7-1998

ILLINOIS SWAMP RABBIT STUDY

Alan Woolf
Southern Illinois University Carbondale

Michael Barbour
Southern Illinois University Carbondale

Joel Porath
Southern Illinois University Carbondale

W-127-R-3

ILLINOIS SWAMP RABBIT STUDY

FINAL REPORT

Federal Aid Project W-127-R-3

Submitted by:

Cooperative Wildlife Research Laboratory, SIUC

Presented to:

Division of Wildlife Resources
Illinois Department of Natural Resources

Principal Investigator

Alan Woolf

Graduate Research Assistants/Staff

Michael Barbour (Graduate Assistant)
Joel Porath (Graduate Assistant)

July 1998

TABLE OF CONTENTS

LIST OF TABLES

Page

Job 1.1

Job 1.3

FINAL REPORT

STATE OF ILLINOIS

W-127-R-3

Project Period: 1 July 1995 through 30 June 1998

Project: Illinois Swamp Rabbit Study

Prepared by Alan Woolf and Michael Barbour

Cooperative Wildlife Research Laboratory
Southern Illinois University at Carbondale

NEED: Swamp rabbits (*Sylvilagus aquaticus*) typically inhabit bottomland forests and wooded riparian zones that border lacustrine, palustrine, and riverine habitats. Kjolhaug et al. (1987) reviewed the known history and distribution of swamp rabbits in Illinois. The evidence was clear that swamp rabbits were less common than historical accounts indicated, and their distribution was more restricted. The well documented conversion of bottomland forests to agriculture and other uses led to the decline of numbers of swamp rabbits and a more restricted distribution. We found rabbits inhabiting at least 22 sites totaling about 12,485 ha in 7 southern Illinois counties (Kjolhaug 1986, Kjolhaug et al. 1987). Although the rate of habitat loss has lessened, existing populations are vulnerable to habitat conversion on private lands, and lack of management on state and federal properties can result in loss of habitat quality due to successional changes and maturation of bottomland forest habitats.

OBJECTIVES

1. Determine current distribution and relative abundance of swamp rabbits in Illinois.
2. Relate habitat size, structure, and composition to presence and abundance of swamp rabbits.
3. Develop/implement a systematic swamp rabbit population and habitat data collection and monitoring system.

EXECUTIVE SUMMARY

This segment is the final year of a 3-year grant proposal that was designed to compare current status and distribution of the swamp rabbit with that determined a decade ago (Woolf 1985) to allow assessment of the stability of extant populations. The 3 study objectives were incorporated in 3 jobs with recommendations to improve the management of swamp rabbits presented in Job 1.4 (Analysis and Report). This Final Performance Report, the attached thesis (Porath 1998), and a file of site descriptions and maps fulfill the requirements of Job 1.4. Following is a brief description of the major accomplishments and findings of Jobs 1.1-1.3.

Job 1.1. Habitat and Population Inventory

The objective was to determine the current distribution and relative abundance of swamp rabbits in Illinois. Historical records, previous research findings (Woolf 1985), National Wetland Inventory data, aerial photography, satellite imagery, and "expert" opinion were used to identify 78 discrete sites >5 ha in 20 southern Illinois counties that represented potential swamp rabbit habitat. Permission was obtained to search 71 sites, and signs of swamp rabbits were detected at 32 sites in 14 counties.

Reference files for each site visited were established and are maintained at the Cooperative Wildlife Research Laboratory (CWRL), Southern Illinois University at Carbondale (SIUC). The files include: an aerial photograph and/or a 7.5' topographic map with the site boundary, landownership data, search summary, and site description. A Master's thesis (Porath 1998) is attached in lieu of a final report for this job.

Job 1.2. Habitat Characterization

The objective was to relate habitat size, structure, and composition to presence and abundance of swamp rabbits. Average size of unoccupied sites was smaller (307.7 ha) than occupied sites (654.8 ha). Vegetation structure and composition was sampled on 23 occupied and 21 unoccupied sites. The major difference found was that occupied sites had lower (P =

0.014) tree density than unoccupied sites. The resulting greater cover present in occupied sites undoubtedly improved the quality of those habitats for swamp rabbits. A Master's thesis (Porath 1998) is attached in lieu of a final report for this job.

