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Eric M. Schauber
Southern Illinois University Carbondale, schauber@siu.edu

Paul D. Scharine
Southern Illinois University Carbondale

Clayton K. Nielsen
Southern Illinois University Carbondale

Lyann Rubert
Southern Illinois University Carbondale

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Eric M. Schauber
Cooperative Wildlife Research Laboratory
Southern Illinois University
Mailcode 6504
Carbondale, IL 62901
618-453-6940; FAX 618-453-6944; Email schauber@siu.edu

An Artificial Latrine Log for Swamp Rabbit Studies

Eric M. Schauber,[1] Cooperative Wildlife Research Laboratory and Department of Zoology, Southern Illinois University, Carbondale, IL 62901

Paul D. Scharine, Cooperative Wildlife Research Laboratory and Department of Zoology, Southern Illinois University, Carbondale, IL 62901

Clayton K. Nielsen, Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL 62901

Lyann Rubert, Cooperative Wildlife Research Laboratory and Department of Zoology, Southern Illinois University, Carbondale, IL 62901

ABSTRACT Managers use latrine surveys to monitor swamp rabbit (*Sylvilagus aquaticus*) populations, but may miss rabbits in sites lacking suitable latrine logs. We tested artificial latrine logs in logless thickets in southern Illinois, generally detecting swamp rabbits in fewer visits than by live trapping. Artificial logs can aid swamp rabbit monitoring, especially in logless habitats.

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[1] E-mail: schauber@siu.edu

The swamp rabbit (*Sylvilagus aquaticus*) is endemic to the southeastern United States and typically inhabits bottomland hardwood forests with dense understory (Chapman and Feldhamer 1981, McCollum and Holler 1994). Swamp rabbits are legal game animals in much of their range, but their abundance and distribution have declined in some areas along the historic northern range limit (Korte and Fredrickson 1977, Whitaker, Jr. and Abrell 1986, Kjolhaug et al. 1987). Managers require information about abundance, distribution, and habitat associations of the swamp rabbit for conservation purposes, but swamp rabbits are cryptic, inhabit dense cover, and are difficult to live-trap. Fortunately, swamp rabbits habitually defecate on elevated substrates (especially logs), producing conspicuous latrines. Zollner et al. (1996) found that swamp rabbits deposited 91% of fecal pellets on logs and appeared to select broad, moss-covered logs in advanced decay. Latrines likely serve a social signaling function associated with reproduction, although swamp rabbits may also defecate while using logs as elevated lookouts (Whitaker, Jr. and Abrell 1986, Zollner et al. 1996). Because pellet groups on elevated substrates are visually obvious, surveying for latrines is easy, inexpensive, and frequently used to monitor the local presence and abundance of swamp rabbits (Terrel 1972, Heuer, Jr. and Perry, Jr. 1976, Wolff and Barbour 2002, Scheibe and Henson 2003).

Although latrine surveys are easy and inexpensive, they may fail to detect swamp rabbits inhabiting areas that lack suitable latrine substrates. Zollner et al. (2000) found that distribution of latrines in areas inhabited by swamp rabbits was strongly correlated with presence of downed logs. Recently afforested areas (e.g., retired agricultural fields), however, likely provide dense understory suitable for swamp rabbits' habitation but lack logs or stumps suitable for fecal deposition. Our objective was to develop and field-test an artificial latrine log (ALL) to facilitate latrine surveys for swamp rabbits in habitats lacking suitable latrine substrates.

