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SYMPATRY AND SYNTOPY OF THE CRICKET FROGS *ACRIS CREPITANS* AND *ACRIS GRYLLUS* IN SOUTHEASTERN VIRGINIA, USA AND DECLINE OF *A. GRYLLUS* AT THE NORTHERN EDGE OF ITS RANGE

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***Abstract*.—The three species of *Acris* (cricket frogs) have experienced widespread declines in the northern portions of their ranges in the eastern United States since the middle of the 20th Century. In *A. blanchardi* and *A. crepitans*, these declines have been observed for decades but remain unexplained. The recently discovered decline of *A. gryllus* in North Carolina was obscured by sympatry and syntopy with its cryptic sibling species, *A. crepitans*, which is stable or expanding. The region of decline of *A. gryllus* is adjacent to its global northern limit, where sympatry with *A. crepitans* conceals the range limits and conservation status of both species. We investigated the historic and current ranges of sympatric *Acris* in southeastern Virginia. We established the 20th Century ranges of *Acris* using 1769 museum catalog records from 282 collection sites and morphometric analysis of 205 specimens from 42 sites. We acoustically identified *Acris* at 140 choruses in southeastern Virginia in 2010 and 2011. Before 1990, *A. gryllus* might have ranged further north and west than expected from museum records or published maps. On the Virginia Peninsula at the putative global northern limit of the range of *A. gryllus*, the species has declined and now occurs only in syntopy with *A. crepitans.* In contrast, *A. gryllus* persists in sympatry with *A. crepitans* in the Chowan basin and remains in allopatry in the Great Dismal Swamp. We propose adapting our approach to sympatric *A. gryllus* and *A. crepitans* to investigate other potential declines among sibling amphibians in the Atlantic Coastal Plain.**

Key Words.— *Acris crepitans*, *Acris gryllus*, amphibian decline, Atlantic Coastal Plain, community composition, Fall Zone, range edges, syntopy

INTRODUCTION

Although the global decline of amphibian populations began decades ago, much remains unexplained (IUCN et al. 2008). Scientific and public attention has focused on declines of rare, charismatic, or narrowly distributed species in protected or apparently intact habitats, even though these account for a minority of amphibian declines (Stuart et al. 2004). Although losses of abundant or widely distributed species are expected to have large consequences for ecosystem structure and function (Gaston and Fuller 2008; Gaston 2010), widespread declines of common amphibians have received little attention. Leading causes of amphibian declines have been identified by the research community to include invasive species, UV-B radiation, overexploitation, habitat alteration and loss, the pathogen *Batrachochytrium dendrobatidis* (Bd), and climate change (Blaustein and Kiesecker 2002; Beebee and Griffiths 2005; Wake and Vredenburg 2008; Rohr and Raffel 2010; Johnson et al. 2011). Anthropogenic habitat alteration and loss threatens two-thirds of amphibian species (IUCN et al. 2008), but *Bd* and climate change are more prominent in the primary literature (Ohmer and Bishop 2011). One-quarter of species are so poorly understood that their status and threats cannot be determined (IUCN et al. 2008; Alford 2011). Complex interactions might exist between different causes of decline such as *Bd*, climate change, and habitat alteration (Rohr et al. 2008; Rohr and Raffel 2010; Blaustein et al. 2011; Hof et al. 2011). Widespread declines are likely caused by spatially and temporally variable environmental influences and differences in the sensitivity of populations to them (Blaustein and Kiesecker 2002). Estimation of local extinction through occupancy surveys is hindered by imperfect detection of the presence or absence of species (MacKenzie et al. 2002; McClintock et al. 2010). Natural fluctuations in amphibian metapopulations can resemble or obscure declines (Pechmann et al. 1991; Pechmann and Wilbur 1994; Trenham et al. 2003; Werner et al. 2007). Pairwise assessment of current occurrence at historic sites can overestimate local extinction; ecological succession can account for absence of a species at locations where a wetland might no longer be suitable or extant (Thurgate and Pechmann

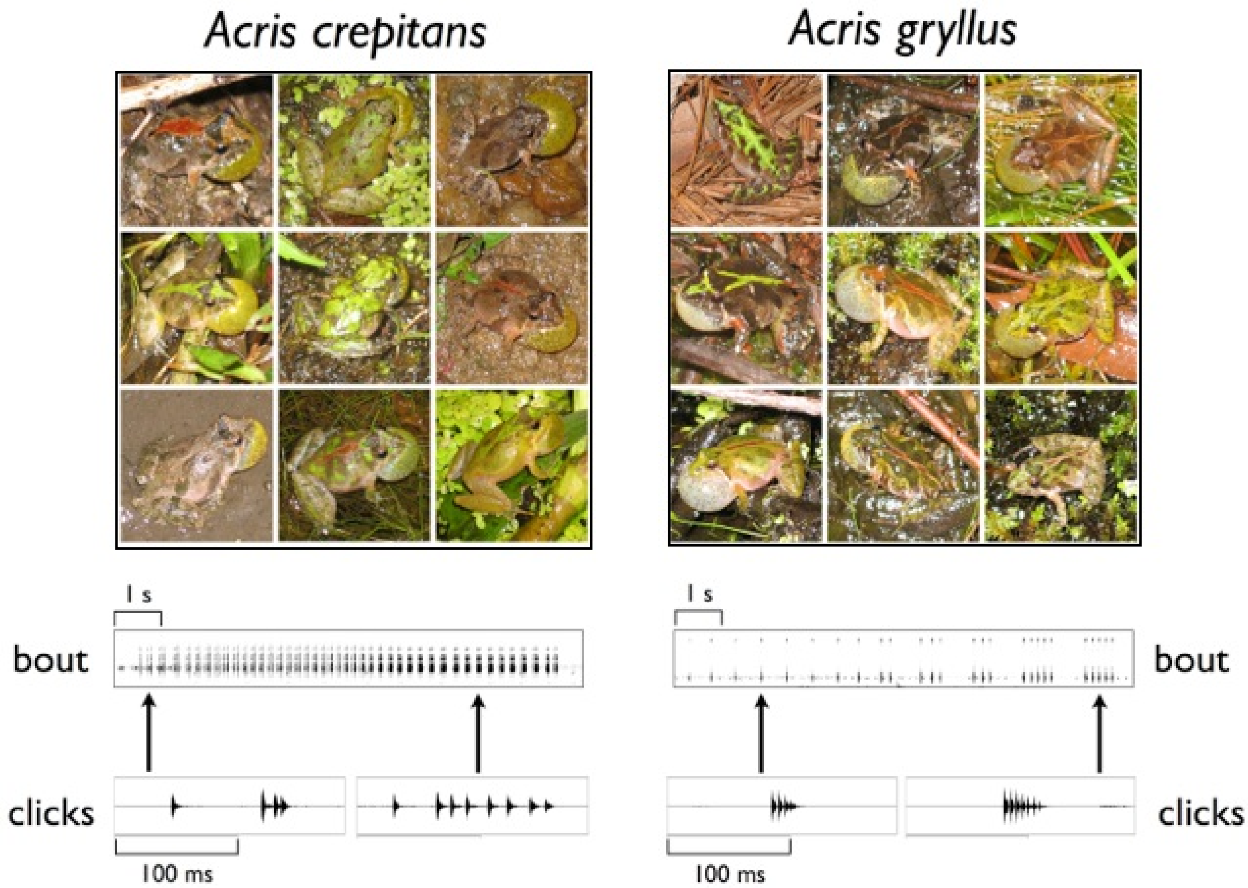

FIGURE 1. The sympatric sibling cricket frogs *Acris crepitans* and *A. gryllus* are highly variable in appearance (photographs), so visual identification is difficult. However, the "click" vocalizations of the two species (depicted in three oscillograms per species with amplitude on the y-axis and time on the x-axis) reliably distinguish them (Micancin and Mette 2009). Click on the photographs to hear the call depicted in the sonogram for each species. If you do not hear sound, verify your computer's volume is on and that you are using the most recent version of Adobe Reader or Adobe Acrobat. (Recorded and photographed by Jonathan Micancin).

2007). Because the causes of most amphibian declines are potentially numerous, heterogeneous, interactive, and difficult to detect, much work remains to understand, let alone mitigate, the global amphibian decline crisis (Beebee and Griffiths 2005; Rohr and Raffel 2010; Blaustein et al. 2011).

Since the 1960s, cricket frogs (genus *Acris*) have disappeared throughout northern portions of their ranges in North America; *A. blanchardi* (Blanchard's Cricket Frog) in the upper Midwest from the Appalachians to the Rocky Mountains and *A. crepitans* (Northern Cricket Frog) in the northeastern United States (Lannoo et al. 1994; Gray et al. 2005; Gibbs et al. 2009). Many anthropogenic influences have been proposed to explain these losses (Beasley et al. 2005; Gray et al. 2005; Irwin 2005; Gibbs et al. 2009; Beauclerc et al. 2010). There has been little progress in evaluating these proposals, perhaps because multiple and interacting changes in a heterogeneous landscape impede detection of the causes of decline (Blaustein et al. 2011). The recently-discovered decline of *A. gryllus* (Southern Cricket Frog) resembles other *Acris* declines by occurring sometime since the 1960s in the northern portion of its range (Micancin and Mette 2009), the species has disappeared from a region of the Atlantic Coastal Plain and Fall Zone (the ecotone between the Coastal Plain and Piedmont Plateau; Beane et al. 2010) in North Carolina (NC) spanning three river basins (Roanoke, Tar-Pamlico, and Neuse). However, the decline of *A. gryllus* pivotally differs from other *Acris* declines by taking place in sympatry and syntopy (Rivas 1964) with a sibling species, *A. crepitans,* which has a stable range in the same region or is expanding from the Piedmont into the Coastal Plain. The two species are similar in ecology, morphology, and behavior (Mecham 1964; Bayless 1969; Micancin 2008) and the difficulty of identifying the two species in sympatry (Fig. 1) likely obscured the decline of *A. gryllus* (Micancin and Mette 2009).

Sympatric *Acris* provide an opportunity to overcome empirical obstacles to evaluating causes of widespread amphibian declines. The physical and taxonomic proximity of the two species suggests that the decline of *A. gryllus* is not caused by agents that are broadly detrimental to amphibian communities, such as *Bd* or total habitat loss. The decline of *A. gryllus* is more likely to be caused by agents that are devastating to that species but not *A. crepitans* in the same assemblages, which might include heterospecific interactions. By comparing these sibling species in heterogenous assemblages, it might be possible to isolate and identify complex causes of local decline and extinction of *A. gryllus*. The decline of *A. gryllus* in the Neuse, Tar-Pamlico, and Roanoke basins in NC is adjacent to the northern range limit of the species in the Chowan and James basins in southeastern Virginia (VA), where extensive sympatry with *A. crepitans* obscures the western and northern limits of *A. gryllus* (Conant and Collins 1991; Mitchell and Reay 1999). In this study, we expanded the geographic scope of our ongoing investigation of the decline of *A. gryllus* in sympatry with *A. crepitans.* We used museum records of *Acris* from 1895–2002, morphometric analysis of specimens from 1939–1989, and an acoustic survey of extant populations in 2010–2011 to describe and compare the historic and current ranges of the *Acris* cryptic sibling species in sympatry and parapatry in VA. By comparing proportional occurrence of populations of *A. gryllus* and *A. crepitans* in sympatry and syntopy, we tested the hypothesis that *A. gryllus* has declined at the global northern limit of its range.

