The Rabies Reporter

MNR Publication 51709 **Volume 13, Number 3** **ISSN 1705-2106**

Inside this issue:

The Rabies Reporter, a scientific newsletter about current issues in rabies research and control, is a joint effort of the Rabies Research Unit of the Ontario Ministry of Natural Resources; the Rabies Laboratory at the Animal Diseases Research Institute of the Canadian Food Inspection Agency; the Ontario Ministry of Health; and the Geographic Information Systems Laboratory at Queens University, Kingston. Articles for future issues will be welcomed by the editor. The Rabies Reporter is not refereed, and should not be cited in papers intended for refereed journals. Send contributions, letters and inquiries to:

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Rabies in Ontario – July to September 2002

The ratio of bats (51) to other species (20) this quarter tells a lot. Before oral vaccination began in 1989, bats made up only 2% or less of annual rabies cases. Rabid bats were always more numerous in the third quarter than during the rest of the year. Now that we have reduced the incidence of fox and raccoon strains, bats stick out. In fact, the pig and cat in Middlesex were identified as infected with bat strain.

The conspicuous feature of the rabid bats was their wide distribution: all regions except western and northern Ontario had many bat cases, and these were usually widely distributed across the counties in each region. The number of rabid bats is slightly less than in 2001, but still near record levels.

Rabies was almost absent from the Sudbury area in the third quarter, after the high case load of winter and spring. That is fairly typical of northern outbreaks, which tend to peak quickly, and die out soon. We baited the entire area in September, but that happened after the cases had declined to almost nothing. Again, that has been typical of the north!

There was only one rabid raccoon in eastern Ontario during the quarter. That was the lead in a small flurry of cases in October: these will be discussed in more detail in the next issue.

Fox strain rabies in skunks continued in the western region. The case numbers were low, but the total for the year will likely be very similar to last year.

In summary, it was a quiet and boring quarter, except for the high rabid bat count.

Charlie MacInnes
RRDU
Peterborough, ON

Bait Drops 2002

Person, was this a busy summer! It began on 15 August when one aircraft (C-GOGA) headed for Youngstown, Ohio to start the Appalachian Ridge project, and a second aircraft (C-GOPG) headed for Brockville, Ontario. The plane that went to Ohio had the prototype of the OES Bait-Trac system, and OPG came to Brockville with the first production model.

15 August 2002 - Thursday

OPG arrived at Brockville about noon. Some of the Rabies Unit were there to greet them, but most were not scheduled to arrive until late Friday morning. During the afternoon, they did a short test flight. This is the first year of using the OES computer system to run the bait machine, so there were bound to be teething problems. The first two turned up on the test flight: the bait machine ran backwards when first turned on in Ohio, and it turned out that the software was not inserting the magnetic declination as planned.

16 August - Friday

When I arrived at 1200, a flight was loaded and ready to go. It was a hot day, but with a brisk wind. The combination made the flying uncomfortable for the crew

in the back. The flight came back after only half the lines were done. In this case, the problem was heat and rough air. All the crew were sick, including an experienced rabies flyer.

17 August - Saturday

A piece of advice: using someone else's old computer is dangerous to history. I wrote up each day, through Sunday, only to find that unfamiliar software had locked the file, so nothing past Friday was saved. Here I am on Wednesday trying to remember what happened on Saturday, or was that on Sunday????

The first OES problem was solved in a few minutes, but we don't know what cause or the solution were! Beverly Stevenson was setting up the first flight, and when she checked the pilot display, it displayed an error message which indicated that it was not connected to the main computer. All the connections checked out OK, but the message would not go away. Bev finally shut down the computer, then restarted it, and the problem was gone. There were a few problems in the air, but these all seemed due to lack of practice on the new system.

The hot, humid weather broke late Saturday, as a cold front with attendant thunderstorms swept through the area. Flying on Saturday was not pleasant, as the wind got up in the afternoon, but everyone did quite well. A couple of experienced baiters were sick on their first flights, but the volunteers, mostly TVR trappers, did well.

18, 19, 20 August - Sunday, Monday, Tuesday

The cooler, dryer weather made for excellent flying, although the wind picked up on Sunday and Monday afternoons. We completed 4 flights each day, involving up to 10 hours in the air, so whatever went wrong did not slow us down!

On Sunday, there was a high density flight to be done (150 baits/km^2). Part way through the flight, it became clear that the bait machine had slowed down, so the flight came back. Again, the exact cause could not be pinpointed, although it seemed that the belt was slipping. There is a screen on the computer to increase the torque from the motor, but there are chains and gears on the bait machine that need to be lubricated and adjusted, too. Finally, we do not have any theory to indicate the maximum capacity of the machine, although this job seemed well within capacity we have used in other years.

Monday morning everything was ready for takeoff at 0645, but there was a TV cameraman due to fly. We waited, and waited, and waited.

21 August - Wednesday

Another beautiful day. Flights went well, more or less. OPG had to come back from the middle of a high density flight, because, again, the belt slowed down, but it was quickly fixed, and they went back up and completed the flight. OGC arrived at lunchtime, and was off on a flight in mid-afternoon. OGC dropped sachet baits, on a high density plot, using the old control system, as we are still waiting for an OES system to install. We will be done tomorrow, except that the weather forecast is not good.

22 August - Thursday

We almost got it done. There was high overcast in the morning, but the flying conditions under it were excellent. Each plane did two flights, but OPG had to come home during its second, because the rain had started, and was worse at the north end than down at Brockville. So we shut down for the day, with the result that departure for Vermont will be delayed in the morning. Actually, this may not matter much, because the crew who are driving will get on the road as soon as they have loaded the plane,

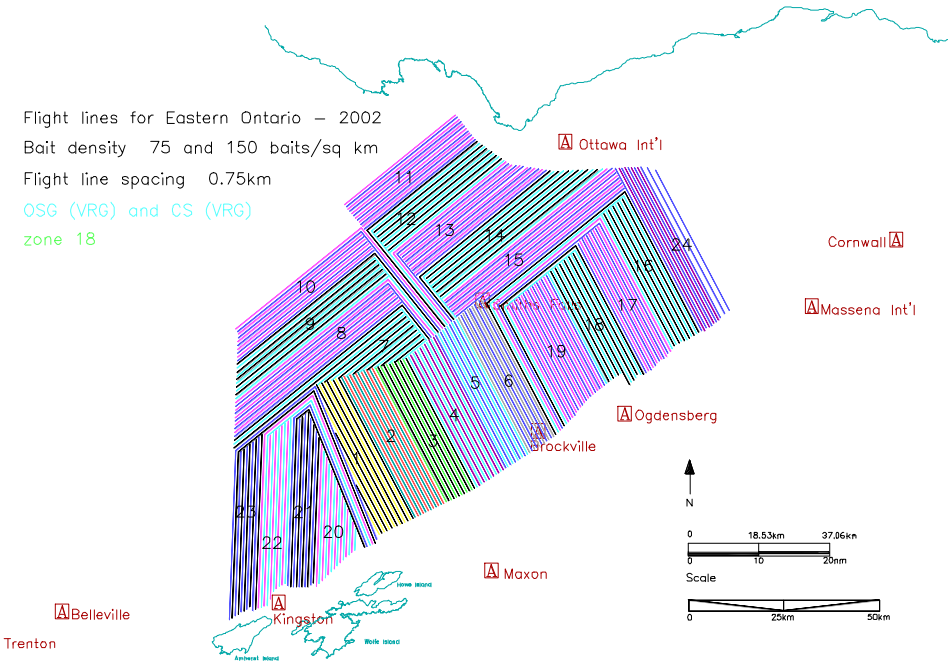

Figure 1. Area baited in eastern Ontario with VRG baits to control the spread of raccoon rabies.

and the planes will get to Morrisville before the ground group arrives anyway.

There was a minor glitch on my flight, one of those tiny details. We were dropping sachet baits on a high density plot. We ran out of baits with two lines to go. It turned out that we were baiting correctly, but the ground crew had not loaded enough baits. Lucy was using numbers from last year, when sachets were loaded in our tubs, 20 bags per tub. What was loaded was boxes, from the manufacturer, which contain 15 bags/box. No one corrected the count, so we got 25% too few baits. There are 270 sachets per bag.

23 August – Friday

Moving day. The last Brockville flight set out early, the rest of the crew packed up the equipment, then set out for Morrisville, VT. By superb organization, two aircraft and four vehicles full of crew arrived in Morrisville between 1200 and 1300. OGC went up for one flight, while OPG received scheduled maintenance, and Andrew Silver converted the bait machine for sachet baits.

24 August – Saturday

A cloudy day, but no rain, and not much wind. Each aircraft did 5 flights, so that broke the back of the 19 to be done. Everything went so smoothly that there was very little to report. The navigators found that the bait rate recommended for solid baits did not drop enough sachets. Corrections were made by individuals, on the go, but these were not available to everyone. A few discrepancies between bags of baits reported and bags of baits dropped. It seems that a few tubs did not have precisely 20 bags, so everything has been recounted, and each crew count "dead" bags when they get back on the ground.

