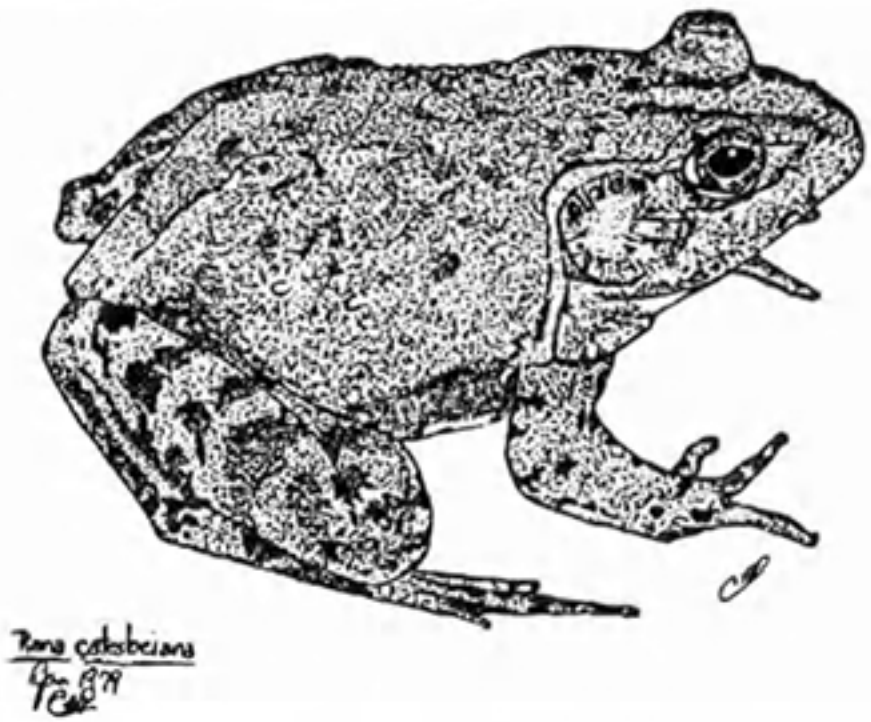
CATESBEIANA



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BULLETIN INFORMATION

Catesbeiana is published twice a year by the Virginia Herpetological Society. Membership is open to all individuals interested in the study of amphibians and reptiles and includes a subscription to *Catesbeiana*, two newsletters, and admission to all meetings. Annual dues for regular membership are $15.00 (see application form on last page for other membership categories). Payments received after September 1 of any given year will apply to membership for the following calendar year. Dues are payable to: Dr. Paul Sattler, VHS Secretary/Treasurer, Department of Biology, Liberty University, 1971 University Blvd., Lynchburg, VA 24502.

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EDITORIAL POLICY

The principal function of *Catesbeiana* is to publish observations and original research about Virginia herpetology. Rarely will articles be reprinted in *Catesbeiana* after they have been published elsewhere. All correspondence relative to the suitability of manuscripts or other editorial matters should be directed to Dr. Steven M. Roble, Editor, *Catesbeiana,* Virginia Department of Conservation and Recreation, Division of Natural Heritage, 217 Governor Street, Richmond, VA 23219.

Major Papers

Manuscripts submitted for publication should be typewritten (double-spaced) on good quality 8½ by 11 inch paper, with adequate margins. Consult the style of articles in this issue for additional information, including the appropriate format for literature citations. The metric system should be used for reporting all types of measurement data. Computer diskettes (Word or WordPerfect format) are desired for longer papers. Submissions concerning the herpetofauna of selected areas, such as a park, city or county, should be prepared in article rather than field note format. Articles will be refereed by the editor and one or more qualified reviewers. All changes must be approved by the author before publication; therefore, manuscripts must be received by the editor before **March 1** and **September 1** to be considered for publication in the spring and fall issue, respectively, of *Catesbeiana*. Reprints of articles are not available, but authors may reprint their own articles to meet professional needs.

(Editorial policy continued on inside back cover)

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Lynchburg, Virginia
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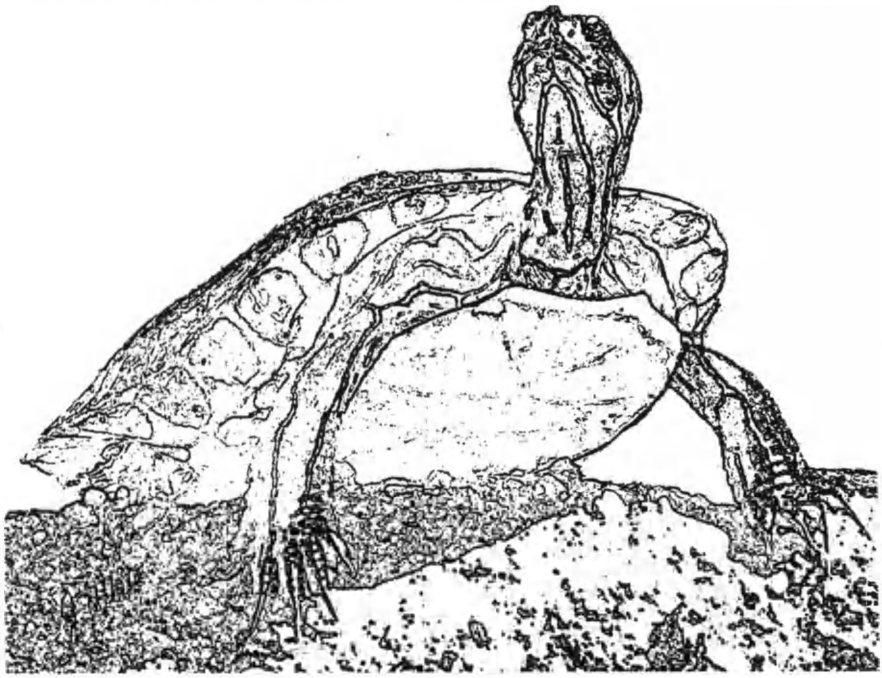

Northern Red-bellied Cooter (*Pseudemys rubriventris*)
Drawing by John White

Effects of pH and Heavy Metal Concentrations on Amphibian Breeding and Community Structure on a Reclaimed Pyrite Mine in Northern Virginia

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Introduction

Much attention has been paid in recent years to the effect of low pH on community structure and breeding success of amphibian populations (Freda and Dunson, 1985; 1986; Pierce and Wooten, 1992; Sadinski and Dunson, 1992; Wissinger and Whiteman, 1992; Warner et al., 1993; Whiteman et al., 1995). A few studies have focused on the role of other aspects of water chemistry, such as aluminum or heavy metal concentrations and their effects in concert with pH (Clark and Hall, 1985; Cummins, 1986; Ireland, 1991; Bradford et al., 1992), and fewer still have evaluated this effect in an abandoned mine environment (Porter and Hakanson, 1976; Lefcort et al., 1998). The research described here is an investigation of the impact of acidity and other abiotic factors on the establishment of amphibian communities, and on the use of artificial pools for amphibian breeding in new habitat created as a result of mine reclamation activities at the Cabin Branch Pyrite Mine in Prince William Forest Park, Prince William County, Virginia.

The Cabin Branch Pyrite Mine began operation in 1889 and was active until 1920. Until July 1995, the site consisted of approximately 8.1 ha of historic foundations and features, underground workings, and pyrite tailings piles. Several investigations had shown that the exposed tailings piles remained unvegetated due to low pH (3.5-5.7), instability and erosion, and high concentrations of sulfur, iron, and lead (Resource International, 1993; National Park Service (NPS) Geologic Resources Division, 1990, 1996). Stormwater channels and diversion pools were created as a result of the mine reclamation project, and, although not designed as amphibian habitat, species were observed using these areas shortly after the project was completed in September 1995 (pers. obs.).

Surface runoff was sampled prior to site reclamation and waters were found to have a pH of 4.0 and aluminum content of 32,840 micrograms/l; cadmium, chromium, copper, lead, manganese, nickel, silver, and zinc were all found at concentrations that exceeded Environmental Protection Agency (EPA) fish and water ingestion criteria (Resource International, 1993). Stream samples taken from Quantico Creek, which runs through the mine site, indicated pH levels of 4.0-5.5 and elevated levels of iron, lead, and manganese (NPS, 1990). Preliminary post-reclamation data for Quantico Creek indicated a pH of 6.3-6.4 and significantly reduced levels of copper, iron, and zinc (NPS, 1996).

A quantitative, post-reclamation assessment consisted of three elements: water chemistry, fish surveys, and macroinvertebrate sampling (Hamblin-Katnik et al., 2000). Water chemistry data obtained in the middle of the reclamation site indicated reduced levels of copper, zinc, and iron as a direct result of the reclamation effort. U.S. Geological Survey (USGS) post-reclamation data indicated a pH range of 5.9-6.9 for surface water and from 4.5-7.0 for groundwater (R. Seal, pers. comm.). Total contained base metals (Zn, Cu, Cd, Co, Ni, Pb) ranged from 0.1-4.2 mg/l for surface water and from 0.4-7.4 mg/l for groundwater. Preliminary field sampling performed on the control site (Site K-Carter's Pond) indicated a pH of 5.1-5.4 and conductivity in the range 80.6-86.1 microsiemens/cm.

Study Sites

The study sites consisted of 10 newly created pools (sites A-J) at the reclaimed Cabin Branch Pyrite Mine and a 50+ year-old impoundment named Carter's Pond (site K) that served as the control site (Fig. 1). Sites A-J were created during the reclamation project in 1995 to divert stormwater away from mine tailings. Site K was located approximately 2 km to the south and east of the main study area. Canopy characteristics, hydroperiod, substrate, and average surface area and depth of all study sites are summarized in Table 1.

Materials and Methods

Grab water samples were taken from each study pool (10 sites) and the control pond on a monthly basis from March through October 1998, 1999, and 2000. Samples were analyzed by the USGS. Five parameters

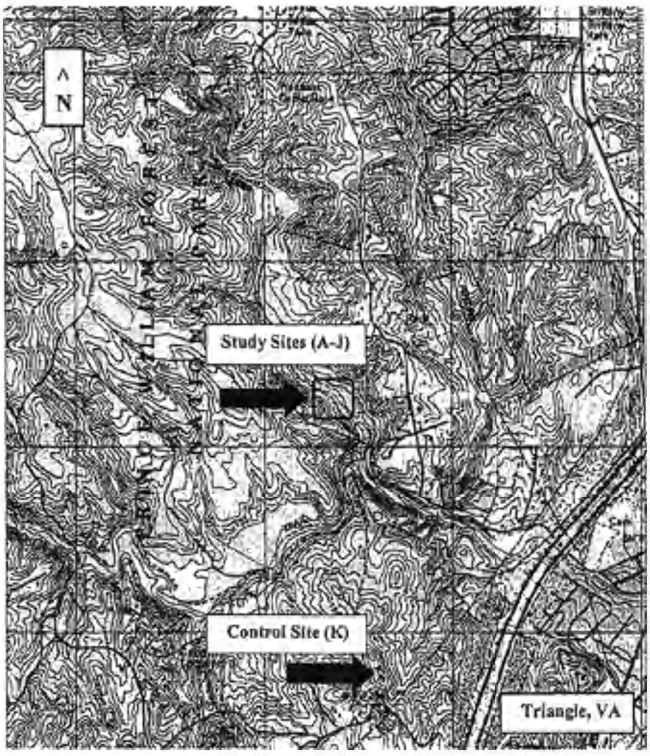

Fig. 1. Study and control site locations in Prince William Forest Park, Prince William County, Virginia (from USGS topographic map Quantico, VA: scale 1:24,000).

