

***Pseudemys alabamensis* Baur 1893 –  
Alabama Red-Bellied Cooter, Alabama Red-Bellied Turtle**

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**SUMMARY.** – The Alabama red-bellied cooter, *Pseudemys alabamensis* (Family Emydidae), is a poorly known aquatic species, most closely allied with members of the *P. rubriventris* complex. It is an Alabama and Mississippi endemic, found in the lower part of the Mobile Bay Drainage Basin in Mobile and Baldwin counties, Alabama, as well as the Pascagoula River and Back Bay of Biloxi watersheds in Harrison and Jackson counties, Mississippi. The species was designated as Endangered by the U.S. Fish and Wildlife Service in 1987 and as Endangered by the IUCN Red List. Threats to the species include predation by hogs, raccoons, crows, and fire ants; harvesting and collecting (including human consumption of eggs); destruction of submerged vegetation beds by dredging; pollution and development; destruction of nesting habitat; bulkheading of bayous (preventing access of females to upland nesting sites); incidental capture by recreational fishermen on baited hooks; and injury from boat propellers and vehicular traffic. A recovery plan for the species was approved in 1990. *Pseudemys alabamensis* is the Official State Reptile of Alabama.

**DISTRIBUTION.** – USA. Restricted to the lower Mobile Bay drainage of southwestern Alabama and the Biloxi drainage of southeastern Mississippi.

**SYNONYMY.** – *Pseudemys alabamensis* Baur 1893, *Pseudemys rubriventris alabamensis*, *Chrysemys (Pseudemys) alabamensis*, *Chrysemys rubriventris alabamensis*.

**SUBSPECIES.** – None recognized. The southeastern Mississippi population differs slightly morphologically but is not recognized as a distinct taxon; genetic phylogeographic analysis is needed.

**STATUS.** – IUCN 2007 Red List: Endangered (EN B1+2c) (assessed 1996, needs updating); CITES: Not Listed; US ESA: Endangered.



**Figure 1.** Adult female *Pseudemys alabamensis*. Photo by Robert H. Mount (from Leary et al. 2003).



**Figure 2.** Plastron of adult male *Pseudemys alabamensis*, West Pascagoula River, Mississippi. Photo by Thomas M. Mann.

**Taxonomy.** — The Alabama red-bellied cooter, *Pseudemys alabamensis*, was described by Baur (1893) and was previously included within the description of *Pseudemys mobilensis* (= *P. concinna mobilensis*) by Holbrook (1838) and *Ptychemys mobilensis* (= *P. c. mobilensis*) by Agassiz (1857). Neither specimen from the Gustave Kohn collection (now in the United States National Museum, USNM 20966–20967) that Baur (1893) used for the description of *P. alabamensis* was specified as the holotype. McCoy and Vogt (1985) designated USNM 20966, an adult male collected at the type locality (“Mobile Bay, Ala.”) as the lectotype.

Subsequent to Viosca (1923), and before Crenshaw (1955) and Carr and Crenshaw (1957) returned *P. alabamensis* to species status, the Alabama red-bellied cooter was considered to be an invalid taxon and was designated as a “mutant of *P. floridana mobilensis*” (= *P. concinna mobilensis*) (Carr 1938), or a variant of “*P. floridana suwanniensis*” (= *P. c. suwanniensis*) (Carr 1952). It was also included within what is now *P. nelsoni* (De Sola 1935), or considered a subspecies of *P. rubriventris* (Stejneger 1938; Wermuth and Mertens 1961, 1977). Although *P. alabamensis* is now generally accepted as a valid species (McDowell 1964; Weaver and Rose 1967; Ernst and Barbour 1972, 1989; Mount 1975; Behler and King



**Figure 4.** Plastron of hatchling *Pseudemys alabamensis*, West Pascagoula River, Mississippi. Photo by Thomas M. Mann.



