ing rains and gradually increasing air temperatures between January and June (Buen, 1944). Lake Pátzcuaro is not stratified thermally, so water temperatures at depths as great as 12 m reflect changes in mean monthly air temperature (Deevey, 1957).

On 10 occasions between 30 September and 19 February, one large male (204 g, 170 mm S-V), and a large female (160 g, 150 mm S–V) were placed together overnight in a concrete tank (69 × 69 cm) in water 20 cm deep. On the night of 10–11 February, three spermatophores lacking seminal fluid were deposited. Humphrey (1962) has noted that such spermatophores are deposited by axolotls at the beginning of the breeding season in his laboratory colony. During the night of 18–19 February the male deposited 16 more spermatophores, all with seminal fluid, and fertile eggs subsequently were laid by the female. Between 30 March and 28 April two more pairs of achoques bred in two attempts. Large numbers of fertile eggs have been obtained and larvae are being raised.

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Literature Cited

Buen, F. de. 1944. Los lagos Michoacanos. II. Pátzcuaro. Rev. Soc. Méx. Hist. Nat. 5(1–2): 99–125.

Deevey, E. S., Jr. 1957. Limnologic studies in Middle America with a chapter on Aztec limnology. Trans. Conn. Acad. Sci. 39:213–328.

Duellman, W. E. 1961. The amphibians and reptiles of Michoacan, Mexico. Univ. Kans. Pub. Mus. Nat. Hist. 15(1):1–148.

Dugès, A. 1870. Una nueva especie de ajolote de la Laguna de Pátzcuaro. La Natur. 1:241–244.

Dunn, E. R. 1939. *Bathysiredon*, a new genus of salamanders, from Mexico. Not. Nat. No. 36, 1 p.

Humphrey, R. R. 1962. Mexican axolotls, dark and mutant white strains: care of experimental animals. Bull. Phila. Herpetol. Soc. 10 (2–3):21–28.

McDowell, B. and K. Ross. 1961. Mexico in motion. Nat. Geogr. 120(4):490–539.

Smith, H. M. and E. H. Taylor. 1948. An annotated checklist and key to the Amphibia of Mexico. U. S. Nat. Mus. Bull. No. 194, 118 pp.

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THE TAXONOMIC STATUS OF *TYPHLOTRITON BRAGGI* (CAUDATA, PLETHODONTIDAE).—The name *Typhlotriton braggi* was recently proposed (Smith, 1968) for a group of salamanders collected from caves and springs in Independence County, Arkansas, and other unspecified localities in Arkansas and southern Missouri. In that paper, information about the holotype, paratypes, and collection localities was scant. Cushman Cave, Independence Co., was given as the type-locality. Only one additional locality (Fair Spring, near Cushman) was listed, and the paratypes were neither listed nor identified by collection number. The holotype was neither identified by a number nor was it described, except for the comment that it was 120 mm in overall length. Several specimens from unspecified localities and of unstated nomenclatural significance were illustrated. Characterization of the new species relied heavily on information given in a previous paper (Smith, 1960).

Because of the sketchy nature of the description, additional information about the type-series and a reevaluation of its taxonomic relationship to *Typhlotriton spelaeus* are desirable. The two men (Charles C. Smith and Arthur N. Bragg) who could most appropriately have added information about this nominal species have died, and we have undertaken the task.

Holotype and type-locality.—In the Stovall Museum of Science and History, University of Oklahoma, were untagged and uncatalogued specimens identified by loose paper labels as the holotype and paratypes. These specimens have been deposited in the U. S. National Museum.

