The Rabies Reporter

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In this issue:

POST-EXPOSURE TREATMENTS: WHY ARE THEY SO SLOW TO DECLINE??

There were 1048 humans treated in Ontario as a result of exposure to a rabid animal. This total is disappointing: why has it not declined faster and further, as the number of rabid animals has declined?? Figure 1 shows the Ontario history of animal rabies and post-exposure treatments (PET). There are many facets to this problem, and there are no easy solutions.

Is there, or should there be, any relation between the number of laboratory-confirmed rabid animals and the number of people receiving PET? This question raises the question of risk assessment. The major way to reduce PET frequency is to change the criteria for assessing risk. That in turn demands the admission that if protecting people from rabies 100.00% of the time is too expensive, are we willing to accept 99.98%, or some lesser level of protection, if by doing so we save scarce health dollars? That in turn poses the question whether more lives can be saved by applying such savings in other areas of public health. There are no black-and-white answers in such debates.

A revolution in thinking about rabies was forced upon us in 1980-85 by the demonstration that there really are variants of rabies virus. I believe that the full implications of that series of discoveries have not trickled down to the physicians and inspectors who are assessing whether a particular rabies incident required post-exposure treatment (PET).

Before the identification of rabies strains by monoclonal antibodies, and later through RNA and DNA analysis, rabies was considered a single virus which could infect and kill all mammal species. Classical immunology could not demonstrate that rabies from a fox was different from rabies from a raccoon. Furthermore, one vaccine protected against all forms of rabies (at least in North America). Occasionally a human or animal would develop rabies without being bitten by a rabid animal. How could that happen?? Viruses are tiny particles, but capable of causing replication of themselves if they get into appropriate host cells. In theory, a single virus particle, delivered to the right place, is enough to cause infection. Rabies virus can be absorbed through mucous membranes or wounds, but not through unbroken human skin. Rabies is quite a fragile virus, readily killed by drying. Therefore, these mysterious infections must, so people thought, be the result of a tiny drop of saliva, containing virus, getting into a cut, or into an eye or mouth. We can, and did, imagine many ways in which saliva and virus could go that route. But these were all after-the-fact guesses. Remember that!

In practice, when you want deliberately to infect an animal, it takes many more than one virus particle, at least to achieve infection predictably. For example, the ERA live virus rabies vaccine that was used for many years required a minimum injection of about 1,000,000 virus particles to insure that the virus would replicate long enough to stimulate immunity in over 98% of individuals treated. When using ground salivary gland from a rabid fox to challenge vaccinated animals, and

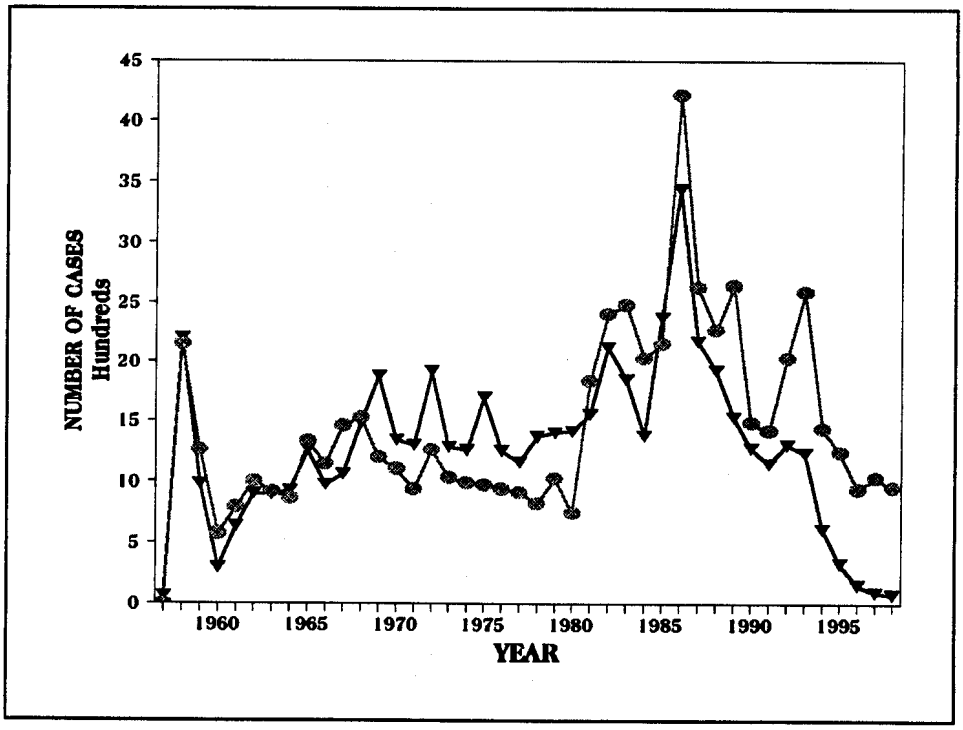

Figure 1. The total number of rabies cases (black line and symbols) and the total numbers of humans treated after exposure to rabies (gray line and symbols) in Ontario since 1958. Note that the number of people treated before 1958 has not been found. Data from the Canadian Food Inspection Agency and the Ontario Ministry of

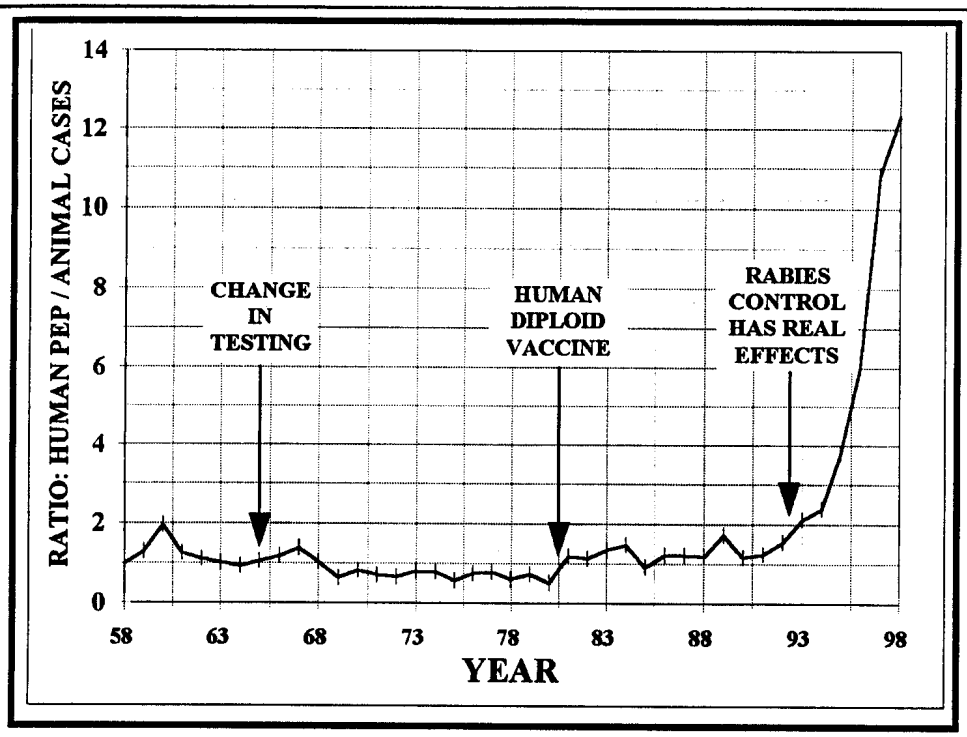

Figure 2. The ratio of human post-exposure treatments to rabid animals for each year since 1958. The failure of PET's to decline as rabies cases declined is clearly shown by the steep rise in this ratio since rabies control had sharply reduced the number of rabid animals.

unvaccinated controls, we still use large quantities of virus. It is not clear why such large numbers of virions are needed to guarantee that infection will take place. On the mirror side, how few particles are actually capable of starting an infection? No one offers a number.

Modern medicine has shown that different individuals have immune systems which differ in competence to resist infection, and that not all infectioious agents are treated the same by the different immune capabilities. Also, the same individual will have different immunocompetence at different times in its life: some diseases suppress the immune system temporarily, others more permanently. Mental or physical stress is also reported to affect the "strength" of the immune response. Therefore, it would be unrealistic to search for a universal minimum number of rabies virus particles that will cause infection. That will vary among individuals, and vary over time within individuals. Another possibility raised by this knowledge is that some individuals are more likely to contract rabies than others, or that some may take many more virus particles to start an infection than others do. However, those are again educated guesses, and there are no known tests to investigate the subject.

