

NATIONAL RABIES MANAGEMENT PROGRAM SUMMARY REPORT 2009

**United States Department of Agriculture
Animal and Plant Health Inspection Service**



Protecting People | Protecting Agriculture | Protecting Wildlife

USDA-APHIS-Wildlife Services
National Rabies Management Program
59 Chenell Drive, Suite 2
Concord, NH 03301 USA



WRITTEN BY:
Kathy Nelson

REVIEWED BY:
Dennis Slate

APPROVED BY:
Richard Chipman



Oral rabies vaccination (ORV) programs in the United States began in the early 1990s in New Jersey and Massachusetts with the goal of preventing the raccoon (*Procyon lotor*) variant of rabies from spreading to populated vacation areas of Cape May and Cape Cod, respectively. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) program's initial involvement in cooperative ORV was in 1995 in south Texas to prevent canine rabies in coyotes (*Canis latrans*) from gaining a larger foot-hold in the U.S. One year later, an ORV program began in west-central Texas to prevent rabies in gray foxes (*Urocyon cinereoargenteus*). In 1997, WS began involvement in cooperative ORV projects in Ohio and Vermont to prevent the spread of raccoon rabies. Since 1998, when WS' National Rabies Management Program (NRMP) received its first federal funds explicitly to be applied to rabies control, the ORV program expanded and in 2009 focused on raccoon rabies in 15 eastern states, canine and gray fox rabies in Texas, and gray fox rabies in Arizona. Wildlife Services participated in coordinated ORV programs that led to the distribution of more than 9.5 million baits over 213,901 km² in 2009, an area about the size of Kansas (Table 1).

Table 1. Oral rabies vaccination (ORV) bait distribution and area baited by Wildlife Services and cooperators in the United States, 2009.

State	Target species	ORV baits distributed	Area baited (km ²)	Bait distribution methods
Alabama	Raccoon	457,030	7,558	Fixed-wing, ground
Arizona	Gray fox	129,600	4,105	Fixed-wing, ground
Florida ^a	Raccoon	356,800	4,823	Ground, helicopter, bait station
Georgia	Raccoon	200,798	3,327	Fixed-wing, ground
Maine	Raccoon	69,586	1,345	Fixed-wing, ground
Maryland	Raccoon	69,030	1,086	Ground, helicopter
Massachusetts	Raccoon	61,204	704	Ground, helicopter, bait station
New Hampshire	Raccoon	16,369	360	Fixed-wing, ground
New York	Raccoon	817,108	13,188	Fixed-wing, ground
North Carolina	Raccoon	238,867	4,028	Fixed-wing, ground, helicopter
Ohio	Raccoon	874,301	13,923	Fixed-wing, ground
Pennsylvania	Raccoon	873,464	15,184	Fixed-wing, ground
Tennessee	Raccoon	615,401	11,131	Fixed-wing, ground, helicopter
Texas	Coyote	470,085	20,104	Fixed-wing, ground
Texas	Gray fox	2,429,844	82,081	Fixed-wing, ground
Vermont	Raccoon	411,607	7,057	Fixed-wing, ground
Virginia	Raccoon	286,022	4,877	Fixed-wing, ground, helicopter
West Virginia	Raccoon	1,174,986	19,017	Fixed-wing, ground
Total		9,552,102	213,901	

^a Includes 175,000 baits distributed by county officials in Broward County.

In the Northeast, WS continued cooperation with Cornell University, state agencies and international partners in New Brunswick, Quebec, and Ontario, Canada to try to prevent the northern and western spread of raccoon rabies. These ORV zones extended along a portion of the New Brunswick border with Maine; the Quebec border with New Hampshire, Vermont and New York; and the Ontario border in northern and western New York (Figure 1). As a continued response to the first confirmed case of raccoon rabies variant in Quebec in 2006, and to help maintain raccoon rabies free status in Ontario, Vermont and New York WS implemented trap-vaccinate-release (TVR) efforts along the U.S.-Canada border. These TVR programs resulted in the hand vaccination of 4,617 animals in Vermont (1,963) and northern New York (2,654).

