

The Rabies Reporter

The Ministry of Natural Resources and Forestry

MNRF Publication 51709, Volume 33

January — December 2022



The Rabies Reporter is a scientific newsletter about current issues in rabies research and control. It is a joint effort of the Wildlife Research and Monitoring Section of the Ontario Ministry of Natural Resources and Forestry; the Rabies Laboratory at the Ottawa Laboratory (Fallowfield) of the Canadian Food Inspection Agency; and the Ontario Ministry of Health. Articles for future issues will be welcomed by the editor. The Rabies Reporter is not peer reviewed and should be cited as a newsletter. Send contributions, letters and inquiries to: rabies@ontario.ca.

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ISSN (print): 1186-8961
ISSN (pdf): 1705-2106

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Controlling the spread in 2022

Anne McCarthy, Ministry of Natural Resources and Forestry

We are happy to report that all 2022 cases of terrestrial rabies in Ontario were detected in a single city (St. Catharines), in an area less than 35km². For the second year in a row there were no cases of raccoon rabies detected in the Hamilton area, which was the original epicenter of the outbreak. Controlling the spread and is an important step towards reaching our goal of eliminating terrestrial rabies in Ontario.

In 2022, 61 rabies cases were detected in the province. Of those, 23 were raccoon strain rabies (Figure 1). While the raccoon strain cases did increase slightly in number from 2021 (14 raccoon strain), cases remained low and were contained to a small area in Southern Ontario.

In 2022, we tested 4,762 samples from sick, strange acting, found dead, or roadkill wildlife. This is the largest number of animals tested since the start of the outbreak. From December 2015 to December 2022, 517 raccoon strain and 21 fox strain cases have been detected in Ontario (Figure 2).

Raccoon strain: Between January and December, only 23 raccoon strain rabies cases were detected — all were detected in the City of St. Catharines (5 raccoons and 18 skunks).

Fox strain: For the fourth year in a row, no fox strain cases were detected. Monitoring and sampling of dead, sick or strange acting animals continues within the surveillance area.

Bat strains: In 2022, 37 cases of bat rabies were detected. Two cases were detected in skunks (one in Kitchener and one in Hamilton) and 35 were detected in bats (32 big brown bats, two silver haired bats and one little brown bat). The cases were detected in Brant, Dufferin, Durham, Haldimand, Halton, Hamilton, Huron, Kawartha Lakes, Lanark, Niagara, Norfolk, Ottawa, Peel, Peterborough, Prescott and Russell, Prince Edward, Simcoe, Toronto, Wellington, York counties.

In 2022, a dog imported from Iran was found to be infected with dog strain rabies.

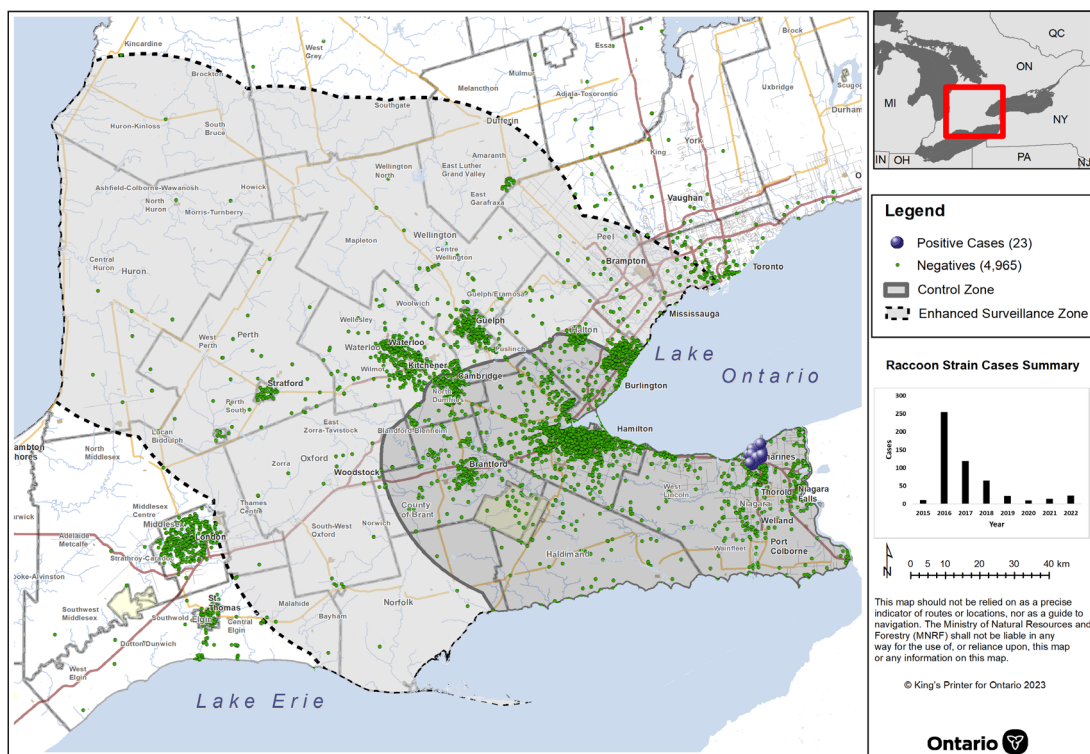


Figure 1. Terrestrial rabies cases (N=23) detected and negative samples collected in southern Ontario from January–December 2022.

