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Barriers, Corridors, and Raccoon Variant Rabies in Northeastern Ohio: Research in Progress

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ABSTRACT: The raccoon variant of rabies is distributed throughout the eastern and southeastern United States. Historically, the westward spread of raccoon variant rabies has been prevented by geographical barriers and the distribution of oral rabies vaccines (ORV). In 2004, raccoons positive for raccoon variant rabies were discovered beyond the vaccination zone in northeastern Ohio, suggesting the potential westward spread of the disease. To evaluate the potential westward spread of rabies across Ohio, we are employing two strategies: telemetry, and genetics. We are radio-tracking raccoons to determine which factors, if any, may be considered barriers or corridors to raccoon movement. In addition, we are collecting genetic samples from raccoons in urban and rural areas in 9 distinct regions of northeastern Ohio. These samples will be used to evaluate relatedness between raccoon populations. We hypothesize that the degree of genetic relatedness will be proportional to the distance separating populations. Populations showing less or more relatedness may be indicative of barriers or corridors to movement, respectively. Preliminary movement data suggest that raccoons are remaining within their home ranges in greenbelt areas, although some have traveled over 2.0 km into urban and suburban areas before returning. Genetic sampling is 45% complete, and analysis will be performed once all samples have been collected. The results from this study will provide a more thorough understanding of raccoon movement in northeastern Ohio. This information will allow researchers to recommend ORV bait distribution strategies to more effectively stem the westward spread of raccoon variant rabies.

KEY WORDS: Cleveland, disease, Ohio, oral rabies vaccine, *Procyon lotor*, rabies, raccoon

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INTRODUCTION

Rabies is a fatal zoonotic disease with genetically discrete variants in distinct wildlife species. Historically, the raccoon (*Procyon lotor*) strain of rabies was restricted to parts of Florida and Georgia. In the 1970s, rabies-infected raccoons were found along the Virginia-West Virginia border, an occurrence linked to animal translocations (Nettles et al. 1979). This event established a new front for raccoon rabies, which has expanded throughout the eastern United States, presenting a human health risk from Florida to Canada (Figure 1). Between 1998 and 2003, vaccination zones were established using a combination of geographic features and the distribution of oral rabies vaccines (ORV) (Slate et al. 2005). In 2004, raccoon variant rabies was detected in eastern Ohio beyond the ORV zone, indicating

a localized breach in these barriers and the potential for westward spread of the disease (Blanton et al. 2007). Modeling suggests that raccoon variant rabies could spread across the state of Ohio in as little as 41-70 months if unimpeded by geographic barriers, which are largely absent in Ohio, or by extensive vaccination programs (Russell et al. 2005). We are monitoring raccoons in northeastern Ohio to evaluate the potential for westward spread of the disease and whether barriers or corridors for movement exist.

STUDY AREA

This study is being conducted in Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties in northeastern Ohio (Figure 2). Raccoons are being captured in urban and rural areas and in parks and greenbelts. The telemetry portion is restricted to Cuyahoga, Lake, and Geauga Counties, with particular attention being paid to a network of parks known as the "Emerald Necklace", which surrounds the city of Cleveland (Figure 3).

METHODS

Raccoons are being captured using cage traps and immobilized with a 5:1 mixture of ketamine:xylazine (Kreeger et al. 2002). A genetic sample is obtained from each raccoon, and a tooth (first premolar) is extracted for aging (Johnston and Watt 1981). Immobilized raccoons are fitted with uniquely numbered ear tags and a VHF radio collar (Advanced Telemetry Systems, Inc., Isanti, MN) before being released at the point of capture. Raccoons are tracked using VHF radio telemetry once per week. Locations are calculated using Location of a Signal (LOAS) software (Ecological Software Solutions, Sacramento, CA) and plotted using ArcMap v9.2 software

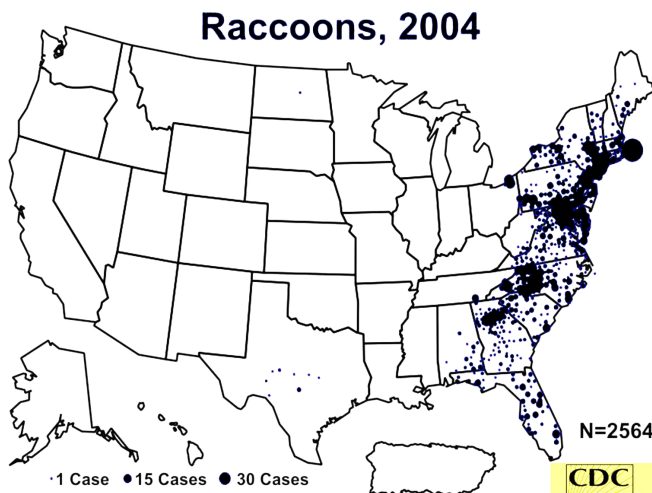


Figure 1. Raccoon rabies distribution in the United States, 2004.

