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Abstract: Small mammal bait preferences and population status were studied in Great Smoky Mountains National Park during the summer of 2010. The possible occurrence of the least weasel (*Mustela nivalis*) in the Park was also assessed. Traps baited with peanut butter caught significantly more small mammals than empty traps or traps baited with potted meat. The overall number of small mammals caught was significantly less than in an extensive study in the Park during 1999–2003, although the effort (measured as trap-nights) for the two studies was similar. A drought that occurred between the two studies and/or the relatively recent appearances of the coyote (*Canis latrans*) and European wild boar (*Sus scrofa*) may have contributed to the significantly lower numbers of small mammals caught. Implications of climate change for small mammal populations are discussed. *M. nivalis* was not trapped during the study. Future, more intensive studies are recommended to explore thoroughly the possibility of *M. nivalis* inhabiting the Park and the effects of *C. latrans* and *S. scrofa* on small mammal populations within the park.

Key Words: Small mammals; population dynamics; Smoky Mountains.

INTRODUCTION

Small mammals play a vital role in ecosystems by regulating plant growth and by providing a primary source of food for a broad array of carnivores (Chew 1974; Linzey 1995; Reid 2006). Because of these important functions, small mammals have been the subjects of diverse research and it is essential to understand their population ecology. Extensive research with live-trapping has determined bait preferences for small mammals (Fitch 1954; Patric 1970). Other studies have explored the effects of weather on live-trapping capture rates (Getz 1961; Gentry et al. 1966) as well as habitat use (Seagle 1985). Nevertheless, little is known about the interrelationship of weather, habitat use and bait preference.

Small mammal population numbers have been shown to be affected by food availability (Taitt 1981; Desy and Batzli 1989; Korpimäki et al. 2004), seasonal effects (Tanton 1965; Briese and Smith 1974; Hansen et al. 1999; Korpimäki et al. 2004) and predation (Desy and Batzli 1989; Boonstra et al. 1998; Korpimäki and Norrdahl 1998). Evans (1942) and Yahner (1992) demonstrated that the occurrence of a period of abnormally high temperatures coinciding with abnormally low levels of precipitation, leading to a drought, has immediate adverse effects on small mammal population levels. However, there is a lack of data exploring longer-term effects of drought on small mammal numbers.

A common predator of small mammals is the least weasel (*Mustela nivalis*). Despite its widespread occurrence in the Northern Hemisphere it has yet to be documented in Great Smoky Mountains National Park (Linzey 1995; 2008). *M. nivalis* prefers open areas, such as grassy meadows and fields, but has been found in forested areas as well (Sheffield and King 1994; Reid 2006). Much of the park is forested but it also includes open habitats (Linzey 2008). Diet analysis of *M. nivalis* revealed a specialization for intermediate-sized rodents such as meadow vole (*Microtus pennsylvanicus*), southern red-backed vole (*Clethrionomys gapperi*), white-footed mouse (*Peromyscus leucopus*) and deer mouse (*Peromyscus maniculatus*) (Sheffield and King 1994).

