



USDA

*Wildlife Services
Rabies Management
National Report FY 2001*



TABLE OF CONTENTS

EXECUTIVE SUMMARY	-----3
COOPERATIVE RABIES CONTROL PROGRAM	
ALABAMA 2001	-----5
ARIZONA 2001	-----8
MARYLAND 2001	-----11
MASSACHUETTS 2001	-----14
NEW YORK 2001	-----17
OHIO 2001	-----21
PENNSYLVANIA 2001	-----26
VERMONT 2001	-----29
VIRGINIA 2001	-----33
WEST VIRGINIA 2001	-----36

EXECUTIVE SUMMARY

During fiscal year (FY) 2001, Wildlife Services (WS) cooperated in oral rabies vaccination (ORV) projects targeting the coyote (*Canis latrans*) and gray fox (*Urocyon cinereoargenteus*) in Texas. In the eastern United States, the program participated in coordinated interstate ORV projects targeting raccoons (*Procyon lotor*) (Figure 1). In the Northeast, these efforts included coordination with Provincial governments in Ontario and Quebec, Canada to ensure effective field delivery of ORV. In addition, WS cooperated in smaller, independent projects in Pinellas County, Florida; Anne Arundel County, Maryland; Fairfax County, Virginia; and on the Cape Cod isthmus, Massachusetts. Wildlife Services was instrumental in providing emergency response teams and resources to assist state, county, and municipal authorities in a trap-vaccinate-release project to eliminate a rabies outbreak in skunks (*Mephitis sp.*) near Flagstaff, Arizona.

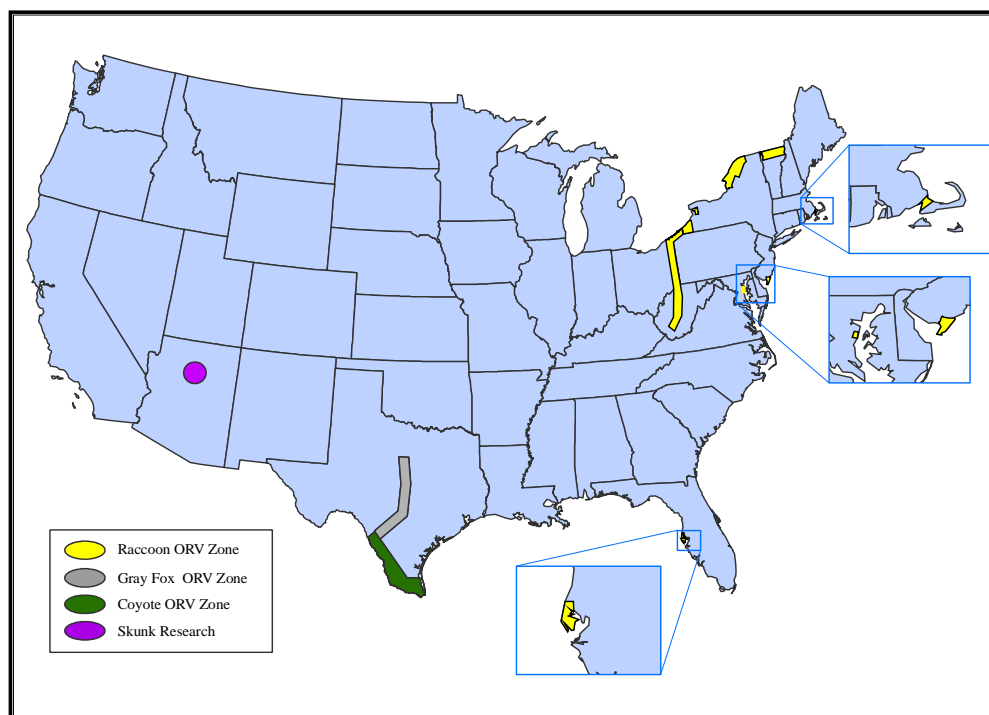


Figure 1. Location of ORV zones, by species, in the United States, 2001. Wildlife Services also cooperated in a county effort in Fairfax, Virginia (not depicted).

Wildlife Services continues to assume an important cooperative role with the Texas Department of Health (TDH) and several other agencies and organizations in ORV efforts that began in 1995. Since 2000, this successful program has consisted of maintaining a 40-mile wide barrier in Texas, along the Rio Grande, to prevent the canine strain of rabies from re-emerging in coyotes from Mexico. A single case of canine strain was confirmed within the southern portion of the vaccination zone near Laredo in 2001, underscoring the importance of this preventative management measure. During FY 2001, the maintenance barrier was the same as in FY 2000, covering approximately 11,000 mi² with approximately 750,000 vaccine laden baits. In addition, WS is an important funding and operational partner with the TDH in ORV efforts to contain gray fox variant of rabies in west central Texas. In 2001, WS assisted in the distribution of 900,000

baits over 9,000 mi² to contain a unique strain of gray fox rabies in Texas. Wildlife Services fills a critical cooperative niche of providing expertise and equipment to obtain the requisite coyote and gray fox samples to continue to monitor and evaluate the status of these ORV programs. Access to Commodity Credit Corporation (CCC) funds (USDA emergency funds) will allow for full restoration of the ORV effort aimed at eliminating this rabies virus from gray foxes in Texas.

An increase in appropriated funding and access to CCC funds, allowed WS and its cooperators to extend ORV project as planned, from southeastern Ohio to the Charleston, West Virginia area. This Appalachian Ridge Project now includes over 7,500 mi² and the distribution of 1.5 million ORV baits. Adding to the Ohio barrier, which was created in 1997, offers greater protection against raccoon variant of the rabies virus from spreading west and affecting a much broader area of the United States. Completing this step sets the stage for implementing the 2002 plan for extending the ORV zone south again, interfacing with high mountains of east Tennessee. Integrating the ORV zone with high mountainous habitat should lead to the creation of a barrier of greater integrity at a lower cost. In trying to achieve our first phase rabies management goal of preventing additional spread, WS and its cooperators will continue to seek ways to optimize ORV by keeping costs at the lowest practical level, without compromising effectiveness.

Oral rabies vaccination was conducted throughout much of Erie County, Pennsylvania in FY 2001. Concerns over the September terrorist attacks forced this project to be conducted by ground rather than by air. Nevertheless, completion of baiting was an important preparatory step for significantly expanding ORV in Pennsylvania in 2002.

In the Northeast, WS worked closely with Cornell University and cooperating state agencies in ORV along the Quebec, Canada border, from the Connecticut River Valley in Northeastern Vermont to the St. Lawrence Valley in northern New York. Wildlife Services also participated in ORV on the Niagara Frontier and in Chautauqua County, New York, which links vaccination zones along the south shore of Lake Erie from New York to Ohio. These projects required close field coordination with our Canadian counterparts in Ontario and Quebec.

Wildlife Services participated in cooperative ORV projects in Massachusetts, Maryland, and Florida. Enhanced surveillance was initiated in Alabama to delineate the leading edge of the raccoon rabies front. This information is essential for formulating a raccoon rabies control strategy along the front in Alabama, a broad corridor through which raccoon rabies could spread west.

Wildlife Services responded immediately to a request for assistance in containing and eliminating rabies in skunks in vicinity of Flagstaff, Arizona. The lack of an effective oral vaccine for skunks required that individual skunks be live-trapped, hand-vaccinated, and released back into the wild to create a population immunity to stop the spread of the virus. The outbreak was an unprecedented event in that it was characterized by skunk to skunk transmission of a bat variant of the rabies virus, perhaps representing the potential emergence of a new terrestrial rabies strain in North America.

Wildlife Services operations provided funding to our research program at the National Wildlife Research Center, to develop research projects to support national rabies control efforts. The Wildlife Services Rabies Management Team, composed of WS and other Animal and Plant Health Inspection Service (APHIS) personnel, as well as expertise from other federal and state agencies and universities, dedicated considerable effort toward strategic planning to address infrastructure, technical, research, and personnel needs for an effective ORV program to meet both short-term goals of rabies strain containment, followed by elimination of the virus in terrestrial reservoirs.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM ALABAMA 2001

BACKGROUND

Raccoon (*Procyon lotor*) rabies is enzootic in Alabama east of a “diagonal line” from the northeast to southwestern part of the state. It is known to be present in at least 33 of the state’s counties. To protect human health and safety and prevent the further westward advancement of raccoon strain rabies, Alabama Wildlife Services (WS) became involved in the larger cooperative oral rabies vaccine (ORV) program in 2001. The primary objective in the pilot year was to establish a surveillance protocol to determine the western front of the raccoon rabies virus in Alabama to aid in developing an effective ORV program. At this point, the Coosa and Alabama River systems are the known front of the westward movement of raccoon rabies. We know rabies is enzootic east and south of the Coosa and Alabama River systems, and we also know isolated cases have been identified west and north of the Alabama River. Priority counties for surveillance bordering the river systems’ west banks were identified, equipment and supplies were purchased, and personnel issues such as training and assignment of duties were conducted (Figure 1).

ORV PROGRAM 2001

Current emphasis is on enhanced surveillance to prepare for ORV once the leading edge of the raccoon rabies front is well defined.

MONITORING, SURVEILLANCE, AND EVALUATION

Eighteen priority counties for surveillance bordering or in close proximity to the Coosa and Alabama River systems’ west banks were identified (Figure 1). They include DeKalb, Cherokee, Marshall, Etowah, Blount, St. Clair, Shelby, Chilton, Bibb, Autauga, Elmore, Dallas, Perry, Wilcox, Marengo, Clarke, Washington, and Mobile. Counties west of these counties are also important to ascertain that we have established the active front correctly. Health Departments, law enforcement agencies, local veterinarians, Alabama Department of Conservation and Natural Resources employees, and others were contacted and made aware of the enhanced surveillance project and encouraged to participate by reporting sick or unnatural acting raccoons.

In FY 2001 only Dallas County near Selma, Alabama was sampled (Figure 1). This yielded 19 raccoons that were trapped, shot, or found dead. Blood serum, brainstems, and other biological data were collected from these animals, and all have tested negative for rabies. This area was chosen as the first phase of the surveillance as it is a known raccoon rabies breach of the Alabama River.

OTHER RABIES CONTROL ACTIVITIES

None to report for Alabama in FY 2001, other than ancillary benefits which may have resulted from constructing bat exclusion devices at several locations.

