



Geographic Variation in Body Size of Green Snakes (*Opheodrys aestivus*)

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HERPETOLOGICAL NOTES

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GEOGRAPHIC VARIATION IN BODY SIZE OF GREEN SNAKES (*OPHEODRYS AESTIVUS*).—Genetic and phenotypic responses to heterogeneous environments may be important determinants of life history traits in squamate reptiles (Tinkle, 1972; Dunham and Miles, 1985). For example, body size may vary according to resource availability among environments (Case, 1978), and often is correlated with critical life history variables (Peters, 1983; Dunham and Miles, 1985). Thus, knowledge that body size varies among populations can be useful because it suggests possible life history variation as well. The purpose of this paper is to document variation in body size in *Opheodrys aestivus* among seven geographic areas.

Methods.—A total of 582 museum specimens of *O. aestivus* was examined and grouped according to five geographic localities throughout the species range: Kansas, “Virginia” (including Virginia, Maryland, the District of Columbia, and New Jersey), “South Texas” (south of a line drawn approximately from Langtry-Ozona-Temple-Huntsville-Beaumont and including Coahuila and Tamaulipas, Mexico), “North Florida” (north of a line drawn approximately from Tampa to Orlando), and “South Florida” (south of said line, including the Keys). In addition, 180 living and museum specimens from White County, Arkansas, were examined. Sex, snout–vent length (SVL), sexual maturity (based on the presence of enlarged ova or convoluted oviducts in females and enlarged testes in males), and stomach contents were recorded for each specimen. SVL statistics on 111 adult specimens from Barnwell County, South Carolina, were provided by J. W. Gibbons (pers. comm.). Total lengths reported in the literature were converted to SVL’s by subtracting tail length according to the proportions given by Palmer and Braswell (1976). Unless otherwise stated, specimens reported in the literature were assumed to be mature if males exceeded 290 mm and if females exceeded 350 mm SVL (Plummer, 1984). Statistical procedures follow SPSS Inc. (1986).

Results.—Adult body sizes (SVL) among the seven localities are shown in Figure 1. Analysis of

variance among six localities (South Carolina excluded) demonstrated a significant difference among SVL’s in both sexes (males, $F = 16.71$, $P < 0.0001$; females, $F = 28.55$, $P < 0.0001$). The heterogeneity in SVL’s is due to the aberrant South Florida sample, all remaining samples being statistically indistinguishable (Student-Newman-Keuls procedure, $P < 0.05$ in both sexes). Literature records for maximum and/or mean SVL’s from Missouri (Anderson, 1965), Kansas (Collins, 1982), Illinois (Smith, 1961), Indiana (Minton, 1972), Louisiana (Clark, 1949; Tinkle, 1960), and Ohio (Conant, 1938) are in agreement with these data. The largest reported *O. aestivus* (735 mm SVL, sex unknown) was collected on Key West, Florida (Allen and Slatten, 1945).

Both sexes of South Florida *Opheodrys* increase in size proportionally as the ratio of mean female SVL to mean male SVL is similar in most samples (S. FL = 1.13, N. FL = 1.18, S. TX = 1.15, AR = 1.15, VA = 1.12). Literature records of 1.15 from Indiana (Minton, 1972) and 1.13 from Louisiana (estimated from Fig. 4 of Tinkle, 1960) complement these findings. A possible exception in Kansas (1.25) may be the result of a relatively small sample size. The lack of small males in the South Carolina sample may have resulted from heavy mortality at the time of collection (J. W. Gibbons, pers. comm.), rendering the sample without sexual size dimorphism (ratio = 1.00).

Discussion.—South Florida *Opheodrys* populations differ from other populations in two additional aspects. Differences in scutellation between South Florida and more northern populations led Grobman (1984) to propose a new subspecies (*O. a. carinatus*) for the South Florida populations. The northern range limit of *O. a. carinatus* approximates the Tampa–Orlando boundary used in this study. Duellman and Schwartz (1958) commented on differences in ventral coloration between North and South Florida populations.

Is the variation in body size of *O. aestivus* accompanied by variation in life history traits? Only preliminary data are available in this regard. Minimum size at maturity in South Florida males was similar to other samples (Fig. 1), but in a large sample of adult South Florida females, minimum SVL (365 mm) was greater than in