As a component of the greater Appalachian Ridge ORV zone, Ohio continued biannual baiting of the Contingency Action ORV zone (east of Cleveland) in the spring and fall of 2009. Wildlife Services integrated TVR into the rabies control campaign within the Contingency Action zone to prevent the spread of raccoon rabies that was first detected in 2004 about 10 km (6 mi) west of the established ORV zone. These TVR efforts resulted in the hand vaccination of 3,777 animals in northeastern Ohio. The number of rabid animals with raccoon variant in this Contingency Action zone decreased to 3 cases in 2009 (all in striped skunks) with enhanced surveillance in place (from a high of 46 cases in 2004).

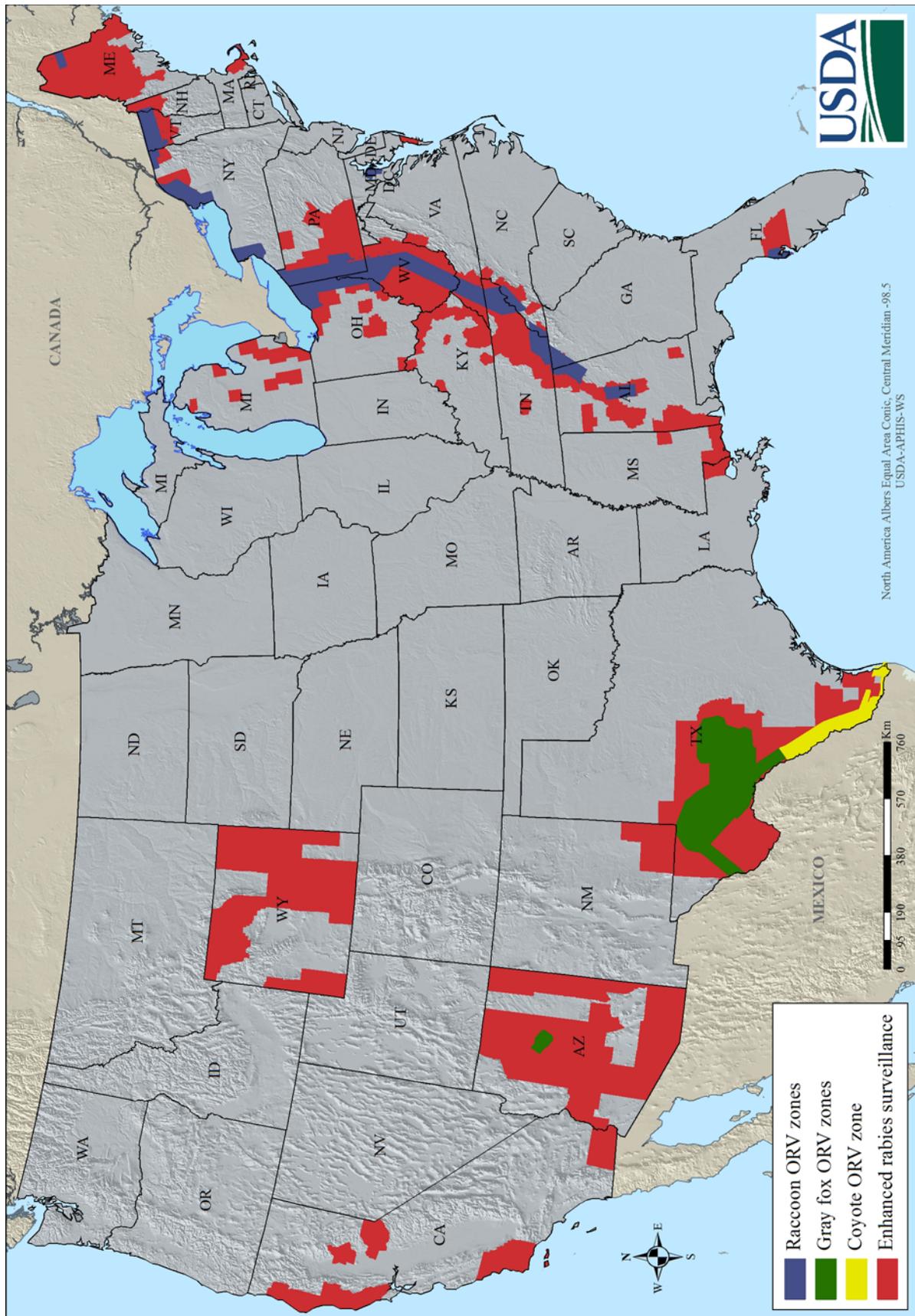


Figure 1. Cooperative oral rabies vaccination (ORV) zones and Wildlife Services enhanced rabies surveillance counties in the United States, 2009.