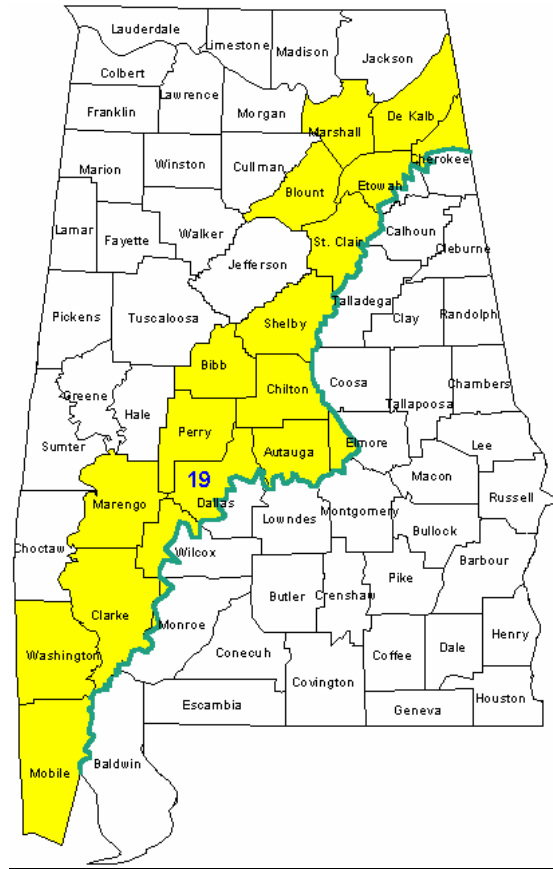


Figure 2. Priority counties identified for raccoon rabies enhanced surveillance in Alabama, 2001. During FY 2001 Dallas County was the first phase of the surveillance effort, yielding 19 raccoons.

SUMMARY

The summer of 2001 marked the first year Alabama became involved in the raccoon ORV project. At this point, the primary objective is to identify the entire westernmost front of raccoon rabies in Alabama, after which an ORV program will be initiated. Currently, the known front is the Coosa and Alabama Rivers, which bisect the state in an approximate southwest to northeast direction. Eighteen counties bordering or close to the west banks of these river systems have been identified as priority counties for raccoon surveillance, understanding counties west of these are important as well in determining the westward front of raccoon rabies.

Equipment and supplies were purchased specifically for the ORV project and personnel were trained in various disciplines related to the project. Personnel from the Centers for Disease Control and Prevention (CDC), Atlanta came to Alabama to train WS personnel and demonstrate the procedures for collecting the required tissue to be submitted for rabies testing. At this phase of the project all raccoons are euthanized and blood serum and brainstems are collected and sent to CDC for rabies testing. Other biological data such as sex, age, and GPS coordinates of capture/collection location are collected as well.

A hierarchy has been established for the collection of raccoons to be submitted for rabies testing: 1) sick, unusual acting animals; 2) animals found dead in unusual places (e.g., in a shed or beside a house); 3) road-killed raccoons; 4) collection by shooting (primarily night-shooting);

and 5) collection by trapping various sites. Major cooperators in the priority counties, such as state and county health departments, local law enforcement agencies, state conservation departments, veterinarians, and others likely to be outdoors or come in contact with raccoons will be contacted and encouraged to participate in our surveillance efforts (WS personnel will be the primary participants in the collection efforts of 4 and 5). In FY 2002 aggressive collection efforts will be implemented in the 18 priority counties, and willing cooperators will be provided with equipment and materials to facilitate the collection of raccoons and encourage their participation. A user-friendly method of reporting suspect raccoons or animals collected by cooperators will be developed. This will include contacting the Alabama WS office and personnel from that office will respond by collecting suspect raccoons or picking up those which may have been collected and held (e.g., road kills picked up and frozen at a local facility).

The Alabama ORV project is an integral part of the national ORV program exploring ways to stop the westward movement of the raccoon rabies virus and ultimately trying to eliminate this unique variant of the rabies virus.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM ARIZONA 2001

BACKGROUND

Two terrestrial strains of rabies, striped skunk (*Mephitis mephitis*) and gray fox (*Urocyon cinereoargenteus*), occur in Arizona. The skunk strain typically occurs in the southeastern counties. The gray fox strain occurs primarily in the eastern counties, into the central part of the state, below the Mogollon Rim. Bat (Order *Chiroptera*) strains of rabies also occur throughout the state. The last documented human rabies case in Arizona occurred in 1981.

In 2001, the number of rabies cases in Arizona set a new record high. Positive rabies cases occurred in 10 of the 15 counties. The Arizona State Health Laboratories tested 2,671 animals for rabies, 1,129 of which were wildlife. The Arizona Department of Health Services (AZDHS) reported 129 (4.8%) animals testing positive (Figure 1). This represented a 27% increase from the 101 rabies cases in 2000, and a 130% increase from the previous 10 years annual average of 56 positive cases. All of the 129 positive rabies cases reported were identified in wildlife; at least 7 species of bats and 5 terrestrial species, including the striped skunk, gray fox, coyote (*Canis latrans*), bobcat (*Lynx rufus*), and badger (*Taxidea taxus*).

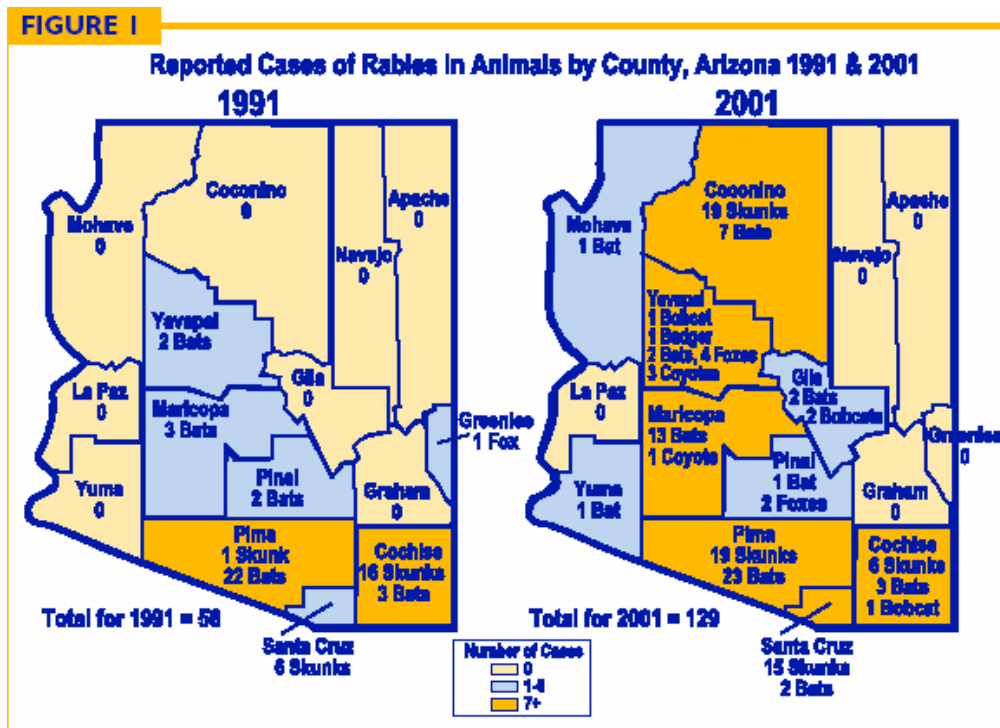


Figure 1. Animals that tested positive for rabies, by species and county, in Arizona, 1991 and 2001 (Arizona Department of Health Services 2002).

BAT VARIANT IN SKUNKS

Since the 1960's, terrestrial rabies has been unknown in Northern Arizona. From January 11, 2001 to July 24, 2001, 19 striped skunks tested positive for rabies (Figure 2). Laboratory testing confirmed that the strain originated in insectivorous bats. This was the first documented event of a bat strain of rabies being transmitted and maintained in skunks.

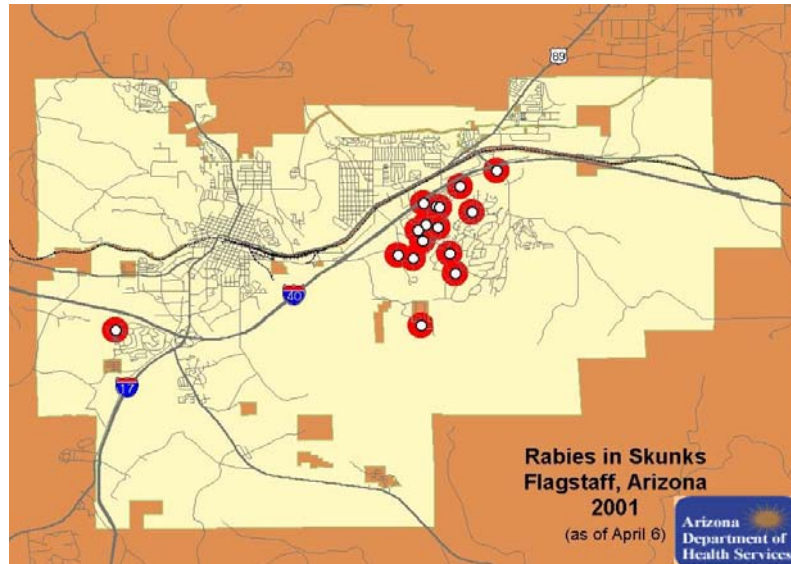


Figure 2. By April 6, 2001, 16 skunks were found positive with the bat variant of rabies; three more were identified by July 24, 2001, (not included on the map). The city of Flagstaff is located in the south central part of Coconino County, at 7,000 feet in elevation; summer temperatures range from 37 to 79° F, winter temperatures range from 15 to 43 ° F; average rain fall equals 19.8 inches, with an average of 84.4 inches of snow.

TRAP-VACCINATE-RELEASE PROGRAM 2001

In April 2001, the Centers for Disease Control and Prevention (CDC), AZDHS, and Coconino County Department of Health Services (CCDHS) requested assistance from Wildlife Services (WS) for help to control the spread of a bat strain of rabies in the skunk population in the Flagstaff area. Wildlife Services obtained Animal and Plant Health Inspection Service (APHIS) contingency funds to help address this unprecedented outbreak. From May 8, 2001, through June 30, 2001, WS conducted a trap-vaccinate-release (TVR) program to eliminate the outbreak of a bat strain of rabies in striped skunks. The TVR program was modeled after the TVR program used by the Ontario Ministry of Natural Resources in Toronto, Ontario, Canada. Wildlife Services cooperated with a variety of agencies and groups including: Ontario Ministry of Natural Resources, Arizona Game and Fish Department, AZDHS, CCDHS, CDC, Coconino Humane Association, Flagstaff Police Department, Merial Limited, and USDA-APHIS.

Wildlife Services TVR program included 6 weeks of intensive trapping. Participants from the following WS programs provided support in the trapping and monitoring: Mississippi, Oklahoma, Idaho, Tennessee, Michigan, New Hampshire, and WS-National Wildlife Research Center. Tomahawk live traps, No. 105 (7 X 7 X 24 inch), were used by all WS employees. All target animals were ear-tagged and hand-vaccinated without chemical immobilization.

During 6 weeks of trapping, 174 striped skunks were captured. Of these, 112 were vaccinated, 19 euthanized, and 43 recaptured. In addition, WS vaccinated 2 raccoons (*Procyon lotor*) and 2 gray foxes. All euthanized skunks tested negative for rabies and bubonic plague. Trapping was conducted for a total of 6,748 trap nights, which included 179 target captures (2.7%), 206 non-target captures (3%), for an overall catch rate of 5.7%.

