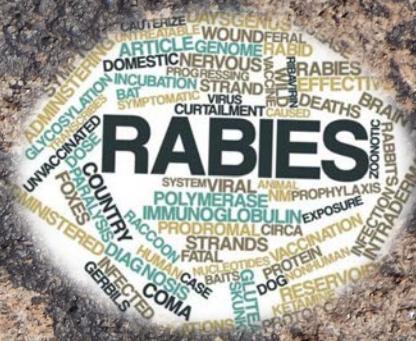


# Update - Implementation of the North American Rabies Management Plan



**David Bergman, Tim Algeo, Luis Lecuona, and Richard Chipman**

## **On Behalf of the North American Rabies Management Plan**

# NARMP Goals and Components



- I. Prevent the spread of specific terrestrial rabies variants in North America
- II. Eliminate specific rabies variants at the local, regional, national and international level

Coordination &  
Collaborative  
Planning

Enhanced  
Surveillance

Management &  
Monitoring

Oral Rabies  
Vaccination

Public Health  
Surveillance

Applied  
Research

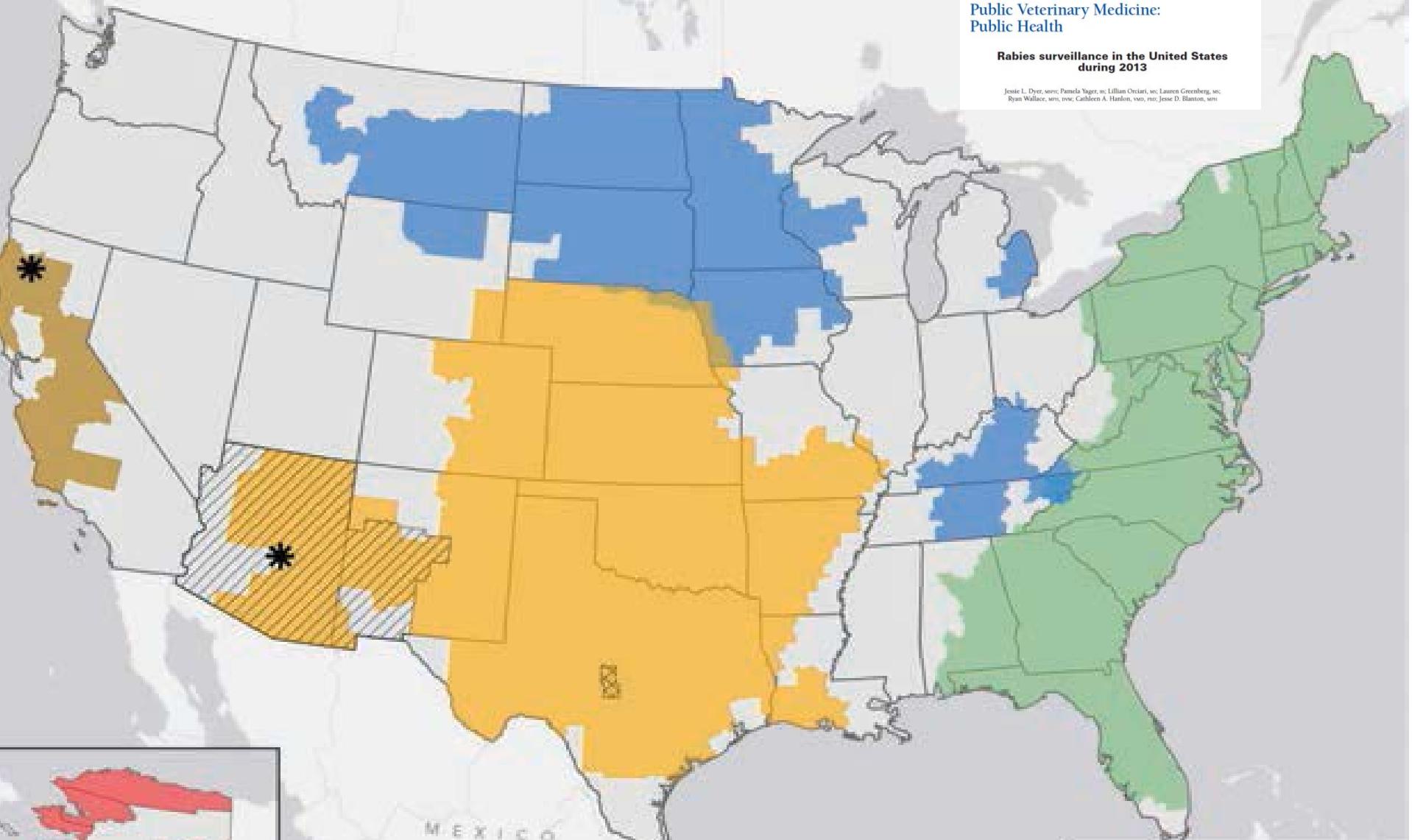
Contingency  
Actions

# Challenges



Rabies surveillance in the United States  
during 2013

Jessie L. Dyer, svrc; Pamela Yager, svc; Lillian Orciari, svc; Lauren Greenberg, svc;  
Ryan Wallace, svrt; nvc; Cathleen A. Hanlon, svso, nvc; Jesse D. Blanton, svrc



Terrestrial Rabies Virus Variants

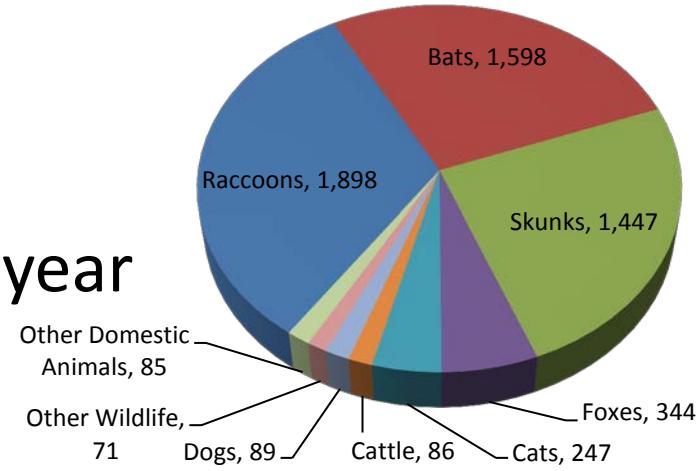
- |              |            |           |           |
|--------------|------------|-----------|-----------|
| ■ Arctic Fox | ■ CASKunk  | ■ NCSkunk | ■ SCSkunk |
| ▨ AZFox      | ▨ Mongoose | ■ Raccoon | ▨ TXFox   |



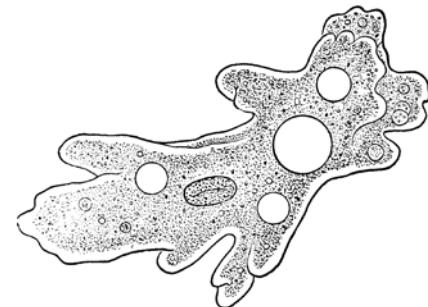
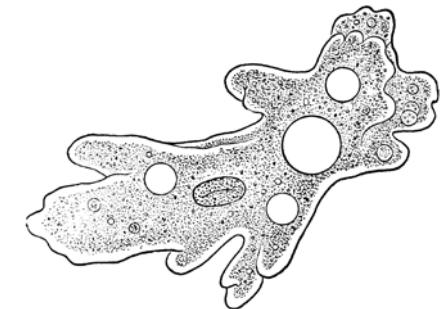
# U.S. Rabies Statistics (2013)



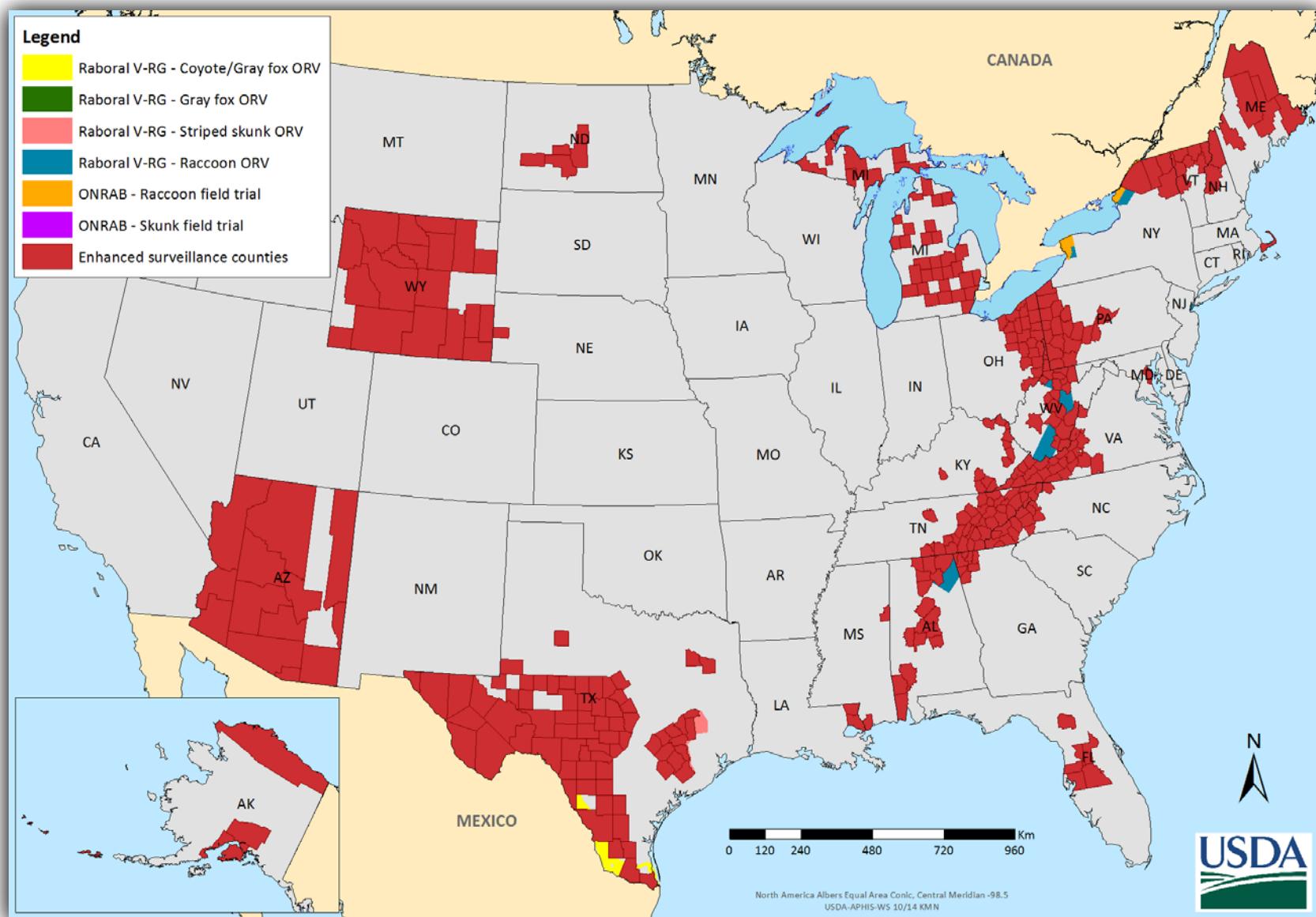
- 5,865 rabies cases (incl. 3 humans)
- 92% of rabies cases were in wildlife
- Up to 40,000 people exposed each year
- >\$300 million annually



# Rabies Elimination “Amoeba” Strategy



# Current ORV Distribution in the U.S. (2014)



# Program Metrics: Sampling (2005-2014)



## Serology

Virus Neutralizing  
Antibodies

(blood samples)