Job 1.3. Population and Habitat Monitoring

The objective was to develop/implement a systematic swamp rabbit population and habitat data collection and monitoring system. We used data collected from Jobs 1.1 and 1.2 to recommend 9 sites for monitoring to determine sensitivity of techniques to detect population status and habitat changes. Criteria were identified to standardize search times and methods so survey results would be comparable over time and among observers. However, we concluded that additional data were needed to properly evaluate and refine the proposed monitoring system. Thus, the proposed monitoring system was not implemented and a job to accomplish that was planned for a subsequent project segment.

Job 1.4. Analysis and Report

The objective was to provide recommendations to improve management of the swamp rabbit in Illinois. We recommend that a science-based management plan be developed based on findings from this project and jobs in subsequent study segments. The management plan should be based on identification of "critical" population units and their habitats and should include habitat management to maintain composition and structure that can meet food and cover requirements during major flood events. Management experiments should be conducted (the concept of "adaptive resource management") to determine the type and scope of habitat manipulations that lead to desired population response. It should be recognized that forested wetlands are the essential element of swamp rabbit habitat and their protection is a requirement. However, protection alone will not suffice; management of habitat units will be needed to minimize risk of losing extant populations to stochastic events, or the lack of suitable habitat.

LITERATURE CITED

Kjolhaug, M. S. 1986. Status, distribution, and factors determining habitat quality of the swamp rabbit in Illinois. M. A. Thesis, Southern Illinois University, Carbondale, Illinois, USA.

_____, A. Woolf, and W. D. Klimstra. 1987. Current status and distribution of the swamp rabbit in Illinois. Transactions of the Illinois Academy of Science 80:299-308.

Porath, J. W. 1998. Swamp rabbit (*Sylvilagus aquaticus*) status, distribution, and habitat characteristics in southern Illinois. M. S. Thesis, Southern Illinois University, Carbondale, Illinois, USA.

Woolf, A. 1985. Current status and distribution of the swamp rabbit in Illinois. Final Report, Illinois Federal Aid Project W-96-R (mimeo).

STUDY 1. STATUS AND DISTRIBUTION OF THE SWAMP RABBIT IN ILLINOIS

JOB 1.1. HABITAT AND POPULATION INVENTORY

Objective: Determine the current distribution and relative abundance of swamp rabbits in Illinois.

A thesis by Porath (1998) in lieu of a final report for this job is attached. The thesis details methods and includes: a list of locations identified as potential swamp rabbit habitat (Porath 1998:38-42), a list of locations of sites searched for swamp rabbit sign 1995-1997 (Porath 1998:43-46), and site descriptions of locations in southern Illinois occupied by swamp rabbits in 1995-97. To supplement these data, 13 additional sites in 10 counties were searched October-December 1997 (Table 1). Following is the abstract of Porath's (1998) thesis:

Swamp rabbits (*Sylvilagus aquaticus*) were studied in southern Illinois from 1995 to 1997 to: (1) identify the available potential habitat; (2) determine the distribution and status of populations; and (3) identify habitat characteristics of locations occupied and locations unoccupied by swamp rabbits. I identified 3,329 individual sites totaling 91,723 ha that met a definition of potential swamp rabbit habitat in 20 counties of southern Illinois. I condensed these values to 78 sites totaling 33,705 ha that better represented swamp rabbit habitat in the 20 counties. Fifty-eight of the 78 sites were searched for signs of swamp rabbit occupancy. Presence was identified on 30 sites in 14 counties (Alexander, Franklin, Gallatin, Jackson, Johnson, Massac, Monroe, Pope, Pulaski, Randolph, Saline, St. Clair, Union, and Williamson). Swamp rabbit sign was not found in Hamilton, Jefferson, Lawrence, Perry, Wayne, and Wabash counties. Minimum total area of all occupied habitat was 19,644 ha; 8,655 ha were federally owned, 6,500 ha were privately owned, and 4,588 ha were state owned. Unoccupied sites averaged smaller ($\bar{x}$ = 307.7, range = 29-1,491 ha) than occupied sites ($\bar{x}$ = 654.8, range = 23-3,904 ha, P = 0.059). Vegetation was sampled on 23 occupied and 21 unoccupied sites. Occupied sites had lower (P = 0.014) tree density than unoccupied sites. I also found a strong negative relationship on occupied sites between tree density and percent ground cover,

suggesting that fewer trees on occupied sites allowed more sunlight to promote ground cover beneficial to swamp rabbits for food and cover. I recommend: (1) selective cutting to open the forest canopy and promote early successional ground cover growth; (2) leaving slash piles created during selective cutting to enhance winter habitat and survival; and (3) evaluate and improve habitat on areas where swamp rabbits seek refuge during extended periods of flooding. Also, because bottomland forests in southern Illinois are highly fragmented, a population dynamics study is needed to determine if some sites are serving as sources for smaller satellite areas that might be population sinks. Management of documented sources and sinks on federal and state owned land is the best option to ensure the survival of swamp rabbits in Illinois.