MONITORING, SURVEILLANCE, AND EVALUATION

Prior to, during, and after the 6-week TVR project, WS used and evaluated 3 methods to assess the relative abundance of skunks in the Flagstaff area. Methods included: 22 passive track plots; 10 - 1 mile spot light transects; and mark and recapture. Mark and recapture models have parameters which could not be met for this project. Spot light surveys were conducted each week for 6 weeks and yielded only 2 sightings. The passive track index proved to be the most useful methods to index skunk activity.

OTHER RABIES CONTROL ACTIVITIES

Wildlife Services assisted AZDHS and Yavapai County in conducting active and passive rabies monitoring in Yavapai County. Several terrestrial species, including gray fox, coyote, badger, and bobcat tested positive for gray fox strain rabies. Wildlife Services removed 232 striped skunks, 4 gray foxes, and other species while responding to both nuisance wildlife and human health and safety calls. Approximately 20 skunks, 1 gray fox, and 1 coyote were submitted for rabies testing.

Wildlife Services personnel also provided assistance and information on rabies management at different agency meetings as follows: August 6, 2001, the Yavapai County Board of Supervisors; August 8, 2001, the Native American Ranger Workshop, sponsored by the Inter Tribal Council of Arizona, with 8 different tribes present; August 20, 2001, Yavapai County Board of Supervisors; August 25, 2001, Greenlee County Cattle Growers Association; and September 18, 2001, provided assistance for human health and safety concerns pertaining to an urban gray fox in Maricopa County.

SUMMARY

In 2001, WS played a critical role in rabies management by having a quick and collaborated management response for a new and unique rabies epizootic in Coconino County. Since our efforts, and those of the AZDHS, 217 skunks have been hand vaccinated, and there have been no new reported cases of rabies in skunks in Coconino County. WS provided assistance for rabies surveillance in Yavapai County. Wildlife Services plans to provide continued surveillance and management support for Yavapai County in 2002.

In 2002, WS plans to participate in a placebo skunk bait study and a radio telemetry study to assess skunks movement patterns in Flagstaff. It is the goal of the Arizona WS program to continue to provide support and to be on call to respond to any request for rabies surveillance and management. Wildlife Services looks forward to a strong cooperative relationship with the State and local Departments, while providing federal leadership in rabies management.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM MARYLAND 2001

BACKGROUND

Raccoon (*Procyon lotor*) rabies first entered Maryland in Allegany County in 1981. It quickly spread and is present throughout the state. Raccoon rabies was first documented in Anne Arundel County in 1984. In 2000, Anne Arundel County reported 43 cases of animal rabies, a downward trend from the 73 reported in 1998 and 97 cases in 1997. From 1996-1998 an average of 18 cases of animal rabies was reported from the Annapolis Peninsula alone. In October 1998, the Anne Arundel County Department of Health initiated an oral rabies vaccination (ORV) project on the Annapolis Peninsula. Baits containing Raboral V-RG® vaccine have been distributed each year on the Annapolis Peninsula since October 1998 and on Gibson Island since 2000. In 2001, the ORV project was expanded with the assistance of Wildlife Services (WS) to the Broadneck Peninsula, Anne Arundel County. Annapolis Peninsula, Gibson Island, and Broadneck Peninsula comprise 94 km², 4 km², and 88 km², respectively.

ORV PROGRAM 2001

Ground baiting occurred on Annapolis and Broadneck Peninsulas from September 10 to 13, and helicopter baiting occurred September 18 to 20 and 26 (Figure 1). Gibson Island ground baiting was completed by September 29. Fishmeal polymer (FMP) baits were distributed all baited areas in Anne Arundel County. On the Annapolis Peninsula, 8,329 baits were distributed by helicopter and 1,813 baits by hand. On Broadneck Peninsula, 4,686 baits were distributed by helicopter and 2,022 baits by hand baiting on the ground. On Gibson Island, 400 baits were distributed by hand. The cost for each bait is \$1.32. Aircraft and flight crew for the 2001 ORV program were provided by the Anne Arundel County Police Department. Baiting efforts and support were provided by Anne Arundel County Department of Health, WS, and volunteers from the general public.

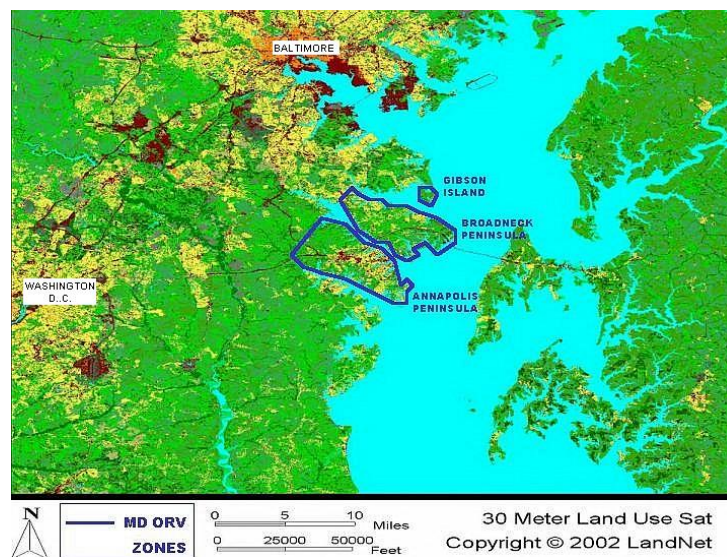


Figure 1. Oral rabies vaccination zones in Anne Arundel County, Maryland, 2001.

MONITORING, SURVEILLANCE, AND EVALUATION

Annapolis Peninsula, Broadneck Peninsula, and Gibson Island Studies

The goal of the ORV program is to achieve sufficient levels of immunity in the raccoon population to reduce the number of people and pets exposed to rabid animals. In 2001, WS joined the Anne Arundel County Department of Health in a multi-year study to assess aerial ORV baiting efficacy on two peninsulas and 1 island in Anne Arundel County. Residential property and public parks consisting of wooded and waterfront lots typify the surveillance area.

On August 6, 2001, WS initiated pre-ORV raccoon live trapping to collect blood serum as well as other biological data to evaluate and monitor project success on the Broadneck Peninsula. Samples were collected from 54 raccoons in 482 trap nights. On October 22, 2001, WS initiated post-ORV raccoon live trapping and collected samples from 29 raccoons in 461 trap nights (Table 1).

Table 1. Results of pre-bait and post-bait surveillance efforts on the Broadneck Peninsula during the 2001 ORV project.

Pre-bait			Post-bait	
Trap nights	482		Trap nights	461
Raccoons	54		Raccoons	34
Recaptures	3		Recaptures	3
Total	57		Total	37
Success Rate	12%		Success Rate	8%
RVNA Positive ^a	19%		RVNA Positive ^a	29%

^arabies virus neutralizing antibodies

On October 31, 2001, WS initiated post-ORV raccoon live trapping on the Annapolis Peninsula and Gibson Island on November 19, 2001. Samples were collected from 51 raccoons in 319 trap nights on the Annapolis Peninsula and 9 raccoons in 58 trap nights on Gibson Island (Table 2).

Table 2. Results of post-bait surveillance efforts on the Annapolis Peninsula and Gibson Island during the 2001 ORV project.

Annapolis Peninsula			Gibson Island	
Trap nights	319		Trap nights	58
Raccoons	64		Raccoons	9
Recaptures	7		Recaptures	0
Total	71		Total	9
Success Rate	22%		Success Rate	16%
RVNA Positive ^a	38%		RVNA Positive ^a	11%

^arabies virus neutralizing antibodies

Levels of rabies virus neutralizing antibodies in pre- and post-ORV live-trapped raccoons will be used to help determine the effectiveness of current baiting in the three ORV zones in Anne Arundel County. The location of recaptures will also aid in determining home range size/movement patterns of the raccoons in the study areas.

SUMMARY

The summer of 2001 marked the first year of WS cooperative participation in the Anne Arundel County Department of Health ORV Project for the Annapolis and Broadneck Peninsulas. In 2002, the ORV program will continue with the ORV Project in Maryland, expanding serology survey efforts to a new study area south of the Annapolis Peninsula.

To date 45,850 Raboral V-RG® baits have been distributed across three ORV zones in Anne Arundel County encompassing a 186 km² area (72 mi²). During the 3 years prior to the beginning of this project in October 1998, an average of 18 rabid animals was reported from the Annapolis Peninsula. Since the program was initiated in 1998, only 1 rabid raccoon was reported during 1999, and none were reported in 2000 and 2001.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM MASSACHUSETTS 2001

BACKGROUND

Terrestrial wildlife rabies was first detected from a northern Massachusetts town in 1992, and subsequently spread to all counties except Barnstable (Cape Cod) and Dukes (Martha's Vineyard and Nantucket Islands) counties. Rabies remains a problem in Massachusetts. By early 2002, 2,065 raccoons (*Procyon lotor*) and 1,059 striped skunks (*Mephitis mephitis*) had tested positive for rabies. A potentially confounding development is that annual rabies prevalence in skunks has exceeded the annual prevalence in raccoons in some years. This trend has also been noted in neighboring Rhode Island. Several small-scale studies to address the questions of strain typing and potential reporting biases are in pilot-study stages. State public health officials continue to monitor specimens collected and tested due to human or domestic animal exposure and for rabies surveillance. Several high profile conflicts between carnivores and humans highlighted the level of fear Massachusetts' residents have about rabies.

ORV PROGRAM 2001

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (WS) cooperated in the Cape Cod oral rabies vaccination program (CCORV) in southeastern Massachusetts. This Tufts University and State Department of Public Health led project (1994-present) is designed to reduce the incidence of terrestrial rabies in an area directly adjacent to the Cape Cod Canal, in order to prevent the spread of rabies to Cape Cod, a heavily populated tourist destination south of Boston. Full-time assistance from WS began in 2001 and included: bait acquisition and distribution, surveillance trapping, and small-scale studies including relative density estimation and technique trials. During 2001 the CCORV program expanded its vaccination area from 420 to 728 km² (Figure 1). During April and October 7, 2000 fishmeal polymer baits containing Raboral V-RG[®] were distributed as evenly as possible at approximately 100 baits/km² from vehicles. Rabies cases continue to occur within the CCORV treatment zone, but no rabies has occurred on the Cape.



Figure 1. The Massachusetts ORV zone and expansion to the west shown as red lines. Baiting in 2001 occurred from the Cape Cod Canal to the red line farthest west.

Providing Wildlife Services

A full-time WS biologist began work in the CCORV zone in April 2001. Tasks included office establishment, introductory meetings with cooperators, and field work.

Relative density indices:

Pitch pine-scrub oak communities dominate much of the current CCORV zone. Given that low raccoon densities are predicted for this habitat type, WS undertook two density studies in southeastern MA to assess baseline raccoon densities for pitch pine-scrub oak and mixed forest communities in 2001. Confirmation of low raccoon relative densities in these habitat types could increase cost effectiveness of ORV bait use through reduced baiting in habitats seldom used by raccoons.