Vermont is the latest retirement

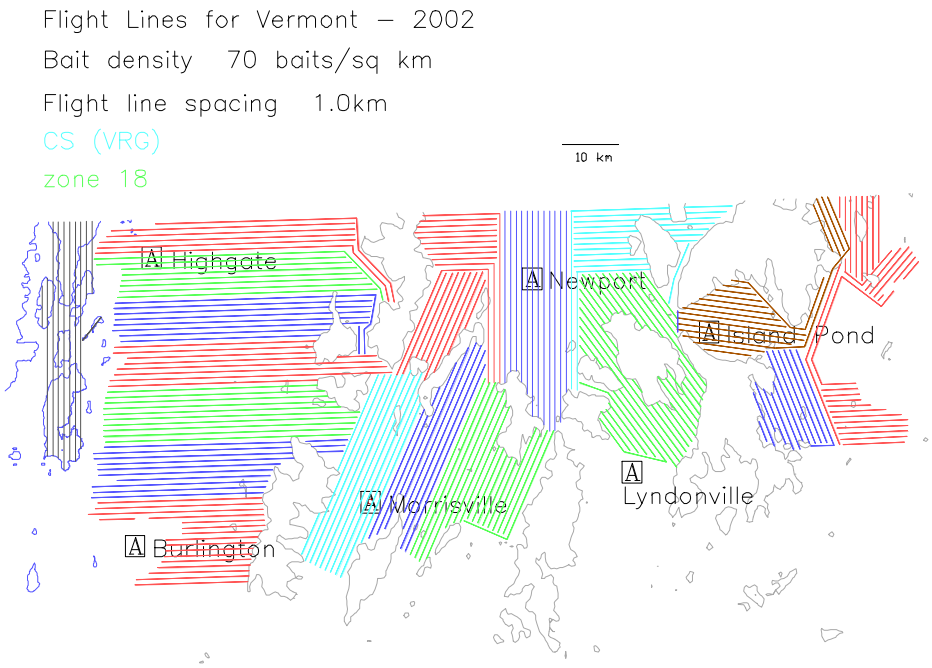

Figure 2. Vermont bait zone August 2002. Baited with VRG baits to help control raccoon rabies.

land. It was amazing how many houses were hidden in the hardwood forests. That generated a lot of off-time, which obscured the fact that the machines were not dropping sachets fast enough. Once the ground crew began to look at the flight sheets, it became clear that we were still not dropping enough baits. To make matters worse, the two aircraft required different correction factors.

25 August - Sunday

Arrived at the airport at 0615. Is this the last day of Vermont baiting? There is one problem - there is an 80% cover of low cloud. It is low enough that the top of Jay Peak, to the north, is hidden. Unfortunately, that was not trivial. I went out in OGC at 0640 for flight 13, right over the airport area. We did 7 lines, watching the clouds get thicker and lower. We were in and out of light rain at the north end of the lines. Finally, we could see rain and mist right to the ground ahead of us, and the rain on the windshield became heavy enough to obscure vision. The pilot wisely turned around while he could still see, and we landed three minutes later. OPG had gone out just behind us, tried three flights, all to the west, and came back without dropping any baits.

When we landed, there was a county sheriff's car to meet us. They had been passed a series of complaints of low-flying aircraft by Burlington airport. Laura Bigler, and Ray Fread, the pilot, explained what we were doing, and what permissions we had. The sheriff's deputy had heard about the bait program, and decided that the whole matter was due to communications failure. The incident ended with smiles and handshakes all around.

It looked as though we might lose most of the day. Then, between 1000 and 1030, the clouds broke up, and the rest of the day was wonderful!

I rode on a flight around Burlington. It pointed out a need for better ground evaluation of baitable areas

around cities. Also, Burlington tower radar advised us that we were about to fly into a military no-fly zone, which was not on our flight map. It is a rifle and machine gun practice range, which is quite often used on weekends! The volunteer riding with us knew all about it. Later, Burlington tower called to say that the range was not active, so we could have overflown it. Again, a critical piece of advance information was missing.

By the end of the day we had the radio aerials down, all the spares etc. packed into the planes, and basically, all ready to head for Ogdensburg.

26 August – Monday

Our next stop was Ogdensburg, New York, where there were almost a million baits to drop. The zone was extended south this year, to cover the Black River valley in Lewis County, and parts of Oswego County. If no plan develops to eliminate raccoon rabies from all of New York state, this section, which constitutes the shortest barrier from Lake Ontario to the Adirondack high country, will become a permanent barrier to keep raccoon rabies away from the St. Lawrence.

The shift to Ogdensburg went so smoothly that we completed four bait flights by 1630. Most of the crew left Morrisville at 0800, while the planes had to wait until 0900, for the airport office to open so they could pay their fuel bills. Four of our baiting crew rode the planes over so the first flight could take off as soon as the radios were set up, and the planes unloaded, etc. When I arrived at 1230, one plane was almost finished. Most of the crew had gone to town to register at the hotel, so I got Mike Pedde to fly two back-to-back flights, and off we went on flight 6, between Ogdensburg and Massena. The lines were perpendicular to the St. Lawrence, starting approximately opposite Morrisburg ON.

The weather continues to be excellent, although the afternoon flight was a bit bumpy.

August 27 - Tuesday

Both planes were off before 0640, per an agreement with Fort Drum. Since baiting over Fort Drum, which is a very active US military base, always requires a lot of advance work, it is really a good thing to get it done early in the north country operation. We have five flights scheduled for OPG, and four for OGC (plus some scheduled maintenance on OGC). We completed all that, and we are ready to take off at 0630 tomorrow.

Tomorrow may be a big day. Perhaps the two computers will finally catch up with us. There have been two last minute complications. The first was simple - to speed delivery, OES proposed to send them without the mounting strips for the plexiglass cover over the touch screen. Andrew said we had to have the covers, so we had to wait 12 hours for the glue to dry. Then a more serious glitch hit hard. The upgrades to the software caused the operating system to crash. So, while the glue dried, the software team worked overtime.

Great credit in Ogdensburg must go to Laurie Maki, the rabies coordinator from the St. Lawrence County Health Department. Laurie is here at the airport before us, and is one of the last to leave. She is coordinating volunteers, so that there are just the right number for each flight. She even phones each one during the day, to

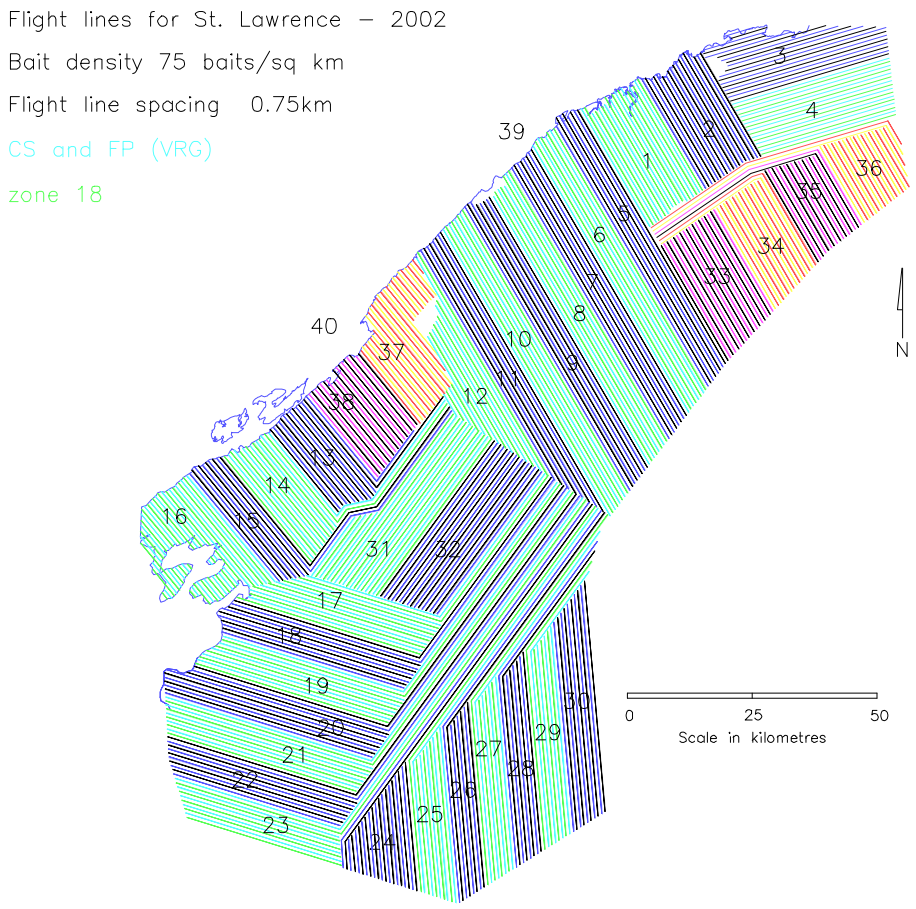

Figure 3. The St. Lawrence region of New York baited with VRG baits for raccoon rabies.

tell them when to get here. This is excellent, as they do not have to wait around for a plane to come back, as she has told them when to expect it. The volunteers are a keen lot, ranging from local pilots to health department personnel, and anyone who is interested. Laurie also has done a great job of scheduling the media. We had two TV crews on today's flights.

August 28 - Wednesday

The 0630 takeoff happened at 0645, as OGC had to wait for a volunteer. I really felt for the pilot who sat in his cockpit, ready to go, for 15 minutes.

August 29 - Thursday

Another very fine day for baiting, high overcast, medium temperatures, little wind. So that part of the day went smoothly.

The new computers arrived, thanks to Roly Tinline, at about 1500. The two units have a new version of the software, incorporating several of the improvements we have requested. Andrew, very wisely, proposed that he put a new unit into OPG, which already had a computer, and do a test flight to make sure the new system works. It did not work. The computer did not crash, but some parts of the software which were working on the older version, no longer worked with the new software. For example, the Course Deviation Indicator (CDI) is supposed to show how far from the flight line the aircraft is. The new version had the CDI working only to the right of the line, and not to the left. The magnetic declination fix caused some problem, and Roly had to do three quick runs to the base computer to change various input files, before the test flight even took off.