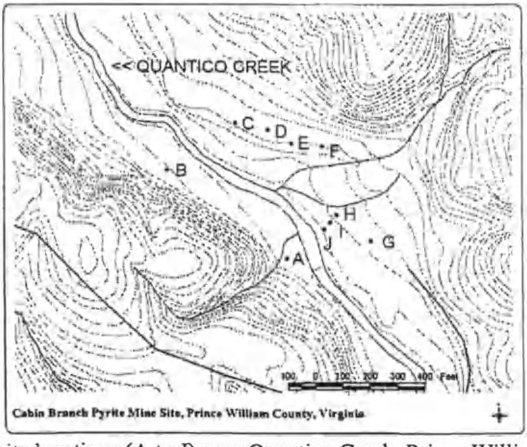

Fig. 2. Study site locations (A to J) near Quantico Creek, Prince William Forest Park.

Table 1. Summary of study site characteristics.

Site	Canopy	Hydroperiod	Substrate	Surface area (m^2)	Depth (cm)
A	Open; full sun most of day.	Semi-permanent.	Silt; vegetated with grasses.	71.1	31.6
B	Open; full sun most of day.	Held water through mid-summer.	Leaf; unvegetated.	19.7	20.3
C	Open; shaded early a.m., late p.m. by mixed oak/pines.	Spring/seep fed. Semi-permanent.	Silt; vegetated with grasses, rushes, and cattails.	10.3	9.5
D	Open; shaded early a.m., late p.m. by mixed oak/pines.	Held water through mid-summer.	Silt; vegetated with grasses.	15.2	8.4
E	Open; shaded in late p.m. by mixed oak/pines.	Held water through mid-summer.	Silt and leaf; vegetated with grasses.	23.3	10.7
F	Closed; shaded by mature oak trees.	Held water through mid- to late summer.	Leaf; vegetated with grasses.	9.8	8.0
G	Closed; shaded by mature pine trees.	Held water through mid-summer.	Silt; vegetated with grasses.	20.0	11.9
H	Open.	Spring/seep fed. Held water through early summer.	Silt; sparsely vegetated with rushes.	15.9	7.2
I	Open; shaded in early a.m., late p.m. by pine trees	Held water through mid-summer.	Silt; vegetated with grasses and rushes.	10.7	6.0
J	Closed; shaded by pine trees.	Held water through mid-summer.	Silt; vegetated with grasses and rushes.	17.4	14.0
K	Open; one side of pond has mature oak forest.	Permanent.	Silt and sand; vegetated with grasses and rushes.	1 hectare (estimated); 10,000 m^2	N/A

(pH, conductivity, dissolved oxygen, and water and air temperature) were recorded using field monitoring equipment. Dissolved total iron, ferrous iron, sulfate, and nitrate concentrations were determined in the field using a portable spectrophotometer. The following is a complete list of all water

chemistry analyses: pH, conductivity, salinity, water temperature, air temperature, dissolved oxygen, alkalinity, NO_3^-, Fe^{2+}, total Fe, F, Cl, SO_4, Ag, Al, As, Au, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Ge, Gd, Hf, Ho, In, K, La, Li, Na, Mg, Mn, Mo, Ni, Nb, Nd, P, Pb, Pr, Rb, Re, Sb, Sc, Se, SiO_2, Sm, Sn, Sr, Ta, Tb, Te, Th, Ti, Tl, Tm, U, V, W, Y, Yb, Zn, and Zr.

Field observations of study pools and the control pond were conducted on a weekly basis throughout the breeding season (March - October). Total number of egg masses/pool, total number of eggs hatched/pool and the percentage of eggs that hatched in each pool were recorded using methods described by Cook (1983). Mesh egg bags made of fiberglass window screen were designed as a substitute for egg boxes (Heyer et al., 1994) because of the low water levels consistently found at sample sites (Fig. 3). All amphibian species using the pools were identified, age-classed, and counted (pond census) using two methods: a D-frame dip net and visual encounter surveys (Heyer et al., 1994). The dip net was hand-held for 1-meter sweeps, based upon pool size. Small pools (<5x10 meters) required 5 sweeps of the dip net; larger pools 10 sweeps; and the control pond 20 1-meter sweeps (after Mitchell, 1996).

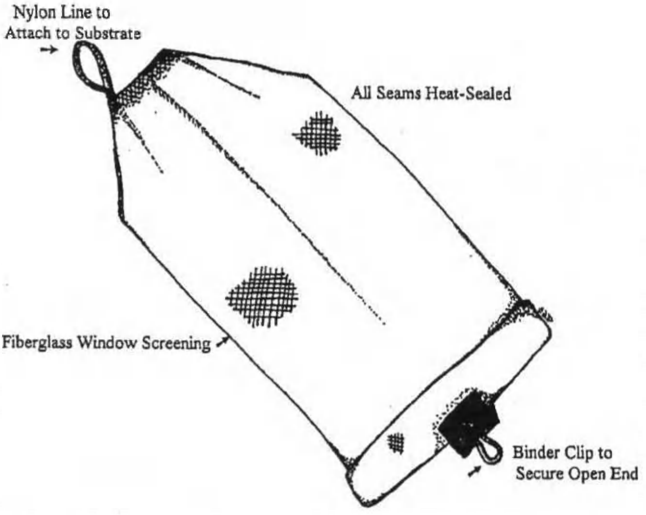

Fig. 3. Mesh egg bag (original artwork by Carol Pollio).

Anuran call surveys were conducted biweekly for a ten-minute period at each sample site. All species heard and observed, along with their relative chorus size were recorded. Chorus sizes were scored as follows: 0 = none heard; 1 = individual calling/no overlap of calls; 2 = several individuals/some overlap of calls; 3 = full chorus. Aluminum minnow traps (41 cm length by 18.5 cm in diameter) were placed in five locations at site K (control pond) 12-24 hours prior to sampling. All traps were removed and individuals identified and returned to the pond during weekly sampling efforts.

All study ponds were measured and depths recorded throughout the field observation period to quantify seasonal changes. Three depth measurements were taken across a transect line through the mid-point of each of the 10 study ponds and the mean determined. Differences in individual pool substrate and sedimentation, and surrounding habitat and vegetation were described and recorded.

Statistical analysis of the data was performed using SAS Version 6.12 and with the assistance of Zar (1999). Parameters were analyzed first through the Analysis of Variance Ryan-Einot-Gabriel-Welsch Multiple Range Test procedure (REGWQ), while those with abnormal distributions were then tested with a two-way ANOVA and the Kruskal-Wallis Chi-Square Approximation procedure (Ag, Al, alkalinity, Be, Cr, Cu, Fe, Mn, Pb, Se, Tl) with site and season as variables.

Results

Of the 67 parameters analyzed by USGS, 29 had concentrations at or near zero and will not be discussed further (Ag, As, Au, Be, Bi, Cs, Eu, Ga, Ge, Gd, Hf, Ho, In, Nb, Re, Sb, Sc, Se, Sn, Ta, Tb, Te, Th, Tm, U, V, W, Yb, and Zr). A total of 21 parameters indicated statistical differences among sites (alkalinity, Al, As, Be, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Na, Tl, V, Zn, pH, dissolved oxygen, and conductivity). The most biologically significant of these are shown in Table 2 (EPA 1986, 2000, 2001). The nine parameters found in highest concentrations will be discussed in detail (Al, Ca, Cd, Cu, Fe, Pb, Zn, pH and conductivity). The means and ranges of pH, conductivity, dissolved oxygen, water temperature, air temperature, and average depth are shown in Table 3.

Table 2. Summary of water chemistry results by site.

Site	Al	Alk	As	Cd	Cu	Fe	Pb	Mg[1]	Mn	K	Na[1]	Tl	V[1]	Zn	Cond[1]	pH
A	* #			* #	* #	#	* #	*	#	*		#		* #	*	* #
B	#	* #		#	* #	* #	* #		#	*	*	#		#	*	* #
C	#	* #							#							
D	#	* #				* #			#							
E	#	* #							#							
F	#	* #	*		#	#	* #		#				*			
G	* #			#	* #	* #	* #	*	#					#	*	* #
H	* #			#	* #	* #	* #	*	#			#		#	*	* #
I	* #			#	* #	* #	* #	*	#				*	#	*	* #
J	* #			#	* #	* #	* #	*	#			#		* #	*	* #
K	#				#				#					#		#

* Statistically Significant Concentration

Exceeds EPA Standard (EPA 1986, 1999, 2001)

[1] = No Established EPA Standard

Abbreviations: Al=Aluminum; Alk=Alkalinity; As=Arsenic; Cd=Cadmium; Cu=Copper; Fe=Iron; Pb=Lead; Mg=Magnesium; Mn=Manganese; K=Potassium; Na=Sodium; Tl=Thallium; V=Vanadium; Zn=Zinc; Cond=Conductivity; pH=Acidity.

Table 3. Summary of physical and chemical characteristics of study sites. Data are reported as means (first line) and ranges (second line).