How did the recognition that there are different variants of rabies force us to change our thinking? It made clear that all mammal species are not equally susceptible to all variants of rabies. Raccoons only rarely were infected with the Arctic fox rabies which was so prevalent in red foxes and striped skunks in Ontario from 1958 to 1996. We know that raccoons are roughly 10 time more abundant than foxes in Ontario, and foxes and raccoons use the same den systems, sometimes on the same day, so they must meet frequently. Thus, lack of infected raccoons was not because they avoided rabid foxes. Foxes are not often infected with the raccoon variant. Foxes and raccoons are not often seen with the skunk variants. Bat rabies is infrequently encountered in any terrestrial species, but gray foxes and horses are more often seen with bat rabies than either cats or dogs. Notice that no mammal species has been shown to be completely resistant to any specific rabies variant, but no large systematic survey has been conducted on that subject.

Only a few species of mammals, including medium-sized carnivores and some bats, are responsible for spread of rabies in the wild. We now realise that individual rabies variants are spread by only one to five species in the wild. Other species only rarely are infected. Dogs appear special in this regard. They are moderately to extremely susceptible to all the terrestrial variants of rabies in North America, and, in fact, world-wide. Their susceptibility to bat strains is less documented, but the rarity of dogs with bat rabies suggests they are not as susceptible to bats forms as they are to terrestrial variants. The other special feature of dogs is the intimacy of their contact with humans. In Ontario, the average confirmed rabid dog resulted in more than 10 PET's.

A key question when discussing PET is "How do humans measure up in susceptibility to the various forms of rabies"? Humans do not have their own form of rabies. There has so far been no human die of the raccoon variant. Is that due to low infectivity of this particular virus to humans, or to effieciency of public health campaigns to get exposed people to seek PET, or some combination of the two?? In Ontario, after 40 years and over 55,000 rabid animals, there have been only two fatalities to the Arctic fox variant, and across all North America I can find fewer than ten others since 1948. All of these cases involved serious bites. However, all occurred before we knew how to type rabies viruses, so the only way to identify that these were due to the Arctic fox variant was by location, and the identity of the biting animal. Since 1948 in Ontario, the only (two) human deaths were people who were actually bitten by rabid terrestrial animals (one skunk, one cat). Accumulating indirect and circumstantial evidence indicates that humans have a low probability of becoming infected by any of the rabies strains spread by terrestrial mammals in North America. That certainly does not mean never, but, on a per-contact basis, the great majority of contacts with known rabid animals did not result in rabies. I believe that, for these forms of rabies, the possibility of infection from non-bite sources is so low that it should be ignored. There are no direct data, variant by variant, to back this belief, but all the fragments of evidence point clearly to the validity of the idea.

One summary for the U.S.A (Rupprecht, C.E., J.S. Smith, M. Fekadu, and J.E. Childs. 1995 The ascension of wildlife rabies: a cause for public health concern or intervention? Emerging Infectious Diseases 1(4)) is very revealing. In the period 1976-1996, there were 8 humans infected by domestic animals, 3 by wildlife,

and 25 who died without a known exposure to a rabid animal. All of the latter have been shown to have bat variants of rabies. It is a big jump to go from these solid data to propose that perhaps the mysterious infections of the distant past, those which led to the fear of a tiny droplet of infectious saliva . . ., may actually have been due to exposure to a bat, but this idea may have important implications to the decision on who really needs PET. Certainly, however, the point is made that exposure to rabid terrestrial animals may have much less serious implications than exposure to potentially rabid bats. So, from thinking of rabies as all one virus, we must progress to thinking of two groups of rabies viruses, those spread by bats, and those spread by terrestrial species.

It appears that the probability of infection by non-bite routes is negligible for rabies spread by terrestrial species, but that for bat variants, any contact is dangerous. The current CDC recommendation that anyone who is in the same room as a bat should seek PET, unless the bat is captured an proven to be free of rabies, is based on these hard experiences. Yet, in Ontario, hundreds of rural residents and cottagers share their dwellings with bats, without many incidents. There are also bats living in cities, mostly in attics. Don't forget, however, the report of a rabid silver-haired bat in a northern Ontario cottage (Rabies Reporter 8(2):2-3). The frequency of rabid bats in normal bat colonies is poorly documented. It appears that most colonies are rabies-free most of the time, and there is weak evidence that rabies occurs in several colonies over county-sized areas when it does crop up. Surveys which sampled several thousand bats found few or no rabies cases. When one rabid bat is found in a house containing a bat colony, others can often be found by searching, yet rabies does not appear to wipe out whole colonies. We are trying to view the picture of a puzzle the size of a large table, using six or seven pieces obtained at random!

Although the recommendations for rabies PET all say that treatment is not warranted in cases of indirect exposure, it appears that some PET's in Ontario were given in defiance of that recommendation. I know of one such case: some dog show acquaintances of mine had a real tragedy. They let three collies out into a fenced yard for exercise one night. There was a frightful fracas, and they found one bitch dead, another badly injured, and the third also bitten. The source of the trouble was never identified, but a rabid coyote was a logical explanation. The family, of course, ministered to the hurt dogs, and all were given PET. There might have been saliva from the possible rabid coyote, and they might have got some into a cut or scratch. Let's not take any chances. . . . Well, there went $2800 from the provincial health care budget for PET alone, completely contrary to existing recommendations and policies. In the following article, by Doreen Montando, evidence is presented that treatment for indirect exposure was not frequent in one recent Ontario survey, but it is not zero as it should be.

Thinking in the medical and conventional wisdom communities appears to be governed in this case by outdated education. For a long time we taught that one tiny drop of saliva might . . . Now, and for more than a decade, we know better. But people still want treatment, and doctors still give it. I suspect that even scratches from the claws of mammals should be excluded from PET recommendations, but again, that is an educated guess. Of course, when a child is attacked by a cat, it may not be clear which wound is bite and which is scratch. On the other hand, rabid cats are reported to bite much more ferociously than normal cats, even unfriendly normal cats.

PET's administered because an animal bit or scratched, but ran away and could not be found for testing constituted 23% of the total, when rabies was still abundant in southern Ontario, during the 1980's. That led us to predict that PET's should drop to 500 per year, as the annual average at the time was just over 2000 PET's per year. At the moment, the rate of PET's has stayed at 1000 or more per year for 5 years, during three of which there were fewer than 5% as many rabies cases as there were in the 1980's. Figure 2 shows some interesting changes in the rate of PET's in Ontario, This graph was derived by dividing one set of numbers from figure 1 by the other. Three events which may have been important are flagged in Figure 2. It is clear that the rate of PET per rabid animal has escalated rapidly as rabies was controlled. Looking back at Figure 1, the problem is that PET's have not dropped off as rabies became scarce. The middle flag, marked when human diploid cell vaccine (HDCV) for humans became available, in 1981, is also important. The vaccines available before HDCV caused painful, and potentially serious side effects. HDCV is close to painless and has few side effects. Note that, when HDCV was phased in Ontario jumped in one year from about 0.7 PET's/rabies case to 1.2, almost double. When there were potential side effects of vaccine, doctors seem to have been more discriminating about the administration of PET. Now that the vaccine is safer, we give it almost twice as frequently! At $700 per person!! What is wrong with this picture?? What is more interesting is that, if we extended the "additional" treatments back in time, there would have been over 15,000 more people treated from 1958 to 1981, if HDCV had been available. The mirror image of that projection is that those people were not treated, yet no one contracted rabies as a result of not being treated. Thus, the evidence is clear that we have, since 1981, increased the rate of unnecessary PET treatments.

The first flag is interesting, as it shows that the ratio of PET's to rabid animals is not really predictable. Before 1968, there were more PET's per rabid animal than happened for the next decade. The only recorded event in the general time period was the change from the search for Negri bodies to the use of the fluorescent antibody test (FAT), in 1964. When Negri bodies were the order of the day, specimens had to reach the laboratory in good condition, ideally packed on ice, but not frozen, within 24-48 hours. Fewer animals would have tested positive than do today with the more robust FAT. Add to the problem that overnight transportation to Ottawa was not as reliable in the 1960's as it is today, and you will understand that we probably detect rabies in a higher proportion of potential cases today than we did before 1964.

The third flag is the heart of this article. Whatever governed the PET:rabid animal ratio before the rabies control program began, the ratio has climbed to unprecedented values since the number of rabid animals dropped sharply. Doreen Montando's article deals with that in more detail.

Clearly we need new education campaigns aimed at reducing the number of PET's administered. I (who am a wildlife biologist, and neither a medical doctor nor a veterinarian) have received enough calls from members of the public looking for evidence to support their desire for PET

that I can state confidently that public perceptions are a major problem. We seem to be fighting a case analogous to the bambi syndrome. At the turn of the last century deer were rare, and much was written about the need to protect them. Now that they are a lot more numerous, and we know a lot more about them, it's still a long uphill battle to counter the ideas that were pounded into people almost a hundred years ago!

