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Amphibian and Reptile Diversity of a Threatened Natural Area in Central Virginia

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INTRODUCTION

The political boundaries of Virginia encompass a wide variety of habitats that support rich vertebrate faunas. Some of these habitats have been studied thoroughly (e.g., Dismal Swamp, Shenandoah Valley sinkhole ponds, Shenandoah National Park), but others have been studied only marginally or not at all. Despite the fact that biological investigations of Virginia started in the late 1600s with the unpublished works of John Banister (Ewan & Ewan, 1970) and have continued to the present, there are numerous areas of the state that have not received our attention. Many of these are currently threatened with destruction due to ever-expanding urban sprawl. Many of the rich local faunas present in historical and relatively recent times are likely to disappear in the near future. Thus, the results of natural history investigations of such diverse

natural areas are worthy of publication.

A parcel of land formerly owned by the Commonwealth of Virginia in eastern Henrico County called the Elko Tract is one such diverse natural area. It has been partially inventoried by Natural Heritage Program (now Division of Natural Heritage, Virginia Department of Conservation and Recreation) personnel (Virginia Natural Heritage Program, 1989). This tract is currently threatened by industrial development by the county. Because the Elko Tract harbors uncommon natural communities and a rich diversity of plants and animals, natural history reports on various taxonomic groups would be valuable and should be placed on public record. Herein, I report on an investigation of the amphibians and reptiles in one portion of the Elko Tract, and demonstrate that one sampling technique can yield considerable insight into the species richness of the area.

MATERIALS AND METHODS

Study Area

The Elko Tract is a 972 ha area formerly owned by the Commonwealth of Virginia. All but 42 acres were sold to Henrico County by then Governor G. Allen for \$1.00. The study site was located in the eastern portion of the county between White Oak Swamp (a tributary of the Chickahominy River) and Portugee Road. This tract lies immediately to the west of the community of Elko, located at the junction of VA Route 156 and the C&O railroad. The tract was comprised of the following habitat types at the time of the survey: clearcut, upland pine forest, upland mixed pine and hardwoods forest, upland hardwood forest, and swamp forest (Virginia Natural Heritage Program, 1989). Wetlands in the area consist of an acidic seepage swamp and a bottomland hardwood forest. The swamp supports a dense mat of sphagnum, numerous herbs and shrubs, and a variety of broadleaved wetland trees (including *Nyssa sylvatica*, *Acer rubrum*, *Fraxinus pennsylvanica*, and *Magnolia virginiana*). The bottomland hardwoods are dominated by *Quercus lyrata*, *Q. michauxii*, *N. sylvatica*, and *Ulmus americana*.

Methods

A site at the edge of the seepage swamp and the upland habitats was selected in which to establish a drift fence/pitfall array to sample terrestrial vertebrates. A single drift fence array with pitfall traps was installed on 9 August 1989. The array consisted of three 7.5 m sections of aluminum flashing set upright in the ground in an exploded "Y" configuration. Each arm of the drift fence was located about 7.5 m from the imaginary center. Plastic buckets (19 l) were buried flush with the ground at each end of each drift fence (n = 6 total). Each pitfall was inoculated with dilute formalin to quickly kill and preserve the specimens for other studies. The array was checked 15 times from 23 August 1989 to 7 July 1990. On each visit all specimens were removed from the pitfalls, counted, and placed in plastic containers for transfer to the Virginia Museum of Natural History. All of these specimens have been catalogued. I counted each of the available specimens and scored them for size and sex, where possible.

RESULTS AND DISCUSSION

A total of 27 species of amphibians and 33 species of reptiles are known to occur in the Chickahominy River watershed (Mitchell & Reay, 1999). Of these, 24 species of amphibians and 31 reptiles, some 92% of the entire watershed fauna, are likely to occur in the Elko Tract. Twenty-four species (18 amphibians, 6 reptiles) were confirmed for the small portion of the Elko Tract sampled by the drift fence/pitfall array. All of the species in this report were caught in the pitfall traps (Table 1). Additional species were apparently recorded (1 amphibian, 11 reptiles; Virginia Natural Heritage Program, 1989, p. 20) but documentation on them cannot be located. Anuran diversity was higher than the other taxonomic groups probably because of the higher species richness and large number of captures for several species (Table 2). Evenness (J) between the two groups of amphibians was higher than that for reptiles, reflecting the greater rates of capture of several species in each group (Table 2).

The known terrestrial amphibian fauna at the Elko Tract was dominated by two species of widespread anurans, *Bufo fowleri* and *Rana clamitans*. Most of the captures were of metamorphs during the summer months. Metamorphs also dominated the captures of *Bufo americanus*, *Rana catesbeiana*, and *Rana palustris*. Metamorphs of these species disperse widely from breeding sites and are frequently caught in pitfall traps in a variety of terrestrial habitats (Gibbons & Semlitsch, 1982; Mitchell et al., 1997). Adults dominated the captures of *Pseudacris crucifer* and *Pseudacris feriarum*. Other species were caught in low numbers because they were either arboreal or occurred in low population sizes in this area.

Except for the eft stage of *Notophthalmus viridescens*, which wanders widely (Gill, 1978), salamander samples largely consisted of adults. The presence of juveniles of three species (*Ambystoma*, *Pseudotriton*) indicates that breeding habitat was located nearby. The relatively large number of *Hemidactylium scutatum* suggests that the small, acidic wetland in the tract was used as a breeding site by this species.

Reptiles were represented by low numbers of several widespread species (Table 1). The adult *Sceloporus* samples were mostly males (n = 10, females n = 3). One species of skink (*Eumeces fasciatus*) and the only teiid lizard found in the East (*Cnemidophorus sexlineatus*) were represented by a single juvenile each. Adults and a juvenile of the

Table 1. Amphibians and reptiles collected in pitfall traps in the Elko Tract, Henrico County, Virginia. Juveniles include recently metamorphosed frogs.

