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A SURVEY OF SMALL VERTEBRATES IN A CENTRAL GEORGIA PIEDMONT FORESTED HABITAT

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ABSTRACT

We present the findings of a survey of small vertebrates inhabiting a typical central Georgia (Baldwin County), mixed pine-deciduous Piedmont forest. Samples were collected from June 2010 to November 2010 and February 2011 to May 2011, using drift fences equipped with pitfall traps, funnel traps, and snake traps. Moreover, the trapping data used to determine taxonomic diversity of the woodlands was augmented with direct observations. Our findings suggest amphibians were the most abundant small vertebrates (55.9% of all captures), followed by reptiles (35.4%) and lastly, small mammals (8.7%). The most abundant reptile was *Anolis carolinensis* with 75 captures, followed by *Rana clamitans* with 57 captures for the amphibians, and *Blarina carolinensis* with 14 captures for the mammals. One *Storeria occipitomaculata* and one *Pseudemys concinna* were observed and collected during this study, representing the first Baldwin Co. record of both species.

Key words: small vertebrates, central Georgia Piedmont habitat, drift fence survey

INTRODUCTION

Animal populations are often used to assess the environmental health of a given area. Small vertebrates tend to be more susceptible to physical changes in their habitat caused by urbanization, various types of land management, and pollution (1). As an example, Balmori (2) noted amphibians are very important components of the ecosystem and good bio-indicators, suggesting that a dense population of amphibians usually indicates a healthy environment.

In a typical central Georgia Piedmont forest, certain species of small vertebrates are expected to be observed, while others are not since not all

species of small vertebrates have the same habitat or microhabitat requirements. For example, in a central Georgia woodlot, Parmley *et al*. (3) found *Ochrotomys nuttalli* common in areas having well developed herbaceous understory and often thick, lush, ground cover. The species was rare to completely absent from areas with moderate to sparse ground cover and little to no understory. On the other hand, there are certain species that can be observed in multiple types of habitats ("habitat generalist"). Parmley *et al*. (3) found *Peromyscus leucopus* to be somewhat of a "habitat generalist" because it was collected in diverse riparian settings ranging from woodlands with a lush, thick understory and ground cover to more xeric ones with sparse groundcover and no understory.

In this study, we utilized drift fence sampling to investigate the small vertebrate populations of a typical central Georgia Piedmont forest in Baldwin County. The goal of this study was to evaluate the taxonomic diversity, percent abundance, and relative abundance of small vertebrates in this community.

Previous Vertebrate Survey Work in Central Georgia: Although the diversity of small mammals in central Georgia is relatively well documented (3, 4), few have reported the occurrence of amphibians, reptiles, and small mammals. Reports on small mammals of central Georgia have provided insight on habitat use, relative abundance, and seasonal abundance among other things. For example, Parmley and Harley (4) reported on the relative seasonal abundance of shrews in two central Georgia deciduous woodlots. They noted that the relative abundance of shrews was higher in the spring than in the summer in both woodlots and higher in the mesic woodlot than in the xeric one during both seasons. *Blarina carolinensis* (over *Sorex longirostris*) was the most abundant species in both woodlots regardless of season (4). Parmley *et al*. (3) reported on the small mammals of the riparian woodlands of a central Georgia Piedmont creek (Champion Creek; Baldwin Co.). In this study, the taxonomic diversity of small mammals included four species of squirrels (*Sciurus carolinensis, Sciurus niger, Glaucomys volans*, and *Tamias striatus*), one species of shrew (*Blarina carolinensis*), and seven species of cheek rodents (*Mus musculus, Sigmodon hispidus, Peromyscus leucopus, P. gossypinus, Ochrotomys nuttalli, Oryzomyz palustris*, and *Reithrodontomys humulis*). *Peromyscus* species were the most abundant small mammal living in the riparian strip (3). Beard (pers. comm., 2008) studied the edge effect and location of *Peromyscus* in fragmented central Georgia woodlots, suggesting this rodent was most abundant in the interior of the woodlots she studied. Lowe and Parmley (5) reported on the small vertebrates of a mixed bottomland forest habitat associated with a marsh in central Georgia, further commenting on the effectiveness of trap types. During this investigation, 43 species were captured, including 17 amphibians, 16 reptiles, and 10 mammals, and a significant correlation between temperature, rainfall, and capture rates was established. Whaley (6) sampled the vertebrate fauna of a central Georgia mesic (bottomland) habitat and captured 229 amphibians, 55 reptiles, and 85 mammals. The most abundant amphibian was