Table 1. Swamp rabbit habitat locations searched during October-December 1997 segment.

County	1:24,000 7.5' Quadrangle Map Sheet	Section	Legal Description	Density[a]	Area (ha)	Ownership
Jackson	Elkville	14,15,22,23	T.7S-R.1W	absent	83	private
Jackson	DeSoto	27,28,33,34	T.8S-R.1W	absent	98	private
Jackson	Altenburg	19,24,30	T.9S-R.4-5W	absent	95	federal
Jefferson	Ina	6,30,31	T.3-4S-R.2E	absent	420	state
Johnson	Vienna	33,28	T.12S-R.2E	low	103	private
Lawrence	Lawrenceville	16,17,18,20,21	T.3N-R.11W	absent	243	private
Pope	Waltersburg	24,25	T.13S-R.7E	absent	87	private
Randolph	Red Bud/Evansville	6,7	T.5S-R.7W	absent	42	private
Randolph	New Athens East	14,22,23,24	T.1-2S-R.6-7W	absent	1,320	private
Saline	Rudement	27,28,32,33,34	T.9S-R.6-7E	very low	171	private
Wabash	Grayville	3,4,9,10	T.3S-R.14W	absent	59	private
Wayne	Golden Gate	28,29,33,34	T.2S-R.9E	absent	620	private
Williamson	Crab Orchard Lake	20,21,22,27,28,29,33	T.9S-R.2E	absent	139	federal

[a]Relative swamp rabbit abundance was classified as high, moderate, low, very low, and absent according to the following number of pellet logs found per site: $\geq$20 pellet logs = high; 10-19 pellet logs = moderate; 5-9 pellet logs = low; 1-4 pellet log(s) = very low; and 0 pellet logs = absent.

JOB 1.2. HABITAT CHARACTERIZATION

Objective: Relate habitat size, structure, and composition to presence and relative abundance of swamp rabbits.

The methods, findings, and conclusions from this job are reported in the attached thesis (Porath 1998).

JOB 1.3. POPULATION AND HABITAT MONITORING

Objective: Develop/implement a systematic swamp rabbit population and habitat data collection and monitoring system.

INTRODUCTION

Swamp rabbits are associated with forested wetlands throughout their range, preferring floodplains, swamps, river bottoms, and other lowland areas (Chapman and Feldhamer 1981). Many wetland and bottomland areas have been cut for timber production or cleared and converted to agriculture resulting in the loss or fragmentation of many bottomland hardwood areas (Abernathy and Turner 1987). The conversion of forested wetlands to agricultural and other uses has led to a decline in the swamp rabbit's distribution and abundance throughout their range (Toll et al. 1960, Terrell 1972).

In a review of the known history and distribution of swamp rabbits in Illinois, Kjolhaug et al. (1987) reported that swamp rabbits were less common and had a more restricted distribution than historical accounts indicated. Searches of southern Illinois counties conducted 1984-1985 and 1995-1997 revealed that swamp rabbits occupied 22 sites in 7 counties (Kjolhaug et al. 1987) and 32 sites in 14 counties (Porath 1998), respectively. Although Porath (1998) found swamp rabbits occupying more sites covering more total area than Kjolhaug, et al. (1987), this was probably because of a more extensive search. Although there were changes in swamp rabbit occupancy on specific sites, there appeared to be little change in swamp rabbit distribution over the period between searches. The majority of changes in site occupancy appeared to be influenced by successional changes, disturbance events, and/or the floods of 1993 and 1995;

most changes occurred on private lands. The distribution and status of the extant population has been assessed (Job 1.1) but continuing monitoring will be necessary to maintain knowledge of the population status.

METHODS

Site Selection

Data collected in Jobs 1.1 and 1.2 were used to select sites proposed for population monitoring. We recommend monitoring populations on 2-3 sites within 4 categories: large river areas, the Cache river system, inland areas, and peripheral areas. Following are criteria for proposed categories:

Large River. Sites that are adjacent to or within 0.5 km of the Mississippi or Ohio rivers having a population abundance of moderate to high based on data collected in Job 1.1, and containing good habitat (Jobs 1.1 and 1.2).

