

reported on data from only two complete natural nests of 12 and 13 eggs. His reported egg dimensions were within the range of those we measured in Brazil: 50-62 mm (mean=56.6; sd=3.96) by 35-43 mm (mean=38.5; sd=2.2) and weighed 36.5-51 g (mean=44.3; sd=5.09). Eggs from one clutch averaged 7 mm longer and 10 g heavier than those from the other. Twenty-eight eggs collected 5-7 December 1981 from four nests on the Río Tomo were incubated under artificial conditions. Nine hatched after 100-101 days under an ambient temperature regime of 27-32°C. The hatchlings were within the range of the ones we measured: 25-33 g (mean=30.6; sd=2.6) and 47-53 mm in carapace length (mean=51.2; sd=1.7). The most striking difference between the two studies was the difference in nesting season, this being three months later in Colombia than in Brazil.

Since the mean temperatures between the nests in the shade and sun were not significantly different (*t* test) there was no reason to sex hatchlings from both areas. The one clutch sexed from the shade was not significantly different from 1:1 (Fisher's exact test). Since these temperatures were low enough to produce 100% males in all other species of turtles studied it suggests that this species could have genetic sex determination (GSD). However, it is also possible that this species could have a low threshold temperature so it is necessary to incubate eggs at higher temperatures (31-32°C) to make certain that sex is genetically determined. It would not be surprising that sex may be determined genetically in this species, since it nests along forest streams, often under closed canopy, where temperatures are relatively low and not extremely variable. Many other neotropical species with extended incubation times (*Phrynops geoffroanus*, *Staurotypus triporcatus*, *Claudius angustatus*) also have genetic sex determination (Vogt, 1992; Vogt and Flores, 1992), so it would not be surprising to find GSD in this species as well. Before any massive transplantation of nests to protected areas is undertaken we plan to perform controlled incubation experiments under laboratory conditions at temperatures of 26, 30, and 32°C to be sure that we did not coincidentally use the threshold temperature in this species. Due to high predation of natural nests by humans, tegus (*Tupinambis*), and other natural predators, the success in artificial incubation, and the dispersed conditions of nesting impeding the guarding of natural nests, it is recommended that all located nests be removed and incubated under guarded conditions to enhance the eggs' survivorship. A long-term mark-recapture program of the hatchlings and yearlings released in 1994 may give insight as to the age at which hatchlings should be released. We are not recommending headstarting as a sole conservation measure, but are testing its feasibility by incubating eggs under protected conditions at natural temperatures and testing the survivorship of the hatchlings when released at different ages.

Acknowledgments. — José Luis S. Matos is thanked for locating nests, taking nest temperatures, and acting as a farinha-powered chain saw to blaze a canoe path through Igarapé Mungubau. João Soares Feijão and Jose Lino dos

Santos Benjamim are thanked for assisting in locating nests. Funding for this study was provided by Associação Brasileira para a Conservação das Tartarugas (Pró-Tartaruga). Vogt was supported by a grant from the Dirección General de Asuntos del Personal Académico de Universidad Nacional Autónoma de México while on sabbatical leave and by Conselho Nacional de Desenvolvimento Científico e Tecnológico of Brazil while preparing the manuscript at Instituto Nacional de Pesquisas da Amazônia (INPA) in the Department of Ecology. Oneide Ferreira da Cruz is thanked for helping in data collection and drawing the maps.

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Accepted: 10 June 1994

Chelonian Conservation and Biology, 1994, 1(2):148-150
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Maximum Size and Clutch Size Records for Eastern Painted Turtles, *Chrysemys picta picta*, from Mid-Coastal Maine

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The eastern painted turtle, *Chrysemys picta picta* (Cryptodira: Emydidae) is a relatively small North American freshwater turtle. According to Conant and Collins (1991) adults of the subspecies have an average range of 115 to 152 mm carapace length, with a maximum recorded size of 181 mm. According to Ernst and Barbour (1972) clutch size varies from 2 to 11 eggs. The midland painted turtle, *C. p. marginata*, reaches an average range of 115 to 140 mm carapace length, with a maximum recorded size of 195 mm, and clutch size is 3 to 10 eggs (Conant and Collins, 1991; Ernst and Barbour, 1972). New England represents a zone of partial hybridization between these two subspecies (Conant