If PET's do not fall to much lower levels, support for oral vaccination against raccoons against rabies may suffer. A major element of cost-effectiveness of oral vaccination is the reduction in PET, and, even more, the reduction in investigations by public health inspectors, to determine which animal bite reports generate need for PET.

The PET data that I received from the Ministry of Health, shown in Figure 1, do not tabulate the sources of exposure. I cannot believe that the new guidelines for exposure to bats were responsible for over 500 PET's in 1998! The next article, which appeared in PHERO, does shed some light on this, for a short sample period.

Ms. Montando makes a clear case that most PET's are administered as a result of actual bites, and the overwhelming majority of those bites are by dogs or cats. Therefore, if we want to reduce the frequency of PET, we must advance on two fronts, first to reduce the number of Ontarians bitten by dogs, and second, to find ways to estimate more accurately and precisely the risk of a particular dog bite. I am especially impressed, or should the word be concerned, by the very large proportion of the bite incidents that involve strange dogs and cats, which could not be identified for 10-day confinement. If they were identifiable, the 10-day confinement would clarify the risk of rabies. I wish we could assess the owners who let their dogs run loose the costs of the PET's thus generated, but you have to catch the dog, and then the owner, first!!

Is there a difference in risk of rabies due to small nips versus bigger bites? Currently, as long as the skin is broken, and the dog cannot be proven healthy, PET is recommended. Vaccination status of the dog is not considered, but that is not important: if the dog is available to be held for the mandatory 10 days, we do not need to know about vaccination. If the dog bites and runs away, and cannot be identified, it is impossible to verify vaccination status. Rabid dogs bite savagely, whereas defensive normal dogs usually give disciplinary nips. Having asked the question, I have to side with the public health staff, who have to make a possibly life-or-death decision: can they judge the dog's condition from the size of the bite? Not likely.

Many of the dog bites are, from the descriptions, events which had a high probability of being behaviour expected of a normal dog. But I, who breed dogs, and have lived with many dogs for 35 years, can say that easily. How many public health workers know that much about dogs? Even if they did, would it help reduce PET's? Two incidents which happened to friends of mine recently resulted in dogs being confined for 10 days, when everyone involved, including the health worker, agreed that it was proibably not necessary. In both cases the personb bitten was the dog's owner, and neither owner beleieved there was the least risk of rabies. Should that make a difference?

Dr. LeBer states that the rules for PET change when there has been no case of terrestrial rabies for two years. On the surface that seems reasonable, but there are some questions of detail. There has been no case of a terrestrial strain of rabies in the Ministry of Health's Eastern Region since November 1996. So can the Eastern Region change the rules? Will we react correctly to cases of bat rabies in terrestrial species? There are still rabid bats reported in the Eastern Region, but the last terrestrial animal with a bat variant was a fox in 1994. I pick on the Eastern Region both because it is rabies-free, but also because it is larger than the U.S. state of Rhode Island. No-one would question declaring Rhose Island rabies free on the data given above, but the Eastern Region is only part of the Ontario rabies zone. Should that matter?

Administration of PET involves risk assessment. It would be prohibitively expensive to treat anyone who had been exposed to every remote possibility of rabies infection. The problem is to assess that risk of infection if a particular exposure case does not receive treatment. I believe we are now in an era where we should also ask whether the risk is low enough that the money involved would be better spent in an area where the risks are higher. New knowledge should change that process, but, unfortunately, most of that new knowledge is educated guesses, not backed by hard data. There is a serious job to be done by the Ministry of Health and the Health Units, to review the risk factors and bring down the number of PET's administered, now that the risk of rabies is much less than it was. Please get to it, ladies and gentlemen!

This article was written to generate discussion and debate. The Rabies reporter looks forward to printing opinions submitted in response to this starter. The bottom line is that we must find ways to reduce PET in Ontario. How can we do that??

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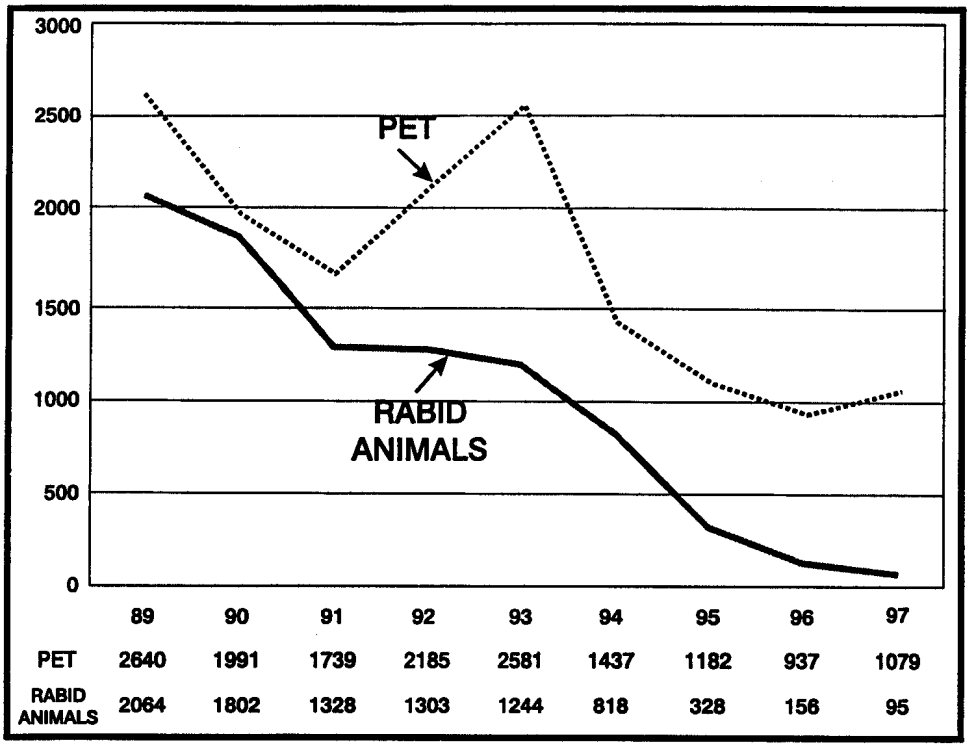
RABIES POST-EXPOSURE TREATMENT (PET): ONTARIO, APRIL 1 TO JUNE 30, 1998

Introduction

Since the inception of the Ministry's of Natural Resources fox oral rabies vaccine program in 1989, the identification of laboratory confirmed rabid animals in Ontario has declined by 95%. There has also bee a concurrent 61% decrease in people receiving rabies post-exposure treatment (PET) (Figure 1). During the period from 1989 to 1997, the methods for determining laboratory confirmed rabid animals and recommendations for PET have not changed. The decrease in PET was expected to be higher given the significant animal rabies decrease from 1989 to 1997. As indicated in Figure 1, the number of people receiving PET since 1994 remained relatively constant, with 1182 in 1995 and 937 in 1996. To help understand the reasons for the lack of a significant decline in the number of people receiving PET in the presence of declining rates of rabid animals, a study about persons receiving PET over a three month period in 1998 was conducted by the Ministry of Health. A questionnaire was designed to assess how often PET was being given under appropriate circumstances.



	89	90	91	92	93	94	95	96	97
PET	2640	1991	1739	2185	2581	1437	1182	937	1079
RABID ANIMALS	2064	1802	1328	1303	1244	818	328	156	95

Figure 1. Annual Post-Exposure Treatments (PET) and confirmed animal rabies in Ontario, 1989 to 1997. Data from Ontario Ministry of Health and Canadian Food Inspection Agency.

Materials and Methods

A self-administered mailed questionnaire was distributed to all 37 health units in July 1998. Data requested for each person who had received PET from April 1 to June 30, 1998, included demographic characteristics, date of exposure, health unit involved, nature of exposure (bite versus non-bite), exposed site, possible risk factors for the exposure (e.g. provocation and its nature) and species and rabies status of animal(s) involved. The questionnaire was not designed to quantify the number of vials of HDCV or RIG administered or persons receiving pre-exposure prophylaxis. Data were analysed using EpiInfo Version 6.0 (Centres for Disease Control and Prevention, Atlanta, GA).