Plymouth

The Plymouth study area (PSA) was representative of suburban/rural portions of the CCORV treatment zone, and is comprised of mixed pitch pine/scrub oak forest cover types, and human altered landscapes. Three unique raccoons, 3 skunks (inclusive of 1 recapture), 2

opossums (*Didelphis virginiana*), and 1 gray fox (*Urocyon cinereoargenteus*) were captured. Under the WS ORV protocol for relative density estimation, density indices of 1.1 raccoons, 0.7 skunks (and opossums), and 0.3 gray foxes/km² were estimated for the PSA. Serum samples from each captured animal were submitted to Tufts University.

Middleborough

A second relative density study was conducted at the Rocky Gutter State Wildlife Management Area, in Middleborough Massachusetts. The Middleborough Study Area (MSA) was representative of rural portions of the proposed new CCORV treatment zone and was comprised of mixed forest cover types (white pine-scrub oak dominated), and was somewhat less arid than the PSA. A large seasonal wetland dominated the MSA. An interstate highway and a lightly populated residential neighborhood were adjacent to it. Wildlife Services captured 2 unique raccoons and 1 opossum. Under the WS National protocol for relative density estimation, density indices of 0.7 raccoons/km² were estimated for the MSA during the study. Passive tracking efforts under bisecting power lines revealed few raccoon tracks, supporting the trapping findings of extremely low raccoon relative densities for this type of habitat.

Surveillance trapping:

Additional surveillance trapping efforts incidental to relative density indexing by WS during 2001 yielded 21 raccoons and 6 skunks (8.9% and 2.5% trap success over 233 trap nights). In addition, Tufts University employed a full-time trapper who engaged in surveillance trapping throughout the CCORV zone during summer 2001.

Road kill surveys:

Wildlife Services began investigating the potential for reporting bias in surveillance efforts through a cooperative project with the State Public Health Lab to test road-killed skunks and raccoons. These samples will be compared to those submitted by police departments and animal control agents

2002

Future plans for WS include an investigation of the potential utility of several types of track stations for assessing relative raccoon, skunk, and other carnivore densities to support ORV decisions in southeastern Massachusetts. In addition, surveillance trapping, road kill surveys, and the development of a Cape Cod contingency plan to address a potential epizootic of raccoon rabies are planned for 2002.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM NEW YORK 2001

BACKGROUND

Raccoon (*Procyon lotor*) rabies first entered New York in 1990. It quickly spread and is present throughout the state, except for Franklin County, the Adirondack Mountains, and parts of Long Island. Raccoon rabies was first documented in St. Lawrence County in 1997. An epizootic occurred in 1998 with 148 confirmed wildlife cases. The outbreak continued to spread in 1999, resulting in 139 cases. Following the epizootic in St. Lawrence County, an intensive oral rabies vaccination (ORV) program was initiated in 1998 with the goal of preventing northward spread of raccoon rabies to new areas. The ORV program in northern New York includes all of Jefferson County, the northern portion of St. Lawrence County, and the western portion of Franklin County. The bait zone is commonly referred to as the St. Lawrence Region and comprises 9,458 km² (5,874 mi²) (Figure 1). Cornell University leads this project. Wildlife Services (WS) is an active participant, providing the major source of cooperative funding and federal wildlife management leadership.

ORV PROGRAM 2001

Aerial baiting occurred from August 9 to 16, 2001. Two types of baits containing Raboral V-RG® vaccine were distributed as part of the 2001 ORV program. During 29 flights, 549,450 coated sachet (CS) baits and 125,917 fishmeal polymer (FMP) baits were distributed. Coated sachet and FMP baits cost \$1.00/bait and \$1.32/bait, respectively. Aircraft and flight crew for the 2001 ORV program were provided by the Ontario Ministry of Natural Resources (OMNR). Ground and baiting support also was provided by WS, Cornell University, and St. Lawrence County Department of Health.

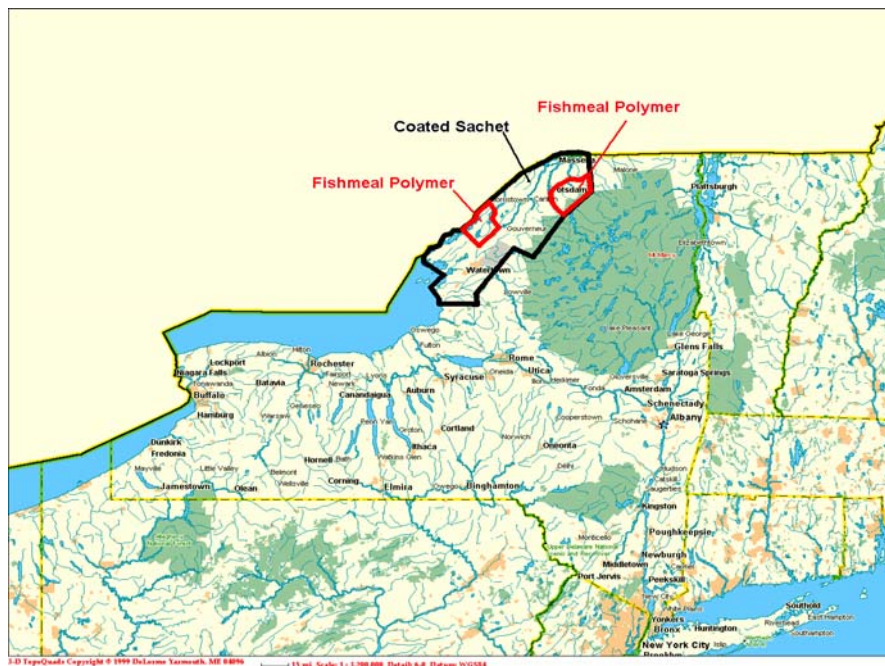


Figure 1. Oral rabies vaccination zones in St. Lawrence and Jefferson Counties, New York, 2001.

MONITORING, SURVEILLANCE, AND EVALUATION

The goal of the ORV program is to achieve sufficient levels of immunity in the raccoon population to create a barrier to the spread of the rabies virus to new, uninfected areas. On September 27, 2001, WS initiated post-ORV raccoon live trapping to collect blood serum and tooth samples as well as other biological data to evaluate and monitor project success. Samples were collected from 199 raccoons and 14 skunks in 1,684 trap nights (Table 1).

Table 1. Results of surveillance trapping efforts during the 2001 ORV project in St. Lawrence Region of New York.

Coated sachet		Fishmeal polymer	
Trap nights	1,081	Trap nights	603
Unique raccoons	98	Unique raccoons	101
Recapture raccoons	10	Recapture raccoons	
Total raccoons	108	Total raccoons	101
Trap success	10%	Trap success	17%
Skunks	10	Skunks	4
Mean elevation	100m/300ft	Mean elevation	125m/400ft

Population Monitoring

Raccoon rabies has spread to new areas at about 18-24 miles/year since the disease became established in the Mid-Atlantic region in the late 1970's. Raccoon rabies appears to spread most rapidly in preferred raccoon habitats, while major physiographic features such as rivers, large lakes and mountain ranges appear to prevent or impede the spread of rabies. The St. Lawrence River may act as a physical barrier, impeding the northward movement of rabies. In addition, high mountainous elevations with contiguous forest such as those in the Adirondack and Appalachian Mountains may support low raccoon densities and also act as barriers to the spread of the rabies virus. In a coordinated effort with other states in which WS cooperates in ORV projects, five density studies have been completed in New York to help document raccoon population density trends. This information along with data from other states will have broader application in future ORV baiting strategies (Table 2).

Table 2. Results of raccoon population monitoring efforts in the St. Lawrence Region of New York since 1999.

Year	Town	Elevation	Raccoon/km ²
1999	Louisville (lowland)	75m	9/km ²
1999	Colton (foothills)	450m	2/km ²
2000	Cranberry Lake (mountains)	470m	0/km ²
2000	Colton (river corridor)	450m	2/km ²
2001	Hammond (lowland)	100m	11/km ²

St. Lawrence River Shoreline Study

In 2001, WS initiated a multi-year study to assess aerial ORV baiting efficacy along the St. Lawrence River shoreline. Steep topography, numerous small islands and a large number of camps and summer homes typify the area, posing challenges for distributing baits to targeted

raccoon habitat. Inability to distribute sufficient numbers of baits to raccoon habitat immediately along the river may be exacerbated by bait flight lines that run perpendicular to the river.

Levels of rabies virus neutralizing antibodies in pre and post-ORV live-trapped raccoons will be used to help determine the effectiveness of current aerial baiting along the St. Lawrence shoreline. The location of recaptures will also aid in determining home range size/movement patterns of the raccoons using the river shoreline (Table 3). This study will continue in 2002 and include a radio telemetry component to more fully assess raccoon movement seasonal movement patterns along the river. The results of this study may have broader applicability to ORV projects given the potentially common problem of distributing baits close to shorelines because of dwelling and human activity.

Table 3. St. Lawrence River shoreline pre-bait and post-bait trapping results.

Pre-bait		Post-bait	
Trap nights	1,488	Trap nights	684
Raccoons	110 ^a	Raccoons	32
Recaptures	76	Recaptures	16
Total	186	Total	48
Success Rate	13%	Success Rate	7%
Elevation	100m	Elevation	100m

^aincludes Hammond density study.

OTHER RABIES CONTROL ACTIVITIES

In June 2001, WS provided assistance to The Nature Conservancy (TNC) to protect the great blue heron (*Ardea herodias*) nesting colony on Ironsides Island on the St. Lawrence River. Four raccoons were removed in 39 trap nights. Raccoon samples were used in the ORV evaluation.

In July 2001, WS provided assistance to the New York State Office of Parks, Recreation, and Historic Preservation, to reduce property damage and human health and safety threats associated with raccoons at campsites on Wellesley and Grindstone Islands. During 107 trap nights, 47 raccoons were captured and euthanized according to the American Veterinary Medical Association guidelines. Blood serum and tooth samples as well as other biological data were collected from each raccoon for evaluation of the effectiveness of ORV along the St. Lawrence River shoreline.

Also, during July 2001, WS assisted New York State Department of Health (DOH) with the capture, data collection, and tagging of little brown bats (*Myotis lucifugus*) as part of a project to test the efficacy of bat exclusion devices at major roost sites.

In September 2001, WS assisted the DOH in collecting biological data for the ORV program in the upper Lake Champlain Valley. In 1,217 trap nights, WS captured a total of 102 raccoons.

SUMMARY

The summer of 2001 marked the fourth year of WS cooperative participation in the St. Lawrence Region ORV project. This project is part of a larger Northeastern ORV effort that in 2001 included Vermont, Quebec and Ontario. In 2002, the ORV program will continue with the

ORV in New York projected to expand south along the Lake Ontario plain into Oswego County. The St. Lawrence River shoreline study will add the use of radio telemetry to better monitor individual raccoon movement patterns in relation to ORV baiting.