MATERIALS AND METHODS

Catalog and morphometric assessments of historic occurrence.—We used catalog information and specimens from the herpetological collections of the Carnegie Museum of Natural History (CMNH), the North Carolina Museum of Natural Sciences (NCSM), and the National Museum of Natural History (USNM) to describe the 20th Century (C.) occurrence of *A. gryllus* and *A. crepitans* throughout VA. We consolidated the species identity and locality information of 1769 catalog records (383 CMNH, 136 NCSM, and 1250 USNM) at 282 collection sites from 1895–2002 to describe the composition of *Acris* sites (*A. crepitans*, *A. gryllus*, or syntopy). To determine if the museums' records accurately represented the sympatric ranges of these cryptic species, we conducted a morphometric analysis of 205 specimens from 42 sites from 1938–1989. We selected specimens for measurement from sites throughout VA, which is primarily occupied by *A. crepitans* in allopatry according to museum records and range maps (Mitchell and Reay 1999; Beane et al. 2010). Therefore, the majority of specimens were identified in museum catalogs as *A. crepitans* (101 CMNH, 79 USNM, and 13 NCSM) rather than *A. gryllus* (9 NCSM and 4 USNM). We took non-destructive measurements of snout-vent length (SVL), anal tubercle diameter (ATD), and extent of hindfoot webbing from each specimen for analysis with a discriminate function that identifies sympatric *Acris* to species (Micancin and Mette 2009). In sympatry, *A. gryllus* has smaller anal tubercles and less extensive hindfoot webbing than *A. crepitans*. When $P \geq 0.95$ for the discriminant function's identification of a specimen, we either verified or reassigned the catalog identification. If $P < 0.95$, we removed the specimen from further consideration in the analysis. Barring large measurement error, determinate specimens ($P \geq 0.95$) possessed phenotypes that clearly identified them to species. Indeterminate specimens ($P < 0.95$) might possess intermediate phenotypes of hybrids (Mount 1996) or reflect measurement error or limitations of the discriminant function.

We used the locality information for specimens and Google Earth v. 5.2 (Mountain View, California, USA) to map the 20th C. occurrence of *A. gryllus* and *A. crepitans* in VA. We produced two estimates of historic ranges: one using the museums' identifications of specimens at 282 sites and another using the discriminant function's identification of specimens at 42 sites. From these maps, we selected target sites within the historic range of *A. gryllus* in VA for our resurvey in 2010–2011. When locality data of museum specimens were imprecise or when satellite imagery suggested that *Acris* breeding habitat at a historic collection site had been lost through succession or development, we selected up to five possible survey locations within a 2 km diameter around the most likely historic location.

Acoustic survey of current occurrence.—From 18 May to 15 July 2010 and 29 May to 26 June 2011, we surveyed *Acris* choruses at wetlands in the Coastal Plain of southeastern VA and northeastern NC, including historic sites. We surveyed wetlands from Hanover County, VA south through the Richmond metropolitan region to Dinwiddie County and southeast to Gates County, NC and the Great Dismal Swamp National Wildlife Refuge. The survey area encompassed the majority of the Fall Zone and Coastal Plain of southeastern VA. Wetlands ranged in size and permanence from ephemeral puddles and ditches to beaver ponds, millponds, and small reservoirs. When wetlands were located on private or otherwise restricted property, we collected data from the nearest public road or obtained permission to access the site. We began surveying after 2100 each night and ended at approximately 0130 when calling activity waned. We visited each *Acris* chorus between one and three times during the survey period. Choruses were audible from sundown on every night from mid May through late July except on cold or stormy nights or if extremely dry conditions caused small wetlands to disappear late in the season (Micancin 2008). To reduce the opportunity for missed detection of either species in *Acris* choruses, we avoided surveying in these conditions.

At each chorus, we recorded latitude and longitude using a GPS unit (Garmin eTrex Vista Cx, Olathe, Kansas, USA) and took digital photographs of individuals (Canon Powershot G11, Tokyo, Japan). We determined whether the chorus contained *A. crepitans*, *A. gryllus*, or both species by ear and assigned abundance scores (three levels) for each species (Weir et al. 2005) while making a 5 min audio voucher recording (Marantz PMD-661 digital recorder, Kanagawa, Japan; Audio-Technica AT-897 directional microphone, Tokyo, Japan; Beyerdynamic DT 231 supra-aural closed headphones, Heilbronn, Germany; uncompressed .wav files with a sampling rate of 22.05 kHz). Acoustic differences reliably discriminate species in the field (Blair 1958; Nevo and Capranica 1985; Micancin and Mette 2009). Although the vocalizations of *A. crepitans* and *A. gryllus* are similar, consistent differences in the temporal patterns of pulses (Fig. 1) are audible in the field, can be visualized in sound analysis software (WildSpectra, www.unc.edu/~rhwiley/wildspectra), and are sufficient for identification of the two species in syntopy (Nevo and Capranica 1985; Micancin 2008; Micancin and Mette 2009). Males of both species produce rapid pulses of sound that are repeated to form calls or "clicks" (variable around 100 ms in *A. crepitans* and consistently less than 40 ms in *A. gryllus*), that in turn are repeated to form click groups and then bouts of a few seconds to over a minute (Blair 1958; Nevo and Capranica 1985; Wagner 1989; Micancin 2008; Micancin and Mette 2009). The clicks of *A. crepitans* contain 1–7 pulses that are repeated at variable intervals until the last click group of a bout, which is often a distinctive "rattle" of closely-grouped pulses of equal interpulse interval (*Acris crepitans* translates as "clattering locust"). Because of this variation, successive clicks of a single *A. crepitans* male are audibly different. The clicks of *A. gryllus* contain 8–12 pulses that are repeated with little variation in interpulse interval; this interval is always much faster than in *A. crepitans*. Because of the rapid and consistent repetition of pulses, successive clicks of a single *A. gryllus* male are audibly similar (Micancin 2008; Micancin and Mette 2009). To the human ear, *A. crepitans* has long and highly variable clicks and rattles in which pulses are distinguishable while *A. gryllus* has short and invariable clicks that sound not much longer than *A. crepitans* pulses. Therefore, the sympatric species are identifiable in the field, both in allotopy and syntopy, using acoustic survey techniques. Low numbers of one species amidst a large chorus of the other species impedes detection of the minority species, so we observed and recorded choruses with a focus on discriminating individuals and detecting the distinct click structure of either species using a directional microphone and closed headphones. In cases in which we identified both species at a site by ear but could not visualize both species in the digital recording the following day, we revisited the site the next night.

Comparison of historic and current occurrence.— We used chi square to compare *Acris* species composition observed in our 2010–2011 acoustic survey with expected ratios from 20^{th} C. museum collections. Because historic collections from northeastern NC are lacking, we restricted the comparison to VA. We determined whether the proportions of sites in the acoustic survey had changed from historic data if the observed composition had less than a 5% chance of resulting from a random sample of the expected composition ($P \leq 0.05$). We avoided the analysis of current presence-absence at individual historic sites, in part because natural fluctuations within amphibian metapopulations and the impermanence of breeding wetlands can falsely suggest decline (Pechmann et al. 1991; Trenham et al. 2003).

We compared observed sites in 2010–2011 with sites in museum records from 1895–2002, 1895–1949, 1950–1975, and 1976–2002. We also compared 2010–2011 sites with sites in our morphometric analysis of specimens from 1939–1989. All comparisons included total observed (current) and expected (historic) sites throughout the 2010–2011 survey area in southeastern VA as well as sites within three separate areas (Fig. 3): (1) the VA Peninsula and the Fall Zone north of the Appomattox River (R.) ("VA Peninsula"), (2) the Coastal Plain south of the James R. and Appomattox R. and west of the north-south barrier formed by the Blackwater R. and the Surry Scarp ("west of the Blackwater R.") and (3) the Coastal Plain east of the Blackwater R. and Surry Scarp ("east of the Blackwater R."). We identified these subdivisions according to geographic discontinuity in the historic and current data arising from these landscape features. The tidal James R. and urbanization along the Appomattox R. form a likely barrier to north-south dispersal while the Blackwater R. and Surry Scarp define the eastern boundary of current sympatry.

A three-variable Chi square comparison of *A. crepitans*, *A. gryllus*, and syntopic sites produces an impossible statistical result ($P = 0.0$) if the observed (current) composition includes syntopic sites where the expected (historic) composition had none. Micancin and Mette (2009) showed that 20% of sympatric *Acris* were misidentified in the NCSM collection and predicted that syntopy of *A. crepitans* and *A. gryllus* was substantially under-detected in museum collections. Consequently, a higher incidence of syntopic *Acris* in current surveys than in museum collections could arise through improved detection

TABLE 1. Numbers and proportions of sites with *A. crepitans*, *A. gryllus*, or both species in syntopy in an acoustic survey, morphometric analysis of specimens, and museum records in Virginia (VA). Chi square tests of goodness-of-fit (see Results) compared site totals observed in the 2010–2011 acoustic survey in southeastern VA and two component areas (VA Peninsula and Chowan Basin) with expected totals (the products of museum proportions and total sites in 2010–2011); boldface indicates historic (expected) proportions that significantly differed from proportions observed in the acoustic survey. These tests were not performed when expected totals were less than 5.0 (McDonald 2009). Because some museum sites were sampled more than once, the sum of sites from 1895–1949, 1950–1975, and 1976–2002 exceeded total sites in 1895–2002.

	Acoustic Survey 2010–2011		Morphometry 1939–1989		Museum Records 1895–2002		1895–1949		1950–1975		1976–2002	
	n	prop.	n	prop.	n	prop.	n	prop.	n	prop.	n	prop.
Virginia												
A. crepitans	-	-	16	0.43	236	0.84	28	0.65	57	0.73	156	0.92
A. gryllus	-	-	14	0.38	34	0.12	14	0.33	12	0.15	12	0.07
syntopic	-	-	7	0.19	12	0.04	1	0.02	9	0.12	2	0.01
Total	-		37		282		43		78		170	
north & west VA												
A. crepitans	-	-	9	0.6	153	1	21	1	34	1	100	1
A. gryllus	-	-	2	0.13	-	-	-	-	-	-	-	-
syntopic	-	-	4	0.27	-	-	-	-	-	-	-	-
Total			15		153		21		34		100	
southeast VA												
A. crepitans	75	0.54	7	0.32	83	**0.64**	7	**0.32**	23	**0.52**	56	**0.8**
A. gryllus	27	0.19	12	0.55	34	**0.26**	14	**0.64**	12	**0.27**	12	**0.17**
syntopic	38	0.27	3	0.14	12	**0.09**	1	**0.05**	9	**0.2**	2	**0.03**
Total	140		22		129		22		44		70	
VA Peninsula												
A. crepitans	33	0.87	5	0.42	47	0.69	2	0.5	18	**0.53**	29	**0.88**
A. gryllus	0	0	4	0.33	12	0.18	2	0.5	8	**0.24**	3	**0.09**
syntopic	5	0.13	3	0.25	9	0.13	0		8	**0.24**	1	**0.03**
Total	38		12		68		4		34		33	
W. of Blackwater R.												
A. crepitans	42	0.51	2	0.25	33	0.85	5	**0.71**	3	**0.6**	27	**0.93**
A. gryllus	8	0.1	6	0.75	3	0.08	1	**0.14**	1	**0.2**	1	**0.03**
syntopic	33	0.4	-	-	3	0.08	1	**0.14**	1	**0.2**	1	**0.03**
Total	83		8		39		7		5		29	
E. of Blackwater R.												
A. crepitans	-	-	-	-	3	0.14	-	-	2	0.4	1	-
A. gryllus	19	1	2	1	19	0.86	11	1	3	0.6	9	2.25
syntopic	-	-	-	-	-	-	-	-	-	-	-	-
Total	19		2		22		11		5		4	

of the two species in acoustic surveys rather than from a change in composition in southeastern VA since the collection of museum specimens. Therefore, we repeated all three-variable comparisons with two-variable analyses in which we counted each syntopic site as one *A. crepitans* observation and one *A. gryllus* observation. Three-variable comparisons of sites with *A. crepitans*, *A. gryllus*, or syntopy permitted assessment of changes in chorus composition. Two-variable comparisons of observations of *A. crepitans* and *A. gryllus* permitted assessment of changes in relative occurrence of the two species.