Site	pH	Conductivity[1]	Dissolved Oxygen (mg/l)	Temperature (°C)		Depth (cm)
				Water	Air	
A	6.4	767.7	6.4	18.9	22.7	31.6
	3.7-7.7	72.0-2909.0	1.36-20.2	5.60-39.3	0.40-42.0	2.8-65.4
B	6.3	700.9	4.4	20.4	24.3	20.3
	3.4-7.9	264.0-1475.0	2.0-9.0	6.60-28.4	8.7-36.8	5.36-44.3
C	6.9	238.9	5.7	19.3	24.2	9.5
	4.1-8.3	77.0-896.0	0.0-13.9	5.1-31.3	4.4-36.6	0.83-18.7
D	6.7	100.7	5.2	19.9	23.6	8.4
	4.7-8.1	30.4-271.4	0.86-14.2	3.1-32.4	2.9-33.0	2.7-14.3
E	6.9	169.6	5.7	17.8	22.5	10.7
	5.0-8.3	40.4-483.4	1.5-13.2	3.9-26.6	3.4-32.7	2.16-23.6
F	7.0	184.9	4.9	16.9	21.4	8.0
	6.0-8.3	3.6-520.0	1.0-12.1	2.4-25.4	1.1-34.0	2.8-15.5
G	4.1	856.4	7.5	13.8	17.7	11.9
	2.7-6.3	57.4-1929.0	1.0-12.1	5.2-26.7	0.7-31.6	3.0-20.2
H	3.9	897.8	7.1	21.5	22.00	7.2
	2.4-6.2	208.0-3700.0	2.2-12.0	6.1-36.0	3.7-35.0	3.0-12.3
I	4.2	700.2	6.8	16.9	20.8	6.0
	2.6-6.5	310.1-1292	2.6-12.0	1.3-32.0	1.1-31.5	1.4-9.7
J	4.1	1058.2	6.5	15.6	20.6	14.0
	2.5-6.7	326.0-1884.0	2.2-12.0	1.6-25.8	1.3-36.8	5.7-21.3
K	5.9	68.1	6.1	21.0	23.5	n/a
	4.5-8.5	16.1-112.0	1.5-11.0	4.8-31.8	2.1-37.0	n/a

[1]Microsiemens/cm

Low pH, a characteristic known to negatively affect amphibian breeding, hatch success, and survivorship (Pierce, 1985), was statistically significant at sites A, B, G, H, I, and J (Table 2). High conductivity was also found to be statistically significant at these same six sites, indicating a high level of hydrogen-ion activity, and, hence, high concentrations of heavy metals in these ponds. Aluminum concentrations for all sites exceeded the EPA (1986) freshwater standard of 87Φg/l for pH ranging between 6.5 and 9.0. Sites G, H, I, and J had extremely high levels of Al (means ranging from 5750 micrograms/l to 22,218 micrograms/l). Site A was significantly different from all other sites in Cd concentration, however, six sites (A, B, G, H, I, and J) exceeded the EPA Criterion Continuous Concentration (CCC) Standard (2001). Calcium concentration has been shown to reduce Cd toxicity in aquatic organisms (EPA, 2001). Ca concentrations ranged from 3.7-116.2 micrograms/l, with sites A, B, G, H, I, and J resulting in the highest values. However, these concentrations were not likely to noticeably reduce Cd toxicity (EPA, 2001). High levels of Cd were observed at sites A, B, G, H, I, and J (ranging from 0.0-39.5 micrograms/l), with site A being statistically significant compared to all other sites (mean=39.5 micrograms/l). Sites A, B, G, H, I, and J exceeded the EPA CCC Standard for Cd (0.25 micrograms/l) and Zn (120 micrograms/l), with Zn concentrations ranging from 2550.0-8583.2 micrograms/l. The EPA CCC Standard for Cu of 9.0 micrograms/l was exceeded at eight sites; A, B, F, G, H, I, J, and K. The concentration of Cu at sites C, D, E, F, and K was found to be statistically similar, ranging from 4.0-15.3 micrograms/l, while sites A, B, G, H, I, and J ranged from 376.3-2030.0 micrograms/l. Eight of eleven sites exceeded the EPA CCC Standard for Fe (1000 micrograms/l), with the mean of site C approaching the standard at 961.2 micrograms/l and sites E and K near 500 micrograms/l. Lead concentrations were elevated above the EPA CCC Standard of 2.5 micrograms/l at sites A, B, F, G, H, I, and J, ranging from 5.2-75.5 micrograms/l.

Thirteen amphibian species were observed within the study sites through anuran call surveys, visual observation, trapping, and dipnetting (Table 4). Anuran calls were heard at all sites, with the exception of site G. Successful breeding, determined by the presence of larvae, was observed at seven of the eleven sites. Four sites (G, H, I, and J) had no breeding success. During this study, 20,227 individual amphibians were observed

Table 4. Amphibian species and life stages observed at study sites.

Species	A	B	C	D	E	F	G	H	I	J	K
Acris crepitans	ac	ac	ajlc	ajlc	c	a		c	c	c	ajlc
Bufo americanus	aec	*	*	*	*	elc	ae	aec	ae	aec	lc
Bufo fowleri			ejlc	c	c	c					lc
Hyla chrysoscelis	*	aelc	ejlc	ejlc	elc	elc				c	ejlc
Pseudacris crucifer	ac	ac	ajlc	lc	alc	c				c	ajlc
Rana catesbeiana	aj	c									ajlc
Rana clamitans	ac	c	alc	el		a				c	*
Rana palustris	ajc									a	ajc
Rana sphenocephala	aj		ac		a	a				a	alc
Rana sylvatica	ae	a	ejl	aejl	ael					j	aejl
Ambystoma maculatum				el	el						ael
Ambystoma opacum											a
Notopthalmus viridescens				aj							ajl
Total Species Observed	9	7	8	9	8	7	1	2	2	8	13
Total Species Calling	6	6	7	5	5	4	0	2	1	5	10
Total Species Breeding	1	2	7	7	5	2	0	0	0	0	12
Shannon Diversity Index	0	.07	.71	.46	.52	.08	0	0	0	0	.67

a = adult; e = egg; j = juvenile/subadult; l = larvae; c = calling

* = all 5 of the above categories were documented

through dipnetting or trapping, but no deformities or abnormalities were found.

Breeding data were analyzed using the Shannon Diversity Index (Zar, 1999). Sites A, B, and F had in an index near zero (Table 4). Diversity indexes could not be computed for sites G, H, I, and J because no species bred successfully at these sites. Sites C, D, E, and K exhibited the highest species diversity, obtaining index values of 0.71, 0.46, 0.52, and 0.67, respectively. Shannon Index results were then tested for differences, based upon the method developed by Zar (1999). Twenty-one comparisons were calculated, comparing sites A, B, C, D, E, F, and K with each other. Taking into account the number of comparisons, sites B and F (0.69) and sites C and K (0.03) were considered to have statistically similar Shannon Diversity indices ($p>0.0024$). Chi-Square tests were performed comparing the total number of larvae captured by site, the total number of species observed by site, and the total number of species observed breeding by site. The null hypothesis used was that all sites were the same. However, all eleven sites were significantly different from each other. For the total number of larvae by site, $X^2 = 60{,}276.81$ for the critical value 18.307 ($\alpha=0.05$, df=10). Similarly, comparing the number of species observed by site resulted in $X^2 = 19.65$. Finally, the comparison of species breeding by site resulted in $X^2 = 48.33$. These data indicate that two pairs of sites (B and F, C and K) exhibited statistically similar diversity indices; however, each site was unique in its number of larvae, total species observed, and total species breeding by site.

Fifty egg masses were collected, counted, and returned to the study ponds. Of those, ten were exposed to drying as water levels decreased, leaving 40 intact from which to obtain survivorship results. Table 5 summarizes mean egg mortality by site. Sites A, C, H, and I experienced 90-100% mortality for all species. Sites B and E were in the 70-80% range, and sites D, F, and K had mean mortalities of less than 70%. High mortality is common for amphibians with aquatic eggs, ranging from 77.8% for *Ambystoma maculatum* to as low as 9% in *Rana aurora* (Duellman and Trueb, 1994). However, there is some evidence to suggest that egg bags may have interfered with hatching success, as bagged *Hyla chrysoscelis* eggs suffered 100% mortality in site A, while unbagged eggs hatched and survived until metamorphosis.

Table 5. Egg mortality by site and species.

Site / Species	% Mortality (Mean)	Number of Egg Bags
A	100.0	11
Bufo americanus	100.0	5
Rana sylvatica	100.0	4
Hyla chrysoscelis	100.0	2
B	73.0	2
Bufo americanus	46.0	1
Hyla chrysoscelis	100.0	1
C	94.7	3
Bufo americanus	91.0	1
Rana sylvatica	96.5	2
D	53.6	7
Bufo americanus	78.5	2
Rana sylvatica	52.4	3
Hyla chrysoscelis	24.0	1
Ambystoma maculatum	37.0	1
E	76.6	4
Bufo americanus	100.0	1
Rana sylvatica	78.7	2
Hyla chrysoscelis	45.0	1
F		
Hyla chrysoscelis	62.0	1
G	n/a	0
H		
Bufo americanus	100.0	4
I		
Bufo americanus	100.0	2
J	n/a	0
K	68.0	6
Rana sylvatica	27.0	1
Hyla chrysoscelis	91.3	4
Ambystoma maculatum	16.0	1

Minnow traps were used at Site K beginning on 22 May 1998 and resulted in the collection of seven anuran (*Rana catesbeiana, R. clamitans, R. palustris, R. sylvatica, R. sphenocephala, Pseudacris crucifer, and H. chrysoscelis*) and one salamander species (*Notophthalmus viridescens*).

An analysis of larval density by sample and site was performed; however, the results were inconclusive. The sites with the largest surface area (A, B, K) yielded very low densities of larvae, while smaller sites (C, D, E, F, G, H, I and J) showed highly variable densities, ranging from no individuals to 48.1 individuals per month per square meter of surface area.

Discussion

According to the Virginia Division of Natural Heritage (VADNH, 1991), the number of expected and/or observed amphibians that depend upon surface water for reproduction at Prince William Forest Park is 14. VADNH did not find *Pseudacris feriarum* or *R. sphenocephala* within the study area, although *R. sphenocephala* is commonly found there. Ernst et al. (1997) identified 15 amphibians for Prince William County that would be expected to be present in the park. Of those, only two were not observed at site K (*P. feriarum* and *Scaphiopus holbrookii*). An intensive survey for *P. feriarum* conducted by Pollio and Kilpatrick (2002) did not locate any populations within the study area.

In general, species found at the control site (K) were representative of the amphibian community that would be expected to develop in the study site. The absence of some amphibians at sites A through J, particularly those that require an extended hydroperiod (*R. catesbeiana*, *R. clamitans*, *Ambystoma opacum*), may be the result of drying conditions during mid-summer through early fall. However, the majority of expected species should readily colonize a newly formed pool within close proximity to established populations (Laan and Verboom, 1990; Webb, 1994; Kent and Langston, 2000; Lehtinen and Galatowitsch, 2001; Pechmann et al., 2001; Tourè and Middendorf, 2002).

Laan and Verboom (1990) noted that the number of species found in newly created pools was positively influenced by the proximity of the

pools to woodlands. All sites within my study area were within approximately 100 m of mature forest, allowing for readily available recruitment populations. Within approximately the same distance is Quantico Creek, which supports amphibian breeding through a series of shallow eddies and beaver ponds. The fact that only site C was statistically similar in diversity to site K indicates that other factors influenced site colonization.