Rana sphenocephala, followed by *Terrapene carolina* for the reptiles, and *Peromyscus leucopus* and *Microtus pinetorum* for the mammals. Williams (7) surveyed the small vertebrates of a xeric upper Coastal Plain habitat in southern Baldwin Co., Georgia. In this study 393 individuals were collected, comprising seven species of amphibians, eight species of reptiles, and nine species of mammals. *Gastrophryne carolinensis* was the most abundant amphibian collected, followed by *Sceloporus undulatus* for the reptiles, and *Blarina carolinensis* for the mammals. Herrington (8) sampled the small vertebrate community in a lowland hardwood forest in Marion Co., Georgia. A total of 40 species of amphibians, 16 species of reptiles, and 12 small mammal species were recorded during this investigation. In his study, the most abundant amphibian was *Rana clamitans* (n=459), followed by *Kinosternon subrubrum* (n=40) for the reptiles, and *Ochrotomys nuttalli* (n=59) for the mammals.

MATERIALS AND METHODS

Study site: The study site was the woodlands at the Georgia College Biological Field Station (hereafter Lake Laurel Site), located approximately 3 km E and 4 km N of Milledgeville, Baldwin Co. (N 33°.07.172 / W 083°.10.981), with an area of approximately 48 hectares. The woodlands sampled consisted of mixed deciduous and coniferous trees (*e.g.*, Loblolly Pine, *Pinus taeda*; Oak, *Quercus* sp.; Red Maple, *Acer rubrum*; Chalk Maple, *Acer leucoderme*; Beech, *Fagus grandifolia*; Ironwood, *Carpinus caroliana*; Winged Elm, *Ulmus alata*) with a 70-80% canopy cover.

Sampling Gear and Methodology: Drift fences associated with pitfall and funnel traps were used to survey the small vertebrates in the woodlands of the Lake Laurel Site. A small vertebrate is here defined as an amphibian, reptile, or mammal smaller than an opossum; a small vertebrate that can be captured utilizing pitfall and/or funnel traps. Gibbons and Semlitsch (9) stated that pitfall traps in association with terrestrial drift fences are an effective method for sampling herpetofaunal communities, although previous research shows that a combination of pitfall and funnel traps allows for a more complete community survey (5, 10, 11, 12, 13). Drift fences act as an artificial barrier that intercept animals moving through the environment and directs them toward traps set along the barrier (14).

Following basic protocols used in previous studies (5, 9, 14), three standard plus-shaped drift fences of silt fencing were constructed at the Lake Laurel site (Fig. 1). Each arm of the drift fence array measured 7.5 m in length and 0.60 m in height. Drift fences were positioned along a hillside (bottom, middle, and top of the hill); each approximately 70 m from Lake Laurel. Twelve 20 L buckets per fence were placed at ground level along the fence, distally from the center of the cross. Midway along each arm, one 41.9 x 22.9 cm funnel was placed in a depression on each side of the drift fence (Fig. 1). Each drift fence contained 8 funnel traps (Fig. 1), yielding a total of 24 for all three fences. Sampling began June 7, 2010 and was completed November 19,

2010, for a total of 80 days and 4,800 trap nights. Traps were re-opened February 21, 2011 for a second sampling period that ended May 6, 2011, for a total of 53 days and 3,180 trap nights. Collectively, sampling periods yielded a total of 133 days and 7,980 trap nights. Traps were inspected daily.

