The Rabies Reporter

November 1993 | Volume 4, Number 3 | ISSN 1186-8961

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Rabies Predictions,
September 1993 - March 1994

This fall, the Ministry of Natural Resources Rabies Control Program baited eastern Ontario, a small area near Kapuskasing, and a new control "wall" in Durham Region and parts of Victoria and Simcoe Counties. As well, approximately 16,000 baits were dropped on an active rabies outbreak in the Lindsay/Peterborough area. That work resulted in three distinct areas for prediction: (i) the old control areas in eastern and northern Ontario; (ii) the new control area in Central Ontario, from Hastings County to Durham Region and Simcoe County; and (iii) the rabies endemic area comprising the counties of southwestern Ontario, east as far as Metro Toronto and York Region.

Rabies in the old control areas will remain low. Expect to see, however, scattered rabies cases in eastern Ontario since rabies in foxes continues in neighboring Quebec. Rabies should decline throughout the new control area in central Ontario due to the baiting along the western edge and the ongoing decline of incidence on the eastern side of the area (Hastings and Prince Edward Counties).

There are four foci of infection in southwestern Ontario. Rabies has been moving westward through York Region and high incidence will continue. After a long quiet period, rabies has moved into Niagara, and will peak this winter. Rabies is building in Lambton County and the western portions of Middlesex and Elgin. That outbreak will peak this winter. There will also be high incidence in the Counties of Wellington, Waterloo, Dufferin and the southern part of Simcoe County. Rabies has moved into this area from the Grey/Bruce/Huron area and from a previous outbreak in Elgin/Oxford. The problematic areas for prediction are the Regions of Wentworth, Peel and Halton. They have had sporadic and low incidence for many years. This winter, however, they are surrounded by high incidence areas and should experience increases in rabies in both foxes and skunks. In the remaining parts of southwestern Ontario rabies has peaked and has started to decline. That decline will continue.

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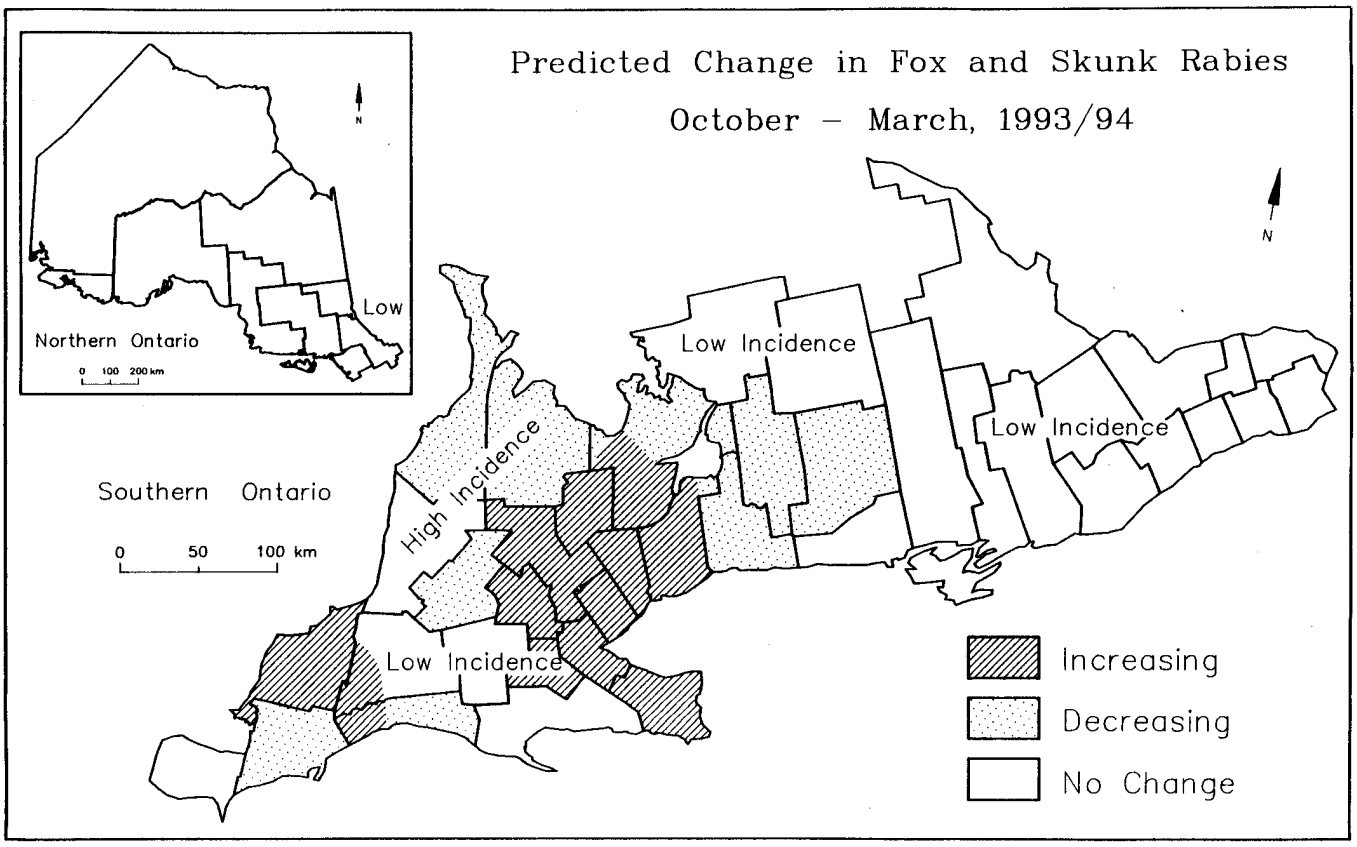