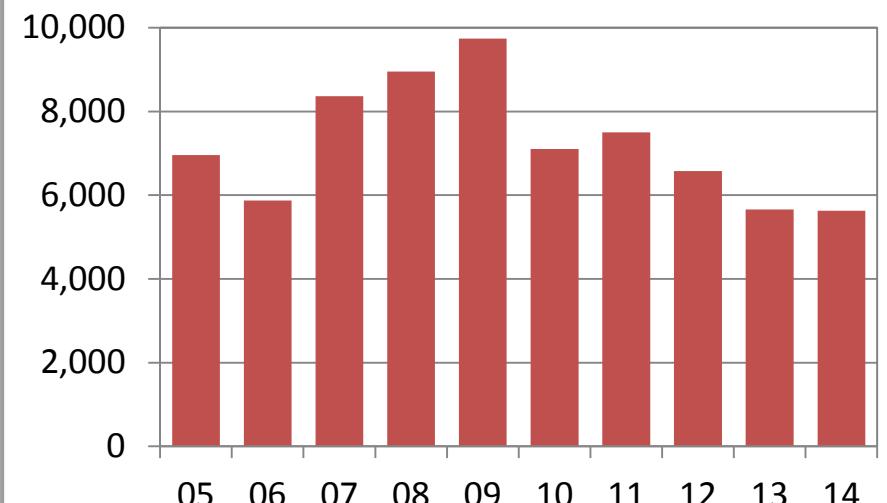
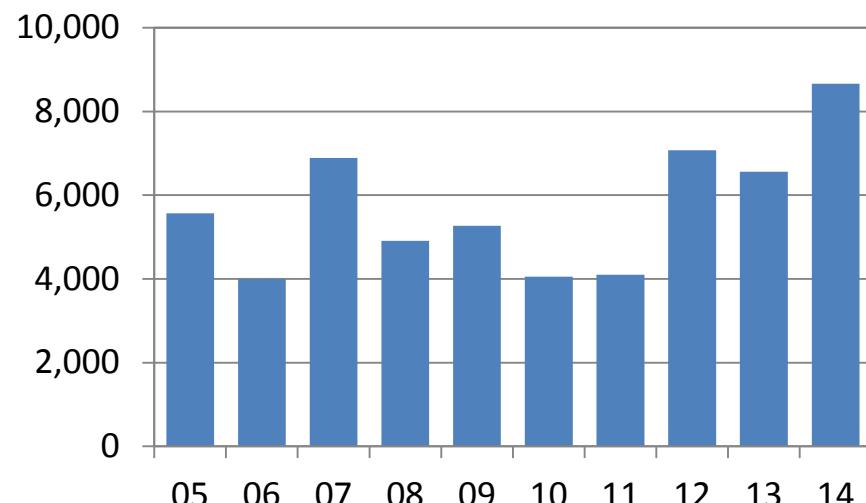
Avg. >5,700

## Surveillance

Virus Antigen  
Detection

(brainstem samples)

Avg. >7,200



# Enhanced Rabies Surveillance by USDA/WS (2005-2014\*)

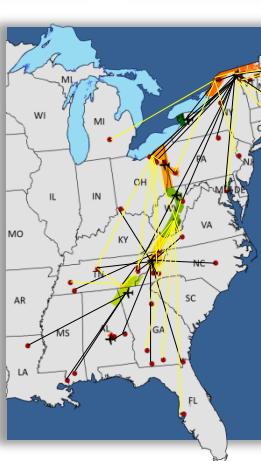
direct Rapid Immunohistochemical Test



Year	Enhanced Surveillance Samples	dRIT Tested	Rabid by dRIT	Percent Rabid by dRIT
2005	3,788	2,848	59	2.1%
2006	6,930	6,072	109	1.8%
2007	9,959	8,136	157	1.9%
2008	10,999	8,790	142	1.6%
2009	12,256	10,534	160	1.5%
2010	9,231	7,294	145	2.0%
2011	9,492	7,574	141	1.9%
2012	7,783	6,605	117	1.8%
2013	5,877	5,471	142	2.6%
2014*	4,506	3,669	76	2.1%
<b>Total</b>	<b>80,821</b>	<b>66,993</b>	<b>1,248</b>	<b>1.9%</b>

\* Data through 10/15/2014

# 2014 ORV Operations Summary



**Baits Distributed: 8,198,991**

**Distance Flown: 274,167 km**

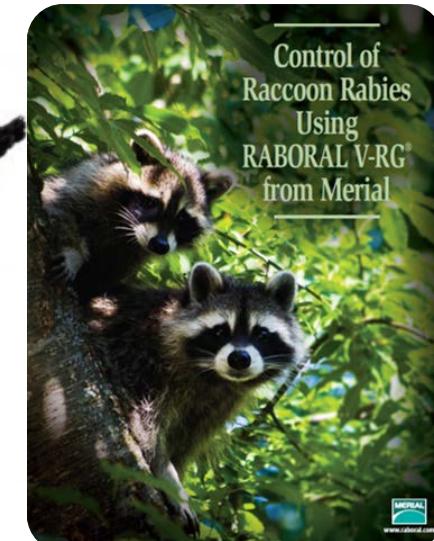
**Area baited: 162,902 km<sup>2</sup>**

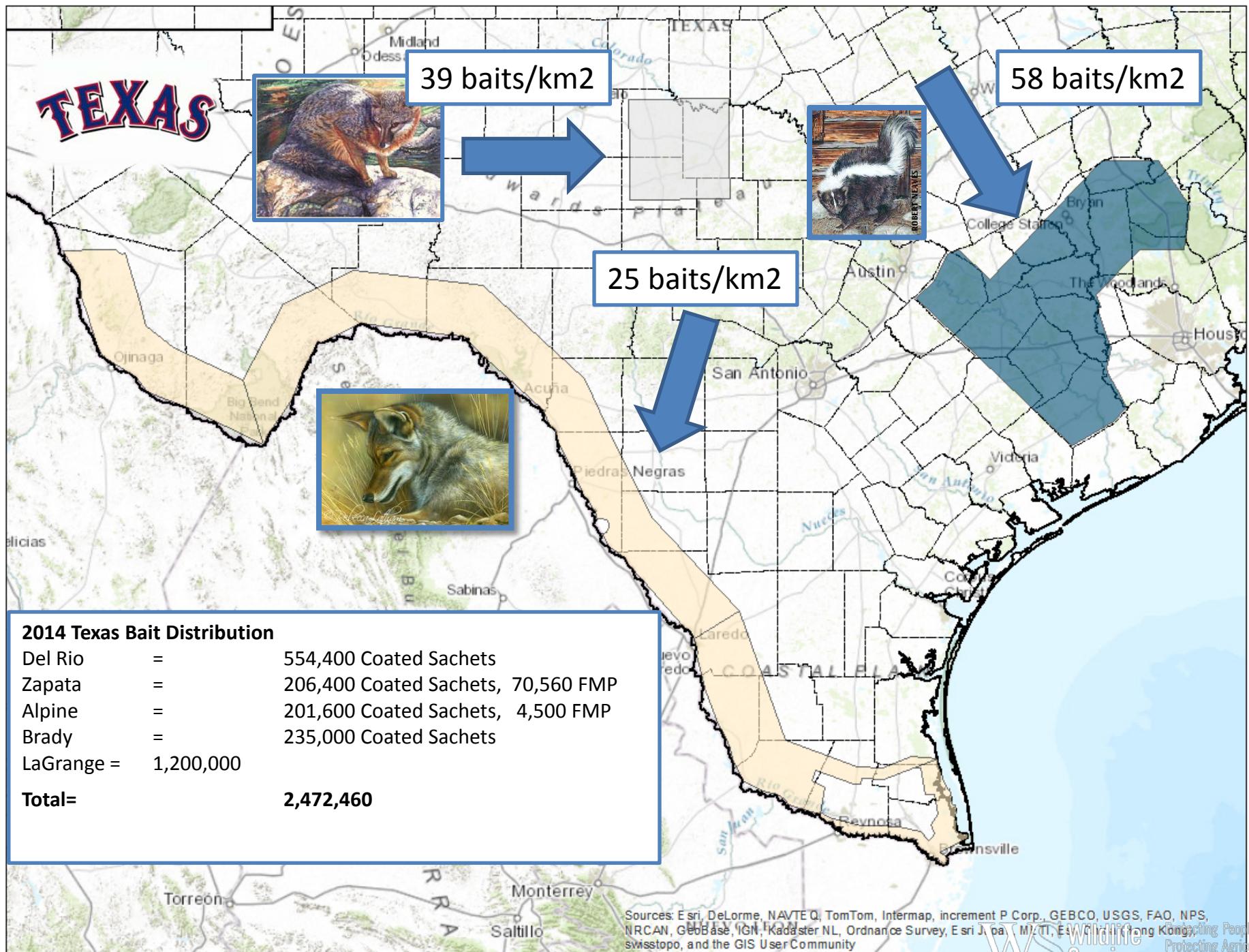
**Hours of Flight: 1,133**

**Across 15 States**

# Management with Raboral V-RG® ORV in U.S.

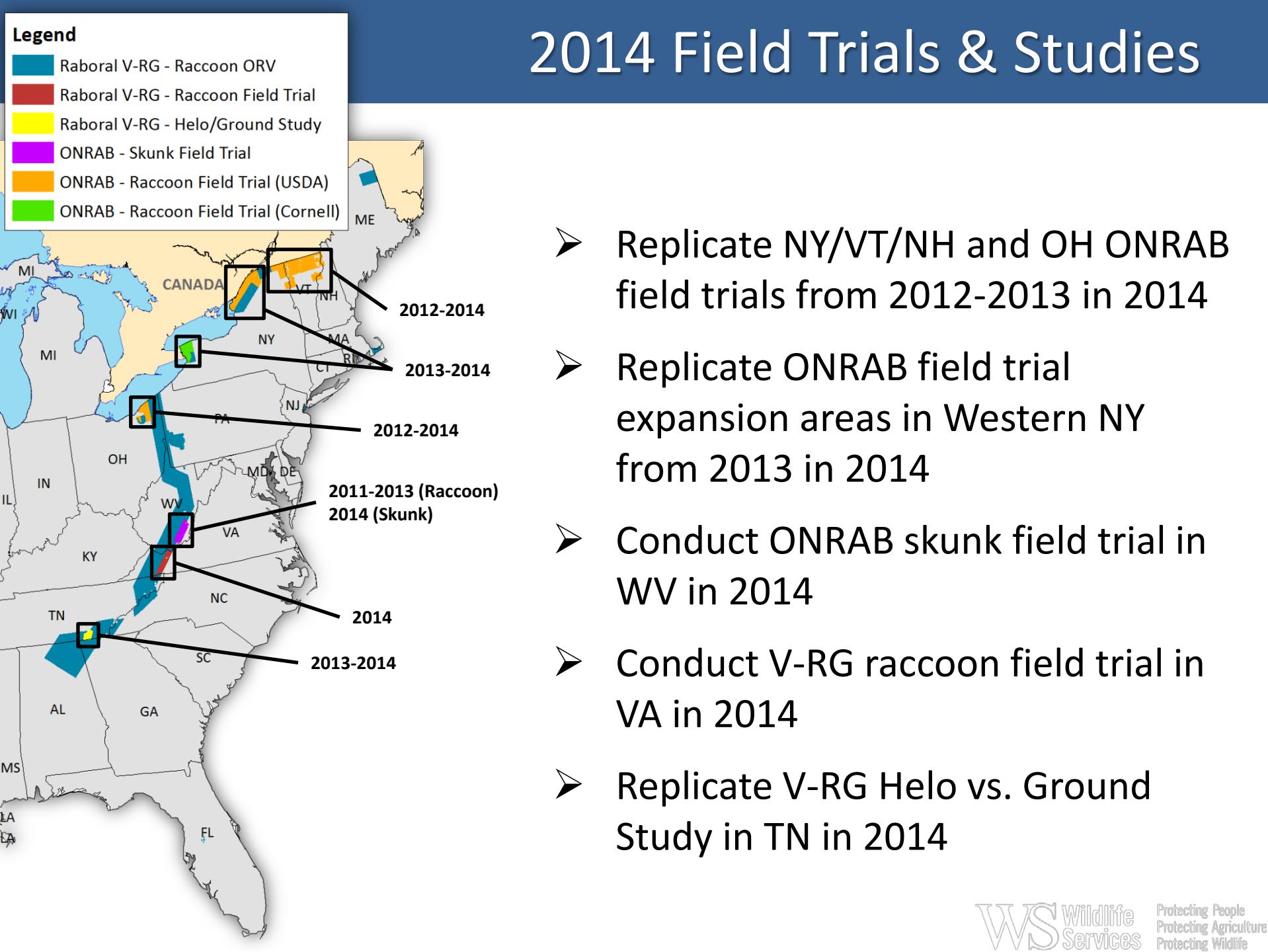
- Raboral V-RG® is the only licensed ORV in the U.S.
- >155 million V-RG baits distributed in U.S. since 1992
- Coordinated ORV with V-RG has resulted in 3 major accomplishments in the U.S.