I cannot say enough to praise Roly Tinline's and Dave Ball's efforts to get this new system working properly. I could not possibly do what Roly has done, because I am not familiar enough with the navigation geometry in my head. When Roly said that the OES programmers were having trouble with azimuth calculations, I did not understand, until he pointed out that the problem is that 360° is also 0° (both are true north). I understand now what a problem that introduces to programming. Roly has listened to our problems, tested his own ideas, and served as our point person in dealing with the programmers at OES. The system seems to have worked well, although the latest problems are a fine illustration of why people should not write, or alter programs under stress!

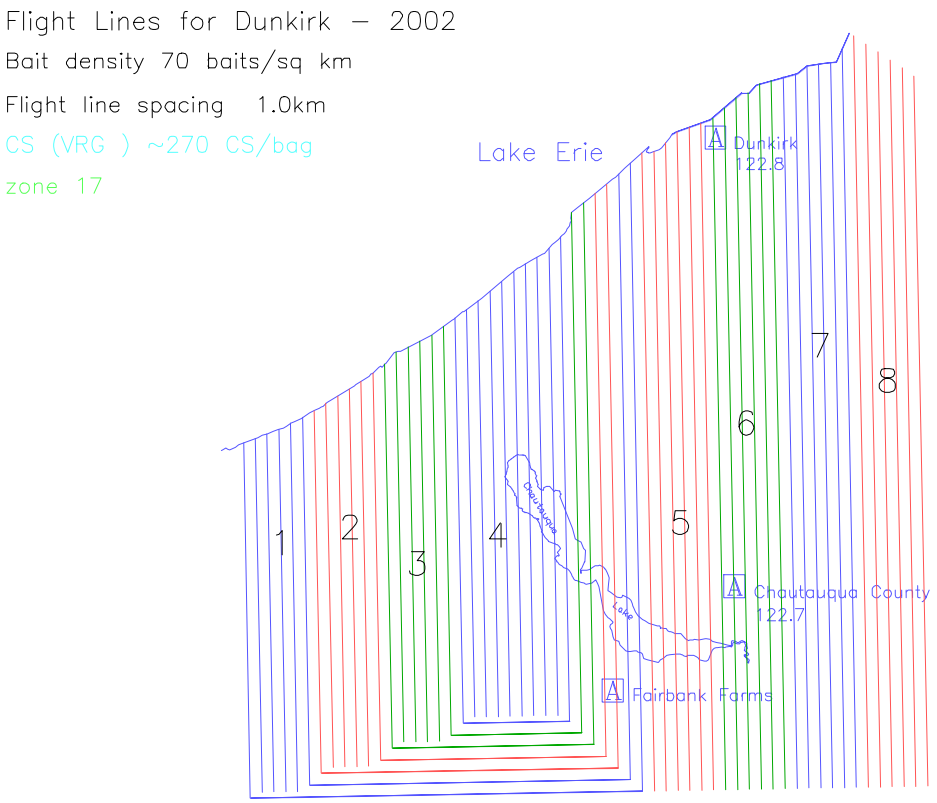

Figure 4. The baited zone around Dunkirk, New York.

After many phone calls between team members, we decided that the correct fix for the OES system was to install the old version of the software for now. That will allow the OES programmers to fix the glitches, and test the fixes.

We also ran into a problem with the sachet dropping. We simply load the sachets in a uniform line on the belt, and they fall off the end of the belt into the chute out of the plane. This means that the drop rates for normal baits, which are dispensed via the fingers on the drum at the end of the belt, no longer apply. Clever navigators quickly calculated a correction to the baits per second settings to get the right number of sachets out, but this knowledge was not transmitted to all navigators. In any case, it took the first day to get a good conversion, and it turned out that this was different for the computer-equipped OPG than for the old bait system in OGC. The result was that there were 4 flights out of 40 that were seriously underbaited, and had to be reflown to add additional baits.

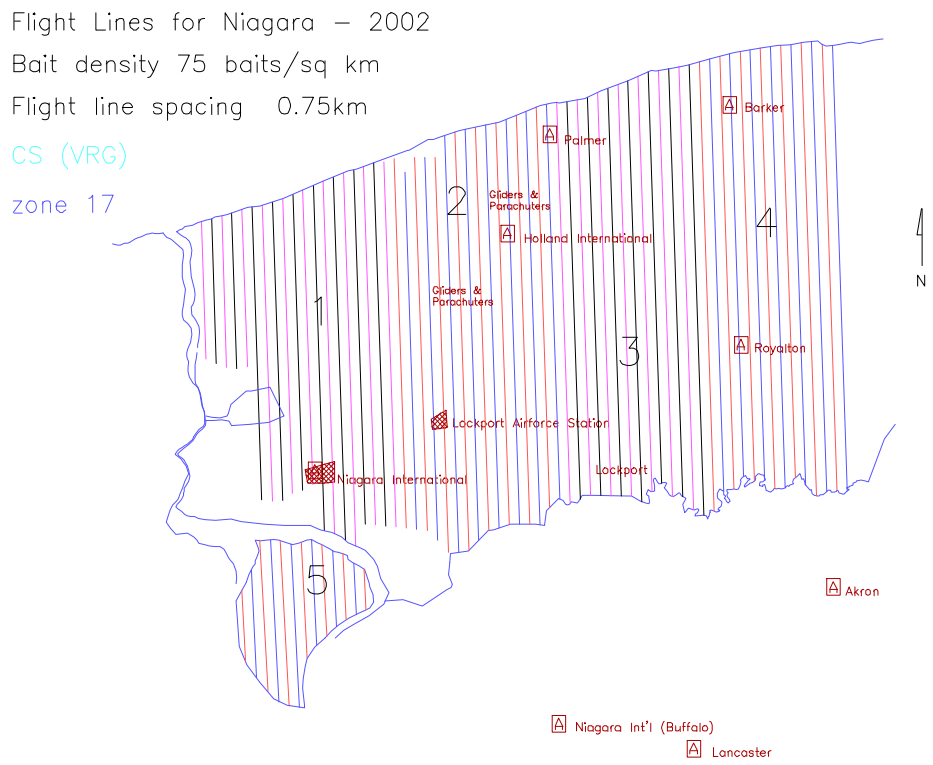

Figure 5. The Niagara region of New York state was also baited with VRG baits for raccoon rabies.

Murphy got us on this one: there have only been two rabid raccoons in the whole area so far this year, and the lightly baited areas were right around both of those locales! We got one supplementary flight done today, but two will have to be tacked into the tight schedule tomorrow.

Saturday - August 31, 2002

This was a day with a tight schedule. We were to do two flights with each aircraft, then move to Niagara Falls, and do one or two flights there. Laura Bigler got all the volunteers organised to turn up at the Niagara Falls airport. Well, then two early flights came right back after takeoff due to the standard fall problem, morning ground fog. So here we are waiting for the fog to burn off, and the whole day has to be rescheduled.

Next stop was the Niagara frontier, with major expansions this year. Since 1995, we have baited Niagara County. This year, the much larger Erie County joined the project. Erie contains Buffalo and its suburbs, and extends south of the mouth of the Niagara River along the Lake Erie shore, to join with the eastern border of Chautauqua County. The western edge of Chautauqua County joins Erie County, Pennsylvania, with the result that there is now a bait zone extending continuously from Lake Ontario to Tennessee! I did not accompany the crew on this leg, so there is no blow-by-blow account. The planes flew from Niagara Falls, then moved to Dunkirk. After they were done at Dunkirk, the planes went to Ohio and West Virginia, while the Ontario RRDU staff came home.

The Appalachian Ridge flying suffered from a lot of heavy rain, and was behind schedule, which would have delayed the Stratford fox bait drop. Then, the ground crew discov-

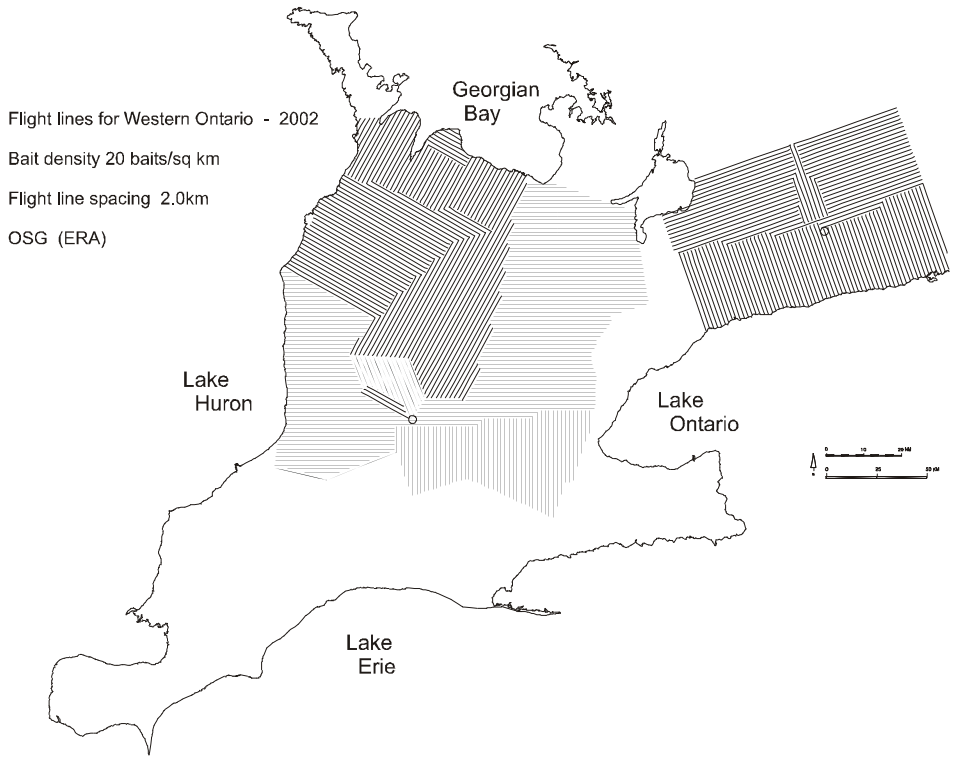

Figure 6. The portions of southwestern Ontario were baited with ERA baits to control the arctic fox strain of rabies.