STUDY AREA

Southern Illinois constitutes part of the northern limit of the swamp rabbit's historic range (Kjolhaug et al. 1987). Suitable swamp rabbit habitat comprised approximately 56,000 ha in southern Illinois, mostly along the Mississippi, Ohio, Big Muddy, and Cache rivers (Woolf and Barbour 2002). We conducted research in selected patches of early-successional habitat in Alexander, Pulaski, Johnson, and Union counties in southern Illinois. We chose sites near bottomland hardwood forest patches known to currently or historically maintain swamp rabbit populations. These sites had all been recently (i.e., within 15 yr) reverted from agricultural production to federal farm programs (i.e., Wetlands Reserve Program) or otherwise managed for early-successional habitat. Given the recent agricultural use of these sites, no downed logs were present for swamp rabbits to defecate upon. Dominant overstory species were swamp white oak (*Quercus bicolor*), pin oak (*Q. palustris*), red oak (*Q. rubra*), bald Cypress (*Taxodium distichum*), sweetgum (*Liquidambar styraciflua*), and American sycamore (*Platanus occidentalis*). Understory species present included Allegheny blackberry (*Rubus allegheniensis*), poison ivy (*Toxicodendron radicans*), broom sedge (*Andropogon virginicus*), goldenrod (*Solidago spp.*), and various sedges (*Carex spp.* and *Cyperus spp.*).

METHODS

We constructed each ALL as a frame of 0.95-cm plywood with a rectangular piece of carpet covering the top (Fig. 1A, B). Carpet provided an absorbent substrate for scents, mimicking moss, and also was springy because it was only supported by the perimeter of the frame over most of its length. The ALLs had flat tops, based on swamp rabbits' preference for large-diameter logs that provide relatively flat platforms. To facilitate transport, we skeletonized the

frame to reduce weight and bound it loosely together with nylon cable ties (zip ties) looped through holes in the plywood, allowing the frame to fold flat (Fig 1B). Each ALL weighed approximately 1.2 kg and measured 96 × 19 cm when collapsed. In the field, we tightened and trimmed the zip ties to make the frame rigid, then stapled the carpet on top.

We deployed 404 ALLs at 29 early-successional sites in southern Illinois (10-20 ALLs/site, 0.2-6.2 ALLs/ha) in November-December 2006. These sites had dense woody vegetation <10 cm diameter at breast height and were <2 km from sites where we had detected swamp rabbit presence via surveying for latrines on existing logs. We distributed ALLs within each site to maximize coverage of suitable habitat but also placed them near obvious runways or suspected swamp rabbit fecal pellets. We examined ALLs for the appearance of swamp rabbit fecal pellets 3-4 times between 26 January and 30 April 2007 at intervals of 12-45 days. We identified round fecal pellets on ALLs as swamp rabbit pellets based on size comparison with eastern cottontail (*S. floridanus*) pellets (which are rarely found on natural logs) in sites inhabited by both species.

We also set 8-20 Tomahawk live traps (1.5 kg, Model 205 Collapsible, Tomahawk Live Trap Co., Tomahawk, WI) at each site (0.2-6.7 traps/ha) and checked them each morning for periods of 8-14 days (sometimes shortened by flooding). We baited each trap with apple, covered it with burlap, and surrounded it with leaves and woody debris. We identified captured rabbits as swamp rabbits or eastern cottontails based on size and pelage coloration and marked each rabbit with uniquely numbered ear tags (Model 1005-3, National Band and Tag Co., Newport, KY; Southern Illinois University Institutional Animal Care and Use Committee Protocol no. 06-035). We compared efficiency of ALLs and live trapping for detecting swamp

rabbits by effort required for first detection (Foresman and Pearson 1998), measured in number of visits to each site.

RESULTS

We captured swamp rabbits at 11 of 29 sites (38%) and swamp rabbits established latrines on ALLs in 7 sites (24%), all sites where we captured swamp rabbits. We captured 23 individual swamp rabbits ($\leq$4 individuals/site) a total of 34 times in 4,741 trap-nights. Percentage of ALLs with swamp rabbit latrines increased over time (Fig. 2A), indicating that once swamp rabbits began using a log they continued using it. We detected swamp rabbits at more sites and in less time (in days) via live trapping than via ALLs, because we trapped for $\leq$14 consecutive days per site, but ALLs yielded lower effort to detection in terms of site visits (Fig. 2B) in all but 2 sites. At the end of our study, latrine size ranged as high as 649 pellets on one ALL (median = 59 pellets/used ALL). Our ALLs cost $1.62/ALL (approx. $700 total) in materials (we acquired discarded carpet from installers at no cost) compared with $49/trap (>$3,000 total). The ALLs were still in good condition in April 2007, after >4 months in place, with the only apparent problems being rodent damage to zip ties and some disruption by humans.

