

***Graptemys nigrinoda* Cagle 1954 – Black-Knobbed Map Turtle, Black-Knobbed Sawback**

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SUMMARY. – The black-knobbed map turtle, *Graptemys nigrinoda* (Family Emydidae), is a medium-sized aquatic turtle of the southeastern United States. It is limited in its range to the Mobile Bay drainages of Alabama and Mississippi. The turtle prefers large to medium-sized river systems. Little information is available on the habits or life history of this species. The black-knobbed map turtle is listed as Endangered by the state of Mississippi and a Protected Nongame Species by the state of Alabama. The current IUCN Red List Status of *G. nigrinoda* is Near Threatened, but a revised status of Least Concern is recommended in light of recent surveys in which *G. nigrinoda* was the most commonly observed and collected species of emydid within its range.

DISTRIBUTION. – USA. Restricted to Mobile Bay drainages of Alabama and Mississippi.

SYNONYMY. – *Graptemys nigrinoda* Cagle 1954; *Graptemys oculifera nigrinoda*; *Malaclemys nigrinoda*.

SUBSPECIES. – Two recognized: *Graptemys nigrinoda nigrinoda* (Northern Black-Knobbed Map Turtle) and *Graptemys nigrinoda delticola* Folkerts and Mount 1969 (Southern Black-Knobbed Map Turtle).

STATUS. – IUCN 2007 Red List: Near Threatened (LR/nt) (assessed 1996, needs updating);

CITES: Appendix III (*Graptemys* spp.; USA); US ESA: Not Listed.

Taxonomy. – The black-knobbed map turtle, *Graptemys nigrinoda*, was described by Cagle (1954). The holotype, Tulane University 14662, is a juvenile female collected from the Black Warrior River, 17.5 miles SSW of Tuscaloosa, Tuscaloosa County, Alabama.

Two subspecies, the northern black-knobbed map turtle, *G. n. nigrinoda*, and the southern black-knobbed map turtle, *G. n. delticola*, are recognized (Folkerts and Mount 1969). Freeman (1970) offered several objections

to the subspecific designations presented by Folkerts and Mount (1969). Freeman argued that “Folkerts and Mount have failed to show that *delticola* has any clear-cut sets of characteristics which are peculiar to the region which it inhabits.” He claimed the authors failed to demonstrate any “steps” or breaks in certain morphological features within the species’ range. Freeman contended that the authors were dealing with an example of geographic variation manifested by several north to south clines. Additionally,



Figure 1. Adult male *Graptemys nigrinoda* from Alabama, USA. Photo by James C. Godwin.



Figure 2. Sexual size dimorphism in *Graptemys nigrinoda*. Adult female above, adult male below. Photo by James C. Godwin.

Freeman argued that because the range of *G. nigrinoda* is continuous and the designated zone of intergradation is extensive, “it seems improbable that ‘well-defined’ geographic races have developed.” Folkerts and Mount (1970) rebutted Freeman’s arguments, and *G. nigrinoda* has since been considered polytypic by most herpetologists.

Cagle (1954) stated that the black-knobbed map turtle and the yellow-blotched map turtle, *G. flavimaculata*, are closely related to each other and to the ringed map turtle, *G. oculifera*. Cagle believed the three form a unique complex ranging from the Pearl River eastward to the Alabama River. He suggested that the three species might be placed under one ‘superspecific’ designation. However, he also reported that the morphological gap between *G. nigrinoda* and *G. flavimaculata* is much greater than that between *G. flavimaculata* and *G. oculifera*. Cagle suggested that *G. flavimaculata* could perhaps be appropriately listed as a subspecies of *G. oculifera*. Mertens and Wermuth (1977) considered the three to be subspecifically related.

Lamb et al. (1994) identified three distinct monophyletic clades within *Graptemys* based on analysis of mtDNA. The black-knobbed map turtle was placed within the *pseudogeographica* clade that also included *G. ouachitensis*, *G. caglei*, *G. pseudogeographica*, *G. flavimaculata*, *G. oculifera*, and *G. versa*. However, relationships within the clade were basically unresolved.

Description. — *Graptemys nigrinoda* is a medium-sized aquatic turtle. Adult females range from 170-220 mm in carapace length and adult males from 70-120 mm (Lahanas 1986). The carapace is moderately domed, possessing a median keel. The first four vertebrals possess median, backward-projecting, knob-like protuberances which arise from the posterior portion of the scute. The second and third vertebral projections are more pronounced.

