yet hibernate. When the water temperature drops as low as 8°C (46.4°F), the turtles enter a state of hibernation. We change half the water every month, and all the water every 2–3 months.

We feed the turtles every other day when the water temperatures are at or above 22°C (71.6°F), which seems to keep the turtles in good physical condition. These turtles are primarily carnivores, so the diet consists of a variety of meats, such as shrimp, fish (e.g., loach), pork, and beef. The female will occasionally eat vegetables, and we encourage her to eat tomato by offering it when she is hungry. The male will not eat vegetables.

In the winter of 2005/2006, we kept the water temperature at 25–30°C (77–86°F) so the turtles would not hibernate.

Breeding

Sexual dimorphism is apparent in this species. The female is larger than the male (weights given above), and has a more domed carapace, a flatter plastron, a blunter snout, a shorter tail, the vent located under the carapacial rim, and a plastral pattern displaying a dark central figure covering only the medial third of the pectoral, abdominal, and femoral scutes. During the mating season, the stripes on the neck and limbs of the female change from their usual yellow to a more orangeish color. The male has a flatter carapace, a more concave plastron, a more pointed snout, a longer and thicker tail, the vent located beyond the carapacial rim, and a plastral pattern with a more extensive dark central figure covering the gular scutes entirely, the seams of the humeral scutes, the medial half of the



Plastral patterns of male (left), female (right), and juvenile *Cuora yunnanensis*



Cuora yunnanensis laying eggs



Cuora yunnanensis eggs from 29 April 2006 incubating



Two *Cuora yunnanensis* hatching



A third *Cuora yunnanensis* hatching



Recently hatched *Cuora yunnanensis*



Cuora yunnanensis hatchlings

pectoral scutes, most of the abdominal and femoral scutes, and half of the anal scutes. The head of the male has a light orangeish tint year round, and during the mating season, the stripes on the neck and limbs become intensely orange.

When the female and male are put together (under observation) during the breeding season, mating usually takes place. We observed underwater courtship and mating in April and December. The male is always ready, but we observed that when the female was gravid, she avoided mating by displaying aggression, such as biting the male's head and forelegs, so we kept them completely separated during this period. Approximately 2 weeks before egg laying the female became inactive, basked frequently, and ate very little. She was put in the nesting area frequently during this time. Eggs were laid at night or in the early morning. On 29 April 2006 the female laid four eggs, one of which was deformed (see photo). The three normal eggs averaged 42.1 millimeters in length and 22.6 millimeters in width, and weighed an average of 12 grams. On 27 May 2006 we found four more eggs. A year later we collected a clutch of eight eggs on 25 May 2007, so clutch size ranged from four to eight eggs, with the ability to double clutch in a single season. The hard-shelled eggs are white and elongate. Eggs ranged from 32.9 to 44 millimeters in length, from 20.1 to 29.2 millimeters in width, and from 8.8 to 13 grams (see Table 1). Only the three normal eggs from the first clutch turned out to be fertile.

Incubation

We incubated the eggs in a plastic box, half buried in a 10-centimeter-deep substrate of slightly moistened sand and soil mixture (ratio 1:2). The substrate did not retain enough moisture, so we sprayed with a misting bottle as needed. After about 24 hours in the incubator, the eggs began to "chalk up" (turn ivory-white) starting with a central dorsal patch that then extended over the entire egg within a week. At incubation temperatures of 28–30°C (82–86°F), hatchlings emerged after 64–68 days.

Hatchlings

The elongate oval carapace of the hatchling *Cuora yunnanensis* is slightly domed with three keels and a smooth (not serrated) margin. The carapace is grayish-brown with a yellow wedge-shaped mark on each marginal scute. The plastron has a light yellow background with an extensive black medial figure (most similar to that of the adult male). The yellow bridge has two black blotches and the ventral marginals have triangular black spots. Typical of the species, the mottled chin has brown spots and (irregular) lines on a whitish background, and the head has a lateral stripe pattern similar to that seen on the adults. The head is narrow with a pointed snout.

The hatchlings measured 34.1–34.8 millimeters in carapace length and 25.5–27.4 millimeters in carapace width, and weighed 6.5–8.3 grams (see Table 2). The tails measured 24–26 millimeters, and extended well beyond the carapace rim, being proportionately slightly longer than the tails of hatchlings of most other congeneric (*Cuora*) species. The yolk sac was completely resorbed at the time of hatching and the umbilicus closed within 7–9 days. The egg tooth fell off after 6–8 days.

For the first few weeks, we kept the hatchlings individually in moist basins with a water depth of 8–12 millimeters, at a water temperature of 28–30°C (82.4–86°F), and with a rock for basking. During the early sensitive period, the hatchlings were fed once daily with chopped meats such as pork, fish, and shrimp. Vegetables are not preferred by hatchlings. Once they are a few months old, we feed the juveniles chopped earthworms, whole small worms, and small fish.