Species	Adults	Juveniles
Frogs		
<i>Acris crepitans</i>	1	0
<i>Bufo americanus</i>	10	38
<i>Bufo fowleri</i>	10	91
<i>Gastrophryne carolinensis</i>	0	1
<i>Hyla chrysoscelis</i>	4	5
<i>Pseudacris crucifer</i>	20	0
<i>Pseudacris feriarum</i>	6	0
<i>Rana catesbeiana</i>	0	10
<i>Rana clamitans</i>	2	92
<i>Rana palustris</i>	2	22
<i>Scaphiopus holbrookii</i>	1	1
Salamanders		
<i>Ambystoma opacum</i>	1	1
<i>Eurycea cirrigera</i>	6	0
<i>Hemidactylium scutatum</i>	30	0
<i>Notophthalmus viridescens</i>	0	20
<i>Plethodon cylindraceus</i>	2	0
<i>Pseudotriton montanus</i>	1	6
<i>Pseudotriton ruber</i>	1	3
Total amphibians	97	290
Lizards		
<i>Cnemidophorus sexlineatus</i>	0	1
<i>Eumeces fasciatus</i>	0	1
<i>Eumeces inexpectatus</i>	2	0
<i>Sceloporus undulatus</i>	13	4
Snakes		
<i>Carphophis amoenus</i>	1	0
<i>Storeria dekayi</i>	1	0
Total reptiles	17	6

common southeastern five-lined skink (*E. inexpectatus*) were captured in this study. Only two species of small snakes, both represented by adults, were caught in the pitfall traps during the sampling period.

In addition to the amphibians and reptiles, the following small mammals were collected by the drift fence/pitfall technique: *Blarina brevicauda* (short-tailed shrew), *Condylura cristata* (star-nosed mole), *Cryptotis parva* (least shrew), *Microtus pennsylvanicus* (meadow vole), *Mus musculus* (house mouse), *Peromyscus leucopus* (white-footed mouse), *Reithrodontomys humulis* (eastern harvest mouse),

Table 2. Numeric assessment of the diversity of taxonomic groups of amphibians and reptiles at the Elko Tract site, Henrico County, Virginia. N_{sp} = number of species, N_{ind} = number of individuals, H' = Shannon diversity index value, H_{max} = the maximum diversity possible given the number of species, and J = evenness.

Group	N_{sp}	N_{ind}	H'	H_{max}	J
Frogs	11	316	0.750	1.041	0.720
Salamanders	7	71	0.649	0.845	0.768
Amphibians	18	387	0.937	1.255	0.746
Reptiles	6	23	0.439	0.778	0.565
All species	24	410	1.001	1.380	0.726

Sorex hoyi (pygmy shrew), *Sorex longirostris* (southeastern shrew), *Tamias striatus* (eastern chipmunk), and *Zapus hudsonius* (meadow jumping mouse) (Virginia Natural Heritage Program, 1989).

This assemblage of small mammals indicates that the area sampled was a mix of habitats supporting grassland specialists and forest generalists (Pagels et al., 1992; Bellows & Mitchell, 2000). The small mammal community at Elko Tract consists of the same species as those found in southeastern Virginia (Erdle & Pagels, 1995) and the upper Coastal Plain (Bellows et al., 1999), further supporting the conclusion that this area is rich in biodiversity and is representative of the terrestrial vertebrate fauna of central Virginia.

The single drift fence/pitfall array technique used in this study yielded insights into the rich terrestrial vertebrate community of the Elko Tract. This sampling method has been used successfully in many places around the state, e.g., southeastern Virginia (Buhlmann et al., 1994), the Virginia mountains (Mitchell et al., 1997), and central Virginia Piedmont (Pagels et al., 1992). Numbers caught in the pitfalls in Elko Tract are comparable to those obtained for several upland and wetland sites in southeastern and other parts of Virginia (Buhlmann et al., 1994; JCM unpublished data). The technique effectively samples small terrestrial vertebrates moving across the landscape. It is not reliable for capturing highly aquatic, arboreal, or large terrestrial species. Thus, the perception of the structure of the amphibian and reptile community at Elko, although comprised of a rich fauna, is incomplete. Other techniques that could have provided additional records are visual (haphazard) encounter surveys, frog call surveys, coverboard surveys, and various other means of trapping (Heyer et

al., 1994). Most of these techniques are either time-prohibitive or target fewer taxa than large-scale drift fences with pitfall traps. Multiple techniques should be used simultaneously to sample all habitat types for all possible species.

The Elko Tract harbors a high diversity of amphibians, reptiles, and small mammals due to the diversity of microhabitats associated with the uplands and wetlands of the White Oak Swamp. This wetland is part of a tributary that leads to the Chickahominy River and associated habitats, which itself contains a high diversity of amphibians and reptiles (see distribution maps in Mitchell & Reay, 1999). Although there are no state or federally listed species of amphibians and reptiles in this area, the diversity of taxa reflects the many different habitat types in this portion of eastern Henrico County. This county is experiencing a high rate of urban sprawl (personal observations) and the Elko area in particular has been targeted for industrial development. As a consequence, few tracts of land as biologically rich as the Elko Tract will remain in this area after the next couple of decades. Places such as the Elko Tract will likely suffer the same fate as other wetlands in central Virginia (e.g., Mitchell, 1996). I encourage other reports on the various taxa of areas such as the Elko Tract to assist with documenting Virginia's rich biological heritage for the public record before they disappear.

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