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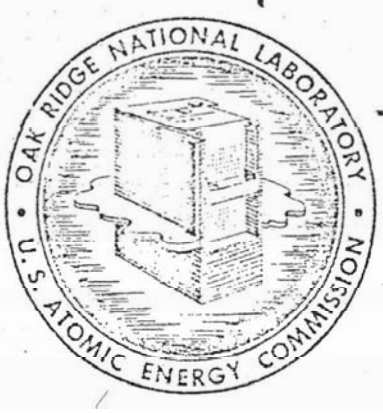
THE HERPETOFAUNA OF THE OAK RIDGE AREA

R. M. Johnson



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HEALTH PHYSICS DIVISION

THE HERPETOFAUNA OF THE OAK RIDGE AREA

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DECEMBER 1964

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THE HERPETOFAUNA OF THE OAK RIDGE AREA

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ABSTRACT

The herpetofauna of the Oak Ridge area was investigated (a) to ascertain the kinds of amphibians and reptiles (herptiles) occurring in the area, (b) to evaluate habitat preferences of the herptiles, (c) to evaluate the suitability of the various species populations for ecological investigations, and (d) to prepare a reference collection of herptiles of the area.

Collecting was performed by (a) prowling about the various kinds of habitats by day and by night and collecting by hand, (b) walking transects by day and by night and collecting by hand, (c) trapping with hardware-cloth drift fences and funnel traps in terrestrial habitats, (d) using dipnet, funnel traps, and hoop nets in aquatic habitats, and (e) driving roads by day and by night. The most productive method of collecting in terrestrial habitats and streams was hand collecting; in fluvial and pond habitats it was with dipnet, funnel trap, and hoop net.

The numbers of monotypic species of herptiles collected are as follows: salamanders, 3; anurans, 2; turtles, 2; lizards, 4; and snakes, 2. The numbers of polytypic species collected are as follows (numbers in parentheses are subspecies represented): salamanders, 4 (4); anurans, 10 (12); turtles, 8 (10); lizards, 1 (1); and snakes, 15 (18). The largest numbers of species and specimens were collected in flood-plain and pond habitats; the least numbers were collected in pine plantations.

Herptiles judged as occurring in populations of sufficient size, seasonal availability, and ease of sampling for extensive field and laboratory investigations are as follows: *Desmognathus fuscus; Hyla versicolor; Acris crepitans; Rana clamitans; R. palustris; Chrysemys picta; Pseudemys scripta; Natrix septemvittata;* and *N. sipedon.*

A reference collection containing specimens of each species and subspecies collected was prepared and deposited with the Radiation Ecology Section, Health Physics Division.

I. INTRODUCTION

Two surveys have been made of the herpetofauna of eastern Tennessee (Johnson, 1958; King, 1939). The Oak Ridge area was omitted from both of these studies. Thus, the herpetofauna of the Oak Ridge area could only be inferred. Recognizing the desirability of a knowledge of the herpetofauna of the Oak Ridge Area, S. I. Auerbach, Chief, and Paul B. Dunaway, Mammalogist, Radiation Ecology Section, suggested the survey herein reported.

The objectives of this survey were to (a) ascertain the species and subspecies of amphibians and reptiles (herptiles) occurring in the Oak Ridge area, (b) evaluate habitat preferences of the herptiles, (c) evaluate the suitability of the various species populations for ecological investigations, and (d) prepare a reference collection of herptiles.

II. MATERIALS AND METHODS

A. The Study Area

The entire Oak Ridge area (see Map S-16A, 1959, Oak Ridge Area) was included in the survey. Collection sites were selected on the bases of suggestions of P. B. Dunaway, R. C. Early, F. Taylor, other personnel of the Radiation Ecology Section, and of past experience with the collecting of herptiles in eastern Tennessee.

Collections were made in each of the major recognized types of habitats and many of the established Ecology Study areas. No effort was made to spend equal numbers of trap-hours or man-hours in each kind of habitat, but the number of hours spent in each was recorded, as were the species and numbers of individuals collected. The habitat bordering the road was recorded when specimens were encountered on the roads.

B. Methods of Collecting

The kinds of equipment used in the performance of the field work were as follows: garden cultivator, wrecking bar, dipnet, cloth sacks and glass jars, polystyrene coolers, 6-v battery-powered headlamp, and funnel traps.

The funnel trap was a rectangle with an entrance in one end. The entrance was a reclining pyramid extending 10 to 15 in. into the trap. At the apex of the pyramid was a 2- by 5-in. opening positioned approximately 5 in. above the bottom of the cage. The pyramidal entrance to the trap was fitted with a partition of hardware cloth, which resulted in two adjacent openings each approximately 2 by 2.5 in. at the apex. The partition extended several inches beyond the opening into the trap and was laced to a drift fence. The trap was 15 in. in cross section and 30 in. long. It was constructed of $\frac{1}{8}$-in. mesh hardware cloth.

The drift fence was a strip of $\frac{1}{8}$-in. mesh hardware cloth 30 in. high and 50 ft long. A funnel trap was secured to each end of the fence. The fence was buried in the ground for a depth of about 2 in. and secured to stakes at intervals sufficiently close to keep the fence upright. One exception to this arrangement was an installation of one trap, from each front corner of which a fence 25-ft long extended at a 45° angle.

Animals collected by these drift-fence installations were removed from the traps through a hole (covered while the trap was in operation) in the top of the trap.

A larger funnel trap constructed on the same plan as described above, but of $\frac{1}{2}$-in. mesh hardware cloth, was used to collect turtles in the pond in Section D-4. Drift fences were not used with this trap. It was merely placed in the water. The back corner of the trap was raised above the surface of the water to permit trapped turtles to obtain air.

At old house places, cover sets were arranged. These consisted of lumber, tin, and other rubble placed in piles of a size convenient to handle. These cover sets were visited at irregular intervals and moved to collect herptiles, which may have been utilizing them for cover while resting, for parturition or egg-laying, or hunting food.

A total of eight drift-fence installations were used. The sites at which these were installed were Ecology Study areas 0800 (old field), 0801 (pine plantation and mixed hardwood and pine), 0804 (house place), 7850 (upland forest and flood-plain forest), and 7851 (ruderous habitat). Another installation was in an old field-transition in Sector F-7 approximately 1 mile west of the West Portal of ORNL.

Cover sets and drift-fence installations were supplemented with hand collecting. This was conducted in two ways. One method consisted of merely exploring the Oak Ridge area and collecting where persons recommended and where experience and intuition suggested herptiles might be found. The other method consisted of establishing transects and periodically traversing them. Transects were established in Ecology Study areas 0800 (old field), 0916 (upland forest), and 7660 (old field, old field-transition, and upland forest). These line transects were 500 ft long, 1063 ft long, and 1100 ft long, respectively. They were laid out on compass bearings and marked with cane poles and trees, which were sprayed with chrome-aluminum paint. Hand collecting was done at night as well as during the day. Specimens encountered on the roads during travel around the area were also collected.

C. Habitat Types

1. Fluvial Habitat. The Clinch River, Poplar Creek, and East Fork Poplar Creek to about the 800-ft contour line are included in this category. Characteristics of this habitat are (a) generally steep banks of bare soil or rock cliffs and ledges where exposed, (b) moderate to deep channel, (c) continuous current, although variable in rate of flow in even a 24-hr period, and (d) usually turbid water.

2. Stream Habitat. This includes such water courses as Bear Creek, East Fork of Poplar Creek above the 800-ft contour line, and Grassy Creek. Characteristics of this habitat are (a) silt, sand, and gravel bottom in level portions and gravel-and-rock bottom where the fall is more precipitous, (b) depth varying from a few inches to several feet, frequent scour holes, (c) gravel and sand-and-mud bars occurring in level portions, (d) continuous current, affected primarily by precipitation or lack of it, (e) shoreline steep or low, in the latter case with a sparse to dense cover of emergent herbaceous or woody vegetation or both, and (f) width varying from 4 ft to as broad as 20 ft.

3. Spring Branch. This habitat is characterized by (a) clear water derived from one or more springs, (b) relatively constant temperature, (c) bottom varying from silt to gravel and rock, depending upon substrate and slope, (d) current continuous, except during dry periods, (e) water depth usually shallow, seldom exceeding 1 ft, (f) freedom from aquatic vegetation in heavily wooded, well-drained, or precipitous areas, or dense attached, emergent and submergent vegetation in low, poorly drained areas.