Rabies Bait Drops in 1993

The bait drop in eastern Ontario took place 27 September - 5 October 1993. The drop placed 544,000 baits over the 28,805 km^2. The area covered and the flight line layout was the same as in 1992 and 1991. A major advance in procedure was implemented: the Air Service has installed new ARNAV 7000 GPS-Loran units in the Twin Otters, which enabled us to upload whole flights from a lap-top computer directly into the navigation system. Carolyn Fielding and Roly Tinline spent a lot of advance time getting the software in order. There are still some glitches, such as sometimes losing the remaining flight plan when the aircraft banks too sharply. Roly Tinline, by talking directly to experts at ARNAV, had the system working as well as it could, and in the process, he suggested a lot of programming updates for ARNAV to work on.

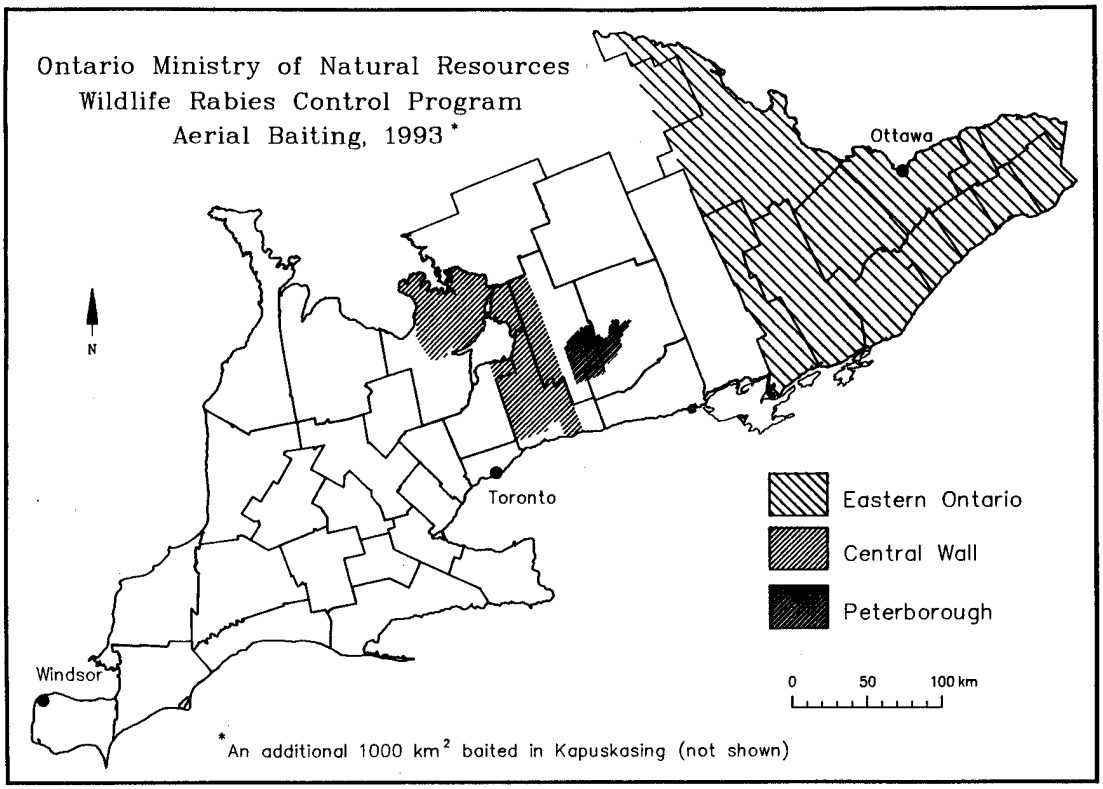
Volunteers from the Ontario Federation of Anglers and Hunters,Sir Sandford Fleming College, Queen's University, New York (Department of Environmental Conservation and Cornell University), Agriculture Canada, the Toronto Humane Society and AAA Animal Control worked hard to get the baits into and out of the aircraft. These people are an essential part of the team. The Machesney Lake ranger camp was once again accomodations for everyone. Harold, Dan, Susan and Lana maintained their reputations for giving us first-class support.