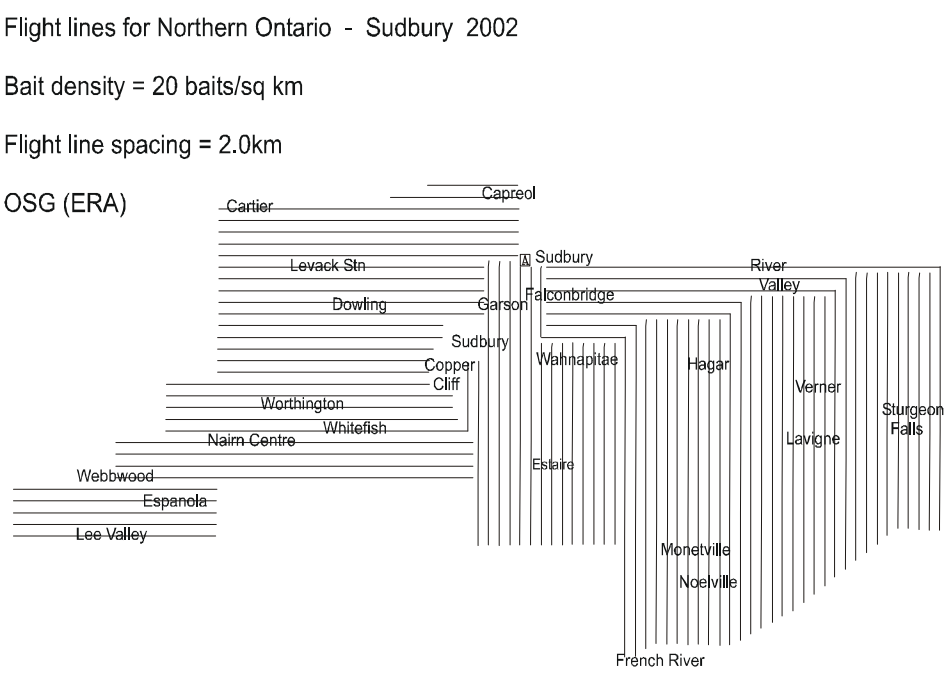

Figure 7. ERA baits were also distributed in the Sudbury area to help control an outbreak of arctic fox strain of rabies.

including two trips by helicopter over green spaces in the city, and hand baiting, especially on the campus of Laurentian University.

This was the biggest bait drop season ever, and it was remarkable how smoothly it went. We really do not want to run two operations, far apart, again. The OES BaitTrac system worked pretty well, considering that it was very new, and events, including the public service strike, had delayed a lot of planned testing.

Thank you to one and all for a lot of hard work!

Charlie MacInnes
RRDU
Peterborough, ON

ered that Merial had not delivered about a million baits. So the planes dropped what they could, and headed for Stratford. They went back to West Virginia in mid-October to finish the job. Rain delayed that effort, too. The planes finally left on a Sunday with three flights unflown. The ground crew said the first day those might have been done was the following Wednesday.

Fox baiting began in Stratford on Sunday 15 September, when the crew arrived, and training and orientation was completed. Oh, yes, the planes came in too. We were only in Stratford until Thursday, then one day in Peterborough, including overnight, and on to Sudbury. I drove to Sudbury the evening of 20 September, and I can confirm that it really was necessary for the planes to stay in Peterborough. There was a magnificent display of lightning, thunder and downpour as I drove the last 50 km, and that kept up until midnight. Weather was fine for the next three days, and we got all the baiting done,

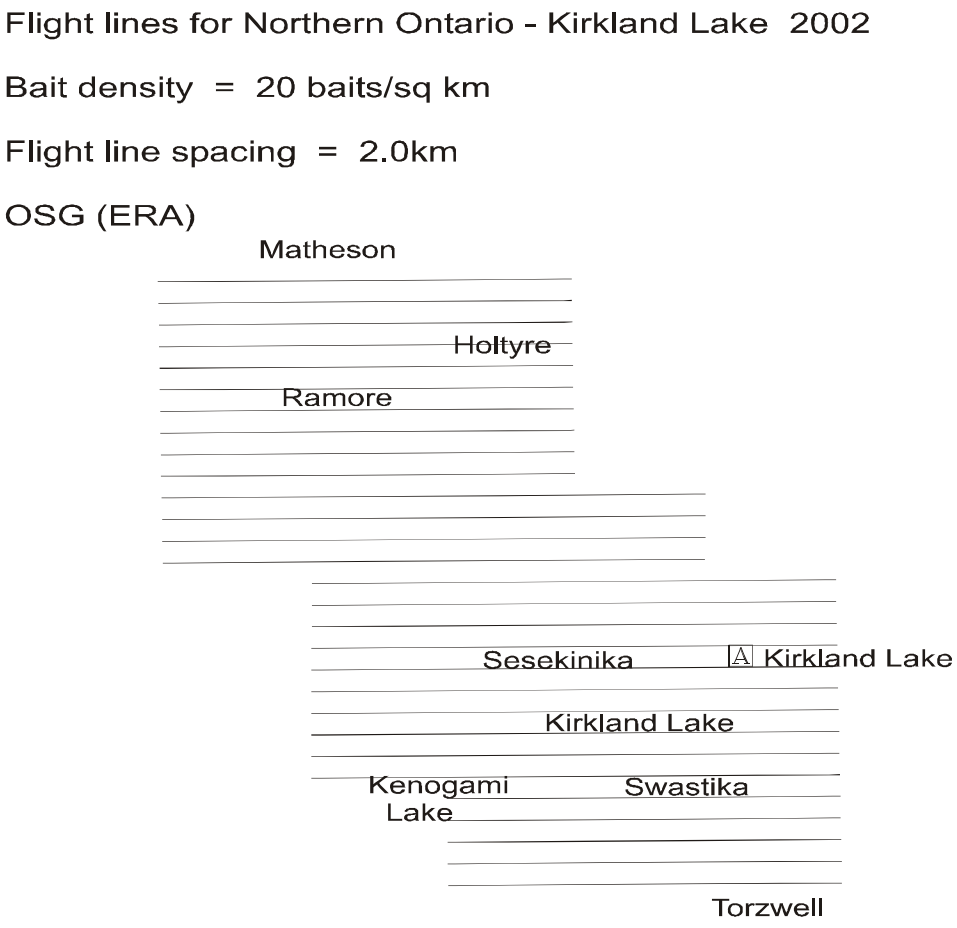

Figure 8. The Kirkland Lake area in northern Ontario was also baited with ERA baits.

The Ontario Baiting System - An Historical Perspective

In the 1970s and 1980s, the Rabies Unit carried out several experimental bait drops. First, we concentrated on getting a bait that was acceptable to foxes. By the mid-80s, we had a bait that worked in the field, and a vaccine and bait combination that worked in the lab, so it was time to put the two together in the wild. That was done in 1985, and the experiments worked, on a limited scale. Steve Smith, the chairman of the Rabies Advisory Committee at the time made a very wise decision, and said that if we did not immediately put this winning formula in the field on a scale large enough to see rabies controlled, the program would probably lose its funding. That led to a hustle to get the means to mass-produce baits, and to find a way to drop them over large landscapes.

In this period of scaling up, Peter Bachmann came to one Rabies Unit meeting with a solemn warning. If we persisted in using Cessna 172's to drop baits, the proposed eastern Ontario project would take 16 airplanes (with appropriate staffing) one month, flying from four different airports. The Unit instructed Peter to find a better way. He contacted the Ontario Provincial Air Service, an arm of our own MNR. The senior Twin Otter pilot brought both a Twin Otter and a Turbo Beaver down to demonstrate their capabilities. We chose the Twin Otter, and part of the team was formed.

Two Twin Otters came to Kingston Airport in late September 1989, to start the first "production" bait drop, and we got to know our Air Service as real people, and the good people they turned out to be. We were soon on a first name basis with Neil Ayers and his pilots, plus another key member of the team, an AME called Berj Sailian. Over the succeeding years, Berj made many contributions, designing better equipment inside the aircraft, and honing the ground organization to optimize flying time.

Since we were flying from Kingston, a local Rabies Unit acquaintance came along, and brought several students as volunteers, so Roly Tinline joined the team. That first year, we tried to navigate the Twin Otters along flight lines hand drawn onto topographic maps. By the end of the first day, it was clear that that would not work. Neil, in his quiet way, suggested that there was a Loran system in the aircraft. Could we provide the latitude and longitude of each point where a planned line changed direction. So Peter spread the maps out on a hangar floor, and worked through the night to get the waypoints off the maps. Oh, waypoint was a new word we rabies biologists had to learn. Professor Tinline watched this, and said that next year, this could all be done on computer.

