Banisteria, Number 11, 1998

Notes on the Distribution and Ecology of Some Amphibians and Reptiles in Southeastern Virginia

Joseph C. Mitchell

Department of Biology
University of Richmond
Richmond, VA 23173

Sandra Y. Erdle[1] and John F. Pagels

Department of Biology
Virginia Commonwealth University
Richmond, VA 23284-2012

INTRODUCTION

Historically, the Great Dismal Swamp covered a large area of approximately 5700 km^2 in southeastern Virginia and northeastern North Carolina (Kearney, 1901; Oaks & Whitehead, 1979). Much of the landscape was composed of saturated forested wetlands and upland swales bisected with rivers and streams. The region was characterized by hardwood-dominated forests that included bald cypress (*Taxodium distichum*), tupelo gum (*Nyssa aquatica*), swamp black gum (*N. sylvatica*), and Atlantic white cedar (*Chamaecyparis thyoides*), before the arrival of Europeans (Whitehead & Oaks, 1979). Removal of forest cover by the colonists and their decendants and construction of deep drainage ditches allowed conversion of much of the landscape to agriculture and, more recently, urban and suburban development (Levy & Walker, 1979). Much of the current landscape not used for agriculture or development supports various stages of ecological succession. Patches of second-growth and later regenerations of hardwood forest remain scattered throughout the region. The present study was conducted in several habitat types that represent much of the current range of variation in natural habitats.

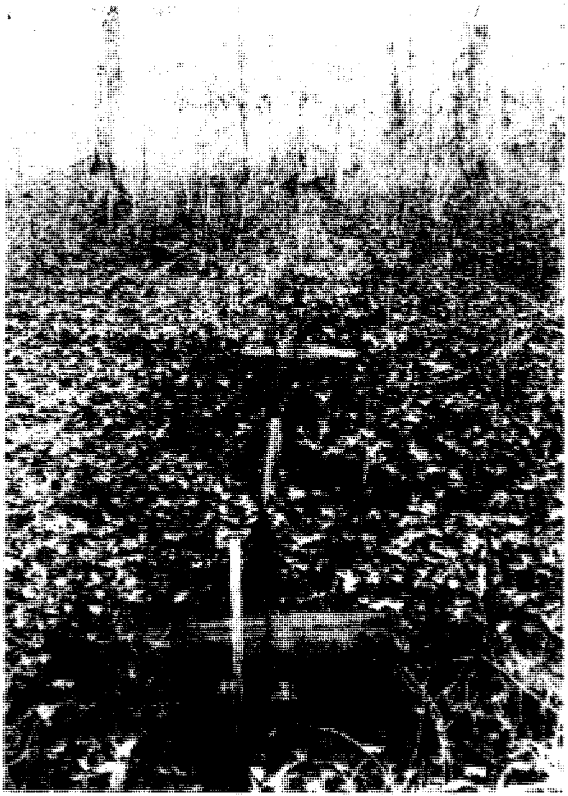
The checklist of amphibians and reptiles native to southeastern Virginia is essentially complete (Tobey, 1985; Mitchell, 1994). However, the microgeographic distribution of these species within the historical Great Dismal Swamp and vicinity is not thoroughly understood (Mitchell et al., in press). This is due, in part, to loss of habitat, especially wetlands, in southeastern Virginia east of the Great Dismal Swamp National Wildlife Refuge. Additional factors include constraints on accessibility to remaining natural areas on public and private property and types of inventory techniques that were used historically by herpetologists in the area (e.g., hand collection, nighttime road-cruising). Known distributions of species and habitat associations of the herpetofauna are based on specimens in museum collections and records in the literature. Information derived from these sources produces gaps in distribution patterns and often provides only anecdotal knowledge of habitat affinities. Thus, although we know which species occur in the area, additional information, especially quantitative data, could be a substantial contribution.

Here we present herpetofaunal results of a pitfall trap study designed to gain information on the distribution of shrews in southeastern Virginia (Erdle & Pagels, 1995). Although amphibians and reptiles were caught incidentally to the original objective, the collections nevertheless provide useful distributional and ecological information. These observations supplement those summarized for the amphibians and reptiles of the historical Great Dismal Swamp by Mitchell et al. (in press).