The greater Appalachian Ridge ORV zone, which extended from Ohio-Pennsylvania to northeastern Tennessee-North Carolina in 2009 (Figure 1), included the last phase of a 2-year study in southeast Ohio along the West Virginia border to evaluate a potential new baiting strategy called pulse baiting. Pulse baiting is designed to deliver 8 baits (in this specific study) in a pulse that result in a cluster of baits on the ground to facilitate access by family groups of raccoons that may encounter them. At the time of annual ORV baiting (late summer), adult female raccoon movements normally include young of the year. Each reproductively competent female has an average litter of 4 young. The goal of this baiting strategy trial was to determine if greater levels of seroconversion can be established by reaching a larger segment of the juvenile cohort of raccoons. A pulse of 8 baits/13.6 seconds is released by aerial means as opposed to 1 bait/1.7 seconds by the traditional baiting strategy. Serological results from these efforts are encouraging and plans are to continue evaluating the baiting method as needed in suitable areas. The remaining Appalachian Ridge ORV zone, along with the Georgia-Alabama-Tennessee ORV zone, baiting operations near Birmingham, Alabama and natural barriers to impede rabies spread, made up control programs targeting raccoons that reached from Lake Erie to the Gulf of Mexico.

In 2009, WS continued to participate in cooperative ORV projects in Barnstable County, Massachusetts; Anne Arundel County, Maryland; and Pinellas County (and adjacent counties), Florida (Figure 1). These projects provided information on ORV effectiveness and surveillance strategies. Future contingency actions may be planned to integrate TVR with ORV to attempt to restore Cape Cod to raccoon rabies free status. The current strategy is to systematically conduct control from the eastern part of the Cape west toward the Cape Cod Canal, with the objective of reestablishing an ORV zone west of the canal sufficient to prevent raccoon rabies reemergence on Cape Cod. The Cape May, New Jersey project that began in 1992, was the longest running operational ORV project in the U.S., but due to County funding limitations this area was not baited in 2009. All of these projects have peninsular geography in common, which represents a more favorable landscape (surrounded by water on three sides thus restricting raccoon movements) for evaluating rabies status and if elimination could be achieved on a relatively small scale. Although raccoon rabies elimination in these areas via traditional ORV baiting strategies (aerial and ground distribution) remains a challenge, bait stations were deployed as part of the Massachusetts and Florida projects in 2009. If these bait station field trials show promise, plans are to continue and possibly expand their use.

Wildlife Services fills an important cooperative role with the Texas Department of State Health Services (TDSHS) and several other agencies and organizations in ORV efforts that began in Texas in 1995, by providing funding, field expertise, infrastructure, and equipment to help obtain samples for continued monitoring and evaluating of ORV status targeting coyotes in south Texas and gray foxes in west Texas. The rabies control program in coyotes is a balance of enhanced surveillance applied in tandem with an ORV zone maintained along the Rio Grande River (Figure 1) to prevent re-emergence of this rabies virus variant from feral dog (*Canis lupus familiaris*) or coyote sources in Mexico. Single cases were confirmed in dogs near Laredo in 2001 and 2004 within 1.6 km (1 mi) of the U.S.-Mexico border. No additional cases have been reported since 2004 and the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) declared the United States free of canine rabies in 2007 (Velasco-Villa et al. 2008).

Wildlife Services is also an important funding and operational partner with the TDSHS in conducting ORV efforts to contain and eliminate a unique gray fox rabies variant in west-central Texas (Figure 1). In 2009, WS and the TDSHS continued enhanced surveillance and baiting in response to fox variant rabies cases that emerged west of the ORV zone in 2007. In 2009, WS cooperated to distribute more than 2.4 million baits over approximately 82,000 km² (32,000 mi²) to contain gray fox rabies in Texas (Table 1). As a result, only two cases of the fox variant unique to Texas were confirmed in 2009, a coyote in March and a domestic dog in May.