In 1992 (I think), we tried to help out another pioneer team, led by Dr. Charles Rupprecht, then at the Wistar Institute. Our plan foundered, however, when the key State of New Jersey lawyer was on holiday the wrong week, and we could not get approval for an Ontario aircraft to drop baits in New Jersey. Then, at the 1993 Wildlife Disease Association annual conference, in Guelph, I was approached by Keith Clark and Guy

YEAR	Ontario	Quebec	New York	Texas	Vermont N. Hampshire	Ohio	PA	W.Virginia	Virginia	Tenn.	YEAR TOTAL	Flight Hours
1989	285,010										**285,010**	**128.8**
1990	744,088										**744,088**	**250.0**
1991	674,126										**674,126**	**135.4**
1992	687,001										**687,001**	**144.4**
1993	699,385										**699,385**	**176.3**
1994	1,485,000										**1,485,000**	**241.5**
1995	1,629,092	148,000	159,379	830,000							**2,766,471**	**505.8**
1996	1,280,289		343,507	2,565,253							**4,189,049**	**920.2**
1997	1,230,840	67,075	347,032	2,549,040	71,640						**4,265,627**	**902.6**
1998	965,796	118,404	396,312	2,663,000	114,800	576,720					**4,835,032**	**980.1**
1999	1,009,096	211,392	615,383	2,755,000	186,239	1,215,768					**5,992,878**	**1013.1**
2000	1,600,460	90,720	866,670	1,970,000	195,258	863,280					**5,586,388**	**965.6**
2001	1,500,487	140,220	900,000	1,671,000	234,721	1,013,397		763,689			**6,223,514**	**1076.0**
2002	1,317,225	0	1,281,720	0	332,033	629,930	1,034,927	1,577,758	393,451	111,414	**6,678,458**	**972.9**
TOTAL	**15,107,895**	**775,811**	**4,910,003**	**15,003,293**	**1,134,691**	**4,299,095**	**1,034,927**	**2,341,447**	**393,451**	**111,414**		

Grand Total: 45,112,027 8412.7

Figure 9. Rabies baits served by Ministry of Natural Resources aircraft.

Moore of the Zoonosis group of the Texas Department of Health. They had won an appropriation to combat rabies in coyotes which had crossed the Rio Grande from Mexico into south Texas, and was almost up to San Antonio, a city as large as Toronto. Keith told me he had an ad out for a team leader, and he wanted to know how to harness our technology. I told him to send his project leader up to fly with us for a week, and we would make sure he learned all aspects of our system. So, in the 1994 baiting season Gayne Fearneyhough flew with us. About six weeks after he returned to Texas, he phoned to ask if there was any way we could get the Ontario team to Texas. As a result of a lot of hard work with two groups of lawyers, and a major logistic effort, two Ontario aircraft got to Texas in February 1995, and there began a partnership which lasted through January 2001. Brad Hicks, the computer whiz of the Texas team hit it off with Dave Ball, the programmer of Roly's team at Queens, and new software was developed to keep better track of operations.

Somewhere in the same time period, Don Lein of the diagnostic lab of Cornell University's College of Veterinary Medicine introduced himself, and two assistants, and the Cornell-Ontario team to fight raccoon rabies along the New York – Ontario border came into being. Don, and Laura Bigler, had a broader vision, and carried out a lot of lobbying in Albany and Washington. From those efforts were hatched the Northeast Rabies Control Plan, and an intensifying vision of coordinated efforts among the many states and provinces affected or threatened by raccoon rabies. When raccoon rabies entered Ohio, that state mounted an oral vaccination effort. Their first year, they dropped baits on their own, using state aircraft, chiefly helicopters. Then they asked for help from Ontario. A key part of the Texas operation was the group from USDA-APHIS-Wildlife Services, and the Ohio arm of Wildlife Services joined the effort. Dennis Slate, director of the New Hampshire office of Wildlife Services became national coordinator for the fight against rabies, and applied his considerable expertise to serious efforts to raise funds. And so, the US efforts started as isolated fragments, but came together.

When fox rabies was persisting in Quebec, Ontario asked for permission to drop baits in that province. When raccoon rabies approached the Quebec border in Vermont, Don Lein and Laura Bigler found great interest, and Quebec both contributed to baiting in Vermont, and dropped baits along their side of the border. Well, they asked the Ontario team to do the actual drops, but they have done a fine job of organizing everything, before, during and after the drops.

The Appalachian Ridge project grew out of the State of Ohio oral vaccination program. Appalachian Ridge is led by Wildlife Services, and in 2002 dropped baits in parts of Pennsylvania, Ohio, West Virginia, Virginia and Tennessee. It is due to expand in coming years, and be met by a comparable wall coming up from the Gulf of Mexico along the Alabama-Mississippi border. Florida will start oral vaccination, in the early parts of 2003.

We did not realize, in that hangar at Kingston airport in 1989, where all this might lead. We have learned a lot along the way. We really were not welcome at the Kingston airport, because we had so much going on and so many people involved that we got in the way. From our point of view, the busy airport traffic cost us extra flying. We moved to Irvine Lake in 1991, and learned the virtues of operating from an airport where rabies is the major activity. The Texans taught us a lot more. And this year we implemented a new navigation system, discussed elsewhere in this issue.

One person stands out in all these efforts. Neil Ayers has participated in every major bait drop since the beginning. He is the leader of the pilots, yet many of his contributions are behind the scenes. It was Neil who developed the good working relationship with US air control and customs agencies, so that we have always been able to cross the border on schedule, and be met by inspectors who were already briefed about us. Neil has a great memory for equipment, and his friendly diplomacy makes it easy for him to borrow what is needed. Up front, Neil has done a lot of flying for rabies. Of the 8,412 hours flown, Neil must have flown close to 1,000 of those personally.

The Air Service has always done their best to support the rabies program. It is not easy to juggle priorities on a day-to-day basis, but somehow, they deliver aircraft at the right moment. Their maintenance organization has always been a big help, as has the avionics shop.

The table on the previous page summarizes fourteen years of aerial baiting by Ontario aircraft. This table was prepared by Peter Bachmann, and Neil Ayers, with help from several others. While I have named a few individuals above, many more made real contributions to the overall effort. We have made a lot of good friends during the past 14 years. As a group, we have learned a lot about getting baits out efficiently.

Thank you to everyone who has participated over the 14 years.

Charlie MacInnes
RRDU
Peterborough, ON

BaitTrak – OMNR's New Flight Control System for Baiting Operations

Since 1993, OMNR has dispersed vaccine-ladden baits from the Air Service's Twin Otter aircraft using a combination of a bait dispensing machine and the aircraft's ARNAV navigation system. Flight line "waypoints" were uploaded into the ARNAV's memory by the ground crew and, in flight, the ARNAV display guided the pilot along a flight line between consecutive waypoints. The bait machine (essentially a conveyor belt feeding to a dispenser drum) was controlled by a "navigator" who sat beside the pilot monitoring the aircraft's ground speed displayed on the ARNAV unit and frequently adjusting the bait machine's drum speed to dispense baits at a pre-determined bait density. The navigator also turned the bait machine off and on to ensure that baits were not dropped in the wrong place (built-up areas, lakes, etc.) and recorded bait count statistics for each flight line. The system was quite reliable and helped dispense over 30 million baits, but it had two large drawbacks. It did not record where the plane actually went, and it did not provide useful estimates of the times and places where baits were not dropped. We recognized that, given OMNR's expanding role in the North American wildlife rabies control program, we needed a system that was easier and more cost efficient to use, that monitored the spatial distribution of dispersed baits, that linked seamlessly with our flight planning software (FLPLAN)[1] and that could, as required, be used in other aircraft and with other bait dispensers, for new baits not yet developed.

This fall, OMNR said goodbye to "old faithful" and replaced it with "BaitTrak", a modular computer-based system built by OES (a London, Ontario electronics design and manufacturing firm) to the specifications laid out by the Rabies Research and Development Unit (RRDU) and the GIS Lab at Queen's University. Equipped with this system, Air Services' Twin Otters dropped almost seven millions baits in an area stretching from Tennessee, West Virginia and Ohio eastward into Pennsylvania, Ontario, New York, Vermont, and New Hampshire in a little over two months.

Both the ground and aircrews appreciated BaitTrak's many advantages over the old system. The design specifications drawn up by RRDU, Air Services and Queen's personnel were aimed at fixing the deficiencies and frustrations of the old system, and to do that in the computer hazardous environment of a working aircraft full of messy baits. First, because the BaitTrak computer automatically controlled the bait machine's drum speed as a function of ground speed and automatically stored a count of baits dropped, the navigator's major task was to observe land use along the flight line and turn the bait machine off and on as appropriate. The result was a more accurate and efficient placement of baits. The ARNAV system had limited memory capacity, so often the pilot or navigator had to switch the unit during a flight, because the whole of a flight plan exceeded the allowable number of legs. ARNAV also blanked out the display for 30 seconds before each turn. These drawbacks were eliminated by BaitTrak. Simplifying the system also minimized training time for navigators – an important consideration when control programs in the USA rely on personnel "borrowed" from other duties for short periods. It also provided an added safety bonus. Navigators were able to spend more time helping the pilot spot potential hazards such as telecommunications towers.

Second, the BaitTrak system allowed flight databases prepared by FLPLAN to be uploaded directly via a flash card to the BaitTrak computer. (A flash card is an easily plugged in or unplugged solid state memory device with no moving parts, readily available at stores such as Business Depot. Many digital cameras store their photos on flash cards.) In the old system, the flight databases were formatted specifically for the ARNAV system and then uploaded via a laptop with proprietary ARNAV software and through a specially installed serial port in the cockpit. Furthermore, the ARNAV system was designed for a small number of point to point flights and not the multiple flight/multiple flight line environment of a baiting operation. This limited the number of waypoints we could upload which, in practice, constrained us uploading one day's flights at a time. In contrast, the flash card for the BaitTrak system can hold all the flights for an entire control programme. In addition to eliminating daily uploads, storing all potential flight plans on-board gave the air crew a wide selection of alternate flight plans when local weather conditions forced the crew to abort the current flight plan.