Last year we dropped 108,000 baits in northern Ontario, to combat a fierce and unusual outbreak in the Districts of Timiskaming and Cochrane (see The Rabies Reporter Vol. 3, #3). The outbreak was already subsiding by the time we dropped the baits, so it was of great interest to see what happened. As you can see from the maps in this issue, rabies disappeared completely from two of the three areas we treated last year. Eleven of the 15 cases were along Highway 11 from Moonbeam to Kapuskasing, west of the area baited last year. Therefore, we decided to drop baits only where there was rabies, and continue to monitor the whole area.

A single plane load of 18,000 baits was dropped in the area on 22 September.

The other baits were dropped in a band designed to establish a 50+ km wide "wall" of immunized foxes stretching from the east shore of Georgian Bay to Lake Ontario, as shown on the map. The purpose was to impede movement of rabies between the eastern and western parts of southern Ontario. When we looked at the latest rabies case maps, it became clear that there was only one active outbreak east of this wall, in the Lindsay-Bobcaygeon-Peterborough area. We therefore scrounged up enough baits to cover that outbreak, in the hope that, by taking advantage of a natural low in rabies, we might almost clear a large area. It will take two or three years to see whether this attempt succeeded.

The Central Wall operations took three days (12 - 14 October) with one aircraft. We were based at the Oro-Barrie-Orillia airport, where facilities were excellent. We spaced the flight lines 2 km apart, which resulted in drop rates up to 3.7 baits per second. That fast drop rate really pushed the loading crews, most of whom were volunteers. Drs. Dorothy Geale and John Churchill of the Bowmanville Office of Agriculture did a wonderful job of finding and organizing volunteers to help the operation. We had people from most of the Animal Control agencies in the drop area, as well as Agriculture Canada staff and a variety of people who called to ask how they could help. One of those was Heather McRae, who wrote an excellent article for her paper, the Scugog Citizen. There is no substitute for first-hand experience, is there Heather?



The Rabies Unit is very grateful to all the volunteers who made operations possible, and to the many MNR and Agriculture Canada staff who help by explaining our program to the public. We could not run a smooth operation, and have continued public support, without their help.

Charles MacInnes
MNR Rabies Unit

Human Adenoviruses as Vectors of Wildlife Rabies Vaccines

Vaccination against rabies, practised from the time of Louis Pasteur over 100 years ago, has improved considerably since those early days. While post-exposure vaccination with killed rabies virus has proved to be a very effective method of preventing human deaths due to rabies in developing nations, the fact that 20,000 people worldwide still die annually from this cause suggests that this approach is not necessarily the best possible solution to the rabies problem. Even in Ontario, the economic consequences of living with wildlife rabies far exceeds any amount that might be spent in effective control by field vaccination, and amply justifies the program being pursued to reduce or eliminate rabies in foxes and skunks in this province. In the absence to date of a suitable alternative, the use of the live fixed rabies strain virus in the baits of the field vaccination program in Ontario is appropriate since this vaccine is effective in developing immunity in foxes and since in Ontario, the presence of rabies in skunks appears to be tied to that in foxes. Raccoon rabies, however, expected to enter this province from New York state in the next few years, is independent of foxes. We also know that rabies can persist in skunks in some parts of the U. S. A. in the absence of foxes, suggesting that it may be wise to prepare for this eventuality in Ontario as well. The fact that the live fixed rabies vaccine is not effective in baits for skunks or for raccoons makes it of vital importance to rapidly develop and test alternative vaccines that will work effectively in all of these species.

One of the recently developed and rapidly expanding areas of rabies vaccine research is the potential to use relatively benign viruses to deliver the rabies glycoprotein gene to the host animal and in this way provoke an immune response and protection against rabies. Since only one protein of the rabies virus is present in this type of vaccine there is no possibility of developing rabies from the vaccine. If the benign carrier virus or "vector" can infect the host animal by the oral route, then it is possible to consider the use of this type of vaccine in wildlife bait situations. A number of vectored rabies vaccines have been developed recently, based either on poxvirus or on adenovirus as carriers. Vaccinia virus (the virus that was previously used to vaccinate us against smallpox) recombinant vectors are being used in western Europe to reduce or eliminate wildlife rabies and are also being tested in the USA for possible use against raccoon rabies. Because we believe that adenovirus vectors have a number of advantages over the systems currently in use I will briefly describe some of our work in this system.