Results

All 37 health units participated. Five health units (North Bay and District, Northwestern, Peel Region, Porcupine and Thunder Bay District) reported no provision of PET for the period of time under study. The remaining 32 health units reported 261 PET's for the 3 month period. Central East was the region reporting the highest number of people treated for contact to suspect or confirmed rabid animals (Figure 2) and Southwest Ontario had the highest incidence rate per 100,000 people. The City of Toronto Health Unit accounted for 58 (22%) people treated in the province, followed by York Region (6%), Waterloo Region (6%), Windsor-Essex(5%) and Hamilton-Wentworth (5%). Seventy-one percent (186/261) of the exposures occurred in urban settings, indicative of higher concentrations of companion pet and human populations than in rural areas. There were no remarkable differences observed in patients' age, sex or type of exposure between those who reside in urban or rural settings. Fifty-five percent of the exposed people were male (143.261). The median age of those exposed was 28 years with a range from 3 to 85. While 44% (111/151) of the patients were aged 20 to 49, the group at highest age-specific risk were children and adolescents aged 5 to 19 years (Figure 3). Of the known animal species, dogs were involved with 104 of the 261 exposures and 97% of these were stray or unknown animals not available for isolation by a public health inspector for the legally required 10-day observation period. Exposure by other animal species were as follows: cats (76, of which 74 were stray), raccoons (26), bats (21), other wildlife (16, skunks (6), foxes (3), and other domestic animals (2 steers and 1 sow). Other wildlife involvement included four squirrels, three muskrats, two groundhogs, and one each of a deer, ferret, wolf, weasel, unspecified rodent, porcupine and mole.

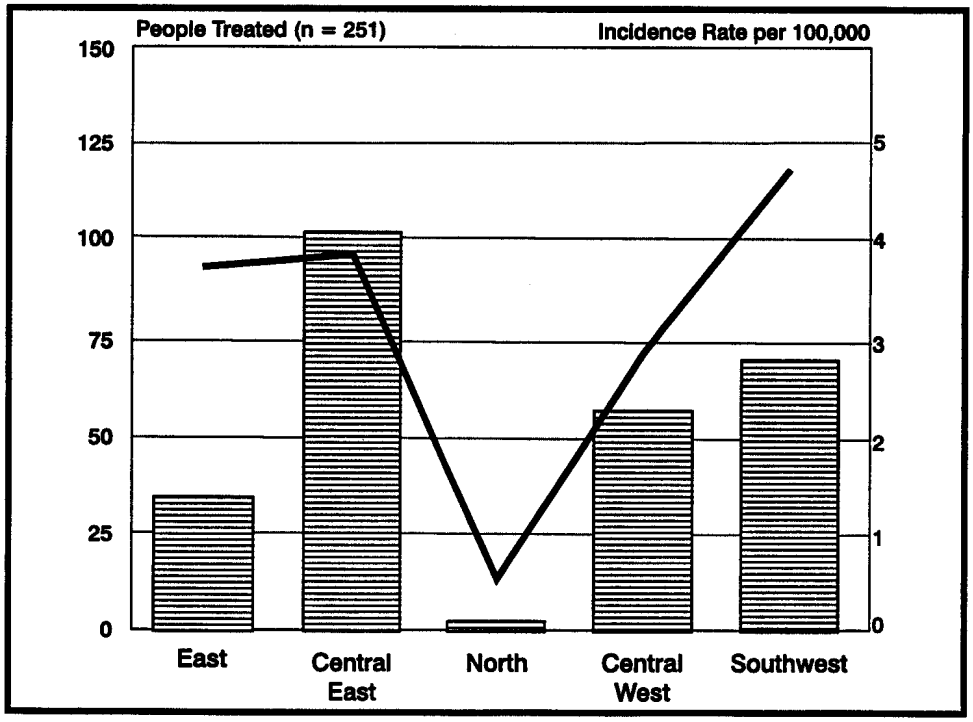


Figure 2. Rabies PET by Ministry of Health Region. The black line is the incidence per 100,000, the bars show the actual numbers treated.

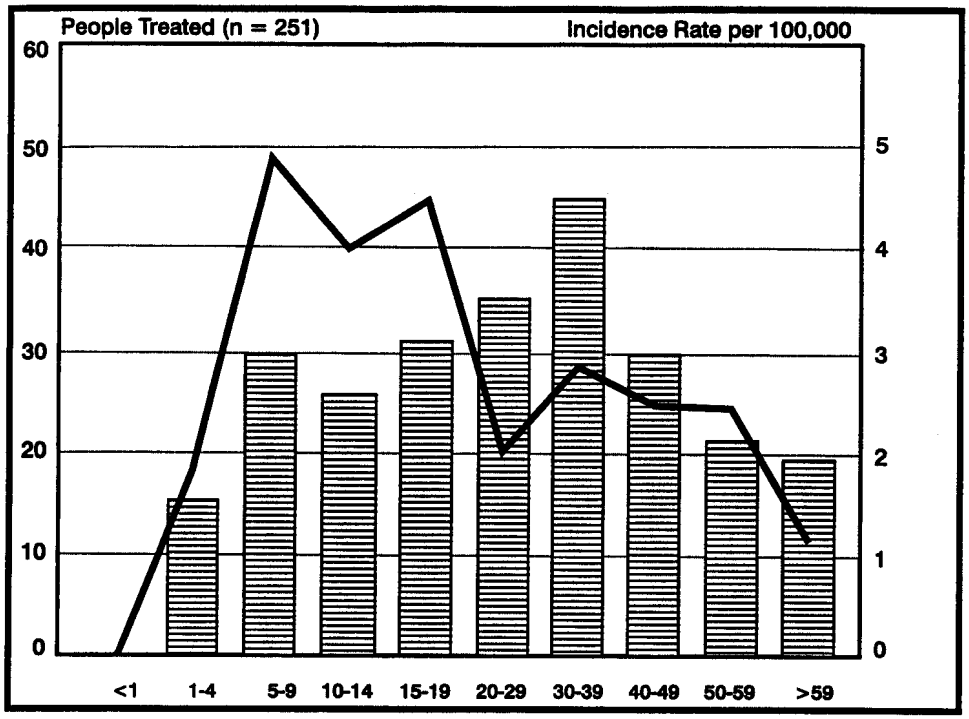


Figure 3. The age structure of humans receiving PET. The black line shows the incidence per 100,000, the bars show actual numbers of people treated.

Bite exposures were responsible for 225 (86%) of the PET patients, followed by non-bite exposures (17), scratches (12), and non-bite indirect exposures (7). Bite exposures are incidents where there is skin penetration by the suspect animal. Non-bite direct exposures occur in the event of saliva contact with a mucous membrane or pre-existing wound not considered superficial (bled within the previous 24 hours) and non-bite indirect exposures are due to secondary contact with infected material such as saliva on a foreign object, e.g. the handling of a dog leash. Two hundred and three (90%) of the bite exposures involved penetration of the skin, and 119 of those incidents were described as drawing blood. Of the 12 scratch exposures, seven reported that it was superficial. The body sites most commonly affected in bite and scratch exposures where the site was reported were the hand (117), followed by the leg (50), arm (23), head (14), torso (8), foot (5), neck (2) and shoulder (1). No treatments were recommended for exposure by ingestion of suspected tissue or following contact with animal urine or feces.

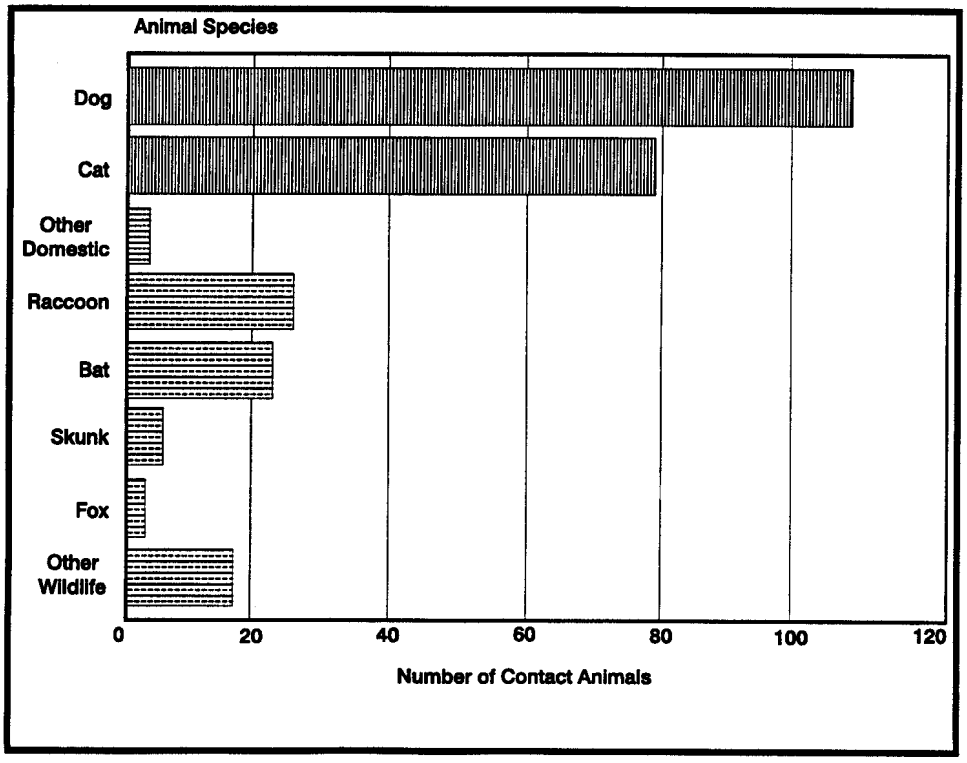


Figure 4. Rabies PET by species contacts. The overwhelming number of PET's were administered due to contact with cat or dog.