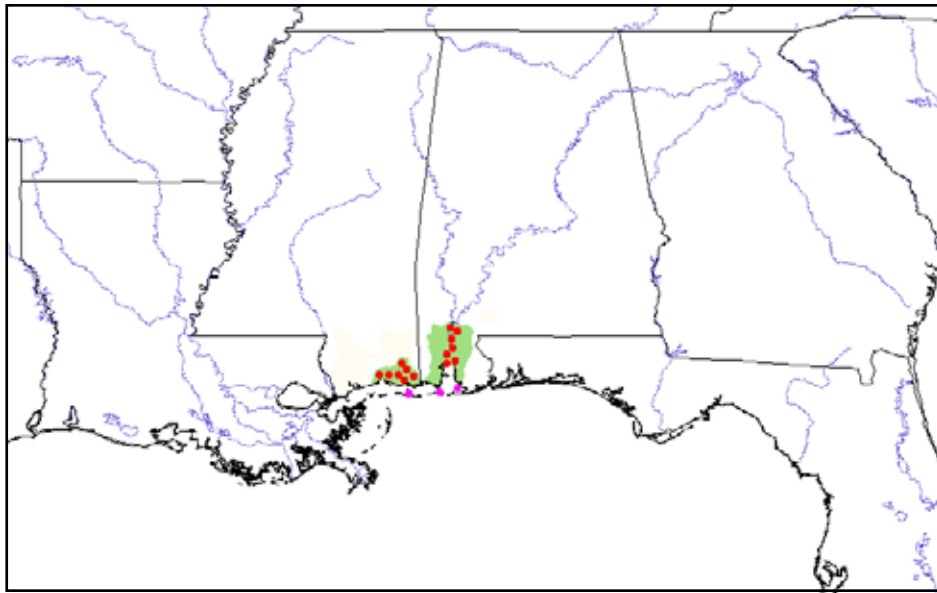
**Figure 3.** *Pseudemys alabamensis*. Top: Adult male; Middle: Adult female; Bottom: Adult male from Mississippi. Photos by James L. Dobie (top and bottom) and Thomas M. Mann (middle).

1979; Meany 1979; Pritchard 1979; McCoy and Vogt 1979, 1985; Dobie 1982, 1985, 1986, 1992a, 1993; Ward 1984; Seidel and Palmer 1991, Iverson 1992; Seidel 1994; Ernst et al. 1994), some investigators have indicated the possibility that it may be a subspecies of *P. nelsoni* (Crenshaw 1955; Carr and Crenshaw 1957; Jackson 1978; McCoy and Vogt 1979).

*Pseudemys alabamensis* is most closely allied with members of the *P. rubriventris* species complex (i.e., *P. alabamensis*, *P. nelsoni*, and *P. rubriventris*, see Seidel and Palmer 1991; Seidel 1994) based on the presence of a central notch in the upper jaw bordered by a cusp on each side, a vomer forming part of the triturating surface, and a prefrontal arrow formed from the meeting of the sagittal head stripes with the supratemporal stripes.

Some individual *P. concinna*, *P. texana*, and *P. gorzugi* (Ernst 1990) also have an upper jaw notch with cusps, a prefrontal arrow, and an orange-red plastron that suggest inclusion of these species within the *P. rubriventris* group





**Figure 5.** Distribution of *Pseudemys alabamensis* in southeastern USA. Red points = museum and literature occurrence records based on Iverson (1992) plus more recent and authors' data; purple points = waifs reported from offshore islands, not representing actual populations; 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.

(Ward 1984). However, other morphological features and liver proteins link *P. alabamensis* with other members of the *P. rubriventris* complex and differentiate it from members of the *P. concinna* complex (McDowell 1964; Weaver and Rose 1967; Seidel and Palmer 1991; Seidel 1994). Seidel (1994) re-evaluated the inclusion of *P. texana*, *P. gorzugi*, and *P. concinna* in the *P. rubriventris* group and concluded that many features used by Ward (1984) were homoplastic features shared by *P. texana*, *P. gorzugi*, *P. concinna*, and members of the *P. rubriventris* complex. Seidel (1994) recognized a monophyletic *P. rubriventris* group based on biochemical and morphological evidence.

Leary et al. (2003) provided a morphological analysis of red-bellied turtles from Mississippi and Alabama to determine whether the Mississippi population was taxonomically distinct. Though some minor differences were found, they were interpreted as clinal, and the Mississippi population was not felt to be distinct enough to warrant description as a new taxon. However, genetic analysis is needed to elucidate potential phylogeographic patterns among the populations (Lydeard 1995).