In July 2009, Arizona WS implemented its first operational ORV program in Flagstaff to control an outbreak of rabies in gray foxes. Between November 2008 and July 2009, 23 gray foxes, 6 striped skunks and 1 ringtail (*Bassariscus astutus*) were confirmed rabid in the Flagstaff area; all but 1 gray fox had a rabies variant associated with big brown bats (*Eptesicus fuscus*). These were the first terrestrial cases of rabies in Flagstaff in over two years, with previous outbreaks primarily in skunks. Wildlife Services and the Coconino County Health Services District cooperated to distribute 129,600 coated sachets surrounding the city of Flagstaff (Table 1). Concurrently, WS re-established a TVR program to vaccinate animals (specifically skunks) in and around the city. TVR efforts resulted in the hand vaccination of 144 animals: 113 striped skunks, 18 gray foxes, 10 raccoons, and 3 bobcats (*Lynx rufus*). Over the multi-year TVR effort (2001 and 2004-2009), 640 animals have been trapped, vaccinated, and released: 567 striped skunks, 47 raccoons, 21 gray foxes, 3 bobcats, and 2 Western hog-nosed skunks (*Conepatus mesoleucus*). The significance of spillover of other rabies virus variants in skunks is not well understood, but the apparent inability to orally vaccinate a sufficient segment of skunk populations with the currently licensed oral rabies vaccine-bait hampers our ability to apply this strategy to control rabies in skunks and potentially confounds progress toward effective raccoon rabies control in the eastern U.S. The Arizona program remains critical to an

enhanced understanding of the role the striped skunk may play in rabies outbreaks and the nationwide efforts to reduce and eventually eliminate rabies in wild carnivores from the U.S.

A GonaCon™ trial in captive dogs continued on the Navajo Nation in 2009. This initiative was taken under the North American Rabies Management Plan (NARMP). GonaCon™, developed by WS' National Wildlife Research Center (NWRC), stimulates the production of antibodies that bind to the gonadotropin-releasing-hormone (GnRH). By binding to the GnRH, the antibodies reduce GnRH's ability to stimulate the release of sex hormones, inhibiting sexual activity. GonaCon™ has shown to result in an immune response that contracepts both males and females for upwards of two or more years. Simultaneous injection of rabies vaccine and GonaCon™ may have the potential to improve our ability to control rabies by additive effect of reduced dog fecundity in the control strategy. Arizona WS cooperated with NWRC and the Navajo Nation to continue safety and immunogenicity evaluations of GonaCon™. Ten dogs were administered a new formulation of GonaCon™ containing an adjuvant and antimicrobial compounds to determine if there would be similar injection site reactions as there were using the first generation GonaCon™ formulation. Nine of 10 dogs developed measurable Anti-GnRH titers during the study. Three of 10 dogs developed draining tracts at the injection site leading researchers to determine that more evaluation is necessary before GonaCon™ field trials can be initiated that would include following vaccinated female dogs through several breeding cycles in the presence of males to determine if they were contracepted.

In 2009, Arizona WS coordinated with Merial Limited, the CDC, and the Navajo Nation to continue evaluating the acceptance of an experimental enrobed sachet (ES) bait matrix with feral and free-ranging dogs. This study followed an ORV placebo bait study conducted in 2003 and 2004 that determined the coated sachet (CS) was the preferred among several commercially available baits tested in handout models for dogs. One limitation of commercially produced CS baits is the absence of a biomarker. In addition, the fishmeal crumbles coating the bait exterior frequently fall off during shipment and hand distribution, potentially affecting the overall attractiveness of the bait to target species. An experimental bait matrix using an enrobing process to coat the plastic sachet could potentially alleviate these drawbacks. This study replicated work done in 2008, comparing bait acceptance of the experimental ES to the CS. Results of the 2009 study were similar to those in 2008 in that only 29% of dogs (31% in 2008) offered the ES chewed the bait in a way that would facilitate delivery of a vaccine to the oral cavity, while 60% of dogs (62% in 2008) offered the CS would have likely received a dose of oral vaccine. While the enrobed sachet bait was not readily accepted and may not be suitable, it is beneficial to continue to evaluate new vaccine-baits and delivery strategies for feral and free-ranging dogs on the Navajo Nation. Results from the Navajo Nation field trials represent potential for technology transfer to Mexico and other countries where dog rabies remains a problem and where a segment of the dog population cannot be effectively captured and vaccinated parenterally.