These knob-like projections are often reduced to small, pointed swellings in old females. The posterior marginals are conspicuously serrate. The pale yellow to yellow-orange plastron is large, unhinged, and has an anterior and posterior notch (Shoop 1967; Mount 1975; Lahanas 1986).

The carapacial ground color of the northern black-knobbed map turtle is greenish olive to brown. The median vertebral projections are black. Thin yellow-green, nearly circular rings are present on the pleurals. The rings are outlined in black and may encircle a dark central smudge (Lahanas 1986). The lateral portion of the vertebrals possess light reticular markings. The dorsal surfaces of the marginals have complete or incomplete light circular lines. The ventral surfaces of the marginals have concentric dark rings at the sutures (Cagle 1954). The plastral ground color is yellowish with narrow dark lines bordering the sutures



Figure 3. Hatchling *Graptemys nigrinoda* from Alabama, USA. Photo by James C. Godwin.

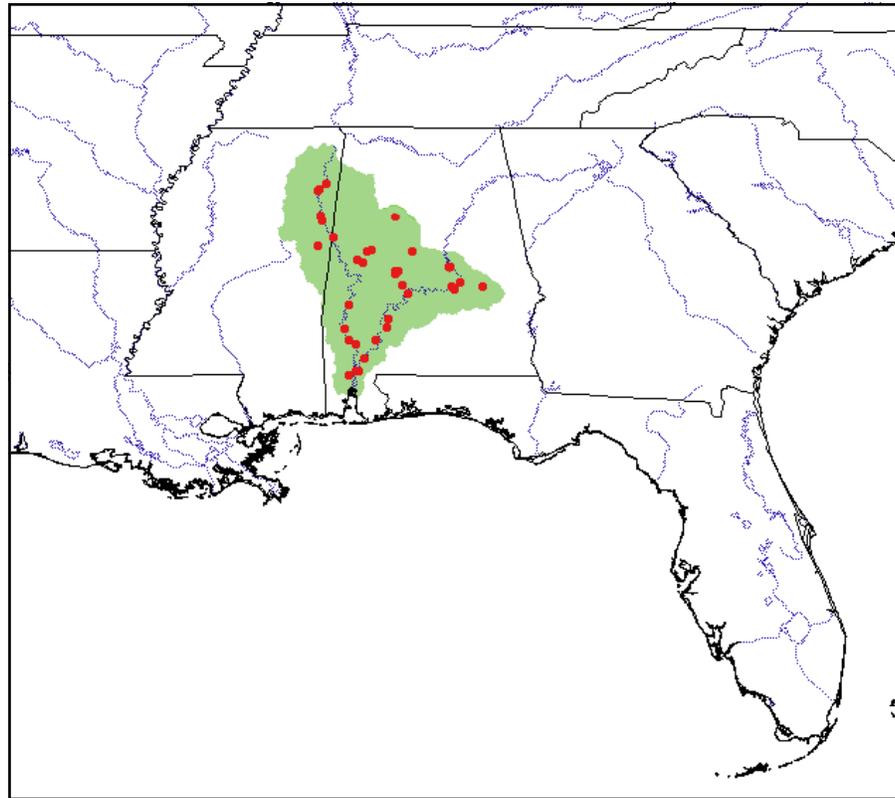


Figure 4. Distribution of *Graptemys nigrinoda* in southeastern USA. Red points = museum and literature occurrence records based on Iverson (1992) plus more recent and authors' data; green shading = projected distribution based on GIS-defined hydrologic unit compartments (HUCs) constructed around verified 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., unpubl. data), and adjusted based on authors' data.

or with a dark figure occupying not more than 30% of the plastral area (Folkerts and Mount 1969).

The head is relatively small, olive to brown in color and has yellow stripes. A pair of yellow postocular crescent-shaped blotches is present. These blotches are strongly recurved and usually connected posteriorly to longitudinal stripes. The legs and tail also possess longitudinal light stripes. The soft parts are predominantly light colored with the light stripes wider than the darker greenish-olive to brown interspaces. The undersurfaces are lighter than the dorsal surfaces (Mount 1975).

The southern black-knobbed map turtle is similar to the nominate subspecies except as follows. A complex dark plastral pattern occupies 60% or more of the plastral area. This plastral pattern may be composed of expanded dark lines that follow the seams or may be a central dark figure. The postorbital blotches are not crescent-shaped and are not noticeably recurved. These blotches are often disconnected from the light head stripes. The soft parts of the southern black-knobbed map turtle are predominantly dark, the dark interspaces being wider than the narrow light stripes. The ground color of *G. n. delticola* is black, unlike the greenish-olive to brown ground color in the nominate subspecies. The carapace is higher in *G. n. delticola* than in *G. n. nigrinoda*.