# Status of ONRAB Field Trials (baits and vaccines)





# Serology Status for ONRAB Field Trials

## % of Rabies Virus Neutralizing Antibodies in Raccoon Sera



PRE	NY	VT/NH	OH	WV
2011	---	---	---	9.6
2012	33.2	21.3	37.9	42.2
2013	<i>pending</i>	58.9	<i>pending</i>	<i>pending</i>
2014	<i>pending</i>	<i>pending</i>	<i>pending</i>	<i>pending</i>

POST	NY	VT/NH	OH	WV
2011	---	---	---	<b>49.2</b>
2012	<b>65.1</b>	<b>67.6</b>	<i>pending</i>	<i>pending</i>
2013	<i>pending</i>	<b>75.7</b>	<i>pending</i>	<i>pending</i>
2014	<i>pending</i>	<i>pending</i>	<i>pending</i>	<i>pending</i>

# Baiting Strategies: 2013-2014

## Helo vs. Ground ORV Study (TN)

- Determine effectiveness of two ORV baiting strategies: Helicopter vs. Ground
- Conduct raccoon telemetry to determine home ranges and ORV bait availability in Helicopter vs. Ground zones

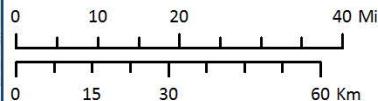


# 2014 West Virginia (ONRAB) and Virginia (V-RG) Field Trials

## Oral Rabies Vaccination (ORV) Distribution Areas

- ONRAB @ 300 baits/km<sup>2</sup> (Skunks)
- Raboral V-RG @ 75 baits/km<sup>2</sup>
- Raboral V-RG @ 150 baits/km<sup>2</sup>

 Field trial sampling cells

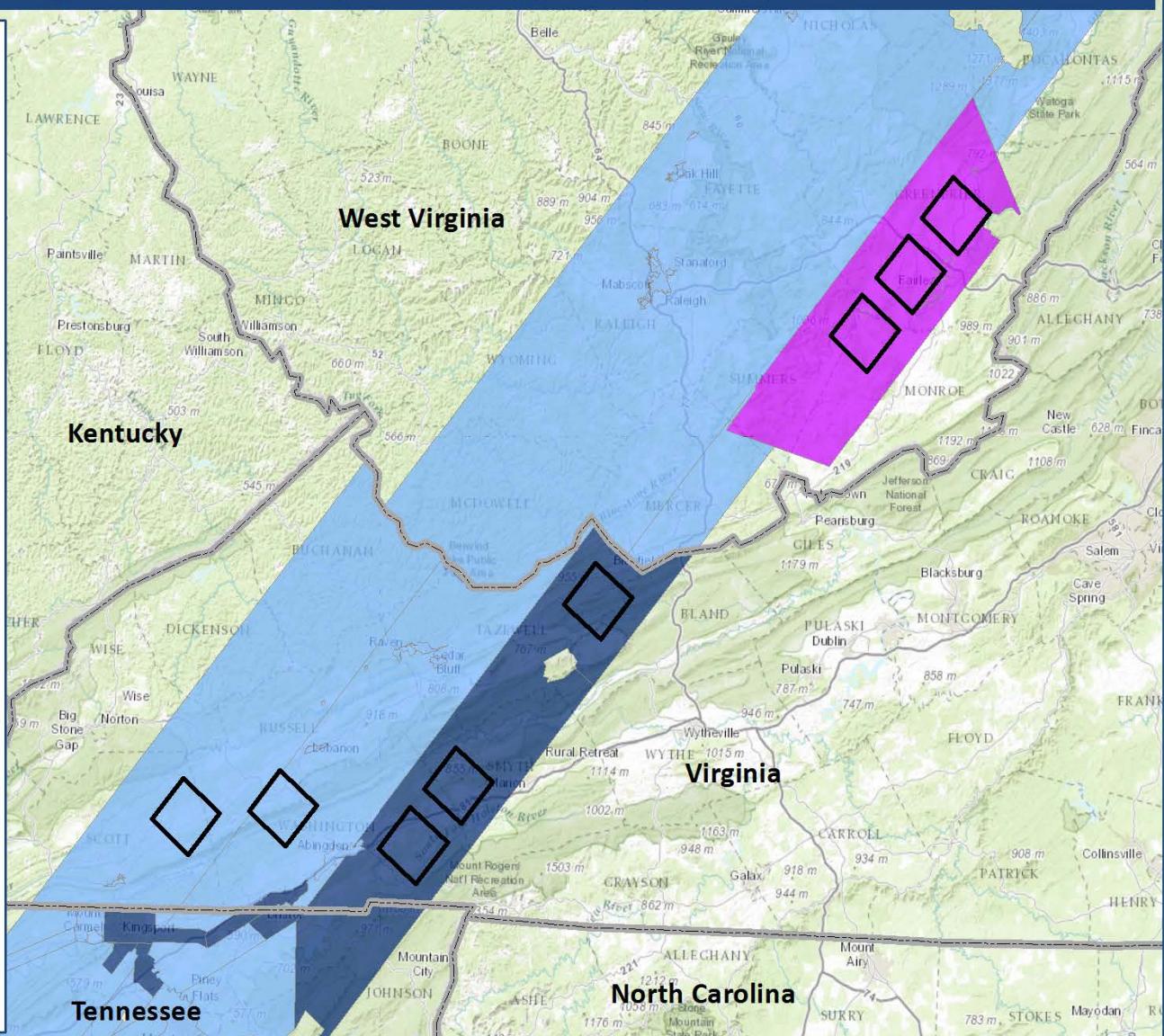


Coordinate System: North America Albers Equal Conic, Central Meridian -73.0

Datum: NAD 1983

Data Sources: USDA/APHIS/Wildlife Services

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCan, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap



# Contingency Action Methods

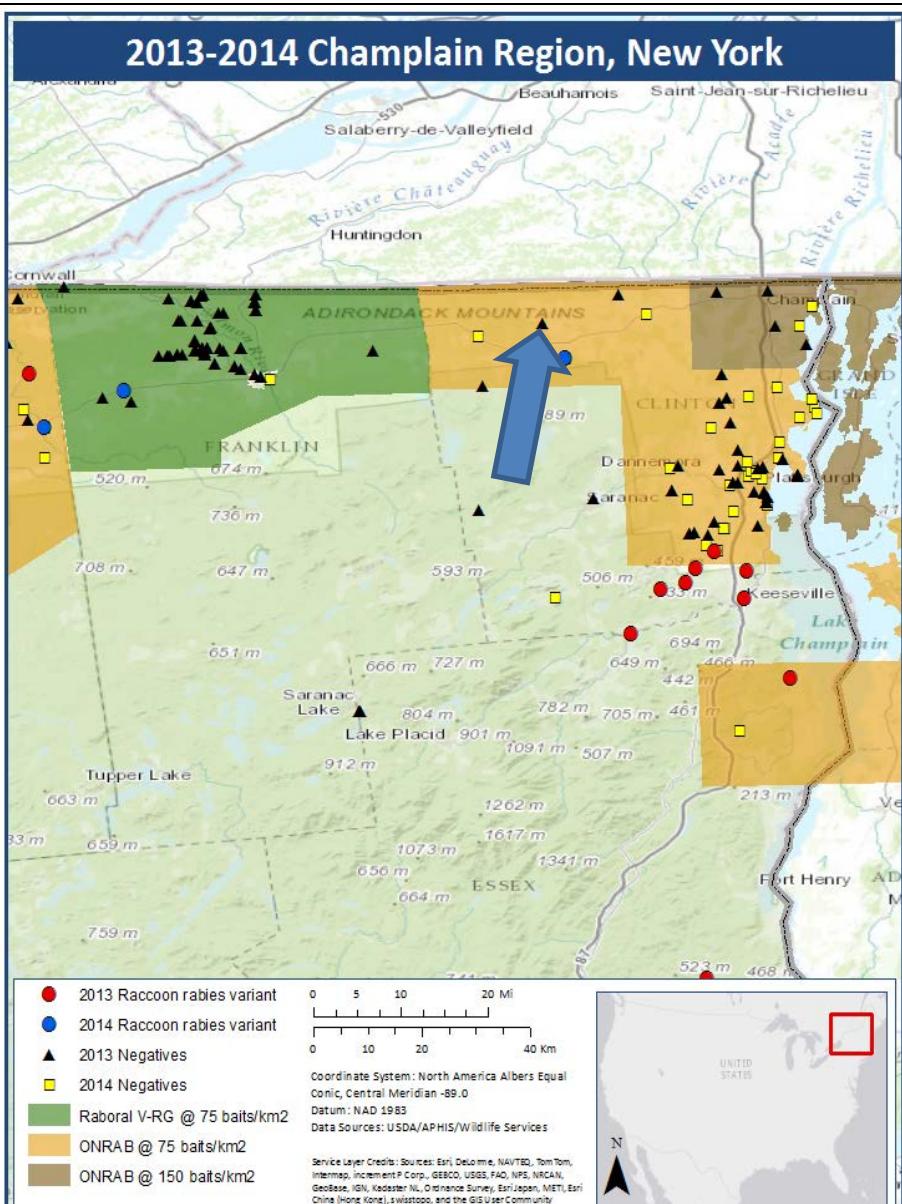
- Enhanced rabies surveillance
- Oral rabies vaccination (75/150 baits/km<sup>2</sup>)
- Trap-vaccinate-release
- Local population reduction

Contingency Action



# New York Response

## 2013-2014 Champlain Region, New York



- Sick-acting striped skunk collected by WS on October 7, 2014. Positive for raccoon variant
- Farthest north that raccoon rabies has been detected in Clinton County.
- 8 miles south of Quebec border
- Historic ORV Zone since 2007.
- VR-G, ONRAB, TVR.