DISCUSSION

Managers monitoring cryptic species can benefit from methods that are inexpensive, efficient, and convenient. The ALLs we tested were less expensive and generally detected swamp rabbits with less effort than live traps, although ALLs required more time for detection. We also found ALLs much more convenient to use because live traps must be checked at least daily (Animal

Care and Use Committee 1998), whereas ALLs can be checked months after deployment, with greater detection probability the longer left in place.

Zollner et al. (2000) described swamp rabbits as one of the least-studied lagomorphs, despite their abundance in many areas. The paucity of research stems in part from swamp rabbits' cryptic behavior and low trappability (Woolf and Barbour 2002, Watland et al. 2007). Visual surveys for latrines have provided a useful tool for assessing status of swamp rabbit populations and potential responses to habitat manipulation and other management actions, and ALLs are likely to aid detecting swamp rabbits in habitats where latrine substrates are lacking.

Management Implications

Artificial latrine logs may expand the scope and flexibility of latrine surveys by increasing sensitivity in areas lacking logs or other suitable latrine substrates, such as lands recently retired from agricultural production. Such lands can be a substantial component of potential habitat for swamp rabbits. Managers seeking to quickly detect swamp rabbit presence in latrine-lacking habitats should use intensive live trapping if money and person-power permit. However, managers may benefit by using artificial latrine logs when person-power or funds are limited, in long-term monitoring, or when surveying a large number of sites. To maximize swamp rabbit detection, managers should place ALLs in areas of cover, especially near evidence of rabbit activity, and leave them in place for several months to allow time for rabbits to establish latrines.

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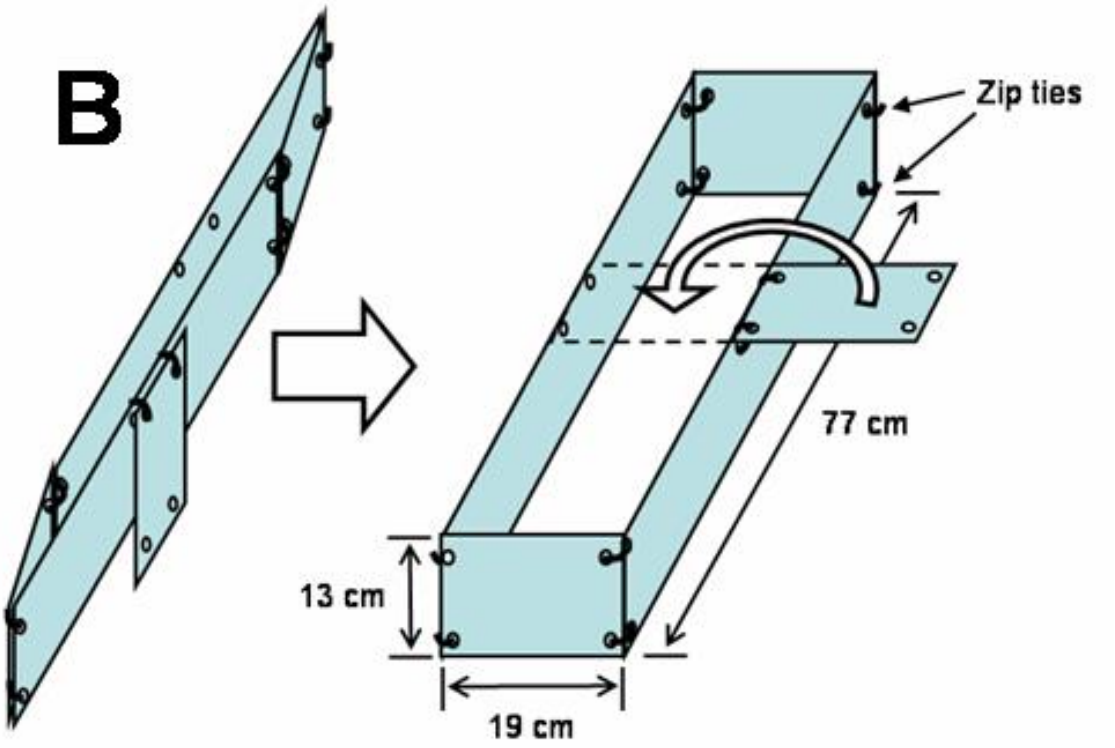
Figure captions