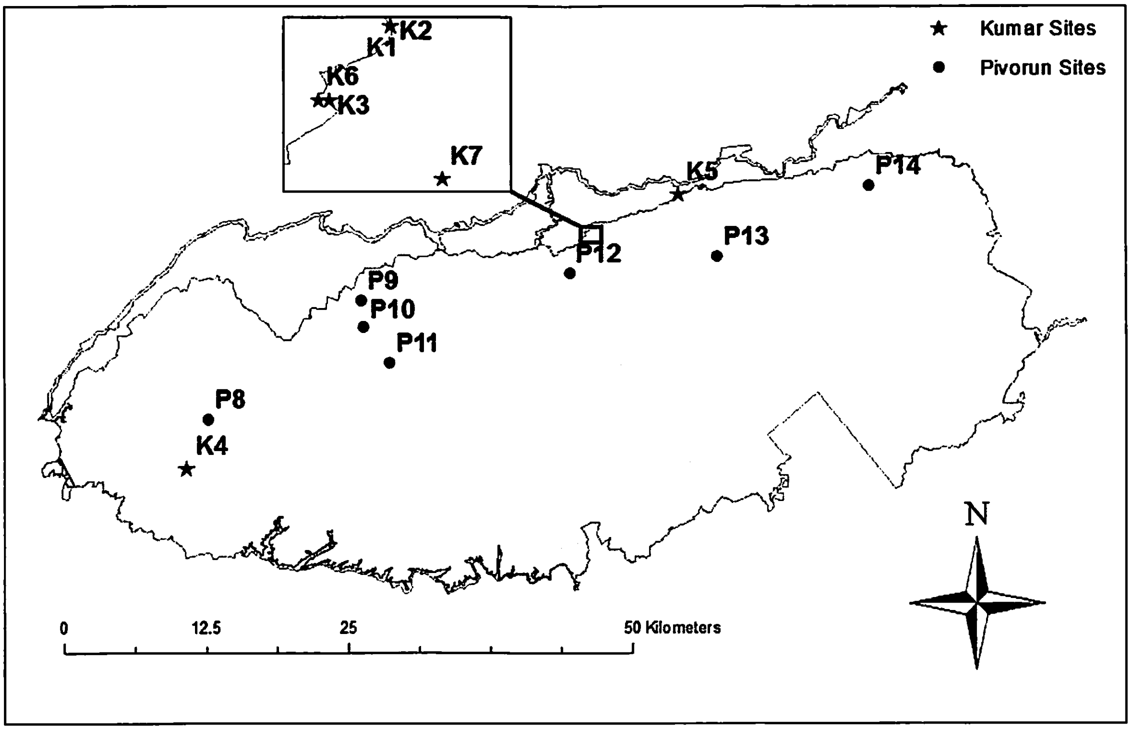

FIG. 1. Study sites in Great Smoky Mountains National Park (shaded), Sevier County, Tennessee, June and July 2010. The Park encompasses 2,072 km^2 of forested mountains bordering Tennessee and North Carolina and contains the highest species diversity in North America. Pivorun's study sites are indicated with dots and Kumar's are indicated with stars.

These rodents are all found in the Park although *M. pennsylvanicus* is known from just one specimen (Linzey 1995). When these mammals are scarce, *M. nivalis* is known to prey upon birds, eggs, invertebrates, shrews, moles, young rabbits, salamanders and carrion (Sheffield and King 1994; Reid 2006). All are commonly found in the park (Linzey 1995; 2008).

M. nivalis was first recorded in Tennessee 113 km northeast of the Park (Tuttle 1968) on Roan Mountain (elevation approximately 1,463 m) on 25 September 1962. It has also been documented four times in North Carolina in close proximity to the Park (40 km northeast of the Park in 1916, 16 km southeast of the Park in 1959, 40 km east of the Park in 1963, and 72 km east of the Park in 1965) (Linzey 1995). Recently, an adult female *M. nivalis* was caught by a cat 3.2 km from the boundary of the Park in Gatlinburg, Tennessee (Linzey et al. 2002). A photograph taken inside the Park of a possible *M. nivalis* raiding a bird's nest is in the possession of DWL. This evidence suggested that *M. nivalis* may inhabit the Park, but it has yet to be documented.

Three main objectives are: 1) explore the effects that weather and habitat have on small mammal bait preference; 2) explore the longer-term effects of drought on species numbers and diversity; and 3) document the presence of *M. nivalis* in the Park.

Natural History of Great Smoky Mountains National Park

Great Smoky Mountains National Park supports a wide variety of both floral and faunal species as well as diverse community types (Whittaker 1956, Linzey 1995; 2008). The Park includes approximately 2,072 km^2 of forested mountains with deep gorges, valleys and streams. The varied topography and diverse climatic conditions contribute to the highest species diversity in North America. There are over 10,000 documented species in the Park with an estimated 90,000 undocumented species (Linzey 2008). Habitats include five different forest types, balds, rock outcroppings, caves, rivers, streams, lakes, vernal pools and bogs. An elevation range of 261 to 2,025 m contributes to a wide variation in temperature and precipitation in the Park (Linzey 2008). The Park is home to the first ever All Taxa Biodiversity Inventory (ATBI). The goal of the ATBI is to identify and record all the species in the Park. As of November 2012, the ATBI has recorded 923 species new to science and 7,636 species new to the Park (B. Nichols pers. comm.).

METHODS

Research was conducted during June–July 2010 in Great Smoky Mountains National Park in the southern

Table 1. Total small mammal captures during present study in Great Smoky Mountains National Park. All locations trapped and specimens caught are represented below. Numbers in parentheses indicate number of specimens of indicated species caught. Capture rate = Total Specimens/ Trap-nights.