Wildlife Services and cooperators implemented contingency actions in New York, Ohio, Texas, and Vermont in 2009. Contingency actions often include an integration of ORV, TVR, and increased enhanced rabies surveillance. Enhanced surveillance is designed to complement public health surveillance and provide greater intensity and scope in suspect animal testing to delineate the leading edge of rabies distribution, allowing for sound ORV decisions while maximizing the effective use of resources. Enhanced surveillance includes obtaining samples from: animals exhibiting behaviors suggestive of rabies but not implicated in human or domestic animal exposures, road kills, other animals found dead, animals with wounds or lesions suggestive of rabies, and animals removed near locations where rabies has recently been confirmed. In 2009, WS continued to enhance rabies surveillance in the states conducting ORV for raccoons, as well as emphasizing surveillance in adjacent states west of the raccoon ORV zone, including: Michigan, Kentucky, Mississippi and Louisiana (Figure 1). Texas and New Mexico collected 1,594 and 84 animals, respectively, in support of coyote and gray fox ORV programs. Arizona collected 600 animals in support of gray fox ORV and bat-skunk studies. In addition, California and Wyoming collected and submitted animals for testing to better determine the presence of skunk variants of rabies. During enhanced surveillance efforts in 2009, WS' cooperation led to the collection and submission of 12,254 samples for rabies testing (Table 2) by WS, the CDC, local health department laboratories, and local agriculture department laboratories. These samples resulted in 217 rabid animal locations on which to base and improve control decisions.

Since 2005, 55 WS personnel have attended direct rapid immunohistochemistry test (dRIT) training at the CDC in Atlanta, Georgia. The dRIT is an unlicensed procedure designed for consideration as a potential confirmatory measure of the direct fluorescent antibody (dFA) test (the test most frequently used to diagnose rabies). In addition, the dRIT may be used to enhance field surveillance among suspect wildlife, particularly in support of ORV programs. The dRIT may be used in remote locations to improve sample turnaround and not overburden rabies laboratories, but it is not to be used for public health surveillance in the U.S. Animals involved in potential or actual rabies exposures with humans or domestic animals are evaluated through standard procedures by public health experts at established local, state, or federal laboratories. From 2005-2009, WS implemented the dRIT

in 19 states. In 2009, WS (and the TDSHS) tested 10,533 (86.4%) animals collected for enhanced surveillance using the dRIT; 160 tested positive for rabies (Table 2).

Table 2. Wildlife Services enhanced rabies surveillance and use of the direct rapid immunohistochemistry test as part of rabies management programs in the United States, 2009.

State	Enhanced surveillance animals	WS tested by dRIT	Rabid by dRIT
Alabama	200	200 (100%)	0
Arizona	600	598 (99.7%)	34
California ^a	56	0	
Florida	422	420 (99.5%)	7
Georgia	125	125 (100%)	1
Kentucky ^a	184	184 (100%)	0
Louisiana ^a	46	46 (100%)	0
Maine	197	72 (36.5%)	6
Maryland	0		
Massachusetts	66	60 (90.9%)	7
Michigan ^a	21	21 (100%)	5
Mississippi ^a	56	56 (100%)	0
New Hampshire	2	2 (100%)	0
New Mexico ^a	84	47 (56.0%)	0
New York	39	0	
North Carolina	80	80 (100%)	24
Ohio	922	921 (99.9%)	1
Pennsylvania	3,980	3,891 (97.8%)	51
Tennessee	944	938 (99.4%)	19
Texas ^b	1,594	523 (32.8%)	0
Vermont	94	0	
Virginia	347	347 (100%)	4
West Virginia	2,006	2,002 (99.8%)	4
Wyoming ^a	189	0	
Total	12,254	10,533 (86.4%)	160

^a ORV not applied in this state.