**Description.** — *Pseudemys alabamensis* is a large emydid turtle; females attain a maximum carapace length of at least 375 mm, and males at least 295 mm (Dobie 1993). Typically, the adult female carapace is highly domed, elongate-oval in outline, and is slightly serrated along the posterior margin. The carapace of males is more variable; although some are highly domed, most exhibit a relatively low lateral profile. The carapace surface has prominent longitudinal ridges that become more pronounced with size and age. The background carapace color is greenish, olive brown, or black. The carapace markings are variable, but yellow, orange, or orange-red vertical markings occur

on the costal scutes and on the dorsal sides of the marginal scutes of small individuals of both sexes. In some melanistic males, however, the markings on the carapace are faint or no longer visible, and the carapace may have scattered reddish spots. The carapace of hatchlings is nearly circular in outline, green, and has yellow markings.

The plastron and bridge are large and a posterior plastral notch is present. The plastral color may be cream, yellow, orange, or orange-red. The plastral markings are plain to ornate in hatchlings. Plastral markings are reduced or lost in larger individuals, and black vermiculations are present in some large melanistic males and females. The plastron of old adults, particularly melanistic males, may be strongly suffused with coral, pinkish, or orangish color; this is most striking on the periphery of the plastron and on the dorsal surface of the epiplastral lip, but may also occur on the bridge and ventral surface of the marginal scutes.

The skin of adults is olive to black and marked with yellow, cream, or orange striping. The striping in some melanistic males and females may be replaced by blotches while, in others, the stripes are obliterated by melanin. A prefrontal arrow is formed from the meeting of the sagittal head stripe with the supratemporal stripes. The prefrontal arrow is often broken, with one or more breaks in the sagittal stripe, particularly in larger specimens. Breaks in the sagittal stripes are commonly positioned such that the sagittal stripe does not join with the supratemporal stripes, which typically unite at the midline dorsoposterior to the nares. The skin of hatchlings is green with yellow, cream, or orange striping. All *P. alabamensis* have horizontal eye-bars, generally unbroken. By contrast, sympatric *P. concinna* typically lack any eye-bar, but if present, the eye-bar is incomplete (Mann et al. 2000).

The upper jaw has a central notch, bordered by a maxillary cusp on each side, and the edge of the tomium is serrate. Cusps may be obliterated by wear in older adults, and may not be conspicuous in hatchlings. In a 2-year study in Alabama, Nelson (unpubl. data) observed maxillary cusps on 266 of 268 individuals. The mandible is flat ventrally, the dorsolateral edges are serrate, and there is a cusp at the tip. Sexual dimorphism is pronounced: males are smaller, have elongate foreclaws, and a greater precloacal tail length. Melanism, although variable, is much more pronounced in older males than in females; males are more likely to have black vermiculations on the plastron, color patterns on the carapace, and striping on soft body parts are often obscured by melanin.

**Distribution.** — The Alabama red-bellied cooter is endemic to southwestern Alabama and southeastern Mississippi. It has a small range limited to vegetated streams and embayments in the lower part of the Mobile Bay Drainage Basin in Mobile and Baldwin counties, Alabama (Mount 1975; McCoy and Vogt 1979, 1985; Dobie 1985, 1986, 1992a,b, 1993) and the Pascagoula River and Back Bay of Biloxi watersheds in Harrison and Jackson counties, Mississippi (Leary et al. 2003).

Presumed waifs have been verified from Mobile Bay, AL (USNM 20966 and Tulane University 19721), Dauphin Island, AL (Jackson and Jackson 1970), Bon Secour, AL (TU 19723), Perdido Bay, AL (TU 19722), Horn Island, MS (photo of dead hatchling, G. Johnson, 1986), Round Island, MS (Floyd, pers. obs.), and South Rigolets Island, MS (MMNS 2981). Specimens reportedly from Bon Secour and Perdido Bay, AL (TU 19722 and TU 19723) are from the Kohn collection and the localities are questionable because the specimens were probably obtained from fish markets in New Orleans, Louisiana. A population of *P. alabamensis* in Little River State Park (= Claude D. Kelley State Park), Monroe County, AL, no longer exists (Mount 1975). Locality data provided by Mount (1975) for Auburn University Museum (AUM) *P. alabamensis* specimens 22703-05 are from Gunnison Creek, not Chickasaw Creek in Mobile County, AL. Specimens designated *P. alabamensis* by various investigators from the Florida Panhandle, Texas, and Tennessee were misidentified (Dobie 1985). Specimens from the Pascagoula River Drainage Basin, Jackson County, MS, and those from the Biloxi River, Harrison County, MS (Mann et al. 2000), the Tchoutacabouffa River, Harrison County, MS (Allen 1932; Mann et al. 2000), and the Mississippi Sound (Loding 1922; Haltom 1931; T. Vandeventer, pers. comm.) are *P. alabamensis* (Leary et al. 2003).