Site	Trap-nights	Specimens Caught	Total Specimens	Capture Rate
Site 1	540	*Peromyscus maniculatus* (1)	1	0.002
Site 2	480	none	0	0.000
	360	*Didelphis virginiana* (4)[a]	5	0.014
Site 3		*Blarina brevicauda* (1)		
Site 3a	119	*Didelphis virginiana* (1)[a]	1	0.008
Site 4	120	*Peromyscus maniculatus* (1)	1	0.008
Site 5	300	*Synaptomys cooperi* (1)	1	0.003
Site 5a	193	none	0	0.000
Site 5b	114	*Sigmodon hispidus* (4)	4	0.035
	480	*Napaeozapus insignis* (1)	2	0.004
Site 6		*Blarina brevicauda* (1)		
Site 7	340	*Peromyscus maniculatus* (6)	6	0.012
Site 7a	160	none	0	0.000
Totals	3,206	*Peromyscus maniculatus* (8)	21	0.007
		Didelphis virginiana (5)[a]		
		Sigmodon hispidus (4)		
		Blarina brevicauda (2)		
		Synaptomys cooperi (1)		
		Napaeozapus insignis (1)		

[a] This represents a single juvenile individual that was repeatedly caught. It was not included in the statistical analysis for bait preference and drought effects.

portion of Sevier County, Tennessee (Fig. 1). Seven study sites were selected based on previous experience of one of us, (DWL), and previously had been minimally trapped. Several sites were close to reported sightings of *M. nivalis* and provided suitable habitat for it (see Appendix I for exact locations). Institutional Animal Care and Use Committee approved the permit issued to DWL.

Each site was divided into five 60 m long transects spaced 20 m apart. Four trap clusters were placed along each transect 20 m apart. Each trap cluster consisted of three traps placed within a radius of less than or equal to two meters to give each individual access to all three baits (Patric 1970). Three traps were set and were marked with surveyor's flagging. Two sizes of Sherman live traps (W.T. Sherman Company) were used – approx. 5.3 × 6.7 × 17.5 cm and 7.6 × 7.6 × 25.4 cm (width, height, length). The larger traps were selected specifically for *M. nivalis*. Two smaller traps and one of the larger traps were used at each cluster. One trap was empty, one was baited with Jif smooth peanut butter and one was baited with Armour potted meat. The potted meat was a mixture of pureed and canned beef, chicken and pork. It was used primarily to attract *M. nivalis*, but it was also used to explore situations where any small mammals, particularly insectivores, preferred it to peanut butter. Baits were randomized among the traps using a random number table. Traps were placed in the three best positions to capture small mammals. The best three sites were ranked from most likely to catch a specimen to least likely and the rank that each of the three treatments (peanut butter, potted meat, or empty) was presented also was randomized at each cluster.

Table 2. Small mammal captures at Pivorun's sites during 1999–2003. Captures occurred in Sherman live traps baited with peanut butter set in June or July in deciduous forests below 700 m. Capture rate = Total Specimens/Trap-nights.

Site	Trap-nights	Total # Specimens Caught	Capture Rate
P8	98	4	0.041
P9	98	3	0.031
P10	49	1	0.020
P11	147	12	0.082
P12	294	13	0.044
P13	49	1	0.020
P14	49	2	0.041
Total	784	36	0.046

Traps were checked once or twice a day. They were checked every morning, within the first three hours after sunrise. Traps were initially checked again within the last two hours prior to sunset, but no specimens were ever captured during the daylight interval. A captured specimen was identified, and when possible, the total length, tail length, and hind foot length were measured and the site location was recorded with a handheld GPS unit (Garmin eTrex). Also, digital photographs of specimens were taken with either a Nikon D40 or Canon XT camera. Individuals were marked for recapture identification by fur clipping along the back. Traps were re-baited only when bait was missing or remained untouched for five days. The number of days that traps were set at each study site varied from two to nine days (Appendix I).

The Northeast Regional Climate Center at Cornell University provided current and historical weather data for the Park from the weather station in Gatlinburg, TN, which is located at an elevation of 443 m approximately 5 km from the study area. Weather data were used to determine if there were any major differences in temperature and precipitation during the years of the two studies; no significant differences were found.