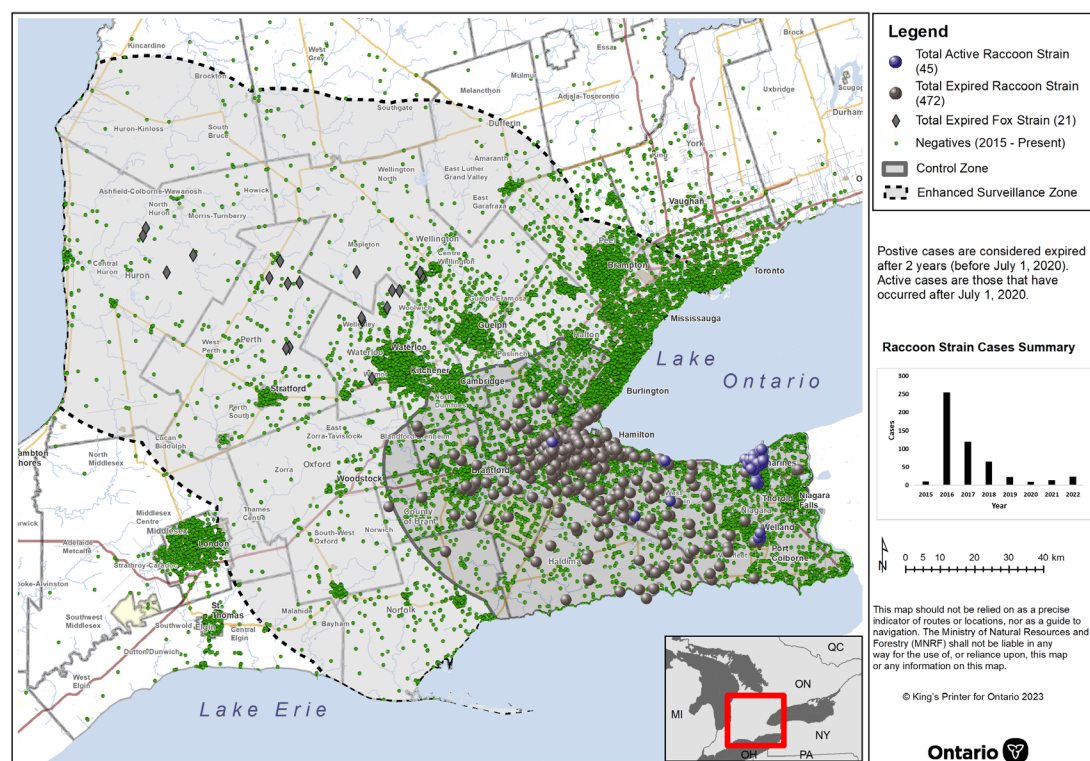


Figure 2. All terrestrial rabies cases active and expired (>2 years) detected in southern Ontario from December 2015–December 2022 along with the current surveillance and control zone.