4. Springs. This refers to the "boil" area where ground water issues from the substrate.

5. Embayment. This refers to the impoundments lateral to the Clinch River. These are characterized by (a) turbid water (sometimes more so than the river), (b) periodic rise and fall of water level, often several feet in a single 24-hr period, (c) usually gently sloping shoreline covered with herbaceous or herbaceous and woody vegetation, which may be emergent or submerged depending upon water level, (d) reversible current affected by rise and fall of the river level or none, and (e) possibility of becoming fluvial habitats in time of low water if they are drowned stream or river mouths.

6. Pond. A permanent body of water except during prolonged dry periods. It is characterized by (a) zonal stratification of shoreline vegetation, (b) abundant algal growth, both floating and attached, (c) shoreline of grasses, sedges, and rushes or this herbaceous vegetation plus woody plants, (d) no current, and (e) high temperatures (over 30°C) in late spring and summer.

7. Pool. A temporary body of water, seldom lasting for more than a few weeks after being formed by rainfall or flooding from an adjacent river or stream. The bottom and the kinds of vegetation occurring in it depend upon the site. Roadside ditches are the smallest type of pool; flood-plain pools resulting from overflow of the river are among the largest.

8. Marsh. A continually wet area characterized by (a) saturated organic substrate, (b) dense vegetation of sedges, grasses, and rushes, (c) supply of ground water as well as rainfall, and (d) a surface temperature of the water that may exceed 30°C in late summer. Button bush and willow may encircle it and occur in it.

9. Spring Seep. This is a marsh in miniature, if it occurs in an area that is relatively low and poorly drained and exposed to the sky. In wooded areas living vegetation is often replaced by a thick deposit of leaves and branches. The organic or organic and mud-and-silt bottom is saturated. Except in dry weather there is usually a detectable current. The water temperature remains relatively constant even in the summer.

10. Upland Forest. Deciduous forest occurring on well-drained sites. It has at least three strata -- canopy, understory or shrub layer, and ground cover. Canopy trees include oaks, hickories, maples, tulip poplar, and beech in varying combinations depending upon slope exposure. Understory and shrub layers contain dogwood, oaks, hickories, maple, and beech. The ground cover consists of seedlings of canopy or understory species, ferns, and vernal herbaceous plants. Leaf litter is usually well developed.

11. Flood-Plain Forest. Deciduous forest occurring in stream valleys and poorly drained sites. It has at least three strata -- canopy, understory or shrub layer, and ground cover. Canopy species include sweet gum, sycamore, oaks, and not infrequently pine. The understory and shrub layer contain saplings and pole-sized trees of the canopy species, ironwood, hop hornbeam, and maples. The ground cover is often dense and contains grasses, vines, and cane.

12. Mixed Hardwood and Pine. As implied by the name, this habitat is characterized by deciduous trees of various species, depending upon site, and pine in nearly equal abundance. In upland sites the deciduous species include those listed for upland forest; in lowland sites, the deciduous species include those listed for the flood-plain forest. Understory or shrub layers or both

may be present. Characteristically, the ground cover is composed of grasses and perennial weeds. Floristic composition varies with the site. The leaf-litter layer when developed consists of leaves of both hardwood species and pine.

13. **Pine Plantation.** This refers to woods composed of planted pines. The trees are in rows, the canopy is closed, the substrate consists almost entirely of a thick mat of pine needles, and there is no understory, shrub layer, or ground-cover vegetation. As regards herptiles, these habitats are sterile.

14. **Old Field-Transition.** This refers to abandoned fields in advanced stages of succession to forest. Saplings and pole-sized deciduous and pine trees are numerous. Grasses and perennial weeds are the dominant ground cover, although bramble patches and vines such as honeysuckle may be "locally abundant."

15. **Old Field.** This refers to abandoned fields in which grasses and perennial weeds are the dominant vegetation. Brambles may be present as scattered individual plants or isolated clones. Saplings of pine, cedar, and sumac may be present as widely spaced individual plants.

16. **Ruderous Area.** This refers to sites where nature or human activity have removed most or all of the vegetation. Areas of bare substrate are present. Rubble may be scattered about. What vegetation does occur consists of bunch grasses, annual weeds, some perennial weeds, and patches of lichens and drought-resistant mosses. Occasional cedars, pines, or oak seedlings and saplings may be present.

17. **House Place.** This refers to abandoned homesites. Honeysuckle and brambles are a common feature of this habitat. The ground cover elsewhere is most often a dense sod of grass or grass and perennial weeds. Collapsing buildings and other rubble may be present.

Admittedly, these habitats are rather subjectively defined. However, they are accurate enough to characterize the kinds of situations in which the various herptiles have been collected.

D. Identification and Presentation of Species

Identifications of specimens were based upon comparisons with material in the research collections of the Department of Biology, Tennessee Polytechnic Institute, and with literature reports as follows: salamanders – Bishop (1941–1947), Highton (1962), and Valentine (1963); anurans – Walker (1946), and Wright and Wright (1949); turtles – Cagle (1953), Carr (1952), Tinkle (1958), Tinkle and Webb (1955), and Webb (1962); lizards – Smith (1942); snakes – Auffenberg (1955), Blanchard (1921, 1942), Conant (1946), Clay (1938), Dowling (1951a), Neill (1963), and Wright and Wright (1959). General references used were Blair *et al.* (1957) and Conant (1958).

In the presentation of the herpetofauna, the section on identification contains the information upon which the identification was decided; it is not intended as complete description of each species or subspecies.

Standard measurements, counts of morphological attributes, and color descriptions were employed. The number of ventral scutes for snakes was counted by the traditional method and by the method recommended by Dowling (1951b). The latter counts have been recorded in parentheses (accounts of snakes).

Localities listed for each species refer to sectors on Map S-16A. The localities include areas where sightings of individuals, calls, shed skins, and other identifiable evidence of the occurrence of a herptile were observed. Localities were also listed on the basis of creditable reports by personnel of the Radiation Ecology Section.

The habitats for each species are listed in order of frequency of occurrence as indicated by the results of this survey and prior experience. If two or more habitats seem to be frequented with equal regularity, they are presented with the conjunction "and."

E. Reference Collection

Each species reported upon in this paper is represented by one or more preserved specimens. The specimens are from among those collected during this survey or are supplied from my personal collection. Each specimen, or series of specimens such as tadpoles, is labeled with collection data. Specimens are selected to illustrate sexual and ontogenetic variation, if such variation is significant for identification.

Specimens in excess of those required to prepare the reference collection have been deposited in the research collections of the Department of Biology, Tennessee Polytechnic Institute.

III. THE HERPETOFAUNA

A. Taxonomy and Nomenclature

The taxonomic arrangement used in this report follows that of Schmidt (1953).

Ordinal, subordinal, and familial names are those employed by Goin and Goin (1962). Authorities for generic and specific names are as follows: *Desmognathus fuscus*, Valentine (1963); genus *Pseudotriton*, Lazell and Brandon (1962); all other salamanders, Schmidt (1953); *Bufo americanus*, Sanders (1961); *Pseudacris triseriata*, Schwartz (1957); all other frogs and toads, Schmidt (1953); genus *Sternothaerus*, Tinkle (1958); *Trionyx spinifer*, Webb (1962); all other turtles, Schmidt (1953); lizards, Schmidt (1953); genus *Ancistrodon*, Schmidt (1945, 1953); genus *Virginia*, Zillig (1958); and all other snakes, Schmidt (1953).

Common names for the various herptiles are those recommended by the Committee on Herpetological Common Names (1956) and used by Conant (1958).

B. Class *Amphibia*: Order *Caudata*

1. Family *Ambystomatidae*.

Ambystoma maculatum (Shaw), Spotted Salamander.

Localities. – Sector G-6.

Identification. – A single specimen of this species was collected. It measured 92 mm in total length, 52 mm in body length. Other data obtained are as follows: 13 costal grooves; 18 dorsal yellow spots; dorsal ground color dark purple; and ventral color dark gray.

Habitats. – Pond, pool, spring branch, and marsh.

2. Family *Salamandridae*.

Diemictylus viridescens viridescens (Rafinesque), Eastern Red-Spotted Newt.

Localities. – Sectors E-4 and G-6.

Identification. – One Red Eft and 25 larvae were collected and examined. The eft measured 53 mm in total length and 27 mm in body length. It had a salmon-colored ground color with red, black-bordered dorsolateral spots. The larvae had a light greenish-yellow ground color, tail keel continuous with the dorsal keel, a dark line through the eye, a row of white dashes on the sides, and a dorsolateral series of pale spots.

Habitats. – Upland and flood-plain forest (eft) and pond (larvae and adult).

3. Family *Plethodontidae*.

Desmognathus fuscus (Rafinesque), Dusky Salamander.

Localities. – Sectors E-18 and G-6.