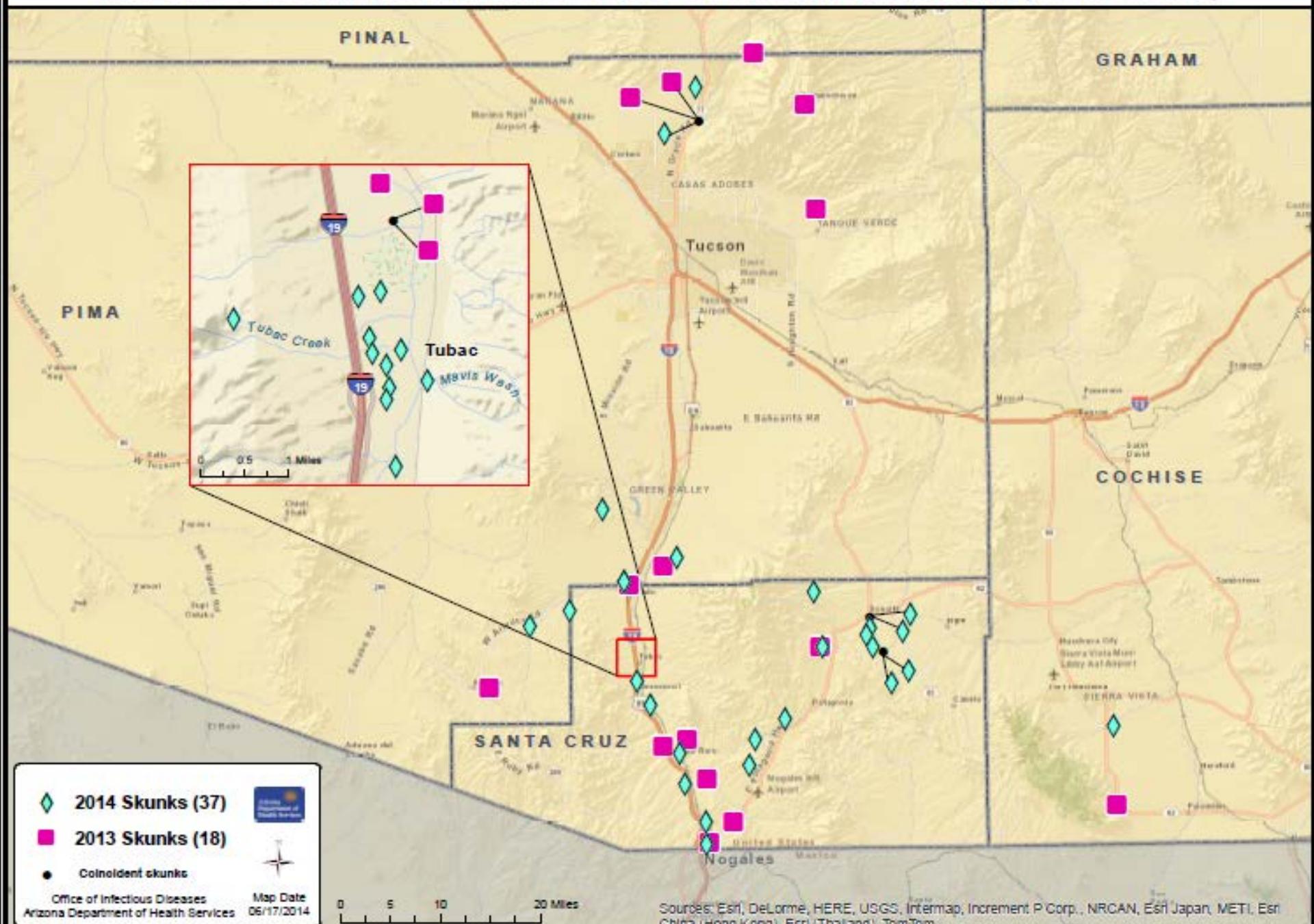


# New York Response



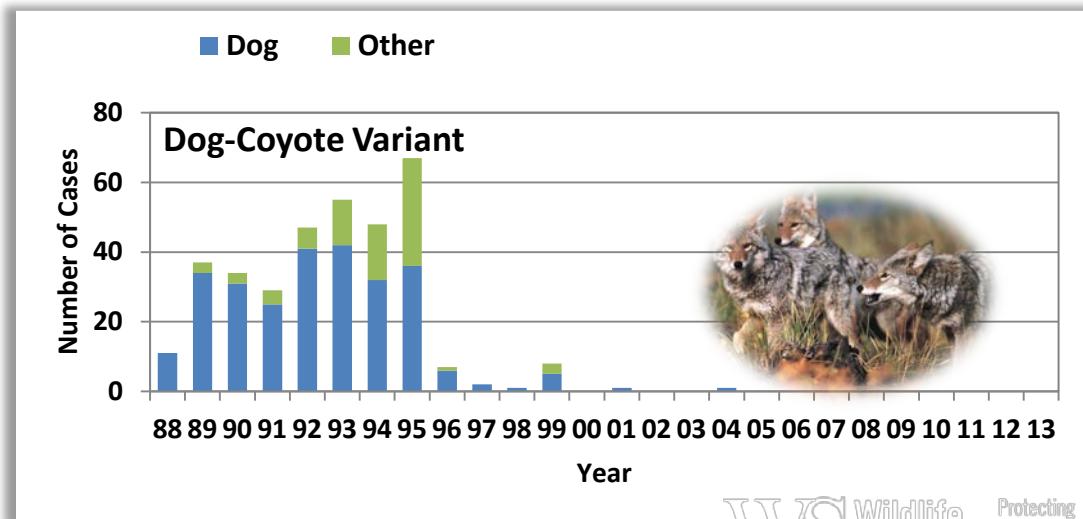
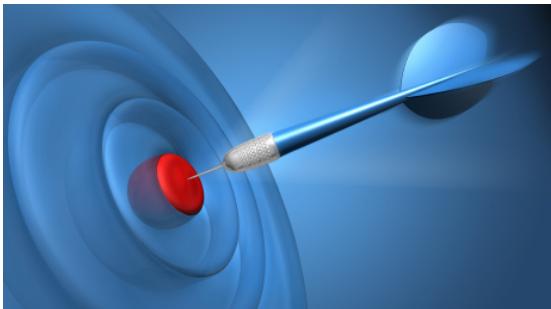
- **Focal trapping** (October 15-17, 2014) for enhance surveillance
- A target of **50 samples** for rabies testing.
- Blood and first pre-molar tooth collected.
- **October 21-31, Conduct TVR.**
- Blood and first pre-molar tooth collected.
- **Weather and raccoon behavior dependent.**

# RABIES POSITIVE SKUNKS FOR SOUTHERN ARIZONA (2013-2014)



# Cooperative Rabies Management Program Accomplishments

- ❑ No canine rabies in U.S. since 2004, declared free in 2007
- ❑ One gray fox rabies case in Texas since May 2009
- ❑ No appreciable spread of raccoon rabies to the West
- ❑ Also: No cases of bat-like virus in gray foxes near Flagstaff, AZ
- ❑ Also: Conducted broad scale ONRAB Field Trials in 5 states (2011-2014)

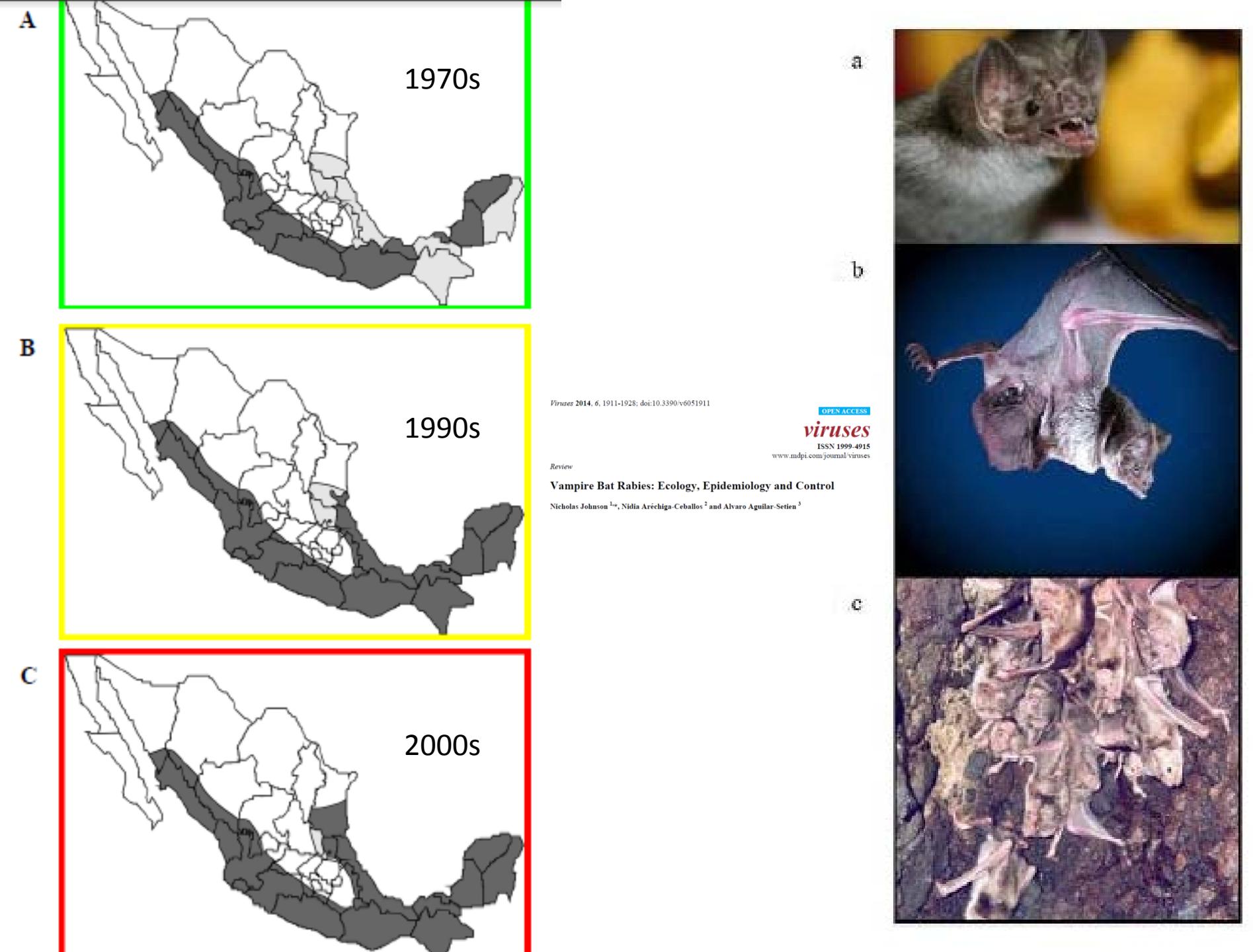


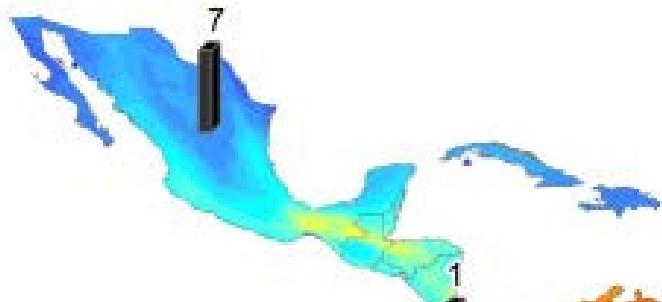
**Figure 2. The scope of the problem.**



Stoner-Duncan B, Streicker DG, Tedeschi CM (2014) Vampire Bats and Rabies: Toward an Ecological Solution to a Public Health Problem. PLoS Negl Trop Dis 8(6): e2867. doi:10.1371/journal.pntd.0002867

<http://127.0.0.1:8081/plosntds/article?id=info:doi/10.1371/journal.pntd.0002867>





Rabies Variants

Chiroptera  
Richness

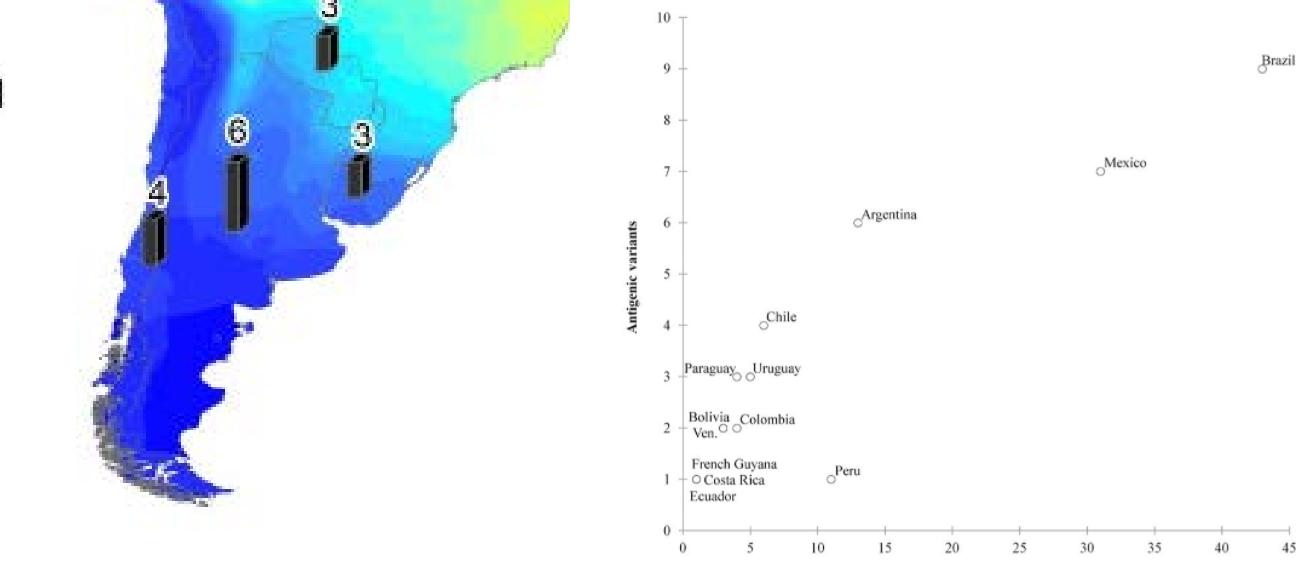


Fig. 2 Bat richness showing the number of bat species (rabies positive or not) present in Latin America (colored shading) and number of antigenic variants of bat rabies reported (gray bars).