To date over 2.1 million Raboral V-RG® baits have been distributed across the St. Lawrence Region encompassing a 9,586 km² area (5,953 mi²). Since the program was initiated in 1998, there has been a noted decline in reported positive terrestrial rabies cases in the ORV zone, decreasing from about 150 in 1998 and 1999 to 13 in 2000. In 2001, there were only 3 reported terrestrial rabies cases in the area.

The New York ORV program is an integral part of the larger Northeastern cooperative effort, which in turn, is tied to national planning efforts to contain the raccoon strain and explore strategies to eliminate this unique variant of the rabies virus.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM OHIO 2001

BACKGROUND

Raccoon (*Procyon lotor*) strain of rabies was first documented in Mahoning County, Ohio in 1996. In April 1997, an epizootic was identified in northeastern Ohio, with 62 rabies cases in 1996. Because of the epizootic and a peak in public interest, an oral rabies vaccination (ORV) program was initiated to prevent westward spread of raccoon rabies. Initially, ORV zone included Trumbull, Mahoning, and Columbiana Counties and encompassed 1780 km² (688 mi²). As a result of enhanced surveillance, raccoon rabies was detected outside of the ORV zone in Ohio. In the fall of 1999, the ORV zone was expanded by 3-fold to include: Ashtabula, Trumbull, Mahoning, Columbiana, Carroll, and Jefferson Counties, encompassing 6497 km² (2509 mi²) (Figure 1). To date, the ORV zone encompasses 8,518 km² (3289 miles²) and includes Ashtabula, Trumbull, Columbiana, Mahoning, Jefferson, Carroll, Harrison, Belmont, and Monroe Counties (Figure 2). Ohio's ORV zone is part of the Appalachian Ridge Project (ARP), which incorporates natural features (Ohio River and Lake Erie) and mountains further south in West Virginia, integrated with ORV to prevent the spread of raccoon rabies to the west.

The Ohio Department of Health (ODH) is the lead agency for ORV in Ohio. Wildlife Services (WS) is an active cooperator, now providing a major source of federal funding and wildlife management leadership. Other cooperators include Ohio Department of Agriculture (ODA), Ohio Division of Wildlife (ODW), Centers for Disease Control and Prevention, The Ohio State University, and local and county health departments

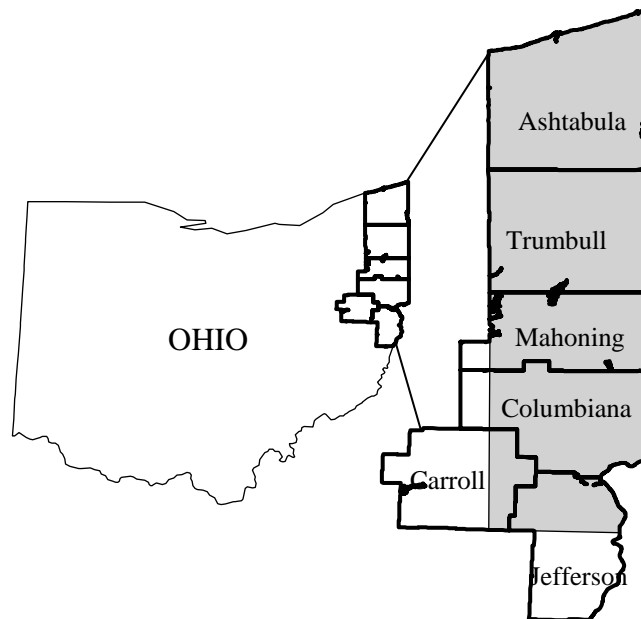


Figure 1. The Ohio ORV bait zone from the fall of 1999 to the spring of 2001.

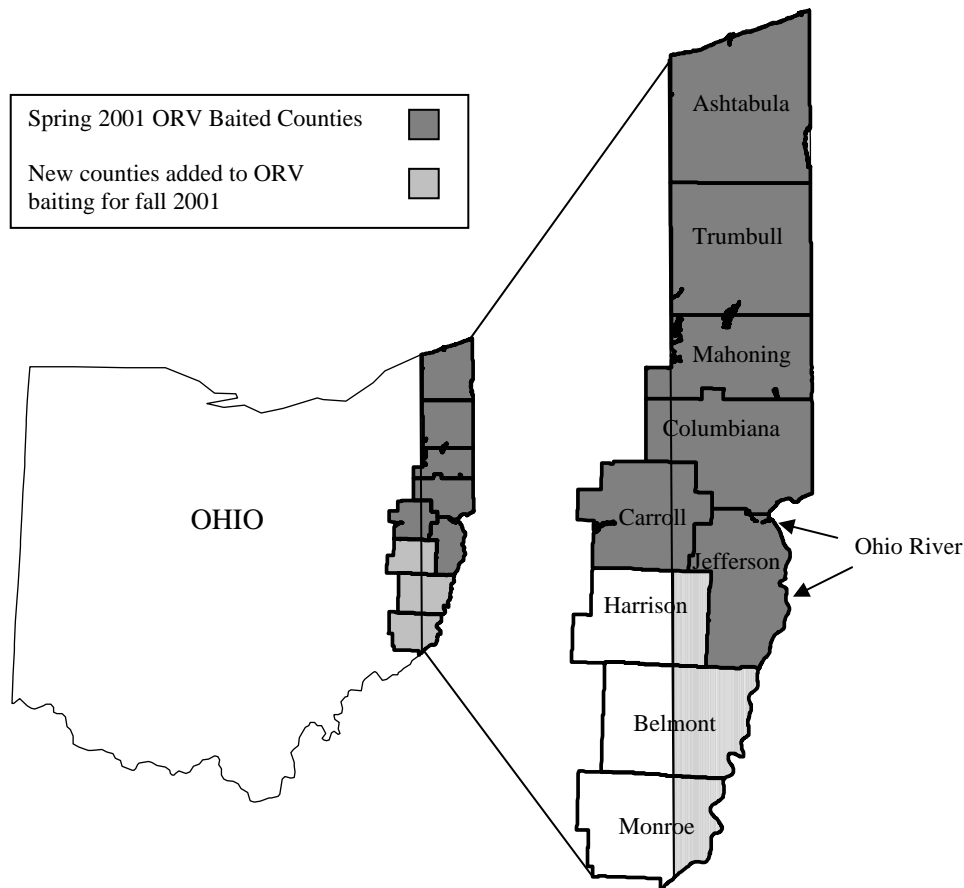


Figure 2. Ohio's current ORV zone where 656,985 fishmeal polymer baits were distributed across 8,518 km² (3,289 mi²) in 2001.

ORV PROGRAM 2001

Two baiting campaigns were conducted in Ohio in 2001. One occurred in the spring from March 26 to April 1, 2001 and included: Ashtabula, Trumbull, Mahoning, Columbiana, Jefferson, and Carroll counties (Figure 2). Thirty flights were completed and 520,560 Fishmeal Polymer (FMP) baits were distributed. The second campaign occurred from September 10-25 and extended Ohio's rabies barrier to include Belmont, Monroe, and Harrison Counties (Figure 2). Fifty-three flights were completed and 656,985 FMP baits were distributed. Fishmeal polymer baits used in both campaigns contained Raboral V-RG® vaccine and cost \$1.32 each. Aircraft and flight crew for the 2001 ORV program were provided by the Ontario Ministry of Natural Resources (OMNR). Ground and baiting support was provided by WS, ODH, ODW, ODA, Ohio National Guard, and county/local health departments.

MONITORING, SURVEILLANCE, AND EVALUATION

The goal of the ORV program is to achieve sufficient levels of immunity in the raccoon population to create a barrier to halt the spread of the rabies virus to new, uninfected areas. During the spring and fall of 2001, WS participated in 3 trapping campaigns designed to collect serum and tooth samples from raccoons as well as other biological data to evaluate and monitor

project success. On April 23, 2001, WS initiated the spring post-ORV raccoon live trapping effort. Samples were collected from 348 raccoons during 1,780 trap nights (Table 1). On June 7, 2001, WS switched from spring post-ORV raccoon live trapping in Ashtabula, Trumbull, Mahoning, and Columbiana counties to fall pre-ORV trapping, in the recently added bait zones of Belmont, Monroe, and Harrison Counties. Fall pre-ORV trapping provides background information about raccoons in naive areas that the bait zone has expanded to include. Samples were collected from 111 raccoons during 398 trap nights during fall pre-ORV trapping (Table 1). On October 15, 2001, WS completed the year with fall post-ORV raccoon live trapping in the new baited zone. Samples were collected from 61 raccoons during 558 trap nights (Table 1). Non-target captures included feral cats (*Felis catus*), opossum (*Didelphis virginiana*), woodchuck (*Marmota monax*), skunk, fox, mink (*Mustela vison*), cottontail rabbit (*Sylvilagus floridanus*), and river otter (*Lontra canadensis*).

Table 1. Results of surveillance trapping efforts during Ohio's 2001 spring and fall ORV project seasons.

Spring post-bait		Fall pre-bait		Fall post-bait	
Trap nights	1,780	Trap nights	398	Trap nights	558
Raccoon captures	348	Raccoon captures	111	Raccoon captures	61
Recaptures	57	Recaptures	0	Recaptures	1
Non-Targets captures	65	Non-Targets captures	3	Non-Targets captures	9
Trap success rate	23%	Trap success rate	28%	Trap success rate	11%

OHIO RADIO TELEMETRY PILOT STUDY

In 2001, WS initiated a multi-year pilot study that will maintain 30 radio-collared raccoons for research. Three groups of 10 animals each were radio-collared in 3 counties in Ohio (Table 2). During the 2001 telemetry field season, WS collected data to determine home ranges, den site fidelity, seasonal movements, mortality, and general biology of raccoons. This study will continue in 2002, with similar data collected. Wildlife Services also will utilize radio telemetry data to determine if the spacing between flight lines during aerial bait drops is distributing baits across raccoon habitats in Ohio such that bait uptake by raccoons is maximized. The current distance between flight lines is 500 meters.

Table 2. Results of radio-telemetry trapping efforts during the summer of 2001.

Group 1 (Columbiana County)		Group 2 (Mahoning County)		Group 3 (Trumbull County)	
Trap nights	63	Trap nights	75	Trap nights	112
Raccoons captured	10	Raccoon captured	10	Raccoons captured	11
Raccoons collared	10	Raccoons collared	10	Raccoons collared	10 ^a
Trap success rate	16%	Trap success rate	13%	Trap success rate	10%

^a1 raccoon was not collared due to a prior injury.

OTHER RABIES CONTROL ACTIVITIES

Throughout 2001, WS provided assistance to the ODH to aid with raccoon submissions for rabies testing. During the 2001 trapping seasons all raccoons which appeared to have puncture wounds (bite marks), exhibited disorientation, or showed signs of illness were euthanized in accordance with the American Veterinary Medical Association guidelines and

were submitted for testing. In addition, wildlife showing signs of sickness were obtained from residents and submitted to the ODH for rabies testing. Fourteen animals were submitted by Ohio WS in 2001, all animals tested negative for rabies.