Human adenovirus type 5 is a virus of the nose and upper respiratory tract that produces relatively mild cold symptoms in some infected individuals. Despite the fact that over 70% of the normal adult population is infected with adenovirus 5 there is no evidence for any significant correlation between this virus and human disease. This suggests that adenovirus 5 is a very safe virus to use as a vector for rabies in situations where human contact with the vaccine may be possible. The other attractive features of adenoviruses as vectors are their relative stability, ease of production, and ability to infect a wide range of species by the oral route. A particularly important feature of human adenovirus type 5 is the fact that it can be used to immunize animals which are not suitable hosts for replication of this virus. For example, human adenovirus type 5 does not grow in canine cells in culture and probably does not produce infectious virus in dogs, but can be used as a recombinant vector to immunize dogs against rabies.

Over the past four years, my laboratory and that of Dr. F. Graham at McMaster have been involved in the development and testing of four different recombinant adenovirus vectors which are capable of inducing immunity to rabies virus in treated animals. Each of our prototypes had certain properties that made it more suitable for particular vaccine applications than the one before it. In all of these studies we had the welcome and necessary collaboration of Dr. J. Campbell at the University of Toronto and Drs. K. Charlton and A. Wandeler at the Animal Diseases Research Institute in Nepean.

We believe our third recombinant vector (AdRG1.3) is a very suitable candidate for use as a wildlife vaccine. This vector was constructed to produce a high-level response in species such as dogs in which human adenovirus will not grow. This construct has been shown by Dr. Wandeler to induce a high level anti-rabies immune response in skunks when introduced by the oral route. We believe that AdRG1.3 will be even better in raccoons than our previous recombinants and are anxious that this be tested as soon as possible.

We are continuing to work on the development of a recombinant adenovirus rabies vaccine which would be acceptable for use in domestic animals and perhaps even in humans if required. While the practical applications may be some years away we can envisage a time when, through use of effective, inexpensive vaccination, the threat of rabies to human well-being will be a thing of the past.

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Secondary Contact Is It A Risk? Commentary

The August 1993 issue of The Rabies Reporter contained an article with the above title. The author included statistics on the number of postive rabid animals, the number of humans receiving post-exposure treatment, and the number of human deaths due to rabies world-wide. Two conclusions reached by the author were that many people receive post-exposure treatment unnecessarily, and that secondary contact presents no risk of disease for humans.

These conclusions may be correct, but the facts presented do not support the conclusions reached. It is impossible to determine if people are being treated unnecessarily by merely looking at the ratio of persons treated to the number of rabid animals detected. The only way to determine if treatment was unnecessary is to review the details of each case and determine what the risk factors were. Unless the risk is zero, I believe it would be a physician's duty to recommend treatment for anyone exposed to rabies or any other potentially fatal disease.

The conclusion that secondary contact presents no risk is also not supported by any of the statements in the article. The author reports that the rabies virus can survive for several hours at 20C, and for days at 4C and therefore, one can deduce, may be on the surface of a pet's coat after the pet is bitten by a rabid animal. He also reports that cases of rabies have occurred after licks from a rabid animal to a wound or mucosa. The fact that no people in Canada have died after secondary contact may not indicate that there is no risk. It could also be due to the fact that these people received treatment. This theory could only be proven by withholding post-exposure treatment from people after secondary contact and observing how many die of rabies. It may take some time before there is a human death and many dollars will be saved by avoiding the cost of post-exposure treatment, but is this really an option? How much is a human life worth?

S. Shearer DVM
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Editorial Comment

Dr. Shearer's comments reflect very well the current philosophy regarding post-exposure treatment - if there is the least risk of rabies - apply post-exposure treatment, at a cost to the health care system of over $550.00 per individual. However, I believe that the above article errs seriously in asking that the decision for treatment be made on a risk versus no-risk basis. In the real world there is very rarely no risk: rather, we are in the very difficult situation of deciding how small a small risk really is. I searched in vain through Dr. Carswell's article to find a bald statement that there is no risk due to secondary contact. Rather, Dr. Carswell carefully marshalled the existing evidence, all of which indicated that the risk is low. He gave his opinion on whether he would recommend treatment after secondary exposure. He made it quite clear that it was his own interpretation, although he cited WHO documents which appeared to support his idea.