Rev. Inst. Med. Trop. Sao Paulo  
57(1):63-72, January–February, 2015  
<http://dx.doi.org/10.1590/S0036-46652015000100009>

## BAT-BORNE RABIES IN LATIN AMERICA

Luis E. ESCOBAR<sup>(1,2)</sup>, A. Townsend PETERSON<sup>(3)</sup>, Myriam FAVI<sup>(4)</sup>, Verónica YUNG<sup>(4)</sup> & Gonzalo MEDINA-VOGEL<sup>(1)</sup>

BAT-BORNE RABIES IN LATIN AMERICA

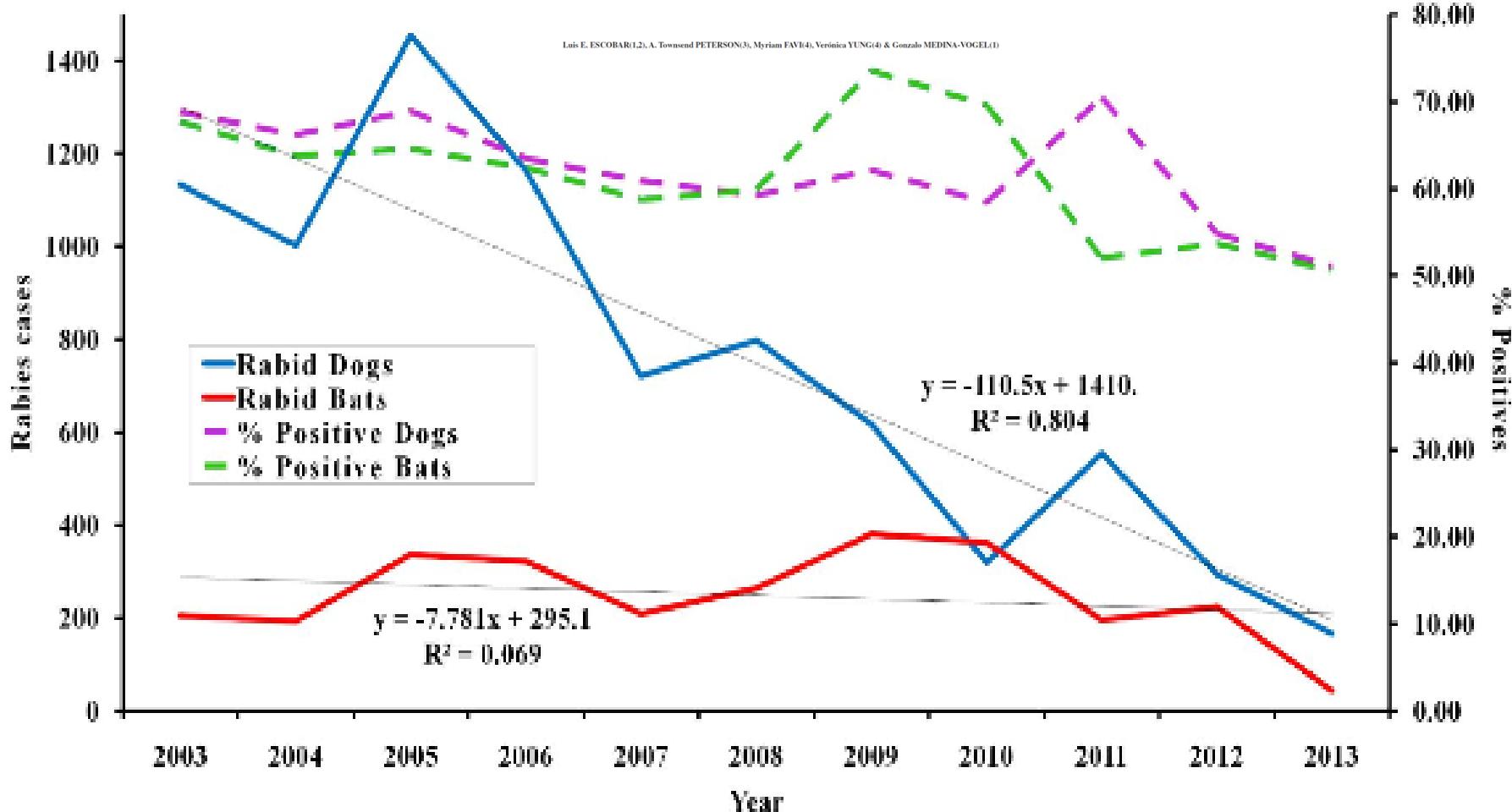


Fig. 1 Dog (blue line) and bat (red line) rabies cases during 2003-2013, based on samples from Latin American and Caribbean countries considered in this study. Belize, Costa Rica, Ecuador, Guatemala, Guyana, French Guyana, and Haiti did not have reports for this period. Notice the linear trend (black line) for each host group. Proportion of positive bat (green dash line) and dog samples (purple dash line) is shown. Source: SIEPI-PANAFTOSA/PAHO-WHO, data available on <http://siepi.panaftosa.org.br/>



SUBSECRETARÍA DE PREVENCIÓN Y PROMOCIÓN DE LA SALUD  
CENTRO NACIONAL DE PROGRAMAS PREVENTIVOS Y CONTROL DE ENFERMEDADES

**Lineamientos Generales**  
**Primera Semana Nacional de Vacunación**  
**Antirrábica Canina y Felina 2015**  
22 AL 28 DE MARZO

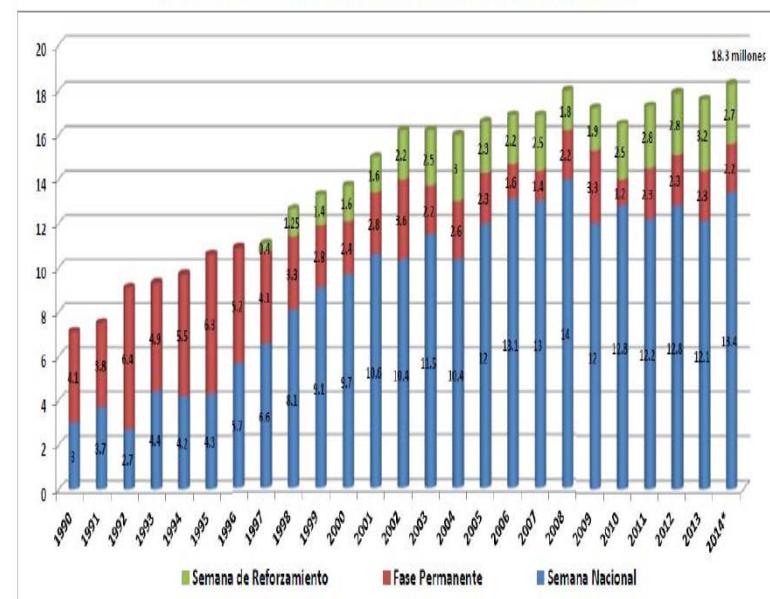


**CENAPRECE**  
CENTRO NACIONAL DE PROGRAMAS PREVENTIVOS Y CONTROL DE ENFERMEDADES



SECRETARÍA DE SALUD  
SUBSECRETARÍA DE PREVENCIÓN Y PROMOCIÓN DE LA SALUD  
CENTRO NACIONAL DE PROGRAMAS PREVENTIVOS Y CONTROL DE ENFERMEDADES

DOSIS APLICADAS DE VACUNA ANTIRRÁBICA CANINA EN MÉXICO, 1990 - 2014



\*Fuente: sistema de información en Salud (SIS) DGIS México

\*\*Cifras preliminares enero a diciembre de 2014



★★★★★ 4 Votos

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## Mexico spearheads rabies control in America

*Around 177 million pesos have been invested in the cause in recent years, benefitting 440 thousand Production Units across 25 states.*

Published November 3, 2014 by DGSA  
Information DGSA



The Secretariat of Agriculture, Livestock, Rural Development, Fishery and Food has invested 177 million pesos in the Campaign against Paralytic Bovine Rabies over the last 8 years, benefitting 440 thousand Production Units in 25 states across the Republic.

Through this campaign, they have attended to a vulnerable livestock population of 44.8 million bovines, pigs, horses, goats and sheep; producing annual

incidence rates of 0.0007% in the livestock sector.

## **Report of rabies in feedlot cattle introduced to Baja California from the state of Guerrero, Mexico**

José Luis RODRIGUEZ CASTILLO<sup>1</sup>, Alfonso de la MORA VALLE<sup>2</sup>, Gerardo Enrique MEDINA BASULTO<sup>1</sup>,  
Francisco Javier MONGE NAVARRO<sup>1</sup>, Rosa María BERMUDEZ HURTADO<sup>1</sup>, Gilberto LOPEZ VALENCIA<sup>1,\*</sup>

<sup>1</sup>ULADI, Institute for Research in Veterinary Sciences, Autonomous University of Baja California, Mexicali, Baja California, Mexico

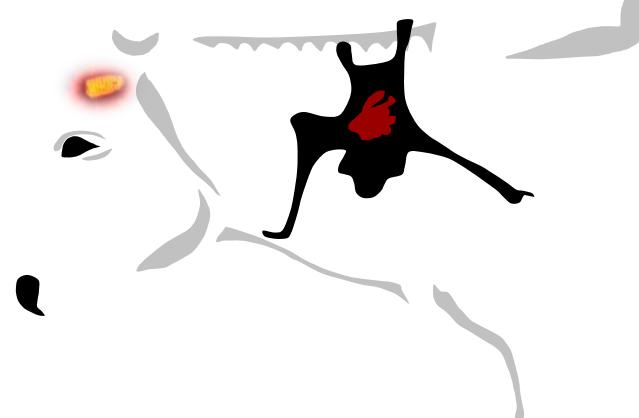
<sup>2</sup>Pathology Laboratory, Institute for Research in Veterinary Sciences, Autonomous University of Baja California,  
Mexicali, Baja California, Mexico

# Strategic Initiative 2014-2015

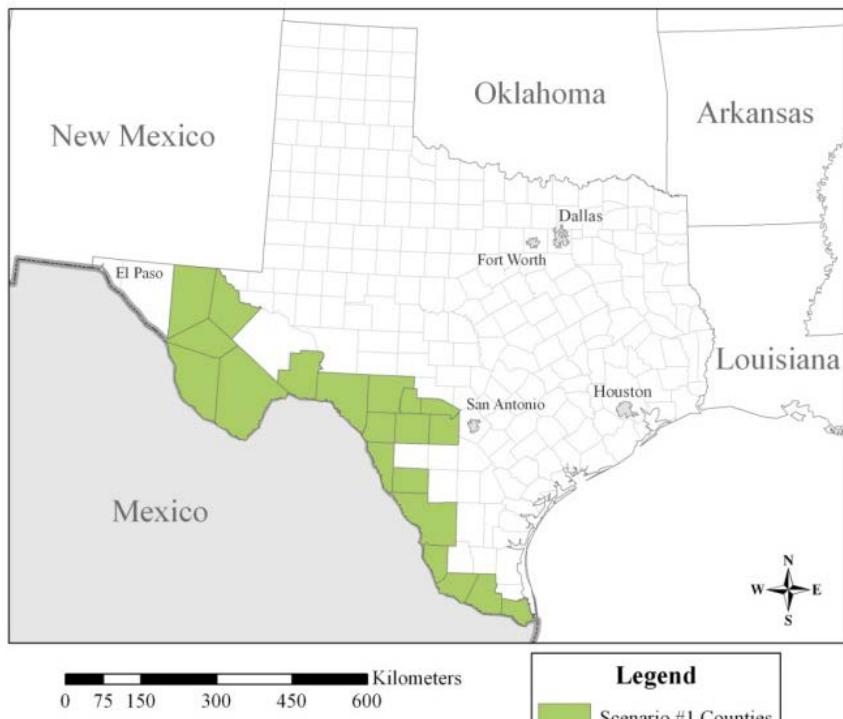


# Ecological niche modeling for Vampire Bats

- In collaboration with an ENM modeler at USGS in Fort Collins, NWRC is developing a ENM for vampires
- **Preliminary analyses of these data predict *current day* suitability in Texas**