^b Includes samples tested by the Texas Department of State Health Services using the dRIT.

In all states conducting ORV, WS continues to take the lead on post-ORV monitoring to evaluate program effectiveness by collecting blood and tooth samples for determining rabies virus neutralizing antibody (RVNA) levels and bait uptake (when biomarker is available) in raccoons, skunks, coyotes, foxes, and bobcats. Density indexing is also used to characterize raccoon and skunk populations and to provide post-ORV serum samples for analysis. Typically, WS presents ORV program evaluation data (serology, tetracycline, and age results) from the previous year's monitoring to provide time for laboratory analyses. At the time of this report, however, all states had received 2009 serology results so they are included in this report.

All animals captured by WS in 2009 were trapped in accordance with federal, state, and local laws and handled according to the American Society of Mammalogists, Animal Care and Use Committee guidelines. All animals that had to be euthanized by WS in 2009 were done so in accordance with the American Veterinary Medical Association's Panel on Euthanasia recommendations.

In 2009, a mean positive antibody response of 32±13% was observed for 4,695 raccoon serum samples collected post-ORV (Table 3); 265 of the positive samples had a previous record of hand vaccination. Post-ORV sera were also collected from 19 striped skunks, 1 gray fox, and 1 red fox during raccoon rabies management programs. One skunk (5%) had a detectable RVNA response, but it had a prior record of hand vaccination. Texas collected sera from 103 coyotes and 161 gray foxes to evaluate ORV efficacy targeting those species in south and west-central Texas, respectively; 52 (51%) coyotes and 132 (82%) gray foxes had RVNA (Table 3). Texas also collected post-ORV sera from 1 bobcat during evaluation of the coyote ORV program (no RVNA) and from 102

coyotes and 2 raccoons (no RVNA) during evaluation of the gray fox ORV program; 74 coyotes (73%) had detectable rabies antibodies. To evaluate a new ORV program targeting gray foxes around Flagstaff, Arizona, sera were collected from 21 gray foxes post-ORV; 13 (62%) showed detectable rabies antibodies. Arizona also collected sera from 72 skunks, 11 coyotes, 10 raccoons, and 5 bobcats post-ORV; 1 skunk (1%) and 1 raccoon (10%) had a rabies antibody response.

Table 3. Wildlife Services post-oral rabies vaccination (ORV) sampling efforts as part of rabies management programs in the United States, 2009.

State	All post-ORV serum samples	Positive rabies antibody response (≥ 0.05 IU)	4-12 weeks ^a post-ORV samples	Positive rabies antibody response (≥ 0.05 IU) ^b
Raccoon ^c				
Alabama	280	63 (22.5%)	280	63 (22.5%)
Florida	283	83 (29.3%)	101	28 (27.7%)
Georgia	96	30 (31.3%)	96	30 (31.3%)
Maine	144	38 (26.4%)	144	38 (26.4%)
Maryland	218	96 (44.0%) ^d	197	87 (44.2%)
Massachusetts	66	36 (54.5%) ^d	50	28 (56.0%)
New Hampshire	19	4 (21.1%)	8	0
New York	259	111 (42.9%) ^d	259	111 (42.9%)
North Carolina	125	28 (22.4%)	106	22 (20.8%)
Ohio	832	346 (41.6%) ^d	354	211 (59.6%)
Pennsylvania	1,143	116 (10.1%) ^d	461	15 (3.3%)
Tennessee	227	97 (42.7%)	220	97 (44.1%)
Vermont	174	88 (50.6%) ^d	78	40 (51.3%)
Virginia	436	78 (17.9%)	319	60 (18.8%)
West Virginia	393	111 (28.2%)	172	45 (26.2%)
Total	4,695	1,325 (28.2%)	2,845	875 (30.8%)
Mean \pm St. Dev.		32 \pm 13%		32 \pm 18%
Arizona (gray fox)	21	13 (61.9%)	21	13 (61.9%)
Texas (coyote)	103	52 (50.5%)	103	52 (50.5%)
Texas (gray fox)	161	132 (82.0%)	161	132 (82.0%)

^a Samples taken during optimal evaluation period of 4-12 weeks post-ORV bait distribution.