The holotype (USNM 167146) is a transformed, adult female; in the jar with it was a loose label bearing the penciled notation "*Typhlotriton braggi.* Holotype. Cushman Cave, near Cushman, Ark. IV/29/59, col. by

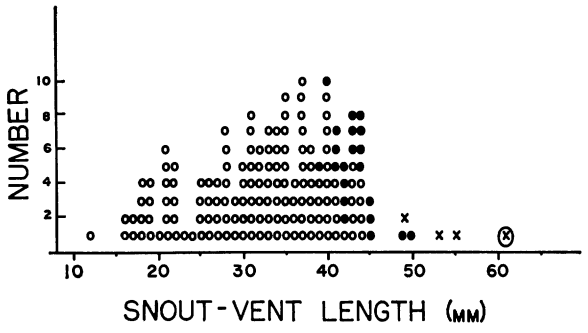

Fig. 1. Size-frequency distribution of holotype and paratypes of *Typhlotriton braggi*. Solid circles indicate immature larvae of which gonads were examined. Transformed individuals are indicated by "X"; encircled "X" is the holotype.

Frank Wise and Chas. C. Smith." This specimen is 60 mm in snout–vent length (tip of snout to posterior angle of vent) and 117 mm in total length. It has 18 trunk vertebrae. The eyes are small and recessed; eyelids completely cover the eyes but are fused together only near the corners. Oviducts are coiled and moderately enlarged, and the ovaries contain many moderately small, but yolking, ova. The specimen appears slightly emaciated or dehydrated.

The statement that the type-locality is 3½ miles SE of Cushman (Smith, 1968:156) is probably in error. Previously (Smith, 1960: 70–71), Fair Spring was listed as 3½ miles SE of Cushman, and Cushman Cave as 3 miles W of Cushman. Actually, a large, locally popular cave known by residents of Cushman as Cushman Cave is located 1½ miles NW of Cushman, matches Smith's (1960:68, 71) descriptive comments, and is certainly the type-locality.

Paratypes.—Following are localities from which paratypes (189 in all) of *T. braggi* were collected, with the museum numbers of the specimens indicated in parentheses. As far as we can determine, these comprise the entire type-series. Six larvae from Bat Cave, Ozark Co., Missouri, and two from "cave at Scout Camp" are in the collection of Smith's material at the University of Oklahoma, but these are not marked as paratypes. The statement (Smith, 1960:157–8) that some paratypes came from southern Missouri may be based on these specimens, or may stem from previous comments by Smith (1960:66, 72) rather than on designated paratypes.

ARKANSAS: Independence Co., stream below Allen Cave (USNM 167150); Bell Cave (USNM 167149); Cushman Cave (USNM 167147–167148); stream just below Cushman Cave (USNM 167151–167154); stream below first big spring W of Cushman Cave (USNM 167155); Fair Spring, near Cushman (USNM 167156–167163); a mixed assemblage from the following localities (provenance of individuals uncertain) (USNM 167164)—Fair Spring, Glenn Creek spring, Scout Cave, stream below Cushman Cave. Newton Co., John Eddings Cave (USNM 167165). Stone Co., spring W of Mountain View (USNM 167166).

Three paratypes (one from Cushman Cave, two from Bell Cave) are transformed; the rest are larval and sexually immature. The paratypic juvenile male from Cushman Cave is 49 mm S–V length and 95 mm total length. It resembles juvenile *T. spelaeus* from southern and central Missouri. The transformed paratypes from Bell Cave are old adult males (four testis lobes each), 53 and 55 mm S–V length, 104 and 103 mm total length. The eyes are small, recessed, and covered by nearly completely fused eyelids. These two paratypes resemble adult males of *T. spelaeus*.

The larval paratypes cover a broad range of body sizes (Fig. 1). Smith (1960, 1968) suggested that some populations or individuals are neotenic. Brandon (1966) previously evaluated the possibility of neoteny in *Typhlotriton* and found no supporting evidence. There is no evidence of neoteny in any of the paratypic *T. braggi*, contrary to Smith's (1960:70) statement that all males over 60 mm total length and females over 80 mm total length appear to be sexually mature. Specimens of these lengths would be about 33 and 44 mm in S–V length (the tail contributes 45% of the total length in *T. spela-*

eus). Gonads and reproductive tracts of 21 of the largest branchiate paratypes (39–50 mm S–V length) were examined. Eleven of these are immature females, seven are immature males, and three are unidentified to sex but are immature. The comment by Smith (1960:71) that large female larvae have oviducts filled with eggs suggests that a few individuals at Fair Spring may be neotenic. We have not seen these or similar specimens.