RESULTS

***Historic occurrence of sympatric* Acris.—**In museum records of 282 *Acris* collection sites throughout VA from 1895–2002, 236 sites had only *A. crepitans,* 34 had only *A. gryllus,* and 12 sites had the two species in syntopy (Table 1). Of the 205 specimens that we morphometrically analyzed from 42 sites throughout VA, the discriminant function identified ($P > 0.95$) 102 specimens as *A. crepitans* and 55 specimens as *A. gryllus*. The discriminant function changed the identification of 52 specimens: 48 specimens cataloged as *A. crepitans* were re-identified as *A. gryllus* and four

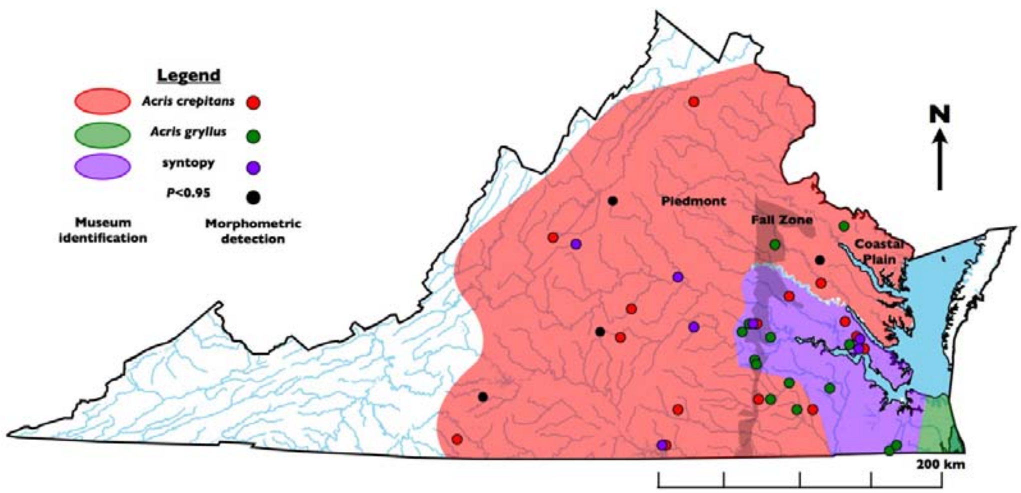

FIGURE 2. Historic ranges of *A. crepitans* and *A. gryllus* in Virginia according to CMNH, NCSM, and USNM records from 282 collection sites in 1895–2002 (shaded areas) and occurrence of the two species according to morphometric identification of museum specimens from 37 sites in 1939–1989 (points). $P < 0.95$ points indicate sites where no determinate identification was made. Fall Zone (dark red shading; adapted from Ator et al. 2005) is the ecotone between the Piedmont and Coastal Plain.

specimens cataloged as *A. gryllus* were re-identified as *A. crepitans*. Analysis of the remaining 48 specimens (23.4%) was inconclusive ($P < 0.95$). Remeasurement of these indistinct specimens (46 catalogued as *A. crepitans*, two as *A. gryllus*) confirmed that they had larger anal tubercle diameters than acoustically-identified *A. gryllus* and more extensive hindfoot webbing than acoustically-identified *A. crepitans*. Whether this reflects greater heterospecific overlap in these phenotypes in VA than in NC or hybridization of the two species is unknown. According to the morphometric analysis, 16 sites had *A. crepitans,* 14 sites had only *A. gryllus,* and eight sites had the two species in syntopy. At four sites, the discriminant function did not conclusively identify ($P < 0.95$) any specimens among the few samples we examined.

Museum catalogs indicated that in the 20th C., the range of *A. gryllus* in VA (Fig. 2) extended from the southeastern coast and the Dismal Swamp west into the eastern (Blackwater R.) and central (Nottoway R.) tributaries of the Chowan R. basin and northwest along the VA Peninsula. The species reached its global northern limit in Hanover County (Co.) north of Richmond and its western limit in VA along the Fall Zone in Chesterfield Co. and Dinwiddie Co. During the same period, the range of *A. crepitans* extended from the Blue Ridge Mountains throughout the Piedmont, Fall Zone, and the Coastal Plain of southeastern VA excluding the area between the Great Dismal Swamp and the Atlantic Ocean. Therefore, according to CMNH, NCSM, and USNM records, the two species were sympatric throughout most of the range of *A. gryllus* in VA. However, syntopy was uncommon in museum collections from this large area of sympatry. Published distributions depict *A. gryllus* occurring throughout the upper Coastal Plain and *A. crepitans* on the Eastern Shore of the Chesapeake (Mitchell and Reay 1999; Beane et al. 2010).

The morphometric analysis re-identified specimens from *A. crepitans* to *A. gryllus* ($P>0.95$) at six sites outside of the known range of *A. gryllus* in VA. These included four sites up to 150 km west of the known range of *A. gryllus* in Amelia Co. in 1987 (CMNH 130048, 130050, 130053, 130056, 130060, 130061, 130063, 130069, 130074), Augusta Co. in 1988 (CMNH 128542), Cumberland Co. in 1989 (CMNH 130101), and Mecklenburg Co. in 1988 (CMNH 128417), and two sites up to 80 km north of the known range of the species in Caroline Co. in 1966 (USNM 485832) and Westmoreland Co. in 1964 (USNM 405630). The morphometric re-identification of the only specimen cataloged as *A. crepitans* (USNM 404582) to *A. gryllus* from the Great Dismal Swamp suggested that only *A. gryllus* occupied the extreme southeast of VA in the 20th C.

Current occurrence of sympatric* Acris *in southeastern Virginia.—In our 2010–2011 acoustic survey, we identified *Acris* at 140 choruses in southeastern VA from the Fall Zone north of the Appomattox R. (the Richmond metropolitan area) and VA Peninsula to the NC border (Table 1 and Fig. 3). We identified 75 choruses with only *A. crepitans*, 27 choruses with only *A. gryllus*, and 38 syntopic choruses.

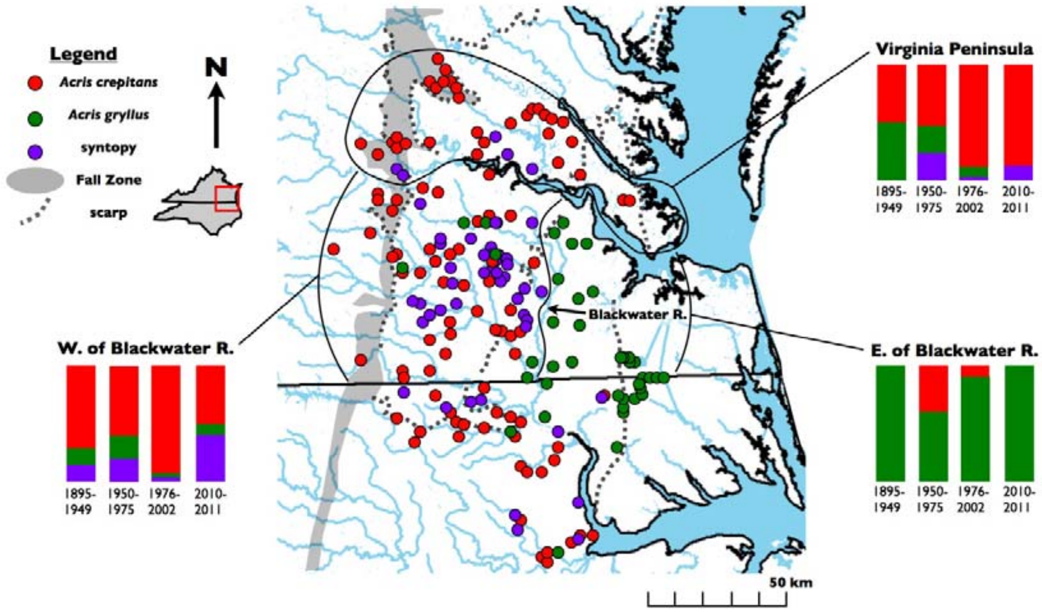

FIGURE 3. Chorus composition at 140 sites in southeastern VA and 47 sites in northeastern NC in 2010–2011. Bar graphs denote historic and current (2010-2011) proportions of choruses of *A. crepitans*, *A. gryllus*, and both species in VA. Sites in NC were not used in the analysis because historic data are lacking in this area. Fall Zone and scarps were adapted from Ator et al. (2005).

All 19 choruses east of the Blackwater R., including 11 choruses in the Dismal Swamp National Wildlife Refuge, had only *A. gryllus*. Of 83 choruses west of the Blackwater R., 42 were entirely *A. crepitans*, eight were entirely *A. gryllus*, and 33 had *A. crepitans* and *A. gryllus* in syntopy. Therefore, between the Blackwater R. and the Fall Zone, *A. gryllus* rarely occurred without *A. crepitans* while *A. crepitans* often occurred without *A. gryllus*. Of 38 choruses on the VA Peninsula, 33 were entirely *A. crepitans*, none had only *A. gryllus*, and five had *A. crepitans* and *A. gryllus* in syntopy.

Changes between historic and current occurrence in southeastern Virginia.—We identified three different conditions in *Acris* proportions east and west of the Blackwater R. and along the VA Peninsula (Tables 1 and 2, Fig. 3). Additively, these conditions resulted in no significant difference (χ^2 = 1.23, df = 1, P = 0.267) throughout southeastern VA between observed proportions of occurrence in 2010–2011 (0.63 *A. crepitans*, 0.37 *A. gryllus*) and expected proportions from all 1895–2002 museum records (0.67 *A. crepitans*, 0.33 *A. gryllus*). The significant difference (χ^2 = 53.08, df = 2, P < 0.001) between observed proportions of composition in southeastern VA (0.54 *A. crepitans*, 0.19 *A. gryllus*, 0.27 syntopy) and expected proportions from the overall museum record (0.64 *A. crepitans*, 0.26 *A. gryllus*, 0.09 syntopy) suggests that syntopy was underrepresented in museum records of the 20th C. or that it was significantly higher in 2010–2011. Without excluding an increase in syntopy, the significantly higher proportion (χ^2 = 10.656, df = 2, P = 0.005) of *A. gryllus* detected in the morphometric analysis (n = 22 sites; 0.32 *A. crepitans*, 0.55 *A. gryllus*, 0.14 syntopy) compared to the overall museum record indicated that *A. gryllus* is under-represented in the museum record of southeastern VA.