In Alabama, the Alabama red-bellied cooter appears to be abundant in the segment of the Tensaw River extending from the mouth of Hurricane Creek south to Clover Leaf Landing, in the Raft River, Minette Bay, Apalachee River, and in Chocalata Bay in Baldwin County. *Pseudemys alabamensis* occurs as far north as David's Lake in Mobile County, AL. In Mississippi, *P. alabamensis* is most abundant in the marsh-flanked, sluggish bayous draining into the West Pascagoula River and Bluff Creek, one of its major tributaries.

Similarly, it is most common in the marsh-flanked portions of the major tributaries to Back Bay of Biloxi, including lower reaches of the Biloxi River, the Tchoutacabouffa River, and Old Fort Bayou (Mann et al. 2000).

**Habitat and Ecology.** — Many aspects of the life history and ecology of *P. alabamensis* are poorly known. Very little is known about growth rates, size and age at sexual maturity, life span, courtship, mating, total number of clutches laid per annum, total reproductive potential, movement patterns, basking habits, overwintering sites, and population dynamics.

Most *P. alabamensis* in Mississippi have been collected in shallow, fresh to brackish water with little current and supporting abundant aquatic spermatophytic vegetation, usually in areas flanked by extensive *Juncus roemerianus* or *Cladium jamaicense* marshes (Mann et al. 2000). The largest identified red-bellied cooter populations in Mississippi are in Mary Walker Bayou and Sioux Bayou, habitat classified as brackish marsh (Eleuterius 1973). However, they also live in freshwater marshes upstream of brackish marshes, and some make seasonal use of salt marshes at the mouth of the West Pascagoula River (Mann et al. 2000). A few specimens have been collected in sluggish bayous or oxbows flanked by bottomland forest upstream of the open marshes more typical of red-bellied cooter habitat in Mississippi. The northernmost such record for the Pascagoula River is an adult female found in Little Bear Bayou by Terrence Majure (MMNS #5306): one adult female was found on Hwy 613 in Hurley by L. McCoy in 2003 (photos on file at MMNS) and two juveniles and one subadult male were found in Old Fort Bayou (Floyd et al. 1998; photos on file at MMNS).

The earliest reported date for nesting activity for *P. alabamensis* in Alabama is 23 April (in 1990, R. Clay, pers. comm.). Gravid females have been found as late as 14 August (Dobie 1993). Total number of eggs per clutch ranged from 4–10 (mean = 6.4 eggs, n = 16 clutches) for data gathered in Alabama (Dobie and Leary, pers. obs.). Nelson (unpubl. data) radiographed 40 animals from Alabama over 3 yrs and found an average of 13.5 eggs in the oviducts. Additional surveys by Nelson in Alabama yielded an average of 10.8 eggs/nest (range 7–15 eggs, n = 16 individuals, for data collected in 2001) and 12.0 eggs/nest (n = 24 individuals, for data collected in 2003). Floyd (1995) excavated six nests in Mississippi that contained 11–14 eggs, mean = 12 eggs. Females can lay multiple clutches in a single season (interval between deposition events = 17–18 days for two females, Dobie, pers. obs.). Similarly, nesting observations and detection of eggs via palpation during recaptures indicated that three females nested at least twice during the 1995 season (Floyd 1995).

Females at Gravine Island (a known nesting site in Alabama) nest primarily at night, but Godwin (2002) also noted daytime nesting activity following heavy thunderstorms. Individuals at Apalachee River and Justins Bay nest primarily during daylight hours. In Mississippi, *P. alabamensis* may nest anytime within a 24-hr period, but most nesting occurs between the late afternoon and midnight (Floyd 1995).