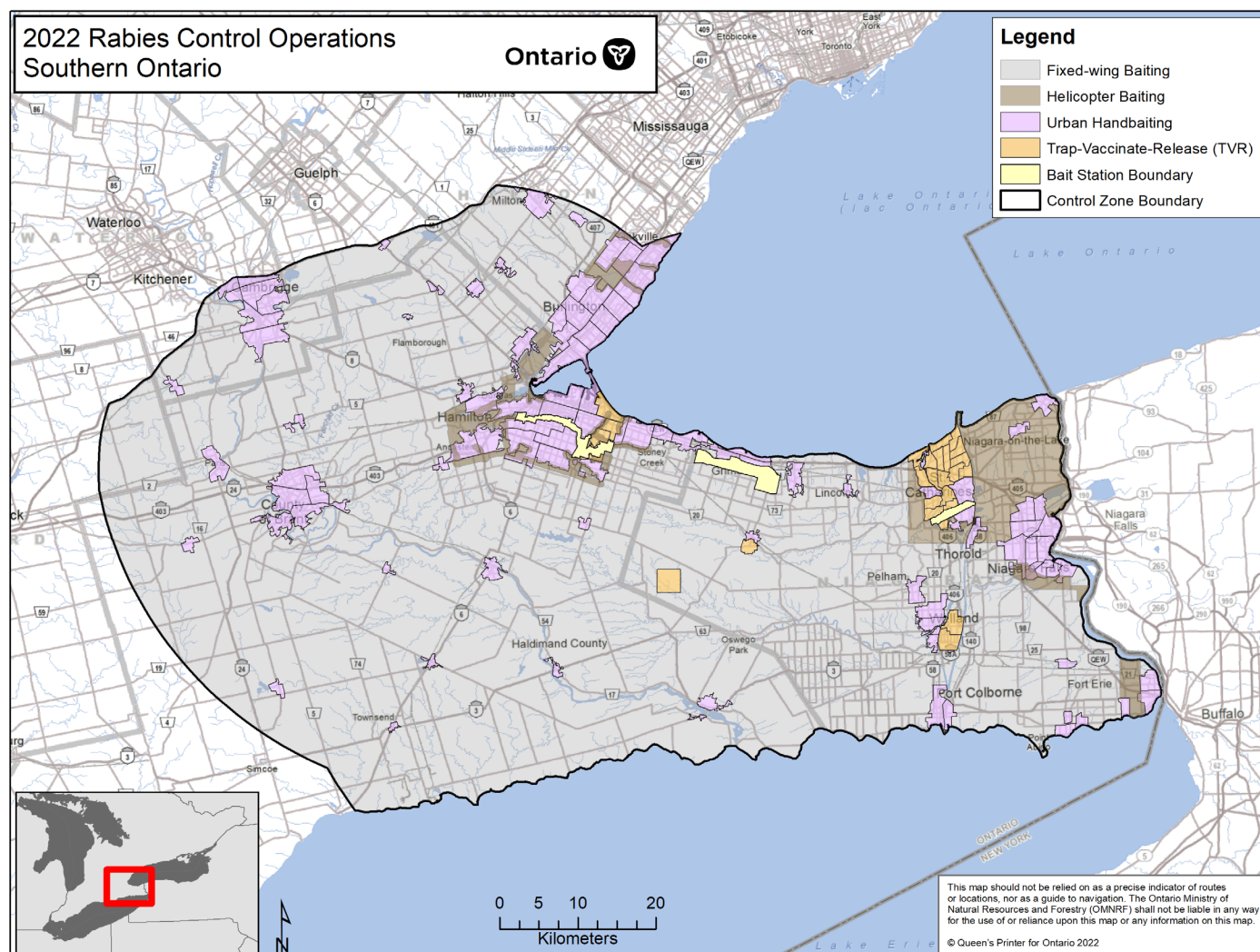
Rabies surveillance and control program – 2022

Ministry of Natural Resources and Forestry

In 2022, we continued our efforts to control, contain, and eliminate terrestrial rabies in Southern Ontario. There were 23 cases of terrestrial rabies — all were raccoon strain and all were detected in the city of St. Catharines.

The 2022 rabies control zone was reduced by approximately 4,600 km² and 472 of the 504 cases detected between December 2017 and July 2022 had expired (more than 2 years old) and there were no recent cases in the northern part of the zone.

We continued to focus on oral rabies vaccine distribution using the ONRAB bait, trap-vaccinate-release (TVR) and enhanced surveillance within 50 km of any positive cases (Figure 3). In 2022, over 729,000 baits were distributed in southern Ontario by hand, air and bait station. Enhanced surveillance focused on the collection of sick, strange acting, or found-dead wildlife for rabies testing.



Aerial baiting

Baiting flights in southwestern Ontario were conducted from August 15-19. A total of 537,799 baits were distributed by fixed-wing aircraft at densities of 75, 150 and 300 baits/km² over an area of 5,700km².

An additional 43,450 baits were distributed by helicopter from August 22-23 at a density of 150 baits/km². Of these, 28,450 were distributed in the Niagara region, east of St. Catharines to the Ontario/US border and 15,000 were distributed throughout the Golden Horseshoe.

Ground Distribution

Our staff distributed baits by hand (hand-baiting) and via bait stations. Hand-baiting targets urban skunk and raccoon habitat where the use of aircraft would not be practical or feasible (Figure 3). Hand-baiting also gives staff the opportunity to interact directly with members of the public, educating them about the rabies program and that rabies may be present in the area.