Historical data for small mammal captures in the Park were provided by Discover Life in America in order to examine the possible effects of a previous drought (http://www.dlia.org/). Edward Pivorun (Clemson University), through the Park's All Taxa Biodiversity Inventory, led a study in the Park from 1999 to 2003 to inventory the small mammals present in the Park. He extensively trapped all areas of the Park and accumulated over 20,000 trap-nights, using mostly Sherman live traps and some pitfall traps. Data from this study and Pivorun's study were compared if they met the following criteria: sampling occurred in June or July, in deciduous forests below 700 m elevation and peanut butter was used as bait (Tables 2, 3, Fig. 1).

A three-way ANOVA was used to determine if there was any difference among traps baited with peanut butter, meat or unbaited (Program R version 2.11.0, R Development Core Team 2010). Individual specimens that were captured three or more times were not included in the bait preference analysis so as not to bias the results. Tukey's test determined which treatments were statistically different from each other (Program R version 2.11.0, R Development Core Team 2010). An unpaired *t* test was used to compare capture rates at all of our sites and Pivorun's (http://www.graphpad.com). These capture rates were first arcsine transformed to normalize them. Also, a nonparametric Mann Whitney *U* test was used to confirm the results of the *t* test, in case the arcsine transformation did not normalize the data enough (http://elegans.swmed.edu).

Table 3. Small mammal captures at Kumar's sites in 2010. Captures occurred in Sherman live traps baited with peanut butter set in June or July in deciduous forests below 700 m. Capture rate = Total Specimens/Trap-nights.

Site	Trap-nights	Total # Specimens Caught	Capture Rate
Site 1	180	1	0.006
Site 2	160	0	0.000
Site 3	120	0	0.000
Site 5	214	4	0.019
Site 6	160	1	0.006
Site 7	113	5	0.044
Total	947	11	0.012

RESULTS

The two-month 2010 study had 3,206 trap-nights with one trap-night being equivalent to one trap being set over one night. The total number of small mammals captured during the entire study was 21, giving a capture rate of 0.007 (total specimens caught/total trap-nights) (Table 1). Of the 21 captures six were recaptures giving a total of 15 unique individuals captured.

Only specimens that were captured fewer than three times were considered for the bait preference analysis yielding a sample size of 16. Traps baited with peanut butter caught 11 total specimens (9 unique individuals). Traps baited with potted meat caught 2 total specimens (2 unique individuals), while empty traps caught 3 total specimens (3 unique individuals). There was a significant difference among the bait treatments (F-stat = 14.3, df = 2, $p < 0.001$). The peanut butter treatment was found to be significantly different from both the meat treatment ($p < 0.001$) and the no bait treatment ($p < 0.001$). There was no statistical difference between the meat treatment and the no bait treatment. The sample size was too small for analysis of other factors affecting bait preference, such as weather or habitat.

The 11 specimens that were captured in June or July in deciduous forests below 700 m elevation with peanut butter as bait were compared to Pivorun's data (Table 3). Pivoun's study caught more specimens (Fig. 2) and had significantly higher capture rates (T-stat = 3.0, df = 11, p = 0.01; Mann Whitney *U*-stat = 36.5, p = 0.02). Pivorun's study caught more of every species except the hispid cotton rat (*Sigmodon hispidus*). No evidence that *M. nivalis* occurs in the Park was found.

DISCUSSION

Beer (1964) and Patric (1970) previously demonstrated a preference for peanut butter as bait in live traps. Beer (1964) found that peanut butter mixed with rolled oats was preferred over all other baits, including meat baits, while Patric (1970) found that peanut butter alone was preferred over all other baits, including meat baits. Both studies confirmed that peanut butter alone was preferred to meat alone.