In studies of created wetlands, nine species colonized sites within the first two years of construction in Florida (Kent and Langston, 2000), while Tourè and Middendorf (2002) reported an average of 13 species in Maryland. The amphibian communities that developed at sites C, D, and E were similar, with 9 of 14 expected species observed. One significant difference between this study and the previous studies cited is that the latter sites were created wetlands. The sites that I studied consisted of artificial pools that were not intended to serve as amphibian habitat. As such, they were not sited for optimal proximity to recruitment areas, nor were they constructed to facilitate amphibian access, yet results showed that some were still successful and significantly similar to the control site.

Dunson and Travis (1991) noted that there was too little appreciation among ecologists for the influence of abiotic factors. They argued that abiotic factors and physiological responses to those factors determine the "conditions" that reverse competitive dominance among closely related species. In this case, where high concentrations of heavy metals and low pH levels were present, community assemblages varied greatly from those that one would expect to develop. Species richness at sites A, B, G, H, I, and J, where Al, Cd, Fe, and Zn were found at high concentrations, was very low. Some species, such as *H. chrysoscelis* and *Bufo americanus*, dominated sites with high concentrations of Cd, Cu, and Zn, while the literature suggests that *P. crucifer*, *R. sylvatica*, and *A. maculatum* should have been the first and most prolific colonizers (Webb, 1994) and are positively correlated with each other (Dale et al., 1985). Blem and Blem (1991) noted that *A. maculatum* flourished in sites with lower Al, Cu, and Pb levels than sites containing declining populations. Sites C, D, E, and K had these three species in common, more neutral pH values, and the lowest concentrations of heavy metals.

All sites with low, statistically significant pH levels had Shannon Index values of zero or near zero. Egg mortality at sites H and I was 100%. The range of pH for these sites (3.9-4.2) supports the findings of Pierce (1985), who concluded that most common amphibian species experience 100% mortality at pH levels below 4.0. In his study, *R. sylvatica* was the most tolerant species with 50% surviving at pH levels between 3.5-4.0. This indicates that other factors may have influenced the use of these sites by *R. sylvatica*. The higher pH values at sites A and B (6.4 and 6.3, respectively), given their low diversity indices, indicated that other variables were responsible for the lack of breeding success at these sites.

Glooschenko et al. (1992) concluded that amphibians avoided high acidity and heavy metal concentrations in an area with a history of mining and smelting operations. These findings did not coincide with the results of this study. In relation to buffering capacity, *P. crucifer* reproduced successfully in sites C, D, E, and K. Calling at sites A, B, F, and J, indicated that this species did not avoid poorly buffered breeding sites. *Rana clamitans* was observed calling at sites A, B, C, J, and K, and reproduced successfully at sites C, D, and K, also indicating that they did not avoid poorly buffered sites (A, J, and K). The failure of this species to reproduce at sites B, E, and F can be explained by the frequent drying of these sites, making them less suitable habitat for this species (Webb, 1994; Skelly et al., 1999; Kent and Langston, 2000; Pechmann et al., 2001; Babbitt et al., 2003).

All sites, including the control site, had elevated levels of Al (all exceeded a mean of 121.5 micrograms/l). Site B exhibited the highest mean alkalinity, suggesting that the Al was buffered and allowed for successful breeding by at least two of the more environmentally tolerant species, *H. chrysoscelis* and *B. americanus* (Pierce, 1985). Birge et al. (2000) identified Al LC_{50} data for several species found within the study site that were consistent with the data collected; *Rana pipiens* exhibited 50% mortality at 90 micrograms/l, *R. catesbeiana* at 80 micrograms/l, *Bufo fowleri* at 280 micrograms/l, and *A. opacum* at 2280 micrograms/l. Sites that supported ranid anurans (C, D, E, F, and K) all fell below the 280 micrograms/l level and sites that exceeded the 2000 micrograms/l level (G, H, I, and J) experienced 100% mortality for all species. Even more interesting is that site A (mean = 1962.5 micrograms/l) did not produce *B. americanus* tadpoles, while site B (mean = 637.5 micrograms/l) did,

indicating an Al tolerance level of *B. americanus* higher than that of *B. fowleri* (Birge et al., 2000). *Rana sylvatica* was found to be the most acid tolerant species reviewed by Pierce (1985), yet it was unable to successfully hatch in site A (100% mortality observed), supporting the theory that the Al concentration played a significant role in the lack of breeding success at this site.

High concentrations of Cd can produce substantial effects on amphibian reproduction and community structure. Birge et al. (1979) found an LC_{50} of 40 micrograms/l for narrow-mouthed toad (*Gastrophryne carolinensis*) eggs, indicating that the concentration of Cd at site A (mean = 39.5 micrograms/l) may have contributed significantly to its lack of breeding success and low species diversity. Lefcort et al. (1998) found 100% mortality of Columbia spotted frog (*Rana luteiventris*) tadpoles at both 19.1 and 26.6 micrograms/l, a concentration level only found at site A. Individual sample results for site A included three dates for which much higher levels of Cd were observed; 180 (2-IX-98), 170 (7-X-98) and 100 micrograms/l (2-VIII-99), which could have affected amphibian eggs to a great extent, based upon the findings of Birge et al. (1979). It appears that the LC_{50} for *H. chrysoscelis* of 39.6 micrograms/l was consistent with the Cd concentration observed at site A, where this species was successful. *Rana catesbeiana* and *R. palustris*, adults and juveniles of which were found at site A, may have been reproductively unsuccessful there as a result of their lower tolerance for Cd (Birge et al. 2000). Similarly, *R. sphenocephala*, a species closely related to *R. pipiens*, was present at site A and did not reproduce there, indicating a tolerance nearly identical to that species. The data of Birge et al. (2000) strongly suggest that Cd toxicity did not prevent salamander species from using sites in this study, given their high tolerance for this metal.

Copper is extremely toxic to amphibians (Birge et al., 1979; Khangarot and Ray, 1987; Freda, 1991; Horne and Dunson, 1995; Birge et al., 2000). In laboratory experiments, Horne and Dunson (1995) found that concentrations of Cu as low as 15 micrograms/l were significantly more lethal to both *R. sylvatica* and *Ambystoma jeffersonianum* at higher pH levels (5.5), while Gottschalk (1995) identified a ninety-six hour LC_{50} of 24.5 micrograms/l in *H. chrysoscelis*. By comparison, the concentration of Cu at sites C, D, E, F, and K ranged from 4.0-15.3 micrograms/l, while sites A, B, G, H, I, and J ranged from 376.3-2030.0 micrograms/l.

Shannon Index data identified sites C, D, E, F, and K as more diverse than sites A, B, G, H, I, and J, mirroring the Cu concentration data.

Birge et al. (2000) documented a tolerance level for Zn of 87,000 micrograms/l for *B. fowleri*, which would indicate that this species should have been successful at sites A and B based upon this metal alone. The additive effect of both Cd and Zn, particularly at sites A, B, G, H, I, and J, may have played a significant role in breeding failure at these sites, and specifically, the absence of *B. fowleri*. Data gathered here suggest a very high tolerance for Cd and Zn for *H. chrysoscelis* eggs and larvae, in contrast with the findings of Gottschalk (1995). It is likely that some amphibian species have developed a higher tolerance for metal concentrations as a result of using the mine site in the past for reproduction, as has been found in species with high tolerance for acidity (Cook, 1983; Pierce, 1985; Dale et al., 1985). The highest Zn mean recorded, 8583.2 micrograms/l at site A, should have allowed for successful reproduction for at least some of the more tolerant species, according to Khangarot and Ray (1987), yet only *H. chrysoscelis* was successful there.

The toxic effects of Pb on amphibians vary widely by species (Horne and Dunson, 1994; Birge et al., 2000). Horne and Dunson (1994) found no significant effect on breeding of *R. sylvatica* for Pb concentrations up to 10 micrograms/l, supporting the observation that eggs in site A (mean 19.7 micrograms/l) experienced 100% mortality. Smith and Huyck (2000) found that Pb toxicity is affected by water hardness and developed a correction factor that increased the Acute Freshwater toxicity value to 82.0 micrograms/l. These data explain the ability of *B. americanus* and *H. chrysoscelis* to reproduce successfully at site B (mean = 75.5 micrograms/l) and represents the first documentation of a Pb toxicity level for these species (75.5-82.0 micrograms/l).

Absence of salamander reproduction at all but three sites (D, E, and K) clearly indicated their increased susceptibility to toxic substances in the environment. Glooschenko et al. (1992) found *A. maculatum* in only two of the 118 ponds surveyed in a previously mined area, indicating substantial sensitivity to heavy metals and acidification. In eastern Virginia, Blem and Blem (1991) observed that high Al, Cu, Si, and Zn concentrations were significantly associated with a decline in

reproductive activity and density of *A. maculatum*. The absence of salamander activity at site C cannot be readily explained and may be due to factors outside the scope of this study, such as recruitment or pool physical characteristics.

Sites D and E had similar species richness as sites C and K. The primary factor that these sites shared, other than generally good water quality, was hydroperiod. Sites D and E experienced mid-summer drying, while sites C and K held water throughout the year. According to Dale et al. (1985), three species (*R. catesbeiana*, *R. palustris*, and *R. septentrionalis*) were positively correlated with each other in year-round surface waters; *R. clamitans* was found in both wet and dry habitat types. These findings are consistent with this study as *R. catesbeiana* and *R. palustris* successfully reproduced at site K, but not at sites C, D, E, or F, and *R. clamitans* was successful at sites C, D, and K. Similarly, Babbitt and Tanner (2000) and Babbitt et al. (2003) found no correlation between species richness and hydroperiod; however, species distribution varied with hydroperiod length: *R. sylvatica* dominated short and intermediate hydroperiod sites, while *R. catesbeiana*, *R. clamitans*, *B. americanus*, and *P. crucifer* dominated sites with longer hydroperiods. Species distribution in this study was similar for *R. sylvatica* and *R. catesbeiana*; however, *B. americanus*, *R. clamitans*, and *P. crucifer* appeared to be more opportunistic, calling at nearly every site regardless of hydroperiod.

Species richness in sites B and F was identical and these sites were determined to be statistically similar; however, site F did not exhibit the same high levels of heavy metals as site B. Site F had approximately 90% canopy cover, leaving this site completely shaded, compared to sites C, D, and E, which were in full sun for most of the daylight hours. Skelly et al. (1999) found that the majority of amphibians were not present in closed-canopy ponds, while only one anuran species was frequently found (*R. sylvatica*). In addition, *B. americanus* and *H. versicolor* were observed using both closed- and open-canopy ponds, supporting the results at site F, where *B. americanus* and *H. chrysoscelis* eggs were observed. Werner and Glennemeier (1999) suggested that reduced food resources and low dissolved oxygen in closed-canopy ponds appeared to have a strong influence on amphibian distribution and survivorship. These habitat disparities most likely contributed to the low species diversity and richness noted at site F.