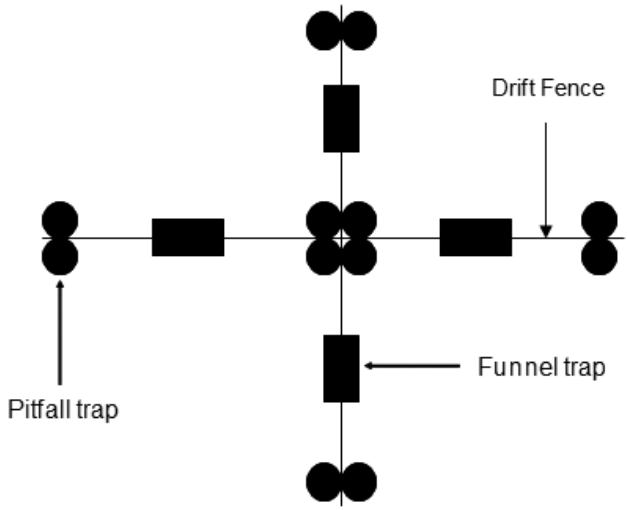

Figure 1. Diagram of drift fence used in Lake Laurel trapping study, Baldwin Co., Georgia

Small and large snake funnel traps were incorporated into the drift fence arrays to replace some funnel traps at the beginning of the second sampling period. The small snake traps (45.73 x 20.32 x 20.32 cm) and large snake traps (45.73 x 30.48 x 20.32 cm) were rectangular with a single funnel on one end. Funnel traps and snake traps were alternated around the drift fence so that each fence had four funnel traps and two of each snake trap.

Drift fences remained open for five consecutive days and closed for two days when possible. In the field, specimens were visually identified to the lowest practical taxonomic ranking and released. Specimens observed at the site, but not captured, were used to determine the overall diversity of the study site. Any deceased specimens were incorporated as voucher specimens into the Georgia College & State University Vertebrate Collection.

Percentage abundance was determined for all species captured as a percentage of the total number of individuals captured within each class. Relative abundance was calculated as the number of captures per 100 trap nights (3, 4). Trap nights were calculated by multiplying the number of days sampled by the combined number of pitfall, funnel, and snake traps.

RESULTS AND DISCUSSION

During this investigation, a total of 356 small vertebrates were captured, including 199 amphibians, 126 reptiles, and 31 mammals (Table I). These vertebrate groups are individually discussed below.

Table I. Percent of captures and relative abundance from a 2010-2011 small vertebrate trapping survey of Lake Laurel, Baldwin Co., Georgia.

Taxa	Number Captured	% of Captures Within Class	Relative Abundance **(per 100TN)**
Amphibia			
Bufo sp.	5	2.51	0.06
Bufo terrestris	27	13.57	0.34
Rana clamitans	57	28.64	0.71
Rana sphenocephala	11	5.53	0.14
Rana catesbeiana	2	1.01	0.03
Pseudacris crucifer	2	1.01	0.03
Hyla avivoca	2	1.01	0.03
Hyla cinerea	1	0.50	0.01
Acris crepitans	20	10.05	0.25
Acris gryllus	35	17.59	0.44
Acris sp.	22	11.06	0.28
Plethodon glutinosus	9	4.52	0.11
Eurycea bislineata	1	0.50	0.01
Notophthalmus viridescens	5	2.51	0.06
Reptilia			
Anolis carolinensis	75	59.52	0.94
Sceloporus undulatus	8	6.35	0.10
Eumeces laticeps	3	2.38	0.04
Eumeces inexpectatus	6	4.76	0.08
Eumeces fasciatus	8	6.35	0.10
Scincella lateralis	5	3.97	0.06
Coluber constrictor	9	7.14	0.11
Elaphe obsoleta	2	1.59	0.03
Carphophis amoenus	2	1.59	0.03
Diadophis punctatus	1	0.79	0.01