Hatchlings may emerge from nests during the year of egg deposition (Floyd 1995), but some overwinter within nests and emerge the following spring (Nelson, pers. obs; T. Floyd, pers. obs.).

Nesting in Mississippi has been documented in a variety of uplands flanking marsh habitat of the adults or flanking smaller bayous that drain into such habitats (Floyd 1995). Nesting habitats include open, patchy forests of maritime live oak or longleaf pine; all known nesting sites have experienced significant anthropogenic alteration. Nesting typically occurs in areas with partial shade; usually within the dripline of large trees, sometimes at the base of the tree trunk. Occasionally, nests were found immediately adjacent to buildings (Floyd 1995). In addition, nesting has been documented in alligator nest mounds at an alligator farm along Hwy 90 between the Escatawpa River and the headwaters of Bayou Cumbest (Floyd, pers. obs.). In Mississippi, nesting substrate may be well-drained sandy loam or more poorly drained soil with a higher clay content (Floyd 1995). The smallest mature female in Alabama (determined via palpation of oviductal eggs) had a midline carapace length of 262 mm. The smallest verifiably mature female in MS had a midline carapace length of 300 mm. Carapace length of the smallest adult male was 226 mm, an Alabama specimen with elongated foreclaws.

Barnacles (*Balanus* sp.) were found on five females out of a total of 125 *P. alabamensis* captured in Alabama in 1992–93 (see also Jackson and Ross 1972), and barnacles have been seen on at least 3 of 85 specimens (predominantly adults) captured in Mississippi in Mary Walker and Sioux Bayous from 1992–95 (Mann et al. 2000). Leeches (*Placobdella* sp.) were found on 13 of 103 (12.6%) individuals (males and females) captured in Alabama, and have also been seen on individuals in Mississippi (Mann, pers. obs.).

Turner and Nelson (2001) analyzed stomach contents of 80 individuals (7 males and 63 females) from Alabama. Diet consisted primarily of submerged aquatic vegetation including *Hydrilla verticillata* (an introduced species), *Najas guadalupensis*, and *Vallisneria americana*. In Mississippi, *P. alabamensis* has been observed eating *V. americana* and *Sagittaria kurtziana* (Floyd 1995).

Information on movement patterns are largely unknown, though a radiotelemetry study revealed that individuals move as far as 17.9 km (11 mi) away from the release site (Nelson and Turner 2004). They remain dormant in soft sediments during cold periods, but may be active during any month of the year in mild winters (Nelson and Turner 2004).

**Population Status.** — McCoy and Vogt (1979) provided estimates of the relative abundance of *P. alabamensis* in Alabama in site-counts of 127 individuals over a 12 day period and capture of 20 animals in 1056 trapping hours. They used a 30x spotting scope for visual counts and several double-throated hoop nets attached to leads between two hoop nets and one 929 m gill net set by a commercial fisherman. The accuracy of visual surveys are questionable given that differentiating between *P. alabamensis* and sympatric *P. concinna* is difficult unless specimens are in hand. Based on data for captured individuals, the capture rate for *P.*

*alabamensis* was one individual per 52.8 trap hours (McCoy and Vogt 1979).

In Alabama, 36 *P. alabamensis* were trapped in 7946 hours in 1992 and 61 individuals were trapped in 6330 hours in 1993 (Dobie and Leary, unpubl. data). Results for the two years yield a total of 97 individuals captured in 14,276 hours, or one per 147 hours). Results indicate that 2.78 times as many hours were required to catch a single specimen in 1992 and 1993 relative to capture rate reported by McCoy and Vogt (1979). Such results suggest that a decline in the number of *P. alabamensis* has occurred from the late 1970s to the present. In addition, the relative proportion of adults and juveniles captured between 1968–70 and 1971–81 in the Gravine Island area suggest that decreased recruitment has occurred within that time frame (Dobie, unpubl. data). Ten of the 24 individuals (42%) captured from 1968–70 were juveniles or small adults, but in the 1971–81 period, only 1 of 20 animals captured (5%) was a small individual.

During another study from 1992–93 that focused on the lowermost portion of the Mobile Basin, AL, only 6 of the total 102 captured females were juveniles (5.9%), and 3 of the 23 captured males (13%) were juveniles. The sex ratio from this investigation was skewed 4.4:1 in favor of females.