One disadvantage of peanut butter as a bait is that it attracted carnivores [e.g., black bear (*Ursus americanus*)] that either crushed the trap or carried it away. Sometime before dawn on 16 June 2010, an *U. americanus* destroyed 17 traps baited with peanut butter and just two traps baited with meat, even though a trap baited with meat was within two meters of each trap baited with peanut butter. During the study, other traps also disappeared, presumably because of bears or other carnivores. More traps baited with peanut butter were

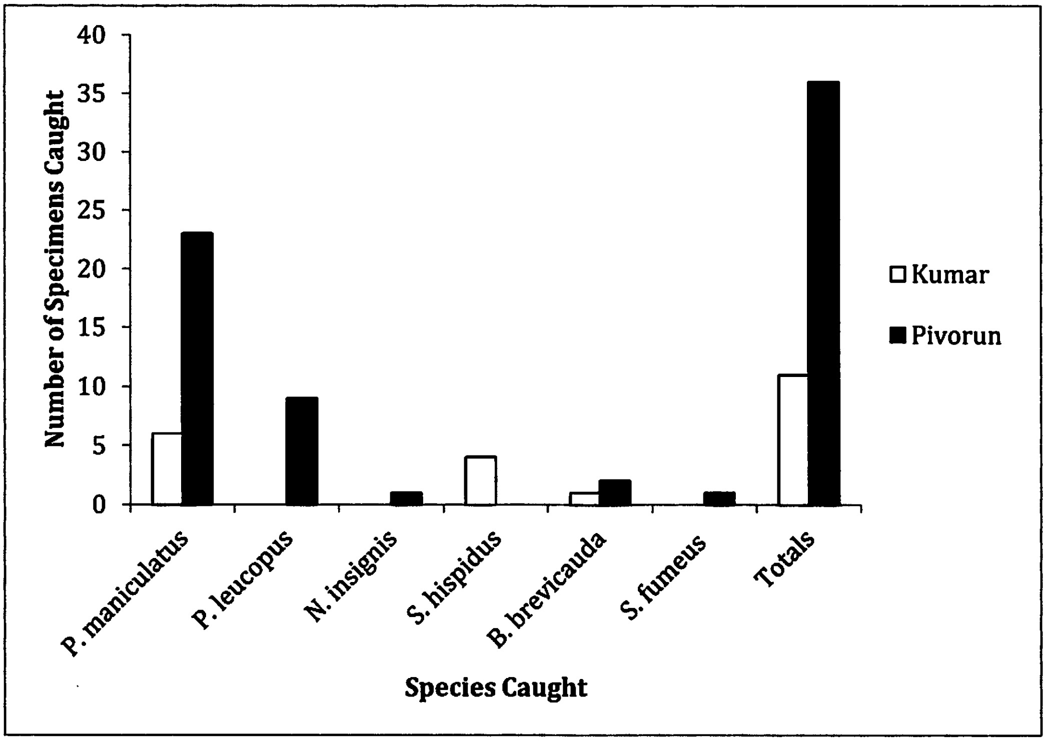

FIG. 2. Differences in numbers of specimens caught during studies by Pivorun in 1999–2003 (black) and Kumar in 2010 (white) in Great Smoky Mountains National Park. Pivorun's study caught significantly more specimens. All specimens were captured in Sherman live traps baited with peanut butter set in June or July in deciduous forests below 700 m.

either destroyed or disappeared, compared to traps baited with potted meat.

Even though peanut butter may be the preferred bait choice when trying to maximize the total number of specimens caught, it has yet to be shown to be preferred by every species of small mammal. Deer mice (*Peromyscus spp.*) are readily trapped in North America and seem to prefer peanut butter, but shrews (Soricidae) are more difficult to trap (Fitch 1954). Since more deer mice than shrews were captured, the deer mice caught may have biased the preference to peanut butter. Shrews are insectivorous; hence they may prefer a meat bait to a peanut butter bait.

Fewer captures resulted during the 2010 study than Pivorun's study (Fig. 2). *S. hispidus* appears to be the only outlier in the data not agreeing with the trend of fewer captures. Prior to 1991, *S. hispidus* was known from only four Park locations. Two additional locations have been found, but *S. hispidus* is still rare (Linzey 1995). Note that during Pivorun's four-year study, which consisted of about 22,000 trap-nights and 90 trapping locations, *S. hispidus* was never captured. It seems *S. hispidus* is rare in the Park, which may account for it deviating from the trend of fewer captures.

Interestingly, seven *P. maniculatus* were caught and no *P. leucopus*. Linzey (1995) previously found that *P. maniculatus* is more abundant at high elevations while *P. leucopus* is more abundant at low elevations with overlap around 915 m (Linzey 1995). Six of the seven *P. maniculatus* were caught at elevations below 600 m. All but 60 of the 3,206 trap-nights were at elevations below 700 m, yet no *P. leucopus* were trapped.