Table I. *(Continued)*

Storeria dekayi	2	1.59	0.03
Agkistrodon contortrix	3	2.38	0.04
Pseudemys concinna	1	0.79	0.01
Terrapene carolina	1	0.79	0.01
Mammalia			
Blarina carolinensis	14	45.16	0.18
Sorex longirostris	1	3.23	0.01
Microtus pinetorum	1	3.23	0.01
Peromyscus sp.	4	12.90	0.05
Ochrotomys nuttalli	3	9.68	0.04
Reithrodontomys humulis	2	6.45	0.03
Sigmodon hispidus	2	6.45	0.03
Tamias striatus	4	12.90	0.05

Amphibians: Amphibians were the most abundant small vertebrates captured and/or observed, comprising 55.9% of all captures (Fig. 2). A total of 199 amphibians were captured during the survey period, including five families: three families of anurans (Ranidae, Bufonidae, and Hylidae) and two of salamanders (Plethodontidae and Salamandridae). Anurans accounted for 92.5% of all amphibian captures, while salamanders comprised only 7.5%.

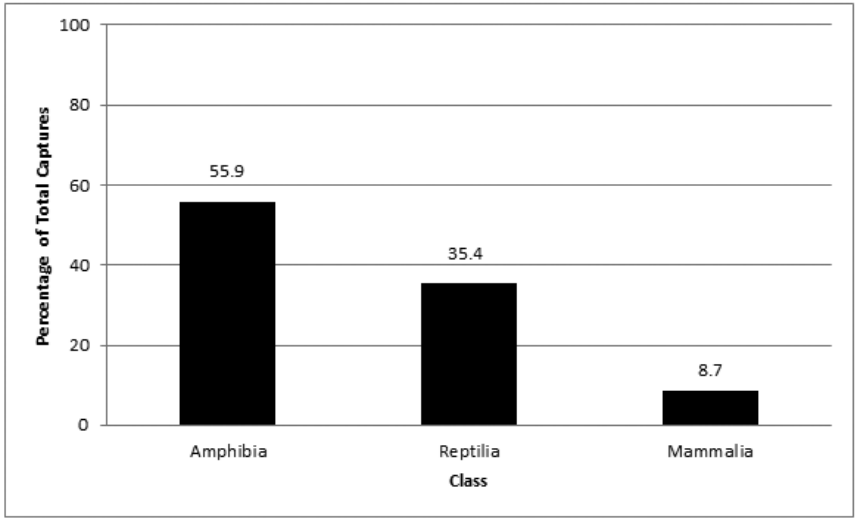

Figure 2. Percentages of vertebrate classes captured during a 2010-2011 small vertebrate trapping study at Lake Laurel area, Baldwin Co., Georgia.

Among the ranids, *Rana clamitans* was the most abundant frog with 57 captures, followed by *R. sphenocephala* with 11 captures, and *R. catesbeiana* with only two. *Rana clamitans* and *R. sphenocephala* were commonly seen on the forest floor throughout the sampling period. Only one species of bufonid (*Bufo terrestris*) was captured during the sampling period. Most of the *B. terrestris* captured were adults and sub-adults, whereas most of the specimens observed in the area were juveniles. *Bufo fowleri* was not captured during this survey even though the study site is considered prime habitat for the species.

Five species of hylid frogs (*Acris crepitans, A. gryllus, Pseudacris crucifer, Hyla avivoca,* and *H. cinerea*) were captured and/or observed throughout this investigation. Only two *H. avivoca* and one *H. cinerea* were captured; both found on the side of a pitfall trap. *Acris crepitans* and *A. gryllus* were quite common on the forest floor throughout the duration of the survey. Two *Pseudacris crucifer* were taken during this investigation; the individuals were both adults and were captured in funnel traps.

