

MAXIMUM CLUTCH SIZE OF THE AMERICAN ALLIGATOR

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Abstract.—We present data on a clutch of American alligator (*Alligator mississippiensis*) eggs that exceeds the previously reported maximum clutch size. This clutch consists of 75 eggs collected in June 1925 at Lake Miccosukee, Jefferson County, Florida and deposited in the Field Museum of Natural History. Fifty-seven intact eggs from the original clutch remain. Egg width measurements suggest a single female alligator produced this clutch. The total length of this female is believed to be 294 cm.

Fecundity is one of the most important life-history traits of an organism, and clutch size is a generally accepted measure of fecundity in oviparous reptiles (Shanbhag et al. 2000). The American alligator, *Alligator mississippiensis* (Daudin), is an oviparous, mound-nesting crocodylian that occurs throughout the Atlantic and Gulf coastal plains from northeastern North Carolina, south to the Rio Grande Valley in Texas (Ross and Ernst 1994). Maximum clutch size reported in field studies of the American alligator ranges from 38 to 68 eggs. The largest clutch was found by McIlhenny (1935) in Louisiana and consisted of either 62 (p. 20) or 68 (p. 89) eggs; the reason for this discrepancy is unknown. Both Kellogg (1929) and Wilkinson (1983) found nests containing 60 eggs, while others report a maximum clutch size ranging from 38 to 58 eggs (Reese 1915, Giles and Childs 1949, Joanen 1969, Metzen 1977, Goodwin and Marion 1978, Dietz and Hines 1980, Fuller 1981, Ruckel and Steele 1984, Carboneau 1987, Brandt 1989, Coulson and Coulson 1993, Platt et al. 1995, Rhodes and Lang 1996, Brandt and Mazzotti 2000). We here present data on a clutch of American alligator eggs that exceeds the previously reported maximum clutch size and has apparently been overlooked by other workers.

This clutch consisted of 75 eggs found in a single nest by Leon L. Walters and Herbert L. Stoddard during June 1925 (Davies 1926, Schmidt 1932, Stoddard 1969). The collection was made during an expedition to southern Georgia sponsored by the Field Museum of Natural History where the eggs were later deposited (FMNH 8219). The collection locality given on the museum accession card is "Beachton,

Grady County, Georgia,” but according to a detailed account by Stoddard (1969) the nest was found at Lake Miccosuke (30°34'N; 83°58'W), a large freshwater lake in adjacent Jefferson County, Florida, approximately 17 km south of Beachton. Photographs of habitat, alligators, and alligator nests taken at Lake Miccosuke by Walters and Stoddard during the expedition and archived in the Field Museum support this assertion. Beachton is most likely a reference to the site of the expedition headquarters, established at Sherwood Plantation near Beachton (Davies 1926, Stoddard 1969), rather than the collection locality.

Of the original clutch, 57 intact eggs and shell fragments representing an undetermined number of additional eggs remain in the Field Museum. Additionally, the museum accession card states “some fragments were apparently discarded, July 1941.” Although the complete clutch is no longer extant, we accept the record of 75 eggs as it is independently reported in several sources (Davies 1926, Schmidt 1932, Stoddard 1969), 75 eggs are listed on the museum accession card, “75 eggs in one nest” is written on six eggs, and “75” is pencilled on every egg.