Cache River. Sites adjacent to or within 0.5 km of the Cache River having the same criteria stated for Large River areas.

Inland. Those areas having the same population and habitat criteria as the river areas, except they are >2 km from the Mississippi, Ohio, and Cache rivers.

Peripheral. Areas >2 km distant from the Cache, Mississippi, and Ohio rivers that had low population abundance as indicated by data from Job 1.1; and were either <100 ha, or if larger, the habitat was rated as marginal.

Priority for public land was used when selecting all sites. However, private lands were selected in some cases because of the low number of publicly owned sites meeting the criteria.

Pellet Counts

We recommend monitoring swamp rabbit populations using permanent transects to count pellet groups and pellet logs because other methods require greater time and effort. Following are proposed monitoring methods.

Transect Layout.–Number of transects per site will vary based on the size of the patch to give equal coverages. Transects will be systematically placed to provide optimum coverage of the site. However, an experimental site will be established where transects also will be placed randomly to determine if the systematic placement biases results.

The beginning point of each transect will be permanently marked at the site. Reference files for each site will be created and maintained at the CWRL SIUC that will include the coordinates of the starting point, bearing of the transects, directions to the beginning point of the transects, a topographic map with transects and their starting points marked, and landownership data.

Search.–To ensure that counts are comparable over time, counts will be made during 15 January - 15 February each year. Counts will not be made <48 hours after snowfall.

Counts will be made by following the transect bearing, searching for pellet groups on logs or other elevated objects. All logs within 2 m of the transect will be recorded and examined for pellets. Data recorded will include total number of logs, the number of used logs, pellet groups and total number of pellets on each log, pellet groups on the ground, and distance of log from transect. Also, we will record weather conditions, number of swamp rabbits seen, and flood conditions.

Population Indices.– Several population indices will be evaluated to determine the most effective index of relative swamp rabbit abundance. Indices to be evaluated include the proportion of logs used, pellets/ha, and pellet groups/ha.

RESULTS

Using these criteria, 9 sites (Table 2) were recommended for monitoring swamp rabbit populations.

DISCUSSION

Swamp rabbits commonly deposit fecal pellets on or beside elevated objects such as logs and stumps. This behavior has been used to indicate the presence of swamp rabbits, and fecal

pellet counts have been used as a swamp rabbit population density index (Terrel 1972, McCollum and Holler 1994). Terrel (1972) and Heuer and Perry (1976) suggested using the proportion of logs used by rabbits instead of total pellet counts because they suspected a relationship might exist between the number of available logs and the proportion of logs used by rabbits. In any case, the number of elevated defecation sites in an area should be examined carefully as skewed pellet group counts can result due to the differences in visibility of pellet groups. Counts should also be standardized by season because seasonal fluctuations in swamp rabbit pellet densities have been observed throughout their range (Terrel 1972, Whitaker and Abrell 1986, Smith et al. 1993).

Table 2. Sites recommended for swamp rabbit population monitoring in southern Illinois.

Site	County	1:24,00 7.5' Quadrangle Map Sheet	Section	Legal Description	Density[a]	Area (ha)	Ownership
river							
Bumgard Island	Alexander	Cache/Thebes	6,7,8,16,17,18,21,22	T.17S-R.2W	high	628	private
Hodges Creek	Pulaski	Olmstead	29,28,33,4,3	T.15-16S-R.1E	high	249	private
Cache							
Heron Pond	Johnson	Glendale	11,14	T.13S-R.4E	mod	1,418	federal
Cache River	Johnson	Cypress	8,9,10,11	T14S-R.2E	high	2,637	federal
inland							
Horseshoe Lake Island	Alexander	Tamms/Cache	9,16,15	T.16S-R2W	high	115	state
Bells Pond	Johnson	Vienna/Karnak	15,14,22,23,21,27	T.13S-R.2E	high	2,248	state
peripheral							
Kaskaskia	Randolph	Red Bud	4,5,8,9,16	T.3-4S-R.7W	low	1,259	state
Saline River	Saline	Rudemont	6	T.10S-R.7W	low	308	private/ federal
UCCA	Union	Jonesboro/Mill Creek	17,18,20	T.13S-R.2W	very low	226	state

[a]Relative swamp rabbit abundance was classified as high, moderate, low, very low, and absent according to the following number of pellet logs found per site: ≥20 pellet logs = high; 10-19 pellet logs = moderate; 5-9 pellet logs = low; 1-4 pellet log(s) = very low; and 0 pellet logs = absent.