Discussion

Rabies post-exposure treatment appeared to be warranted with almost all exposure incidents during the three-month period of time assessed in this study. Bite exposures, the highest risk for transmission of rabies virus from rabid animals, were reported as the reason for 86% of all treatments. Of the 225 animal bite incidents, only four animals were confined for a 1 day observation period, as the remaining were either at large and not captured and PET was administered as a precautionary measure. In five cases, the animal was destroyed and disposed of by either Humane Society officials or private veterinary practitioners without prior knowledge of the biting incident. However, investigation of one biting incident concerned a cat killed by a vehicle, resulted in the submission of a specimen, which proved to be negative. Three of the biting incidents occurred with travellers in foreign countries where rabies is endemic and reporting on the rabies status of suspect animals could not be established. Of the four animals which were confined, treatment was correctly initiated with two who were involved with an unprovoked bite to the head. Initiation of treatment likely was not warranted with the two other patients as the bite occurred on the hand and arm only. This anatomical site is associated with a four to six week incubation period, thus allowing sufficient time during observation to begin treatment should the animal develop symptoms of rabies. Eight exposures occurred due to intervening during a catfight. All of the cats involved escaped.

Five percent of the reported treatments occurred due to scratches, primarily from cats. While a scratch may not represent a true exposure unless the animal's claws are contaminated with saliva, the

incident should be considered similar to a bite wound if the scratch is deep e.g., evidence of blood. Of the 17 non-bite direct exposures, nine people were treated because of handling cattle which died of unknown causes, three because of skinning either deer or raccoons, and the remaining cases from touching live bats. Specimens were not available for testing due to dead stock removal, scavenging of the carcass by wild animals or escape. With respect to the livestock contact, the possibility of rabies was suspected after carcass disposal. In the event of an unexplained death and without clinical information provided by the veterinarian, PET may be warranted but each incident needs to be assessed, preferably with the assistance of a federal veterinarian from the Canadian Food Inspection Agency. Of the seven non-bite indirect exposures, possibly none of the victims should have received PET. Cases involved the touching of fox saliva on a chicken coop, the handling of dogs sprayed by skunks, and of dogs which fought with high-risk species i.e., foxes and skunks. The secondary or tertiary transmission of rabies virus has never been documented and skunk spray is not known to be implicated. Of the 22 people treated because of exposure to a bat, five were due to a bite, 10 because of a scratch, handling or saliva contamination of a pre-existing abrasion and seven because of the presence of a bat in the room. The provision of PET for the latter cases followed appropriate protocols for treatments with a history of a bat in the same room as a sleeping person and in the absence of a specimen for testing. It is interesting to note that during the study period, only one of the 225 animals involved with exposures was confirmed positive for rabies. This was a dead bat handled by two children aged five and six years.

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DISEASE CONTROL SERVICE COMMENT

Often the argument is made that one would expect a significant decrease in the number of individuals receiving PET if there are few cases of laboratory-confirmed rabid animals. This expectation is not borne out because human to animal exposures are frequent, and current rabies treatment guidelines published in the Canadian Immunization Guide 1 do not require confirmation of rabies in the animal. The protocol states that individuals exposed to a suspect escaped cat or dog, which is not available for a 10-day observation period or for submission of a CNS specimen, require local treatment of the wound and administration of RIG and HDCV. Until Ontario is free of terrestrial animal rabies for at least two consecutive years, a condition required by the U.S. Department of Health and Human Services before declaring a country or political unit as "reporting no cases of rabies", bite exposures from escaping high risk animals e.g., cats, dogs, foxes, skunks and raccoons, whether provoked or not, should continue to be treated for the possibility of a rabies virus exposure. Such treatment may be discontinued if the animal can later be identified and either observed for evidence of the disease as is done with cats or dogs, or a negative test result is reported concerning the submitted brain tissue, as occurs with wild animals. it is usually problematic to confirm the identification of an escaped wild animal and PET should be provided if in doubt.

Based on descriptions of the incidents, many of the exposures could have been avoided through prudent anticipation of a bite or other type of exposure. Rabies post-exposure treatment is not without risk, and systemic allergic reactions to the human diploid cell vaccine have been uncommonly reported in persons receiving primary immunization and in up to 7% of persons receiving a booster dose. Immediate anaphylactic reactions have occurred in 1 in 10,000 persons administered HDCV. Twenty-two people were treated because of their samaritan intervention during a cat or dog altercation. The median age of this group of individuals was 38, which suggests that public awareness information about animal behaviour should not exclude adults. The median age for teasing animals as a form of provocation was 46 years. There were six of these incidents and they involved scaring stray cats, annoying raccoons and a fifty-eight year old spouse who picked a skunk up by the tail to show her husband in the garden.

One of the most common forms of provocation reported for those who received PET was the petting and feeding of unfamiliar animals by school age children and adolescents (median age 15 years). Animals involved included stray cats (14), stray dogs (7), raccoons (7), a ferret, a muskrat and a skunk. Certainly, a component of the mandatory rabies awareness program in schools should include the advice to avoid contact with these animals, at least until their demeanour can be established over time. Finally, individuals who are responsible for confining animals such as animal control officers should be reminded to enquire about bite exposures from their clients before they are requested to destroy an animal and to report such incidents to their local health department.

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SO FAR, SO GOOD RABIES IN ONTARIO FIRST QUARTER 1999

There were 13 rabid animals confirmed in Ontario during the first quarter of 19999. That is the same number as last year, again, down 97.2% from the 471 case average for first quarters from 1980 to 1989. There really is not much to say. Rabid skunks were down (from 8 to 5), rabid livestock were up (5 >7), and there was one bat. All the cases were in 2 of 5 regions.

The only point worth noting is that, during the final stages of the disappearance of rabies from eastern Ontario, a majority of the last cases were livestock. If that is a pattern, then the fact that livestock were the largest group in the current quarter may be a good sign. Why should rabid cattle be a good sign?? The likeliest explanation is that a higher proportion of livestock than skunks or foxes are submitted to the laboratory. However, before rabies control began, there were more skunks than livestock confirmed to be rabid. Thus, the relatively high number of livestock cases as rabies disappears is puzzling.

Charlie MacInnes
Rabies Unit
Peterborough

OHIO BAITING DIARY

Saturday, April 24 OPG was scheduled to depart Sudbury at 9:00 a.m. and fly directly to Peterborough to pick up three Rabies Unit staff. Neil Ayers decided on Saturday morning to depart at 8:30 a.m. instead so arrived at Peterborough early where he had to wait for Andrew Silver and Kim Bennett. OPG departed Peterborough and landed in Buffalo, New York at 10:30 a.m. to clear customs. OPG was scheduled to wait for OPJ in Buffalo. After waiting approximately an hour and a half for OPJ to arrive from Sudbury, we were off and bound for Elser-Metro Airport in Youngstown, Ohio.

After landing, the planes were unloaded and Bob Hale decided to upload the flights for the next day. Upon checking the flights that he had uploaded into both aeroplanes, Bob discovered that the routes had not uploaded properly. He attempted uploading a second time and tried a different computer cable but still to no avail. Bob then went back to the Operations Central trailer to figure out the problem. In the meantime, Beverly Stevenson was busy training Gord Leamy , a pilot who was new to the baiting program. Using the battery power from the aeroplane, they spent several minutes running through the different steps involved in the navigation system and baiting equipment.

By the end of training, Bob Hale had still not been able to get the flights to upload properly. He had already tried another laptop by this point being convinced that the problem was electronic. A group of people including Bob Hale, Bev Stevenson and Andrew Silver gathered in the trailer to brainstorm. After staring at the computer screen and going through the various steps involved in uploading, Bev Stevenson noticed that there was a space before the waypoints in the computer file. Bob and Bev went through the flights manually to remove these spaces and renumber the waypoints. Success! We had found the problem but fixing it was time consuming. We had to go through each flight and manually fix all waypoints in the flights for the following day.

Bob uploaded the flights into one plane to ensure that everything was functioning properly and then decided to quit for the day. Anything else could wait until tomorrow.

Sunday, April 25 The morning was spent giving refresher courses in navigation and baiting for all personnel involved. The first flights were ready to be flown by early afternoon. Everything seemed to be running much more smoothly than the previous day. That was until we were actually ready to take off. Due to the length of time involved in briefing Gord on the navigation and baiting system, and the time involved in trying to correctly upload the flights, the battery on OPJ had been significantly drained. Gord was able to start the right engine and decided to let one engine run for a few minutes to recharge the battery before starting the left engine. While starting the first engine, a breaker had popped and the battery was not recharging. The engineers had to find the airport manager and borrow a charger to ground boost the aeroplane.