We measured the intact eggs ($n = 57$) with metric dial calipers and found the mean (± 1 SD) length and width to be 71.2 ± 2.2 mm (range = 65.9 to 77.8 mm) and 44.2 ± 0.5 mm (range = 42.6 to 45.5 mm), respectively. These egg dimensions are within the range of values (length = 50.0 to 97.5 mm; width = 31.3 to 49.3 mm) reported by others (Goodwin and Marion 1978, Wilkinson 1983, Ruckel and Steele 1984, Ferguson 1985, Platt et al. 1995, Brandt and Mazzotti 2000). Egg length (L) and width (W) were converted to centimeters and used to determine egg mass (EM) by the equation $EM = 0.61(LW^2)$ (Thorbjarnarson 1996). The estimated mean (± 1 SD) egg mass for this clutch is 84.4 ± 3.5 g (range = 72.9 to 93.1 g), somewhat larger than the mean of 76.6 g (Thorbjarnarson 1996), but within the range (33 to 128 g) reported for *A. mississippiensis* (Goodwin and Marion 1978, Dietz and Hines 1980, Platt et al. 1995, Brandt and Mazzotti 2000). Multiplying mean egg mass by clutch size (Thorbjarnarson 1996) yields an estimated clutch mass of 6360 g.

Because two alligators occasionally deposit eggs within the same nest mound (Enge et al. 2000), it is possible this clutch represents the reproductive effort of more than one female. We consider this unlikely; multiple clutches within a single nest can usually be distinguished by differences in egg dimensions, particularly egg width (Platt and Thorbjarnarson 2000). Among oviparous reptiles, intraclutch egg length often exhibits considerable variation, but egg width is highly conserved, possibly due to constraints imposed by the diameter of the pelvic aperture (Congdon and Gibbons 1985, Werner 1989, Thorbjarnarson 1994). Thus, the unimodal distribution (Fig. 1) and relative lack of variation (coefficient of variation = 1.1%) in egg-width measurements, strongly suggest a single female produced the clutch.

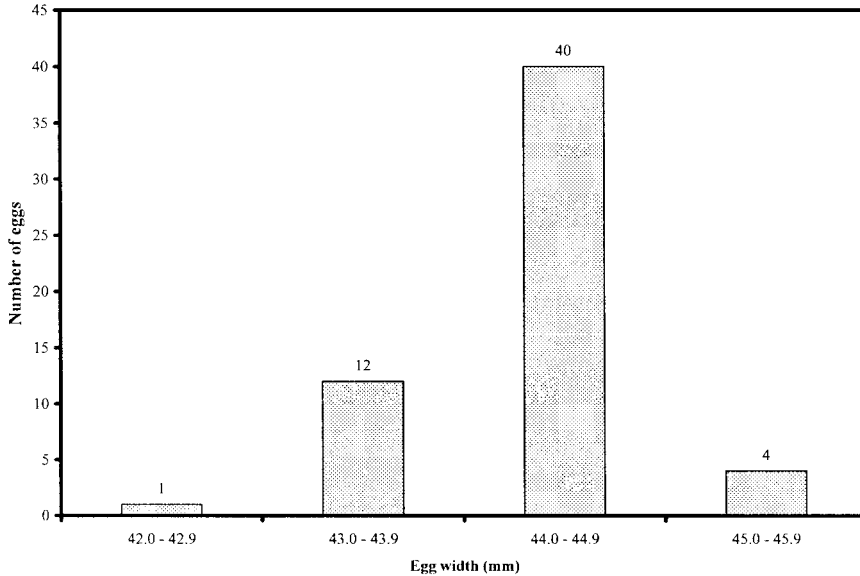


Figure 1. Distribution of egg width measurements ($n = 57$) from a large clutch of American alligator eggs collected by Leon L. Walters and Herbert L. Stoddard in 1925.

Some confusion surrounds the total length (TL) of this female. Stoddard (1969) stated that “we caught several gators, including an eleven-foot [335 cm] female that was to be exhibited at the museum with her nest of seventy-five eggs . . .” However, we believe this statement is most likely an erroneous recollection written many years after the event. We determined the TL of the female on exhibit at the Field Museum (Schmidt 1932) to be only 253 cm, and according to Davies (1925) the largest female alligator collected by the expedition measured “nine feet, eight inches” (294 cm). Furthermore, the alligator described by Stoddard (1969) is larger than any female alligator known from Louisiana or Florida (278 to 309 cm; McIlhenny 1935, Dundee and Rossman 1989, Woodward et al. 1995), and exceptionally large females are often reproductively senescent (Ferguson 1985) and therefore unlikely to produce a large clutch.