Identification. – Forty-eight specimens, 34 adults and subadults and 14 larvae, were examined. Data from the adults and subadults are as follows: total length 31 to 96 mm; body length 18 to 57 mm; 4–5 pairs of paravertebral light spots on subadults; base of tail with a yellowish to reddish dorsal band bordered by dark scallops; a dorsal band on the body bordered by a dark irregular band, or dorsal color not a distinct band but bordered with dark spots and vermiculations; venter uniformly mottled with dark pigment; 14–15 costal grooves; and adult males without vomerine teeth. The larvae have 4–5 pairs of light paravertebral spots, a narrow light vertebral line, and short white gills.

Habitats. – Spring, spring branch, and spring seep; stream; and marsh.

Plethodon glutinosus glutinosus (Green), Slimy Salamander.

Localities. – Sectors D-7 and E-4.

Identification. – Four adult specimens were collected. Data from these specimens are as follows: total length (one specimen with a complete tail) 142 mm; body length 65 to 86 mm; 16 costal grooves; right vomerine teeth 5–10 (7.5), left vomerine teeth 4–10 (7.0); white iridiophores on back and sides; and chin lighter than venter.

Habitats. – Upland and flood-plain forest and cave.

Pseudotriton ruber ruber (Sonnini), Northern Red Salamander.

Localities. – Sectors D-4 and F-10.

Identification. – Three specimens, two adults and one larva, were examined. Data from the adults are as follows: total lengths not measurable; body length 45 to 78 mm; 16 costal grooves; 7 costal folds between appressed limbs; venter spotted; dorsal spots fused; white flecks on snout and head; and anterior margin of lower jaw black. The larva has a reddish-brown dorsal color with numerous small punctations, immaculate venter, and short white gills pigmented at the base.

Habitats. – Spring and spring seep, marsh, and pool.

Eurycea bislineata (Green), Two-Lined Salamander.

Localities. – Sectors E-6 and E-18.

Identification. – Four recently transformed larvae (subadults) and 12 larvae were examined. Data from the recently transformed individuals are as follows: total length 46 to 53 mm; body length 24 to 28 mm; 14 costal grooves; 2–4 costal folds between appressed limbs; and dorsolateral dark stripes extend to distal fourth of tail, invaded ventrally with light areas.

This combination of characters approximates the description of *E. b. rivicola* as described by Mittlemen (1949). But, it is considered prudent to withhold subspecific designation of the population from which these specimens were collected. A larger sample is needed, especially since previous work on *E. bislineata* in the valley portion of eastern Tennessee indicates the presence of *E. b. bislineata* (Johnson, 1958: 52–55).

The larvae have been assigned only to *E. bislineata* on the basis of data as follows: broad median dorsal band, a row of dorsolateral light spots in darker ground color on each side, and pigmented gills.

Habitats. – Spring, spring seep, and spring branch; pool; and marsh.

Eurycea lucifuga (Rafinesque), Cave Salamander.

Localities. – Caves in sectors C-4 and E-4.

Identification. – Six adults were available for examination. Data from these specimens are as follows: total length 131 to 156 mm; body length 51 to 62 mm; 14 costal grooves; toes of appressed limbs overlap; ground color yellow to yellowish orange with black spots and dashes; and immaculate venter.

Habitats. – Cave.

C. Class *Amphibia*: Order *Anura*

1. Family *Pelobatidae*.

Scaphiopus holbrooki holbrooki (Harlan), Eastern Spadefoot Toad.

Localities. – Sector F-10.

Identification. – A series of 15 or more male spadefoot toads was collected and subsequently lost. These toads are unmistakable in appearance and call. That the population is identifiable as *S. h. holbrooki* is inferred from previous work on spadefoot toads in eastern Tennessee (Johnson, 1958: 59–61).

Habitats. – Pools in ruderous areas and old fields.

2. Family *Bufonidae*.

Bufo americanus americanus (Holbrook), American Toad.

Localities. – Sectors D-4 and G-6.

Identification. – Nine specimens, one adult female and eight recently transformed juveniles, were examined. Data from these specimens are as follows: body length of adult 77 mm and of juveniles 18 to 20 mm; dark dorsal spots with one or two warts; an enlarged wart on the tibia; parotoid glands connected to postorbital ridge by a spur; and venter, especially the chest, heavily mottled with dark pigment.

Habitats. – Upland and flood-plain forest, old field, old field-transition, house place, and ruderous area.

Bufo woodhousei fowleri (Hinckley), Fowler's Toad.

Localities. – Sectors B-8, F-5, F-16, G-6, and H-10.

Identification. – Ten specimens, one adult and nine recently transformed juveniles, were examined. Data from these specimens are as follows: body length of adult 53 mm and of juveniles 18 to 32 mm; dark dorsal spots with three or more warts; no enlarged wart on tibia; parotoid glands in contact with postorbital crest or nearly so; and venter immaculate or with a dark spot in center of the chest and with sparse or no dark flecks.

Habitats. – See *B. a. americanus*.

3. Family *Hylidae*.

Acris crepitans crepitans (Baird), Northern Cricket Frog.

Localities. – Sectors B-8, D-4, G-6, F-10, and H-10.

Identification. – Sixteen adult specimens were examined. Data from these specimens are as follows: body length 19 to 23 mm; heel of extended leg not reaching beyond the snout; phalanges 1–3 of toes I and IV of hindfoot webbed; and alternate dark and light stripes on posterior surface of thigh ragged.

Tadpoles were identified as *A. c. crepitans* on the bases of (a) lateral margin of papillary border straight, (b) labial tooth-row formula 2/2, and (c) tip of tail black.

Habitats. – Pond, marsh, stream, and embayment.

Hyla crucifer crucifer (Wied), Northern Spring Peeper.

Localities. – Sectors B-8, F-10, and G-6.

Identification. – Specimens of this frog were not collected. However, its distinctive call was recognized. That the subspecies *H. c. crucifer* is the proper designation for the Oak Ridge population is inferred from previous work with this frog in eastern Tennessee (Johnson, 1958: 67–69).

Habitats. – Pool, pond, and marsh.

Hyla versicolor versicolor (Le Conte), Eastern Gray Treefrog.

Localities. – Sectors D-4, E-5, F-5, F-7, F-10, F-19, and G-6.

Identification. – Twenty-three adults and recently transformed juveniles were examined. Data from these specimens are as follows: body length of adults 24 to 41 mm and of juveniles 12 to 15

mm; dorsum gray to green with a dark irregular dorsal spot; skin granular; and concealed surfaces of thigh of adults yellow.

Tadpoles were identified as *H. v. versicolor* on the bases of (a) straight lateral margin of papillary border, (b) labial tooth-row formula 2/3, (c) lowermost tooth row at least half as long as row above it, and (d) tail heavily mottled with black and reddish spots (in life).

Habitats. – Pool and pond, marsh, flood-plain forest, old field-transition, and house place.

Pseudacris triseriata (Wied), Chorus Frog.

Localities. – Sectors E-10, F-10, and G-6.

Identification. – Adult specimens were not collected. This frog was identified on the basis of calls and tadpoles. Tadpoles were identified as *P. triseriata* on the bases of (a) straight lateral margins of papillary borders, (b) labial tooth-row formula 2/3, (c) lowermost tooth row 1/3 or less that of row above, (d) lower half of tail musculature with a light band with little or no dark pigmentation, and (e) tail crest with dispersed small dark flecks.

On previous work with this frog in eastern Tennessee, I concluded that the population was intermediate between the Western Chorus Frog, *Pseudacris t. triseriata* (Wied) and the Upland Chorus Frog, *Pseudacris t. feriarum* (Baird) (Johnson, 1958: 69–71).

Habitats. – Pool, pond, spring seep, and marsh.

4. Family *Microhylidae*.

Gastrophryne carolinensis carolinensis (Holbrook), Eastern Narrow-Mouthed Toad.

Localities. – Sectors B-7, B-8, D-7, F-5, F-10, and G-6.

Identification. – Fifty-eight specimens were examined. Data from these specimens are as follows: body length 24 to 36 mm; ratio of body length to diameter of eye 10–18; ratio of tibia length to tibia width 2.2–3.2; color of dorsum varying from tan to reddish brown to dark brown; lower sides dark brown; and venter grayish.

Habitats. – Pond and pool, old field, house place, old field-transition, and ruderous area.

5. Family *Ranidae*.

Rana catesbeiana (Shaw), Bullfrog.

Localities. – Sectors B-8, D-4, E-8, F-8, G-6, and G-9.

Identification. – Three adult specimens were examined. Data from these specimens are as follows: body length 118 to 136 mm; ratio of tibia length to body length 0.47–0.50; ratio of intertympanic width to body length 0.19–0.22; dorsum green to greenish brown, usually with faint brown marks; chin and chest yellowish; and dorsolateral folds absent.