Wildlife Services trapped 520 raccoons during 2001 surveillance efforts in Ohio (Table 1). All of the raccoons that WS captured and released during the 2001 surveillance season were ear-tagged with a unique four digit number. These ear tags also contain a phone number and a label, which reads "reward". Wildlife Services logged 44 ear-tag numbers from Ohio residents who collected the "reward" during 2001. A reward of \$20 is paid by WS for each set of ear tags submitted; in return WS is given valuable information on raccoon biology and movements.

In March of 2001, the Ohio WS program in cooperation with the West Virginia WS program conducted raccoon trapping along bridge structures crossing the Ohio River. Natural geographic features, such as Lake Erie and the Ohio River, are thought to act as barriers that may prevent rabies from spreading into previously uninfected areas. However, human-made structures such as locks, dams, and bridges, along the Ohio River may provide travel corridors for raccoons, thus increasing the risk of raccoon rabies progressing westward. To assess the threat of raccoons crossing Ohio River structures, a ranking system is being developed for locks/dams, vehicle/pedestrian, and railroad bridges along 205 km (127.4 miles) of the Ohio River from Pittsburgh, Pennsylvania to Hannibal, Ohio to assess the probability of raccoons crossing each structure. Raccoons which were captured, released and ear-tagged around these structures carry a unique I.D. number and a phone number on the ear tags, which if found or harvested and then reported will give WS valuable movement data about raccoons around the Ohio River.

In November of 2001, WS collected 416 raccoons harvested by fur trappers from within the Ohio ORV bait zone. Raccoons harvested by trappers in Ohio were collected for biomarker detection in teeth and jawbones. Tetracycline hydrochloride is commonly used as a biological marker (biomarker) to assess bait uptake in ORV programs. This biomarker is incorporated in the vaccine-laden FMP baits. Tooth and bone samples collected in 2001 will further help to determine the age structure of raccoons in Ohio and the uptake rate of the oral vaccine baits being dropped via aircraft.

SUMMARY

The spring of 2001 marked the fifth year of WS cooperative participation in the Ohio ORV project. This project is part of a larger ORV ARP effort that includes West Virginia and Pennsylvania. Ohio is an integral part of a proposed national rabies barrier, which extends from Lake Erie south to the Gulf of Mexico. In 2002, the ARP has extended to include a larger part of Pennsylvania and West Virginia in addition to adding Virginia and Tennessee. In 2002, Ohio will continue to participate in the ORV program and the radio telemetry pilot study. To date 4,782,727 FMP baits containing rabies vaccine have been distributed across eastern Ohio encompassing 8,518 km² (3,289 mi²).

Since the program was initiated in 1997, there has been a noted decline in reported positive raccoon rabies cases in the ORV baited zone. Reported positive raccoon rabies cases declined from 62 in 1997 to 26 in 1998. From November of 1999 to October of 2001, there were no detected raccoon rabies cases in Ohio. However, on November 6th of 2001, Ohio had one documented case of raccoon strain rabies, which was located approximately 1.61 km from the Ohio/Pennsylvania border. This case was a reminder that the continuation of ORV combined

with surveillance is important if we expect to contain and reduce foreign diseases such as raccoon rabies in Ohio and throughout the eastern United States.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM PENNSYLVANIA 2001

BACKGROUND

Raccoon (*Procyon lotor*) rabies entered Pennsylvania in 1982. It was first documented in Bedford, Fulton, and Franklin Counties and 12 years later had become enzootic throughout the Commonwealth's 67 counties. Since 1995, approximately 400 wild animals have been diagnosed positive for rabies annually. This represents a 10-fold increase over the 2 decades prior to 1982. The oral rabies vaccination (ORV) program was initiated in 2001 as a result of the success of the Ohio ORV program. The ORV program in northwestern Pennsylvania included most of Erie County and the northwest corner of Crawford County (Figure 1). The bait zone comprised approximately 1,875 km² (724 miles²). The Pennsylvania Department of Health (PDH) provided the state leadership for this project while the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) provided the federal wildlife management leadership and the major source of cooperative funding.

ORV PROGRAM 2001

Fishmeal polymer (FMP) baits containing Raboral V-RG® vaccine were distributed as part of the 2001 ORV program. Fishmeal polymer baits cost \$1.32/each and were distributed by hand from October 1 through 5, 2001. A total of 138,602 baits were distributed by 36 individuals from the following agencies, PDH, Erie County Department of Health, Department of Agriculture, Game Commission, and WS.



Figure 1. Oral rabies vaccination zone in northwestern Erie and Crawford Counties, Pennsylvania, 2001.

MONITORING, SURVEILLANCE, AND EVALUATION

The goal of the ORV program in Pennsylvania is to protect the existing ORV zone in Ohio by expanding the vaccination zone eastward to create an immune buffer zone. In addition, this cooperative initiative will begin to create a vaccinated area of sufficient scope to begin to explore and evaluate raccoon rabies elimination in the state and region. Wildlife Services initiated post-ORV raccoon live trapping on October 23, 2001 to collect blood serum and tooth samples as well as other biological data to evaluate and monitor project success. Samples were collected from 73 raccoons during 681 trap nights (Table 1). Rabies reservoir species were also collected throughout the fall of 2001 to enhance rabies surveillance (Table 2).

Table 1. Surveillance trapping efforts during the ORV project in Erie County, Pennsylvania, 2001.

Fishmeal polymer	
Trap nights	681
Unique raccoons	73
Total raccoons	73
Trap success	11%
Non-targets	53

Table 2. Raccoon rabies surveillance from road-killed animals in Pennsylvania, 2001.

Road-killed animals tested		Results	
		Negative	Positive
Raccoon	15	14	1
Striped Skunk	8	8	0
Opossum	2	2	0
Domestic Cat	1	1	0

Population Monitoring

Currently data are generally lacking on Pennsylvania raccoon population characteristics. Nine density studies are being planned in association with other research objectives for 2002 to assist in developing ORV strategies.

Erie County Ground Bait Study

In 2001, WS initiated a multi-year study to assess large scale ORV ground baiting efficacy and cost effectiveness. The study provides data about vaccine uptake from raccoons at 3 different distances from the bait drop location (along public roads). Trapping was focused in 3 specific zones to help determine if the public road baiting strategy is an effective means of bait distribution. Baits were placed at 3 intervals of distance from baited public roads: immediately adjacent, the maximum distance away, and halfway in between these 2 sites. Levels of rabies virus neutralizing antibodies in pre and post-ORV live-trapped raccoons will be used to help determine the effectiveness of current ground baiting. The location of recaptures will also aid in determining home range size and movement patterns of raccoons. This study will continue in 2002. The results of this study may have broader applicability to ORV projects where baiting by

road may be emphasized given the potential inability to distribute baits by air in all circumstances.

OTHER RABIES CONTROL ACTIVITIES

In November of 2001, WS provided assistance to the Pennsylvania Department of Conservation and Natural Resources to reduce property damage and human health and safety threats associated with raccoons at campsites on Presque Isle. During 24 trap nights, 5 raccoons were captured and euthanized according to the American Veterinary Medical Association guidelines. Blood serum and tooth samples as well as other biological data were collected from each raccoon to assist in the evaluation of ORV effectiveness.

SUMMARY

The summer/fall of 2001 marked the first year of the Pennsylvania ORV project. A total of 138,602 Raboral V-RG® baits was distributed across 2 counties encompassing 1,875 km² (724 mi²). Since program inception, there has been an apparent decline in reported positive terrestrial rabies cases in the ORV zone, decreasing from 6 in 2001 to 1 as of July 2002.

This project is part of a larger Appalachian Ridge Project (ARP) that in 2001 also included Ohio and West Virginia. In 2002, the Pennsylvania ORV program is planned to expand to all western counties contiguous with Ohio and West Virginia and involve the distribution of more than 1.4 million baits over 16,700 km². The Erie County ground bait study will continue in 2002.

The Pennsylvania ORV program is an integral part of the larger ARP, a cooperative effort, which in turn, is tied to national efforts to contain the raccoon strain of the rabies virus and explore strategies to eliminate this unique rabies virus variant.

**WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM
VERMONT 2001**

BACKGROUND

Raccoon (*Procyon lotor*) rabies first entered Vermont in 1994. It quickly spread and has been confirmed in all 14 counties in the state. In less than 2 years, raccoon rabies had spread through 8 counties in Vermont and by the spring of 1996 was approximately 73 km (45.5 miles) south of the United States-Canada border. In May 1997, an intensive oral rabies vaccination (ORV) program was initiated with the goal of preventing the northward spread of raccoon rabies. Through aerial and hand bait distribution, nearly 1,000,000 fishmeal polymer (FMP) and fishmeal-coated sachet (CS) baits containing Raboral V-RG® vaccine have been distributed over northern Vermont since 1997 (Table 1).

Table 1. Oral rabies vaccination program bait distribution from, Vermont, 1997-2001.

Year	Area Baited		% of VT Baited	Baits Distributed		
	km ²	mi ²		FMP	CS	Total
1997	1,637	632	8.6	72,893	0	72,893
1998	2,193	847	11.5	116,270	0	116,270
1999	3,501	1,352	18.4	189,802	0	189,802
2000	3,558	1,374	18.7	198,821	0	198,821
2001	4,110	1,587	21.6	34,703	201,555	236,258

This cooperative effort is lead by Cornell University. Wildlife Services (WS) has been the major source of federal funds for project implementation. Wildlife Services also has provided federal wildlife management leadership by continuing to play an active role in: project planning and coordination, organizing ground support for the bait drop, working in and navigating aircraft to distribute baits, coordinating the hand distribution of baits in areas too populated to bait by air, evaluating if the Green Mountains serve as a natural barrier to the movement of raccoon rabies, and providing surveillance and follow-up field work by collecting blood and tooth samples from live-trapped and suspect-rabid animals within the ORV bait zone.

ORV PROGRAM 2001

In 2001, the bait zone was expanded to include 3 major areas commonly referred to as the Champlain (area west of the Green Mountains in the Lake Champlain basin), the Memphremagog (area east of the Green Mountains in the Lake Memphremagog basin), and the Connecticut River (area of northeastern Vermont on the Connecticut River) regions (Figure 1). During 12 flights, 201,555 CS and 34,703 FMP baits were distributed by aircraft from August 6-8, 2001, while 3,563 FMP baits were distributed by hand from August 9-15, 2001. Coated sachet and FMP baits cost \$1.00/bait and \$1.32/bait, respectively. Aircraft and flight crew for the 2001 ORV bait drop were provided by the Ontario Ministry of Natural Resources (OMNR). Ground and baiting support was also provided by WS, Cornell University, and the Vermont Department of Health.