Finally, there was some good news. The plane was started and the flights for the day went off without a hitch. The crew not on the first flights got busy and loaded the baits into the tubs for the next flights.

Monday, April 26 Everyone arrived at the airport for an early start. It was a beautiful, calm, and somewhat cool morning - perfect for flying. Murphy was still against us though, as we had to de-ice the planes before takeoff. After a one-hour delay, the planes were ready for action. The rest of the day was trouble-free.

Tuesday, April 27 It was another cool morning, but the planes did not require deicing this morning. The first flights went up (almost on schedule for once) and we made significant progress in baiting. Despite our previous days troubles, we were dropping the expected number of baits and completing the flights scheduled for each day. By mid-afternoon, Bob Hale was starting to worry again. We had enough baits to finish the flights for today and do the first set tomorrow morning. The second bait trailer was supposed to arrive sometime after midnight.

Bob Hale was short of baiting staff so pilot Al Quinn volunteered to become a baiter. Al completed his inaugural (and only) flight admirably. Despite being extremely pale when he came off the plane, he did come off empty handed and was glad to do his next flight from the pilot's seat.

Wednesday, April 28 The baits that were supposed to arrive after midnight, were not there when we arrived at the airport. The first 2 flights were sent up without delay. We had enough baits left over to send one plane up on a short second flight. The baits had still not arrived by mid-morning. Bob Hale got back on the telephone and started calling around to find out where they were. By lunchtime, the driver had called a couple of times to get directions and Bob had finally sent someone to meet the truck to show the driver just where the airport was.

The crew shifted into overdrive so that the arriving baits could be quickly loaded into tubs and then onto the planes for the next set of flights. It didn't take long for Bob Hale to notice that he had not received all of the baits ordered. He was short 23 boxes (enough baits for 2 flights). A quick call to Merial had the remaining baits being shipped by FedEx for delivery the following morning.

Thursday, April 29 Despite all of the setbacks, baiting flights were completed today. A total of 177,660 baits were distributed today alone. Due to the high baiting density, the flights were dropping around 7 baits/second. The pressure to get the baiting done while the weather was still good was gone. A little rain in the forecast wouldn't have hurt though. The empty cardboard boxes which the baits arrive in are burnt each day. As the last flight took off, everyone on the ground could hear shouts of a grass fire. Ashes from the trash burn had been carried to some long dry grass where it quickly ignited into a spreading fire. Armed with shovels and rakes, the crew quickly put out the fire and left the remaining garbage to be burnt the next day.

Friday, April 30 After a 7:00 a.m. breakfast, it was off to the airport and to return the rental cars. After group photos and numerous hugs and handshakes and invitations to return, the Canadians headed home.

Bev Stevenson
OFAH and Rabies Unit
Peterborough

PROBLEMS IN OHIO

The Ohio vaccine-bait program is strategically the most important initiative aimed at stopping further spread of raccoon rabies. It took several years fro raccoon rabies to move through the Allegheny Mountains in western Pennsylvania, but once it reached the Ohio Valley and the plains along Lake Erie, the stage was set for it to rush forward across Ohio into Indiana and Michigan, and ultimately Illinois, Wisconsin and Minnesota, as well

as well as to move southward in the Ohio and Mississippi River valleys. So the Ohio program is important well beyond the Borders of the host state.

In April, a chipmunk caught by a cat bit a 12-year-old girl who tried to rescue it. The chipmunk was tested for rabies, and was positive for the raccoon strain. This occurred in Trumbull County, but slightly west of the baited zone. One may joke about how a chipmunk could be bitten by a rabid raccoon and live, but evidence of raccoon rabies west of the vaccination barrier was not welcome news.

In May, a much more serious breach occurred when a rabid raccoon was encountered in Ashtabula County, which lies along Lake Erie. The barrier that far north was 10 miles (16 km) wide, and raccoon rabies had not reached the eastern boundary when this raccoon was taken west of the barrier. In Jefferson County, New York, a 15-mile-wide barrier was breached in 1997. Rick Rosatte's tag-recapture data from the Niagara TVR zone indicated 10% of raccoons moving straight-line distances greater than 15 miles, so perhaps this breach was not surprising. There is always the tension between making sure the barrier is wide enough, and keeping the budget under control. Using normal Ohio baiting parameters, a square kilometre of baits on the ground is worth close to $90.00US. When you want to widen a barrier by 20 km, each linear km costs $1800.00US, and it's a lot of kms from Lake Erie to the wider barrier.

Another 120,000 baits will be placed beyond the breach starting 18 June. That is the earliest date that baits could be delivered, and OPG would be free. Currently the aircraft is servicing goose biologists and other MNR groups in James Bay and along the Hudson Bay coast. Ohio is moving fast to adapt to the moving front, well done Bob Hale and colleagues!!

On the good news side, raccoons rabies cases were down in the first 4 months of 1999 compared with 1998. There were 2 raccoons and 1 chipmunk in 1999, compared with 13 raccoons and 2 cats in the same period last year.

Charlie MacInnes
Rabies Unit
Peterborough

RACCOON RABIES IN NEW YORK, VERMONT, AND NEW ENGLAND

The news on most fronts in northern New England is relatively good. In Niagara County, there were two rabid raccoons in the northern suburbs of Niagara Falls, New York early in the year, near where two cases occurred in late 1998. This caused concern, as we had hoped that rabies would disappear from the county during 1998. However, since the second case in March, all has been quiet.

Along the St. Lawrence, the new barrier is holding. The outbreak in St. Lawrence County has diminished in intensity, as might be expected as the area must have lost a substantial proportion of its raccoons during 1998.

In Vermont there was one case in Orleans County, right between the two baited zones which is cause for concern. This is in a river valley within the Green Mountains. Also, the case was only 23 miles (37 km) from the Quebec border. So far there have been no further developments in that area.

In Maine there is still a lot of controversy about whether oral vaccination works or not. A second contentious point is whether baiting can be stopped once started, or whether protection is only achieved by baiting for the foreseeable future. The Cornell programs in New York are aimed at helping answer those issues, and certainly the Ohio program will provide larger-scale results.

In Massachusetts, the Cape Cod vaccination barrier is still a success, and the project has been asked to bait further onto the mainland

Charlie MacInnes
Rabies Unit
Peterborough

NEWS FROM THE RABIES UNIT

Terry Medd finally achieved his goal of becoming a conservation officer, and left in March for Hornpayne to take up his new posting. Everyone wishes him well. Barry Radford, our information officer, came back to the section after a lengthy secondment to the Lands for Life project. That meant that Derek Pinto, who filled in for Barry very effectively, has moved on. Derek plans to go overseas, possibly to India, as a volunteer worker.

The unit is working hard on manuscripts. One on the successful elimination of rabies from eastern Ontario will be submitted to the Journal of Wildlife Diseases very soon.

The new Ontario Slim bait will be used for the first time during the fall bait drop. Also, baits for this fall will mostly be a dirty green colour, to try to make them less visible, and to have less the look of white chocolate. The unit will conduct a series of drop experiments in late June to learn more about how three types of baits fall from the plane. More later.

Charlie MacInnes
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Peterborough

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.. Articles for future issues will be welcomed by the editor. Comments, letters, submissions and enquiries should be sent to:
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Also, visit our home page on the internet, at
http://www.gis.queensu.ca/RReporter/mm.html , or the rabies home page at
http://www.mnr.gov.on.ca/rabies/rabmenu.html

Animal Rabies Report: January to March 1999

Animal Type	Fox			Skunk			Bat			Dog			Cat			Livestock			Total		
County or Area	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		99	98		99	98		99	98		99	98		99	98		99	98		99	98
Eastern																					
Stormont																			0	0	0
Dundas																			0	0	0
Glengarry																			0	0	0
Prescott																			0	0	0
Russell																			0	0	0
Carleton							1	1											1	1	0
Renfrew																			0	0	0
Lanark																			0	0	0
Grenville																			0	0	0
Leeds																			0	0	0
Frontenac																			0	0	0
Lennox-Addington																			0	0	0
Central																					
Hastings																			0	0	0
Prince Edward																			0	0	0
Northumberland																			0	0	0
Victoria																			0	0	0
Haliburton																			0	0	0
Peterborough						1													0	0	1
Durham																			0	0	0
York Region																			0	0	0
Scarborough																			0	0	0
East York																			0	0	0
City of Toronto																			0	0	0
City of York																			0	0	0
NorthYork																			0	0	0
Etobicoke																			0	0	0
Simcoe																			0	0	0