Third, BaitTrak logged position, time, bait count, bait machine status and GPS conditions every two seconds and stored this information on a flash card. In the old system, the

navigator logged bait counts by flight line and on paper. Continuous logging and digital storage had two benefits. In the case of an aborted flight (or flight line), BaitTrak allowed the aircraft to return easily to the last location baited and resume the aborted flight. More important, the flash card with digital log was easily transferred to the ground operations computer and the flight "replayed" to compare planned and achieved density to assess the accuracy of the bait drop. This careful monitoring reduced the number of baits used because it controlled the tendency to over bait on the "better to be safe than sorry" principle.

The final operational advantage of the BaitTrak system was its simplicity and accuracy. The pilot display and touch screen mounted on the yoke between the pilot and navigator was easy to use (see the note below on LCD visibility). Uploading and downloading were as simple as exchanging a flash card. The BaitTrak computer (located at the back of the aircraft) had an intuitive touch screen display that allowed flight parameters (bait density, flight line spacing, bait type characteristics, etc.) to be changed at will and override parameter specifications input from FLPLAN. Total bait counts from the log were always very close to the counts obtained by compared baits loaded at the start of a flight with baits left at the end of the flight. A common problem with the ARNAV based system was that it needed frequent calibration to ensure bait counts were accurate. The units are all rugged, and were trouble-free in the first year of operation. Dust is a major potential problem in the aircraft, especially when fishmeal-polymer baits are dropped. OES evaluated all these problems, and produced units designed to withstand a difficult operating environment.

Our initial trials did have some problems with the BaitTrack software and the visibility of the pilot display. The software glitches were, however, quickly discovered and eliminated and had very little impact on the campaign beyond the first week of operation. The visibility of the pilot display deteriorated markedly in bright sunshine making it very hard to follow the flight line accurately. Poor visibility in bright light is a major concern with LCD displays. Makeshift glare shields did not help. The problem was eventually resolved using a slave Course Deviation Indicator (CDI) in addition to the LCD touch screen. The slave unit was mounted on the instrument panel directly in front of the pilot and used high intensity lighting to display course deviations. Despite the initial visibility problems, the flights during the first weeks of operation were accurate – a testament to the skill of the Air Services' pilots.

For future operations, a key aspect of the BaitTrak system is its modular design (Figure 1). Each module is stand-alone and communicates with the others using well-defined communication protocols. In this way, as long as a module observes the communication protocol, it can be changed or upgraded in the future independently of the other modules. Consider the link to the bait machine, for example. In essence, the only information needed by a bait machine is a signal from the BaitTrak computer telling it how fast to rotate/move/dispense to achieve a target bait density. BaitTrak sends such a signal to a Programmable Logic Unit (PLC) that converts the signal into appropriate operating instructions for the bait machine. Thus, if the bait machine is replaced or redesigned, the PLC can be programmed to accommodate those changes without affecting the rest of the system. The same thinking holds true for other modules likely to change in future configurations. The Baitrak system has its own GPS card that can be updated if required. As well, since it is independent of the Twin Otter's ARNAV GPS, BaitTrak can be installed in other aircraft. Interestingly, the BaitTrak GPS and the ARNAV GPS share the same antennae via a splitter saving the expense of another antennae. This could be done in other aircraft or, if necessary, another antennae could be installed.

BaitTrak's central module is the on-board computer (about the size of a small hard cover briefcase) currently mounted at the back of the aircraft. In keeping with the modular design this unit could be mounted in any other aircraft and linked to other bait machines. It will be moved to the cockpit of MNR aircraft during this winter. This computer handles six tasks. First, it inputs and stores the flight planning ACCESS database prepared in FLPLAN for a particular campaign. This input (and subsequent output) is accomplished with a flash card. The FLPLAN database provides all the necessary flight parameters: bait type, flight line spacing, target bait density, crew assignments and flight line waypoints. Second, the computer uses the GPS time and location signal from the GPS module to calculate the aircraft's ground speed and flight path. Third, the computer uses the ground speed, target density and flight line spacing information to calculate the "speed" information sent to the PLC to control the bait machine. It also combines the flight path information with the waypoints from FLPLAN database to calculate the navigation information sent to the "Pilot Display" touch screen and the slave CDI mounted in the cockpit. Fourth, the computer monitors the status of the off/on switch on the "Navigator's pendant" and looks for requests from the "Pilot Display" touch screen to

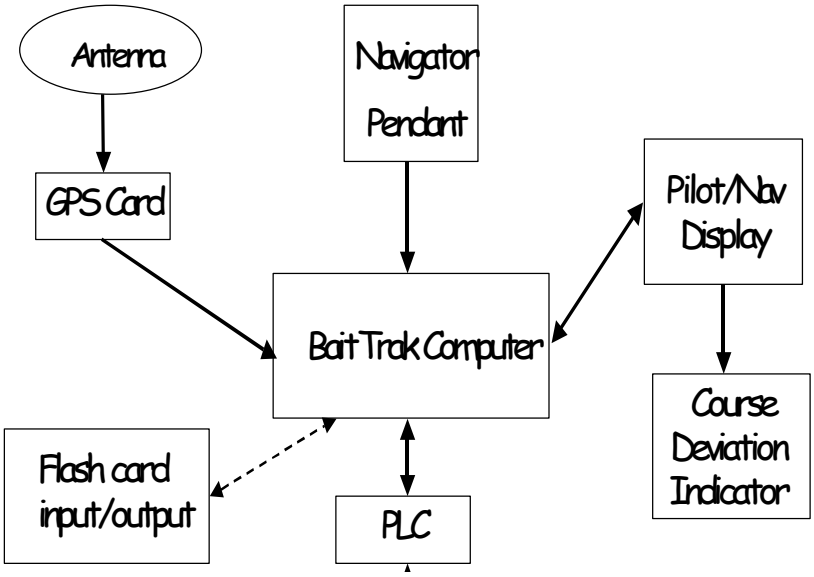

Figure 10. The BaitTrak system's modular design. Each component can be replaced with minimal disruption to the remainder of the system. This allows the system to be used in many different aircraft and with other bait machines. The end result is flexibility and user convenience.

change the nature of the display, abort flights or change flights. Fifth, the computer records the time and location of baits dropped in memory and the status of the bait machinery (on/off/pause/abort). Finally, the computer's own touch screen allows the user to control all flight parameters and the input/output process.

In sum, the BaitTrak system has proved itself as an excellent addition to the air baiting operation. Indeed, for next year, we only want some minor modifications to the information displays in the cockpit. Our major development efforts will concentrate on integrating the flight information collected by BaitTrak with our flight planning software (FLPLAN) and, in doing so, increase the analytical and management capabilities of that software. At the beginning of the last fall's campaign, we agreed with the various bait provincial and state program coordinators to concentrate on testing the BaitTrak system this fall. We also agreed to meet after the fall campaign to review ground and air operations and suggest software enhancements in FLPLAN to increase efficiency. That work is in progress.

Finally, warmest thanks from the users to the team at OES. This team listened to what we wanted, and did their best. When we experienced glitches, they worked long hours to make quick changes. Equal thanks are due to Andrew Silver and Kim Bennett of RRDU, and to Marc Benoit and several others in the Air Service, who worked hard to get the machines properly installed, modified parts to correct problems, and advised the OES team. And finally, thanks to the professionalism of our pilots who put a lot of effort into developing ways to make the system work better for everyone.

Footnotes

1. FLPLAN is OMNR's flight planning and management software written by David Ball from the Queen's GIS Lab. Starting with a base map of the study area (in AutoCAD) showing roads, towns, hazards, etc., the user draws potential flight lines. Using FLPLAN's data entry, selection and drawing tools, the user enters flight parameters (bait density, flight line spacing, airport information, on/off percentages) and builds flights from the AutoCAD flight lines. FLPLAN helps the user design flights by keeping a running track of flight distance and bait requirements. The completed design is stored in database tables that provide the set of waypoints, ranges and bearings for a given flight along with the total required bait load and estimated bait requirements along each flight line. Those database tables are written to a flash card and transferred to the BaitTrak computer which uses the information to provide in-flight guidance for the pilot and navigator. FLPLAN also builds tables with pilot and crew information for each flight to assist ground operations management as necessary. All FLPLAN data tables are stored in ACCESS. BaitTrak accepts these tables as input and outputs flight information in ACCESS format so that post flight information can be compared against planned flights. This year, David Ball wrote a special purpose program to plot actual versus planned flights using the input and output tables. Our goal for the coming field season is to make the integration of pre- and post-flight information transparent to the user of FLPLAN and develop an easy to use "analytic" interface to give the user more choices for post flight and crew management analysis.