Three species of salamanders were captured during this investigation (*Plethodon glutinosus, Eurycea bislineata*, and *Notophthalmus viridescens*). Most of the specimens of *P. glutinosus* were captured in pitfall traps rather than funnel traps. This species of salamander was relatively common throughout the survey. Only one *E. bislineata* was captured, and it was found in a pitfall trap. Five *N. viridescens* (Salamandridae; all individuals in the eft stage) were captured during the survey.

Reptiles: Reptiles represented the second most abundant group encountered during this study, comprising 35.4% of all captures (Fig. 2). A total of 126 specimens were captured, including 6 families. Lizards comprised approximately 83% of all reptile captures, snakes occupied nearly 15%, and turtles occupied approximately 2%.

All of the large colubrids captured during this investigation (*Elaphe obsoleta* and *Coluber constrictor*) were taken in funnel or snake traps, as they seem to be capable of escaping from pitfall traps. Other colubrid snakes captured were the small "ground snakes" *Diadophis punctatus, Carphophis amoenus*, and *Storeria dekayi*. All individuals belonging to these three species were taken in pitfall traps. One specimen of *Storeria occipitomaculata* was observed on the forest floor presenting the first record for Baldwin County (15). The red-bellied snake, *S. occipitomaculata*, was not captured during this investigation and therefore not included in the captured species list (Table I). The only viperid species captured was *Agkistrodon contortrix* (n=3). All specimens of this species were adults and were captured in funnel traps.

Four genera (*Anolis, Eumeces, Scincella*, and *Sceloporus*) and six different species of lizards were captured during this investigation, represented by one species of anole, four species of skinks, and one species of fence lizard (Table I). The most abundant lizard was *Anolis carolinensis* (Polychrotidae) and the least abundant was *Eumeces laticeps* (Scincidae; Table I). Among

the lizards, *A. carolinensis* comprised 59.5% of all reptile captures, while *E. laticeps* only occupied about 2.5%. *Anolis carolinensis* was common throughout the survey based on the number of captures and observations. The green anole was captured in both pitfall and funnel traps. *Sceloporus undulatus* (Phrynosomatidae) was captured and commonly observed throughout the duration of the sampling period.

Two turtles of the family Emydidae were captured during this survey. One *Pseudemys concinna* and one *Terrapene carolina* were captured in pitfall traps; both of which were recently reported for the first time to the Baldwin Co. herpetofauna (16, 17, also see 18). *Pseudemys concinna* is not a woodland species and its capture remains unexplained. Since the individual recorded was a sub-adult, it is very unlikely that the turtle was a female searching for a nesting site to lay eggs. Even though only one specimen of *T. carolina* was captured, the species seemed to be relatively common throughout the forest floor based on several observations.

Mammals: Mammals represented the fewest number of captures and observations during this investigation, accounting for 8.7% of all captures (Fig. 2). Eight genera (*Blarina, Sorex, Sigmodon, Reithrodontomys, Peromyscus, Ochrotomys, Microtus*, and *Tamias*) and eight different species were captured, with *Blarina carolinensis* (Soricidae) being the most abundant. This shrew occupied 45% of all mammal captures, while *Sorex longirostris* (Soricidae) comprised only 3.2%. Captures of *B. carolinensis* were common throughout the survey period and most commonly associated with pitfall traps, but two individuals of this soricid species were taken by funnel traps.

Only one species of chipmunk, *Tamias striatus* (Sciuridae), was captured during the survey. Ground squirrels tend to forage on the forest floor in search of nuts and/or acorns. We suggest the two individuals captured came upon the funnel trap as they foraged along the forest floor.

Five members of the family Cricetidae were captured throughout the sampling period. One *Microtus pinetorum*, one *Sigmodon hispidus*, four *Reithrodontomys humulis*, three *Ochrotomys nuttalli*, and four *Peromyscus* sp. indet. were taken in pitfall traps, and one individual of *S. hispidus* was captured in a funnel trap. Low numbers of *Peromyscus* sp. indet. is a mystery, but it is possible that nocturnal predation on this species in pitfall traps by large colubrids or viperids, or perhaps other mammals explains the low numbers of this cricetid mouse.

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