Capture rates encountered were lower than expected. The capture rate for traps baited with peanut butter was 1.51% for 994 trap-nights. Other nearby studies had higher capture rates. A study from the summer of 1994 in the Park using traps baited with rolled oats and peanut butter had a capture rate of 12.43% for 362 trap-nights (Mills et al. 1998). Another study from June–August 1982 in western North Carolina using traps baited with peanut butter had a capture rate of 39.49% for 4,320 trap-nights (Bruckner and Shure 1985). A third study from July–September 1979 in eastern Tennessee using traps baited with rolled oats and peanut butter had a capture rate of 5.55% for 3,840 trap-nights (Seagle 1985). Differences in habitat and/or elevation may account for some of the differences in capture rates.

Our data was compared to the work of Pivorun that occurred in similar habitat (deciduous forest) and elevation (below 700 m). The significantly lower capture rates in 2010 when compared to Pivorun's may be a result of numerous factors. Even though both studies were in the same habitats, the actual locations varied. Perhaps some of Pivorun's sites provided better habitat, which permitted more individuals to occupy a smaller area, thereby increasing trapping success. However, because a total of 13 sites were compared and chosen by recognized Park mammal experts (EP and DWL), it seems unlikely that one group of sites would be biased toward more capture rates.

An alternative explanation for the difference in trapping success was not related to small mammal abundance but to bait acceptance (Fitch 1954). Fitch (1954) found that bait acceptance was highest when natural food was scarce and lowest when natural food was abundant and followed seasonal patterns. Because data from both our study and Pivorun's study were compared for the same two months (June and July), the variation in trapping success was most likely not caused by changes in bait acceptance.

Weather also influences capture rates. Temperature was shown to affect activity of various small mammal species (Getz 1961). Weather conditions (cloudy, clear, or rainy) were shown to affect daily capture rates of small mammals (Gentry et al. 1966). A comparison of weather data during Pivorun's study and the 2010 study was used to explore the effect of weather on capture rates. The data were similar but insufficient for statistical analysis. However, a major weather abnormality occurred between the two studies with a drought in 2007. Drought has been shown to negatively affect small mammal populations by decreasing food supply, especially green vegetation and arthropods (Fitch 1954; Yahner 1992), reducing small mammal captures (Evans 1942; Yahner 1992; E. B. Pivorun, pers. comm.). Responses to drought have been reported within the year of the drought (Evans 1942; Yahner 1992). The lowered 2010 capture rates were not observed until three years after the drought. Very little trapping was conducted between the 2007 drought and 2010, so it is impossible to determine if the small mammal populations were reduced the year of the drought and are slowly rebounding, or if the drought might have had a delayed effect on population size.

The possibility of a drought reducing small mammal abundance is interesting, given the recent evidence of climate change. Global warming increases temperature and seems to contribute to more extreme weather events, such as droughts (Greenough et al. 2001; Houghton et al. 2001). If the current trend of global warming continues, leading to more frequent and more severe droughts, small mammal populations could become threatened, adversely affecting the species that prey upon them.

Recent additions to the Park's fauna could also have affected the results. The coyote (*Canis latrans*) was first observed in the Park in 1982, although they may have occurred in the Park as early as the 1940s (Linzey 1995; 2008). *C. latrans* has shown a steady increase throughout the Park and is afforded the same protection as native species (Linzey 1999; 2008). It is an opportunistic predator that consumes a wide variety of prey items according to seasonal availability, with small mammals consistently constituting a portion of its diet (Bekoff 1977). Predation by *C. latrans* may be contributing to a small mammal decline in the Park.