East of the Blackwater R., *A. gryllus* appears to remain in allopatry. There was no significant difference (χ^2 = 3.00, df = 1, P = 0.083) between proportions of current occupancy (n = 19 observations; 0.00 *A. crepitans*, 1.00 *A. gryllus*) and the museum record in 1895–2002 (n = 22 observations; 0.14 *A. crepitans*, 0.86 *A. gryllus*). One of the three historic records of *A. crepitans* in this area was invalidated in the morphometric analysis and all records of *A. crepitans* east of the Blackwater R. are suspect (Joseph Mitchell, pers. comm.). In the absence of *A. crepitans* in the current assessment and the rarity and unreliability of historic records of the species, it is does not appear that there has been any change in the allopatric occurrence of *A. gryllus* east of the Blackwater R..

West of the Blackwater R., higher proportions of *A. gryllus* and syntopy in the current survey than the museum record could result from historic misdetection of *A. gryllus* or extensive current syntopy in areas that were not represented in museum collections. The proportion of *A. gryllus* in the acoustic survey (n = 116 observations; 0.65 *A. crepitans*, 0.35 *A. gryllus*) was significantly higher than in the 1895–2002 museum

TABLE 2. Occurrence of *A. crepitans* and *A. gryllus* in the acoustic survey, morphometric analysis of specimens, and museum records. Occurrence totals were calculated by adding syntopic sites to the site totals for each species (Table 1), so total occurrence exceeded total sites in each area. Because some museum sites were sampled more than once, the sum of totals from 1895–1949, 1950–1975, and 1976–2002 exceeded total in 1895–2002. Chi square tests of goodness-of-fit (df = 1) compared occurrence totals observed in the 2010–2011 acoustic survey with expected totals derived from museum records and total observations in 2010–2011; boldface indicates historic (expected) proportions that significantly differed from proportions observed in the acoustic survey. Tests were not performed when any expected total < 5.0 (McDonald 2009).

	Acoustic Survey 2010–2011		Morphometry 1939–1989		Museum Records 1895–2002		Museum Records 1895–1949		Museum Records 1950–1975		Museum Records 1976–2002	
	N	prop.	N	prop.	N	prop.	N	prop.	N	prop.	N	prop.
Virginia												
A. crepitans	110	0.62	23		248	0.84	29	0.66	154	0.88	158	0.92
A. gryllus	67	0.38	21		46	0.16	15	0.34	21	0.12	14	0.08
Total	177		44		294		44		175		172	
north & west VA	-	-	13	0.68	153	1	21	1	122	1	100	1
A. crepitans	-	-	6	0.32								
A. gryllus			19		153		21		122		100	
Total	-	-	13	0.68	153	1	21	1	122	1	100	1
southeast VA												
A. crepitans	110	0.62	10	0.4	95	0.67	8	**0.35**	32	0.6	58	**0.81**
A. gryllus	67	0.38	15	0.6	46	0.33	15	**0.65**	21	0.4	14	**0.19**
Total	177		25		141		23		53		72	
VA Peninsula												
A. crepitans	38	0.88	8	0.53	56	**0.73**	2	**0.5**	26	**0.62**	30	0.88
A. gryllus	5	0.12	7	0.47	21	**0.27**	2	**0.5**	16	**0.38**	4	0.12
Total	43		15		77		4		42		34	
W. of Blackwater R.												
A. crepitans	75	0.65	2	0.25	36	**0.86**	6	**0.75**	4	0.67	28	**0.93**
A. gryllus	41	0.35	6	0.75	6	**0.14**	2	**0.25**	2	0.33	2	**0.07**
Total	116		8		42		8		6		30	
E. of Blackwater R.												
A. crepitans	0		0	0	3	0.14		0	2	**0.4**	1	0.1
A. gryllus	19	1	2	1	19	0.86	11	1	3	**0.6**	9	0.9
Total	19		2		22		11		5		10	

record (n = 42 observations; 0.86 *A. crepitans*, 0.14 *A. gryllus*; $\chi^2 = 42.01$, df = 1, $P < 0.001$). The higher current proportion of *A. gryllus* was significant in comparison with 1895–1949 (n = 8 observations; 0.75 *A. crepitans*, 0.25 *A. gryllus*; $\chi^2 = 6.62$, df = 1, $P = 0.010$) and 1976–2002 (n = 30 observations; 0.93 *A. crepitans*, 0.07 *A. gryllus*; $\chi^2 = 153.33$, df = 1, $P < 0.001$) but not in comparison with 1950–1975 (n = 6 observations; 0.67 *A. crepitans*, 0.33 *A. gryllus*; $\chi^2 = 0.21$, df = 1, $P = 0.647$). The higher current proportion of *A. gryllus* occurrence arose from much higher proportion of syntopic choruses (n = 83 sites; 0.51 *A. crepitans*, 0.10 *A. gryllus*, 0.40 syntopy) in comparison with the museum record in 1895–2002 (n = 39 sites; 0.85 *A. crepitans*, 0.08 *A. gryllus*, 0.08 syntopy; $\chi^2 = 122.71$, df = 2, $P < 0.001$), in 1895–1949 (n = 7 sites; 0.71 *A. crepitans*, 0.14 *A. gryllus*, 0.14 syntopy; $\chi^2 = 44.00$, df = 2, $P < 0.001$), in 1950–1975 (n = 5 sites; 0.60 *A. crepitans*, 0.20 *A. gryllus*, 0.20 syntopy; $\chi^2 = 21.88$, df = 2, $P < 0.001$), and in 1976–2002 (n = 29 sites; 0.93 *A. crepitans*, 0.03 *A. gryllus*, 0.03 syntopy; $\chi^2 = 342.68$, df = 2, $P < 0.001$). Morphometric assessment indicated that *A. gryllus* specimens were frequently misidentified as *A. crepitans* from this area. Such historic misidentification would contribute to the underestimation of syntopy, but we observed current syntopy at just one wetland that was represented in museum record as only *A. crepitans*. Instead, we found 39 syntopic choruses at wetlands in the Blackwater R. and Nottoway basins that were not represented in museum collections, particularly in Sussex Co. (two of three wetlands with historic syntopy remain syntopic; one in Dinwiddie Co. now only has *A. crepitans*). The observed increase in syntopy west of the Blackwater R. likely results from the observation of both species at sites where historic data were unavailable, but historic misdetection of syntopic *A. gryllus* remains an obstacle.

On the VA Peninsula, *A. gryllus* has declined relative to *A. crepitans*. The proportion of *A. gryllus* occurrence was significantly lower in the current survey (n = 43 observations; 0.88 *A. crepitans*, 0.12 *A. gryllus*) than in the museum record in 1895–2002 (n = 77 observations; 0.73 *A. crepitans*, 0.27 *A. gryllus*; $\chi^2 = 5.31$, df = 1, $P = 0.0212$), 1895–1949 (n = 4 observations; 0.50 *A.*

crepitans, 0.50 *A. gryllus*; χ^2 = 25.33, df = 1, *P* < 0.001), and 1950–1975 (n = 42 observations; 0.62 *A. crepitans*, 0.38 *A. gryllus;* χ^2 = 12.77, df = 1, *P* < 0.001). Current proportions of the two species were identical with the record in 1976–2002 (n = 34 observations; 0.88 *A. crepitans*, 0.12 *A. gryllus;* χ^2 = 0.00, df = 1, *P* = 1.00). With no *A. gryllus* sites and few syntopic ones, the current composition (n = 38 sites; 0.87 *A. crepitans*, 0.00 *A. gryllus*, 0.13 syntopy) differed significantly from the museum record in 1895–2002 (n = 68 sites; 0.69 *A. crepitans*, 0.18 *A. gryllus*, 0.18 syntopy; χ^2 = 8.43, df = 2, *P* = 0.0148), in 1950–1975 (n = 34 sites; 0.53 *A. crepitans*, 0.24 *A. gryllus*, 0.24 syntopy; χ^2 = 18.93, df = 2, *P* < 0.001) and in 1976–2002 (n = 33 sites; 0.88 *A. crepitans*, 0.09 *A. gryllus*, 0.03 syntopy; χ^2 = 16.32, df = 2, *P* < 0.001). This indicates that *A. gryllus* was historically allotopic at some sites but the species currently only occurs in syntopy with *A. crepitans.*

Of 140 sites in the acoustic survey of southeastern VA, 19 sites (15 *A. crepitans*, 2 *A. gryllus*, 2 syntopy) closely matched with specific locality information for specimens in museum records from 1955–1987 (11 *A. crepitans*, five *A. gryllus*, three syntopy) but low sample size precluded a statistical assessment. West of the Blackwater R. at nine historic sites (six *A. crepitans*, two *A. gryllus*, one syntopic), the current composition (seven *A. crepitans*, zero *A. gryllus*, two syntopic) appeared equivalent. However, at the northwestern part of the area near the Appomattox R., a historic *A. gryllus* site and a syntopic site both had *A. crepitans* in 2010. At eight historic sites on the VA Peninsula (five *A. crepitans*, one *A. gryllus*, two syntopic), all had only *A. crepitans* in 2010.

DISCUSSION

Our hypothesis that *A. gryllus* is declining in southeastern VA was supported. Our comparison of a 2010–2011 acoustic survey with occurrence expected from 20th C. museum records showed that the species has decreased substantially in proportion to *A. crepitans* along the VA Peninsula and the Fall Zone near Richmond. In 2010, we observed *A. gryllus* only in syntopy with *A. crepitans* on the VA Peninsula and we observed only *A. crepitans* around historic *A. gryllus* sites north of Richmond. This area is recognized as the global northern limit of the range of *A. gryllus* (Conant and Collins 1991; Mitchell and Reay 1999). However, morphometric identification of *A. gryllus* further north or west suggested that the species had a larger range in VA as late as 1989. This is concordant with reports of *A. gryllus* above the Fall Zone in the Valley and Ridge Appalachians and Cumberland Plateau of Alabama, Georgia, and Tennessee (Mount 1996; Jensen et al. 2008; Niemiller and Reynolds 2011). East of the Blackwater R., *A. gryllus* remains in allopatry, but we were unsuccessful in locating extant *Acris* near historic sites north or east of the Great Dismal Swamp National Wildlife Refuge. West of the Blackwater R., the sympatric distributions of *A. gryllus* and *A. crepitans* appear largely unchanged. However, frequent misidentification of *A. gryllus* as *A. crepitans* in museum collections suggests that local extinction of *A. gryllus* is underestimated.

Observational error is an obstacle to identifying changes in occurrence of amphibians because imperfect detection of species can result in inaccurate estimation of occupancy and extinction (MacKenzie et al. 2002; Mazerolle et al. 2007; McClintock et al. 2010). Reducing the consequences of missed detections and false positives in presence-absence studies is possible through repeat sampling of sites followed by estimation of detection probabilities and correction for differences in them (MacKenzie et al. 2002; Mazerolle et al. 2007; Archaux et al. 2011; Bonardi et al. 2011; Olson et al. 2012). However, repeat sampling of field sites to determine detection probabilities can be temporally and financially prohibitive (Welsh et al. 2008; Gómez-Rodríguez et al. 2011), especially in studies across large geographic areas. In such studies, historic occurrence often must be determined from presence-only data composed primarily of small collections of specimens from single visits to sites with imprecise or faulty locality information, which greatly increase the likelihood of error when describing past occurrence of sympatric species (Lips et al. 2004). Analytical approaches that account for the detection reliability of focal species without repeat visits to sites have been proposed (Welsh et al. 2008; Bonardi et al. 2011; Gómez-Rodríguez et al. 2011; Molinari-Jobin et al. 2012). To improve the reliability of field surveys, it is also important to select observational methods that optimize detection of the focal organisms in their particular habitats (Britton et al. 2011). Comparisons of sympatric sibling species can be used to determine relative changes in occurrence and abundance (Bayoh et al. 2010).