No demographic trends are available for Mississippi populations; however, young juveniles have been observed or captured at all sites, so recruitment is occurring. Using trapping gear similar to that used by Nelson (1995, 1996, 1997), Mann et al. (2000) captured 0.18 *P. alabamensis* per trap-day over a 65 day period.

**Threats to Survival.** — Quantitative data assessing temporal changes in *P. alabamensis* numbers are limited. However, observational data indicate that this species is experiencing a decline in Alabama and is at risk of extirpation. For instance, Mount (1975) observed the eradication of one population in Monroe County, AL (Little River State Park) presumably attributable to increased human recreational activities.

Changes in the number of turtles nesting on the northern part of Gravine Island (a primary nesting site in Alabama) are not known. However, it was not unusual for local residents to collect turtle eggs from this site. In fact, one resident of the Gravine Island area reported that collectors often filled five gallon buckets with turtle eggs dug up on a single night (Lahanas 1982). However, according to Lahanas (1982), all the eggs laid by *P. alabamensis* and *Graptemys niginoda delticola* at the site during the 1980 nesting season would not come close to filling a five-gallon bucket. Such information suggests that there has been a decline in the number of *P. alabamensis* nesting on Gravine Island.

In addition to human depredation on the eggs on Gravine Island, domestic swine have certainly contributed significantly to the decline of *P. alabamensis*. Hogs were released on the island in the late 1960s and consumed turtle eggs (Dobie 1985, 1986). After removal of swine in the late 1970s, raccoons (*Procyon lotor*) and fish crows (*Corvus ossifragus*) were the most significant egg predators (Meany

1979; Lahanas 1982; Dobie 1985, 1986, 1992a). The high level of predation and destruction of nests by humans continued in 1992. In that year, 147 turtle nests were found on Graving Island (at least two of which were *P. alabamensis* and 19 were *Graptemys n. delticola*). Of these 147 nests, 126 were destroyed by raccoons, fish crows, and/or humans; only 21 clutches produced hatchlings. The two clutches of *P. alabamensis* included a total of 19 eggs, 10 of which produced hatchlings. No predation on turtle eggs by the introduced red fire ant (*Solenopsis invicta*) was observed, a finding that negates a conclusion stated by Dobie (1986). However, we have observed fire ants taking hatchling *G. n. delticola*, indicating that fire ants could kill and consume *P. alabamensis* hatchlings.

A major nesting area for *P. alabamensis* is located between the east side of the Apalachee River and the west side of Justins Bay, just north of U.S. Highway 90/98 causeway (Battleship Parkway), in the city of Spanish Fort. In July 1993, we found 75 nests, presumably all laid by *P. alabamensis*, all destroyed by raccoons. The remains of six *P. alabamensis* hatchlings were found in August 1993 subsequent to raccoon predation and, possibly, secondary fire ant predation.

It is assumed that the use of the north end of Graving Island on the Tensaw River, the Apalachee River, the west banks of the Justins Bay area, and along Battleship Parkway by females for nesting began after dredge spoils were deposited. This activity concentrated nesting activity and presumably led to abnormally high levels of nest predation. Nesting activity along Battleship Parkway has undoubtedly impacted the *P. alabamensis* populations in Alabama. For instance, 13 adult females, many of which were gravid, were killed by vehicular traffic in one year in this area (Dobie and Leary, unpubl. data). For the past seven years, Nelson and Scardamalia-Nelson (2008) have been conducting field surveys of road-killed turtles on the Mobile Bay causeway, where a total of 553 *P. alabamensis* have been killed (from 24 to 109 each year).

This species is particularly vulnerable to anthropogenic habitat alteration in Mississippi because it has a narrowly circumscribed distribution in only two coastal counties, each of which is experiencing rapid growth. Aquatic spermatophyte beds between the International Paper Plant (now closed) and the mouth of the Escatawpa River have historically been degraded by dredging of ship channels, by the consequent penetration of the salt wedge farther upstream, and by numerous sources of pollution in the Moss Point vicinity (Mann et al. 2000). Surveys in this area in 1999 revealed a predominance of *Pseudemys concinna* and *Trachemys scripta* in zones with the greatest damage to the native aquatic vegetation beds, and that *P. alabamensis* persisted only in small numbers (Mann et al. 2000). With the closure of the paper plant and efforts to improve local water quality, vegetation beds are recovering, and it is expected that the red-bellied cooter population may increase commensurately (Floyd, pers. obs.). Bulkheading (e.g., creating retaining walls) in bayous remains a problem of potential significance in coastal Mississippi, as these

structures may prevent access to uplands by female *P. alabamensis* seeking nesting sites.