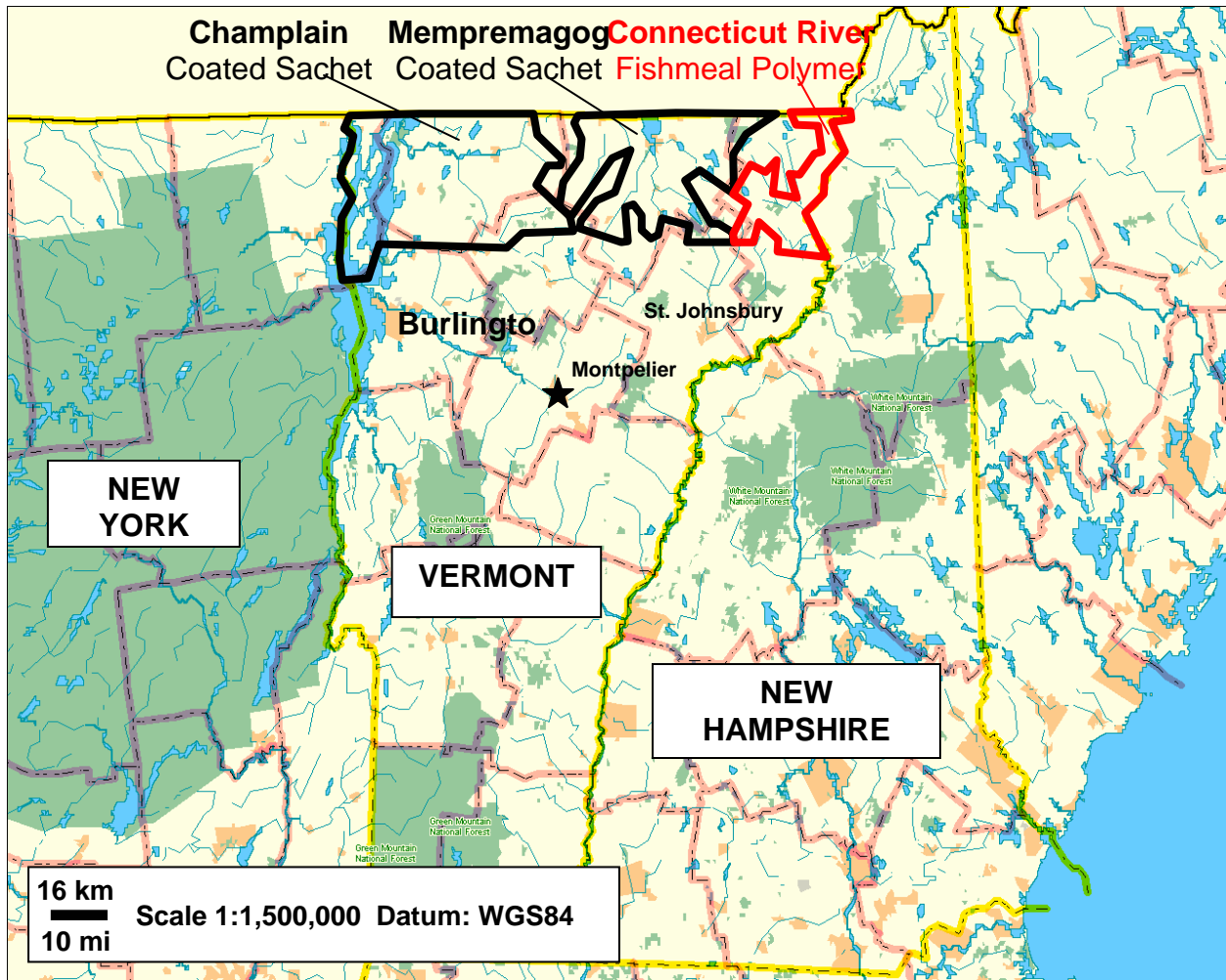


Figure 1. Oral rabies vaccination zones in northern Vermont, 2001.

MONITORING, SURVEILLANCE, AND EVALUATION

In an effort to evaluate the efficacy of the ORV program in Vermont, WS collected blood and tooth samples from 276 live-trapped raccoons during the 2001 evaluation phase. Biological samples will be used to assess bait uptake and immune status of the raccoon populations in the ORV zone.

Population Monitoring

Since 1997, WS has been conducting raccoon relative density studies in Vermont to establish population trends in areas of common agricultural habitat and to determine densities at higher elevations (above 500m). Knowing the range of raccoon densities is essential to establishing an optimal ORV strategy for Vermont. On September 19, 2001, WS initiated a large-scale raccoon relative density study in the towns of Highgate and Franklin, near the Quebec, Canada border. Nine concurrent density studies were conducted using an established study protocol of 50 traps over 10 consecutive nights (500 trap nights) on each 3 km² study area. In cooperation with WS personnel from 8 different states, a total of 211 unique raccoons were

captured on the 9 contiguous cells representing 27 km² (10.4 mi²) in 4,500 trap nights. This information, along with data from previous years and other states involved in ORV programs, will have broader application in future baiting strategies (Table 1).

Table 1. Raccoon population monitoring efforts in Vermont, 1997-2001.

Town	Month-Year	Habitat	Approximate Elevation (m)	Density Index km²	mi²
Highgate-A	Sep-01	Agricultural-Wooded	70	10.3	26.5
Highgate-B	Sep-01	Agricultural-Wooded	75	6.0	15.4
Highgate-C	Sep-01	Agricultural-Wooded	85	8.7	22.2
Highgate-D	Sep-01	Agricultural-Wooded	70	10.3	26.5
Highgate-E	Sep-01	Agricultural-Wooded	75	7.0	17.9
Highgate-F	Sep-01	Agricultural-Wooded	75	12.7	32.5
Highgate-G	Sep-01	Agricultural-Wooded	80	2.0	5.1
Highgate-H	Sep-01	Agricultural-Wooded	95	5.7	14.5
Highgate-I	Sep-01	Agricultural-Wooded	90	7.7	19.7
Stratford, NH	Jul-01	Forest-Low Elevation	300	2.3	6.0
Coventry	Sep-00	Agricultural-Wooded	250	3.0	7.7
Swanton	Sep-00	Agricultural-Wooded	145	3.7	9.4
Swanton	Jun-00	Agricultural-Wooded	145	4.7	12.0
Fairfield	Oct-99	Agricultural-Wooded	280	6.3	16.2
Coventry	Sep-99	Agricultural-Wooded	250	9.0	23.1
Sheldon	Aug-99	Agricultural-Wooded	145	5.0	12.8
Jay Peak	Aug-98	Forest-High Elevation	730	2.7	6.8
Sheldon	Aug-97	Agricultural-Wooded	140	6.3	16.2
St. Albans City	Aug-97	Urban-Suburban	140	9.3	23.9

Small Mammal Sachet Study

The potential for a shift to CS baits to deliver Raboral V-RG® to raccoons over broad geographic areas has raised concerns, including easier small mammal access to vaccinia. Small mammal tracks on tracking stations and gnawing patterns on baits used in bait preference studies do not often permit accurate identification of small mammal species attracted to baits. In August 2000 and 2001, WS used a paired Victor snap trap/Sherman live trap design to determine which species may be attracted to CS baits. Pairs of snap traps or live traps were set 1 meter apart at approximately 15 meter intervals along transects traversing various habitats. At each trap site 1 of the trap pairs was baited and the other left unbaited. In 1,536 trap nights, over an 8-night trapping period, 14 and 37 small mammals were captured from the same study area in 2000 and 2001, respectively (Table 2). Species captured as a result attraction to the CS baits represent potential candidates for testing to determine if they could serve as reservoirs for vaccinia.

Table 2. Small mammals attracted to fishmeal-coated sachet baits in Vermont during 2000 and 2001.

Species	Victor (Snap) Baited		Victor (Snap) Not-Baited		Sherman (Live) Baited		Sherman (Live) Not-Baited	
	2000	2001	2000	2001	2000	2001	2000	2001
Short-tail shrew	3	5	0	2	2	0	2	1
<i>Peromyscus</i> spp.	0	2	0	3	4	3	0	2
Woodland jumping mouse	0	1	0	1	2	0	0	1
Meadow jumping mouse	0	1	0	3	0	0	0	4
Meadow vole	0	1	1	1	0	3	0	2
Unknown sm. mammal	0	1	0	0	0	0	0	0
Total	3	11	1	10	8	6	2	10

OTHER RABIES CONTROL ACTIVITIES

To enhance protection of the State Threatened Eastern spiny softshell turtle (*Apalone spinifera*) WS, at the request of the Vermont Fish and Wildlife Department, conducted raccoon removal activities in North Hero State Park, North Hero, Vermont in the summers of 2000 and 2001. To reduce raccoon egg predation on nesting turtles, WS trapped and humanely euthanized 22 raccoons from the park (16 in 2000; 6 in 2001) in a combined 84 trap nights (36 in 2000; 48 in 2001).

Wildlife Services removed 9 raccoons in 20 trap nights at Camp Abnaki in North Hero, Vermont to reduce nuisance complaints and to limit damage to camp cabins. These raccoons were used as a source of additional samples for ORV evaluation.

In 2001, WS collected 38 animals (32 raccoons, 5 striped skunks [*Mephitis mephitis*], and 1 red fox [*Vulpes vulpes*]) within the ORV bait zone from various road kill surveys, suspect rabid animals shot by Game Wardens, and nuisance raccoons killed by homeowners. Most animals were submitted to the Vermont Department of Health Laboratory for rabies testing and 1 skunk tested positive for the rabies virus.

SUMMARY

The summer of 2001 marked the fifth year of WS cooperative participation in the Vermont ORV program. To date, nearly 1,000,000 Raboral V-RG® baits have been distributed over northern Vermont. Since program inception in 1997, a noted decline in reported positive terrestrial rabies cases has been recognized and based on the annual rate of spread of about 35 miles/year, raccoon rabies would have expected to have spread to Quebec, Canada by as early as 1999.

Vermont WS also is cooperating with New Hampshire WS to coordinate future ORV efforts in northern New Hampshire. The Vermont ORV program is an integral part of a larger Northeastern cooperative effort (that in 2001 included New York and Quebec and Ontario, Canada), which in turn, is tied to national planning efforts to contain the raccoon strain and explore strategies to eliminate this unique variant of the rabies virus.

WILDLIFE SERVICES COOPERATIVE RABIES CONTROL PROGRAM VIRGINIA 2001

BACKGROUND

The first cases of raccoon (*Procyon lotor*) rabies in the mid-Atlantic states occurred in Hardy County, West Virginia and Shenandoah County, Virginia in 1978 and 1979. This outbreak is likely to have resulted from the translocation of rabid raccoons from Florida, where raccoon rabies was first described in raccoons in the late 1940's. More than 3,500 raccoons were translocated to Virginia from Florida between 1977 and 1981 to restock raccoon populations for hunting purposes. Raccoon rabies has since spread from the initial outbreak site and become enzootic in all of the East Coast states, as well as Alabama, Pennsylvania, Vermont, West Virginia, and eastern Ohio. In Virginia, raccoon rabies occurs throughout the state, except for the far southwestern counties. In 2001, there were 502 reported cases of rabies in Virginia, and 288 of these cases were rabid raccoons. The Wildlife Services (WS) program conducted raccoon relative density studies in southwestern Virginia and established cooperative relationships with state and local agencies in 2001 in preparation for oral rabies vaccine (ORV) bait distribution in 2002.