Hatchlings of *G. n. delticola* were described by Lahanas (1982). Newly hatched turtles exhibit a body

pattern and coloration similar to adults; however, colors are more vivid and contrasts are greater than in adults. No ontogenetic color changes have been noted except for fading coincident with growth and aging. Hatchlings are wider than long with pronounced marginal indentations. The knob-like protuberances on the keel are compressed laterally. In addition, newly hatched *G. nigrinoda* have relatively greater plastron and head widths compared to adults, as well as a longer relative post-anal tail length.

Sexual dimorphism is evident in *G. nigrinoda*, as in other species of *Graptemys*. Lahanas (1982) found 4 of 9 morphometric traits to be intersexually different within *G. n. delticola*. The most conspicuous sexually dimorphic character is greater size attained by adult females compared to adult males. The maximum carapace length reported for a female is 221 mm and for a male, 122 mm (Lahanas 1982). The seven largest females Lahanas found averaged 200.6 ± 5.58 mm CL. The seven largest males averaged 113.0 ± 1.91 mm CL. Females have been shown to have relatively higher shells than males (Folkerts and Mount 1969; Lahanas 1982). Black-knobbed map turtle males have significantly longer relative tail lengths than females (Lahanas 1982). Pre-anal tail length was 13.8% of the carapace length for 28 males and 10.1% for 22 females. Post-anal length for males was 22.2% and for females 19.9% (Lahanas 1982). When the tail is extended the vent is posterior to the rear margin of the carapace in males and anterior to the rear

margin in females. The foreclaws of adult males are longer than those of females (Lahanas 1982). Males have been shown to have larger hind foot areas, relative to carapace length, than females of similar size. In addition, the angle of the rear plastral notch is more acute in females than in males (Bailey and Folkerts 1987).

The osteology of *G. nigrinoda* has been described by Killebrew (1979), who gave characters that could be used to differentiate *G. nigrinoda* and *G. flavimaculata*.

Graptemys nigrinoda resembles other *Graptemys* in having a prominent keel, knobs, and extensive light striping on soft parts. It can be distinguished from other turtles by the presence of large circular light rings in each of the pleurals and prominent knob-like protuberances on vertebrals one, two, and three. *Graptemys oculifera* does not possess prominent knob-like protuberances on the vertebrals. *Graptemys flavimaculata* has yellowish to orange blotches within each pleural, normally lacks circular light rings, and lacks prominent knobs on the keel (Cagle 1954).

Distribution. — The black-knobbed map turtle is found in Alabama below the Fall Line in major streams of the Mobile Bay drainage. In Mississippi, it is found in the Tombigbee River system as far north as Bull Mountain Creek at State Hwy 25, Itawamba county (Cliburn 1970). It also occurs above the Fall Line in Bankhead Lake, an impoundment of the Black Warrior River, in the Locust Fork of the Black Warrior River at least as far upstream as the mouth of Crooked Creek in Jefferson County, Alabama (Folkerts and Mount 1969; R. Mount, pers. comm.), and on the Coosa River upstream to Mitchell Dam (Godwin 2001).

Within the range, the nominate subspecies is found in the Cahaba, Tallapoosa, and Coosa rivers, and in the Alabama River downstream approximately to the Wilcox-Monroe county boundary. *Graptemys n. delticola* occurs in freshwater in the Tensaw and Mobile rivers and associated waterways, frequently referred to as the upper portion of the Mobile Delta. The remainder of the range contains intergradient populations (Folkerts and Mount 1969; Mount 1975).

Habitat and Ecology. — The black-knobbed map turtle occurs in medium- to large-sized rivers and associated bayous and oxbows (Mount 1975). Adults and subadults of *delticola* prefer main channels, whereas hatchlings and small juveniles are more often found in shallow, sluggish waters of sloughs and bayous if such habitats are available (Lahanas 1982). Waters (1974) indicated that the availability of basking sites is important in determining the areas along a river the species utilizes. Waters (1974) identified preferred basking sites as exposed logs and snags surrounded by open water. Such sites provide unobstructed views and direct sunlight for an appreciable portion of the day.

