

Geoemyda spengleri (Gmelin 1789) – Black-Breasted Leaf Turtle

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SUMMARY. – The black-breasted leaf turtle, *Geoemyda spengleri* (Geoemydidae), is a very small (carapace length to 107 mm), primarily terrestrial leaf litter turtle that occurs in southern China and northern Vietnam. Few data are available regarding its life history or population status. The species prefers montane forest habitat and apparently rarely enters water. Clutch size in captivity is 1–2 eggs that measure 42–45 x 18 mm, with hatchlings ca. 30 mm in carapace length. Many individuals have been exported from both China and Vietnam via the live pet trade, and this trade appears to have reduced populations of the species. For adequate conservation and management of this species it is necessary to delineate the distribution, life history, and status of each population on the basis of reliable field data.

DISTRIBUTION. – China, Vietnam. Distributed in southeastern China, including Hainan Island, and northern Vietnam.

SYNONYMY. – *Testudo spengleri* Gmelin 1789, *Geoemyda spengleri*, *Geoemyda spengleri spengleri*, *Testudo serrata* Shaw 1802, *Testudo tricarinata* Bory de Saint-Vincent 1804, *Geoemyda spengleri sinensis* Fan 1931.

SUBSPECIES. – None currently recognized. *Geoemyda japonica* Fan 1931 and the Late Pleistocene fossil species *Geoemyda amamiensis* Takahashi, Kato, and Ota 2007, both from the central part of the Ryukyu Archipelago, are closely related taxa.

STATUS. – IUCN 2010 Red List: Endangered (EN A1cd+2cd) (assessed 2000); CITES: Appendix III (China).

Taxonomy. – The black-breasted leaf turtle was first described (without a scientific name) by Walbaum (1785), and subsequently named *Testudo spengleri* by Gmelin (1789) on the basis of Walbaum's specimen, probably brought from

the East Indies. Gray (1834) described the genus *Geoemyda* for this species.

The black-breasted leaf turtle is most closely allied to the Ryukyu black-breasted leaf turtle, *Geoemyda japonica*,



Figure 1. Adult female *Geoemyda spengleri*. Locality unknown. Photo by Yuichirou Yasukawa.



Figure 2. Adult male *Geoemyda spengleri*. Locality unknown. Photo by Nobuhiro Kawazoe.

which was formerly treated as a subspecies of *G. spengleri*. Yasukawa et al. (1992) examined the taxonomic status of the two forms on the basis of morphological characters. As a result, they redescribed the two forms as two separate species; although they recognized several exclusively shared features, suggesting their monophyly among extant species (see *Geoemyda japonica* account in this volume).

Moll et al. (1986) reassigned the Cochin forest cane turtle, previously regarded as *Heosemys silvatica*, to the genus *Geoemyda*. However, subsequent comparisons by Yasukawa et al. (1992) have revealed that this turtle does not share very many features with *G. spengleri* and *G. japonica*, and they tentatively retained the species in *Heosemys*. Mc-

Cord et al. (1995), based on a preliminary cladistic analysis of morphological data, assigned six species (including *silvatica*, *depressa*, *leytensis*, and their new species, *yuwonoii*) to *Geoemyda*. Of these, however, *yuwonoii* was reassigned to a new monotypic genus, *Leucocephalon*, and *depressa* was allocated to *Heosemys* on the basis of a molecular phylogenetic analysis by McCord et al. (2000). Yasukawa et al. (2001), based on a cladistic analysis of morphological data for representatives of almost all geoemydid genera recognized to date, confirmed the relationships “(*spengleri*, *japonica*) *silvatica*”, but retained the phylogenetic status of *leytensis* as unresolved. In their comprehensive molecular phylogenetic analysis of the family Geoemydidae, Spinks et al. (2004) demonstrated the sister-group relationship of *Geoemyda* (as represented by *spengleri* and *japonica*) with the genus *Siebenrockiella* (as represented by *crassicollis*). More recently, Diesmos et al. (2005) assigned *leytensis* to the genus *Siebenrockiella* based on their molecular phylogenetic analysis, but their results did not support a close affinity between *Geoemyda* and *Siebenrockiella*. On the other hand, Praschag et al. (2006) separated *silvatica* from *Geoemyda* and placed it in a new monotypic genus, *Vijayachelys*, also on the basis of a molecular phylogenetic analysis. Therefore, only two extant species, *G. spengleri* and *G. japonica*, and one fossil species, *G. amamiensis* (see Takahashi et al. 2007a, b), are currently recognized as constituting the genus *Geoemyda*.