Compared with larvae in nature a high proportion of paratypes (28%) lack part of the tail. This and comments by Smith (1960, 1968, pers. comm.) suggest that many of the specimens were kept together in captivity for long periods. We can not be sure whether the transformed specimens from Cushman Cave were collected in that condition or were induced to transform in the laboratory (Smith, 1968:156).

A few paratypes are not *Typhlotriton*. Three from Fair Spring are *Eurycea multiplicata* and at least four are either *Eurycea lucifuga* or *E. longicauda*. Five in the mixed assemblage from eastern Arkansas are *E. lucifuga* or *E. longicauda*. Smith (1960:73) found generic identification of larvae difficult.

Discussion.—Smith's (1968) diagnosis distinguished *T. braggi* from *T. spelaeus* by costal groove count, number of grooves between adpressed limbs, presence of "light organs" on some larvae, and presence of well developed, apparently functional eyes in many adults.

The relationship of costal groove counts and of number of grooves between adpressed limbs to the number of trunk vertebrae, and geographic variation in the number of trunk vertebrae in *Typhlotriton* have been discussed previously (Brandon, 1966). Within *T. spelaeus*, eastern populations have a lower modal number of trunk vertebrae than western populations. Of 38 specimens from Cushman Cave and vicinity examined by radiography, 36 have 17 trunk vertebrae and two have 18. Of 44 specimens from Fair Spring, 41 have 17, and three have 18. Thus, the lowest modal number now known (17) is found at the southeastern edge of the range of *T. spelaeus*. This trait can not be used to support specific status for these populations.

Smith (1960:69, 1968:158) described light spots in definite rows on the head and body with small centers which glowed under dim illumination. He called them "light organs," and noted that they do not produce light, but rather reflect it. The light organs are clearly lateral line sensory pits. During 1968 and the spring of 1969, Black examined the lateral line sensory organs of over 150 living, larval *Typhlotriton* from Cushman Cave and Fair Spring in Arkansas; from south of Scraper, Cherokee Co., and Locust Grove, Mayes Co., Oklahoma; and from south of Neosho, Newton Co., Missouri. These larvae were isolated for several months and examined periodically. For comparison, larvae of *Eurycea longicauda melanopleura, E. lucifuga, E. multiplicata,* and *Ambystoma tigrinum mavortium* from cave and spring habitats in Oklahoma were also examined. The lateral line sensory pits of all these larvae reflected light under dim illumination when filled with water or preservatives. The pits appeared identical to the "light organs" shown by Smith (1968:158), and in *Ambystoma* and *Eurycea* they were actually more striking in reflectivity than in *Typhlotriton*.

Stone (1964) has discussed the usual sequence of eye degeneration in *T. spelaeus*. This begins as larvae approach metamorphosis and continues for some time thereafter. Of the three adult *T. braggi* which we have seen, none had well developed eyes that appeared to be functional. Rather, the eyes resemble those of *T. spelaeus* of comparable size and maturity. In view of the comments in the literature (Noble and Pope, 1928; Noble, 1931) about the effects of light in modifying eye degeneration in *T. spelaeus,* the use of eye structure to distinguish *T. braggi* seems unjustified.

In summary, we find nothing distinctive about the specimens upon which the name *T. braggi* is based. We suggest, therefore, that that name be placed in synonymy with *T. spelaeus*.

Literature Cited

Brandon, R. A. 1966. A reevaluation of the status of the salamander, *Typhlotriton nereus* Bishop. Copeia 1966(3):555–561.

Noble, G. K. 1931. The biology of the Amphibia. McGraw-Hill Book Co., Inc., New York.