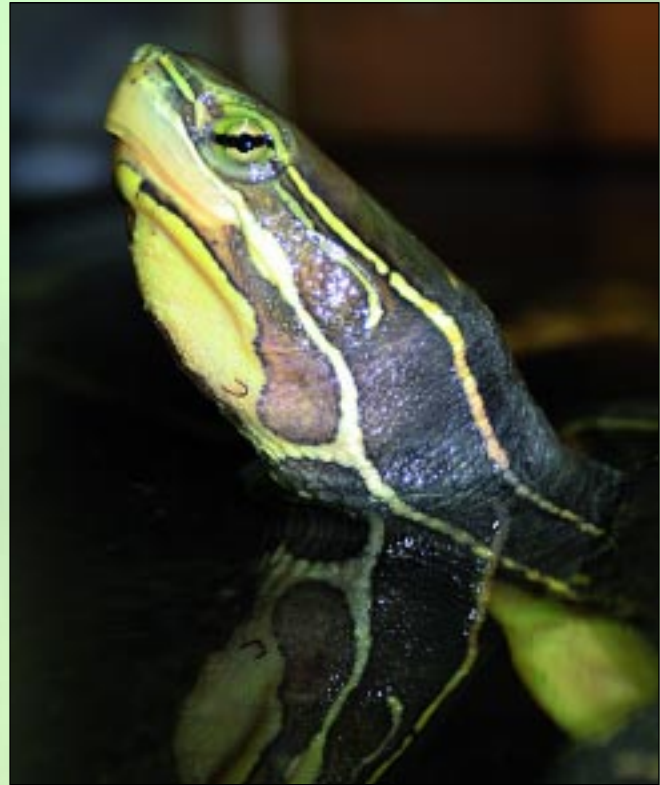
Interestingly, the plastral patterns of all three offspring have changed as the turtles have grown in 2007 and 2008. The initial black central pattern has increased in area, nearly covering the plastral scutes except for small yellowish outer borders, and has faded to a lighter brown color. The remaining yellow ground color has also faded to a creamier pale yellow. The black spots on the ventral marginals have joined in some places forming black bands under the edges of the carapace.

The carapacial keel stripes have changed from yellowish to orangeish-brown and the yellowish wedges on the dorsal marginals have disappeared. The initially yellow mottling and stripes on the limbs have become light orange in color. This sort of pattern change has been observed in other *Cuora* species (e.g., *C. aurocapitata*, *C. pani*, and *C. zhoui*).

We have not yet cooled the juveniles to the point of hibernation in winter, keeping them at 28°C (82.4°F). At 11 months of age, the offspring measured an average of 62.6 millimeters in carapace length and weighed an average of 44.7 grams. ■

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Close-up of the head of a female *Cuora yunnanensis*

Table 1. Egg data for *Cuora yunnanensis*

No.	Date of laying	Weight(g)	Length(mm)	Width(mm)
1	29 April 2006	13	43.1	24.2
2	29 April 2006	12.5	44.0	22.3
3	29 April 2006	10.6	39.2	21.3
4	27 May 2006	8.8	36.1	21.3
5	27 May 2006	12	44.0	21.1
6	27 May 2006	9.9	39.1	22.3
7	27 May 2006	11	38.2	22.3
8	25 May 2007	12.1	39.5	22
9	25 May 2007	9.7	36.1	21.2
10	25 May 2007	12.2	38.9	22.1
11	25 May 2007	9.1	34.4	20.4
12	25 May 2007	12.1	39.3	22.2
13	25 May 2007	10.1	37.5	20.1
14	25 May 2007	12.1	32.9	22.4
15	25 May 2007	12.6	37.5	22.4
Range		8.8~13	32.9~44	20.1~22.2
Mean		11.19	38.65	22.31

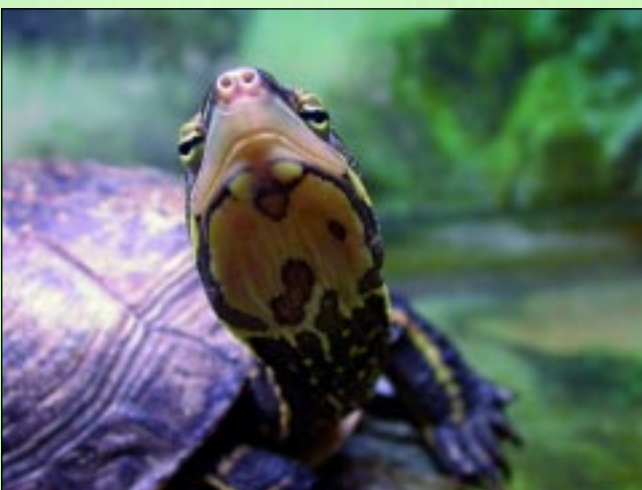
Table 2. Hatchling morphology for *Cuora yunnanensis*

No.	SCL	SMCW	MCH	STL	Weight
1	34.1	27.4	16.5	25	8
2	32.4	25.5	15	24	6.5
3	34.8	26.5	16.8	26	8.3
Mean	33.77	26.47	16.1	25	7.6

SCL = straight carapace length; SMCW = straight maximum carapace width; MCH = maximum carapace height; STL = straight tail length



Female *Cuora yunnanensis*



Throat pattern of female *Cuora yunnanensis*



Cuora yunnanensis juveniles

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