^b Sera collected in all states but Texas are positive at ≥ 0.05 IU; sera collected in Texas are positive at ≥ 0.04 IU.

^c Non-raccoon samples collected during raccoon rabies management programs are not represented in this table.

^d In these states, some raccoons with a positive rabies antibody response had a record of previous hand vaccination by Wildlife Services (MD=37, MA=2, NY=51, OH=158, PA=5, VT=12) either through a coordinated trap-vaccinate-release effort (as in NY, OH and VT) or in urban/suburban areas where ORV baiting is supplemented by hand vaccination (as in Anne Arundel Co., MD; Cape Cod, MA and Allegheny Co., PA).

Teeth were submitted to Matson's Laboratory and Johnston's Biotech in 2009 for tetracycline biomarker analysis and aging. Tetracycline biomarker results for the raccoon rabies management program are not presented because 76% of the 6.5 million ORV baits distributed for raccoons in 2009 were coated sachets that do not contain tetracycline biomarker. Texas continued to distribute dog food and fishmeal polymer baits containing biomarker and therefore collected teeth for ORV program evaluation. In the south Texas (coyote) ORV zone, 53 of 103 coyote teeth tested (51%) showed a presence of tetracycline. The one bobcat tooth sample had no biomarker. In the west-central Texas zone, 108 of 162 gray fox teeth (67%), 62 of 101 coyote teeth (61%); and 1 of 2 raccoon teeth (50%) tested showed a presence of tetracycline. Teeth were not collected from the Arizona gray fox ORV program because only coated sachet baits were distributed. Age results for target species sampled during raccoon, coyote and gray fox rabies management programs were similar to previous year's results (Figure 2). Median raccoon age was 1 year suggesting the importance of young in the overall population, but ages ranged from <1 to 13 years (a pregnant female from Florida and a female from Tennessee). Thirty-two raccoons were aged at ≥ 10 y.o.: 19 at 10 y.o., 4 at 11 y.o., 7 at 12 y.o. and 2 at 13 y.o. Median coyote age was 3 years and ranged from 1 to 14 years. Seven coyotes

were aged at ≥ 10 y.o.: 3 at 10 y.o., and 1 each at 11, 12, 13 and 14 y.o. Median gray fox age was 2 years and ranged from 1 to 7 years.

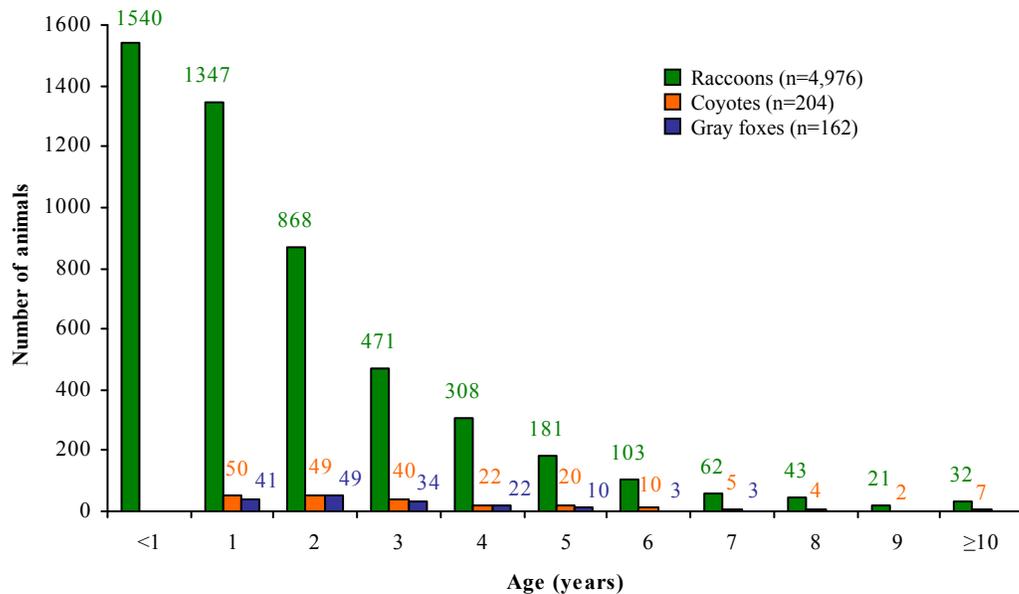


Figure 2. Age class distribution of 4,976 raccoon, 204 coyote and 162 gray fox tooth samples collected by Wildlife Services during cooperative rabies management programs in the eastern United States (raccoons) and Texas (coyotes and gray foxes), 2009.