MONITORING, SURVEILLANCE, AND EVALUATION

In southwest Virginia, raccoon rabies has been found in all counties except Lee, Wise, Dickenson, Buchanan, and Scott; the westernmost counties of Virginia. It is possible that the Appalachian Mountains, which run through this area, have acted as a natural geographic barrier to the westward spread of raccoon rabies. Raccoon populations are likely much lower in the upper elevations of the Appalachians, which could limit contact among animals and impede the spread of the virus.

In July 2001, WS conducted 2 population relative density studies in Tazewell County, Virginia (Figure 1). Studies were conducted according to the same protocol in both an agricultural site and a forested site. This protocol is identical to that used by WS in other states, which are involved in ORV projects. The collection of density data in numerous states allows WS to develop relative density trend data (indices) which may be useful in the development of future ORV baiting strategies. These data may be applicable in determining bait distribution densities and in determining whether high elevations in the Appalachian Mountains serve as a natural barrier to raccoon movement and the spread of the rabies virus.

The raccoon population relative density was estimated at 4.6 raccoons/km² (12/mile²) in the forested site and 7.5 raccoons/km² (19/mile²) in the agricultural site. Additional population density studies will be conducted in 2002.

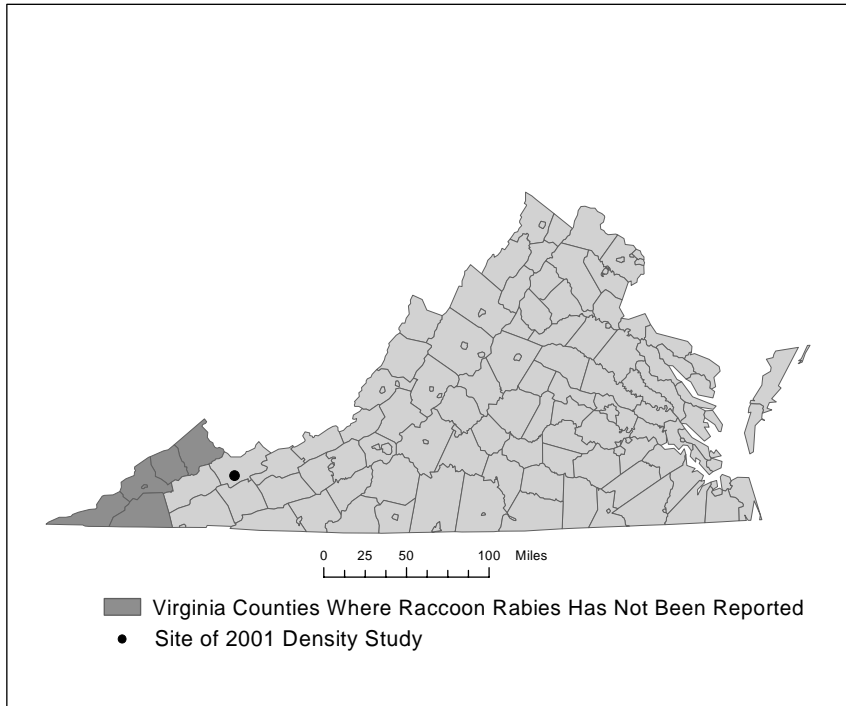


Figure 1. Location of 2 relative density studies and counties in southwestern Virginia where raccoon rabies has not yet been found, 2001.

Tooth and blood samples were collected from raccoons live-trapped during the relative density studies. Blood serum samples were submitted to the Centers for Disease Control and Prevention to be tested for the presence of rabies virus neutralizing antibodies. A positive antibody titer indicates potential past exposure to the rabies virus, although the test is not specific to the raccoon strain of the virus. Only 7% of the samples submitted (n=30) tested positive for rabies virus neutralizing antibodies. Tooth samples were used to determine the age of trapped raccoons.

OTHER RABIES PROGRAM INVOLVEMENT

Fairfax County, located in the northern part of Virginia near Washington D.C., has had the largest number of reported rabies cases of any county in Virginia in recent years (12% and 9% of all reported cases in Virginia in 2000 and 2001, respectively). This may reflect the high human population density and the subsequent increase in opportunities for human contact with rabid wildlife, rather than a greater incidence of rabies. An ORV program has been implemented by Fairfax County to attempt to reduce or eliminate raccoon rabies from portions of the county thereby reducing the need for current level of post exposure treatment for rabies exposures.

In April 2001, the Virginia WS program assisted Fairfax County with an ongoing ORV pilot study being conducted in several county parks. Fairfax county personnel had previously captured raccoons in these parks and serologically tested the animals for pre-vaccination immunity to the rabies virus. The County then hand-distributed ORV baits in some areas of the parks. Wildlife Services assisted with post-baiting raccoon capture to evaluate immunity in the raccoon populations in the baited and unbaited portions of the park.

Rabies is a disease of concern to many groups and government agencies throughout Virginia. There are 2 government-lead committees that are involved with rabies in the state: the Northern Virginia Rabies Round Table and the Virginia Rabies Task Force. Wildlife Services in Virginia has attended and participated in meetings with both of these committees and has met numerous times with the Virginia State Epidemiologist. Additionally, the Virginia Animal Control Association (VACA) is a stakeholder organization that is concerned about rabies. Most of the VACA members are county government animal control officers, who may encounter rabid animals or receive complaints from the public concerning rabies. Wildlife Services gave a presentation about the ORV program at the Annual VACA Conference in October, 2000.

SUMMARY

In 2001, WS became involved in rabies control activities in Virginia. These initial stages of involvement primarily involved the collection of background data (e.g., raccoon density indices and background rabies titers) and increased communication with other state, local, and federal agencies. Wildlife Services began planning for rabies enhanced surveillance and the distribution of ORV baits in southwestern Virginia in 2002.

WILDLIFE SERVICES ORAL RABIES VACCINATION PROGRAM WEST VIRGINIA, 2001

BACKGROUND

The West Virginia oral rabies vaccination (ORV) program was undertaken as part of a nationwide, cooperative effort to stop the westward spread of raccoon (*Procyon lotor*) strain rabies. In 1977, raccoon strain of the rabies virus was first introduced into West Virginia from raccoons translocated from the southern United States to Hardy County. The virus then spread along the leeward side of the Appalachians into Pennsylvania, Maryland, and Virginia until it breached the Appalachian front and began spreading in the cardinal directions through West Virginia. In 2001, 130 confirmed cases of rabies were reported in West Virginia, 96 of which were found in raccoons. Rabies cases have been confirmed in 32 of the 55 counties in West Virginia (Figure 1).

The West Virginia ORV program is being coordinated by the WV Department of Agriculture (DOA), while enhanced surveillance is being conducted by the WV Department of Health and Human Resources (DHHR) and county Departments of Health. Wildlife Services provides funding and operational support, including; coordinating bait drops, raccoon population monitoring, and program progress through our live trapping efforts. The WV Division of Natural Resources (DNR) provides permits for handling wildlife, access to state owned property, and expertise in raccoon ecology and management.

ORV PROGRAM 2001

The 2001 bait zone covered 11,214 km² (4,330 mi²). Fishmeal polymer (FMP) baits containing Raboral V-RG® vaccine were used (Figure 1). A total of 763,689 baits were distributed by air and 60,840 baits were distributed by hand in September. Aircraft and flight crew for the 2001 ORV program were provided by the Ontario Ministry of Natural Resources (OMNR). Ground support was provided by WS, Ohio National Guard and Ohio Department of Health. West Virginia's WS program currently has 4 full-time employees working on the rabies project.

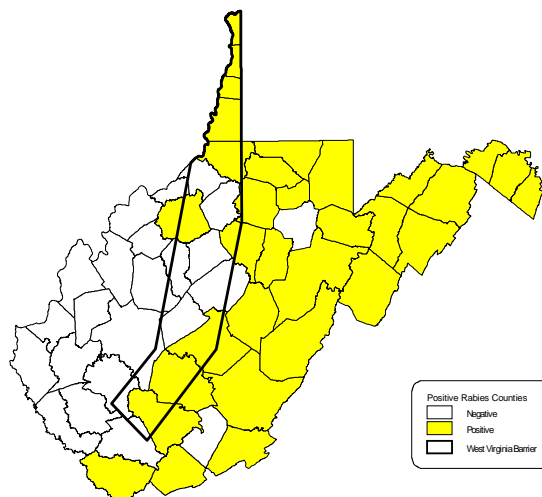


Figure 1. Oral rabies vaccination zone and counties with positive rabies cases in West Virginia, as of December, 2001.

MONITORING, SURVEILLANCE, AND EVALUATION

Population Monitoring

Wildlife Services protocol for population density estimates was used to estimate relative abundance in 4 areas within West Virginia during August, 2001 (Table 1). Two areas were wildlife management areas, managed by the DNR and were representative of habitat found throughout much of the state, with forested rolling hills and permanent streams. The other 2 areas were agricultural areas composed of forest, pasture, and corn fields. Estimates of relative abundance ranged from 8.9 raccoons/km² to 16.6 raccoons/km².

Table 1. Estimates of relative abundance for areas in West Virginia, 2001.

Location	Habitat	Elevation	Raccoon/km ²
Jackson County	Agriculture	300m	16.2/km ²
Clay County	Forested	300m	8.9/km ²
Wetzel County	Forested	300m	16.6/km ²
Braxton County	Agriculture	550m	13.1/km ²

Surveillance and Evaluation

Following the September bait drop, WS live-trapped raccoons to collect blood and tooth samples to measure program success. During the month of October, 54 raccoons were trapped and samples were collected (Table 2). Of the 54 raccoons tested, 11 were returned with a positive titer for a 20% vaccination rate. Trapping success was low during this time of year due primarily to the fall mast drop, which dispersed the raccoons, making trapping difficult.

Table 2. Post bait drop trapping results in West Virginia, 2001.

Location	Raccoons captured	Positive titer
Ohio County	5	0
Nicholas County	3	1
Wetzel County	15	3
Clay County	12	4
Tyler County	12	3
Doddridge County	5	0
Fayette County	2	0
Total	54	11

SUMMARY

West Virginia became involved in the nationwide ORV program in 2001 as a key state in the vision of the national barrier preventing the westward spread of raccoon rabies. During the bait drop, which began on September 11, 2001, 763,689 baits were distributed by air and 60,840 were distributed by hand. Post bait drop monitoring revealed 11 of 54 raccoons captured had a positive titer.

The bait zone in West Virginia will be expanded in 2002 to include 23,250 km² (8,977 mi²) and 1,743,703 baits. During 2002, WS will also begin to investigate the influence of elevation and habitat by collecting pertinent habitat data at each trap location. Trapping effort will be increased during post bait drop monitoring to increase sample size to a more acceptable level.