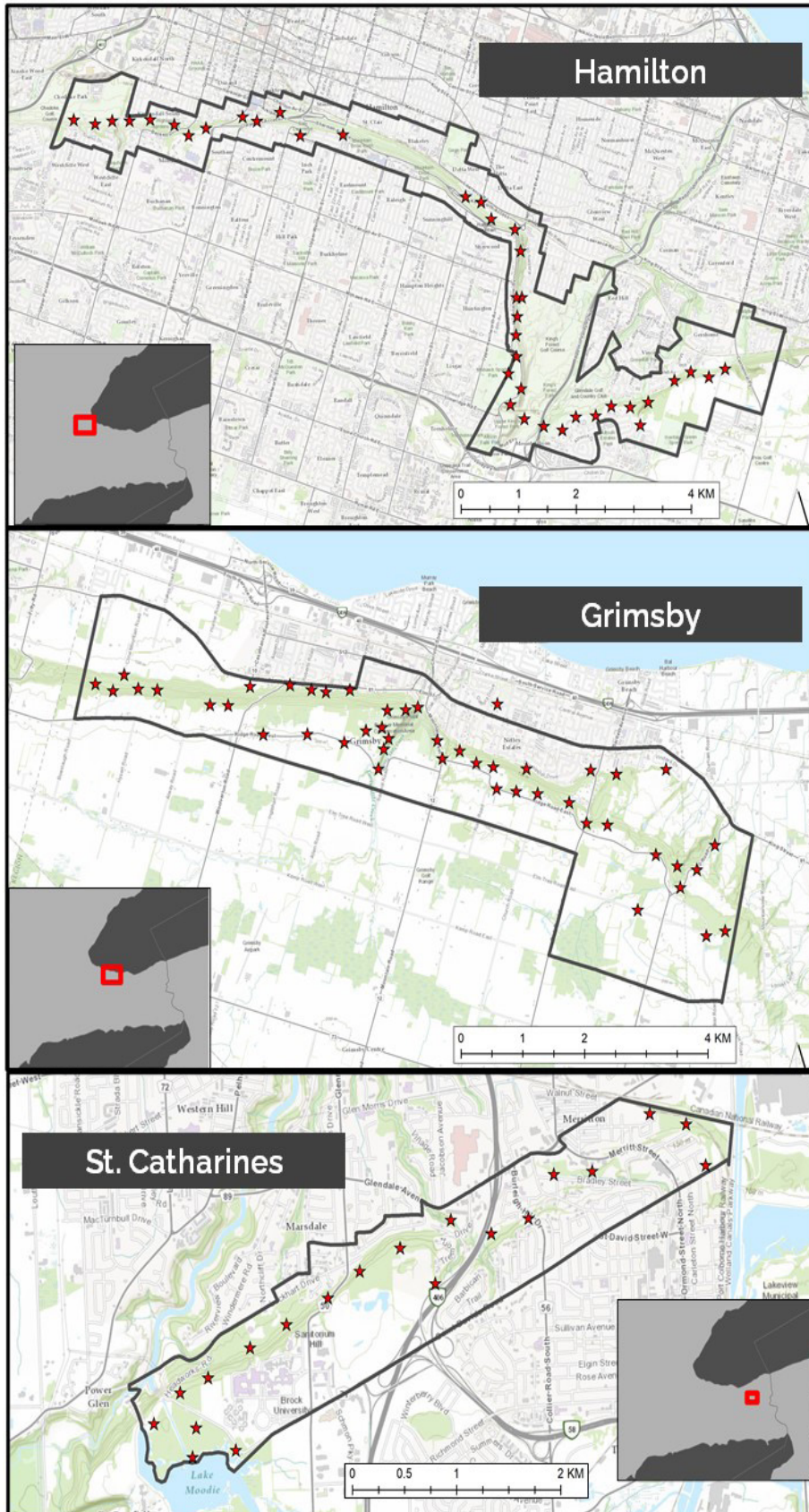
Hand-baiting took place throughout the summer in the Golden Horseshoe area from June 20 to August 30. Crews distributed 110,291 baits at 150 baits/km² covering an area of 758 km² (Figure 3).

Eastern Ontario proactive baiting

To help prevent another re-incursion of raccoon strain rabies from eastern New York State, we distributed 24,150 ONRAB baits by fixed-wing aircraft over a 431 km² area along the St. Lawrence River (Figure 5) on August 7. This area borders the St. Lawrence River near Kingston and Wolfe Island. Baits were dropped at a density of 75 baits/km² over agricultural and forested habitats. From August 8-11, hand-baiting crews distributed 5,177 baits in the city of Cornwall (Figure 5). Once again, we also partnered with the Mohawks of Akwesasne First Nation to provide 1,560 baits for distribution on Cornwall Island (Akwesasne).

Trap Vaccinate Release (TVR)

Ontario's 2022 TVR program ran for twenty-three non-consecutive weeks between May 2 and November 4. Thirty-three cells (trapping areas) covering approximately 133 km² were trapped in Hamilton, St. Catharines, Thorold, Smithville, Caistor Centre and Welland. Staff targeted high risk areas where positive cases were recently detected and, strategic areas to help create a barrier of vaccinated animals to prevent the spread of rabies (Figure 8). With cooperation from the public, municipalities, and various organizations, permission was obtained to set humane live-traps on private and public land. Animals were captured and vaccinated with an intramuscular injection of IMRAB 3 rabies vaccine. Ear tags with unique identification numbers were applied so that mark-recapture data could be used to estimate raccoon and skunk population density and to determine the percentage of animals vaccinated. After vaccination, animals were released at the site of capture. In 2022, 1,930 raccoons, 278 striped skunks, 3 coyotes and 14 red foxes were vaccinated during TVR.



Bait stations

In 2022, we installed temporary bait stations along the Niagara escarpment in the Hamilton, Grimsby and St. Catharines areas to target wildlife corridors in urban and semi-urban areas. Bait stations are polyvinyl chloride tubes that are filled with baits once a week. Wildlife that encounter the stations can self serve by taking a bait or two to get vaccinated and keep moving. Twenty bait stations were set up in St. Catharines, 47 stations in Grimsby, and 39 stations in Hamilton (Figure 4). Stations were rebaited with 75 baits per station once per week. All together, MNRF dispensed 14,051 baits using bait stations along the escarpment in 2022.