Tadpoles were identified as *R. catesbeiana* on the bases of (a) emarginate lateral margins of papillary borders, (b) labial tooth-row formula 2/3, (c) beak narrowly pigmented, dark area on lower mandible less than one-half the width of the mandible, and (d) tail and dorsum with small sharply defined black spots.

Habitats. – Pond, stream, and river.

Rana clamitans melanota (Latrielle), Green Frog.

Localities. – Sectors B-8, D-4, E-7, E-8, F-19, G-6, G-9, and H-10.

Identification. – Eight specimens were examined. Data from these specimens are as follows: body length 27 to 64 mm; ratio of tibia length to body length 0.45–0.53; ratio of head width to body length 0.30–0.39; dorsum dark green or greenish brown with dark spots and blotches; and dorsolateral fold present.

Tadpoles were identified as *R. clamitans* on the bases of (a) emarginate margin of papillary border, (b) labial tooth-row formula 1/3 and 2/3, (c) lowermost row of labial teeth one-third or less as long as row above, and (d) beak narrowly pigmented, pigment less than one-half width of lower mandible.

Habitats. – See *R. catesbeiana*.

Rana pipiens (Schreber), Leopard Frog.

Localities. – Sectors B-8, D-4, E-7, E-8, E-10, F-7, F-8, F-10, F-19, G-6, G-9, and H-10.

Identification. – Twenty-two specimens were examined. Data from these specimens are as follows: body length 53 to 77 mm (the two adults) and 24 to 35 mm (juveniles); light tympanic spot (17 specimens); dark dorsal spots without light-colored border; and brown rostral spot absent. These are characters assigned to the Southern Leopard Frog, *Rana p. sphenocephala* (Cope). The ratio of body length to tibia length (range 1.52–2.00, mean 1.75), and the ratio of body length to snout-tympanum length (range 2.41–3.35, mean 1.78), fall within the range of variation for these characters for *R. p. sphenocephala* and the Northern Leopard Frog, *Rana p. pipiens* Schreber. These data and previous work on *R. pipiens* in eastern Tennessee indicate the Oak Ridge population is best designated as *R. p. sphenocephala* × *pipiens*.

Habitats. – Pond, pool, marsh, spring seep, and flood-plain forest.

Rana palustris (Le Conte), Pickerel Frog.

Localities. – Sectors B-8, F-19, and G-6.

Identification. – Four specimens were examined. Data from these specimens, all recently transformed individuals, are as follows: body length 22 to 29 mm; ratio of tibia length to body length 0.46–0.63; ratio of head width to body length 0.29–0.32; dorsal spots squarish; dark crossbars on upper surface of hindlimb; concealed surface of thigh yellow; and rostral spot present.

Habitats. – Flood-plain forest, pool, stream, spring branch, and pond.

D. Class *Reptilia*: Order *Testudinata*

1. Family *Chelydridae*.

Chelydra serpentina serpentina (Linnaeus), Common Snapping Turtle.

Localities. – Sectors D-4, E-4, E-7, and Miles 10, 18, and 19 on Clinch River.

Identification. – Two females and two males were examined. Data from these specimens are as follows: carapace length – females 82 and 146 mm, males 159 and 190 mm; carapace width – females 67 and 127 mm, males 132 and 164 mm; plastron length – females 57 and 110 mm, males

113 and 140 mm; ratio of width of third vertebral scute to length of all five vertebral scutes – females 0.32 and 0.33, males 0.35; median caudal tubercles more pronounced than lateral caudal tubercles; and knobs on the carapace laminae posterior to center of laminae.

Habitats. – Fluvial, stream, marsh, and pond.

Sternothaerus odoratus (Latrielle), Stinkpot.

Localities. – Sector D-4 and Mile 14.5 on Clinch River.

Identification. – Two adult females, two adult males, and one juvenile were examined. Data from these specimens are as follows: carapace length – females 80 and 114 mm, males 112 and 117 mm, juvenile 61 mm; carapace width – females 59 and 79 mm, males 72 and 73 mm, juvenile 47 mm; plastron length – females 63 and 83 mm, males 73 and 76 mm, juvenile 44 mm; shell depth – females 36 and 46 mm, males 42 mm, juvenile 25 mm; all except juvenile with fleshy tubercles on neck in addition to chin barbels; and all with light stripes on dark ground on head and neck.

Habitats. – Fluvial, pond, and stream.

Sternothaerus minor peltifer (Smith and Glass), Stripe-Necked Musk Turtle.

Localities. – Sector E-7.

Identification. – One adult male was collected. Data from this specimen are as follows: carapace length 118 mm; carapace width 80 mm; plastron length 79 mm; shell depth 43 mm; dark spots, stripes, and reticulations on light ground on head and neck; and head enlarged with well-developed horny beak and wide alveolar surfaces.

Habitats. – Stream, pond, and fluvial.

2. Family *Testudinidae*.

Terrapene carolina carolina (Linnaeus), Eastern Box Turtle.

Localities. – Sectors B-5, B-8, B-12, C-6, C-8, D-4, D-8, D-9, E-4, F-10, F-16, F-19, and G-6.

Identification. – Two adult females, four adult males, and four juveniles were examined. Data from these specimens are as follows: carapace length – females 124 mm, males 119 to 127 mm, juveniles 33 to 83 mm; carapace width – females 94 mm, males 96 to 108 mm, juveniles 30 to 66 mm; plastron length – females 118 mm, males 117 to 124 mm, juveniles 30 to 79 mm; shell depth – females 61 and 67 mm, males 57 to 59 mm, juveniles 14 to 38 mm; posterior marginals flared on all adults, vertical on all juveniles; four hind toes; head color varying from uniform brown to mottled brown, white, and yellow to black and yellow; plastron varying from uniform horn brown to solid black; and carapace varying from dark horn brown to brown or black with conspicuous yellow "E's," from which radiate yellow lines of spots and dashes.

Habitats. – Flood-plain forest, upland forest, old field-transition, old field, house place, and ruderous area.

Graptemys geographica (Le Sueur), Map Turtle.

Localities. – Mile 19 on Clinch River.

Identification. – A single subadult male was collected. Data from this specimen are as follows: carapace length 90 mm; carapace width 74 mm; width of posterior lobe of plastron 40 mm;

depth of shell 32 mm; alveolar surfaces of the upper jaw broad and nearly meeting medially; detached postorbital spot oriented longitudinally; elongate precentral lamina (length/width, 2); and plastron yellow without dark marks.

Habitat. – Fluvial, and possibly embayment.

Graptemys pseudogeographica ouachitensis (Cagle), Ouachita Map Turtle.

Localities. – Miles 10 and 14.5 on Clinch River.

Identification. – A single female was collected. Data from this specimen are as follows: carapace length 116 mm; carapace width 99 mm; plastron length 57 mm; depth of shell 43 mm; width of head 17 mm; postorbital spot rectangular; three longitudinal lines entering orbit; circular yellow spot beneath eye and at symphysis of jaw; and spines present on second and third vertebrals.

Habitats. – Fluvial and possibly embayment.

Chrysemys picta (Schneider), Painted Turtle.

Localities. – Sectors B-5, D-4, E-3, E-4, and G-6.

Identification. – Thirteen adult females and six adult males were examined. Data from these specimens are as follows: carapace length – females 126 to 157 mm, males 101 to 122 mm; carapace width – females 85 to 119 mm, males 75 to 92 mm; plastron length – females 106 to 141 mm, males 92 to 114 mm; width of posterior plastral lobe – females 58 to 74 mm, males 50 to 59 mm; 13 specimens with dark plastral figure; dark plastral figure without dark extensions onto seams of plastral laminae; dorsal stripe narrower than stripes on legs; 13 specimens with seams between second and third vertebrals aligned with seams between second and third costal laminae; four specimens with seams between second and third vertebrals in advance of seams between second and third costals; and laminae of carapace with light foremargins.

The immaculate plastron, light foremargins of carapace laminae, and alignment of seams between second and third vertebral and costal laminae are characters assigned to the Eastern Painted Turtle, *Chrysemys p. picta* (Schneider). The dark central figure on the plastron and the vertebral seam in advance of the costal seam are characters assigned to the Midland Painted Turtle, *Chrysemys p. marginata Agassiz*. Thus, the painted turtle population of the Oak Ridge area is best designated as *C. p. picta* × *marginata* (Johnson, 1954).

Habitats. – Pond, embayment, river, and stream.

Pseudemys concinna hieroglyphica (Le Conte), Slider.

Localities. – Miles 14.5 and 19 on Clinch River.