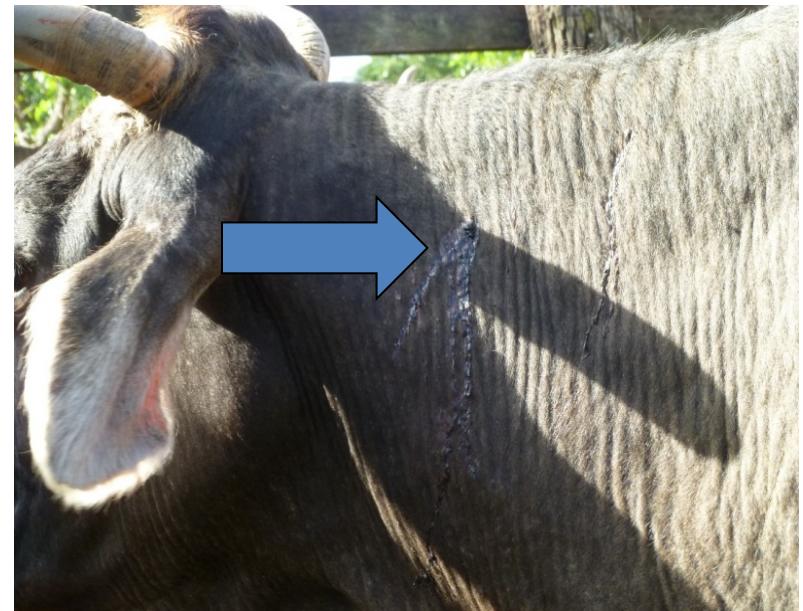
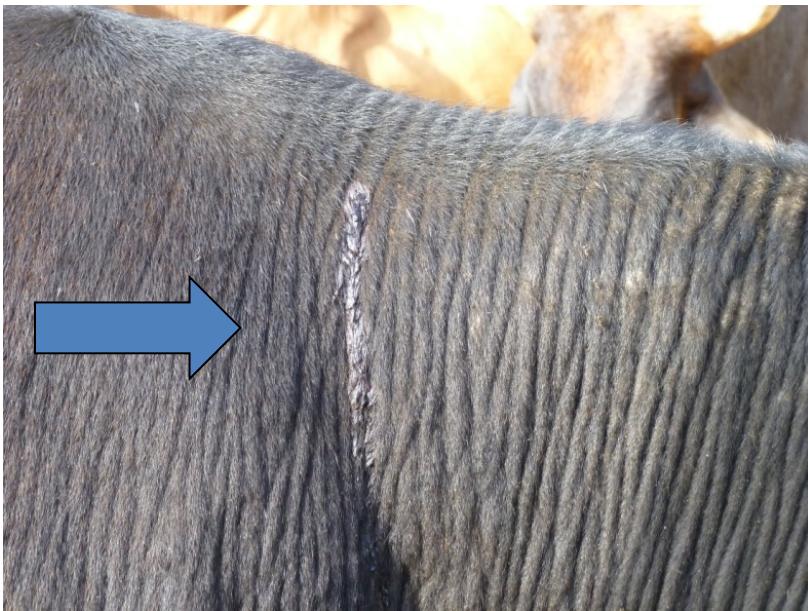


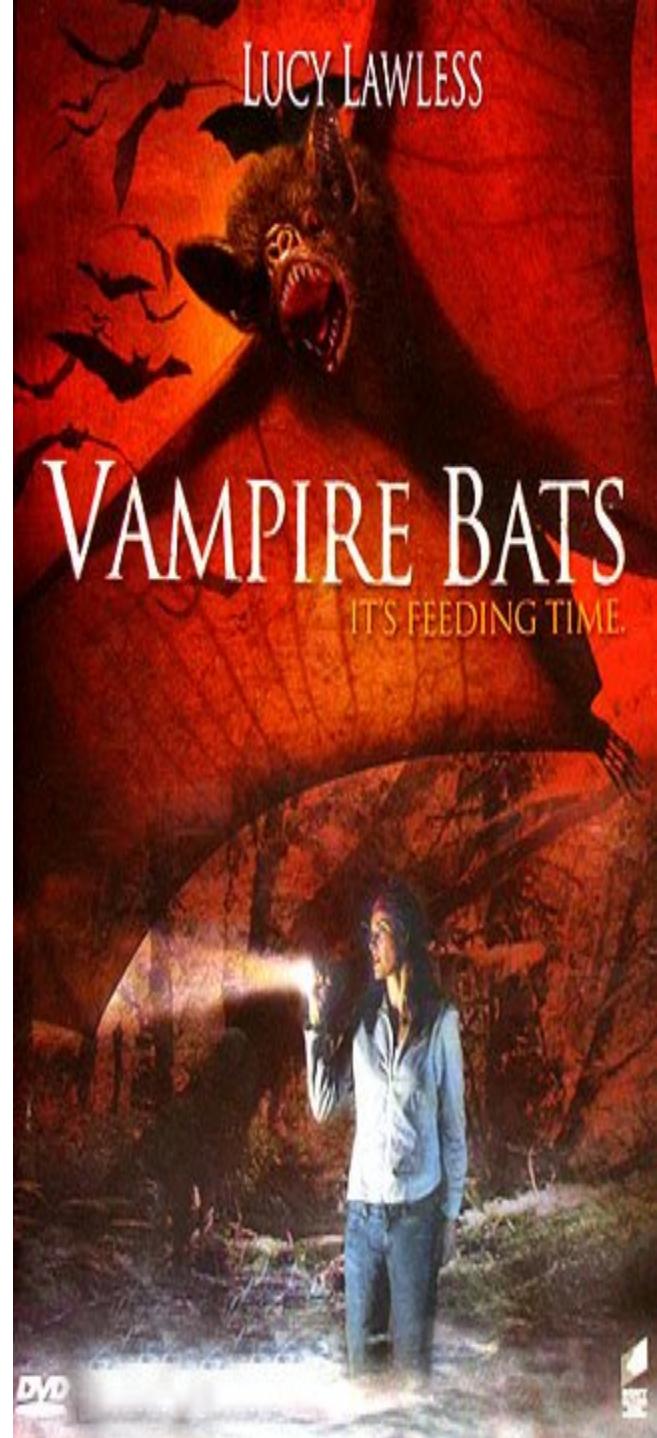
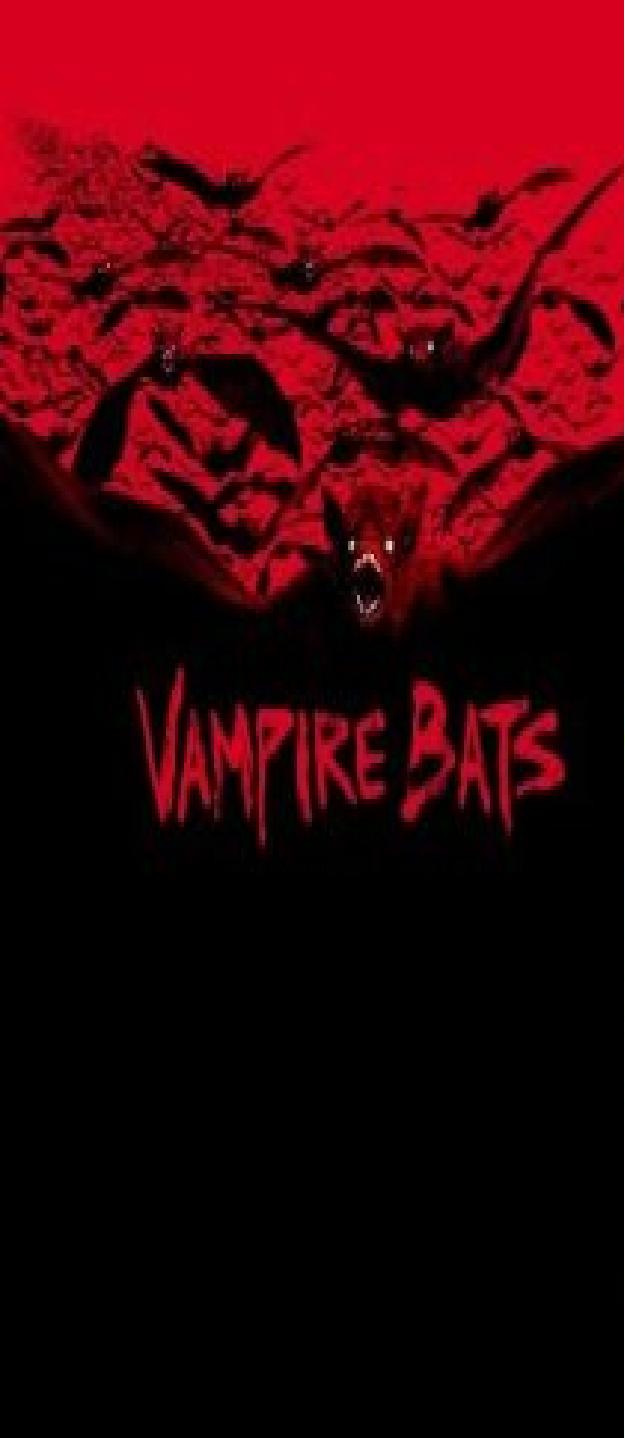
# Economic Impact of Vampire Bats in the U.S



- An economic analysis by Anderson, Shwiff & Shwiff indicated a **total economic impact of \$7.0 million to \$9.2 million** annually under two different scenarios of US invasion

# Development of a surveillance network to detect incursion of vampire bats into the United States



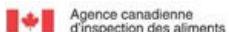




CAINADA

### Samples Submitted

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	NU	NT	YT
Samples Submitted	95	293	230	168	903	147	32	3	3	13	16	11	4