Direct observations of foraging behavior have only been reported once. Wahlquist (1970) observed the turtles consuming beetles and dragonflies that had fallen into a river. Lahanas (1982) examined the gut contents of 15 male

and 17 female *G. n. delticola* in the lower Tensaw River. The males contained 58.3% animal material and 40.4% plant material by volume and females contained 69.2% animal material and 28.1% plant material by volume. The three most important animal items consumed were freshwater sponges, bryozoans, and molluscs. Freshwater algae were the only plants consumed. Lahanas (1982) concluded that, although the black-knobbed map turtle may occasionally feed at the surface, it is predominantly a browser on submerged logs or other submerged objects.

Black-knobbed map turtles are seasonally active from early April through late November (Lahanas 1982). Basking may be observed throughout the day with two peak periods of activity, one during mid-morning and another in the early afternoon (Waters 1974; Lahanas 1982). Hatchlings have been observed basking on limbs of bushes located along river banks and on masses of emergent vegetation (J. Dobie, pers. comm.). Basking is unlikely to occur when water temperatures fall below 10°C (Waters 1974). The primary function of basking was believed by Waters (1974) to be thermoregulation. He also provided evidence that basking is important in ridding the turtle of ectoparasites, eliminating excessive algal growth on the shell, and in the synthesis of Vitamin D.

Males of *G. n. delticola* reach sexual maturity at 3-4 yrs at a plastron length of about 70 mm; females reach sexual maturity at 8-9 yrs at a plastron length of about 170 mm (Lahanas 1982). Females produce 3 to 4 clutches annually, averaging 5.5 eggs per clutch (Lahanas 1982). Nesting is nocturnal and occurs from mid-May through early August (observed on Gravine Island, Baldwin Co., Alabama; Lahanas 1982). Nesting occurs on open expanses of fine sand and nests are located above the water level within 50 m of shore (Lahanas 1982). Hatching begins in mid-August after an incubation period of about 62 days (Lahanas 1982).

The fish crow, *Corvus ossifragus*, is a significant predator of turtle eggs on Gravine Island (Lahanas 1982), as is the armadillo, *Dasyus novemcinctus*, and the raccoon, *Procyon lotor* (Godwin 2002). The imported red fire-ant, *Solenopsis invicta*, may also be an important predator on eggs and hatchlings. Dobie (pers. comm.) stated that the imported red fire-ant is probably a significant predator of eggs of the black-knobbed map turtle on Gravine Island after having found fire-ants in 63 of 79 nest cavities examined. Hatchling and juvenile turtles are thought to be preyed upon by fish, bullfrogs, wading birds, and alligators (Waters 1974; Lahanas 1982). Adults may be prey items for alligators (Waters 1974; Lahanas 1982). Humans are also important predators (Waters 1974; Lahanas 1982). Black-knobbed map turtles are parasitized by leeches externally (Waters 1974; Lahanas 1982) and acanthocephalans internally (Lahanas 1982).

Population Status. — McCoy and Vogt (1980) provided information on distribution and relative abundance of *G. nigrinoda* in Alabama and Mississippi. Their methods included both sight survey and trapping using hoop nets. The study

areas consisted of 42 stations distributed across the known range of the species. They determined that the range of *G. nigrinoda* is much larger than that of either *G. flavimaculata* or *G. oculifera*. The area with the greatest abundance of turtles was in Baldwin County, Alabama, on the Tensaw River, from its junction with Middle River to Bryants Upper Landing. The Alabama River south of Selma “seemed to be particularly depauperate of *G. nigrinoda*, compared to areas farther north and farther south.” Excellent populations of *G. nigrinoda* occur in the Tensaw, Tombigbee, Black Warrior, Alabama, Cahaba, Coosa, and Tallapoosa rivers. The black-knobbed map turtle was the most abundant turtle in both basking surveys and spot trapping surveys over much of the range. Large impoundments on the Alabama and Black Warrior rivers did not appear to be detrimental to the species. Channelized areas on the Alabama and Tombigbee rivers with heavy barge traffic had fewer *G. nigrinoda* than winding areas with moderate current and basking logs. The best populations observed were located in relatively undisturbed areas: the Cahaba River at Sprott, Tombigbee River at Rattlesnake Bend, and the feeder streams to the Tensaw River. All of these areas lack barge traffic, intense boat use, channelization, or noticeable industrial pollution. McCoy and Vogt (1980) concluded that: 1) the species is doing well at most sites and does not warrant listing as threatened at the present time, and 2) future work should concentrate on determining the habitat differences and their causes between areas where the species is abundant, and areas where the species is less common.