Identification. – One adult female, one adult male, one juvenile, and a "hull' were collected. Data from these specimens are as follows: carapace length – female 312 mm, male 250 mm, juvenile 46 mm, hull 237 mm; carapace width – female 226 mm, male 173 mm, juvenile 41 mm, hull 174 mm; shell depth – female 112 mm, male 75 mm, juvenile 18 mm, hull 85 mm; plastron length – female 287 mm, male 215 mm, juvenile 40 mm, hull 116 mm; width of hind lobe of plastron – female 138 mm, male 106 mm, juvenile 21 mm, hull 100 mm; carapace constricted at

sixth marginal; plastron without dark seams except for juvenile, which has dark seams between gular, humeral, pectoral, posterior third of femoral, and anal laminae; supratemporal and paramedian stripes separate; notch of upper jaw not bordered by cusps; tail striped above; leg stripes continuous onto feet; and T-shaped crossbar bisecting upper marginals.

Habitats. – Fluvial and possibly embayment.

Pseudemys scripta (Schoepff), Pond Slider.

Localities. – Miles 14.5, 18, and 19 on Clinch River, Sectors B-5 and D-4.

Identification. – Eight females and nine males were examined. Data from these specimens are as follows: carapace length – females 195 to 250 mm, males 115 to 207 mm; carapace width – females 144 to 173 mm, males 94 to 146 mm; plastron length – females 181 to 229 mm, males 106 to 188 mm; shell depth – females 75 to 104 mm, males 45 to 90 mm; ratio of width of temporal spot to width of posttemporal stripe 1.5–4.5 (mean 2.9); ratio of temporal light spot to width of postocular stripe 1.8–8.0 (mean 5.2); ocelli on lower surface of fourth to seventh marginals wider than interspaces on 14 specimens, equal on one specimen, absent on one specimen, and narrower on one specimen; ocelli on marginals simple where visible; upper surface of nails yellow; bridge predominantly light on 15 specimens; head and neck with dark stripes on light ground on 14 specimens, light stripes on dark ground on two specimens, and one specimen melanistic; and temporal spot orange on 12 specimens, yellow on three specimens, and absent on two specimens.

These specimens exhibit various combinations of characters assigned to two different subspecies: Red-eared Turtle, *Pseudemys s. elegans* (Wied) and Cumberland Turtle, *Pseudemys s. troosti* (Holbrook). Diagnostic characters of *P. s. elegans* (Burger, 1952: 77; Carr, 1952: 251) are as follows: temporal spot much wider than the postocular stripe and ocelli on marginals above bridge wider than light interspaces. Diagnostic characters of *P. s. troosti* exhibited by these specimens are as follows: temporal spot averaging about twice as wide as its posterior extension; upper surface of nails yellow; bridge predominantly light; and simple ocelli on undersurface of marginals. The evidence indicates that the Oak Ridge population of sliders is *P. s. troosti* × *elegans*.

Habitats. – Pond, fluvial, embayment, and stream.

3. Family *Trionychidae*.

Trionyx spinifer spinifer (Le Sueur), Eastern Spiny Softshell Turtle.

Localities. – Mile 19 on Clinch River and Sector D-4.

Identification. – One adult female and three adult males were examined. Data from these specimens are as follows: carapace length – female 356 mm, males 162 to 208 mm, carapace width – female 274 mm, males 140 to 181 mm; single dark line around margin of carapace; ocelli on middle of carapace larger than peripheral ocelli; tubercles on anterior margin of carapace; and postocular and postlabial stripes separate for entire (visible) length.

Habitats. – Fluvial, stream, embayment, and pond.

E. Class *Reptilia*: Order *Squamata*: Suborder *Lacertilia*

1. Family *Iguanidae*.

Sceloporus undulatus hyacinthinus (Green), Northern Fence Lizard.

Localities. – Sectors B-5, E-3, E-4, F-5, F-7, F-10, G-6, and H-10.

Identification. – Six specimens were examined. Data from these specimens are as follows: total length (5 specimens) 148 to 174 mm; body length 60 to 73 mm; dorsal scales 40–45 (mean 42.8); scales around midbody 40–45 (mean 42); femoral pores 13–17 (mean 14.5); and dorsal crossbars extend completely across back.

Habitats. – Old field-transition, ruderous area, house place, and upland forest.

2. Family *Teiidae*.

Cnemidophorus sexlineatus (Linnaeus), Six-lined Race Runner.

Localities. – Sectors B-8, F-5, F-8, G-6, and H-10.

Identification. – Five specimens were examined. These ranged in total length from 163 to 204 mm and in body length from 52 to 75 mm. This lizard is the only member of the family in eastern United States. It is easily identified by the six light stripes on the dorsum, the granular dorsal scales contrasting with the broad ventral scales, and the long spiny tail.

Habitats. – Ruderous area, old field, house place, and old field-transition.

3. Family *Scincidae*.

Lygosoma laterale (Say), Ground Skink.

Localities. – Sectors D-4, F-10, F-19, and G-6.

Identification. – Three specimens were examined. These specimens ranged in total length from 102 to 127 mm and in body length from 37 to 42 mm. These diminutive lizards are easily recognized by their elongate body, dull brown to coppery dorsal band contrasting with the dark brown sides and tail, and the yellowish or bluish venter. The legs are so small as to appear ineffectual in locomotion. Data on scalation from these specimens are as follows: dorsal band 6 scales wide; lateral stripes 1 to 1 ½ scales wide; scales around midbody 25, 27, and 29; scales along middorsal line 62, 66, and 69; pairs of enlarged muchal scales 3, 4, and 4.

Habitats. – Upland forest, flood-plain forest, old field-transition, and house place.

Eumeces fasciatus (Linnaeus), Five-lined Skink.

Localities. – Sectors B-5, B-8, F-10, and H-10.

Identification. – Six adult females were examined. Data from these specimens are as follows: total length (4) 120 to 144 mm; body length 49 to 64 mm; scale rows at midbody 28–30 (mean 29); dorsolateral light stripes on rows 3 and 4; upper labials preceding first to contact orbit 4 (5 on right side in one specimen); 2 postmental scales; median subcaudal scales enlarged (wider than long); intercalary scales on fourth toe of hindfoot not extending beyond second phalanx; and 2 postlabial scales equal to or exceeding height of ear opening.

Habitats. – Flood-plain forest, upland forest, house place, old field-transition, and mixed hardwood and pine.

Eumeces laticeps (Schneider), Broad-headed Skink.

Localities. – Sector D-4.

Identification. – One adult female was collected. Data from this specimen are as follows: tail lost; body length 95 mm; scales around midbody 32; 2 postmentals; median subcaudal scales wider than long; 5 upper labials preceding first to contact orbit; intercalary scales on fourth toe of hindfoot terminating on third phalanx; 2 small postlabials on right side, 1 postlabial on left side, all less than height of ear opening; and dorsolateral light stripes on scale row 4.

One specimen not discussed under *E. fasciatus* nor included above is interpreted as a hybrid *E. fasciatus* × *laticeps*. Data from this specimen, a female, are as follows: body length 48 mm; tail incomplete; 2 postlabials equal to height of ear opening; intercalary row of scales on fourth toe of hindfoot terminating on second phalanx; 4 upper labials preceding first to contact orbit on left side, 5 on right side; 29 scale rows at midbody; and dorsolateral light stripes confined to scale row 4.

Habitats. – Flood-plain forest and upland forest.

F. Class *Reptilia*: Order *Squamata*: Suborder *Serpentes*

1. Family *Colubridae*.

Natrix septemvittata septemvittata (Say), Queen Snake.

Localities. – Sectors D-4, D-6, D-7, E-7, E-8, and G-6.

Identification. – Four females and two males were examined. Data from these specimens are as follows: body length – females 169 to 492 mm, males 265 and 505 mm; tail length – female (3) 85 to 162 mm, male 108 mm; ventral scales – females 134–137 (131–134), males 132 and 142 (130 and 140); subcaudal scales – females 67–80, male 77. All specimens have well-defined median and lateral dark lines in addition to the yellow line on scale rows 1 and 2. The lateral yellow line is bold and continuous from the rostrum to the vent in all but one. Three specimens have a single dark spot on the suture between the last two lower labials on one or both sides. These specimens are referrable to *N. s. septemvittata* as defined by Neill (1963).

Habitats. – Stream and fluvial.

Natrix sipedon (Linnaeus), Water Snake.

Localities. – Sectors D-4, D-6, D-7, E-7, F-5, and G-6.