We examined the status of *A. gryllus* and *A. crepitans* in southeastern VA by comparing presence-only current observations and historic data that differed in detection probabilities of the two species and biased the analysis against describing a decline of *A. gryllus*. In the acoustic survey, missed detections and false positives for either species were reduced by documenting chorus composition using recording equipment and acoustic analysis software that reduced missed detections and minimized false positives (Shirose et al. 1997; Bridges and Dorcas 2000; Genet and Sargent 2003). Missed detections were more likely than false positives in the acoustic survey, but whether these missed detections greatly favor either species because of species differences in transmission efficiency (Ryan and

Wilczynski 1991) is unknown. More importantly, any detection bias against *A. gryllus* in the acoustic survey would need to be substantial to approach the level of bias against the species in the historic record. Most sites in the large area of sympatry on the VA Peninsula south through the Chowan basin were represented in museum collections by specimens of one or the other species, not both. These sites were typically represented by five or fewer specimens and often by only one, which necessarily under-detects syntopic sites and increases the consequences of misidentification of specimens while also limiting our ability to use morphometric analysis to describe historic syntopy of the two species. The frequent misidentification of *A. gryllus* as *A. crepitans* in museum collections reduced the expected (historic) proportions of *A. gryllus* and *A. crepitans* that we compared to observed (current) proportions in chi square tests. Therefore, the decline of *A. gryllus* on the VA Peninsula is more likely to be conservatively estimated than to be overestimated.

Detecting *A. gryllus* in sympatry with its cryptic sibling is easier than detecting many other amphibians with similar ranges and often similar relationships with sibling species in the Atlantic Coastal Plain, the area of highest amphibian diversity in temperate North America (Duellman and Sweet 1999; Smith et al. 2005; Rissler and Smith 2010). The rapid and loud calling of many individual *A. gryllus* and *A. crepitans* in seasonally-prolonged choruses means that both species are audible at more sites and at longer distances than many other species with smaller, fewer, shorter, or quieter breeding aggregations. Among anurans of the Coastal Plain of southeastern VA and northeastern NC, declines are known or suspected in *Acris gryllus*, *Anaxyrus quercicus*, *Hyla gratiosa*, *Lithobates virgatipes*, *Pseudacris nigrita*, *P. ocularis*, and *Scaphiopus holbrookii* (North Carolina Wildlife Resources Commission 2005; Virginia Department of Game and Inland Fisheries 2005; Micancin and Mette 2009). All but *S. holbrookii* exhibit a pattern of distribution among amphibians and reptiles of the Coastal Plain in which regional or global range limits exist in southeastern VA (Beane et al. 2010); these species also share a suspected pattern in which Coastal Plain species have disjunct distributions in southeastern VA and southern NC separated by north-central NC. Like in *A. gryllus*, a decline is suspected in the chorus frog *Pseudacris nigrita* in the upper Coastal Plain of NC in sympatry or parapatry with a cryptic sibling species more familiar from the Piedmont, *P. feriarum* (Lemmon 2009). The exceptional diversity of amphibians in southeastern VA and northeastern NC arises in part from ecotones between the Piedmont Plateau, Southern Atlantic Coastal Plain, and Northern Atlantic Coastal Plain (Ator et al. 2005) that result in complex amphibian assemblages across a variety of habitats. Declines among these assemblages could have substantial negative influences on ecosystem function and regional diversity. Despite the importance of southeastern VA and northeastern NC for amphibian diversity, suspected declines in this area have received little scrutiny. It might be possible to address this scientific deficiency by using the decline of *A. gryllus* to predict the causes of decline of less-easily studied species in the same habitats, particularly *Anaxyrus quercicus*, *Hyla gratiosa*, *Lithobates virgatipes*, *Pseudacris nigrita*, and *P. ocularis*. Early work on sympatric *Acris* suggested that *A. gryllus* is associated with ephemeral or isolated wetlands in pine savannas while *A. crepitans* is associated with larger permanent wetlands in mixed forests (Viosca 1923; Mecham 1964; Boyd 1964; Bayless 1969). Disjunct declines in *A. gryllus* might result from reductions in preferred habitat and subsequent increasing contact with *A. crepitans*. Other species with similar habitat associations as *A. gryllus* might be similarly perturbed.

The decline of *A. gryllus* in NC and VA permits an investigation that is not possible in the declines of *A. blanchardi* in the Midwest and *A. crepitans* in the Northeast. These declines are similar in that each is occurring across vast areas at the northern edge of the species' ranges, but only *A. gryllus* is declining in sympatry with a sibling species that is stable or expanding (Micancin and Mette 2009). Historic and current sympatry and syntopy between *A. gryllus* and *A. crepitans* might allow the segregation of factors affecting both species, such as stochastic fluctuations (Pechmann et al. 1991; Pechmann and Wilbur 1994; Blaustein et al. 2011) and total habitat loss (Micancin and Mette 2009), from more subtle factors that only detrimentally affect *A. gryllus*. This examination might also identify factors associated with the persistence or expansion of *A. crepitans* in the Mid-Atlantic Coastal Plain (Ator et al. 2005) that could apply to studies of its decline in the Northeast.

Knowledge of the status of *A. gryllus* in Virginia is facilitating our current efforts to examine potential causes of the decline of *A. gryllus* in sympatry with *A. crepitans*. Together with the previous study (Micancin and Mette 2009), we have examined the northeastern 380 km of the sympatric ranges of *A. gryllus* and *A. crepitans* and adjacent areas of allopatry of both species. This region includes two noncontiguous areas with decline or disappearance of *A. gryllus* (VA Peninsula and the Roanoke, Tar, and Neuse basins in NC) and two noncontiguous areas where sympatric *A. gryllus* and *A. crepitans* are relatively persistent (west of the Blackwater R. in VA and the Cape Fear basin in NC). Current efforts include a spatial analysis of habitat features associated with occurrence and abundance of the two species, a study of population genetics, and repeat surveys to identify microhabitat associations and temporal variation in occurrence and abundance of the two species in sympatry and syntopy. Future efforts could include an acoustic resurvey and a comprehensive morphometric study of museum specimens to refine the spatial and temporal descriptions of the declines of *A. gryllus.* There is a deficiency of studies that integrate and assess multiple agents of amphibian decline by relating changes in distributions to changes in habitats and demography (Beebee and Griffiths 2005; Blaustein et al. 2011). Within sympatry in VA and NC, spatial heterogeneity in occurrence of *A. gryllus* and *A. crepitans* might permit evaluation of changes in distributions and relative abundance along with spatial variation in habitats and demography and reproductive behavior of the two species.

We suspect that the stability of widespread amphibians is overestimated because high-resolution distributional data remain uncommon and research efforts favor species with smaller ranges. Other studies could use our approach to sympatric *Acris* to detect cryptic declines among widespread species in the southeastern United States or elsewhere. The current status of *A. gryllus* in sympatry with *A. crepitans* relative to 20th C. museum records remains unknown in South Carolina, Georgia, Florida, Alabama, and Mississippi, as does the status of many other anuran species in the Atlantic Coastal Plain. Collaborations of professionals, students, and volunteers can evaluate anurans in this important region of diversity with modest additions to the regular equipment of field biologists and without substantial funding or complex statistical analysis. Such efforts can rapidly increase knowledge of the status of many species of amphibians.

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APPENDIX 1. Chorus composition and geographic coordinates (NAD83) of *Acris* sites in southeastern Virginia (VA) and northeastern North Carolina (NC) in 2010-2011.

Site	Chorus	Latitude	Longitude	County	State	Date
2010 001	*A. crepitans*	37.27415	-76.72379	Williamsburg	VA	18-May-10
2010 002	*A. crepitans*	37.27304	-76.72357	Williamsburg	VA	20-May-10
2010 003	*A. crepitans*	37.26927	-76.72767	Williamsburg	VA	20-May-10
2010 004	*A. crepitans*	37.55453	-77.26995	Hanover	VA	21-May-10
2010 005	*A. crepitans*	37.59223	-77.2963	Hanover	VA	21-May-10
2010 006	*A. crepitans*	37.58301	-77.34885	Hanover	VA	22-May-10
2010 007	*A. crepitans*	37.45853	-76.8655	New Kent	VA	24-May-10
2010 008	*A. crepitans*	37.48351	-76.88621	New Kent	VA	24-May-10
2010 009	*A. crepitans*	37.48307	-76.90628	New Kent	VA	24-May-10
2010 010	*A. crepitans*	37.44315	-77.04681	New Kent	VA	24-May-10
2010 011	*A. crepitans*	37.4657	-76.92904	New Kent	VA	24-May-10
2010 012	*A. crepitans*	37.44873	-76.83772	James City	VA	25-May-10
2010 013	*A. crepitans*	37.43845	-76.78656	New Kent	VA	25-May-10
2010 014	*A. crepitans*	37.40585	-76.85141	James City	VA	25-May-10
2010 015	*A. crepitans*	37.37046	-76.74326	James City	VA	26-May-10
2010 016	*A. crepitans*	37.29708	-76.81931	James City	VA	26-May-10
2010 017	*A. crepitans*	37.59067	-77.35799	Hanover	VA	26-May-10
2010 018	*A. crepitans*	37.58904	-77.36049	Hanover	VA	26-May-10
2010 019	*A. crepitans*	37.65649	-77.3497	Hanover	VA	26-May-10
2010 020	*A. crepitans*	37.65417	-77.3472	Hanover	VA	26-May-10
2010 021	*A. crepitans*	37.62338	-77.32541	Hanover	VA	26-May-10
2010 022	*A. crepitans*	37.37697	-77.38207	Hanover	VA	2-Jun-10
2010 023	*A. crepitans*	37.38262	-77.48131	Chesterfield	VA	2-Jun-10
2010 024	*A. crepitans*	37.37499	-77.51356	Chesterfield	VA	2-Jun-10
2010 025	*A. crepitans*	37.3884	-77.51636	Chesterfield	VA	2-Jun-10
2010 026	*A. crepitans*	37.3848	-77.52792	Chesterfield	VA	2-Jun-10
2010 027	*A. crepitans*	37.36883	-77.61639	Chesterfield	VA	2-Jun-10
2010 028	*A. crepitans*	37.32479	-77.55319	Chesterfield	VA	2-Jun-10
2010 029	syntopic	37.31077	-77.50773	Chesterfield	VA	2-Jun-10
2010 030	syntopic	37.29319	-77.49191	Chesterfield	VA	2-Jun-10
2010 031	*A. gryllus*	36.59143	-76.48965	Suffolk	VA	4-Jun-10
2010 032	*A. gryllus*	36.59088	-76.50173	Suffolk	VA	4-Jun-10
2010 033	*A. gryllus*	36.59042	-76.51381	Suffolk	VA	4-Jun-10
2010 034	*A. gryllus*	36.59248	-76.52307	Suffolk	VA	4-Jun-10
2010 035	*A. gryllus*	36.60077	-76.52363	Suffolk	VA	4-Jun-10
2010 036	*A. gryllus*	36.60941	-76.52423	Suffolk	VA	4-Jun-10
2010 037	*A. gryllus*	36.61836	-76.52474	Suffolk	VA	4-Jun-10
2010 038	*A. gryllus*	36.62086	-76.53349	Suffolk	VA	4-Jun-10
2010 039	*A. gryllus*	36.62087	-76.54485	Suffolk	VA	4-Jun-10
2010 040	*A. gryllus*	36.29789	-76.5809	Chowan	NC	4-Jun-10
2010 041	*A. gryllus*	36.54863	-76.42621	Camden	NC	5-Jun-10
2010 042	*A. gryllus*	36.5474	-76.44597	Camden	NC	5-Jun-10
2010 043	*A. gryllus*	36.54724	-76.46555	Camden	NC	5-Jun-10
2010 044	*A. gryllus*	36.5325	-76.46796	Camden	NC	5-Jun-10
2010 045	*A. gryllus*	36.52979	-76.46786	Camden	NC	5-Jun-10
2010 046	*A. gryllus*	36.51502	-76.47328	Camden	NC	5-Jun-10
2010 047	*A. gryllus*	36.51491	-76.49754	Gates	NC	5-Jun-10
2010 048	*A. gryllus*	36.50443	-76.49853	Gates	NC	5-Jun-10
2010 049	*A. gryllus*	36.49492	-76.4984	Gates	NC	5-Jun-10
2010 050	*A. gryllus*	36.49056	-76.49826	Gates	NC	5-Jun-10
2010 051	*A. gryllus*	36.43635	-76.49692	Gates	NC	5-Jun-10
2010 052	*A. gryllus*	36.44061	-76.53076	Gates	NC	5-Jun-10
2010 053	syntopic	36.93592	-77.08583	Sussex	VA	7-Jun-10
2010 054	syntopic	36.94467	-77.06742	Sussex	VA	7-Jun-10
2010 055	syntopic	36.95331	-77.07681	Sussex	VA	7-Jun-10
2010 056	*A. crepitans*	36.95784	-77.09523	Sussex	VA	7-Jun-10
2010 057	syntopic	36.96567	-77.09388	Sussex	VA	7-Jun-10
2010 058	*A. gryllus*	36.9674	-77.08829	Sussex	VA	7-Jun-10
2010 059	*A. crepitans*	36.96858	-77.08595	Sussex	VA	7-Jun-10
2010 060	syntopic	36.97187	-77.06876	Sussex	VA	7-Jun-10
2010 061	syntopic	36.98694	-77.05562	Sussex	VA	7-Jun-10
2010 062	syntopic	36.98362	-77.07718	Sussex	VA	8-Jun-10
2010 063	syntopic	36.97359	-77.0231	Sussex	VA	9-Jun-10
2010 064	syntopic	36.96446	-77.02496	Sussex	VA	9-Jun-10
2010 065	syntopic	36.96688	-77.02873	Sussex	VA	9-Jun-10