Conclusions

The results of this study indicate that from both a biotic and an abiotic standpoint, sites A, B, G, H, I, and J were significantly different from sites C, D, E, F, and K. Multiple heavy metal concentrations have been shown to exert an additive effect, producing significant amphibian mortality and lack of reproductive success (Gottschalk, 1995; Horne and Dunson, 1995; Leftcort et al., 1998). Specifically, Al, Cd, Cu, and Zn, as well as low pH, clearly affected species richness and diversity in the newly created pools. *Hyla chrysoscelis* eggs showed very high tolerance for heavy metals, except at sites with low pH values. *Bufo americanus* exhibited high tolerance for Cu and Pb, but not Al, Cd, and Zn. *Bufo fowleri*, a species shown to have exceptional tolerance for Cd, Cu, Fe, Pb, and Zn (Birge et al., 2000), was not observed in sites A and B, where it should have been successful. *Ambystoma maculatum* used only three sites (D, E, and K) despite literature suggesting that this species is moderately tolerant.

Species richness and diversity in sites C and D were found to be most representative of the surrounding area and demonstrated that successful colonization and reproduction can occur in areas with a history of severe disturbance. No vernal pool habitat existed prior to the reclamation of Cabin Branch Pyrite Mine. The project plan did not call for the creation of wetlands or amphibian habitat -- no special equipment, engineering plan or wetland plantings were needed to create them. However, despite the reproductive failure observed at some sites, the diverse communities that developed at sites C, D, and E demonstrated that creating functional habitat is possible with little effort and at minimal cost. The rapid colonization of these artificial pools suggests that more effort should be dedicated to incorporating amphibian habitat into reclamation and restoration planning. Restoration of hydrologically diverse habitats, particularly in previously disturbed environments, is critical to amphibian conservation.

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Cope's Gray Treefrog (*Hyla chrysoscelis*)
Photoillustration by John White.

Field Notes

***Eurycea guttolineata* (Three-lined Salamander).** VA: Gloucester Co., Beaverdam Reservoir. 1 October 2005. Kory Steele, Felice Bond, and Wendy Mooring.

An adult three-lined salamander was found at 1100 h on 1 October 2005 among wet vegetation bordering a small stream that feeds one of the 20+ mitigated wetlands created during the construction of Beaverdam Reservoir. Skies were clear with a high temperature of 25°C. Derge and Chazal (2001. Field Notes: *Eurycea guttolineata*. Catesbeiana 21: 33) reported a similar date, time of day, substrate, and weather for their capture of the same species in Middlesex.County. This specimen represents the second known location of three-lined salamanders on the Middle Peninsula (Derge and Chazal, *op. cit.*) and the first for Gloucester County (Mitchell, J. C. and K. K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.). A photograph of the specimen (below) was submitted to the VHS archives (voucher #34).

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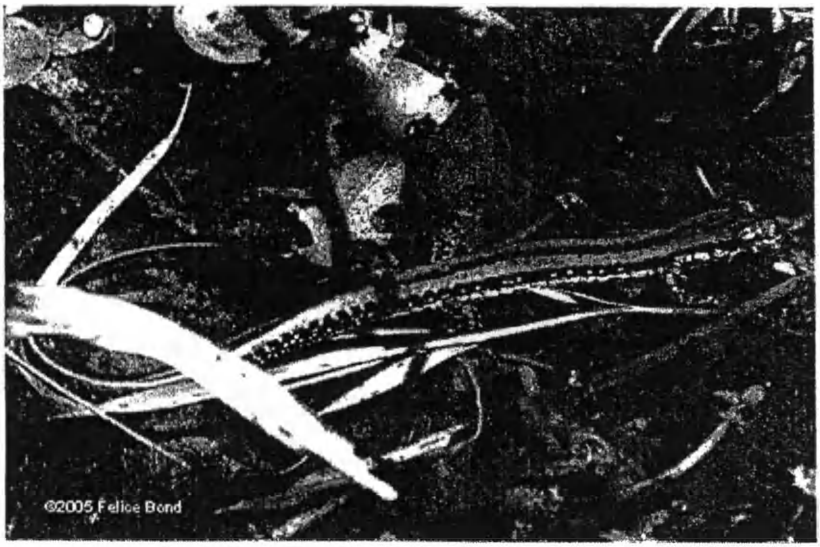

***Rana virgatipes* (Carpenter Frog).** VA: King William Co., Beulahville [UTM 18S 0310807, 4194781 (NAD83)]. 30 June 2005. K. Steele and J. D. Kleopfer.

On 30 June 2005 at 1800 h, we confirmed the presence of carpenter frogs at a 28 ha site owned by Fred Atwood in King William County. At least six males were heard calling sporadically, and one was captured, photographed, and released. Cassette recordings of the calls were also made. Mr. Atwood had first reported hearing carpenter frogs in March 2005 at various locations on his property. Despite other species of frogs calling from many locations, the carpenter frogs' activities were centered in an old oxbow lake adjacent to the Mattaponi River. The males could be heard calling from the base of the buttonbush (*Cephalanthus occidentalis*) that dominated the hydrophytic vegetation.

According to Mitchell and Reay (1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.), *Rana virgatipes* has not been previously recorded from King William County, although it has been found in neighboring Caroline County and in Hanover County near the Pamunkey River. A digital photograph was submitted to the VHS archives (voucher #31).

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***Hyla cinerea* (Green Treefrog).** VA: Henrico Co., 0.2 km NNE jct. U.S. Rt. 301 (Chamberlayne Avenue) and Upham Brook, 2.5 km SE Yellow Tavern, 37° 37' 7.4" W, 77° 26' 26.8" N (NAD 83), 26 June 2000; 0.28 km NW jct. U.S. Rt. 33 (Staples Mill Road) and Hungary Road in Hungary Creek, 0.9 km W Laurel, 37° 38' 30.01" N, 77° 31' 9.14" W, 26 June 2000. J. C. Mitchell and C. Todd Georgel.

Green treefrogs are well-known inhabitants of Virginia's coastal counties and farther inland to eastern Hanover and Greensville counties (Mitchell, J. C. and K. K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia.

Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.). Observations of this species in the two locations in Henrico County reported here were made on the same night during which it was cloudy and humid, with air temperatures of 24-25°C. The Chamberlayne location is a large, apparently beaver-maintained, freshwater marsh with cattails (*Typha latifolia*), pickerelweed (*Pontederia cordata*), and other emergent aquatic plants. A large chorus of at least 50 individual *H. cinerea* was heard on 26 June 2000. I visited this site again on 16 June 2001 and heard another large chorus. Other species at this location were Cope's gray treefrog (*Hyla chrysoscelis*), American bullfrog (*Rana catesbeiana*), and green frog (*R. clamitans*). A cassette recording from this site will be deposited in the VHS archives. The Laurel location was a small beaver pond in Hungary Creek with cattails and alder (*Alnus serrulata*). The chorus here was small, with fewer than 12 males. Other anurans at this location were Fowler's toads (*Bufo fowleri*), Cope's gray treefrogs, American bullfrogs, and green frogs. Observations of this species at this location were unexpected because I did not hear this frog in the early 1980s during several years of extensive fieldwork (Mitchell, J. C. 1988. Population ecology and life histories of the freshwater turtles *Chrysemys picta* and *Sternotherus odoratus* in an urban lake. Herpetological Monographs 2:40-61; JCM, unpubl. data). Other populations of *H. cinerea* in Henrico County have come to light, such as one in Three Lakes Park, 0.8 km downstream of the Chamberlayne location (T. Thorp, pers. comm.). This hylid may have expanded its range in recent years to include several locations in Henrico County. I grew up in this county and did not hear green treefrogs here despite conducting extensive road cruising and searches for Virginia's amphibians and reptiles, especially in the 1980s. Records of this and other primarily Coastal Plain anurans in counties along the Fall Line and westward should documented.

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Eumeces anthracinus anthracinus (Northern Coal Skink).
VA: Augusta Co., George Washington National Forest, east of Co. Rt. 715 on FS 449 north along Dowells Draft. Off FS 449 on Trail 650, upslope and west of Trail 650. 24 March 2002. Mike W. Donahue and W. Buddy Chandler.

VA: Montgomery Co., Jefferson National Forest, south of Co. Rt. 621 and Caldwell Fields; south side of Craig Creek on NE side of ridge above an unnamed tributary between Sugar Bottom Hollow and Mill Hollow. 25 March 2003. Mike W. Donahue and Fred C. Huber.

VA: Rockbridge Co., George Washington National Forest, east side of Great North Mountain, between Craigsville and Goshen, (Bells Valley), northwest on Co. Rt. 614 (Farrow Hollow) to FS 439 to end of FS 430F to tank trap. 15 April 2003. Mike W. Donahue and W. Buddy Chandler.

VA: Rockingham County, George Washington National Forest. Hone Quarry Picnic Area, west on Big Hollow Trail to Hone Quarry Ridge Trail. 29 March 2002. Mike W. Donahue and Fred C. Huber.

Northern coal skinks are known from a few scattered locations in the Blue Ridge Mountains and Ridge and Valley physiographic regions of Virginia (Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp; Mitchell, J. C. and K. K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.). Records for this lizard are uncommon in the state, owing in part to its secretive nature and exceptional skills of avoiding capture. These new records represent incidental encounters and are not part of a concerted survey for this species. Only one of these records was vouchered; the other three are based on sight records. The Rockingham County sight record represents the northernmost reported locality for this species in Virginia, and the Montgomery and Rockbridge sightings are the first reports for these counties (Mitchell, *op. cit.*; Mitchell and Reay, *op. cit.*). Plant species present at these sites included mixed oak hardwoods, blueberry (*Vaccinium* sp.), *Potentilla* sp., *Antennaria* sp., red maple (*Acer rubrum*), and chestnut oak (*Quercus prinus*). All of these sites were typically xeric, forested sites. This mix of vegetation and habitat features is very common and widespread across western Virginia. No additional coal skinks were observed at any of these sites.

The Rockbridge County skink was observed foraging for arthropods for several minutes along the edge of the gravel and dirt berm beside the wooded edge of the road (FS 439). The site had little to no canopy cover over the road. The road was composed primarily of an exposed shale and limestone gravel with little ground vegetation. The skink was not photographed or vouchered and no measurements were taken. Site elevation was approximately 548 meters.

At the Montgomery County site, one male was captured and released. No measurements were taken and it was not photographed. Sides of the head and throat were reddish-orange. The capture site is at the top of a side-ridge above Craig Creek floodplain at an elevation of approximately 548 meters.