Identification. – Five females and two males were examined. Data from these specimens are as follows: body length – females 255 to 805 mm, males 594 and 643 mm; tail length – females (5) 72 to 212 mm, male 230 mm; ventrals – females 138–144 (135–139), males 137 and 139 (133 and 135); subcaudals – females (5) 59–65, male 74; transverse dorsal bands 6–12, mean 9.7; dorsal body blotches 13–22, mean 18.8; width of lateral bars (in scale lengths) 1.5–2, mean 1.6;

width of lateral interspaces 2–3, mean 2.5; total transverse bars and dorsal body blotches 23–33, mean 28.6; and scale rows at midbody 23. The dorsal interspaces of four specimens are lighter than the lateral interspaces. One specimen has four rows of crescent-shaped spots on the venter; four have two rows of crescent-shaped spots and are variously spotted or mottled with gray, which increases in intensity posteriorly.

The number of ventrals, the greater width of lateral interspaces over lateral bars, the light interspaces between the dorsal body blotches, and transverse bands plus dorsal body blotches 23, 25, 27, and 28 on four specimens are characters of the Midland Water Snake, *Natrix s. pleuralis* Cope. The mottled venter, the total dorsal blotches and transverse bands 31, 33, and 33 on three specimens, and two rows of crescent-shaped spots on the venter are characters of the Northern Water Snake, *Natrix s. sipedon* (Linnaeus). For these reasons, and as a result of previous work on *N. sipedon* in eastern Tennessee (Johnson, 1958: 115–119), the Oak Ridge population of water snakes is designated as *N. s. pleuralis* × *sipedon*.

Habitats. – Stream, fluvial, spring branch, pond, and marsh.

Storeria dekayi (Holbrook), Brown Snake.

Localities. – Sectors B-7, F-10, and G-6.

Identification. – A single adult female was available for examination. Data from this specimen are as follows: body length 206 mm; tail length 40 mm; ventrals 129 (126); subcaudals 32; scale rows 17; no dorsal crossbars, but two parallel rows of dark spots down the back; median dorsal area lighter than lateral areas; and belly grayish.

This snake agrees with the description of the Northern Brown Snake, *Storeria dekayi dekayi* (Holbrook), but evidence has been presented elsewhere to indicate the possibility of intergradation between this snake and the Midland Brown Snake, *Storeria d. wrightorum* (Trapido), in eastern Tennessee (Johnson, 1958; 119–120).

Habitats. – Old field, old field-transition, upland forest, mixed hardwood and pine, and house place.

Storeria occipitomaculata occipitomaculata (Storer), Northern Red-Bellied Snake.

Localities. – Sectors E-6 and H-8.

Identification. – A single adult male was available for examination. Data from this specimen are as follows: body length 207 mm; tail length 67 mm; ventrals 117 (113); subcaudals 52; scale rows 15; occipital spots 3; and light mark on fifth upper labial bordered below by black.

Habitats. – Upland forest, old field, and house place.

Thamnophis sirtalis sirtalis (Linnaeus), Eastern Garter Snake.

Localities. – Sectors D-4, E-7, F-10, and G-6.

Identification. – Eight females and one male were examined. Data from these specimens are as follows: body length – females 240 to 680 mm, male 520 mm; tail length – females 68 to 194 mm, male with incomplete tail; scale rows 17 (3) and 19 (6); ventrals – females 144–153 (139–148), male 155 (152); subcaudals – females 58–75, male ?; lateral stripe on scale rows 1–3 (4)

and 2–3 (5); lower labials 10; middorsal stripe present; and black squares in two alternating rows on skin between middorsal and lateral stripes.

Habitats. – Old field, old field-transition, flood-plain forest, and pond.

Virginia valeriae valeriae (Baird and Girard), Eastern Earth Snake.

Localities. – Sector B-5.

Identification. – A single adult male was collected. Data from this specimen are as follows: body length 180 mm; tail length 42 mm; ventrals 118 (115); subcaudals 37; dorsal scale rows 15; upper labials 6; and scales weakly keeled. The dorsal color is gray with black punctations.

Habitats. – Old field, old field-transition, upland forest, mixed hardwood and pine, and house place.

Diadophis punctatus edwardsi (Linnaeus), Northern Ringneck Snake.

Localities. – Sectors B-5, E-7, F-10, and G-6.

Identification. – Two females and four males were examined. Data from these specimens are as follows: body length – females 121 and 238 mm, males 202 to 261 mm; tail length – females 26 and 51 mm, males 54 to 81 mm; ventrals – females 164 and 172 (161 and 169), males 146–157 (142–153); subcaudals – females 47 and 52, males 54–58; and dorsal scale rows 15. All specimens have complete neck rings. Three specimens have immaculate venters, and three have irregular punctations on the venter. All have immaculate chins and gular regions.

Habitats. – Upland forest, flood-plain forest, spring seep, and house place.

Carphophis amoenus amoenus (Say), Eastern Worm Snake.

Localities. – Sectors B-7, E-3, E-4, E-18, F-5, F-10, G-6, and H-10.

Identification. – Five females and nine males were examined. Data from these specimens are as follows: body length – females 180 to 220 mm, one female juvenile 99 mm, males 142 to 192 mm; tail length – females 32 to 40 mm, juvenile 19 mm, males (8) 21 to 48 mm; ventrals – females 111–125 (109–122), males 110–120 (107–117); subcaudals – females 27–32, males 31–37; and prefrontals and one internasal fused (2), both prefrontals and internasals fused (2). The pink ventral color extends onto the first row of scales.

The fusion of the prefrontal and internasal scutes are characteristic of the Midwest Worm Snake, *Carphophis a. helenae* (Kennicott), which also has the ventral color extending onto the second and third rows of scales. This evidence suggests the possibility of intergradation between *C. a. amoenus* and *C. a. helenae* in the Oak Ridge population as reported previously for eastern Tennessee worm snakes (Johnson, 1958: 134).

Habitats. – Upland forest, flood-plain forest, old field, old field-transition, and house place.

Coluber constrictor (Linnaeus), Racer.

Localities. – Sectors B-7, B-8, D-4, D-5, E-3, E-7, E-8, F-3, F-5, F-7, F-8, and G-6.

Identification. – Three females and four males were examined. Data from these specimens are as follows: body length – females 495 to 905 mm, males 795 to 1040 mm; tail length – females 176 to 216 mm, male 264 mm; ventrals – females 175–178 (174–175), males 177 and 182 (174 and

179); subcaudals – females 92–100, male 90; first upper labial in contact with loreal on only right or left side of two females; number of white ventral scales 2–8, mean 3.8; ratio of hemipenial hook to proximal adjacent spine 2.7–4.0, mean 3.7. Three specimens have a greenish-blue venter and blue-black dorsum. The remainder of the specimens have a dark-blue or black venter and a black dorsum. The gulars and chin shields are spotted on two specimens. All specimens have a brown snout. The bottom half of the upper labials is white, and the upper part is the color of the dorsal surface of the head. A male with a greenish-blue venter has a spotted chin and gulars and white on the ventral scutes for nearly a third of the body length.

These specimens as a group present combinations of characters assigned to three subspecies of C. *constrictor*: Northern Black Snake, *Coluber c. constrictor* (Linnaeus); Southern Black Snake, *Coluber c. priapus* (Dunn and Wood); Yellow-Bellied Racer, *Coluber c. flaviventris* (Say). Further, Auffenberg (1958: 114) states, "It is only in the zones of intergradation between light (*C. c. flaviventris) and dark-colored* forms (*C. c. constrictor, C. c. priapus*) that one finds snakes that are very dark above and light below." Thus, the possibility exists that the Oak Ridge population of racers is an intergrade between *C. c. flaviventris* and *C. c. constrictor* or *C. c. priapus* or among all three forms (see Johnson, 1958: 134–138).

Habitats. – Old field, old field-transition, mixed hardwood and pine, house place, ruderous area, flood-plain forest, and upland forest.

Opheodrys aestivus (Linnaeus), Rough Green Snake.

Localities. – Sectors C-7, D-15, and F-7.

Identification. – One adult female and one adult male were collected. Data from these are as follows: body length – female 365 mm, male 386 mm; tail length – female 221 mm, male 237 mm; scale rows 15, keeled; ventrals – female 154 (150), male 156 (154); subcaudals – female 132, male 128. Both are green above and white below.

Habitats. – Old field, old field-transition, and house place.

Elaphe guttata guttata (Linnaeus), Corn Snake.

Localities. – Sectors B-8, B-11, B-12, D-4, E-3, E-5, and F-10.