The most compelling piece of evidence that Dr. Carswell presented, in my opinion, is that from 1960 to 1981 fewer people were treated as a result of secondary exposure than is the current practice, without adverse consequences. There were two human deaths to rabies in Ontario in that period, but both after direct bite contact with a rabid animal. The older vaccines in use before human diploid vaccine became available in 1981 could have serious side-effects. Quite apart from the very painful nature of 14 or more intraperitoneal injections, there were cases of total or partial paralysis, which might last a lifetime. That gave the attending physician an unpleasant choice: should he/she prescribe a painful and potentially dangerous treatment, or withhold treatment and risk having the patient die of rabies. This was a case of weighing one risk against another. Dr. Carswell points out that the rate of treatment has roughly doubled since the new, safer, less painful vaccine was introduced. Before 1981, human post-exposure treatments averaged about 1100 per year, but since then the rate has been 2150 per year. Levels of rabies were higher in the 1980's than previously (see the graph in Dr. Carswell's article), but still, roughly 20,000 people were not treated in 1960-1981, who would have been treated in 1981-1993, after human diploid vaccine became available. I have to assume that none of these people had been directly bitten - if they had, they would have been treated. Thus, they must have been secondary contacts, or, even worse, possible secondary contacts. Not one of those 20,000 people contracted rabies. That means to me that the risk of rabies from secondary contact is less than 1/20,000.

We know that rabies virus is present in the saliva of a rabid animal. We also know that the virus is quite fragile, but there is no direct evidence of how robust or fragile it is when virus-laden saliva is smeared on the hair of a dog. Nor do we know, when a dog

The Rabies Reporter, a scientific newsletter about current issues in rabies research and control, is a joint effort of the Rabies Research Unit, Ontario Ministry of Natural Resources; the Food Production and Inspection Branch of Agriculture Canada; The Ontario Ministry of Health and the Department of Geography, Queens University, Kingston. Article for future issues will be welcomed by the editor. Comments, letters, submissions and enquiries should be sent to:
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comes back from a fight with a rabid fox, whether the moisture on its fur is fox saliva, or its own saliva, etc. The few measures done on foxes indicate that the amount of virus in the saliva varies greatly from individual to individual. A much more interesting point is that we do not know the infectivity to humans of different variants or strains of rabies. Inuit trappers have clearly skinned many rabies-infected arctic foxes, with their bare hands. One sample of 201 carcasses obtained from trappers in the western arctic contained 44 rabies-positive foxes! Similarly, trappers in southern Ontario have skinned hundreds of thousands of foxes, 1960 - 1993. Cooperative studies between the Rabies Unit and ADRI indicate that 0.5 to 4.2% of those were positive for rabies. No eskimo or Ontario trapper has died of rabies. Most trappers now use rubber gloves when skinning, and many have, at their own expense, undergone pre-exposure vaccination. There have been human deaths due to the arctic fox strain of rabies, but surprisingly few, given all these potential exposures, and all have been the result of direct bites.

Consider that no human death has been linked to the raccoon strain of rabies. I am sure that there would have been fatalities if post-exposure treatment were not administered. Consider also that of the last 18 human deaths due to rabies known to have been contracted within the U.S.A., 10 were due to bat strains of the virus. Eight of those ten were due to the strain carried by silver-haired bats, yet that species represented only 1% of all the rabies-positive bats, and bats are a very small percentage of the confirmed animal rabies cases. The lesson is that the different strains of rabies clearly pose different risks to humans. However, the evidence exists in fragments and anecdotes, and could never be used to calculate probabilities. Emphatically, also, there is no strain of rabies which presents no risk at all to human life.

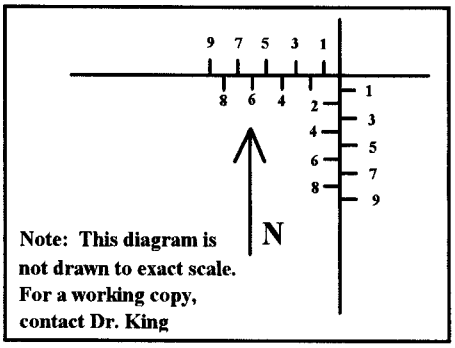
Dr. Shearer asks "How much is a human life worth?" That is a question which we all must ask, more and more often. In the culture of the developed countries, life has been beyond price for a long time. However, health care is consuming more and more of developed nations' economies, and at some point that burden will become insupportable. Therefore, if we view health care dollars as scarce, the question we should ask about post-exposure treatment due to secondary contact is this: if we economise on this, could we save more people by applying the savings to some higher risk group elsewhere in health care? That decision would be easy if we had quantitative estimates of the risks, but, as I have tried to indicate above, those will not be easy to come by.

Rabies control was one of the early successes of public health. Over more than a century we have developed a series of actions which can reduce the fatality rate almost to zero. Britain, Japan and many smaller islands have eliminated the disease completely. The success of wildlife vaccination in Europe and Ontario raises the possibility that we can entirely eliminate terrestrial rabies, although there is a long way to go to make that a practical reality. In these hard financial times, many jurisdictions are questioning whether the cost of doing so is justified. In Ontario, we can show that eliminating the arctic fox strain will save a lot of money in the long term, but there will be overlap in the short term between costs of post-exposure treatment and the cost of the control program. How much is rabies control worth, when its aim is reducing risk to human life?