The Rockingham County skink was collected while it was crossing a fire line. The voucher specimen is currently housed at the U.S. Forest Service Supervisor's Office in Roanoke, Virginia. Upon capture, the skink appeared healthy with no ill effects attributed to the fire. Site elevation was between 854 and 975 meters.

At the Augusta County site, one coal skink was captured and released. No measurements were taken and it was not photographed. Upon release, this animal quickly disappeared under the leaf litter, lending the appearance of "swimming" through the leaves. Site elevation was approximately 600 meters.

These accounts and other recent records (Roble, S. M., D. J. Stevenson, and A. C. Chazal. 1998. Field Notes: *Eumeces anthracinus anthracinus*. Catesbeiana 18: 49-52; Laprado, J., A. Laprado, and K. Laprado. 2004. Field Notes: *Eumeces anthracinus*. Catesbeiana 24: 70) are adding to the general knowledge of the distribution of northern coal skinks in the state. It appears that this species is more common than current records indicate, owing to its generally secretive nature and the limited number of field personnel searching for it.

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***Eumeces fasciatus* (Five-lined Skink).** Washington, Co., 18517 Hillbilly Lane, Bristol (UTM: 39.6446, 40.60222). 10 June 2005. David Carrier.

On 10 June 2005, David Carrier submitted to the Virginia Department of Game and Inland Fisheries two digital photographs of what he believed to be *Eumeces laticeps* (Broad-headed skink). When male *Eumeces fasciatus* are in breeding colors, they can be easily misidentified as *E. laticeps*. The first two photographs did not show enough detail for conclusive identification. A third photograph of the lateral area of the head was requested, so the scutellation could be used in identification. *Eumeces fasciatus* usually (82.3%) has 4/4 preorbital supralabial scales between the rostral scale and the first supralabial to touch the eye, while *E. laticeps* most frequently demonstrate a 5/5 pattern (53.1%). However, *E. laticeps* will occasionally demonstrate a 4/4 pattern (12.2%) (Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.). The third photograph was conclusive in identifying this specimen as *E. fasciatus* by clearly showing only 4 preorbital supralabial scales. Additionally, this specimen did not demonstrate the robust body and broad head characteristic of *E. laticeps*. An unidentified second specimen was seen at the same location. This is the first vouchered occurrence for this species in Washington County (Mitchell, *op. cit.*; Mitchell, J. C. and K. K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.). Digital photographs were deposited in the VHS archives (voucher #33).

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***Scincella lateralis* (Little Brown Skink).** VA: Accomack Co., 24326 Finney Drive, Onancock (on Finneys Neck between Parkers and Finneys creeks), near Cashville, ca. 0.45 km NE jct. Co. Rt. 638 and Finney Drive. 11 June 2001. Timothy R., Michele L., and Timothy W. Brophy.

According to Mitchell (1999. Checklist and keys to amphibians and reptiles of Virginia's Eastern Shore. Catesbeiana 19: 3-18), one of "the

basic natural history needs [for the herpetofauna of Virginia's Eastern Shore] is the fact that we do not yet have a full understanding of the distributional patterns for any species." Accordingly, I report on a vouchered record for *Scincella lateralis* from Accomack County. On 11 June 2001 at 2015 h, an adult little brown skink was found scurrying along the cement apron of the garage at 24326 Finney Drive. This residence is in close proximity to both Parkers Creek (ca. 10 m) and a large agricultural field (ca. 25 m). The skink was not captured, but a color photograph has been deposited in the VHS archives (voucher #69).

This is only the third vouchered location for *S. lateralis* from Accomack County (Mitchell, J.C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.; Mitchell, J.C. and K.K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.) and the northernmost known locality in the county (ca. 16 km NE of nearest vouchered record in Wachapreague). This species has also been found in Northampton County, Virginia (Mitchell, *op. cit.*; Mitchell and Reay, *op. cit.*) and the southernmost counties of Maryland's Eastern Shore (White, J.F., Jr. and A.W. White. 2002. Amphibians and Reptiles of Delmarva. Tidewater Publishers, Centreville, MD. 248 pp.).

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***Lampropeltis getula getula* (Eastern Kingsnake).** VA: Accomack Co., near Daugherty, jct. Co. Rt. 605 and Custis Creek, ca. 0.8 km S of northernmost jct. Co. Rt. 605 and Co. Rt. 648. 27 June 2005. Michele L., Timothy R., Timothy W., Emily D., and Patricia A. Brophy.

On 27 June 2005 at 1330 h, an adult kingsnake was found in the grass along Co. Rt. 605 adjacent to Custis Creek. This is a small freshwater creek that leads to a marshy area. The weather at the time of capture was clear and sunny. The daily mean temperature was 27.5° C (Accomack

County Airport, Melfa, VA). The snake was not captured, but a color photograph has been deposited in the VHS archives (voucher #68).

There are several other vouchered records for *L. g. getula* from Accomack County (Mitchell, J.C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.; Mitchell, J. C. and K. K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.), but this is one of the two northernmost localities in the county. The eastern kingsnake has also been found in Northampton County, Virginia (Mitchell, *op. cit.*; Mitchell and Reay, *op. cit.*) and the southernmost counties of Maryland's Eastern Shore (White, J.F., Jr. and A.W. White. 2002. Amphibians and Reptiles of Delmarva. Tidewater Publishers, Centreville, MD. 248 pp.).

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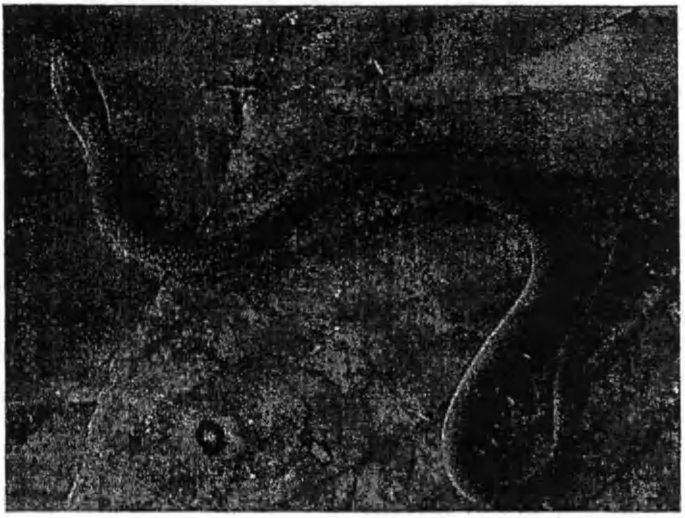
***Opheodrys vernalis* (Smooth Greensnake).** VA: Floyd Co., Co. Rt. 660, 3.2 km W jct. Co. Rt. 653. 24 October 2004. Fred B. First, Jr.

On 24 October 2004, I found an immature smooth greensnake (17 cm total length) under a flat rock near an outbuilding at my residence in remote northeastern Floyd County. The location is a south-facing slope at approximately 640 meters (2100 feet) adjacent to regenerating mixed-growth forest. The site is about 100 meters north of Goose Creek, a tributary at the headwaters of the South Fork of the Roanoke River. The snake was photographed and released. An adult smooth greensnake was found crossing a gravel drive less than 30 meters from the above location in late summer 2003. The mature snake (approximately 37 cm total length) was examined and released.

This is the first report of smooth greensnakes from Floyd County (Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.; Mitchell, J. C. and K. K. Reay. 1999.

Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.). A digital photograph of the immature snake was submitted to the VHS archives (voucher #70).



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***Opheodrys aestivus* (Rough Greensnake).** VA: City of Hampton, Rogers Avenue. 4 October 2005. Kory Steele.

A shed skin of an adult rough greensnake was found on 4 October 2005 approximately 1.25 m high in a stand of *Phragmites australis* in Hampton, Virginia. The vegetation was in a small tidal ditch, surrounded by residential properties, that empties into Long Creek and Salt Pond Creek. The skin measured approximately 45.5 cm SVL and was nearly intact, except only 5.5 cm of the tail remained. The species was confirmed by Barbara Savitzky using scale counts described in Mitchell (1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.).

The shed skin is evidence that rough greensnakes inhabit Hampton and it represents the first documented occurrence in the city (Mitchell, J. C. and K. K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.). Although locality records are abundant for the York Peninsula, they are lacking for the cities of Hampton and Poquoson. The shed skin will be deposited in the Virginia Museum of Natural History.

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***Pseudemys rubriventris* (Northern Red-bellied Cooter).** VA: New Kent Co., 3.2 km SW Lanexa, 37 ° 24' 32.45" N, 76° 56' 16.11" W (NAD 83). 7-8 October 2005. S. M. Johnson.

Red-bellied cooter females lay eggs between 18 May and 11 July in Virginia, eggs incubate for 62-76 days, and hatchlings emerge between 4 August and 21 September (Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.). Nesting dates reported for New Kent County were between 18 May and 4 July (Richmond, N. D. 1945. Nesting habits of the mud turtle. Copeia 1945: 217-219). Hatchlings emerge occasionally in August or September, but otherwise overwinter in the nest and emerge the following April or May (Mitchell, *op. cit.*). Dates of nesting and hatchling emergence in nature are not commonly reported, especially the latter. Such information enhances our database on phenological variation in life history traits in northern red-bellied cooters. We report here an observation of a new late hatchling emergence date in this species.

During the second week of June 2005, SMJ observed female *P. rubriventris* digging nests on a south-facing bank about 15 m above the shore of the Chickahominy Reservoir some 200 m above (E) the dam on the New Kent County side. Nest site substrate was packed sand-loam soil mix. This site was exposed to sunlight during most of the day, as it was not shaded. During 7-8 October 2005, approximately 10 cm of rain fell after two months without measurable precipitation. Hatchlings emerged

from four nests on 7 and 8 October after about 121 days of incubation (using 8 June as the middle point of the second week). Excavations of four nests on 13 October revealed egg shells in two, no egg shell fragments in one, and shells and the dead hatchlings in their shells in the fourth.

These observations extend the length of incubation period for a natural population from early June to early October and provide a new late hatchling emergence date for *P. rubriventris* in Virginia (Mitchell, *op. cit.*). The full incubation period based on all known captive and natural observations is now 62 to about 121 days. Fall emergence in this species may be triggered by abundant rainfall, as it apparently was in this case. However, without such rains during warm periods in early fall, *P. rubriventris* hatchlings may wait to emerge the following spring. Additional reports of such life history observations on this relatively understudied freshwater turtle will help us better understand the ranges and phenologies of its life history traits in nature.

