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Investigating the Ecology, Control, and Prevention of Terrestrial Rabies in Free-ranging Wildlife

Contact Information:

Dr. Mike R. Dunbar, Wildlife Services Research Wildlife Biologist/Veterinarian
NWRC Headquarters, 4101 LaPorte Avenue, Fort Collins, CO 80521
Phone: (970) 266-6360 FAX: (970) 266-6138
E-mail: mike.r.dunbar@aphis.usda.gov
Web site: www.aphis.usda.gov/ws/nwrc

National Wildlife Research Center Scientists Develop New Methods Strategies to Reduce Rabies Transmission from Infected Wildlife to Humans, Domestic Animals, and Wildlife

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and acceptable methods, tools, and techniques.

Increased urbanization, greater acceptance and desire of living closer to free-ranging wildlife, and increasing wildlife numbers have led to increased conflicts between people and wildlife. Such conflicts can take many forms, both direct and indirect. Recently, the potential for the transmission

of diseases among wildlife, livestock, and humans has received greater attention.

Rabies is an acute, fatal viral disease most often transmitted through the bite of a rabid mammal. It can infect people as well as animals. Impacts to society from this and other wildlife diseases can be great. For instance, the cost of detection, prevention, and control of rabies in the United States is approximately \$300 million annually.

In 2000, the United States Secretary of Agriculture enacted a Declaration of Emergency for rabies, citing threats to livestock and to public health and safety. In 2001, NWRC initiated research that could reduce or eliminate the transmission of this disease.

In the United States, terrestrial rabies can be found in many wild animals, including raccoons, skunks, gray fox, arctic fox, and coyotes. In an effort to halt the spread and eventually eradicate terrestrial rabies in the United States, NWRC scientists are conducting research on the behavior, ecology, movements and population structures of raccoons and gray fox. They are also evaluating methods and techniques used to vaccinate free-roaming wildlife against rabies.

Applying Science and Expertise to Wildlife Challenges

Ecological and Genetic Studies on Gray Fox—NWRC scientists are learning more about gray fox ecology and genetics in Texas. The information gathered will help improve the effectiveness of the gray fox oral rabies vaccination (ORV) program in the state.



By combining radio telemetry, global positioning systems (GPS) collars, geographic information systems (GIS) habitat layers and population genetics data, scientists hope to answer questions regarding why breaks or breaches in a vaccination zone appear to occur only in select locations. Scientists want to know if it is due to habitat differences, sex-biased dispersal rates or other factors, such as long distance movements of juveniles.

Since early 2005, NWRC employees, in cooperation with Texas WS and the Texas Department of State Health Services, have been live-trapping and radio-collaring gray foxes inside and outside of the ORV zone. To date, over 200 DNA samples have been collected from gray fox, which may represent the largest DNA collection ever analyzed for this species.

Another major objective is to document fox movements, especially the potential of long-distance movements of gray fox. At present, at least one young male fox has moved over 13 km in a straight-line distance. This finding is significant because it indicates that male gray fox can move considerable distances and potentially breach an ORV

Major Research Accomplishments:

- WS developed new bait designs that have more effectively delivered oral rabies vaccine to wildlife, including skunks and raccoons.
- WS scientists developed the use of infrared technology to detect signs of rabies infection in raccoons and possibly other mammals.
- WS determined that the rabies vaccine, V-RG, is safe for use in additional wildlife species.
- WS scientists are in the process of conducting experimental studies to test a new vaccine formulation to further stabilize the V-RG rabies vaccine that will increase vaccination rates in raccoons and other wildlife.

zone. Once paired with the population genetics data, this type of information will provide key insights into gray fox ecology as it pertains to ORV strategies.

Support for Raccoon Rabies ORV

Program—Since 1995, WS has been involved in a national rabies prevention and oral rabies vaccination (ORV) effort. In support of this program, NWRC scientists conducted a pen study to determine the longevity of the oral V-RG (Merial, Ltd.) rabies vaccine that is currently being used by WS to combat rabies in raccoons. Results showed that the vaccine prevented rabies infection in many raccoons up to 18 months post-vaccination.

NWRC scientists also developed a method using infrared thermography to detect signs of rabies in raccoons. Thermography is a technique that detects and measures variations in the heat emitted by various regions of the body and transforms them into visible signals that can be recorded photographically. Coupled with the knowledge of diseases and their clinical signs, this technique could potentially be used to detect and measure increases in an animal's body surface temperature at specific areas of the body in relation to a particular disease. In the case of rabies, heat associated with viral activity is most prevalent in the nose and rostrum area and shows up as white (hot) or bright red (very warm) on thermal images. The use of infrared thermography in the initial screening and surveillance of diseases, such as rabies, could potentially save millions of dollars for public health and wildlife management agencies.

Current field research is evaluating the risks, possible routes, and prevention strategies associated with the spread of the raccoon rabies across Ohio from infected areas in extreme northeastern Ohio. Scientists are also using genetics to evaluate the trafficking of raccoon rabies across ecosystems in Alabama, Ohio, and Pennsylvania.

Groups Affected By These Problems:

- U.S. citizens
- Wildlife and natural resource managers
- Livestock producers and farmers
- Sporting organizations
- Consumers

Major Cooperators:

- Auburn University
- The Ohio State University
- Pennsylvania State University
- State Departments of Public Health
- Texas A&M University
- University of Northern Arizona
- WS Operations personnel
- Colorado State University
- Centers for Disease Control and Prevention
- Merial (private vaccine development company)
- FoodSource (private bait company)
- Texas State Health Services Department
- Ohio Department of Health Services

Selected Publications:

Dunbar, M. R., and K. A. MacCarthy. 2006. Use of infrared thermography to detect signs of rabies infection in raccoons (*Procyon lotor*). *Journal of Zoo and Wildlife Medicine* 37:518-523.

Slate, D., C. Ruprecht, M. Dunbar, and R. McLean. 2005. Oral rabies vaccination—a progress report. *Proceedings of the Wildlife Damage Management Conference* 11:12-13.

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Jojola, S. M. S. J. Robinson, and K. C. VerCauteren. 2004. Oral rabies vaccine (ORV) bait uptake by striped skunks: preliminary results. *Proceedings of the Vertebrate Pest Conference* 21:122-125.

Robinson S. J., S. M. Jojola, and K. C. VerCauteren. 2004. The role of bait manipulation in the delivery of oral rabies vaccine to skunks. *Proceedings of the Vertebrate Pest Conference* 21:194-197.