Recent basking surveys for *G. nigrinoda* and *G. pulchra* (Godwin 2001, 2003) have supported the prior assessment of McCoy and Vogt (1980). In the Mobile Basin rivers, below the Fall Line, *G. nigrinoda* was the most commonly observed species with an overall average of 15.3 basking turtles/km of river. In contrast, the average for *G. pulchra* over the same river reaches was 2.3 turtles/km. From 2001 to 2003 a total of 224 km of rivers were surveyed in the range of *G. nigrinoda*, including reaches on the Alabama, Black Warrior, Cahaba, Coosa, Tallapoosa, Tensaw, and Tombigbee rivers. The species was most abundant on the Alabama and Cahaba rivers, followed by the Tombigbee, Tensaw, Black Warrior, Coosa, and Tallapoosa. Positively identified males were observed more frequently than females, and all age classes were seen.

Threats to Survival. — The black-knobbed map turtle is potentially threatened by habitat degradation and by direct and indirect persecution by humans. The removal of logs (“snagging”) that are used as basking sites may be deleterious to this turtle. Alteration and destruction of nesting areas and direct interference of nesting females by humans may also threaten this turtle. Additionally, populations may be impacted from human consumption of turtles and turtle eggs (Lahanas 1982) and vandalistic shooting of turtles and collecting turtles for the pet trade (Waters 1974). Commercial fishermen occasionally kill turtles caught on trot lines, and turtles also drown in gill nets and hoop nets (Lahanas 1982).

Conservation Measures Taken. — The black-knobbed map turtle is listed as Endangered by the state of Mississippi and a Protected Nongame Species by the state of Alabama. The U.S. Fish and Wildlife Service lists the species as subcategory 3-C (species now considered to be more abundant or widespread than previously thought).

While *G. nigrinoda* occurs adjacent to conservation lands, the rivers themselves remain vulnerable. Lands with some level of protection include the Delta Wildlife Management Area of the Mobile-Tensaw Delta, managed by the Alabama Department of Conservation and Natural Resources, Haines Island, with river frontage on the Alabama River, Gravine Island on the Tensaw River, both owned by the U.S. Army Corps of Engineers, and the Choctaw National Wildlife Refuge on the Tombigbee River; other protected sites include Ft. Toulouse Historical Park at the confluence of the Coosa and Tallapoosa rivers. While these sites provide only minimal protection for the rivers, they do provide some minor degree of protection for nesting habitat. The Nature Conservancy owns one preserve, Bartons Beach, on the Cahaba River. Incidental protection for *G. nigrinoda* will be achieved as the Mobile Basin Aquatic Ecosystem Recovery Plan (USFWS, 2000) is implemented. The plan addresses the recovery needs of 22 aquatic species, including the Alabama red-bellied turtle, *Pseudemys alabamensis*, whose range overlaps with that of *G. n. delticola*, and any recovery measures for *P. alabamensis* that address habitat will be beneficial also to *G. n. delticola*.

Conservation Measures Proposed. — The current IUNC Red List Status designation of *G. nigrinoda* is Near Threatened. A revised status to Least Concern is recommended in light of the information provided by McCoy and Vogt (1980) and Godwin (2001, 2003) in which *G. nigrinoda* was the most commonly observed and collected species of emydid within its range. An overall average of 23.2 basking *G. nigrinoda*/km of river were observed compared to an overall average of 3.8 basking *G. pulchra*/km during surveys in 2001 and 2003.

Captive Husbandry. — The black-knobbed map turtle has been successfully kept in captivity for research purposes. Waters (1974), while studying the importance of basking in *G. nigrinoda*, successfully held between 10 and 20 individuals in a 300 l glass aquarium. A water depth of 20 cm was maintained and the water was changed regularly. A basking platform was provided and illuminated by an artificial light source. Turtles that were denied a basking platform soon developed thick growths of algae. Males and juveniles thrived without basking for periods of seven to 14 days. However, females not allowed to bask soon developed plastral and carapacial sores. Waters (1974) maintained captive turtles on a diet of ground beef fed twice weekly with lettuce and commercial trout food offered occasionally. Mount (1975) stated that captive black-knobbed map turtles will readily feed on raw liver, chopped fish, and canned dog food. Many freshwater turtles, including *G. nigrinoda*, will readily accept balanced commercial turtle foods such

as Tetra ReptoMin^R with occasional supplementation of insects, worms, slugs, snails, and other invertebrates.

Nijs (1999) reported successful reproduction by captive *G. nigrinoda*.

Current Research. — We are unaware of any research currently being conducted on *G. nigrinoda*.

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