Charles D. MacInnes PhD
Rabies Unit, OMNR

A Useful Tool For UTMC Coding

Carolyn Fielding's article on UTMC codes in the May 1993 issue prompted me to submit an idea we in ther Fort Erie Office have used successfully to speed determining UTMC codes for rabies case locations. We made a tool by photocopying the inset drawing onto a piece of acetate used for overheads. Cut out the grid, laminate it, and you now have a 'see-through' tool. The tool is placed on the appropriate map so that the point where the vertical and horizontal axes of the tool meet is directly over the specimen location, and the axes are parallel to the easting and northing coordinates (light blue lines) on the map. Make sure the tool is pointed north. The coordinates can then be read exactly to the third digit by noting where the blue eastings and northings cross the axes of the tool. We have found this tool very useful in preventing errors.



Example: A specimen is located between northings 77 and 78 and eastings 25 and 26. The tool would be placed on the map with the arrow pointing north, the horizontal line on the tool parallel to and between lines 77 and 78, and the vertical line parallel to and between lines 25 and 26. The intersection of the two axes on the tool is placed exactly where the specimen was found. Find the point where the horizontal line of the tool intersects the blue 25 grid line. If the intersection is at 7 on the horizontal line, then the third digit it 7, and the easting is 257. Read down the vertical line until you find where it intersects the blue northing line 77. If it intersects at the 5, then the northing is 775.

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Animal Rabies Report: July to September 1993

Animal Type	Fox			Skunk			Other Wildlife			Dog			Cat			Livestock			Total		
County or Area	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		93	92		93	92		93	92		93	92		93	92		93	92		93	92
Eastern																					
Stormont						1													0	0	1
Dundas	1	1																	1	1	0
Glengarry			1		1	1			1										0	1	3
Prescott	2	3	1			2	1	1							1			5	3	4	9
Russell																			0	0	0
Carleton						3	1	1										1	1	1	4
Renfrew		1																1	0	1	1
Lanark			3			1	1	1										2	1	1	6
Grenville						1													0	0	1
Leeds								2											0	2	0
Frontenac																			0	0	0
Lennox-Addington			1					3										1	0	3	2
Central																					
Hastings	1	3	53	2	2	5	2	2	6			3	1	1	5			6	6	8	78
Prince Edward			9			2			2			1					1	7	0	1	21
Northumberland		1	12	1	1	2	1	2	8			2						5	2	4	29
Victoria	6	13	36	3	7	9	1	2	3			1						11	10	22	60
Haliburton			1			2													0	0	3
Peterborough	4	15	15	8	8	7	2	2						1	3	1	2	2	15	28	27
Durham	16	44	11	2	16	10	3	3	5			1	2	2	1	3	8		26	73	28
York Region	18	31		5	9				1	1	2				1	4	9		28	51	2
Scarborough																			0	0	0
East York																			0	0	0
City of Toronto																			0	0	0
City of York																			0	0	0
NorthYork					1		1	1											1	2	0
Etobicoke																			0	0	0
Simcoe	10	18	21	5	8	2	1	2	4		2	1		2	1	2	3	6	18	35	35

Animal Rabies Report: July to September 1993 Corrected February 1994

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County or Area	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		93	92		93	92		93	92		93	92		93	92		93	92		93	92
Western																					
Peel	1	2	2			3			3		1	1			1				1	3	10
Halton	3	5	2			9	1	1	1					1	1				4	7	13
Dufferin	3	3	23	2	6	5				1		1	2	2	1	1	2	13	9	13	43
Wellington	21	25	17	3	7	14			3						2	7	16	5	31	48	41
Waterloo	19	23	10	8	12	13	1		1				3	3	1	3	6	3	34	44	28
Perth	13	18	9	1	5	3			1				3	4	1	8	11	8	25	38	22
Grey	15	39	24		6	7						3		4	2		15	10	15	64	46
Bruce	14	46	15	5	14	3		1					1	2		6	25	4	26	88	22
Huron	25	40	6	5	5	5							2	2	1	2	3	1	34	50	13
Southern																					
Wentworth	1	6	2										1	2			2		2	10	2
Haldimand - Norfolk	6	10			1								4	6		1	2		11	19	0
Brant	8	14		1	1		1	1					3	5		2	2		15	23	0
Niagara	29	37				1	1	1		1	1		3	4					34	43	1
Elgin	7	17	48	2	5	3	2	2	2	1	2	2		3	6	1	3	3	13	32	64
Oxford		6	30	1	4	3	1	1	2		1	2			1		4	6	2	16	44
Middlesex	13	22	27		4	3	2	2					2	5	3	1	3	7	18	36	40
Lambton	24	39	2	1	4	2			1		2	1	2	6	1	1	2		28	53	7
Kent	5	20	23	1	2	5		1				1	1	4			9		7	36	29
Essex	7	13				1		1	1		2						1		7	17	2
Northern																					
Muskoka		1	12	1	1	4			1		2								1	4	17
Parry Sound						1													0	0	1
Nippissing			5			1													0	0	6
Sudbury			2																0	0	2
Cochrane	1	14	4		1	1		1	2			1							1	16	8
Timiskiming			64			8			3			4			4			34	0	0	117
Algoma			3																0	0	3