Identification. – Two females and two males were examined. Data from these are as follows: total length – females 1000 and 1178 mm, males 1131 and 1261 mm; body length – females 854 and 1100 mm, males 966 and 1070 mm; scale rows 25-27-19 (2 females, 1 male), 25-23-19 (1 male); ventrals – females 219–232 (216–229), males 217–219 (214–216); subcaudals – females 56 and 64, males 62; dorsal body blotches – females 32 and 34, males 31 and 32; dorsal caudal blotches – females 10 and 12, males 11 and 12. The postocular stripe terminates on the last upper labial. The ground color varies from light gray to brown. The dorsal blotches are red or reddish brown and bordered with black. The venter is checkered with black and white.

Habitats. – Old field, old field-transition, flood-plain forest, and house place.

Elaphe obsoleta (Say), Rat Snake.

Localities. – Sectors B-7, B-10, E-3, E-6, F-4, F-6, and G-6.

Identification. – Five males were examined. A sixth male was collected, but it was excluded from the following account for reasons to be presented later. Data from the five males are as follows: body length 147 to 1287 mm; tail length 147 to 260 mm; ventrals 229–237 (224–233); subcaudals 78–86; dorsal body blotches 31–33; caudal blotches (4) 6–14; scale rows 25-21-17 (2), 25-27-19 (1), 27-21-19 (2). Three of the males possess a postorbital bar. All specimens have a light streak in the midventral region of the tail bordered on each side by black. The skin between the scales is white, and the scales are edged with white. The ground color between the blotches varies from gray to almost as dark as the blotches, which are dark brown to black. Three specimens have discernible lines on each side on scale rows 3-4-5; one specimen has lines on only scale rows 3-4-5. One specimen has no discernible lines. The venter is variously spotted and blotched with gray and black on a light ground color, which is suffused with pink or yellow on some specimens.

On the basis of evident body blotches, the postorbital bar, the presence of stripes, and variability of color and color pattern, it is concluded that the rat snakes of the Oak Ridge area are best designated as intermediate between the Black Rat Snake, *Elaphe o. obsoleta* (Say), and the Gray Rat Snake, *Elaphe o. spiloides* (Duméril, Bibron, and Duméril) (see Johnson, 1958: 142–147).

The specimen omitted from consideration was collected by R. C. Early near the ORNL boat dock at Mile 19. It is 1505 mm in body length and 280 mm in tail length, has 31 gray blotches on its dorsum, pink skin, cream-colored venter faintly spotted and checkered with gray, a gray head lacking prefrontal and postorbital stripes, 229 (224) ventrals, 78 subcaudals, and a scale-row formula 27-31-19. All of these attributes, and especially the coloration, are characters of the Texas Rat Snake, *Elaphe o. lindheimeri* (Baird and Girard). Further, when captured this snake was emaciated and had "cage sores" (crusted, purulent sores beneath the ventral scutes). The apparent identity of the snake and its appearance of having been in captivity for some time make it doubtful that this specimen has been a member of the local population.

Habitats. – Old field-transition, house place, old field, mixed hardwood and pine, flood-plain forest, and upland forest.

Lampropeltis calligaster rhombomaculata (Holbrook), Mole Snake.

Localities. – Sector F-5.

Identification. – A single adult male was collected. Data from this specimen are as follows: body length 785 mm; tail length 122 mm; scale rows 21–17; ventrals 205 (203); subcaudals 53; 50 biconvex dorsal body blotches; and 12 tail blotches. The ground color is tan, the dorsal blotches are reddish brown.

Habitats. – Old field, old field-transition, and mixed hardwood and pine.

Lampropeltis getulus niger (Yarrow), Black Kingsnake.

Localities. – Sectors B-6, F-10, G-6, G-9, and H-10.

Identification. – One female and two males were examined. Data from these are as follows: body length – female 656 mm, males 438 and 903 mm; tail length – female 104 mm; males 65 and 148 mm; ventrals – female 214 (214), males 203 and 213 (200 and 210); subcaudals – female 44, males 50 and 51; crossbands on body – female 42, males 47 and 50; crossbands on tail – female 14, males 13 and 14; crossbands one-quarter scale wide, composed of definite spots and dashes; scale rows 21–19; dark areas alternating with light areas on first scale row 53 and 56 on males; and continuous light band on first scale row for one-quarter length of body on female.

These snakes are most nearly like *L. g. niger*, although intergradation between this and the Common Kingsnake, *Lampropeltis g. getulus* (Linnaeus), has been reported in Tennessee (Johnson, 1958: 153–154; King 1939: 573).

Habitats. – Old field-transition, old field, house place, and mixed hardwood and pine.

Lampropeltis doliata triangulum (Lacépède), Eastern Milksnake.

Localities. – Sectors F-5 and H-10.

Identification. – Three juveniles were collected: two females and one male. Data from these are as follows: body length – females 228 and 230 mm, male 418 mm; tail length – females 30 and 31 mm, male 65 mm; ventrals – females 200–201 (198–201), male 211 (210); subcaudals – females 41–48, male 46; scale rows 21–17; total middorsal blotches – females 41–46, male 49; and dorsal blotches in three rows on females, five rows on male. The ground color is gray, the dorsal blotches are reddish bordered with black, and the venter is white with alternating squarish black spots.

Habitats. – Upland forest and mixed hardwood and pine.

Cemophora coccinea (Blumenbach), Scarlet Snake.

Localities. – Sector F-5.

Identification. – One juvenile specimen was collected. It escaped before it could be preserved. The identity was unmistakable as no other snake in eastern Tennessee, or elsewhere in eastern United States, has scarlet black-bordered saddles on the dorsum, white immaculate venter, and narrow wedge-shaped head.

Habitat. – Upland forest and mixed hardwood and pine.

2. Family *Viperidae*.

Ancistrodon contortrix mokeson (Daudin), Northern Copperhead.

Localities. – Sectors F-5 and H-10.

Identification. – Five adults were examined. Data from them are as follows: body length 555 to 890 mm; tail length 86 to 127 mm; ventrals 147–157 (144–147); subcaudals 43–46; scale rows at midbody 23; crossbands 17–19; middorsal width of crossbands (in scale lengths) 2.5–4. All specimens have spots between the constricted portion of the crossbands and dark stipling on the dorsal scales. The pinkish venter is mottled with gray and checkered with brown spots.

Habitats. – Upland forest, flood-plain forest, mixed hardwood and pine, old field-transition, old field, and house place.

IV. DISCUSSION AND CONCLUSIONS

A. The Herpetofauna

Krumholz (1954: 46) reported several species of herptiles captured during his White Oak Creek survey that were not collected by me during the present study. These were the Wood Frog, *Rana sylvatica* (Le Conte); the Smooth Green Snake, *Opheodrys vernalis* (Harlan); and the Bull Snake, *Pituophis sayi* (Schlegel).

The wood frog may well occur in the area, since it occurs farther south and east. That *O. vernalis* occurs in the area is doubtful. I know of no authenticated reports of this snake in eastern Tennessee. I conclude that he misidentified a rough green snake. As regards the bull snake, two alternatives are available. If the identification were correct, then he must have captured an escapee from some private collection. If the identification were incorrect, he must have captured a specimen of the Pine Snake, *Pituophis melanoleucus* (Daudin), which occurs to the south, the east, and the west of Oak Ridge.

Based upon previous collections in eastern Tennessee (Gentry, 1955; Johnson, 1958; King, 1939; McConkey, 1954) and reports from experienced personnel in the Radiation Ecology Section, herptiles expected or known to occur in the area, but not encountered during this survey, are as follows: Hellbender, *Cryptobranchus alleganiensis* (Daudin); Waterdog, *Necturus maculosus* (Rafinesque); Red-Backed Salamander, *Plethodon cinereus* (Green); Spring Salamander, *Gyrinophilus porphyriticus* (Green); Long-Tailed Salamander, *Eurycea longicauda* (Green); Green Anole, *Anolis carolinensis* (Voigt); Slender Glass Lizard, *Ophisaurus attenuatus* (Baird); Hognose Snake, *Heterdon platyrhinos* (Latrielle); Crowned Snake, *Tantilla coronata* (Baird and Girard); and Timber Rattlesnake, *Crotalus horridus* (Linnaeus).

The rattlesnake was reported to have been seen about 1938 in Bear Creek Valley by J. D. Key (personal communication), Oak Ridge National Laboratory security guard. Fred Taylor (personal communication), Oak Ridge National Laboratory technician, reported seeing a rattlesnake several years ago in the area. M. R. Richmond (personal communication), Assistant Professor of Biology, Tennessee Polytechnic Institute, was reared in the area and reported that he had never seen a rattler or talked with anyone who had.

Several areas appearing suitable for rattlers were investigated carefully, but neither sight nor sound of one was witnessed.