Agence canadienne  
d'inspection des aliments

Canadian Food  
Inspection Agency

Canada

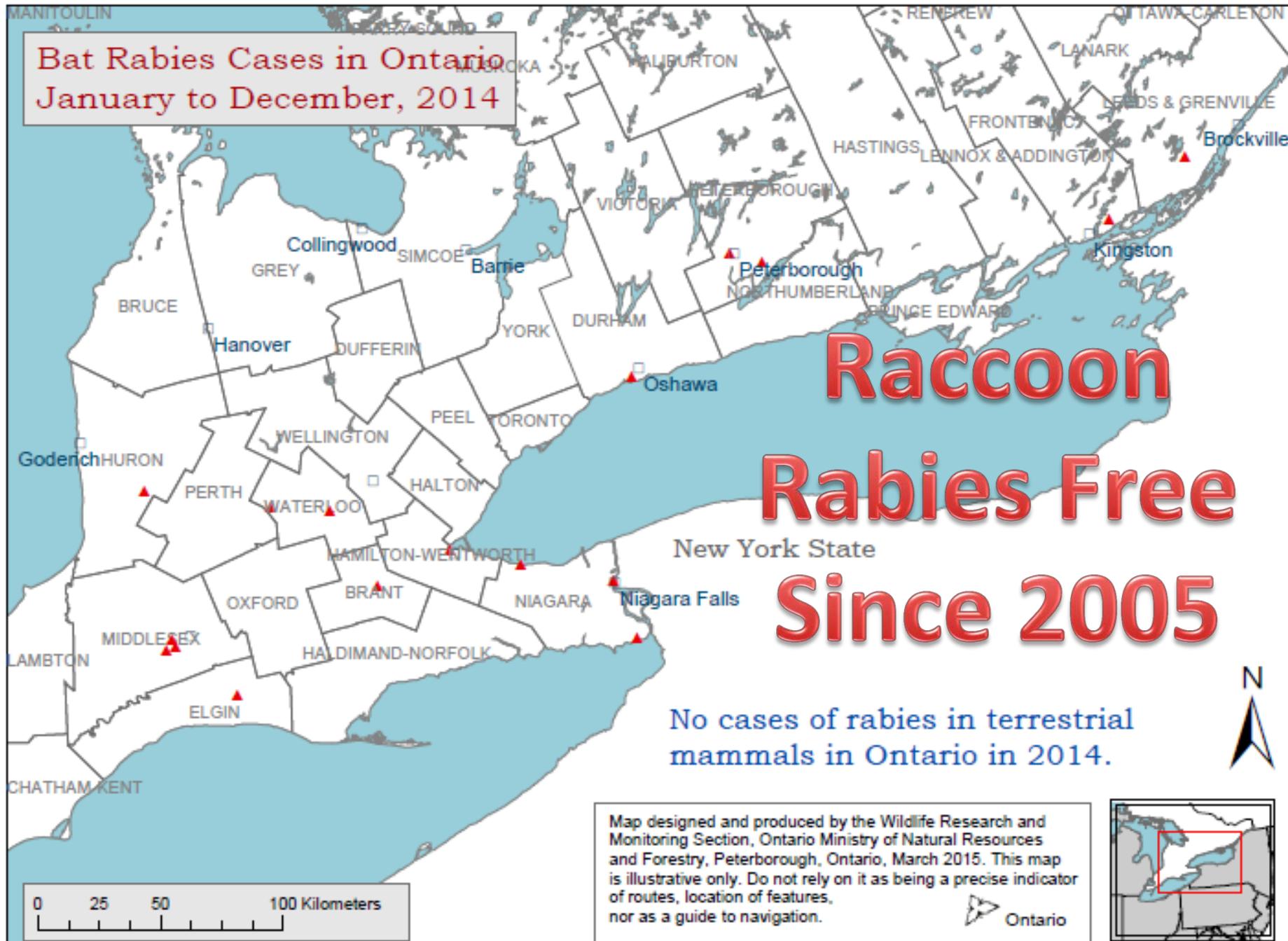
### Rabies Cases

Rabies Cases	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	NU	NT	YT
Arctic Fox						1					7	2	
Bat	9	4	9		18	6							
Bovine				3									
Cat				1		1							
Dog										3	1		
Equine			1										
Raccoon							1						
Red Fox										1		2	
Skunk			10	11			1						
Total	9	4	20	15	18	8	2	0	0	1	10	5	0

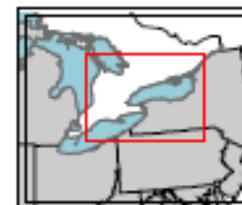
MANITOULIN

WATERSOUND

## Bat Rabies Cases in Ontario January to December, 2014



Map designed and produced by the Wildlife Research and Monitoring Section, Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario, March 2015. This map is illustrative only. Do not rely on it as being a precise indicator of routes, location of features, nor as a guide to navigation.



## Rabies Control Operations - Ontario 2014

- Raccoon Strain Baiting (Aug)
- Raccoon Strain Hand-Baiting (Aug)

Barrie

Peterborough

Kingston

Oshawa

Lake Ontario

Toronto

Guelph

Hamilton

Niagara Falls



0 15 30 60 Kilometers

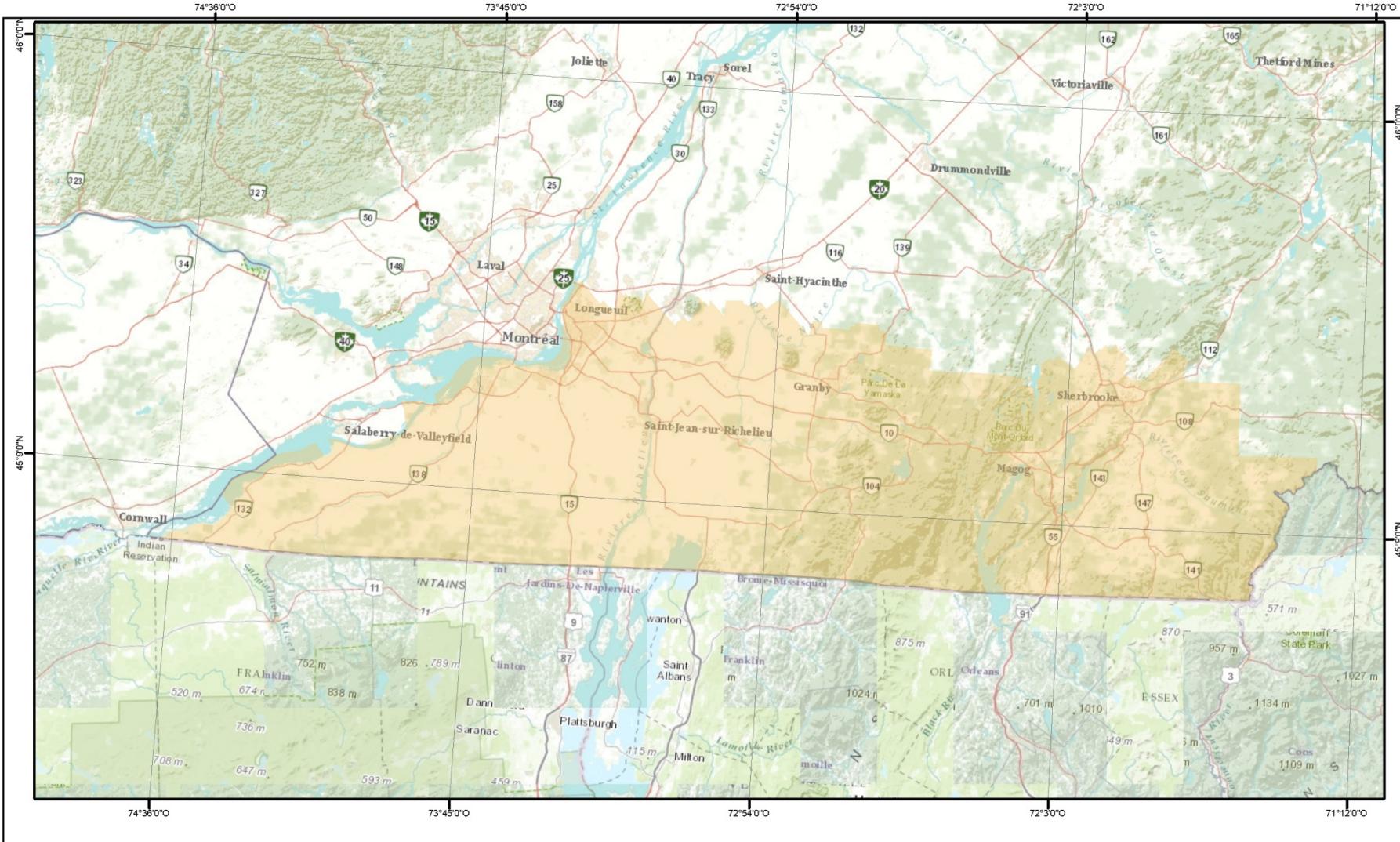
Note: this map is a draft and actual baited areas are subject to change based on local circumstances and additional rabies cases.

Designed and produced by the Wildlife Research and Monitoring Section, Ontario Ministry of Natural Resources and Forestry, Peterborough Ontario. July 2014.

This map is illustrative only. Do not rely on it as a precise indicator of routes, location of features, nor as a guide to navigation.



# Zone de haute surveillance de la rage du raton laveur au Québec en 2014



## Légende

### Zone de surveillance - 2014



#### Métdonnées

Projection cartographique  
Conique Lambert

Système de référence géodésique  
NAD 83

1:1 185 886

0 15 30 60 km

#### Sources des informations géographiques

BDTA 1: 250 000 MRN  
BDGA 1: 1 000 000 MRN

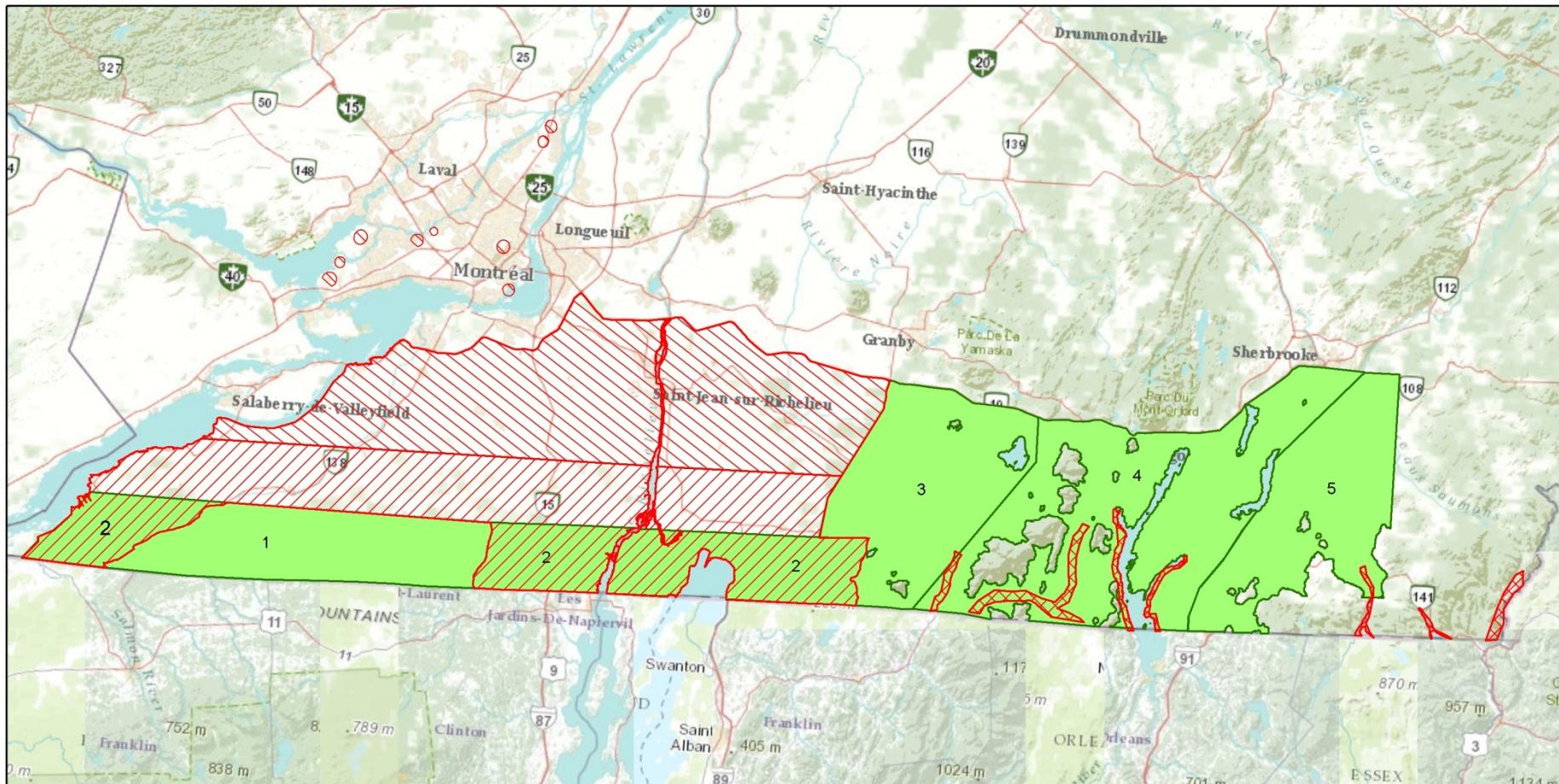
#### Réalisation

Ministère du Développement durable, de l'Environnement,  
de la Faune et des Parcs  
Direction de la biodiversité et des maladies de la faune  
© Gouvernement du Québec, 2014  
Note: Le présent document n'a aucune portée légale



Québec

# Opérations de contrôle de la rage du raton laveur au Québec en 2014



## Largage aérien

Zone	Densité (vaccins/km <sup>2</sup> )
1	100
2	125
3	100
4	75
5	125

## Épandage manuel

Densité Zone (vaccins/km <sup>2</sup> )			
	a	50	(Été)
	b	70	(Été)
	c	60	(Printemps et été)
Grands parcs de MTL	2	60	(Printemps)
	200	200	(Été)