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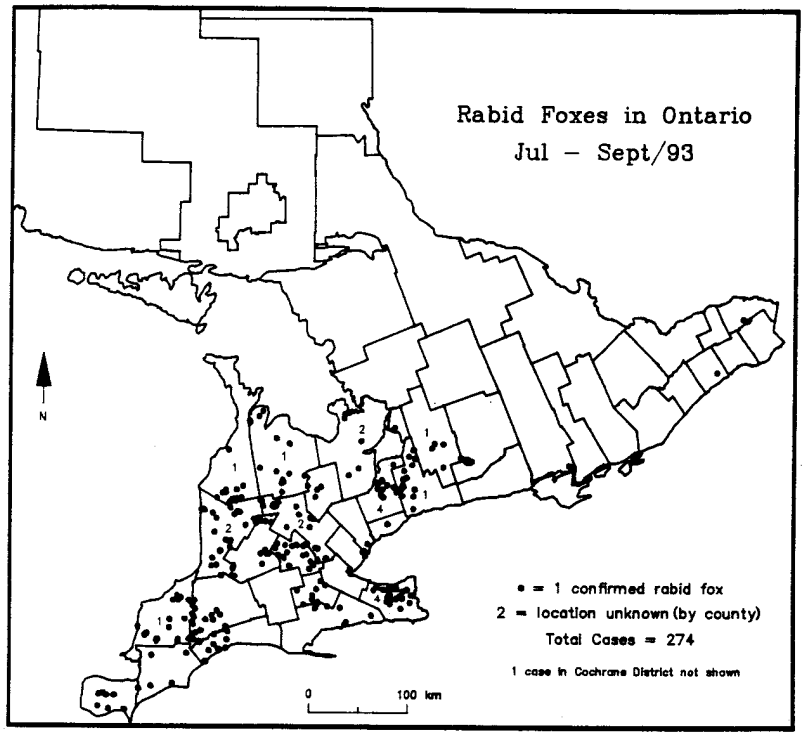
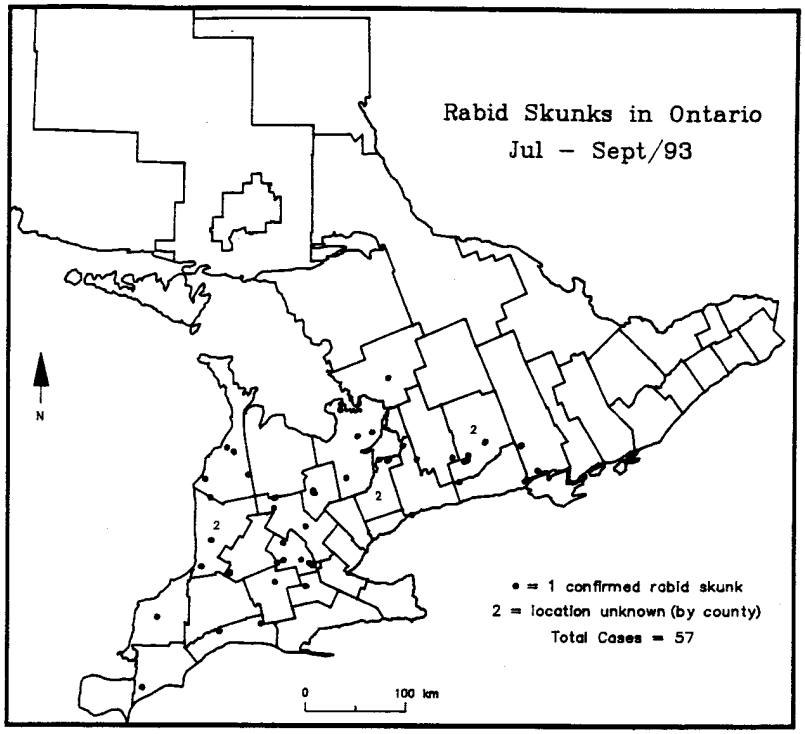
County or Area	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		93	92		93	92		93	92		93	92		93	92		93	92		93	92
Northern (continued)																					
Thunder Bay																					
Rainy River																					
Kenora							1	1													
Subtotals																					
Eastern	0	5	6		1	9	3	8	1						1			10	3	14	27
Central	55	125	158	26	52	39	11	14	29	1	4	9	3	6	11	10	23	37	106	224	283
Western	114	201	108	24	55	62	2	2	9	1	1	5	11	18	10	27	78	44	179	355	238
Southern	100	184	132	6	21	18	7	9	6	2	8	6	16	35	11	6	28	16	137	285	189
Northern	1	15	90	1	2	15	1	2	6		2	5			4			34	3	21	154
Totals	270	530	494	57	131	143	24	35	51	4	15	25	30	59	37	43	129	141	**428**	**899**	**891**