Figure 4. 2022 Hamilton, Grimsby and St. Catharines escarpment bait stations.

MNRF 2022 communications

Anne McCarty, Ministry of Natural Resources and Forestry

Public education and outreach are an important part of the rabies program. We work closely with municipal and ministry partners to inform and engage the public and key audiences about rabies in wildlife. The 5 organic (on 3 platforms each) and 2 paid (on 2 platforms) rabies social media posts on Facebook, Instagram and Twitter that were published in 2022 reached (the number of people who saw the post) over 1.35 million people.

The "Rabies in Ontario" website was updated with weekly rabies case maps until October, when we launched the new interactive map, as well as planned baiting operations, vaccine bait information, and information on rabies in humans, pets, and livestock. Visits to the rabies in Ontario webpages were similar in 2021 to 2020 (Table 1).

Table 1. Number of site visits to Rabies in Ontario web pages from 2015–2022.

Webpages	2015	2016	2017	2018	2019	2020	2021	2022
Rabies (landing)	5,733	23,956	9,071	8,929	19,397	7,844	5,368	4,543
Rabies cases		4,530	8,058	6,764	4,585	3,922	4,988	6,508
Rabies in humans		1,790	8,057	10,688	13,402	8,379	9,082	13,500
Rabies in livestock		73	853	1,285	970	466	417	506
Rabies in pets		1,132	9,444	11,837	16,939	13,906	15,433	19,566
Rabies in wildlife		2,813	10,138	9,538	18,251	11,765	10,581	7,441
Rabies operations*							524*	11,048
Total	2,800	18,481	34,903	43,027	72,563	46,282	46,393	63,112

* [new](#) webpage posted October 14, 2021 separated *operations* section from *rabies in wildlife* page

In 2022, we received and responded to almost 250 calls to the rabies information line – similar to the over 280 call in 2021. Of the calls:

- Almost 30% requested pickup of dead, sick or strange-acting wildlife for rabies testing.
- Over 20% were for advice regarding sick or strange acting animals,
- Over 10% were about ONRAB oral rabies vaccine baits. Calls about baits included queries about the baiting schedule, baits found by dogs and bait safety.

Most calls were received between May and August, when wildlife are most active and baiting operations are underway. The fewest calls were received in winter, when wildlife are less active and baiting operations have ended. As in previous years, most calls originated in or near the control zone (Figure 5).