Figure 1. *Chrysemys picta picta* female, carapace length 184 mm, body weight 730 g, from Mount Desert Island, Maine.

and Collins, 1991), but the specific extent and characteristics of that zone are unclear (Pough and Pough, 1968; Rhodin, 1993). While studying painted turtles in mid-coastal Maine (Hancock County, latitude ca. 44°20'N), we collected three specimens of eastern painted turtles with carapace lengths greater than the previous record of 181 mm, and one specimen with a larger clutch size than the previous record of 11 eggs.

A female *C. p. picta* from Lower West Bay Pond, Gouldsboro (CRF 2658) had a carapace length (CL) of 187 mm, a plastron length (PL) of 175 mm, and body weight (BW) of 745 g, establishing a new maximum carapace size record for the subspecies. A female from North Oak Meadow, Acadia National Park, Bar Harbor, Mount Desert Island (CRF 2419) had a CL of 184 mm (PL 174 mm, BW 730 g) (Fig. 1); and a female from Aunt Betty Pond, Acadia National Park, Bar Harbor, Mount Desert Island (CRF 3089) had a CL of 183 mm (PL 179 mm, BW 790 g). The mean CL of 122 mature females from the same geographic region was

Table 1. Latitudinal variation in mean female carapace length and clutch size in various subspecific populations of *Chrysemys picta*. See Fig. 2 for graphic representation.

Location	subspecies	Latitude	Mean CL	Clutch Size
Maine	<i>picta</i>	44.3	157.9	7.6
Massachusetts	<i>picta</i>	42.5	139.6	6.7
Virginia	<i>picta</i>	38.0	133.0	4.1
Pennsylvania	<i>picta x marginata</i>	40.0	129.0	5.1
Quebec	<i>marginata</i>	45.5	153.0	9.2
Michigan	<i>marginata</i>	43.0	140.0	7.6

157.9 ± 10.7 mm, with a range of 138 to 187 mm (PL 151.6 ± 10.7 mm, range 128-179 mm; BW 501.5 ± 99.4 g, range 325-790 g). Sexual dimorphism in the population is pronounced; the mean CL of 62 males was 134.2 ± 16.0 mm, with a range of 97 to 160 mm (PL 125.6 ± 13.8 mm, range 93-148 mm; BW 292.5 ± 83.2 g, range 140-440 g). Mature females in these studies were defined as all females larger than the smallest documented gravid female; males were defined as all males demonstrating secondary sexual characteristics of elongated foreclaws and enlarged tail.

A female from Hamilton Pond, Salisbury Cove, Mount Desert Island (CRF 1776; CL 173 mm, PL 170 mm, BW 655 g) had a clutch of 13 shelled oviducal eggs when X-rayed on 31 May. The mean clutch size in 97 gravid females from the same geographic region was 7.6 ± 1.65 eggs, with a range of 3 to 13 eggs. There is no evidence at this time of multiple clutching in this population.

All four of the record specimens were identified as *C. p. picta*, and did not exhibit any significant evidence of intergradation with *C. p. marginata*. Plastral figures were absent (except for a minor 10% penetration of a small posterior smudge in one specimen) and the costal sutural disalignment percentages were low (Hartman, 1958). Other specimens in the same geographic region sometimes exhibit slight evidence of intergradation with *C. p. marginata*, and this mid-coastal area of Maine is within the broad zone of partial hybridization between the two subspecies, with *C. p. picta* characteristics most prevalent (Rhodin, 1993).