## Métadonnées

Système de référence géodésique: GCS North American 1983, NAD 83

Projection cartographique: Conique de Lambert

0 10 20 30 km  
1/918 084

## Sources

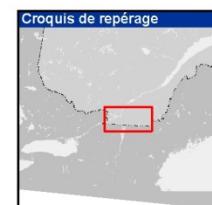
BOGA (1/1 000 000) 2006  
Ministère des Ressources naturelles et de la Faune

## Réalisation

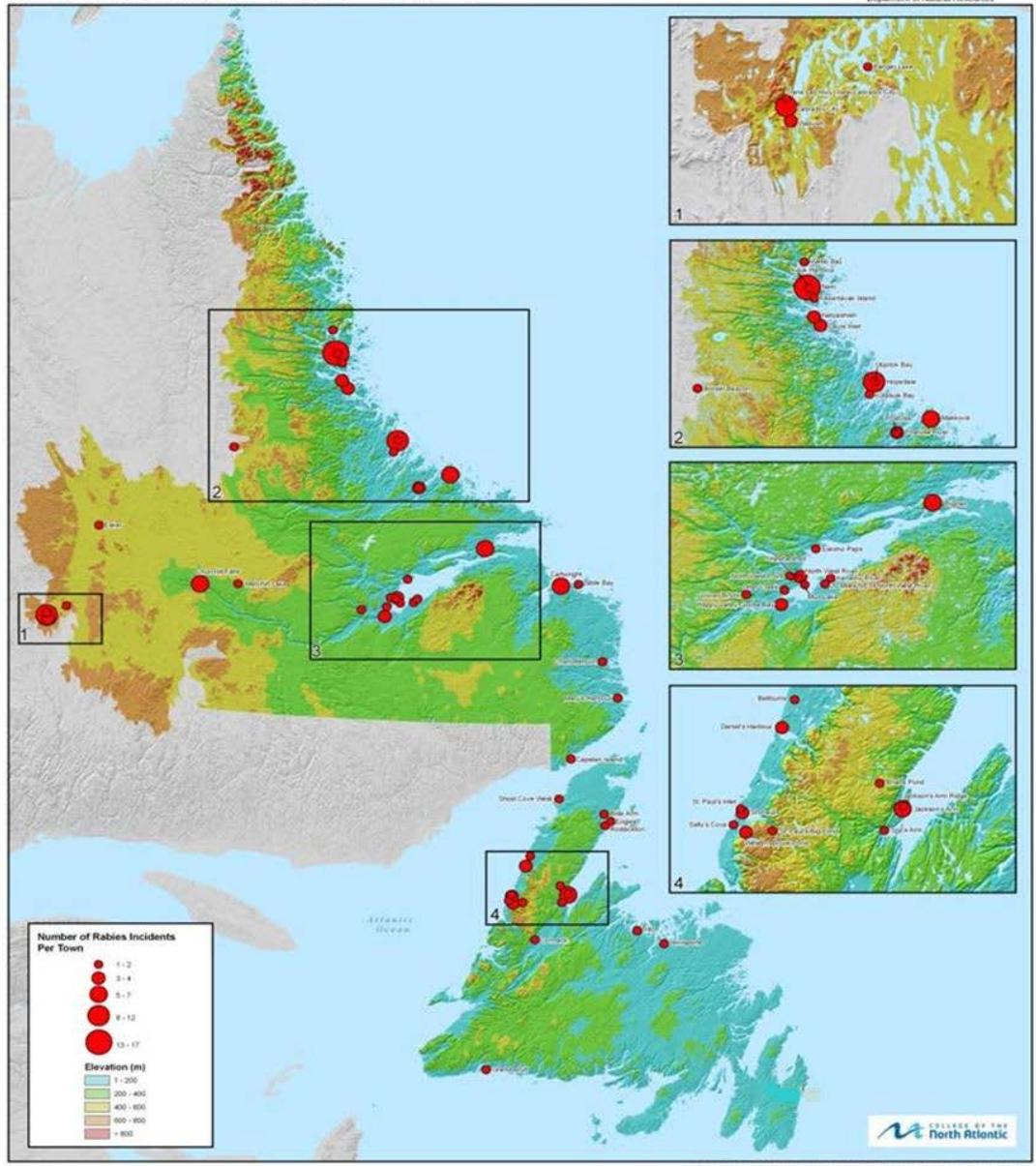
Production: MDDEFP - Direction générale de l'expertise sur la faune et ses habitats

Note: Le présent document n'a aucune portée légale.

© Gouvernement du Québec, 1<sup>er</sup> trimestre 2014



# Rabies Incidents Per Town in Newfoundland and Labrador 1954 - 2011\*



## Rabid wolf chases 2 Labrador families on snowmobile trip

1st rabies case in region since July prompts Labrador officials to ask for public's help

CBC News Posted: Jan 30, 2015 7:09 AM NT | Last Updated: Jan 30, 2015 5:18 PM NT

Labrador mothers of being chased by rabid wolf



Stay Connected with CBC News





# Rabid raccoon bite in Charlotte County prompts call for action

**Health officer urges provincial government to resume inoculation programs, or risk rabies outbreak**

CBC News Posted: Jan 30, 2015 2:52 PM AT | Last Updated: Jan 30, 2015 4:18 PM AT

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New Brunswick's medical officer of health in Saint John is urging the provincial government to resume trap-and-release and bait-and-drop inoculation programs in Charlotte County, or risk a rabies outbreak.

Dr. Scott Giffin says a rabid raccoon bit a man in Oak Bay last week, bringing the total number of confirmed rabid raccoons in the area in recent weeks to at least three.

There have also been



Dr. Scott Giffin says trap-and-release and bait-and-drop programs have proven effective in St. Stephen before. (CBC)

Stay Connected with CBC News



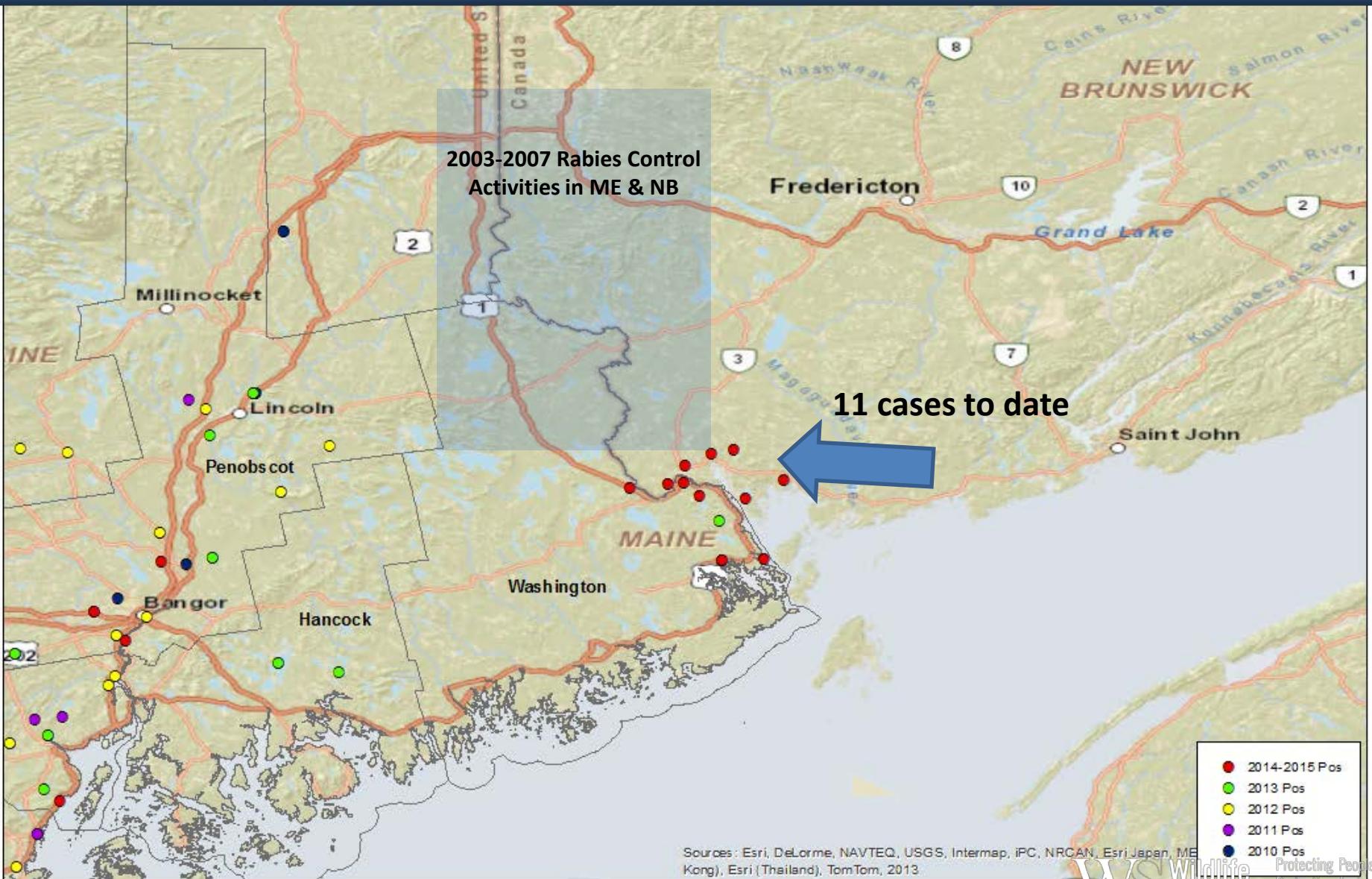
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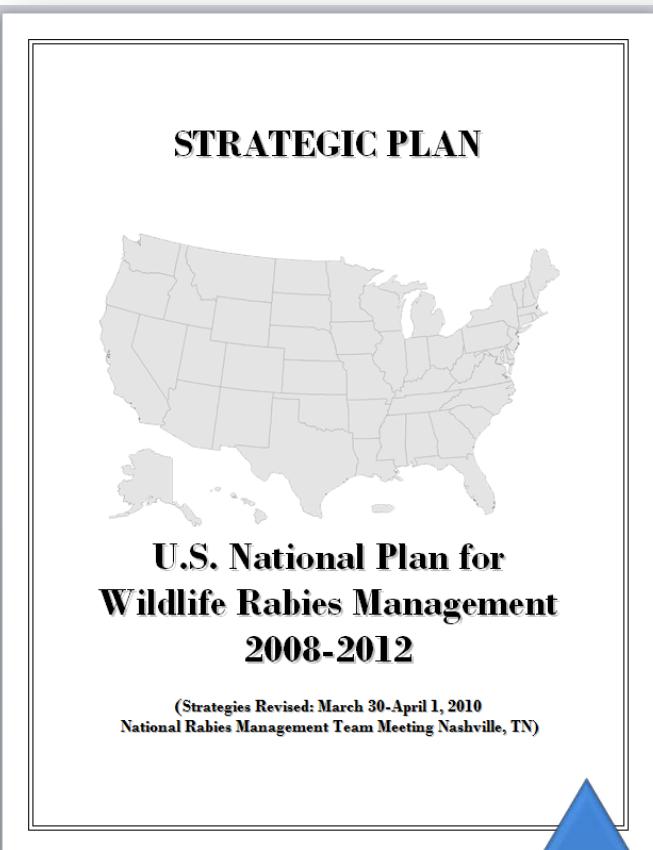


# Border Rabies Control

## (Recent Maine - New Brunswick Cases)



# Strategic Plans: Update (2015)



# Critical Plan Driver

A quest for the safest,  
most effective, least  
expensive oral rabies  
vaccine



# Licensing of ONRAB?



**United States  
Department of  
Agriculture**

- Incorporated in Delaware
- Skunks only
- Ongoing research NWRC

# Requested Specific Outcomes

- Continued support of the North American Rabies Management Plan
- Increased border surveillance between Mexico and the US.
- Participation by Canada in the impacts of climate change on rabies spread associated with Arctic foxes
- Cross border participation in bat surveillance for rabies titers and impacts of climate change on bats especially vampire bats.
- Continued support for data exchange across borders
- Continued support to evaluate rabies vaccines in wildlife species

# Thank You!