Hall (1991) found that clutch size (CS) predicted TL of nesting female alligators by the equation $TL = 144.41 + 2.1512CS$ ($r^2 = 0.64$; $SE = \pm 12.8$ cm); using a value of 75 eggs yields an estimated TL of 305 cm. Given the standard error associated with this estimate, it is therefore likely that the TL measurement given by Davies (1925) is correct. The mass (BM) of this female is estimated to be 120.3 kg from the length-mass relationship $BM = 1.35 - 0.0378 + 4.6 \times 10^{-6}TL^3$ (Chabreck and

Joanen 1979). Relative clutch mass (RCM) and relative egg mass (REM) (calculated by dividing clutch mass and egg mass, respectively, by female mass; Thorbjarnarson 1996) are 6.3% and 0.08%, respectively. These values are somewhat larger than the mean RCM (5.7%), but only half the mean REM (0.16%) reported for *A. mississippiensis* (Thorbjarnarson 1996), suggesting this female maximized her reproductive output by producing a large clutch of small eggs relative to her body size.

If the measurement given by Davies (1925) is accepted, the specimen collected by Walters and Stoddard is larger than any female alligator reported from Louisiana (McIlhenny 1935, Dundee and Rossman 1989), and ranks ninth among the 10 largest female alligators measured in Florida (Woodward et al. 1995). Finally, the size of this female is consistent with the observation of Woodward et al. (1995) that the largest female alligators inhabit eutrophic or hypertrophic lakes, which provide a rich nutritional base for growth.

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LITERATURE CITED

- BRANDT, L. A. 1989. The status and ecology of the American alligator (*Alligator mississippiensis*) in Par Pond, Savannah River Site. M.S. Thesis, Florida International University, Miami.
- BRANDT, L. A., AND F. J. MAZZOTTI. 2000. Nesting of alligators at the Arthur R. Marshall Loxahatchee National Wildlife Refuge. *Florida Field Naturalist* 28:122-126.
- CARBONEAU, D. A. 1987. Nesting ecology of an American alligator population in a freshwater coastal marsh. M.S. Thesis, Louisiana State University, Baton Rouge.
- CHABRECK, R. H., AND T. JOANEN. 1979. Growth rates of American alligators in Louisiana. *Herpetologica* 35:51-57.
- CONGDON, J. D., AND J. W. GIBBONS. 1985. Egg components and reproductive characteristics of turtles: Relationships to body size. *Herpetologica* 41:194-205.
- COULSON, J. O., AND T. D. COULSON. 1993. *Alligator mississippiensis* (American alligator). Nest material. *Herpetological Review* 24:58.
- DAVIES, D. C. 1926. Annual report of the Director to the Board of Trustees for the year 1925. Field Museum of Natural History, Report Series, Publication 235. 6:435-36.
- DIETZ, D. C., AND T. C. HINES. 1980. Alligator nesting in north-central Florida. *Copeia* 1980:249-258.
- DUNDEE, H. A., AND D. A. ROSSMAN. 1989. The amphibians and reptiles of Louisiana. Louisiana State University Press, Baton Rouge.
- ENGE, K. M., H. F. PERCIVAL, K. G. RICE, M. L. JENNINGS, G. R. MASSON, AND A. R. WOODWARD. 2000. Summer nesting of turtles in alligator nests in Florida. *Journal of Herpetology* 34:497-503.
- FERGUSON, M. W. J. 1985. The reproductive biology and embryology of the crocodylians. Pages 330-491 in *Biology of the Reptilia*, Vol. 14 (C. Gans, F. S. Billet, and P. F. A. Maderson, eds.). John Wiley and Sons, New York.