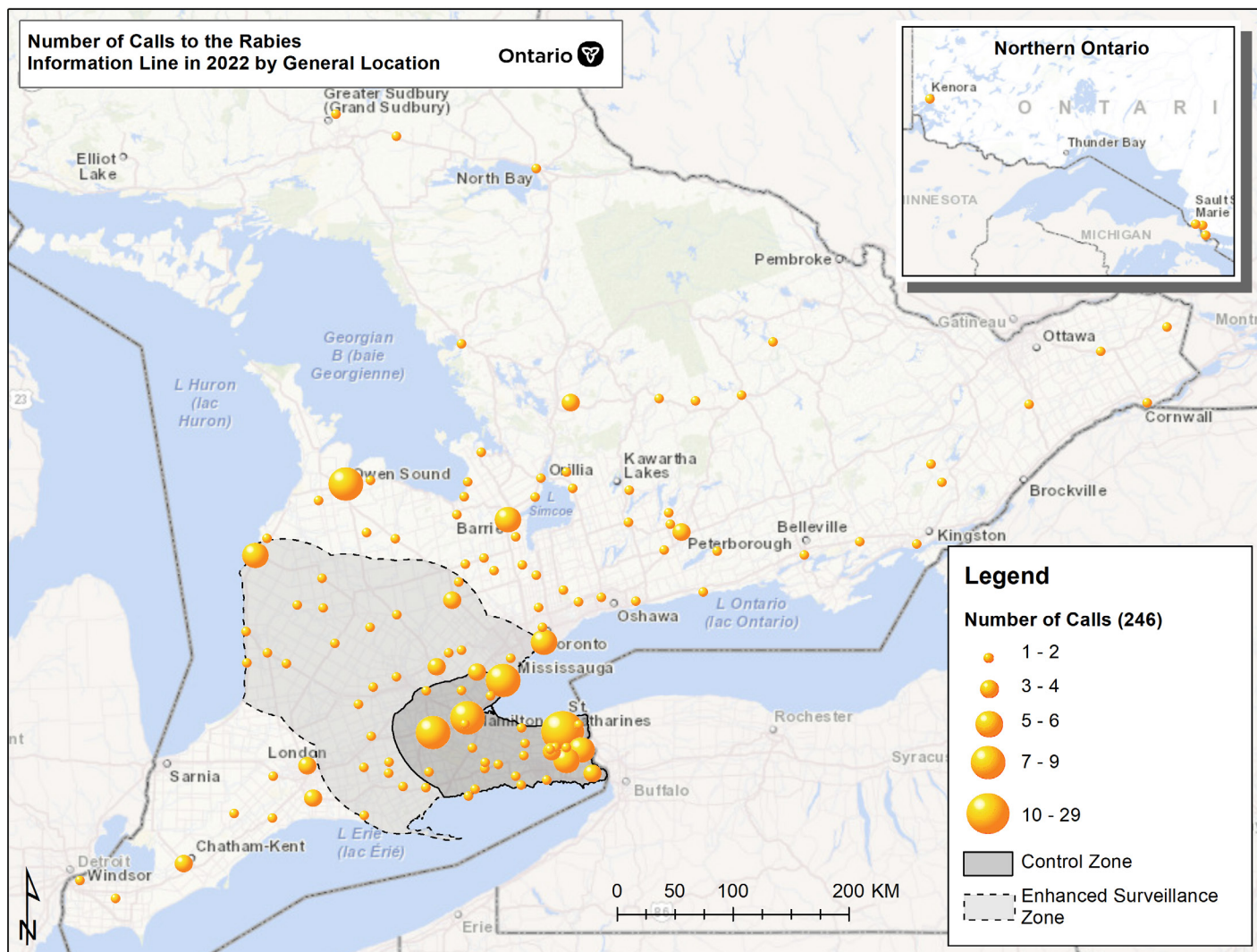


Figure 5: General locations and number of calls to the rabies information line in Ontario in 2022. Calls lacking geographic information are not shown.

New study published that evaluated the effectiveness of Ontario's rabies control operations.

Ministry of Natural Resources and Forestry

Researchers at the University of Montréal, in collaboration with MNRF rabies program staff, published a study comparing control intervention scenarios for raccoon rabies in southern Ontario between 2015 and 2025. They used a spatially explicit agent-based model (Figure 6) to evaluate the effectiveness of provincial rabies control programs in an urban-centric outbreak if control interventions were used until 2025, 2020, or never used.

Without control operations, the disease modeling results predicted rabies to spread as far as 250 km north and 350 km south of Hamilton by 2025 (Figure 7). They found that raccoon rabies was most likely to be eliminated when control interventions were applied over a longer time. Results confirm the importance of wildlife rabies control operations for the protection of public health. Future modelling work should include a multi-species approach in order to evaluate the effect of striped skunks and other potential hosts on raccoon rabies persistence.

The study provides a valuable illustration of how this kind of modelling can be applied to evaluate potential outcomes of rabies management and help identify the most cost-effective approaches for rabies control, with widespread potential applications.