In addition to predation by raccoons, fish crows, fire ants, and humans, hatchlings are probably also consumed by fish, bullfrogs (*Rana catesbeiana*), and great blue herons (*Ardea herodias*). Alligators (*Alligator mississippiensis*) undoubtedly routinely eat *P. alabamensis* given that the remains of two individuals were found in the stomach contents of a 2.25 meter alligator (Dobie 1993). In addition, alligator tooth marks were found on the shells of 73 of 87 adult females (83.9%), 6 of 19 adult males (3.6%), and on 1 of 3 juvenile males in 1992–93 (Dobie and Leary, unpubl. data). Alligator tooth marks have also been observed on most adult *P. alabamensis* in Mississippi. Presumably, few juveniles survive alligator attacks.

Other potential threats to *P. alabamensis* include the use of nets by fishermen and for shrimp harvesting wherein turtles often drown. Numerous Alabama fishermen have reported that turtles are often removed during trawling operations conducted in shallow waterways when animals are overwintering. Individuals are also undoubtedly killed by boat propellers and gunshot. In 1992 and 1993, 20 of 105 individuals (19%) had propeller damage on the shell (often deep wounds that exposed internal soft tissue) and 6 of 105 individuals (5.7%) had been shot (Dobie and Leary, unpubl. data). In many instances, bullets or shotgun pellets are plainly visible in the carapace. *Pseudemys alabamensis* are often shot for human consumption or because locals often perceive turtles to be a threat to the fish populations.

In the late 1960s and early 1970s, individuals were often slaughtered and sold at Clover Leaf Landing on the Tensaw River, AL for \$0.50 to \$5.00/individual. In Mississippi there have been occasional local fisheries for *Pseudemys* (doubtless including *P. alabamensis*) in the Pascagoula area (Floyd, pers. obs.) and in Back Bay of Biloxi (V. Santa Cruz, pers. comm.), but this is no longer legal. Red-bellied cooters are occasionally captured on fish-hooks by recreational fishermen using shrimp as bait; some of these animals may be illegally consumed and many are probably injured by hook extraction or by infection caused by hooks remaining in the gastrointestinal tract after the line is cut to free the turtle (Mann, pers. obs.).

Illegal collection of this rare species for the pet industry or personal gain poses another serious risk. For instance, R.W. Guthrie purchased and/or collected at least 24 *P. alabamensis*; he entered a conditional guilty plea on 16 December 1991 in Mobile, Alabama, on charges that he plotted to eliminate the Alabama red-bellied cooter from the wild. His guilty plea was contingent on a ruling to be made by the 11th U.S. Circuit Court of Appeals on his argument that *P. alabamensis* was of hybrid origin and thus, incorrectly listed as an Endangered species by the U.S. Fish and Wildlife Service. According to the prosecutor, Guthrie aimed to obtain about \$25,000 in federal funds to reintroduce stock from his personal collection back into the wild. The District Court concluded that the Secretary of the Interior did not act arbitrarily in the

designation of *P. alabamensis* as a valid and endangered species. On 19 April 1993, Guthrie was sentenced to serve a 13 month incarceration and pay a \$5000 fine.

The practice of removing logs considered to constitute hazards for boat traffic or “snagging” hazards for equipment used to harvest fish, shrimp, and/or crabs may be deleterious to *P. alabamensis*, given that such sites are commonly used for basking by the species, as well as by *P. concinna*, *G. n. delticola*, and *G. pulchra*. After Hurricane Katrina, the U.S. Coast Guard coordinated a snag removal program on the lower Escatawpa River, in habitat occupied by *P. alabamensis* and *G. flavimaculata*, without consultation with the U.S. Fish and Wildlife Service or the Mississippi Department of Wildlife, Fisheries, and Parks. Lastly, there are abandoned swimming pools in former residential areas along the U.S. Highway 90 Causeway (Battleship Parkway), AL that act as giant pit-fall traps for virtually all wildlife in that area. We have found the remains of dead hatchlings and adults in these pools.