- FULLER, M. K. 1981. Characteristics of an American alligator (*Alligator mississippiensis*) population in the vicinity of Lake Ellis Simon, North Carolina. M.S. Thesis, North Carolina State University, Raleigh.
- GILES, L. W., AND V. L. CHILDS. 1949. Alligator management of the Sabine National Wildlife Refuge. *Journal of Wildlife Management* 13:16-28.
- GOODWIN, T. M., AND W. R. MARION. 1978. Aspects of the nesting ecology of American alligators (*Alligator mississippiensis*) in north-central Florida. *Herpetologica* 34:43-47.
- HALL, P. M. 1991. Estimation of nesting female crocodylian size from clutch characteristics: Correlates of reproductive mode, and harvest implications. *Journal of Herpetology* 25:133-141.
- JOANEN, T. 1969. Nesting ecology of alligators in Louisiana. *Proceedings of the Annual Conference of the Southeastern Association of Game and Fish Commissioners* 23:141-151.
- JOANEN, T., AND L. L. MCNEASE. 1989. Ecology and physiology of nesting and early development of the American alligator. *American Zoologist* 29:987-998.
- KELLOGG, R. 1929. The habits and economic importance of alligators. Technical Bulletin 147, U.S. Department of Agriculture, Washington, D.C.
- METZEN, W. D. 1977. Nesting ecology of alligators on the Okefenokee National Wildlife Refuge. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 31:29-32.
- MCILHENNY, E. A. 1935. The alligator's life history. Christopher Publ. House, Boston.
- PLATT, S. G., R. W. HASTINGS, AND C. G. BRANTLEY. 1995. Nesting ecology of the American alligator in southeastern Louisiana. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 49:629-639.
- PLATT, S. G., AND J. B. THORBJARNARSON. 2000. Nesting ecology of the American crocodile in the Coastal Zone of Belize. *Copeia* 2000:869-873.
- REESE, A. M. 1915. The alligator and its allies. G. P. Putnam's Sons, New York.
- RHODES, W. E., AND J. W. LANG. 1996. Alligator nest temperatures and hatchling sex ratios in coastal South Carolina. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 50:521-531.
- ROSS, C. A., AND C. H. ERNST. 1994. *Alligator mississippiensis* (Daudin). American alligator. Society for the Study of Amphibians and Reptiles, Catalogue of American Amphibians and Reptiles: 600.1-600.14.
- RUCKEL, S. W., AND G. W. STEELE. 1984. Alligator nesting ecology in two habitats in southern Georgia. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 38:212-221.
- SCHMIDT, K. P. 1932. American alligator with nest of eggs placed on exhibition in Harris Hall. *Field Museum News* 3:3.
- SHANBHAG, B. A., R. S. RADDER, AND S. K. SAIDAPUR. 2000. Maternal size determines clutch mass, whereas breeding timing influences clutch and egg sizes in the tropical lizard *Calotes versicolor* (Agamidae). *Copeia* 2000:1062-1067.
- STODDARD, H. L., JR. 1969. *Memoirs of a naturalist*. University of Oklahoma Press, Norman.
- THORBJARNARSON, J. B. 1994. Reproductive ecology of the spectacled caiman (*Caiman crocodilus*) in the Venezuelan Llanos. *Copeia* 1994:907-919.
- THORBJARNARSON, J. B. 1996. Reproductive characteristics of the Order Crocodylia. *Herpetologica* 52:8-24.
- WERNER, Y. L. 1989. Egg size and egg shape in near-eastern gekkonid lizards. *Israel Journal of Zoology* 35:199-213.
- WILKINSON, P. M. 1983. Nesting ecology of the American alligator in coastal South Carolina. Study Completion Report, Aug. 1978-Sept. 1983. Unpublished report, South Carolina Wildlife and Marine Resources Department, Columbia.
- WOODWARD, A. R., J. H. WHITE, AND S. B. LINDA. 1995. Maximum size of the alligator (*Alligator mississippiensis*). *Journal of Herpetology* 29:507-513.