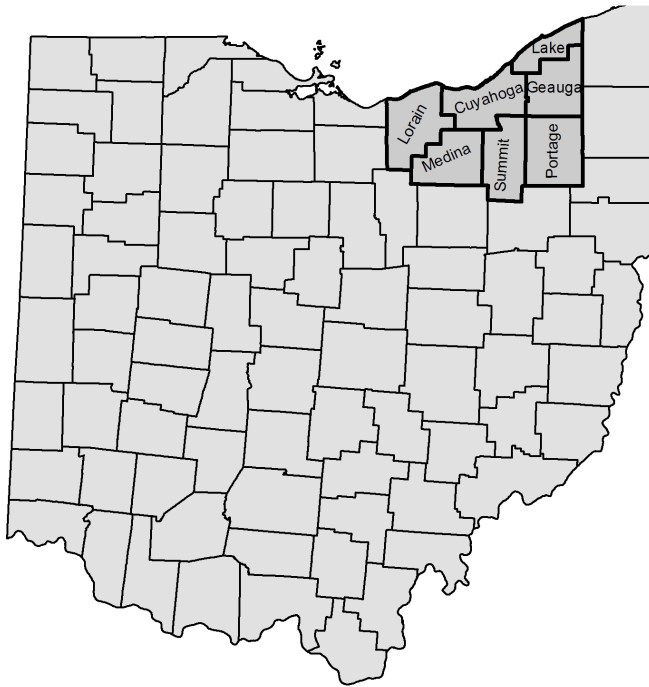


Figure 2. Study sites in northeastern Ohio.

(ESRI, Redlands, CA). Movements will be compared with locations of roads, rivers and urban boundaries to determine whether corridors or barriers to movement exist. Twenty genetic samples (ear punch, blood, and/or hair) are collected from each of 9 distinct regions. These regions are classified as Western, Central, and Eastern, and each have a northern, central and southern collection site. Each site is separated by at least 8.0 km to minimize the potential for home range overlap.

PRELIMINARY RESULTS AND CONCLUSION

To date, 43 raccoons are being tracked, although not all animals are located during every session. Seventeen raccoons died from unknown causes. These collars were re-deployed on new animals. We have experienced 6 confirmed collar failures. Preliminary results suggest most raccoons are staying within a 0.5-km radius of their points of capture, while others have traveled over 2.5 km into suburban areas before returning to their home ranges. It is currently unclear whether major highway crossings were accomplished above ground or through underground culverts or other passages. Approximately 50% of the genetic samples have been collected. More detailed analysis will be performed after all data has been collected. This project has been extended until October 2009.

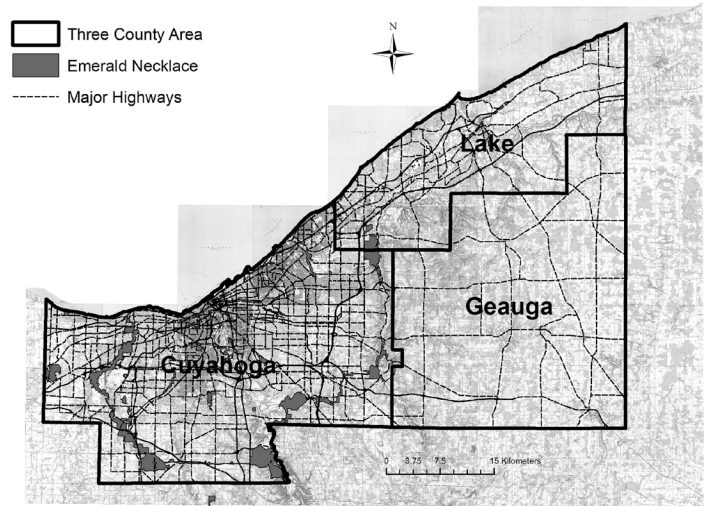


Figure 3. Location of the “Emerald Necklace” relative to Cleveland.

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