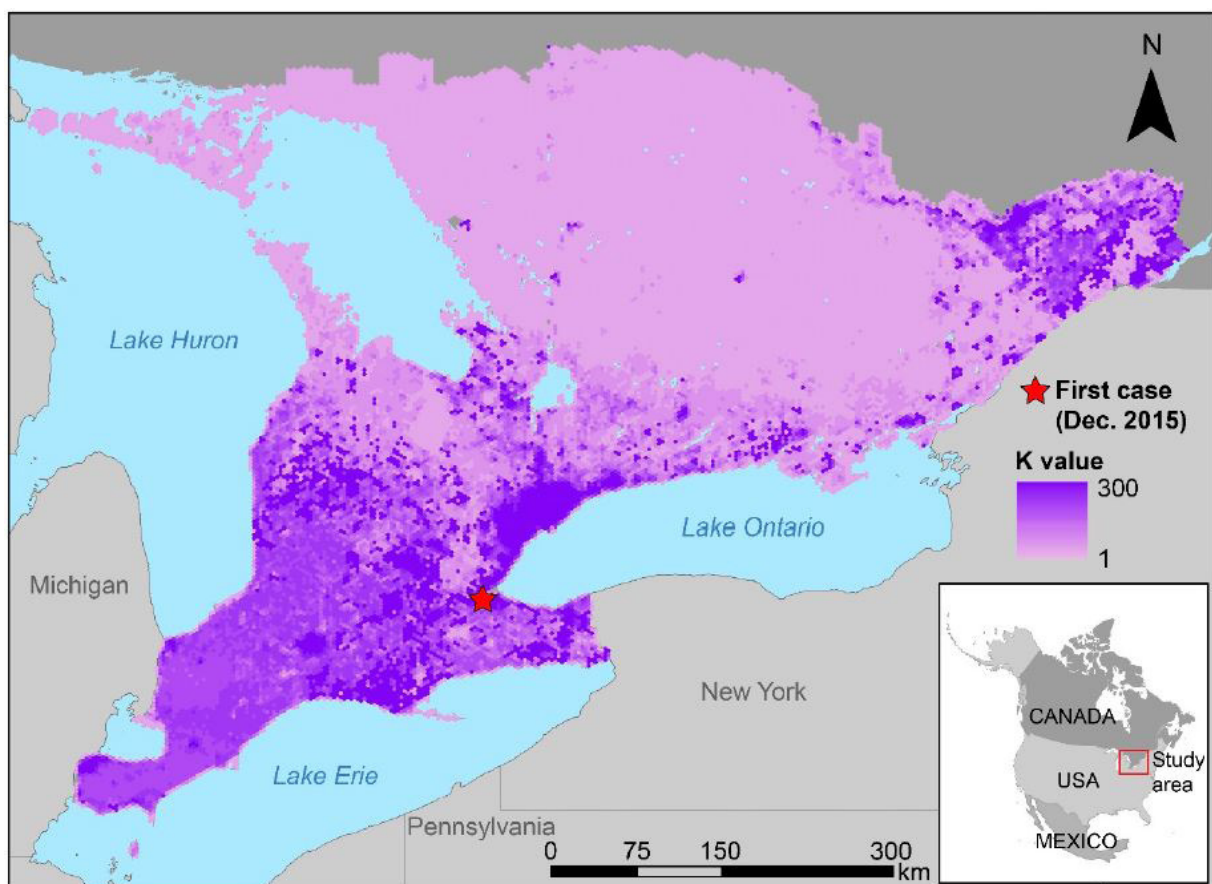


Figure 6: Map of the study area with K values shown with the location of the first detected raccoon rabies case (red star). K values represented the predicted number of raccoons sustained by the habitat in each 10km² grid cell.