MATERIALS AND METHODS

We sampled 25 sites (Table 1) in the Cities of Chesapeake and Virginia Beach in the eastern portion of historical Great Dismal Swamp and associated wetlands between US Route 17 and Back Bay (see Fig. 1 in Erdle & Pagels, 1995) from mid-June 1990 to late-December 1991. Habitat types ranged from old field to shrub-forest edge to forests of various ages and

[1] Present address: Department of Conservation and Recreation, Division of Natural Heritage, 217 Governor Street, Richmond, Virginia 23219



a

b

Fig. 1a,b. a, drift fence and 3.8-1 pitfall trap array design used to capture small terrestrial vertebrates in southeastern Virginia. b, installed, isolated 0.47-1 aluminum can pitfall trap used to capture small terrestrial vertebrates. Photographs by S.Y. Erdle.

composition. Habitats and site locations are described briefly in Erdle & Pagels (1995) and in Table 1. In 13 of the sites (labeled S), a single 5-6 m drift fence made of 30 cm-tall black silt fencing (Enge, 1997) and a pair of 3.8-l (#10 can) pitfall traps were installed in the ground (Fig. 1a). Can openings were sunk flush to the surface of the ground on each side of the ends of the fence. At site S3, two 7.6-l (2 gallon) plastic buckets and 12 single 0.47-l (16 oz) aluminum cans were placed in a variety of locations near the pitfall array. Pitfalls associated with drift fences were shielded with a section of silt fencing constructed to reduce flooding from rainfall (Fig. 1a). In 9 of these sites, four to seven 0.47-l aluminum cans were sunk in selected locations around the area. Number of trap nights ranged from 660 to 2160 for drift fence/pitfall trap arrays and 388 to 3480 for isolated pitfall traps. In another 12 sites (labeled C), 5-11 isolated 3.8-l or 0.47-l aluminum can pitfalls were installed randomly in the substrate (Table 1). Many of the isolated cans were placed adjacent to logs and other surface objects that acted as natural drift fences (Fig. 1b). Number of trap nights in these sites ranged from 1950 to 8174. All pitfalls were half-filled with dilute formalin to facilitate drowning and specimen preservation. Traps were checked approximately bi-monthly and specimens were stored in 50% isopropyl alcohol. All specimens were subsequently identified to species in the laboratory. Snout-to-vent length (SVL) of selected individuals were measured with a plastic ruler to the nearest millimeter. Specimens were deposited in the Virginia Museum of Natural History Herpetological Collection.

RESULTS

A total of 879 specimens of 10 species of amphibians (7 frogs, 3 salamanders) and 7 species of reptiles (2 turtles, 4 lizards, 1 snake) was caught in the 25 sites sampled. Eight species of frogs, 2 salamanders, 1 turtle, 3 lizards, and 1 snake were caught in the drift fence/pitfall arrays alone or with associated can arrays. Four frogs, 2 salamanders, 1 turtle, and 1 lizard were caught in the single can pitfall grids. Species distributions among the 25 sites varied from a single specimen at one site to numerous specimens in 17 sites.

Annotated Species List

1. *Bufo terrestris* (Southern toad) [Sites: C1, C3, C4, C12, S1, S1A, S3, S5, S6, S7, S8, S9, S10, S11, S12]

Of 70 specimens caught, 9 (12.9%) were adults, 58 (82.9%) were juveniles, and 3 (4.2%) were recent metamorphs. Captures of adult males (6) nearly equaled those of females (5). Over half of the juveniles (57%) were caught in June-August 1990. Recently transformed metamorphs were caught during periods of 1-13 August 1990 (11 mm SVL), 10 May-2 June 1991 (9 mm SVL), and 23 August-20 September 1991 (11 mm SVL).

2. *Gastrophryne carolinensis* (Narrow-mouthed toad) [Sites: C2, C3, C4, C6, C9, C11, C12, S1, S3, S4, S5, S6, S8, S9, S10, S11, S12]

A total of 102 individuals was captured (47% adults, 53% juveniles). No metamorphs were caught. Adults and juveniles were captured in all months of the sampling period, except for December 1990 to mid-March 1991. Most juveniles (34 of 54) were captured during September - November 1991. The smallest individual was a recent metamorph at 8 mm SVL caught 26 October - 9 November 1990, and the largest was a female at 30 mm SVL.

3. *Hyla chrysoscelis* (Cope's gray treefrog) [S7]

A single juvenile was captured during the period of 4-30 January 1991.