The head and shell coloration of *G. spengleri* appears to be highly variable, but the geographic variation in coloration or morphology of this turtle has not yet been analyzed appropriately. No subspecies are currently recognized, although *Geoemyda spengleri sinensis* Fan 1931 was for a time considered a separate subspecies before being synonymized.

Gong et al (2009a) demonstrated mitochondrial phylogeographic structure in *G. spengleri* from three Chinese provinces (Guangdong, Guangxi, Hainan) and northern Vietnam. Within southern China two clades from east and west of the Xi Jiang together formed a sister group to hap-



Figure 3. Adult female *Geoemyda spengleri* from Vinh Phuc, Vietnam. Photo by Truong Nguyen Quang.



Figure 4. Adult male *Geoemyda spengleri*. Locality unknown. Photo by Yuichirou Yasukawa.

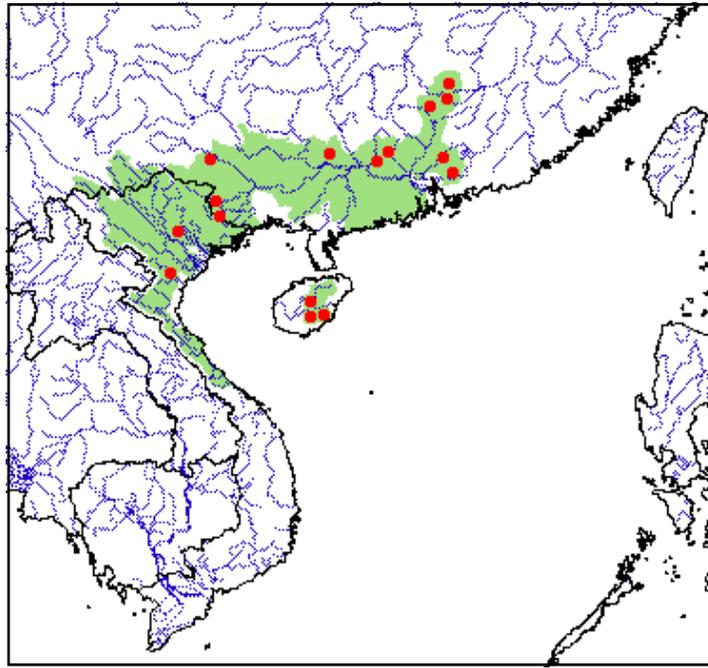


Figure 5. Distribution of *Geoemyda spengleri* in China and Vietnam. Red points = museum and literature occurrence records based on Iverson (1992) plus more recent and authors' data; green shading = projected distribution based on GIS-defined hydrologic unit compartments (HUCs) constructed around verified localities and then adding HUCs that connect known point localities in the same watershed or physiographic region, and similar habitats and elevations as verified HUCs (Buhlmann et al. 2009), and adjusted based on authors' data.

lotypes from northern Vietnam. Turtles from Hainan Island had haplotypes of the same clade as turtles from Guangxi.

Description. — This is the smallest species of the family Geoemydidae, typically only 67.4–107.1 mm carapace length (CL) in adults, and 30 mm CL in hatchlings. The carapace is elongated and depressed, with three strong longitudinal keels, and very pronounced serrations along the posterior margin. Axillary and inguinal scutes are lacking in most individuals, but a pair of very small axillary scutes is occasionally present. The plastron is large, elongate, hingeless (but with some posterior lobe mobility in adult females), and is notched anteriorly and posteriorly. The plastral formula is $Ab \gg Pect \gg Fem > Hum \gg An > Gul$ in most animals. The entoplastron is posterior to the gular-humeral seam and intersected by the humero-pectoral seam.



Figure 6. Juvenile *Geoemyda spengleri* from Tam Dao National Park, Vinh Phuc, Vietnam. Photo by Nguyen Van Sang.

The head is moderate in size. Its dorsal surface is smooth, and lacks small scales. The upper jaw is unnotched with a medial hook, and the triturating surfaces of upper and lower jaws are very narrow without any ridge or cusp. The anterior surfaces of the forelimbs are covered with enlarged imbricate scales, the tips of which are distinctly pointed. Slightly smaller scales of similar shape cover the heels of the hindlimbs. There are no cloacal bursae.