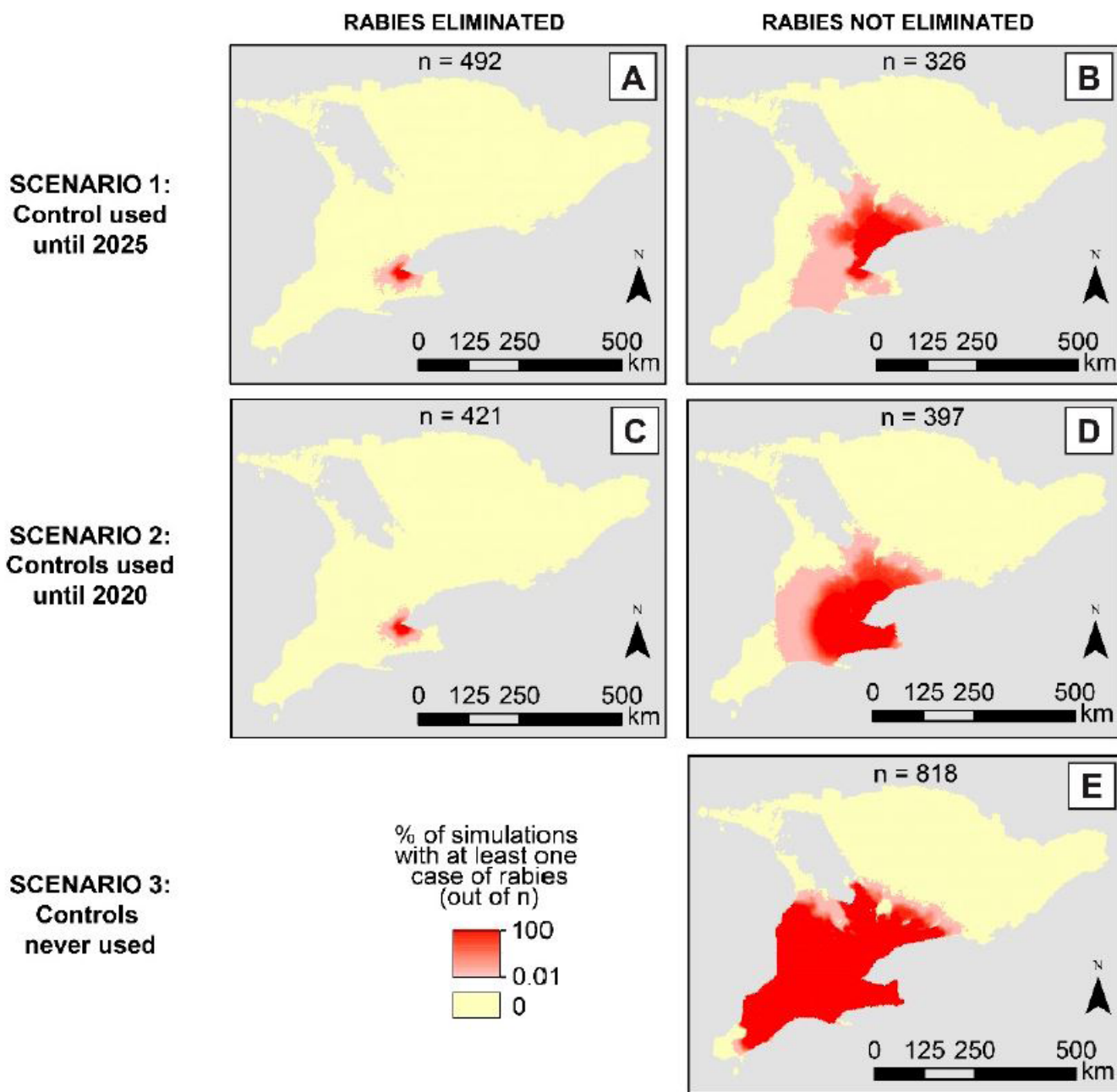


Figure 7: Maps showing the percentage (%) of simulations that predicted at least one raccoon rabies case per 10-km² grid cell between November 2015 and December 2025. Panels (A,C) summarize simulations predicting rabies elimination in Scenarios 1 and 2. Panels (B,D,E) summarize simulations predicting rabies was not eliminated in Scenarios 1, 2, and 3, respectively. The number of simulations used to calculate percentages per map is shown above each panel. For Scenario 3, rabies was only predicted to be eliminated when the disease died off naturally within the first week following its introduction. Therefore, the map for those simulations was not shown

ONRAB joins international efforts to combat rabies in wildlife with Ceva.

Ministry of Natural Resources and Forestry

Ceva Santé Animale (Ceva) finalized the purchase of Artemis Technologies in May 2022. Artemis Technologies produces the ONRAB oral rabies vaccine used by the Ontario rabies control program, other provinces and several US states.

Ceva is the fifth largest animal health group globally. They offer a growing line of products to meet the health needs of animals and expertise in pharmacology and biology. Ceva supports health solutions with products, equipment, training, technical support, data analysis and specialised services to ensure their optimal use.

This acquisition complements Ceva's rabies portfolio and considerable experience in rabies oral vaccine production and management, as well as expanding its presence in North America. "We are pleased to finalize this acquisition which aligns with our goal to expand our efforts in wildlife disease management" says Marc Prikazsky, President and CEO of Ceva Santé Animale.

The production of the ONRAB oral vaccines will continue in Guelph, Ontario and Ceva intends to expand on Artemis' success and continue to work with government partners to develop innovative solutions to combat rabies in wildlife. "We look forward to watching Artemis grow under Ceva's leadership," said Alex Beath, Artemis Owner, and President.



Ontario Animal Rabies Report

Detected rabies cases by region from January to December 2022 compared to same period in 2021.

Animal type Year	Fox 2021	Fox 2022	RAC 2021	RAC 2022	SSK 2021	SSK 2022	Other 2021	Other 2022	Bat 2021	Bat 2022	Dog 2021	Dog 2022	Cat 2021	Cat 2022	LVSTK 2021	LVSTK 2022	Total 2021	Total 2022
Eastern Ontario																		
Frontenac																	0	0
Lanark										1							0	1
Leeds and Grenville									1								1	0
Lennox & Addington																	0	0
Prescott-Russel									1	1							1	1
Ottawa-Carleton									1	1							1	1
Renfrew									1								1	0
Stormont, Dundas, Glengarry									2								2	0
Central Ontario																		
Durham									1	1							1	1
Haliburton																	0	0
Hastings																	0	0
Northumberland																	0	0
Peterborough										1							0	1
Prince Edward										1							0	1
Simcoe										3	1						1	3
Toronto									2	5		1					2	6
Victoria																	0	1
York Region																	0	0
Western Ontario																		
Bruce										2							0	2
Grey									1								1	0
Halton									1	1							1	1
Huron										1							0	1
Peel										2							0	2
Perth									2								2	0
Waterloo						1			1								1	1
Wellington-Dufferin- Guelph									3	3							3	3

Animal type Year	Fox 2020	Fox 2021	RAC 2020	RAC 2021	SSK 2020	SSK 2021	Other 2020	Other 2021	Bat 2020	Bat 2021	Dog 2020	Dog 2021	Cat 2020	Cat 2021	LVSTK 2020	LVSTK 2021	Total 2020	Total 2021
Southern Ontario																		
Brant										1							0	1
Elgin																	0	0
Essex																	0	0
Haldimand										1							0	1
Hamilton						1			1	7							1	7
Kent																	0	0
Lambton									2								2	0
Middlesex									2								2	0
Niagara			2	5	12	18			1	1							15	24
Norfolk									1	2							1	2
Oxford									1								1	0
Northern Ontario																		
Algoma																	0	0
Cochrane									1								1	0
Kenora																	0	0
Muskoka																	0	0
Nipissing									1								1	0
Parry Sound																	0	0
Rainy River																	0	0
Sudbury																	0	0
Thunder Bay																	0	0
Timiskaming																	0	0
Regional Totals																		
Eastern	0	0	0	0	0	0	0	0	6	3	0	0	0	0	0	0	6	3
Central	0	0	0	0	0	0	0	0	3	11	1	2	0	0	0	0	4	13
Western	0	0	0	0	0	1	0	0	8	9	0	0	0	0	0	0	8	10
Southern	0	0	2	5	12	19	0	0	8	11	0	0	0	0	0	0	22	35
Northern	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0
Totals	0	0	2	5	12	20	0	0	27	35	1	1	0	0	0	0	42	61

Acronym Legend

RAC: raccoon

SSK: striped skunk

Other: other wildlife

LVSTK: livestock