4. *Pseudacris crucifer crucifer* (Northern spring peeper) [S3, S4, S5, S7, S12]

Six adults (2 males, 4 females) and 1 juvenile were captured in 5 sites. One recently metamorphic individual (10 mm SVL) was captured during 10-28 May 1991.

5. *Pseudacris brimleyi* (Brimley's chorus frog) [S1, S1A, S4]

Two single, adult females were captured during 17-26 October 1990 and 26 October - 9 November 1990.

6. *Rana clamitans melanota* (Green Frog) [C1, C7, S2, S4, S5, S7, S10, S11]

Of the 129 individuals caught in the pitfall traps, most (83%) were juveniles. The largest number of captures (55 of 107) occurred in mid-June - August 1990. Other captures occurred in all other months through August 1991. Only 1 adult female was captured. Recent metamorphs were captured primarily in June - August in both years; one was caught in the 14 November - 5 December trapping period and 2 in September-November 1991. Eighteen metamorphs averaged 31.7±2.1 mm SVL (28-35).

7. *Rana sphenocephala* (Southern leopard frog) [C1, C5, C12, S1, S1A, S4, S5, S7, S8, S10, S11]

This species comprised the majority of all captures in this study (54% of 879). Only 7 adults were captured. Number of juveniles (230) captured was similar to the number of recently metamorphosed frogs (237). Most of these (195 and 226, respectively) were captured in June - August of both sampling years. A sample of 75 metamorphs averaged 27.8±2.3 mm SVL (22-33).

8. *Ambystoma opacum* (Marbled salamander) [S7, S10, S11]

Six adults (3 males, 3 females) were captured in these 3 sites. The dorsal pattern phenotype of 2 males and 2 females was the typical series of light crossbars. One male had a parallel stripe pattern and one female had 2 crossbars in addition to parallel stripes. A single metamorphic individual was captured during 10-28 May 1991.

9. *Plethodon cinereus* (Red-backed salamander) [C1, C3, C5, C6, C12, S3, S6, S7, S11, S12]

Of the total sample of 43 individuals, 37 were adults and 6 were juveniles. Fourteen of these exhibited the red-back phenotype and 29 the lead-back phenotype. Two adult salamanders had partially regenerated tails. Most specimens were caught in fall and spring, and a few were captured in January 1991.

10. *Plethodon chlorobryonis* (Atlantic coast slimy salamander) [C3, C6, C9, C12, S1, S4, S7, S8, S11, S12]

Fourteen individuals were captured during this 2-year study: 4 adult males, 4 adult females, and 6 juveniles. One adult had a partially regenerated tail. Only one juvenile was captured in summer (15 July - 2 August); all other individuals were captured in fall, winter, and spring months.

11. *Terrapene carolina carolina* (Eastern box turtle) [C12]

A single juvenile was captured at this site during 2-22 August 1991.

12. *Kinosternon subrubrum subrubrum* (Eastern mud turtle) [S2]

A single adult male was captured at this site during 22 August - 21 September 1991.

13. *Eumeces fasciatus* (Five-lined skink) [C2, C6, S1, S6, S7, S12]

Ten of the 14 individuals captured in both years were juveniles, one was an adult male, and 5 were adult females. Tails of most of the specimens were broken during capture or during handling, but all of those with unbroken tails were complete.

14. *Eumeces inexpectatus* (Southeastern five-lined skink) [S5]

A single 46 mm SVL juvenile was captured during 26 April - 10 May 1991 at this site.

15. *Eumeces laticeps* (Broad-headed skink) [S12]

One juvenile female (63 mm SVL) was captured during 6-26 April 1991 at this site.

16. *Scincella lateralis* (Ground skink) [C2, C6, C12, S2, S3, S5, S11]

Twelve specimens were captured during this 2-year study. Eight were adults and 4 were juveniles. All juveniles had complete tails, whereas 6 of the adults exhibited partially regenerated tails.

17. *Carphophis amoenus amoenus* (Eastern worm snake) [S10]

A single adult male was captured at this site during 5-21 September 1990.