APPENDIX 1. Chorus composition and geographic coordinates (NAD83) of *Acris* sites in southeastern Virginia (VA) and northeastern North Carolina (NC) in 2010-2011.

Site	Chorus	Latitude	Longitude	County	State	Date
2010 066	syntopic	36.9074	-77.10454	Sussex	VA	9-Jun-10
2010 067	syntopic	36.99775	-77.07254	Sussex	VA	9-Jun-10
2010 068	syntopic	37.1093	-76.91137	Surry	VA	15-Jun-10
2010 069	*A. gryllus*	37.08593	-76.84283	Surry	VA	15-Jun-10
2010 070	*A. gryllus*	37.09985	-76.82091	Surry	VA	15-Jun-10
2010 071	*A. gryllus*	37.03278	-76.77409	Surry	VA	15-Jun-10
2010 072	*A. gryllus*	37.03186	-76.72742	Isle of Wight	VA	15-Jun-10
2010 073	*A. gryllus*	36.90524	-76.82263	Southampton	VA	15-Jun-10
2010 074	*A. gryllus*	36.84694	-76.75279	Isle of Wight	VA	15-Jun-10
2010 075	*A. gryllus*	36.87167	-76.69986	Isle of Wight	VA	15-Jun-10
2010 076	*A. crepitans*	36.91046	-76.90898	Southampton	VA	16-Jun-10
2010 077	syntopic	36.87727	-76.95635	Southampton	VA	16-Jun-10
2010 078	syntopic	36.80757	-76.98623	Southampton	VA	16-Jun-10
2010 079	syntopic	36.79842	-76.97736	Southampton	VA	16-Jun-10
2010 080	syntopic	36.77396	-77.00242	Southampton	VA	16-Jun-10
2010 081	*A. crepitans*	36.75444	-77.00472	Southampton	VA	16-Jun-10
2010 082	*A. gryllus*	36.76809	-76.83423	Isle of Wight	VA	16-Jun-10
2010 083	*A. gryllus*	36.75467	-76.73764	Suffolk	VA	16-Jun-10
2010 084	*A. crepitans*	37.10341	-76.96887	Surry	VA	17-Jun-10
2010 085	syntopic	37.0906	-77.03409	Surry	VA	17-Jun-10
2010 086	*A. gryllus*	37.09945	-77.049	Surry	VA	17-Jun-10
2010 087	syntopic	37.11144	-77.0599	Surry	VA	17-Jun-10
2010 088	*A. crepitans*	37.11343	-77.06203	Surry	VA	17-Jun-10
2010 089	*A. crepitans*	37.11488	-77.07261	Surry	VA	17-Jun-10
2010 090	*A. gryllus*	37.1012	-77.08028	Surry	VA	17-Jun-10
2010 091	syntopic	37.1158	-77.09375	Surry	VA	17-Jun-10
2010 092	*A. crepitans*	37.10164	-77.14279	Sussex	VA	17-Jun-10
2010 093	syntopic	37.03101	-77.15573	Sussex	VA	17-Jun-10
2010 094	*A. crepitans*	37.00846	-77.19251	Sussex	VA	17-Jun-10
2010 095	*A. crepitans*	37.00088	-77.21831	Sussex	VA	17-Jun-10
2010 096	*A. crepitans*	36.9805	-77.26617	Sussex	VA	17-Jun-10
2010 097	*A. crepitans*	37.02254	-77.28859	Sussex	VA	17-Jun-10
2010 098	syntopic	37.03359	-77.25706	Sussex	VA	17-Jun-10
2010 099	syntopic	37.04422	-77.25076	Sussex	VA	17-Jun-10
2010 100	*A. gryllus*	37.0926	-77.19298	Sussex	VA	17-Jun-10
2010 101	*A. crepitans*	36.94758	-77.3913	Sussex	VA	18-Jun-10
2010 102	*A. crepitans*	36.94292	-77.45262	Sussex	VA	18-Jun-10
2010 103	*A. gryllus*	36.95251	-77.45341	Sussex	VA	18-Jun-10
2010 104	*A. crepitans*	36.99492	-77.47625	Dinwiddie	VA	18-Jun-10
2010 104B	*A. crepitans*	36.98763	-77.48655	Dinwiddie	VA	18-Jun-10
2010 105	syntopic	37.11065	-77.32457	Prince George	VA	18-Jun-10
2010 106	*A. crepitans*	37.18109	-77.33661	Prince George	VA	18-Jun-10
2010 107	*A. crepitans*	37.19476	-77.40198	Petersburg	VA	18-Jun-10
2010 108	*A. crepitans*	37.24852	-77.15153	Prince George	VA	18-Jun-10
2010 109	*A. gryllus*	36.40435	-76.54167	Gates	NC	20-Jun-10
2010 110	*A. gryllus*	36.4239	-76.54012	Gates	NC	20-Jun-10
2010 111	*A. gryllus*	36.4637	-76.55888	Gates	NC	20-Jun-10
2010 112	syntopic	36.92002	-77.26235	Sussex	VA	23-Jun-10
2010 113	*A. crepitans*	36.99029	-77.73642	Dinwiddie	VA	23-Jun-10
2010 114	*A. crepitans*	37.06822	-77.60418	Dinwiddie	VA	23-Jun-10
2010 114B	*A. crepitans*	37.06623	-77.6041	Dinwiddie	VA	23-Jun-10
2010 115	*A. crepitans*	37.15312	-77.51746	Dinwiddie	VA	23-Jun-10
2010 116	*A. crepitans*	37.1353	-77.50883	Dinwiddie	VA	23-Jun-10
2010 117	*A. crepitans*	37.09045	-77.46912	Dinwiddie	VA	23-Jun-10
2010 118	*A. crepitans*	37.10633	-77.44533	Dinwiddie	VA	23-Jun-10
2010 119	*A. gryllus*	36.52647	-76.88417	Gates	NC	27-Jun-10
2010 120	*A. gryllus*	36.59301	-76.93504	Southampton	VA	27-Jun-10
2010 121	*A. crepitans*	36.63199	-77.64625	Greensville	VA	28-Jun-10
2010 122	*A. crepitans*	36.6955	-77.38729	Southampton	VA	28-Jun-10
2010 123	*A. crepitans*	36.72268	-77.30784	Southampton	VA	28-Jun-10
2010 124	syntopic	36.88458	-77.05117	Southampton	VA	28-Jun-10
2010 125	syntopic	36.90781	-77.02731	Sussex	VA	28-Jun-10
2010 126	*A. crepitans*	36.76965	-77.16246	Southampton	VA	29-Jun-10
2010 127	*A. crepitans*	36.71805	-77.08886	Southampton	VA	29-Jun-10
2010 128	*A. crepitans*	36.71626	-77.07443	Southampton	VA	29-Jun-10