Livestock this quarter: 38 cattle; 3 goat; 2 sheep

Other wildlife this quarter: 14 big brown bat; 2 hoary bat; 2 silver-haired bat; 5 coyote; 2 raccoon



Department of Geography, Queen's University



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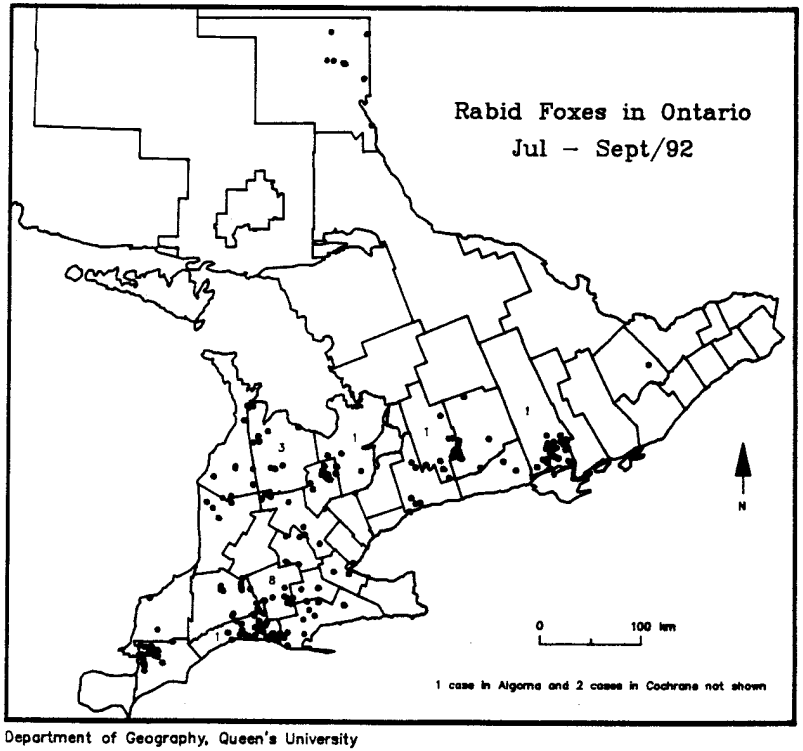

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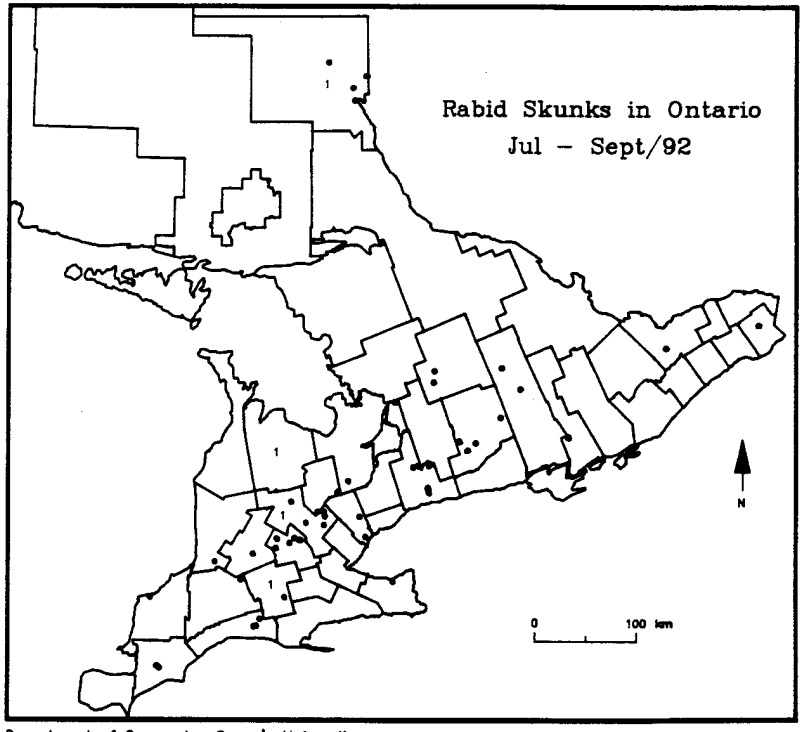

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