In addition, during raccoon rabies management programs in 2009, WS collected teeth for aging from: 209 striped skunks (median age: 1 year, range: 0-12 years); 35 gray foxes (median age: <1 year, range: 0-6 years); 34 red foxes (median age: <1 year, range: 0-3 years); 27 coyotes (median age: <1 year, range: 0-10 years); 14 feral cats (median age: 1 year, range: 0-2 years); and 1 opossum aged at <1 year.

The need for a bait-vaccine combination producing higher levels of RVNA in wild meso-carnivore species serving as rabies reservoirs remains the highest research priority and requires continued systematic research. In 2009, research at Thomas Jefferson University in Philadelphia, Pennsylvania and at the CDC continued to focus on the development of new, safe, and effective oral rabies vaccines with canine adenovirus as a prospective vector for expression of the rabies glycoprotein. Captive challenge trials in skunks and raccoons at the CDC demonstrated strong CAV2-RG (canine adenovirus2-rabies glycoprotein recombinant) performance. A field sero-survey among raccoons (n=500) was completed and showed low prevalence of canine adenovirus antibodies, suggesting low interference for CAV2-RG seroconversion in this species.

Several pen, laboratory, and field studies were continued or initiated through WS' National Wildlife Research Center (NWRC) in Fort Collins, Colorado. Pen and laboratory studies were conducted at the NWRC and Colorado State University, while field studies were conducted in Ohio and Texas. Studies involved new and continued research on: evaluation of raccoon movements, dispersal, habitat and population genetics to predict the spread of rabies in Ohio; estimating raccoon populations through the use of trapping point transects and spatially explicit capture-recapture methods; evaluation of bait attractants to enhance delivery of Raboral[®] V-RG to raccoons; ecology of raccoons in urban areas; spatial ecology of gray foxes, coyotes and bobcats relative to rabies spread in Texas; evaluation of mucosal adjuvants to increase the efficacy of Raboral[®] V-RG in raccoons and skunks; vitrification of Raboral[®] V-RG to improve vaccine stability; evaluation of rhodamine B as a biomarker for use in raccoons and gray foxes; testing of immune system enhancers to increase rabies vaccine antibody titers in raccoons; evaluation of immunocontraception (GonaCon[™]) in raccoons to reduce fecundity in urban areas; testing efficacy of Raboral V-RG[®] in arctic fox (*Alopex lagopus*); and evaluation of infrared thermography to detect rabid animals in the field.

Throughout 2009, WS continued to participate in formal meetings with counterparts from Canada, Mexico, and the Navajo Nation in the context of the North American Rabies Management Plan (NARMP) that identifies information exchange, enhanced surveillance, rabies control, and research as key areas of focus toward meeting

continental goals for rabies management. The NARMP was formally recognized by Canada, Mexico, the U.S. and Navajo Nation at a signing ceremony during the XIX International Conference on Rabies in the Americas held at the CDC in Atlanta, Georgia in September 2008.

In 2010, WS and cooperators will continue to focus on implementing enhanced rabies surveillance in conjunction with ORV to determine areas at risk of rabies spread and to monitor program success. Adjustment to ORV zones may occur as a result of improved surveillance information. Contingency actions are expected to continue in New York, Ohio, Vermont, and Texas. Commitments will continue toward improvements to the existing bait-vaccine and development of new bait-vaccines that perform better and are effective in all meso-carnivore reservoirs.

Velasco-Villa A, SA Reeder, LA Orciari, PA Yager, R Franka, JD Blanton, L Zuckero, P Hunt, EH Oertli, LE Robinson, and C. E. Rupprecht. 2008. Enzootic rabies elimination from dogs and reemergence in wild terrestrial carnivores, United States. *Emerging Infectious Diseases* 14:1849–1854.