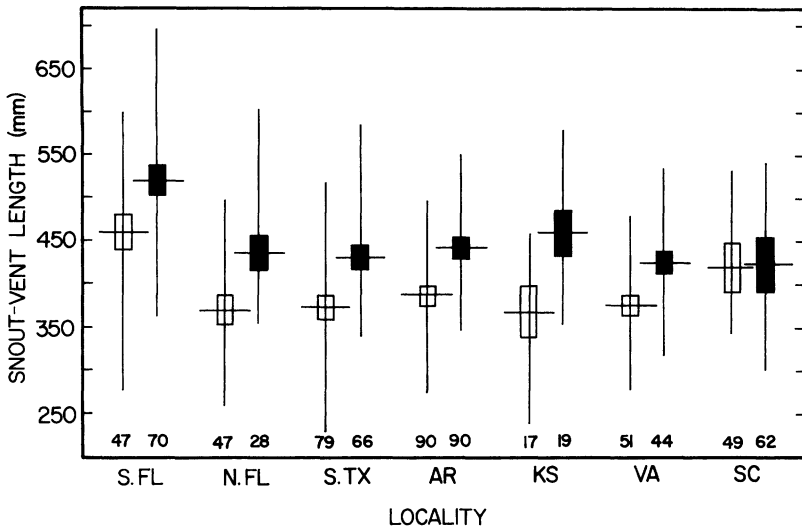


Fig. 1. Geographic variation in *Ophedrys*.

other populations, suggesting a greater size (age?) at maturity. However, a comparison of the largest immature female from Texas (510 mm) and Arkansas (450 mm, Plummer, 1984) to that from South Florida (410 mm) does not support a greater size at maturity in Florida.

A single clutch of nine eggs from South Florida (J.S. Godley, pers. comm.) yielded hatchlings averaging 163 ± 1.4 mm SVL, considerably longer than reported elsewhere (Sabath and Worthington, 1959; Palmer and Braswell, 1976; Morris, 1982; Plummer, 1984). However, because this South Florida female (643 mm) was larger than found in other populations (Fig. 1), and because clutch size, egg size, and hatchling size depend upon female size (Plummer, 1984), it is not clear whether eggs or hatchlings are relatively larger in South Florida.

Why are South Florida *Ophedrys* relatively large? In Case's (1978) general model concerning body sizes between mainland and insular populations, an increase in food availability leads to an evolutionary increase in body size. In snakes, the general trend is to decrease body size on islands (Case, 1978). Schwaner (1985) presented data supporting the "food availability" hypothesis to explain the large differences in body size found among various insular populations of *Notechis ater*. In South Florida, food items found in *Ophedrys* stomachs appeared similar in size and taxonomic composition to other populations (summarized in Plummer, 1981), but whether differences in food availability exist is unknown.

Studying geographic variation in life history traits is best accomplished by examining local populations. Because museum samples of snakes usually consist of specimens collected over wide geographic areas over extended periods, the extent of microgeographic and temporal variation in population traits is obscured (Parker and Plummer, 1987). Thus, when differences are detected using museum specimens (as in the present study), the findings should not be viewed as definitive, but as evidence for a possible line of productive investigation.

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BIOCHEMICAL COMPARISONS AMONG WEST INDIAN *TRACHEMYS* (EMYDIDAE: TESTUDINES).—Species relationships among emydid turtles in the West Indies, genus *Trachemys* (= *Pseudemys* auct., Seidel and Smith, 1986), have not been clearly defined. Boulenger (1889) recognized a close relationship between Antillean turtles and the widely distributed North American *Trachemys scripta*, considering them conspecific. Barbour and Carr's (1940) study, based on external morphology, described six species of West Indian emydids partitioned into two subgroups: 1) *terrapen* (including *T. terrapen* from Jamaica; *T. felis* from Cat Island, Bahamas; *T. decussata* from Cuba); and 2) *stejnegeri* (including *T. stejnegeri* from Puerto Rico and Hispaniola; *T. decorata* from Hispaniola; *T. malonei* from Great Inagua, Bahamas). Williams (1956) partitioned these turtles into three species: *T. decussata* (including populations on Puerto Rico, Hispaniola, Cuba, and Cayman Islands), *T. terrapen* (Jamaica), and *T. decorata* (Hispaniola). Williams further proposed that the Bahamian forms are neither native nor recognizable. Other than Williams' (1956) rejection of *T. felis* and *T. malonei*, his taxonomic arrangement has been generally accepted (Schwartz and Thomas, 1975). The present study utilizes biochemical data to investigate taxonomic relationships among West Indian *Trachemys*.

Materials and methods.—Tissues were dissected from 44 turtles collected on all West Indian islands (except Cuba) known to support populations of *Trachemys*. Localities include: Puerto Rico (*T. stejnegeri stejnegeri*); eastern Hispaniola (*T. s. vicina*); Valle de Neiba plain, central Hispaniola (*T. decorata*); Jamaica (*T. terrapen*), Cat Island, Bahamas (*T. felis*); Great Inagua, Bahamas (*T. malonei*); Hog Cay, New Providence, Bahamas (putative *T. felis* × *T. malonei* hybrids); Marie-Galante, Lesser Antilles (*T. stejnegeri*); and