Fig. 1. Artificial latrine log (ALL). (A) Swamp rabbits readily established fecal latrines on many ALLs deployed in the early-successional habitat in southern Illinois, 2006-07. (B) Schematic of the ALL frame (without carpet top) showing collapsed and deployed configurations. For simplicity, the frame is not shown skeletonized.

Fig. 2. Effectiveness of artificial latrine logs (ALLs) deployed in early successional sites in southern Illinois, 2007. (A) Increasing percent use of ALLs over time (in 2007) since deployment. Each line represents data from one site where swamp rabbits used ALLs. (B) Number of visits until initial detection for ALLs and live trapping on the basis of visits to each of 11 sites with known swamp rabbits. For live trapping, visits reflect consecutive daily visits. Horizontal line indicates the maximum number of ALL checks for a site.



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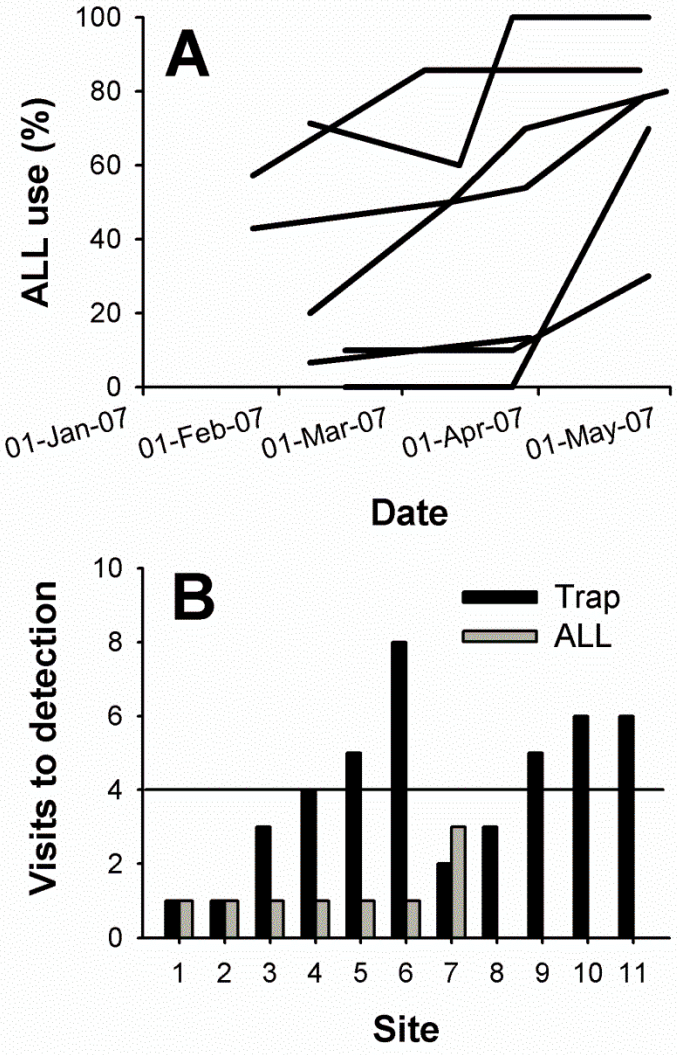
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100
80
60
40
20
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ALL use (%)
01-Jan-07
01-Feb-07
01-Mar-07
01-Apr-07
01-May-07
Date
B
Trap
ALL
10
8
6
4
2
0
Visits to detection
1 2 3 4 5 6 7 8 9 10 11
Site

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