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Site	Chorus	Latitude	Longitude	County	State	Date
2010 129	*A. crepitans*	36.67459	-77.04285	Southampton	VA	29-Jun-10
2010 130	*A. crepitans*	36.68281	-77.01458	Southampton	VA	29-Jun-10
2010 131	*A. crepitans*	36.61757	-76.99652	Southampton	VA	29-Jun-10
2010 132	*A. crepitans*	36.90613	-77.12739	Sussex	VA	30-Jun-10
2010 133	*A. crepitans*	36.85907	-77.18944	Sussex	VA	30-Jun-10
2010 134	syntopic	36.86405	-77.22964	Sussex	VA	30-Jun-10
2010 135	*A. crepitans*	36.86995	-77.29411	Sussex	VA	30-Jun-10
2010 136	syntopic	36.82225	-77.28882	Sussex	VA	30-Jun-10
2010 137	syntopic	36.80705	-77.34112	Sussex	VA	30-Jun-10
2010 138	syntopic	36.83467	-77.41654	Sussex	VA	30-Jun-10
2010 139	syntopic	36.82727	-77.40096	Sussex	VA	30-Jun-10
2010 140	syntopic	36.77581	-77.39006	Sussex	VA	30-Jun-10
2010 141	*A. crepitans*	36.75052	-77.31132	Southampton	VA	30-Jun-10
2010 142	*A. crepitans*	37.40099	-77.18327	Charles City	VA	6-Jul-10
2010 143	syntopic	37.38883	-77.11433	Charles City	VA	6-Jul-10
2010 144	*A. crepitans*	37.36997	-77.15757	Charles City	VA	6-Jul-10
2010 145	*A. crepitans*	37.33053	-77.18316	Charles City	VA	6-Jul-10
2010 146	syntopic	37.33785	-77.03588	Charles City	VA	6-Jul-10
2010 147	syntopic	37.27805	-76.92945	Charles City	VA	6-Jul-10
2010 148	*A. crepitans*	37.18391	-76.53326	Newport News	VA	13-Jul-10
2010 149	*A. crepitans*	37.18525	-76.53781	Newport News	VA	13-Jul-10
2010 150	*A. gryllus*	36.41835	-76.90577	Gates	NC	15-Jul-10
2011 001	*A. crepitans*	36.44568	-77.53224	Northampton	NC	29-May-11
2011 002	*A. crepitans*	36.35909	-77.46574	Northampton	NC	29-May-11
2011 003	*A. crepitans*	36.37765	-77.45303	Northampton	NC	29-May-11
2011 004	syntopic	36.51235	-77.50859	Northampton	NC	4-Jun-11
2011 005	*A. crepitans*	36.55999	-77.44387	Greensville	VA	30-May-11
2011 006	*A. crepitans*	36.57555	-77.4466	Greensville	VA	30-May-11
2011 007	*A. crepitans*	36.57067	-77.37102	Greensville	VA	30-May-11
2011 008	*A. crepitans*	36.63384	-77.32996	Southampton	VA	30-May-11
2011 009	syntopic	36.46959	-76.63609	Gates	NC	3-Jun-11
2011 010	*A. crepitans*	36.49952	-77.31146	Northampton	NC	4-Jun-11
2011 011	syntopic	36.47096	-77.25652	Northampton	NC	4-Jun-11
2011 012	*A. crepitans*	36.44984	-77.2478	Northampton	NC	4-Jun-11
2011 013	syntopic	36.48919	-77.17936	Northampton	NC	4-Jun-11
2011 014	syntopic	36.49895	-77.15401	Northampton	NC	11-Jun-11
2011 015	*A. crepitans*	36.53416	-77.14256	Hertford	NC	4-Jun-11
2011 016	*A. crepitans*	36.43355	-77.09975	Hertford	NC	5-Jun-11
2011 017	*A. crepitans*	36.47228	-76.63437	Gates	NC	10-Jun-11
2011 018	*A. crepitans*	36.41706	-77.04906	Hertford	NC	11-Jun-11
2011 019	*A. crepitans*	36.396	-77.0122	Hertford	NC	11-Jun-11
2011 020	*A. crepitans*	36.404697	-77.253745	Northampton	NC	17-Jun-11
2011 021	*A. crepitans*	36.396176	-77.23482	Northampton	NC	17-Jun-11
2011 022	*A. crepitans*	36.367014	-77.240505	Northampton	NC	17-Jun-11
2011 023	*A. crepitans*	36.375244	-77.161647	Northampton	NC	17-Jun-11
2011 024	*A. gryllus*	36.381791	-77.03493	Hertford	NC	17-Jun-11
2011 025	*A. crepitans*	36.367619	-77.027906	Hertford	NC	17-Jun-11
2011 026	*A. crepitans*	36.26997	-77.005007	Hertford	NC	17-Jun-11
2011 027	*A. crepitans*	36.258943	-76.986437	Hertford	NC	17-Jun-11
2011 028	*A. crepitans*	36.262108	-76.983846	Hertford	NC	17-Jun-11
2011 029	*A. crepitans*	36.240704	-76.942714	Bertie	NC	18-Jun-11
2011 030	*A. crepitans*	36.021906	-76.941598	Bertie	NC	18-Jun-11
2011 031	*A. crepitans*	36.013075	-76.948347	Bertie	NC	18-Jun-11
2011 032	*A. gryllus*	36.015576	-76.898614	Bertie	NC	18-Jun-11
2011 033	*A. crepitans*	36.028872	-76.801966	Bertie	NC	18-Jun-11
2011 034	syntopic	36.028926	-76.771382	Bertie	NC	18-Jun-11
2011 035	*A. crepitans*	36.081807	-77.012766	Bertie	NC	22-Jun-11
2011 036	syntopic	36.088117	-77.026067	Bertie	NC	22-Jun-11
2011 037	syntopic	36.04035	-77.012002	Bertie	NC	22-Jun-11
2011 038	*A. crepitans*	35.991446	-76.943718	Bertie	NC	22-Jun-11
2011 039	*A. crepitans*	36.039655	-76.713024	Bertie	NC	23-Jun-11
2011 040	syntopic	36.35305	-76.83004	Hertford	NC	23-Jun-11
2011 041	*A. crepitans*	36.31814	-76.83053	Hertford	NC	23-Jun-11
2011 042	*A. crepitans*	36.28423	-76.84328	Hertford	NC	23-Jun-11
2011 043	syntopic	36.15514	-76.75677	Bertie	NC	23-Jun-11

APPENDIX 1. Chorus composition and geographic coordinates (NAD83) of *Acris* sites in southeastern Virginia (VA) and northeastern North Carolina (NC) in 2010-2011.

Site	Chorus	Latitude	Longitude	County	State	Date
2011 044	*A. crepitans*	36.03741	-76.76359	Bertie	NC	24-Jun-11
2011 045	*A. gryllus*	36.545786	-76.932182	Southampton	VA	26-Jun-11
2011 046	*A. gryllus*	36.599871	-76.849085	Suffolk	VA	26-Jun-11
2011 047	*A. gryllus*	36.594821	-76.754539	Suffolk	VA	26-Jun-11

APPENDIX 2. Specimens of *Acris crepitans* and *A. gryllus* from the collections of Carnegie Museum of Natural History (CMNH), North Carolina Museum of Natural Sciences (NCSM), and National Museum of Natural History (USNM) that we identified using morphometry and a discriminant function (Micancin and Mette 2009). We modified geographic coordinates (NAD83) from catalog entries where appropriate. *P* indicates the probability that the morphological identification is correct. The discriminant function changed the identity of 52 specimens ($P > 0.95$), including 48 specimens cataloged as *A. crepitans*.

Specimen	**Latitude**	**Longitude**	**County**	**Year**	**Catalog ID**	**Morpho. ID**	***P***
CMNH 13952	36.6225	-79.9990	Henry	1938	*A. crepitans*	*A. crepitans*	0.797
CMNH 18098	36.6225	-79.9990	Henry	1939	*A. crepitans*	*A. crepitans*	0.965
CMNH 21264	?	?	Appomattox	1940	*A. crepitans*	*A. crepitans*	0.999
CMNH 114113	37.3068	-78.6366	Appomattox	?	*A. crepitans*	*A. crepitans*	0.996
CMNH 119945	36.8395	-78.2092	Lunenburg	1987	*A. crepitans*	*A. crepitans*	0.999
CMNH 119946	36.8395	-78.2092	Lunenburg	1987	*A. crepitans*	*A. crepitans*	0.981
CMNH 120016	37.5505	-78.5555	Buckingham	1987	*A. crepitans*	*A. crepitans*	0.965
CMNH 120250	38.0161	-79.1140	Augusta	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128393	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.603
CMNH 128394	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.603
CMNH 128395	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.995
CMNH 128396	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128397	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128398	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.981
CMNH 128399	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.998
CMNH 128400	36.6314	-78.2941	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.993
CMNH 128402	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.995
CMNH 128403	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128404	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128405	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128406	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128407	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128408	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128409	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128410	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.995
CMNH 128411	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128412	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128413	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128414	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128415	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128416	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128417	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. gryllus*	1.000
CMNH 128418	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.913
CMNH 128419	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128420	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128421	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128422	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128423	36.6204	-78.2967	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128471	36.6260	-78.2907	Mecklenburg	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH 128519	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH 128520	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.998
CMNH 128521	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. gryllus*	0.705
CMNH 128522	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.999

CMNH	128523	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.847
CMNH	128524	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH	128525	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH	128526	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH	128527	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.998
CMNH	128528	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.984
CMNH	128529	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.882
CMNH	128530	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.981
CMNH	128531	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH	128532	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	1.000
CMNH	128533	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.998
CMNH	128534	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. gryllus*	0.897
CMNH	128535	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. gryllus*	0.897
CMNH	128536	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.743
CMNH	128537	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.984
CMNH	128538	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.995
CMNH	128539	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH	128540	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.999
CMNH	128541	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. gryllus*	0.820
CMNH	128542	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. gryllus*	0.999
CMNH	128543	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.992
CMNH	130047	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.998
CMNH	130048	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	1.000
CMNH	130049	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.943
CMNH	130050	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.969
CMNH	130051	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.999
CMNH	130052	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.998
CMNH	130053	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.969
CMNH	130054	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.706
CMNH	130055	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.996
CMNH	130056	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	1.000
CMNH	130057	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.673
CMNH	130058	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.999
CMNH	130059	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.965
CMNH	130060	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.984
CMNH	130061	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.999
CMNH	130062	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.996
CMNH	130063	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.969
CMNH	130064	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.706
CMNH	130065	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.936
CMNH	130066	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.999
CMNH	130067	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.882
CMNH	130068	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.820
CMNH	130069	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.984
CMNH	130070	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.992
CMNH	130071	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.935
CMNH	130072	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.882
CMNH	130073	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.897
CMNH	130074	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	1.000
CMNH	130075	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	0.999
CMNH	130098	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	0.847
CMNH	130099	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	1.000
CMNH	130100	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	0.999
CMNH	130101	37.7390	-78.1760	Cumberland	1989	*A. crepitans*	*A. gryllus*	0.997
CMNH	152269	37.7390	-78.1760	Cumberland	1989	*A. crepitans*	*A. crepitans*	0.995
CMNH	152390	37.7390	-78.1760	Cumberland	1990	*A. crepitans*	*A. crepitans*	0.990
CMNH	152466	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.965