Animal Rabies Report: January to March 1999

Animal Type / County or Area	Fox			Skunk			Bat			Dog			Cat			Livestock			Total		
	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		99	98		99	98		99	98		99	98		99	98		99	98		99	98
Western																					
Peel																			0	0	0
Halton																			0	0	0
Dufferin																2	2		2	2	0
Wellington				1	1													1	1	1	1
Waterloo																			0	0	0
Perth						5												1	0	0	6
Grey				4	4											4	4		8	8	0
Bruce						1										1	1	2	1	1	3
Huron						1												1	0	0	2
Southern																					
Wentworth																			0	0	0
Haldimand - Norfolk																			0	0	0
Brant																			0	0	0
Niagara																			0	0	0
Elgin																			0	0	0
Oxford																			0	0	0
Middlesex																			0	0	0
Lambton																			0	0	0
Kent																			0	0	0
Essex																			0	0	0
Northern																					
Muskoka																			0	0	0
Parry Sound																			0	0	0
Nippissing																			0	0	0
Sudbury																			0	0	0
Cochrane																			0	0	0
Timiskiming																			0	0	0
Algoma																			0	0	0

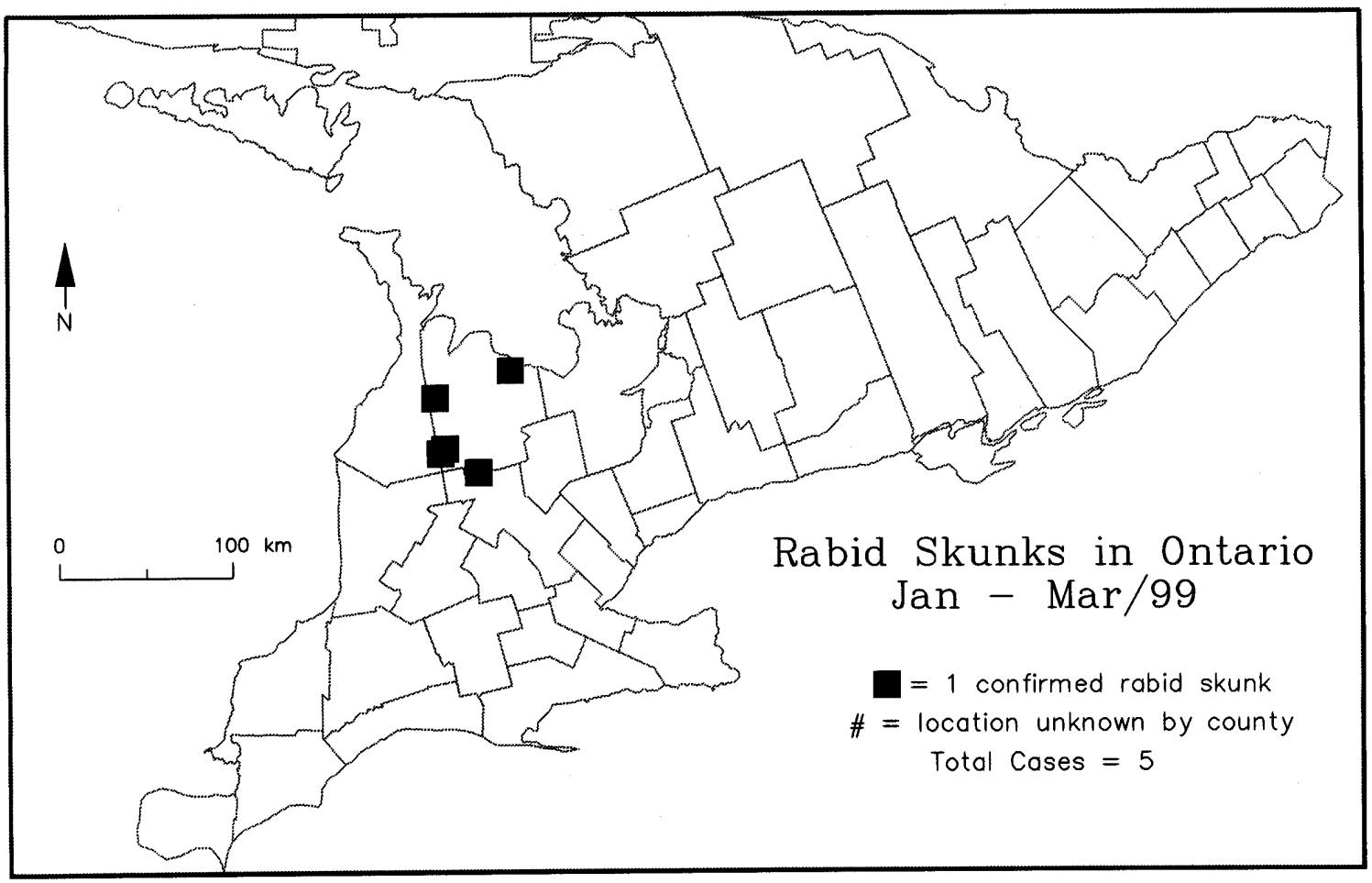
Animal Rabies Report: October to December 1998

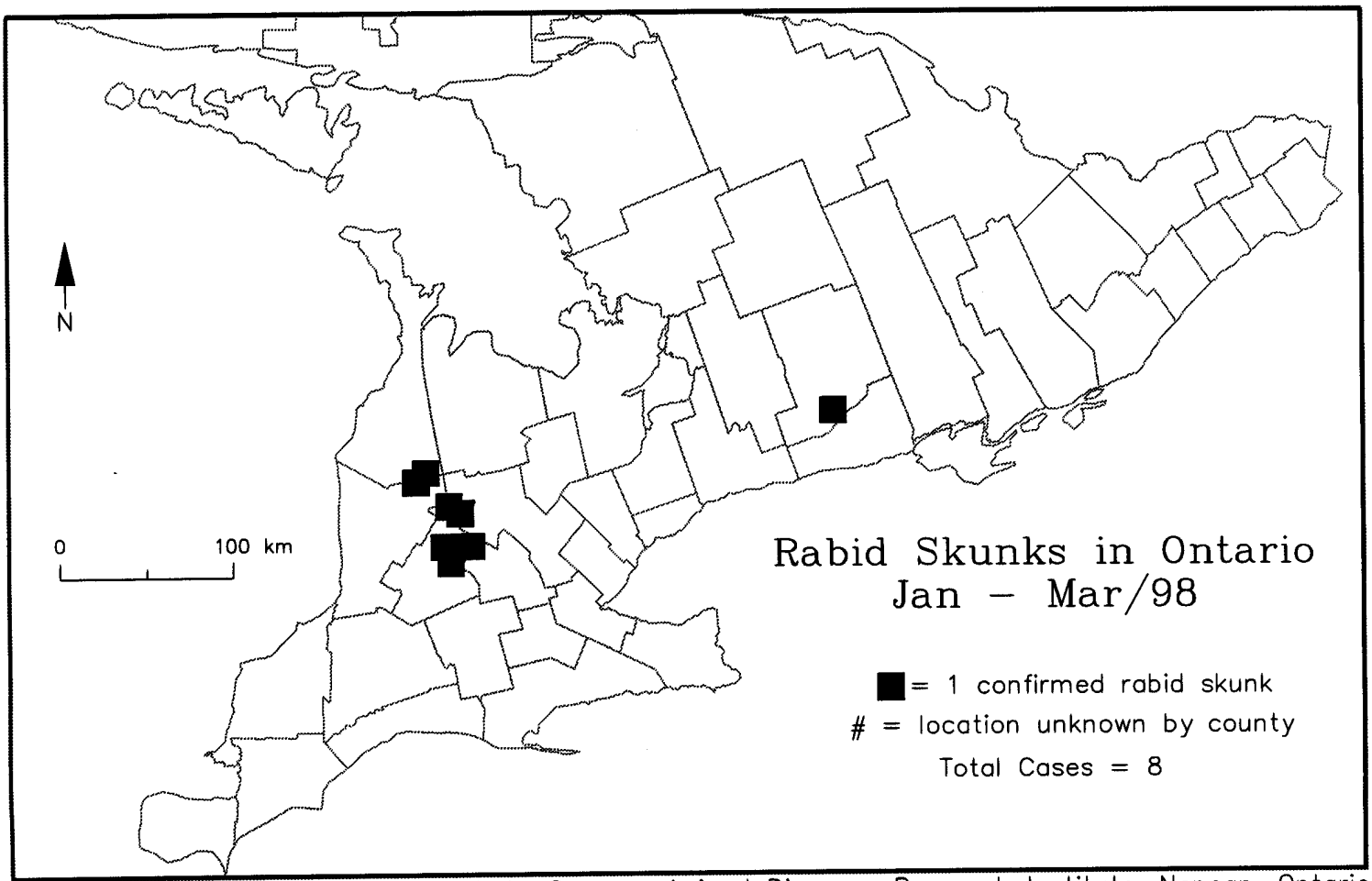
Animal Type	Fox			Skunk			Bat			Dog			Cat			Livestock			Total		
County or Area	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		99	98		99	98		99	98		99	98		99	98		99	98		99	98
Thunder Bay																			0	0	0
Rainy River																			0	0	0
Kenora																			0	0	0
Subtotals																					
Eastern							1	1											1	1	0
Central						1													0	0	1
Western				5	5	7										7	7	5	12	12	12
Southern																			0	0	0
Northern																			0	0	0
Totals	0	0	0	5	5	8	1	1	0	0	0	0	0	0	0	7	7	5	13	13	13