JOB 1.4. ANALYSIS AND REPORT

Objective: Provide recommendations to improve management of the swamp rabbit in Illinois.

The current distribution of the swamp rabbit in Illinois (and Indiana and Missouri as well) is a consequence of the quantity and distribution of suitable habitat. Chapman et al. (1982) noted that the swamp rabbit's range had begun to diminish southward and attributed that to drainage and habitat alteration. Our previous studies in Illinois (Woolf 1985) and this study have shown that the swamp rabbit is less widely distributed than reported historically, but we also found that populations have been able to persist and even thrive where tracts of suitable habitat remain. We view swamp rabbit management as inevitably linked to the protection and maintenance of suitable blocks of habitat, with connectivity where possible.

We propose that a science-based management plan be developed based on findings from this study and jobs planned for the next project segment. Any management plan that is adopted and implemented should be based on identification of "critical" population-habitat units that exist within the distribution of the extant population. Risk to these population units should be defined, and actions identified that will be necessary to protect their habitats in a manner that maintains structure and composition that provides food and cover, especially during flood events.

While protection of forested wetlands should be the cornerstone of any plan, the public ownership of about 53% of potential habitat and 67% of occupied habitat affords opportunity to manage habitat to maintain population units. Management experiments ("adaptive resource management") should be conducted on public lands to determine the type and scope of management actions that result in desired population response. This should allow timely and appropriate management of public lands, in an ecosystem context, to maintain swamp rabbits as a component of Illinois' fauna. To do less will simply leave the fate of extant swamp rabbit populations to stochastic events and the inevitable changes that will occur to the composition and structure of the remnant forested wetlands scattered across southern Illinois.

LITERATURE CITED

Abernathy, Y., and R. Turner. 1987. U. S. forested wetlands: status and changes 1940-1980. Bioscience 37:721-727.

Chapman, J. A., and G. A. Feldhamer. 1981. *Sylvilagus aquaticus*. Mammalian Species 151:1-4.

_____, J. G. Hockman, and W. W. Edwards. 1982. Cottontails. Pages 83-123 *in* J. A. Chapman and G. E. Feldhamer, editors. Wild mammals of North America. John Hopkins University Press. Baltimore, Maryland, USA.

Heuer, E. T., Jr., and H. R. Perry. 1976. Squirrel and rabbit abundances in the Atchafalaya Basin, Louisiana. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 30:552-559.

Kjolhaug, M. S., A. Woolf, and W. D. Klimstra. 1987. Current status and distribution of the swamp rabbit in Illinois. Transactions of the Illinois Academy of Science 80:299-308.

McCollum, R. C., and N. R. Holler. 1994. Comparative use of floodplains by swamp rabbits. Journal of the Alabama Academy of Science 65:263-275.

Porath, J. W. 1998. Swamp rabbit (*Sylvilagus aquaticus*) status, distribution, and habitat characteristics in southern Illinois. Thesis, Southern Illinois University at Carbondale, Carbondale, Illinois, USA.

Smith, W. P., P. A. Zollner, and L. A. Brennan. 1993. Ecology of the swamp rabbit in south-central Arkansas. Completion report, Study No. FS-SO-4104-92. U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. Stoneville, Mississippi, USA.

Terrel, T. L. 1972. The swamp rabbit (*Sylvilagus aquaticus*) in Indiana. American Midland Naturalist 63:398-412.

Toll, J. E., T. S. Baskett, and C. H. Conaway. 1960. Home range, reproduction, and foods of the swamp rabbit in Missouri. American Midland Naturalist 63:398-412.

Whitaker, J. O., Jr., and B. Abrell. 1986. The swamp rabbit, *Sylvilagus aquaticus*, in Indiana, 1984-1985. Indiana Academy of Science 95:563-570.

Woolf, A. 1985. Current status and distribution of the swamp rabbit in Illinois. Final Report, Illinois Federal Aid Project W-96-R (mimeo).

Porath, J. W. 1998. Swamp rabbit (*Sylvilagus aquaticus*) status, distribution, and habitat characteristics in southern Illinois. M. S. Thesis, Southern Illinois University, Carbondale, Illinois, USA.