NCSM	48591	37.0109	-77.2835	Sussex	1939	*A. crepitans*	*A. gryllus*	1.000
NCSM	48592	37.0109	-77.2835	Sussex	1939	*A. crepitans*	*A. gryllus*	1.000
NCSM	48594	37.0109	-77.2835	Sussex	1940	*A. crepitans*	*A. gryllus*	1.000
NCSM	48596	36.8813	-77.2345	Sussex	1940	*A. crepitans*	*A. gryllus*	0.999
NCSM	48597	36.9282	-77.3813	Sussex	1940	*A. crepitans*	*A. gryllus*	1.000
NCSM	48599	36.9282	-77.3813	Sussex	1940	*A. crepitans*	*A. gryllus*	1.000
NCSM	48600	37.1292	-77.5009	Dinwiddie	1939	*A. crepitans*	*A. gryllus*	1.000
NCSM	48601	37.1498	-77.5104	Dinwiddie	1939	*A. crepitans*	*A. gryllus*	0.994
NCSM	50513	37.3157	-76.7984	James City	1941	*A. gryllus*	*A. gryllus*	1.000
NCSM	50514	36.5957	-76.4453	Chesapeake City	1941	*A. gryllus*	*A. gryllus*	1.000
NCSM	50518	36.9730	-77.0214	Sussex	1942	*A. gryllus*	*A. gryllus*	1.000
NCSM	67651	36.9431	-77.4525	Sussex	1978	*A. crepitans*	*A. gryllus*	0.671
NCSM	67651	36.9431	-77.4525	Sussex	1978	*A. crepitans*	*A. crepitans*	0.988
NCSM	68469	37.3844	-77.5619	Chesterfield	1974	*A. gryllus*	*A. gryllus*	0.978
NCSM	68471	37.3103	-77.4253	Chesterfield	1974	*A. gryllus*	*A. gryllus*	0.978
NCSM	68472	37.6191	-77.3136	Hanover	1974	*A. gryllus*	*A. gryllus*	0.671
NCSM	68473	37.6191	-77.3136	Hanover	1974	*A. gryllus*	*A. crepitans*	1.000
NCSM	69727	37.3844	-77.5619	Chesterfield	1974	*A. gryllus*	*A. gryllus*	0.999
NCSM	71996	36.9402	-79.7671	Franklin	1978	*A. crepitans*	*A. gryllus*	0.999
NCSM	72020	36.8412	-77.1164	Southampton	1979	*A. crepitans*	*A. crepitans*	0.999
NCSM	72021	36.8412	-77.1164	Southampton	1979	*A. crepitans*	*A. crepitans*	1.000
NCSM	73920	37.3563	-77.6122	Chesterfield	1974	*A. gryllus*	*A. gryllus*	1.000
USNM	140371	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	140372	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.986
USNM	140373	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	140374	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	140393	37.3697	-76.7435	York	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	140401	38.6842	-77.9038	Culpeper	1958	*A. crepitans*	*A. crepitans*	1.000
USNM	145903	38.2996	-78.4917	Greene	1960	*A. crepitans*	*A. gryllus*	0.671
USNM	145904	38.2996	-78.4917	Greene	1960	*A. crepitans*	*A. gryllus*	0.671
USNM	148442	38.0161	-79.1140	Augusta	1962	*A. crepitans*	*A. crepitans*	0.999
USNM	148443	38.0161	-79.1140	Augusta	1962	*A. crepitans*	*A. crepitans*	1.000
USNM	148444	38.0161	-79.1140	Augusta	1962	*A. crepitans*	*A. crepitans*	0.999
USNM	148445	37.3875	-77.5163	Chesterfield	1962	*A. crepitans*	*A. gryllus*	0.934
USNM	148446	37.3875	-77.5163	Chesterfield	1962	*A. crepitans*	*A. crepitans*	0.996
USNM	404582	36.6336	-76.3635	Chesapeake City	1969	*A. crepitans*	*A. gryllus*	1.000
USNM	405630	38.0883	-76.7969	Westmoreland	1964	*A. crepitans*	*A. gryllus*	1.000
USNM	405974	37.9061	-77.0559	King and Queen	1968	*A. crepitans*	*A. crepitans*	0.898
USNM	406082	37.6972	-77.0333	King William	1968	*A. crepitans*	*A. crepitans*	0.993
USNM	409875	37.3365	-78.7917	Appomattox	1968	*A. crepitans*	*A. crepitans*	0.898
USNM	435219	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.999
USNM	435220	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.822
USNM	435221	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.989
USNM	435222	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.998
USNM	435223	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	435224	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.795
USNM	435225	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	1.000
USNM	435226	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.559
CMNH	130058	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.999
CMNH	130059	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.965
CMNH	130060	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.984
CMNH	130061	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.999
CMNH	130062	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.996
CMNH	130063	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.969
CMNH	130064	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.706
CMNH	130065	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.935
CMNH	130066	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.999

CMNH	130067	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.882
CMNH	130068	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.820
CMNH	130069	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.984
CMNH	130070	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.992
CMNH	130071	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.935
CMNH	130072	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. crepitans*	0.882
CMNH	130073	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	0.897
CMNH	130074	37.4114	-78.0520	Amelia	1987	*A. crepitans*	*A. gryllus*	1.000
CMNH	130075	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	0.999
CMNH	130098	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	0.847
CMNH	130099	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	1.000
CMNH	130100	37.4114	-78.0520	Amelia	1986	*A. crepitans*	*A. crepitans*	0.999
CMNH	130101	37.7390	-78.1760	Cumberland	1989	*A. crepitans*	*A. gryllus*	0.997
CMNH	152269	37.7390	-78.1760	Cumberland	1989	*A. crepitans*	*A. crepitans*	0.995
CMNH	152390	37.7390	-78.1760	Cumberland	1990	*A. crepitans*	*A. crepitans*	0.990
CMNH	152466	37.9760	-78.9947	Augusta	1988	*A. crepitans*	*A. crepitans*	0.965
NCSM	48591	37.0109	-77.2835	Sussex	1939	*A. crepitans*	*A. gryllus*	1.000
NCSM	48592	37.0109	-77.2835	Sussex	1939	*A. crepitans*	*A. gryllus*	1.000
NCSM	48594	37.0109	-77.2835	Sussex	1940	*A. crepitans*	*A. gryllus*	1.000
NCSM	48596	36.8813	-77.2345	Sussex	1940	*A. crepitans*	*A. gryllus*	0.999
NCSM	48597	36.9282	-77.3813	Sussex	1940	*A. crepitans*	*A. gryllus*	1.000
NCSM	48599	36.9282	-77.3813	Sussex	1940	*A. crepitans*	*A. gryllus*	1.000
NCSM	48600	37.1292	-77.5009	Dinwiddie	1939	*A. crepitans*	*A. gryllus*	1.000
NCSM	48601	37.1498	-77.5104	Dinwiddie	1939	*A. crepitans*	*A. gryllus*	0.994
NCSM	50513	37.3157	-76.7984	James City	1941	*A. gryllus*	*A. gryllus*	1.000
NCSM	50514	36.5957	-76.4453	Chesapeake City	1941	*A. gryllus*	*A. gryllus*	1.000
NCSM	50518	36.9730	-77.0214	Sussex	1942	*A. gryllus*	*A. gryllus*	1.000
NCSM	67651	36.9431	-77.4525	Sussex	1978	*A. crepitans*	*A. gryllus*	0.671
NCSM	67651	36.9431	-77.4525	Sussex	1978	*A. crepitans*	*A. crepitans*	0.988
NCSM	68469	37.3844	-77.5619	Chesterfield	1974	*A. gryllus*	*A. gryllus*	0.978
NCSM	68471	37.3103	-77.4253	Chesterfield	1974	*A. gryllus*	*A. gryllus*	0.978
NCSM	68472	37.6191	-77.3136	Hanover	1974	*A. gryllus*	*A. gryllus*	0.671
NCSM	68473	37.6191	-77.3136	Hanover	1974	*A. gryllus*	*A. crepitans*	1.000
NCSM	69727	37.3844	-77.5619	Chesterfield	1974	*A. gryllus*	*A. gryllus*	0.999
NCSM	71996	36.9402	-79.7671	Franklin	1978	*A. crepitans*	*A. gryllus*	0.999
NCSM	72020	36.8412	-77.1164	Southampton	1979	*A. crepitans*	*A. crepitans*	0.999
NCSM	72021	36.8412	-77.1164	Southampton	1979	*A. crepitans*	*A. crepitans*	1.000
NCSM	73920	37.3563	-77.6122	Chesterfield	1974	*A. gryllus*	*A. gryllus*	1.000
USNM	140371	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	140372	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.986
USNM	140373	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	140374	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	140393	37.3697	-76.7435	York	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	140401	38.6842	-77.9038	Culpeper	1958	*A. crepitans*	*A. crepitans*	1.000
USNM	145903	38.2996	-78.4917	Greene	1960	*A. crepitans*	*A. gryllus*	0.671
USNM	145904	38.2996	-78.4917	Greene	1960	*A. crepitans*	*A. gryllus*	0.671
USNM	148442	38.0161	-79.1140	Augusta	1962	*A. crepitans*	*A. crepitans*	0.999
USNM	148443	38.0161	-79.1140	Augusta	1962	*A. crepitans*	*A. crepitans*	1.000
USNM	148444	38.0161	-79.1140	Augusta	1962	*A. crepitans*	*A. crepitans*	0.999
USNM	148445	37.3875	-77.5163	Chesterfield	1962	*A. crepitans*	*A. gryllus*	0.934
USNM	148446	37.3875	-77.5163	Chesterfield	1962	*A. crepitans*	*A. crepitans*	0.996
USNM	404582	36.6336	-76.3635	Chesapeake City	1969	*A. crepitans*	*A. gryllus*	1.000
USNM	405630	38.0883	-76.7969	Westmoreland	1964	*A. crepitans*	*A. gryllus*	1.000
USNM	405974	37.9061	-77.0559	King and Queen	1968	*A. crepitans*	*A. crepitans*	0.898
USNM	406082	37.6972	-77.0333	King William	1968	*A. crepitans*	*A. crepitans*	0.993
USNM	409875	37.3365	-78.7917	Appomattox	1968	*A. crepitans*	*A. crepitans*	0.898
USNM	435219	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.999

USNM	435220	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.822
USNM	435221	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.989
USNM	435222	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.998
USNM	435223	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	435224	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.795
USNM	435225	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	1.000
USNM	435226	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.559
USNM	435227	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.993
USNM	435228	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	435229	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.964
USNM	435230	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.964
USNM	435231	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	435232	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.708
USNM	435233	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.997
USNM	435234	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.898
USNM	435235	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	1.000
USNM	435236	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.964
USNM	435237	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.934
USNM	435238	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.997
USNM	435239	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.989
USNM	435240	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	435241	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.994
USNM	435242	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	1.000
USNM	435243	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.708
USNM	435244	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	435245	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	1.000
USNM	435246	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.964
USNM	435247	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	1.000
USNM	435248	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.981
USNM	435249	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	435250	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.964
USNM	435251	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.898
USNM	435252	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.934
USNM	435254	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.964
USNM	435255	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.999
USNM	435256	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	435257	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	435258	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.881
USNM	435259	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. crepitans*	0.999
USNM	435260	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.964
USNM	435261	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.981
USNM	435262	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	1.000
USNM	435263	37.3852	-77.5285	Chesterfield	1958	*A. crepitans*	*A. gryllus*	0.990
USNM	485832	37.9331	-77.3453	Caroline	1966	*A. crepitans*	*A. gryllus*	1.000
USNM	526002	37.4560	-76.8491	New Kent	1962	*A. crepitans*	*A. crepitans*	0.898
USNM	526003	37.4560	-76.8491	New Kent	1962	*A. crepitans*	*A. crepitans*	1.000
USNM	526035	37.3571	-76.7327	York	1963	*A. crepitans*	*A. gryllus*	0.997
USNM	526036	37.2748	-76.7240	James City	1967	*A. crepitans*	*A. crepitans*	0.912
USNM	526037	37.2748	-76.7240	James City	1967	*A. crepitans*	*A. gryllus*	0.999
USNM	526038	37.2607	-76.6955	James City	1967	*A. crepitans*	*A. crepitans*	0.999
USNM	526039	37.2607	-76.6955	James City	1967	*A. crepitans*	*A. crepitans*	0.997
USNM	526040	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	1.000
USNM	526041	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.999
USNM	526042	37.2748	-76.7240	James City	1967	*A. crepitans*	*A. crepitans*	1.000
USNM	526043	37.2748	-76.7240	James City	1967	*A. crepitans*	*A. gryllus*	0.998
USNM	526044	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	1.000
USNM	526045	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.995

USNM	526046	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	1.000
USNM	526047	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.978
USNM	526048	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.999
USNM	526071	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.862
USNM	526072	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	1.000
USNM	526073	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.974
USNM	526074	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.999
USNM	526046	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	1.000
USNM	526047	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.978
USNM	526048	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.999
USNM	526071	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.862
USNM	526072	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	1.000
USNM	526073	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.974
USNM	526074	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.999
USNM	526046	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	1.000
USNM	526047	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.978
USNM	526048	37.3571	-76.7327	York	1967	*A. crepitans*	*A. crepitans*	0.999
USNM	526071	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.862
USNM	526072	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	1.000
USNM	526073	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.974
USNM	526074	37.2748	-76.7240	James City	1967	*A. gryllus*	*A. crepitans*	0.999