——— and C. H. Pope. 1928. The effect of light on the eyes, pigmentation, and behavior of the cave salamander, *Typhlotriton*. Anat. Rec. 41(1):21.

Smith, C. C. 1960. Notes on the salamanders of Arkansas. No. 1. Life history of a neotenic stream-dwelling form. Ark. Acad. Sci. Proc. 13:66–74.

———. 1968. A new *Typhlotriton* from Ar-

kansas (Amphibia Caudata). Wasmann J. Biol. 26(1):155–159.

STONE, L. S. 1964. The structure and visual function of the eye of larval and adult cave salamanders *Typhlotriton spelaeus*. J. Exp. Zool. 156:201–218.

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HOME RANGE OF THE SPOTTED TURTLE, *CLEMMYS GUTTATA* (SCHNEIDER).—Little is known about home ranges of aquatic chelonians, although the ranges of several terrestrial species have been calculated (Woodbury and Hardy, 1948; Stickel, 1950; Legler, 1960). Aquatic turtles seem to have been neglected because of difficulties in acquiring adequate recapture data. Cagle (1944) studied home ranges of several aquatic species but made no quantitative measurements.

The present study was conducted to determine the home range for spotted turtles, *Clemmys guttata*, in southeastern Pennsylvania. Individuals of *C. guttata* were collected at the White Oak Bird Sanctuary, 3 miles north of Manheim, Lancaster County, Pennsylvania. The sanctuary is a 25 acre privately owned tract with a 6 acre pond and a 13 acre marsh at its northern end. *C. guttata* were found only in the marshy areas. Other turtles found within the home range of *C. guttata* were *C. insculpta, C. muhlenbergii, Chrysemys picta, Chelydra serpentina,* and *Sternotherus odoratus.*

From May 1965 to mid-August 1967, 124 spotted turtles (13 juveniles, 51 adult males, and 60 adult females) were collected by hand, marked using the system of shell notching proposed by Cagle (1939), and released. Points of capture and recapture for each turtle were recorded on duplicate scale maps of the research area.

Three methods were used to calculate home range, the minimum area, the modified minimum area, and a method proposed by Fitch (1958). The minimum area method consists of connecting the peripheral capture points on maps and measuring the enclosed area with a compensating polar planimeter (Mohr, 1947). As this method probably includes areas where a turtle does not normally go, the modified minimum area method of Harvey and Barbour (1965) was also used. With this method, length of the home range was determined by measuring the two most distant capture points. One-fourth of this distance was used to determine the outer boundaries of the home range. If the two outer points were farther apart than one-fourth the range length, they were not directly connected; instead the boundary line was drawn from one of these points to the next outermost point no more distant than one-fourth the range length. Capture points that fell farther than one-fourth the range length from any other point were excluded from the main home range area. These points possibly represent "sallies outside the area" (See Burt, 1943). This method eliminates large areas where there are no captures. These methods were not always useful, due to insufficient recaptures. Fitch (1958) pro-

TABLE 1. HOME RANGE SIZE OF *Clemmys guttata*.

No.	Sex	Recoveries	Home Range Length (m)	Size of Home Range: Minimum Area Method in Acres (m^2 in parenthesis)	Size of Home Range: Modified Minimum Area Method in Acres (m^2 in parenthesis)
5	F	21	165	1.34 (5423)	1.31 (5302)
8	M	21	68	1.26 (5099)	1.19 (4816)
12	F	17	98	1.23 (4978)	1.21 (4897)
18	F	17	143	1.32 (5342)	1.27 (5139)
19	M	23	122	1.34 (5423)	1.27 (5139)
20	M	17	72	1.24 (5018)	1.22 (4937)
21	M	19	171	1.35 (5463)	1.27 (5139)
24	F	20	180	1.39 (5625)	1.27 (5139)
29	M	17	195	1.38 (5585)	1.27 (5139)
70	M	13	64	1.24 (5018)	1.18 (4775)
120	F	16	102	1.27 (5139)	1.20 (4856)