Another relatively recent addition to the Park's fauna, the European wild boar (*Sus scrofa*), may also have influenced the results. *S. scrofa*, an invasive species, is believed to have first entered the park in the 1940s and its population is thought to be growing despite removal efforts (Linzey 1995; 2008). *S. scrofa* occasionally preys upon small vertebrates and while the frequency of vertebrates found in their diets has been high, the volume has been low (Peine and Farmer 1990; Linzey 1995; Massei and Genov 2004). *S. scrofa* has also been shown to significantly disrupt plant communities and leaf litter through their rooting behavior (Bratton 1974; Peine and Farmer 1990; Linzey 1995; 2008; Massei and Genov 2004). Evidence of rooting was found at Sites 4 and 7 and a *S. scrofa* was observed near Site 7. Many small mammals depend on leaf litter for habitat, including *C. gapperi* and *B. brevicauda*, which were virtually eliminated from areas that had been heavily rooted by *S. scrofa* (Singer et al. 1984). However, *P. maniculatus* was unaffected by rooting (Lusk et al. 1994). Competition for food resources between *S. scrofa* and small mammals possibly exists (Focardi et al. 2000). Through some combination of predation, habitat destruction and competition, *S. scrofa* might have a detrimental effect on Park small mammal populations. Weather, in particular the drought in 2007, and the effects of *C. latrans* and *S. scrofa* may have led to the lowered trapping success in 2010.

The fact that *M. nivalis* was not captured neither confirms nor denies its existence in the Park. Evidence of its existence close to the Park prior to 2010 is substantial. *M. nivalis* can exist in low densities depending on prey populations (King and Moors 1979) and is notoriously difficult to trap (McDonough and Olson 2009; C. Collins pers. comm.). A study in Alaska consisting of over 16,000 trap-nights in known *M. nivalis* habitat resulted in zero captures of *M. nivalis* (McDonough and Olson 2007). This suggested that even though substantial trapping within the Park has occurred (the current study - 3,000+ trap-nights; DWL's extensive trapping - 30,000+ trap-nights in a wide variety of habitats and elevations over 48 yrs; and Pivorun's study - 20,000+ trap-nights), there is still a possibility of *M. nivalis* occurring in the Park, given its confirmed occurrence surrounding the Park.

It appears that the small mammals in Great Smoky Mountains National Park are declining and could contribute to the absence of *M. nivalis* in the Park. This fact underscores the importance of an ongoing long-term monitoring effort to determine the population status of small mammals in the Park. Additionally, the effects of weather and habitat on small mammal bait preference needs future research. Bait preference generalizations at the species level also warrant future studies. The distribution of *Peromyscus* within the Park should be studied further to see if the currently accepted distributions remain valid or should be modified perhaps by extending the abundance of *P. maniculatus* to lower elevations. Further research upon the effects that *C. latrans* and/or *S. scrofa* are exerting on the small mammal fauna in the Park is needed. Continued trapping for *M. nivalis* possibly using track plate boxes or remote cameras is recommended (Mowat et al. 2000).

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APPENDIX I

Site 1: 7–16 June 2010, intersection of Kear Branch with Low Gap Road (Easting: 275519, Northing: 3955833, UTMs in NAD83). A small marsh in a cove hardwood forest, 475 m. Dominant trees: *Aesculus flava, Liriodendron tulipifera, Carpinus carolinensis, Acer sp., Betula sp.,* and *Lindera benzoin.* Dominant low vegetation: *Commelina sp., Impatiens sp., Lindera sp., Smilax sp.* and *Bidens sp.* Other vegetation: *Toxicodendron radicans, Lonicera sp., Eupatorium sp., Rubus sp., Dryopteris sp.,* and *Agrimonia sp.*

Site 2: 8–16 June 2010, the intersection of the stream in Kear Branch with Low Gap Road (Easting: 275519, Northing: 3955833, UTMs in NAD83) (Note: Site 2 bordered Site 1 so coordinates identical). Riparian corridor in cove hardwood forest, 488 m. Dominant trees: *Aesculus flava, Liriodendron tulipifera, Carpinus carolinensis, Acer penslyvanicum, Acer rubrum,* and *Tsuga canadensis.* Dominant low vegetation: *Leucothoe sp.* and *Polystichum acrostichoides.* Other vegetation: *Toxicodendron radicans, Thelypteris noveboracensis, Hamamelis virginiana* and *Platanus occidentalis.*

Site 3: 10–16 June 2010, an area near footpath on hillside above Roaring Fork Cove (Easting: 275041, Northing: 3955259, UTMs in NAD83). A secondary floodplain (riparian bench) in cove hardwood forest, 610 m. Dominant trees: *Liriodendron tulipifera, Carpinus carolinensis, Acer penslyvanicum, A. rubrum, A. spicitum, Magnolia acuminata, M. fraseri, Fagus grandifolia, Quercus alba, Pinus sp.* and *Tsuga canadensis.* Dominant low vegetation: *Leucothoe sp., Rhododendron sp.* and *Polystichum acrostichoides.*