DISCUSSION

Drift fence/pitfall arrays are effective inventory methodologies for selected terrestrial amphibians and reptiles in saturated forested wetlands and associated lowland habitats if used across seasons and herpetofaunal activity periods (Mitchell et al., 1993). However, size of the pitfall trap influences directly the species and sizes of individuals caught. The fewer species and numbers of individuals caught by the small 16 oz cans compared to the larger pitfalls in this study demonstrate that pitfall size strongly affects catchability and can bias samples toward smaller species and small individuals of larger species. Comparatively, amphibian species richness (5-11) and total numbers of individuals captured (44-702) were larger in a 6-month study in southeastern Virginia using large drift fences and 19 l (5-gal.) pitfalls (Buhlmann et al., 1993). As with this study, *Bufo terrestris*, *Rana clamitans*, and *Rana sphenocephala* dominated the frog samples and two species of *Plethodon* dominated the salamander samples. Species of larger size (e.g., bullfrogs [*Rana catesbeiana*]) and more adults were captured with the larger pitfall traps than the small pitfalls used in our study.

Although amphibian and reptile species richness of the historical Great Dismal Swamp in southeastern Virginia is well known (Tobey, 1985; Conant & Collins, 1991; Mitchell, 1994; Mitchell et al., in press), microgeographic distribution patterns and the ecology of these species remains to be fully elucidated. Results of this study provide no significant geographic distribution records but they do extend our knowledge of the habitat affinities for most of the 17 species we recorded.

The landscape of southeastern Virginia has been altered severely by agricultural processes and urban and suburban development (Levy & Walker, 1979). Increased demands of an ever growing human population for more urbanization of the landscape suggests that there will be less and less habitat in the future for all but the species with the broadest habitat affinities. Because many of the habitats sampled in this study were disturbed by human activities, at least some of the species encountered will probably persist as long as there are wetland breeding sites and patches of upland habitat for shelter. This list includes species such as *Bufo terrestris*, *Rana clamitans*, and *Rana sphenocephala*. *Eumeces fasciatus* and *E. inexpectatus* may persist because they are able to inhabit some human-made structures. Species like *Plethodon cinereus*, *P. chlorobryonis*, *Scincella lateralis*, and *Terrapene carolina* that inhabit the increasingly isolated patches of upland forest will continue to decline because of the loss of such habitat islands. In addition, species that move overland during seasonal movements and migration also face high rates of mortality from increasing vehicular traffic in the area (Mitchell et al., in press). The long-term projection for the status of the herpetofauna in the historical Great Dismal Swamp of southeastern Virginia is that there will be continued decline in number of populations and additional reduction of the ranges of native species. Because the ecology and life histories of many species are not well understood, all information possible on the natural history and ecology of amphibians and reptiles of the area, including the most common ones (Dodd & Franz, 1993), should be amassed and published before the opportunity is lost.

ACKNOWLEDGMENTS

Funding for this project was provided by U.S. Fish and Wildlife Service and The Nature Conservancy. We thank Judy Jacobs, Karen Terwilliger, and Chris Pague for administrative assistance. K.A. Buhlmann, J.E. Pagels, and K.L. Uthus helped with field collections. Leah M. Geyer assisted in the laboratory during specimen identification and measurement. We thank personnel at the Chesapeake Municipal Airport and Northwest River Park and numerous private land owners for allowing us access to their property. Thomas K. Pauley commented on the manuscript.

LITERATURE CITED

Buhlmann, K. A., J. C. Mitchell, & C. A. Pague. 1993. Amphibian and small mammal abundance and diversity in saturated forested wetlands and adjacent uplands of southeastern Virginia. Pp. 1-7 *In* S.D. Eckles, A. Jennings, A. Spingarn, & C. Weinhold (eds.), Proceedings of a workshop on saturated forested wetlands of the mid-Atlantic region: the state of the science. US Fish and Wildlife Service, Annapolis, MD.

Conant, R., & J. T. Collins. 1991. A Field Guide to the Reptiles and Amphibians Eastern and Central North America. Houghton Mifflin Co., Boston, MA. 450 pp.

Dodd, C. K., Jr., & R. Franz. 1993. The need for status information on common herpetofaunal species. Herpetological Review 24:47-50.

Enge, K. M. 1997. Use of silt fencing and funnel traps for drift fences. Herpetological Review 28:30-31.

Erdle, S. Y., & J. F. Pagels. 1995. Observations of *Sorex longirostris* (Mammalia: Soricidae) and associates in eastern portions of the historical Great Dismal Swamp. Banisteria 6:17-23.

Kearney, T. H. 1901. Report of a botanical survey of the Dismal Swamp region. Contributions of the United States National Herbarium 5:321-550.