Livestock this quarter: 5 cattle, 2 sheep

Bats this quarter: 1 big brown

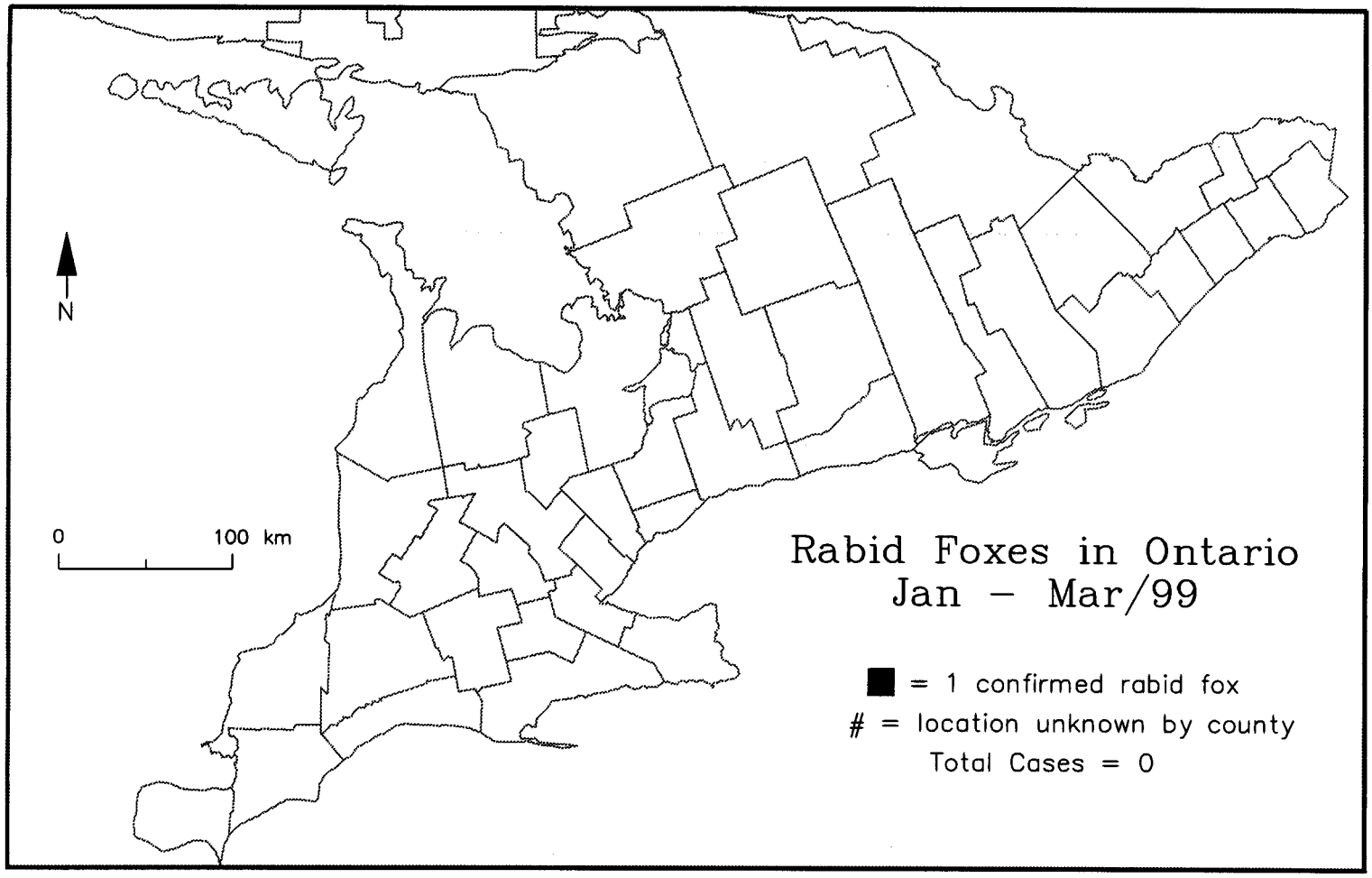
Other wildlife this quarter: None

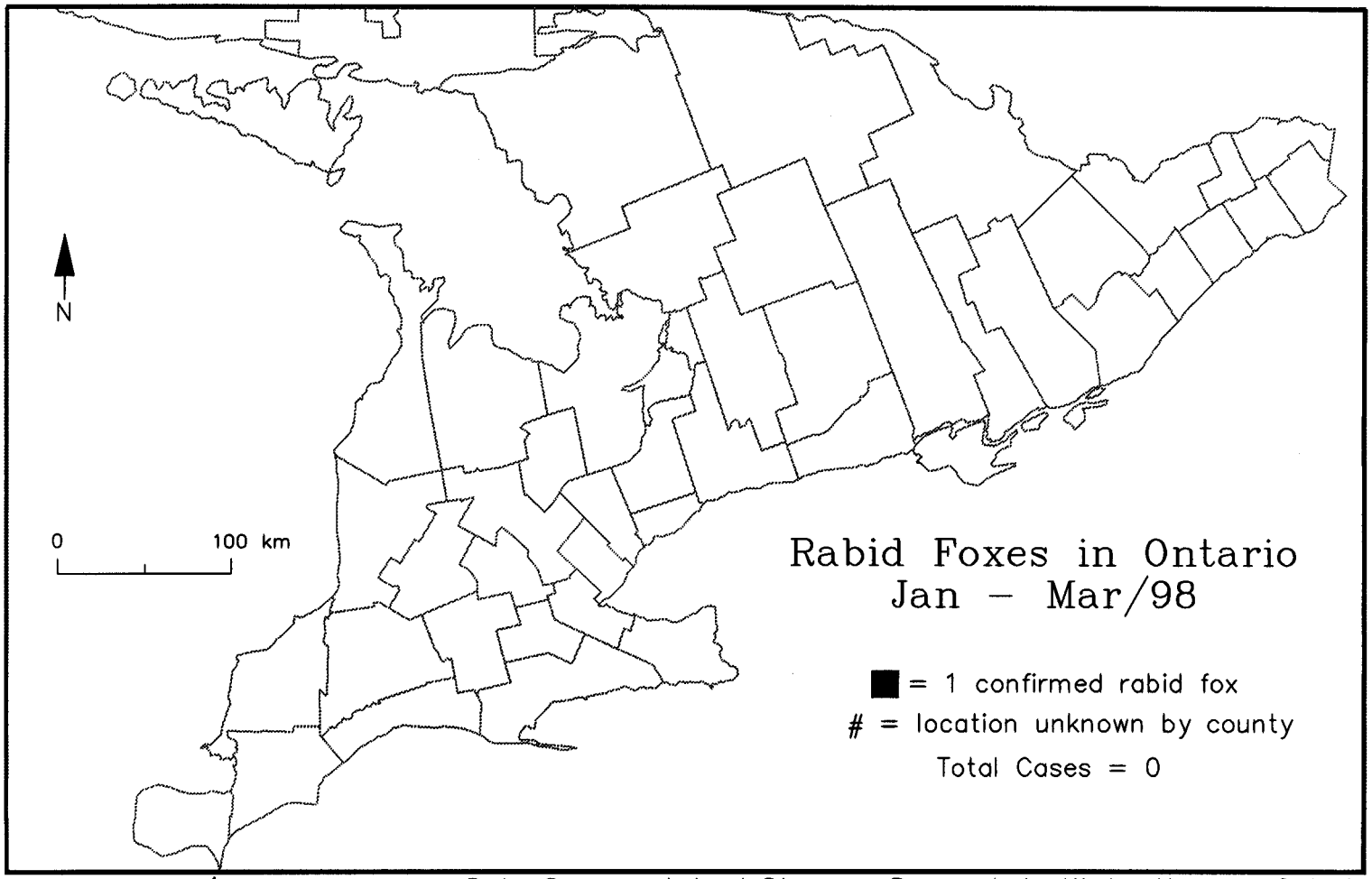




GIS Lab, Queen's University

Data Source: Animal Diseases Research Institute, Nepean, Ontario





GIS Lab, Queen's University Data Source: Animal Diseases Research Institute, Nepean, Ontario