B. Relative Abundance

Traditional methods of estimating population size, e.g., the capture-mark-release-recapture method, were not utilized during this survey. The best remaining method, aside from the subjective

statement that a species is abundant, common, or rare, was an estimate of relative abundance in terms of effort. The measures of effort in this study were hours of collecting, trap-hours, and miles driven.

Initially, the intention was to calculate numbers of species and individuals collected in terms of hours of effort. This resulted in fractional values (e.g., as few as 0.0001 species or individuals per hour), which are to me impracticable if not meaningless. Consequently, abundance has been estimated in terms of trap-hours or man-hours per species and individual. Tadpoles and egg masses of anurans were not included in the calculations as these were not always counted. Further, in season these can be collected in a matter of minutes in sufficient numbers for most kinds of ecological studies. Trap-hours do not include the hours of operation of the fish traps used by the Radiation Ecology Section. The number of man-hours includes time spent on line transects, although no collections resulted from running the transects; no herptiles were even seen along the transects. Estimates of relative abundances are presented in Tables I–IV. Values are rounded to the nearest hour.

Table I. Indices of Relative Abundances in Terms of Trap-Hours per Species

Habitat Type and Total Hours	Salamanders	Anurans	Turtles	Lizards	Snakes
House Place (429)					
Old Field (645)		212		645	645
Old Field-Transition (836)		418		418	836
Pine Plantation (455)					
Mixed Hardwood and Pine (309)					
Upland Forest (959)		959			959
Flood-Plain Forest (976)	976	244	976		488
Pond (547)			137		

Table II. Indices of Relative Abundances in Terms of Trap-Hours per Individual

Habitat Type and Total Hours	Salamanders	Anurans	Turtles	Lizards	Snakes
House Place (429)					
Old Field (645)		10		322	645
Old Field-Transition (836)		167		418	279
Pine Plantation (455)					
Mixed Hardwood and Pine (309)					
Upland Forest (959)		959			959
Flood-Plain Forest (976)	489	244	976		139
Pond (547)			18		

Table III. Indices of Relative Abundances in Terms of Man-Hours per Species

Habitat Type and Total Hours	Salamanders	Anurans	Turtles	Lizards	Snakes
House Place and Ruderous Area (24)	24	5	24	6	3
Old Field (36)		9		36	5
Old Field-Transition (6)				6	3
Mixed Hardwood and Pine (3)			3	2	1
Upland Forest (10)	2	10	10	5	2
Flood-Plain Forest (12)	12	3	12	12	4
Pond (10)	10	1			3
Stream (7)	2		4		2

Table IV. Indices of Relative Abundances in Terms of Man-Hours per Individual

Habitat Type and Total Hours	Salamanders	Anurans	Turtles	Lizards	Snakes
House Place and Ruderous Area (24)		1	6	2	1
Old Field (36)		2		3	3
Old Field-Transition (6)				6	3
Mixed Hardwood and Pine (3)			3	1	1
Upland Forest (10)	1	2	5	1	1
Flood-Plain Forest (12)	2	1	3	12	2
Pond (10)	<1	<1			2
Stream (7)	<1		4		<1

Obviously, in order to evaluate these results, it must be remembered or realized that in a particular kind of habitat only certain kinds of herptiles can be expected to occur. Further, if there is a limited number of species in the habitat, continued trapping or collecting for new species is fruitless if all available species have been captured early during the collecting period. Additionally, it is conceivable that an animal may enter the trap and subsequently escape. Several instances are recorded in my field notes to indicate that this did happen. The evidence, in one instance, was the presence of snake feces and the manner in which the dried grass, placed in the cage to provide cover, was disarranged -- but there was no snake in the trap at the time.

The following conclusions may be drawn from the data presented in Tables I--IV. Excluding aquatic species of turtles from the Clinch River, more species and individuals were captured by hand collecting than by trapping. (Every species collected by trapping was collected by hand.) Trapping among terrestrial habitats resulted in the capture of anurans with greater frequency than

any other herptile; snakes were second and lizards, third. Hand collecting among terrestrial habitats resulted in the capture of snakes with greater frequency than any other herptile; frogs were second and lizards, third. Species and individuals of herptiles were collected in aquatic habitats with greater frequency than in terrestrial habitats. Among terrestrial habitats, species and individuals were most abundant in flood-plain and upland forests and around house places and ruderous areas.

There are many sources of bias affecting the values presented in Tables I–IV. However, the values are only relative, and coupled with field experience they can serve as useful guidelines in planning future work on the various populations.

During this survey a minimum of 1515 miles were driven on the area outside the city limits of Oak Ridge. A total of four species of anurans, three of turtles, and five of snakes were collected. Fifteen anurans, 12 turtles, and 17 snakes were collected. Of these 44 individuals, 25 were dead on the road. More anurans and turtles could have been collected. The data do indicate that large numbers of herptiles can be found by cruising the roads.

C. Populations Suitable for Field Investigations

Available evidence, augmented with subjective evaluation of field observations, indicate that the most suitable species for field investigations are as follows: *Desmognathus fuscus*, Dusky Salamander; *Hyla versicolor*, Eastern Gray Treefrog; *Acris crepitans*, Northern Cricket Frog; *Rana clamitans*, Green Frog; *R. palustris*, Pickerel Frog; *Chrysemys picta*, Painted Turtle; *Pseudemys scripta*, Pond Slider; *Natrix septemvittata*, Queen Snake; and *N. sipedon*, Water Snake.

The salamander, *D. fuscus*, is recommended for the following reasons: It occurs in a variety of aquatic habitats easily accessible to the investigator. It is abundant where it occurs. All stages of the life cycle are available through a large part of the year. It can be collected in large numbers. (This salamander is the most common "spring lizard" sold as fish bait.) It can be kept under refrigeration for indefinite periods of time without the necessity of being fed, but it will feed readily in captivity. Adults and larvae are carnivorous; they in turn are fed upon by larger carnivores. It has been extensively reported upon in the literature.

The frogs are recommended for the following reasons: They are represented by large populations in aquatic habitats easily accessible to the investigator. Except for *R. palustris*, which breeds in the spring, they breed until middle to late summer. The adults, with the exceptions of *R. palustris* and *H. versicolor*, do not move far from the breeding grounds. They have tadpole stages that require from 1 to more than 12 months to metamorphose and are quite easily identified. They are relatively easily maintained in the laboratory. The tadpoles are herbivorous; the adults are carnivorous. Adults and tadpoles are eaten by other carnivores. They are extensively reported upon in the literature.

Of the frogs, *A. crepitans* is probably the best candidate for field investigations, although the tadpole transforms during the season in which it hatches. This is the most abundant frog, or at

least the most conspicuous, in the area. The tadpole and adult stages can easily be collected in large numbers with a dipnet or seine.

The turtles are recommended for the following reasons: They are the species most easily and often taken in traps. They occur in large populations. They are small and easily handled and do well in captivity. They are omnivorus. They have been extensively reported upon in the literature.

Although hatchlings and juveniles were not collected or even observed during this survey, eggs can easily be obtained from gravid females (but only by sacrificing the female) and easily and successfully incubated in the laboratory (Cagle, 1944).

The snakes are recommended for the following reasons: They are relatively easily collected by wading or floating slowly in streams and picking them off bushes as they bask over the water. If they do dive into the water at the approach of the investigator, in clear streams he can observe where they seek refuge on or in the substrate and collect them there. All age groups can be collected in a single habitat. They can be handled with relative ease and, with the exception of *N. septemvittata*, adapt well to laboratory conditions. They are carnivorous; *N. sipedon* feeds upon fish, salamanders, and anurans, both adult and tadpole stages; *N. septemvittata* feeds exclusively upon crayfish. Both are eaten by larger carnivores. They are viviparous and produce large broods. They are extensively reported upon in the literature.

N. septemvittata would be the least desirable of the two species if laboratory populations are to be maintained. It has never been induced to eat in captivity. But it is the easier of the two species to handle in the field for it rarely offers to bite.

The salamander is most effectively captured by hand. A funnel trap placed in a spring, spring branch, or stream (if the current is not so swift that it would smash captured individuals against the wire) might prove effective.

The frogs can be collected with dipnet and seine as mentioned above. Hand collecting of frogs may be successfully augmented by placing drift-fence installations in such a position as to intercept the adults moving through or to and from the water.

The only practicable method of collecting the turtles alive is with traps, such as the one described in this report, or hoopnets, such as those used by the personnel of the Radiation Ecology Section. Baiting the trap used in this survey increased its effectiveness.

The other herptiles in the area would be more useful as incidental study animals. Although seasonally and locally abundant, they cannot easily be collected in abundance, since large aggregations of them are not encountered. If needed for incidental investigations, the most effective method of collecting them would be to search in appropriate habitats.

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