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Animal Rabies Report: July to September 2002

Animal Type	Fox			Raccoon			Skunk			Other Wildlife			Bat			Dog			Cat			Livestock			Totals		
County or Region	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		02	01		02	01		02	01		02	01		02	01		02	01		02	01		02	01		02	01
Eastern																											
Stormont, Dundas & Glengarry													2	2	1										2	2	1
Prescott																									0	0	0
Russell																									0	0	0
Ottawa-Carleton													4	5	5										4	5	5
Renfrew													1	2	1										1	2	1
Lanark													2	2											2	2	0
Leeds and Grenville				1	10	39			2						6										1	10	47
Frontenac													2	3	3										2	3	3
Lennox & Addington															3										0	0	3
Central																											
Hastings																									0	0	0
Prince Edward															1										0	0	1
Northumberland													1	1											1	1	0
Victoria															1										0	0	1
Haliburton																									0	0	0
Peterborough									4				1	2	2										1	2	6
Durham													3	5	1										3	5	1
York Region													3	3	1										3	3	1
Toronto													6	7											6	7	0
Simcoe									1				1	2	3	1	1							1	2	3	5

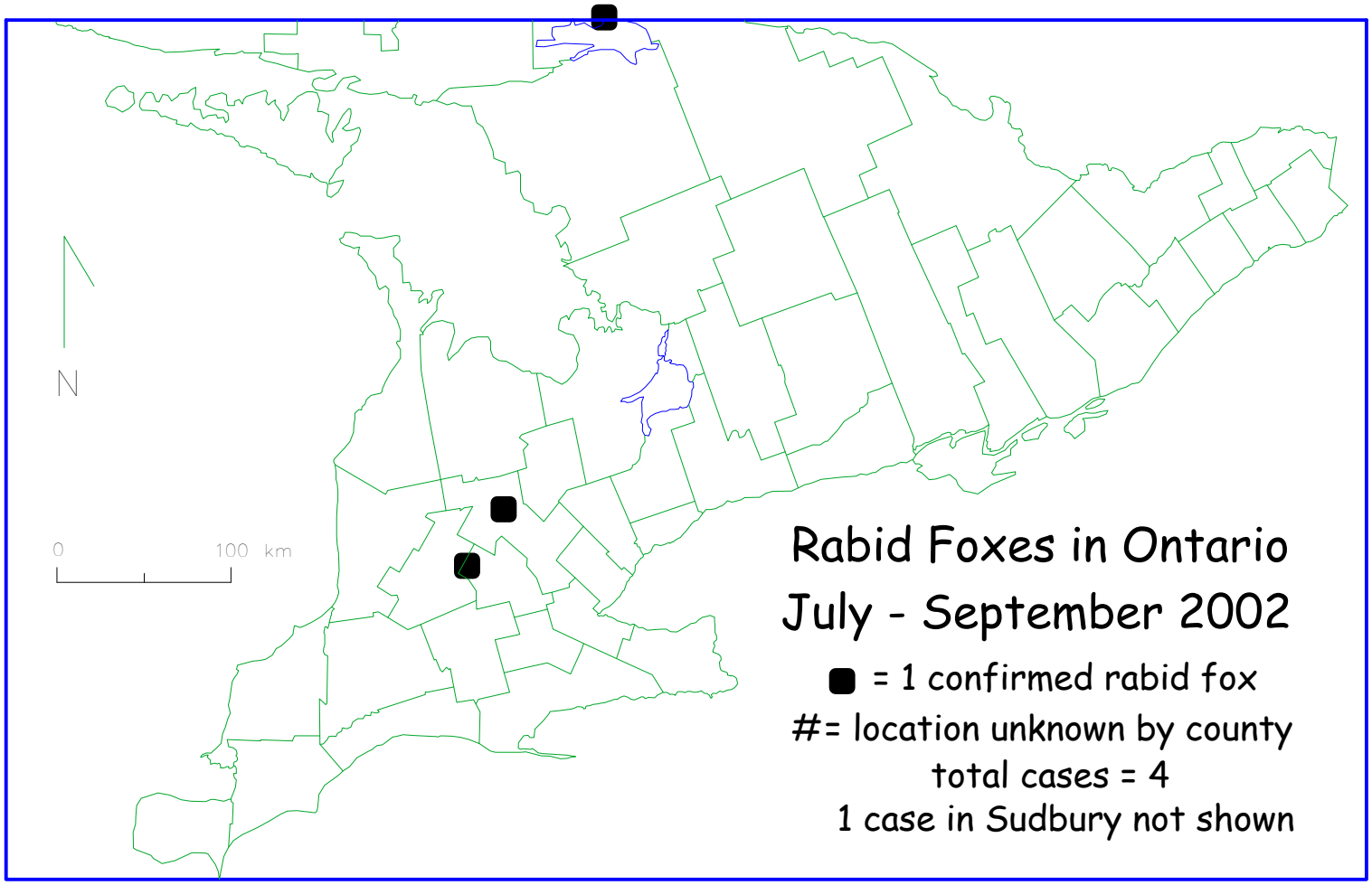
Animal Rabies Report: July to September 2002

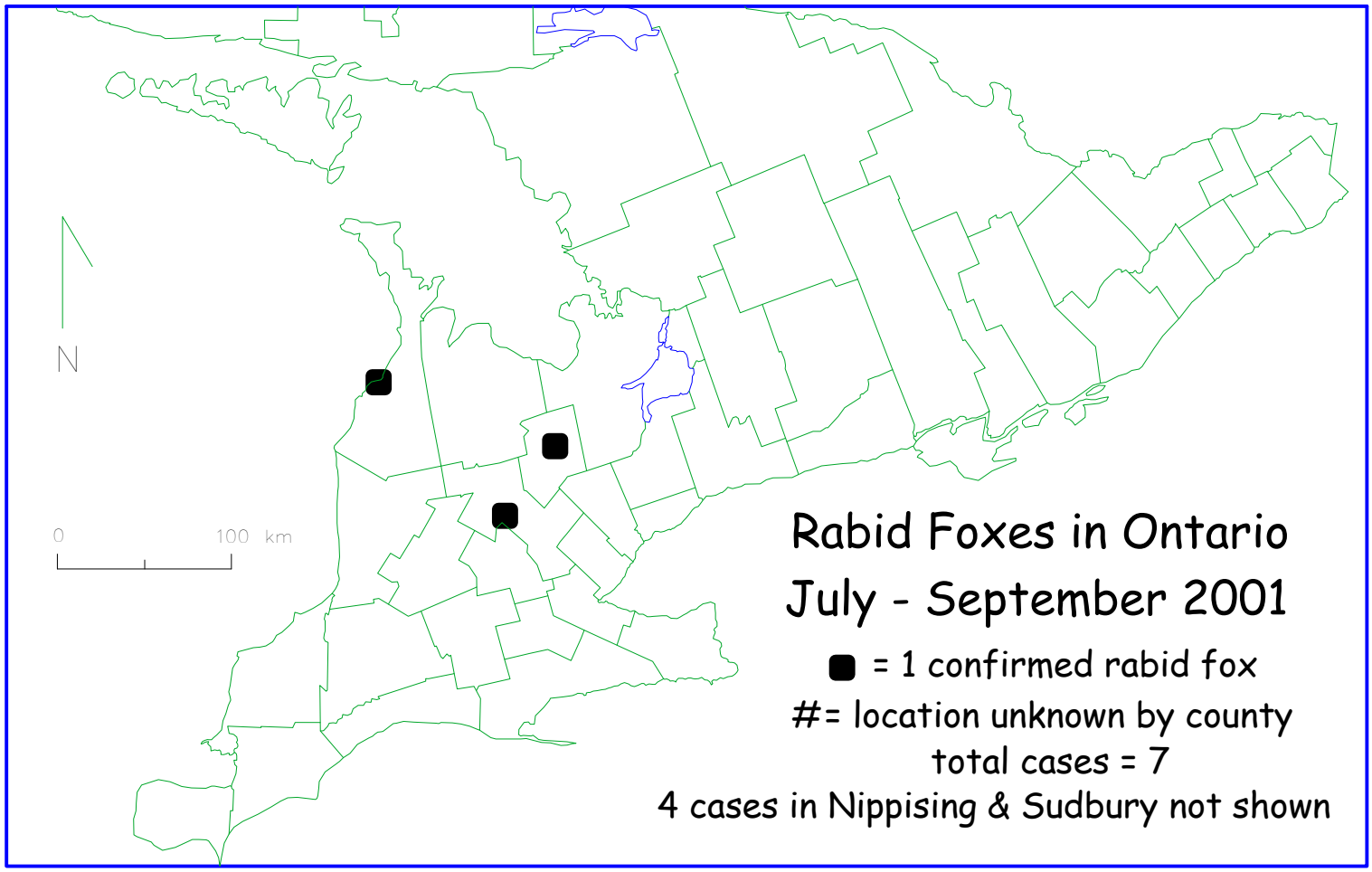
Animal Type	Fox			Raccoon			Skunk			Other Wildlife			Bat			Dog			Cat			Livestock			Totals		
County or Region	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		02	01		02	01		02	01		02	01		02	01		02	01		02	01		02	01		02	01
Western																											
Peel													3	3											3	3	0
Halton													1	1											1	1	0
Dufferin			1					2	1													1	1	8	1	3	10
Wellington	1	1	1					6	5					2	1			1		1			1	1	1	11	9
Waterloo	1	1					1	2	3															1	2	3	4
Perth									3											1					0	1	3
Grey							6	10	6							1	1							2	7	11	8
Bruce			1				2	12	5															1	2	12	7
Huron								4	3																0	4	3
Southern																											
Wentworth															1										0	0	1
Haldimand-Norfolk													2	2	1										2	2	1
Brant													1	1											1	1	0
Niagara													4	4	10										4	4	10
Elgin													1	2	4										1	2	4
Oxford													2	2											2	2	0
Middlesex													7	7	5				1	1		1	1		9	9	5
Lambton													2	2	2										2	2	2
Kent													1	1	1										1	1	1
Essex													1	1											1	1	0