The discovery of three dead hatchlings still in their eggs in the nest is noteworthy. The reason for their death appears to have been due to their being blocked from emergence by the rocks in the nest chamber. Each egg was split before death, so these three likely died after their siblings left the nest. Such mortality affects reproductive success and population recruitment. Our observation suggests that nests of all turtles should be excavated following hatchling emergence to determine if such mortality has occurred. Only after a large data set has been accumulated will we be able to determine patterns and causes. Are such deaths due only to the physical environment in the nest?

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***Terrapene carolina carolina* (Eastern Box Turtle).** VA: Rappahannock Co., 3.7 km NW Sperryville, 38° 40' 43.98" N, 78° 15' 35.68" W (NAD 83). 7 October 2005. M. Day.

Life history information on eastern box turtle females include nesting from May through July, egg incubation for 57-136 days, and hatchling emergence from early September to October (Allard, H. A. 1948. The eastern box turtle and its behavior. Journal of the Tennessee Academy of Science 23:307-321; Ernst, C.H., J. E. Lovich, and R.W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, DC. 578 pp.). In Virginia, nesting occurs from late May to late July (Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.). Nests in a captive, outdoor population in Maryland, derived in part from turtles collected from Virginia, were found from 2 June to 14 July, with incubation times of 69-136 days (Allard, *op. cit.*). Cooke (1910. Incubation period of box turtle eggs. Proceedings of the Biological Society of Washington 23: 124) reported nesting on 16 June and hatching on 26 August after 70-72 days of incubation for a population in Prince Edward County, Virginia. Observations on egg-laying and hatchling emergence dates in nature are noteworthy because they confirm or extend our database on phenological variation in life history traits in eastern box turtles. We provide here our observations on a natural incubation period and a late hatchling emergence in the Blue Ridge Physiographic Province.

On 28 June 2005, MD observed a female *T. carolina* digging a nest in the driveway of her rural house in Rappahannock County. The nest site substrate was clay and rock covered by bank gravel on an east-facing slope. She took four hours to construct and fill the nest (1800-2200 EDT). The female did not move from the site until the next morning, presumably from exhaustion, and only after she fed on earthworms offered by MD. This site received at least 6 hours of sunlight daily during most the incubation period. During 6-8 October 2005, approximately 15 cm of rain fell after nearly two months without measurable precipitation in the region. Water accumulated in the top of the nest site, forming an observable depression. A single hatchling emerged from the nest during the day on 7 October after 101 days of incubation. Excavation of the nest revealed that only one egg had been laid.

These observations extend the known length of incubation for natural populations and add a late hatchling emergence date for eastern box turtles in Virginia (Mitchell, *op. cit.*). Thus, the range of natural incubation in the Commonwealth is 70 to 101 days. The full range based on all known captive and natural observations is 56 to 136 days (Allard, *op. cit.*; Mitchell, *op. cit.*). Natural hatchling emergence dates range from 26 August to 7 October (Cooke, *op. cit.*; this study). The full range of dates based on captive and natural observations is 8 August to 21 October (Allard, *op. cit.*; Mitchell, *op. cit.*). The late natural emergence date reported here is likely due to the extended dry period in August and September. Allard (*op. cit.*) did not note a reason for the late 21 October date; all other observations were in September. Also worthy of note is the clutch size of one egg, the smallest number reported for Virginia (Mitchell, *op. cit.*). Additional reports of natural nesting dates, hatchling emergence dates, and clutch sizes from other locations in Virginia, especially at high elevations, would allow for a better understanding of the phenology of eastern box turtle life history traits in this region.

Photographs of the adult and hatchling have been submitted to the VHS archives.

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***Trachemys scripta elegans* (Red-eared Slider).** VA: Hanover County, jct. U.S. Rt. 301 and Topopotomy Creek, 10.2 km S Hanover Court House, 37° 40' 5.36" N, 77° 22' 57.59" W (NAD 83). 16 June 2005. Steve Quam.

Red-eared sliders have been introduced in many areas well outside of their natural range in the Mississippi River Valley (Ernst, C.H., J. E. Lovich, and R.W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, DC. 578 pp.), including Virginia (Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352 pp.) and other states and countries (e.g., Iverson, J. B. 1992. A Revised Checklist with

Distribution Maps of the Turtles of the World. Privately Printed, Richmond, IN. 363 pp.). Many of the places known for this introduced subspecies in Virginia have been in urban and suburban areas (Mitchell, *op. cit.*). Occurrences of *T. s. elegans* in natural aquatic environments in Virginia also occur, such as in the Tuckahoe Creek drainage in western Henrico County (Mitchell, J. C. 2004. Field Notes: *Trachemys scripta elegans*. Catesbeiana 24: 23). The observation reported here of an approximately 280 cm female, apparently having just emerged from Topopotomy Creek in Hanover County to nest, represents another location for this subspecies in natural waters. All observations of this introduced subspecies should be assembled, mapped, and evaluated so that we can determine the extent of its naturalization in the Commonwealth. Thus, observations in both urban and rural areas should be reported. A copy of the photograph has been sent to the VHS archives.

Acknowledgments: I thank Steve Quam for sharing his turtle photos with me.

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President's Corner

We are looking forward to a great VHS Fall Meeting on October 29th in Science Hall at Liberty University in Lynchburg. Paul Sattler is our host. Our morning schedule includes two workshops - the traditional session for teachers plus a GPS workshop for VHS members. Following lunch, we'll have our fall business meeting, including election of officers, followed by some very interesting herpetological research presentations. Details of the day's activities are printed elsewhere in this issue and are also found on the VHS website (http://fwie.fw.vt.edu/VHS/).

At our fall business meetings, an annual topic for discussion and decision is the location and timing for the following Spring Meeting and Survey. We have a good offer on the table for 2006 (details at the meeting), but other proposals are welcome, both for the coming spring and beyond. If you have a grand idea for our spring gathering, please do a little homework to help the decision-making process. Selection considerations include:

1. Is the county/region in need of herp survey?
2. What are the "featured species" and when is the best seasonal time to do the survey?
3. Are accessible and desirable survey location(s) available?
4. Is there an adequate meeting and HQ site?
5. Are lodging/camping facilities available nearby?

We had a very productive survey on June 3-5 in Richmond County. Thanks go to Sandy Spencer of the Rappahannock River Valley National Wildlife Refuge and to VHS vice president Kory Steele for their work in planning, scouting, and coordinating the survey on the refuge. Nearly three-dozen members participated in the meeting and survey. During the survey, we found thirty-five of the sixty-one species (19/34 reptile; 16/27 amphibian) expected in the area. Twenty-four (12 reptile; 12 amphibian) of these are believed to be new county records, species for which no specimen nor photographic voucher previously existed for Richmond County. That is quite an accomplishment for one weekend! Kory will provide complete details in an upcoming issue of *Catesbeiana*.

My term as president comes to a close at the upcoming fall meeting. It has been a pleasure working with our VHS members and also with

members of the general public, who depend on the Society to a surprising degree. I'd like to take this opportunity to thank all of our officers, both elected and appointed, for their outstanding and dedicated work on behalf of the Society during the past two years. These hard-working people make up the Executive Council, the governing body of the Virginia Herpetological Society. We will be electing a new President and new Vice President on October 29. Please encourage and support them as they assume their responsibilities. Personally, I am looking forward to continuing my work on the Council in my new office, that of Past-President.

Mike Clifford [mjc4h@vt.edu]
VHS President

VHS Grants in Herpetology

The purpose of Grants in Herpetology from the Virginia Herpetological Society is to stimulate and encourage herpetological research in Virginia. These grants are available in amounts up to $500. Grant proposals should include a description of the proposed research, or in the case of surveys, of the extent of the geographic area to be surveyed and the methods that are to be used. Proposals should include a justification discussing the importance of this work to the knowledge of herpetology in Virginia and a budget showing the distribution of funds between travel, equipment, and supplies. Include a CV of the major investigator. Salary is generally not supported by these grants. Electronic submissions are encouraged.

Grant proposals should be addressed to the current President of the VHS and received by January first of each year. The President will distribute copies of the proposal to members of the Executive Council by January 15. After review, the Executive Council members will rank the various proposals and return the results of this ranking to the President by February 15. Criteria for ranking proposals will include the importance of the study to understanding herpetology in Virginia, the conservation status of the species under study, and the likelihood of the recipient being able to complete the project. The President will tally the voting and announce the top recipient(s) by March 1. The Treasurer will then be instructed to mail the requested funds to the grant recipient(s).

The results of all funded proposals must be submitted in manuscript form to the Editor of *Catesbeiana* or presented at a Fall meeting, upon completion of the study. If presented in written form the Editor has the option of either publishing the study or releasing the author from the obligation of publishing in *Catesbeiana* if the Editor so deems the particular study, due to its subject matter, to be more suitable for a publication other than *Catesbeiana*.

Virginia Herpetological Society
Treasurer's Report
October 2005

Previous Checking Balance April 2005	$6,959.43
Receipts:	
May Dues	$160.00
June Dues	$330.00
July Dues	$ 90.00
August Dues	$ 95.00
September Dues	$ 15.00
T-Shirt Sales	$ 25.00
Total Receipts	$715.00
Disbursements:	
Catesbeiana 24(2)	$496.11
Spring Meeting Rental	$100.00
T-Shirt Art Contest Prize	$200.00
T-Shirt Printing	$498.73
Appreciation Plaque	$ 37.33
Total Disbursements	$1332.17
Balance on Hand October 2005	$6342.26

Paul Sattler
VHS Secretary/Treasurer

Virginia Herpetological Society
Minutes of Meeting
June 3, 2005
Heritage Park Resort – Richmond County

Mike Clifford opened the meeting at 7:00 pm with about 30 people in attendance. Mike welcomed everyone to the Spring Meeting and Survey of the Rappahannock River Valley National Wildlife Refuge. Joe McCauley, the Refuge's manager gave the VHS a formal welcome and an introduction to the National Wildlife Refuge system in general and the Rappahannock River Valley Refuge in particular, giving some details on its history and purpose. Sandy Spencer, the Refuge's Wildlife Biologist then provided some details of the habitats which would be surveyed that weekend. The herpetological survey would be used by the Refuge to contribute baseline data for their Comprehensive Conservation Plan mandated by the National Wildlife Refuge System Improvement Act of 1997. Mike Clifford then presented a PowerPoint slide show of the species of herps that were expected to be found, and some that were possible. Richmond County has not been subject to a comprehensive herpetological survey previously such that common species like the American bullfrog and eastern box turtle have never been vouchered. Members were asked to photograph even the common species with digital cameras to provide documentation of what was found on the Refuge. Mike distributed a list of expected species which indicated those few species which were recorded as present in the Mitchell and Reay Atlas. After the slide show, Sandy Spencer and Kory Steele asked members to split into groups and sign up for one of eight sites to survey in the morning.