Site 4: 27–29 June 2010, Gregory Bald (Easting: 240128, Northing: 3934531, UTMs in NAD83). A grassy bald, 1,508 m. Dominant trees: *Quercus sp.* Dominant low vegetation: *Rhododendron calendulaceum* and *Vaccinium sp.*

Site 5: 8–13 July 2010, a marsh along Copeland Creek (Easting: 283369, Northing: 3958787, UTMs in NAD83). A wet riparian flat in cove hardwood forest, 415 m. Dominant trees: *Juglans cinerea, Tsuga canadensis, Carpinus carolinensis,* and *Tilia ameicana* (saplings). Dominant low vegetation: *Toxicodendron radicans, Eupatorium sp., Aster sp., Bidens sp., Cornus sp., Cuscuta sp.* and *Rhus copallinum.* Other vegetation: *Vitis sp.*

Site 6: 14–22 July 2010, an overgrown field behind Ely Mill, Northwest end one way Roaring Fork Motor Nature Trail (Easting: 274958, Northing: 3955265, UTMs in NAD83). An overgrown field in cove hardwood forest, 475 m. No mature trees. Dominant saplings: *Liriodendron tulipifera, Mimosa quadrivalvis var. angustata, Betula sp., Carpinus carolinensis, Carya sp., Juglans nigra, Aesculus flava* and *Liquidambar styraciflua.* Dominant low vegetation: *Cornus sp., Parthenocissus quinquefolia, Prunella vulgaris, Eupatorium sp., Toxicodendron radicans, Rosa sp., Jasminum sp.,* and *Lindera benzoin.*

Site 7: 22 July–28 July 2010, a wooded area along roadsides beyond Thousand Drips Waterfall after the first bridge starting at Northwest end one way Roaring Fork Motor Nature Trail (Easting: 275912, Northing: 3954657, UTMs in NAD83). A riparian corridor in mature cove hardwood forest, 580 m. Dominant trees: *Acer saccharum, Tsuga canadensis, Aesculus flava, Tilia americana, Quercus spp., Betula alleghaniensis, Magnolia acuminata, Magnolia fraseri,* and *Liriodendron tulipifera.* Dominant low vegetation: *Rhododendron maximum.* Other vegetation: *Toxicodendron radicans, Goodyera pubescens, Lindera benzoin, Maianthemum racemosum, Polygonatum sp., Leucothoe sp., Parthenocissus quinquefolia, Urtica dioica, Rubus sp., Hamamelis virginiana, Smilax sp., Polystichum acrostichoides, Viola sp.* and *Gaultheria procumbens.*

Additional trapping conducted periphery of Sites 3, 5 and 7; approximately 20 Sherman extra-long traps [approx. 7.6 × 8.9 × 33.0 cm; (width, height, length)] baited with potted meat and placed in areas to catch weasels. Individual site details follow.

Site 3a: 9–16 June 2010, an area near footpath on hillside above Roaring Fork Cove (Easting: 275041, Northing: 3955259, UTMs in NAD83) within 150 m of Site 3; no noticeable difference in vegetation. Seventeen extra-long traps set.

Site 5a: 24–27 June, 30 June–2 July and 8–13 July 2010, a marsh along Copeland Creek (Easting: 283369, Northing: 3958787, UTMs in NAD83) within 150 m of Site 3: no noticeable difference in vegetation. Ten extra-long traps set less than 150 m northeast of Site 5 in forested area off trail and ten extra-long traps set less than 150 m southwest of Site 5 along trail.

Site 5b: 27–30 July 2010, a marsh along Copeland Creek (Site 5) (Easting: 283369, Northing: 3958787, UTMs in NAD83). 38 traps, with one third being larger (7.6 × 7.6 × 25.4 cm) and two thirds being smaller (5.3 × 6.7 × 17.5 cm), set and baited with peanut butter in same transects, created by gridding site for first trapping attempt.

Site 7a: 25–29 July 2010, a wooded area along roadsides of first 2.4 km of Roaring Fork Motor Nature Trail starting at Northwest end (Easting: 275912, Northing: 3954657, UTMs in NAD83) within 2.4 km of Site 7: no noticeable difference in vegetation. Forty extra-long traps set along roadsides.