Levy, G. F., & S. W. Walker. 1979. Forest dynamics in the Dismal Swamp of Virginia. Pp. 101-126 *In* P.W. Kirk, Jr. (ed.), The Great Dismal Swamp. University Press of Virginia, Charlottesville, VA.

Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.

Mitchell, J. C., S. Y. Erdle, & J. F. Pagels. 1993. Evaluation of capture techniques for amphibian, reptile, and small mammal communities in saturated forested wetlands. Wetlands 13:130-136.

Mitchell, J. C., C. A. Pague, & D. J. Schwab. In press. Herpetofauna of the Great Dismal Swamp. *In* R.K. Rose (ed.), Proceedings of the Third Symposium on the Great Dismal Swamp. Old Dominion University, Norfolk, VA.

Oaks, R. Q. Jr., & D. R. Whitehead. 1979. Geologic setting and origin of the Dismal Swamp, southeastern Virginia and northeastern North Carolina. Pp. 1-24 *In* P.W. Kirk, Jr. (ed.), The Great Dismal Swamp. University Press of Virginia, Charlottesville, VA.

Tobey, F. J. 1985. Virginia's amphibians and reptiles: a distributional survey. Virginia Herpetological Society, Purcellville, VA. 113 pp.

Whitehead, D. R., & R. Q. Oaks, Jr. 1979. Developmental history of the Dismal Swamp. Pp. 25-43 *In* P.W. Kirk, Jr. (ed.), The Great Dismal Swamp. University Press of Virginia, Charlottesville, VA.

Table 1. Location and habitat type of the 25 study sites in southeastern Virginia. Abbreviations: dfp = drift fence/pitfall array, cans = single can pitfalls.

Site	Trap type	City	Coordinates (Lat/Long)	Habitat
S1	dfp/7 cans	VA Beach	36°47'35'' / 76°04'20''	mature hardwood swamp forest
S1A	dfp	VA Beach	36°43'14'' / 76°02'40''	pine/hardwood forest
S2	dfp/4 cans	Chesapeake	36°43'30'' / 76°16'37''	marsh/mature forest edge
S3	dfp/5 cans	Chesapeake	36°39'40'' / 76°19'45''	shrubby, old field
S4	dfp	Chesapeake	36°39'13'' / 76°22'08''	mixed hardwood swamp forest
S5	dfp/4 cans	Chesapeake	36°34'15'' / 76°20'25''	old field/mature forest edge
S6	dfp/4 cans	Chesapeake	36°38'25'' / 76°20'30''	young mixed forest
S7	dfp	Chesapeake	36°36'05'' / 76°14'50''	mature hardwood swamp forest
S8	dfp/7 cans	Chesapeake	36°36'55'' / 76°11'53''	mature hardwood swamp forest
S9	dfp	Chesapeake	36°34'30'' / 76°14'00''	young mixed forest/field edge
S10	dfp/4 cans	Chesapeake	36°34'05'' / 76°11'55''	young mixed forest
S11	dfp/4 cans	Chesapeake	36°34'40'' / 76°09'05''	mature mixed swamp forest
S12	dfp/6 cans	Chesapeake	36°34'30'' / 76°07'55''	mature hardwood swamp forest
C1	11 cans	VA Beach	36°41'45'' / 76°03'55''	yng pine forest/powerline edge
C2	5 cans	VA Beach	36°34'50'' / 76°05'55''	young mixed forest/swamp edge
C3	6 cans	VA Beach	36°37'05'' / 76°07'15''	young mixed forest/field edge
C4	10 cans	Chesapeake	36°40'38'' / 76°08'45''	young mixed forest/field edge
C5	8 cans	Chesapeake	36°36'55'' / 76°16'40''	mature hardwood swamp forest
C6	9 cans	Chesapeake	36°38'40'' / 76°17'45''	young pine forest
C7	10 cans	VA Beach	36°36'46'' / 76°05'02''	mature mixed swamp forest edge
C8	4 cans	Chesapeake	36°40'26'' / 76°09'25''	young forest/shrub field edge
C9	6 cans	VA Beach	36°45'40'' / 76°02'20''	young mixed forest
C10	10 cans	Chesapeake	36°38'15'' / 76°11'57''	weedy, shrub field edge
C11	10 cans	Chesapeake	36°40'35'' / 76°13'40''	young forest/field edge
C12	61 cans	Chesapeake	36°43'14'' / 76°02'40''	mature mixed forest, young mixed forest, shrub/young forest edge, shrub field edge