The Business Meeting began about 9:30 pm after a brief recess. Mike Clifford asked for reports from the officers and standing committees. Paul Sattler reported that the Minutes of the Fall 2004 meeting and the Treasurer's report from April 2005 had been printed in *Catesbeiana* 25(1). Since the Treasurer's report in April there had been payments of $250 for rental to Heritage Park for the meeting, $200 to Roger Hall as the winner of the drawing contest for a new design for a VHS t-shirt, and $500 for the printing of the new t-shirt, which was available for sale at the meeting. There had been $160 received from dues to bring the current balance to about $6,200.

Jason Gibson reported that the Publications Committee had visited the Society's archives at the Virginia Museum of Natural History recently. They were able to assemble a complete set of *Catesbeiana* in addition to the one in the archives, which is available for the Secretary to copy should requests be made for older issues. There was not a complete set of VHS Bulletins, but Paul Sattler was in possession of Mike Clifford's set and was working to first prepare a taxonomic index of *Catesbeiana*, and then he would begin work to include the Bulletins.

Steve Roble was unable to attend the meeting but sent word through Mike Clifford that 175 copies of *Catesbeiana* 25(1) had been printed and 158 copies mailed out. He is in need of new artwork for future issues. There was discussion of how many surveys per year the VHS should make and publish, and why the BioBlitz was not attempting to include herps for their next survey. There seemed to be widespread support for two VHS surveys per year, possibly one in the Fall.

Shelly Miller asked for any articles members had accumulated as the next Newsletter was due shortly in July. John White reported that he was working on a new lizard identification section for the VHS Website. Mike Hayslett was not present so there was no report from the Education Committee on the progress of preparing a Nature Center list for possible distribution of *Catesbeiana* or the Newsletter. Mike Clifford announced that he would head up a Nomination Committee to prepare a slate of nominees for the Fall 2005 election of officers. All three elected positions (President, Vice-President, and Secretary/Treasurer) will be up for election at the Fall meeting.

Old Business: Paul Sattler displayed a spreadsheet containing information gathered for the digital archives. Each photograph or sound recording was given a number, the genus, species, *Catesbeiana* reference, date, locality and collector. It should be possible to search the database by any of these entries. There was some discussion as to how and where the archive database should be located. The consensus was that the VHS Website would be the best location.

New Business: There was discussion as to where the 2005 Fall Meeting should he held. Liberty University and the Science Museum of Virginia

were mentioned as possible locations. Initial suggestions for the Spring 2006 Meeting and Survey included Fairy Stone State Park, Warm Springs Mountain Preserve, Mount Rogers, Mountain Lake or the Peaks of Otter. Paul Sattler presented a proposal to expand the scope of the VHS research grants. In the past, these were open only for field surveys. The proposal was to make them available for any type of research, they would be for an amount up to $500, and the results would be prepared for publication in *Catesbeiana*. This led to some discussion of the type of articles published in *Catesbeiana*. Up to the present, these were almost exclusively survey reports. If the VHS funded molecular, ecological or behavioral studies, would these types of articles be published in *Catesbeiana*? The consensus was that they would. The Executive Council is to draft the criteria and publish them in the Fall issue of *Catesbeiana* (Editor's note: see page 91) or at the Fall Meeting.

The Meeting was adjourned at 10:40 pm.

Paul Sattler
VHS Secretary/Treasurer

DUES REMINDER

Membership in the VHS is on a calendar year basis (expires annually on December 31). Please consider renewing your membership for 2006 now (or at least before January 1) to save our treasurer the time and expense needed to mail you a renewal notice. See the last page of this bulletin for the membership application/renewal form. Save postage by paying your dues at the Fall Meeting if you are planning to attend this exciting event.

Virginia Herpetological Society
2005 Fall Meeting

The VHS will hold its fall meeting on Saturday, October 29, 2005 at Liberty University (Science Hall) in Lynchburg. Paul Sattler is our host. The meeting will include a herpetology workshop for teachers, a GPS workshop for VHS members, the business meeting and biennial elections, papers session, silent auction, and photo contest. Please bring any books, posters, or other items related to herpetology that you would like to donate to the silent auction. Also bring your best herp-related photo. Afternoon presentations will include "Herpetological Surveys in Virginia: An examination of the VHS Bulletins and *Catesbeiana*", "A survey of external lesions in snakes of the Rappahannock River Valley Wildlife Refuge: An on-going study", "Population model for the Timber Rattlesnake in the Blue Ridge Mountains", and "The Peaks of Otter salamander in the contact zone with the Red-backed salamander".

Several instructors will be involved in this year's teacher workshop. During this five-hour workshop, teachers will have the opportunity to learn about Virginia's amphibians and reptiles, captive care and handling of these animals, the online database of the Virginia Department of Game and Inland Fisheries, and other topics. For more information about the workshop contact VHS education committee chairman Mike Hayslett at mhayslet@vt.edu .

We'll also have a separate workshop for VHS members on using the Global Positioning System in herpetological surveys and other environmental fieldwork. This will be a hands-on, indoor-outdoor session. Bring your own GPS receiver or learn with one of our units (eTrex Legends, Rino's, and others). We've used GPS during our last two spring surveys. It is a valuable tool for anyone who spends time in the great outdoors. For more information, contact Mike Clifford at mjc4h@vt.edu .

Meeting Schedule

8:00 am - 1:00 pm	Educational workshop for teachers
9:00 am - 11:00 am	GPS workshop for VHS members
12:00 noon	Lunch (sandwiches, etc.)
1:00 pm	Business meeting & Elections
2:00 pm	Paper Sessions
	Silent auction; photo contest winners

VHS Business Meeting

Agenda items include:
- Election of Officers:
  President, Vice President, Secretary-Treasurer
- Selection of the Spring Meeting/Survey location and date
- Committee reports

Directions to Liberty University – Science Hall

From the South - Follow 29 North into Lynchburg. Turn into the Sonic Drive-In just across from Wal-Mart and follow the road up the hill and across the railroad tracks. At the stop sign turn right and follow the parking lot/road around to the right. At the next 3-way stop sign go straight, pass the tennis courts, green house and park in the area of Science Hall near the large white dome (Vines Center). Science Hall is entered through the door with the first covered walkway.

From the North - Follow 29 South into Lynchburg. Take the exit marked Liberty University. Continue past the River Ridge Mall, cross the bridge over the railroad tracks and turn right just after the tracks. At the second traffic light (by Hardee's) turn right. Go straight through the next traffic light. Follow the road around past the football stadium. Go straight through the first 3-way stop sign. Turn right at the second 3-way stop and park in this lot between the Vines Center (white dome) and DeMoss Hall (the 4-story large building). Science Hall is entered through the door with the first covered walkway.

From the West - Follow 460 East and take the exit marked Liberty University. At the end of the exit ramp turn right. Come down to the first traffic light (by Hardee's) and turn left. Go straight through the next traffic light. Follow the road around past the football stadium. Go straight through the first 3-way stop sign. Turn right at the second 3-way stop and park in this lot between the Vines Center (white dome) and DeMoss Hall (the 4-story large building). Science Hall is entered through the door with the first covered walkway.

From the East - Follow 460 West and take the exit marked Liberty University. At the traffic light at the end of the exit ramp turn left. Follow the road around past the football stadium. Go straight through the first 3-way stop sign. Turn right at the second 3-way stop and park in this lot between the Vines Center (white dome) and DeMoss Hall (the 4-story large building). Science Hall is entered through the door with the first covered walkway.

MEMBERSHIP APPLICATION

I wish to _____ initiate _____ renew membership in the Virginia Herpetological Society for the year _____ 2005 _____ 2006 _____ 2007.

Name _____

Address _____

_____

_____ Phone _____

email address: _____

Dues Category:
____ Regular ($15.00)
____ Family ($20.00)
____ Under 18 ($8.00)
____ Life ($225.00)

Interests: ____ Amphibians ____ Reptiles
____ Distribution ____ Research
____Captive Husbandry
___ Specifically _____

Make checks payable to the Virginia Herpetological Society and send to: Dr. Paul Sattler, VHS Secretary/Treasurer, Department of Biology, Liberty University, 1971 University Blvd., Lynchburg, VA 24502

Visit the VHS web site at: http://fwie.fw.vt.edu/VHS/

Field Notes

The field notes section of *Catesbeiana* provides a means for publishing natural history information on Virginia's amphibians and reptiles that does not lend itself to full-length articles. Observations on geographic distribution, ecology, reproduction, phenology, behavior, and other topics are welcomed. Field Notes will usually concern a single species. The format of the reports is: scientific name (followed by common name in parentheses), state abbreviation (VA), county and location, date(s) of observation, observer(s), data, and observations. The name(s) and address(es) of the author(s) should appear one line below the report. Consult the editor if your information does not readily fit this format. **All field notes must include a brief statement explaining the significance of the record** (e.g., new county record) **or observation** (e.g., unusual or rarely observed behavior, extremely early or late seasonal record, abnormal coloration, etc.). Submissions that fail to include this information are subject to rejection. Relevant literature should be cited in the body of the text (see Field Notes in this issue for proper format). All submissions will be reviewed by the editor (and one other person if deemed necessary) and revised as needed pending consultation with the author(s).

If the field note contains information on a **new county (or state) record**, **verification is required in the form of a voucher specimen** deposited in a permanent museum (e.g., Virginia Museum of Natural History) or a **photograph** (print, slide, or digital image) **or recording** (cassette tape or digital recording of anuran calls) deposited in the archives of the Virginia Herpetological Society. Photographs and recordings should be sent to the editor for verification and archiving purposes; the identity of voucher specimens must be confirmed by a museum curator or other qualified person. Include the specimen number if it has been catalogued. Prospective authors of distribution reports should consult Mitchell and Reay (1999. *Atlas of Amphibians and Reptiles in Virginia*), Mitchell (1994. *The Reptiles of Virginia*), and Tobey (1985. *Virginia's Amphibians and Reptiles: A Distributional Survey*) **[both atlases are available on-line on the VHS website]** as well as other recent literature to determine if they may have a new county record. New distribution records from large cities that formerly constituted counties (Chesapeake, Hampton, Newport News, Suffolk, and Virginia Beach) are acceptable, but records from smaller cities located within the boundaries of an adjoining county will only be published if the species has not been recorded from that county. Species identification for observational records (e.g., behavior) should be verified by a second person whenever possible.

PHOTOGRAPHS

High contrast photographs (prints, slides, or digital images) of amphibians and reptiles will be considered for publication if they are of good quality and are relevant to an accompanying article or field note. Prints should be on glossy paper and no larger than 5 x 7 inches. Published photographs will be deposited in the archives of the Virginia Herpetological Society.