Compared to other populations of painted turtles in eastern North America (Table 1; Fig. 2), these animals from

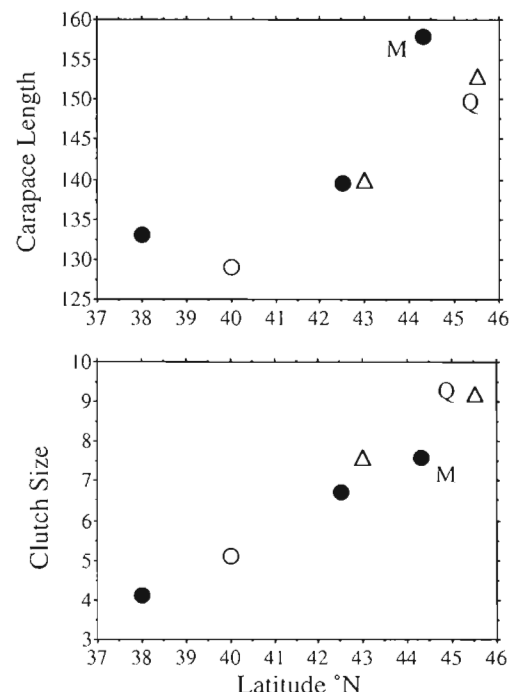


Figure 2. Scattergrams showing latitudinal variation in mean female carapace length (top) and mean clutch size (bottom) for various populations of *Chrysemys picta* listed in Table 1. Solid dots = *C. p. picta*, open circle = *picta x marginata* intergrade, open triangles = *C. p. marginata*; M = Maine, Q = Quebec.

mid-coastal Maine are quite large, and they have a large clutch size. Iverson and Smith (1993) have summarized the latitudinal variation in the reproductive biology of painted turtles. *Chrysemys p. picta* females from Virginia have a mean CL of 133 mm and a mean clutch size of 4.1 eggs (Mitchell, 1985), *C. p. picta x marginata* females from Pennsylvania have a mean CL of 129 mm and a mean clutch size of 5.1 eggs (Ernst, 1971), *C. p. marginata* females from Michigan have a mean CL of 140 mm and a mean clutch size of 7.6 eggs (Congdon and Tinkle, 1982), and *C. p. marginata* from Quebec have a mean CL of 153 mm and a mean clutch size of 9.2 eggs (Christens and Bider, 1986). In central Massachusetts (latitude ca. 42°30'N), *C. p. picta* mature females have a mean CL of 139.6 ± 9.2 mm, with a range of 119 to 170 mm (PL 132.2 ± 8.7 mm, range 113-158 mm; BW 345.3 ± 70.7 g, range 200-555 g, n = 247), and a mean clutch size of 6.7 ± 1.3 eggs, with a range of 4 to 10 (n = 87) (Rhodin and Butler, unpublished data). Massachusetts males are considerably smaller, with a mean CL of 120.7 ± 10.5 mm, with a range of 88-147 mm (PL 112.1 ± 9.2 mm, range 83-136 mm; BW 197.6 ± 46.1 g, range 80-340 g, n = 512) (Rhodin and Butler, unpublished data).

Whether the large maximum size, large mean female size, and large egg clutch size of this Maine population of painted turtles represent primarily latitudinal variation (larger animals producing larger clutches further north) within *C. p. picta* or evidence of partial hybridization with the slightly larger *C. p. marginata* is debatable. The Quebec population of *marginata* (Christens and Bider, 1986; Iverson and Smith, 1993) is located further north than the Maine population, so the animals should be larger, but despite the fact that *marginata* is also usually larger than *picta*, the more southerly Maine population of *picta* has the larger body size of the two (Fig. 2, top). Clutch size data for the Quebec and Maine populations indicate a strong correlation between latitude and clutch size (Fig. 2, bottom), but the populations of *picta* apparently have slightly smaller clutches than *marginata* at similar latitudes. These findings argue for subspecies-specific latitudinal variation being more important than subspecific hybridization for body size characteristics and clutch size in these painted turtles. The Maine population of *C. p. picta* thus appears to demonstrate subspecies-specific latitudinal

variation in body size and clutch size rather than any potential effect of partial hybridization with *C. p. marginata*.

Acknowledgments. — We thank Brian Butler, Harry Cunningham, and Michael and Susan Rhodin for help with field work. John Behler and Peter Pritchard provided helpful critical review. Collecting was carried out under appropriate state and National Park Service permits, with all animals measured, marked, and released. Specimen numbers refer to Chelonian Research Foundation (CRF) database catalogue.

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Accepted: 14 July 1994