The skull is relatively flattened and elongate. The right and left maxillae are in contact with each other anteroventrally, forming a hooked beak. The cranial cavity is much narrowed anteroventrally, and the anterior end of the *processus inferior parietalis* is separated from the palatine and jugal by the pterygoid. The jugal and quadratojugal are connected to form a weak temporal arch. The secondary palate is not well developed, and the upper and the lower triturating surfaces are narrow, ridgeless, and without serration. The *processus trochlearis oticum*, *p. pterygoideus externus*, and *p. coronoideus* are indistinct.

Ground color of the carapace is highly variable, ranging from dark reddish orange to olive. The soft tissue under the scutes is gray or reddish gray, forming a complex pattern of small flecks. On the carapace scutes, dark lines or wedges extend along the longitudinal keels in most individuals, and dark radiations or irregular spots are present in some. The plastron is black or dark brown, with light yellow or ivory lateral margins. The ground color of the head and neck vary from olive-brown or purplish-gray to dark gray, with dark shadowy irregular patterns anterodorsally. Juveniles and females have white, yellow or reddish-orange narrow stripes and spots on the lateral and posterior surfaces of the

head and neck. Adult males show no distinct patterns on the head, and normally not on the neck either. The limbs and tail are similar to the head in ground color, but with numerous whitish or reddish spots. The iris in females is yellowish or reddish, and in males white or light gray (Yasukawa et al. 1992).

Carapace length does not differ significantly between the sexes. The male has a lower and narrower shell, a shorter and slightly concave plastron, and shorter bridges when compared with the female. The tail of the male is long and thick with the vent located far beyond the carapacial rim when the tail is extended; whereas the tail of females is shorter and thinner with the vent located at or only slightly beyond the rim. Sexually dimorphic plastral kinesis is present; adult females have a flexible, fibrous connection between the hypoplastron and the carapace, whereas males have a sutural bony connection. The smallest (CL = 72.5 mm) and the second smallest adult males (CL = 77.7 mm) examined by Yasukawa et al. (1992) had juvenile head patterns but very long, thick tails. The larger specimen had a faintly reddish iris when first captured, but this faded to whitish after a few weeks in captivity.

The karyotype is $2n = 52$ (Kamezaki and Ota, unpubl. data).

Distribution. — The black-breasted leaf turtle is found in southeastern China (Guangdong, Guangxi, Hainan, and Hunan) and northern Vietnam (Wermuth and Mertens 1977; Zhao 1986; Iverson 1992; Yasukawa et al. 1992; Shi 2005; Gong et al. 2009a, b; Fong and Qiao 2010). The species has also been reported from the Indo-Australian Archipelago (i.e., Indonesia and East Malaysia) and the Philippines (Strauch 1865), but these records are probably incorrect (Taylor 1920; Mertens 1942; Iverson 1992; Yasukawa et al. 1992; McCord et al. 1995). Likewise, its occurrence in Cambodia and Laos, assumed by some previous authors (Wermuth and Mertens 1977; Yasukawa et al. 1992), is doubtful (Touch et al. 2000; Stuart and Timmins 2000; Stuart and Platt 2004).

In Vietnam, Nguyen and Ho (1996) described the range as including Vinh Phuc (Tam Dao), Thanh Hoa (Quan Hoa), and Quang Nam – Da Nang (Quang Nam). The coastal city of Da Nang may have been a collection center rather than a field locality.

Smith (1931) described *G. spengleri* as rare, but his concept of the species may have been flawed, or at least may have included parameters of size and distribution that now would be considered to refer to *G. japonica*. Indeed, inclusion of *G. spengleri* in a work entitled “Fauna of British India” is surprising, and Smith’s own field work was principally in South India and Thailand; but his introduction clarified that he also included the fauna of “French Indo-China and southern China.”

Habitat and Ecology. — The black-breasted leaf turtle seems to be primarily terrestrial, but occasionally enters streams (Fang 1930). Pope (1935) considered its abundance in Yaoshan, reported by Fan (1931), as evidence that this turtle prefers intact, forested, montane environments. In captivity, it often enters shallow water but spends much

more time on land (Petzold 1963; Yasukawa, pers. obs.). In Vietnam, this is considered to be a highland, terrestrial, forest species, being replaced at lower altitudes by *Cuora mouhotii* (Hendrie 2000; P. Pritchard, pers. comm.).