**Conservation Measures Taken.** — In 1986, *P. alabamensis* was designated a Threatened species in Alabama. It was designated as an Endangered species by the U.S. Fish and Wildlife Service on 16 June 1987. An Agency Recovery Plan (Dobie and Bagley 1989) for *P. alabamensis* was approved on 8 January 1990. *Pseudemys alabamensis* (then designated as *Pseudemys* sp. undescribed) was placed on the Endangered Species List of Mississippi in 1992. The species was evaluated as Endangered (EN B1+2c) for the IUCN Red List in 1996; being more than 10 years old, an updated assessment is needed.

The Alabama red-bellied cooter was designated as the Official State Reptile of Alabama on 6 February 1990. The Alliance for Zero Extinction (2006) listed *P. alabamensis* as one of the world’s most vulnerable species facing possible extinction as a result of its endangerment and single small site distribution.

In terms of occurrence in protected areas, *P. alabamensis* is found in Meaher State Park and possibly in Little River State Park, both in Alabama. In addition, it almost certainly nests occasionally on the Mississippi Sandhill Crane National Wildlife Refuge, as there are records of nesting turtles along the upper reaches of Sioux Bayou on property immediately adjoining the Refuge. Also, the species occurs on the Grand Bay National Wildlife Refuge and Grand Bay National Estuarine Research Reserve in Mississippi.

**Conservation Measures Proposed.** — Given the small range of this species, all within a zone of burgeoning coastal development, we urge the U.S. Fish and Wildlife Service to declare critical habitat for this species. Because the northern end of Gravine Island, the shores of the Tensaw, Apalachee, and Blakeley rivers, the west bank of Justins Bay and Meaher State Park are primary nesting sites for *P. alabamensis* in Alabama, those areas should be included within designated critical habitat and should be posted and patrolled during periods of nesting activity. Raccoons, fish crows, fire ants, and domestic pigs should be controlled throughout nesting habitats. The invasive exotic cogon

grass (*Imperata cylindrica*) occurs in some nesting areas in Alabama. Its sharp stolons can physically destroy clutches and, where the plant is present in dense mats, it may prevent females from nesting. Once detected, it should be destroyed as soon as possible.

To protect the species from vehicular traffic along Battleship Parkway, low fencing should be installed. As previously mentioned, abandoned swimming pools in that vicinity should be filled.

The state of Alabama should pass restrictions on the possession and discharging of firearms while in boats on public waters. Such restrictions would aid in the protection of the endangered Alabama red-bellied cooter, as well as numerous other organisms, in addition to improving general boater safety.

Nesting sites in coastal Mississippi are apparently more scattered and additional bulkheading within waterways used for access to upland nesting sites should be prohibited, as should dredging of sites supporting vegetation beds used by this species. In addition, since dredging of areas downstream of red-bellied cooter habitat can induce negative changes in the latter due to changes in upstream penetration of the salt wedge, such channel alteration should be more tightly regulated and all areas known to be regularly occupied by this species should be designated as “no wake zones.” Additional research is needed on the significance of nest predators such as fire ants and raccoons, and appropriate control measures should be implemented if warranted. Coastal development has resulted in run-off contaminated with a myriad of pollutants, including oil, antifreeze, silt, fertilizer, herbicide, and poorly treated sewage. Water pollution can destroy vegetation beds vital to *P. alabamensis*. It is imperative that regulatory agencies implement effective measures to reduce the volume of pollutants in coastal waters. The removal of logs to prevent “snagging” of fish, shrimp, and crab nets and traps should be minimized in key *P. alabamensis* habitat.

**Captive Husbandry.** — No details known.

**Current Research.** — Nelson, Langford, Borden, and Turner are examining the reproductive and hatchling ecology of *P. alabamensis*. Jackson and Nelson are conducting a genetic study to examine the relationships between *P. alabamensis* and other *Pseudemys* species. The road-kill survey of turtles continues on the Mobile Bay causeway. Recently, sections of protective, chain-link fencing (4.2 km long) have been installed along the most critical areas on the causeway by the Alabama Department of Transportation; these are presently being monitored (Nelson and Scardamalia-Nelson, 2008).

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