There have been no field observations on feeding habits of the species. In captivity, it feeds on various small invertebrates such as insects and earthworms, as well as pinkie mice and meat. Some animals also feed on plant matter such as bananas and tomatoes (Petzold 1963; Rudloff 1986; Schaefer 2005; Yasukawa, pers. obs.).

Rudloff (1986) reported on a case of breeding of *G. spengleri* in captivity. The female laid three single-egg clutches at 38-day intervals. The eggs were white, brittle-shelled, and much elongated, measuring 42–45 x 18 mm. One egg weighed 8.2 g. Incubation periods were 66 and 73 days in 28 and 25°C, respectively. The shell of one hatchling measured 30 x 24 x 14 mm in length x width x height. In another captive case, a clutch of two eggs was laid, and these eggs hatched after a 67-day incubation period at 30°C (J. Buskirk, pers. comm.).

Population Status. — Fan (1931) reported that the black-breasted leaf turtle was abundant in Yaoshan, China, but there has been no recent specific information regarding the population status of this turtle in Yaoshan or any other parts of China. The species appears to be relatively abundant around Tam-Dao, northern Vietnam (T. Weidenhöfer, pers. comm.).

Threats to Survival. — A large number of *G. spengleri* have been exported for the pet trade via Hong Kong since 1986 (Aoki 1990). It is also reported that this turtle is sold in large quantities in markets of Guangdong and Guangxi provinces, China (Li et al. 1996) and Hainan (Gong et al. 2005). Such trade activities appear to have caused the decline of some populations of this species. It has also been reported in the trade in Hong Kong as pets (Cheung and Dudgeon 2006), and in Taiwan as shells for Traditional Chinese Medicine (Chen et al. 2009).

In Vietnam, this species is excessively collected for the domestic pet trade and illegal export to China. In Hanoi, for example, this species is often found plentifully in local animal markets, where the retail price is the equivalent of \$3–4 (P. Pritchard, pers. comm.). Occasionally specimens are purchased by local people for release in Hoan Kiem Lake, a “sacred turtle lake” in downtown Hanoi, but it is very doubtful that they would survive there. Hendrie (2000) considered that the Vietnamese populations were unlikely to sustain such a high rate of collection as was occurring at that time.

Conservation Measures Taken. — The Chinese Government has assigned the black-breasted leaf turtle to the second grade of the Nation’s Top Priority under Protected Wild Animals (Yunnan Provincial Commission for Compiling Local Chronicles, 1989). No turtles may be exported from Vietnam without a licence.

The IUCN/SSC Tortoise and Freshwater Turtle Specialist Group (1989) listed the species (as *G. s. spengleri*) as Action Plan Rating 3, for species requiring some conservation action.

The IUCN Red List has listed the species as Endangered (Hilton-Taylor 2000). In 2005, this species was added to Appendix III of CITES in China.

The black-breasted leaf turtle occurs in Tam Dao National Park, Vinh Phuc, northern Vietnam, and in Heishiding, Nankunshan, Sanyue, and Tianjingshan Nature Reserves and Nanling Forest Park, Guangdong, southern China.

Conservation Measures Proposed. — The montane forests, which seem to be the primary habitat of this species, are currently being rapidly harvested and cultivated in southern China and northern Vietnam. Preservation of such habitat appears to be an urgent necessity for the conservation of this species. To construct effective procedures for the conservation of this species, it is necessary to understand the detailed distribution, life history, and population status as based on reliable field data. Strict, practical regulations for the handling of this turtle for commercial purposes are also strongly desirable.

Captive Husbandry. — Many hobbyists have reported that this species is not easy to keep alive for long periods in captivity. However, it seems likely that they did not offer even a reasonable facsimile of appropriate habitat to the captive animals, and better success can be expected if individuals are kept in shaded conditions that offer concealment in leaf litter, and where the temperature is kept low, duplicating the thermal regimen of montane forests. Rudloff (1986), Schilde (2004), and Schaefer (2005) reported on a number of cases of captive breeding of *G. spengleri*.

Current Research. — We are not aware of any ongoing field research on the black-breasted leaf turtle in China or Vietnam.

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