Animal Rabies Report: July to September 2002

Animal Type	Fox			Raccoon			Skunk			Other Wildlife			Bat			Dog			Cat			Livestock			Totals		
County or Region	#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative		#	Cumulative	
		02	**01**		**02**	**01**		**02**	**01**		**02**	**01**		**02**	**01**		**02**	**01**		**02**	**01**		**02**	**01**		**02**	**01**
Northern																											
Muskoka																									0	0	0
Parry Sound																									0	0	0
Nipissing	1	2	3															1						1	1	2	5
Sudbury	1	33	14		2				1		2						2		1	1	1		3		2	43	16
Cochrane		1	2									2						1						3	0	1	8
Timiskaming		3										1											1		0	4	1
Algoma																							1		0	1	0
Thunder Bay																									0	0	0
Rainy River																									0	0	0
Kenora																									0	0	0
Regional Totals																											
Eastern				1	10	39			2				11	14	19										**12**	**24**	**60**
Central									5				15	20	9	1	1							1	**16**	**21**	**15**
Western	2	2	3				9	36	26				4	6	1	1	1	1		2		1	2	13	**17**	**49**	**44**
Southern													21	22	24				1	1		1	1		**23**	**24**	**24**
Northern	2	39	19		2				1		2	3					2	2	1	1	1		5	4	**3**	**51**	**30**
TOTALS	**4**	**41**	**22**	**1**	**12**	**39**	**9**	**36**	**34**	**0**	**2**	**3**	**51**	**62**	**53**	**2**	**4**	**3**	**2**	**4**	**1**	**2**	**8**	**18**	**71**	**169**	**173**

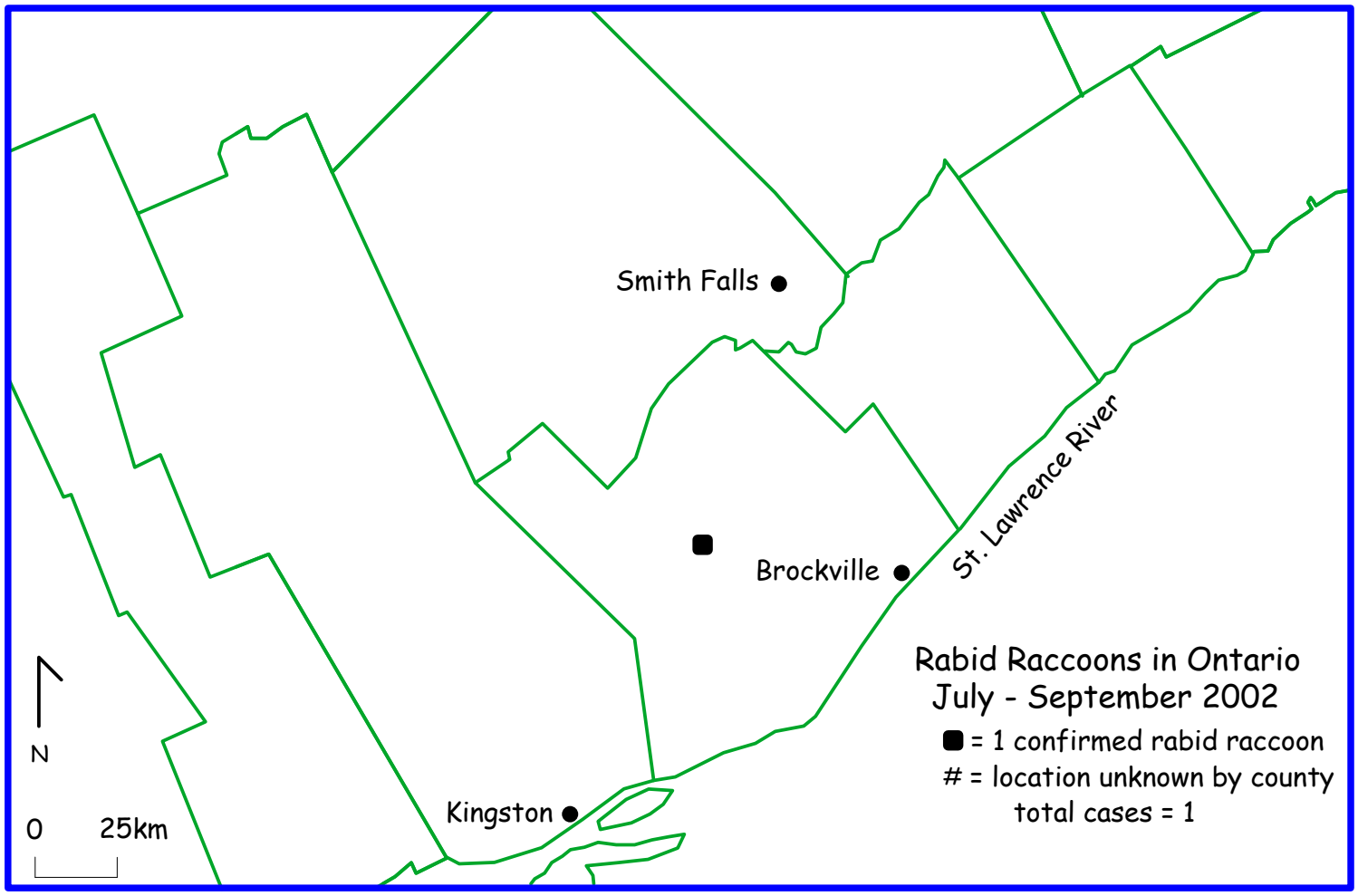
Notes for this quarter: One bat in Niagara was a silver-haired bat. All other bats were big brown bats.
The livestock was a bovine in Dufferin and a porcine in Middlesex.

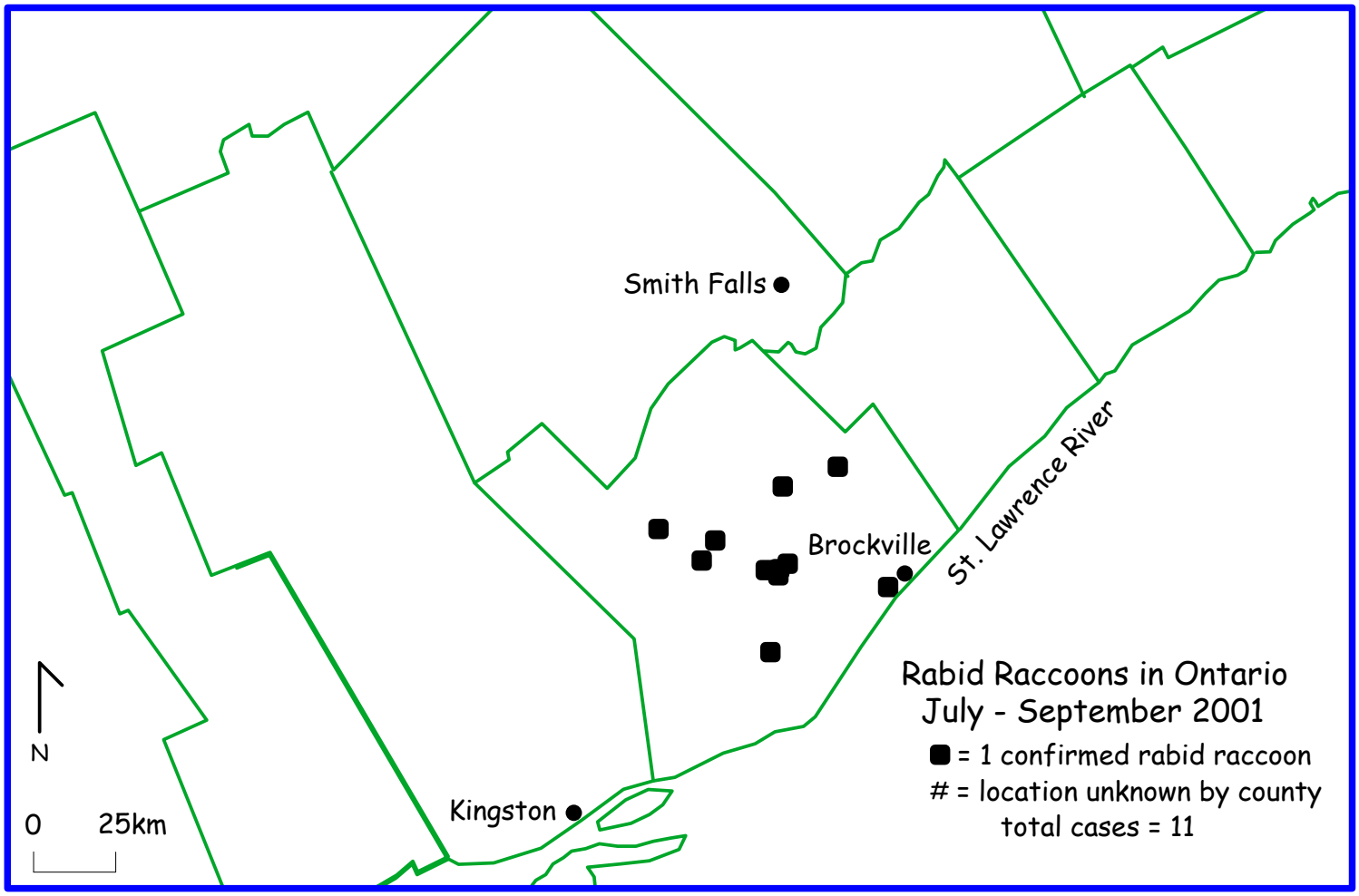




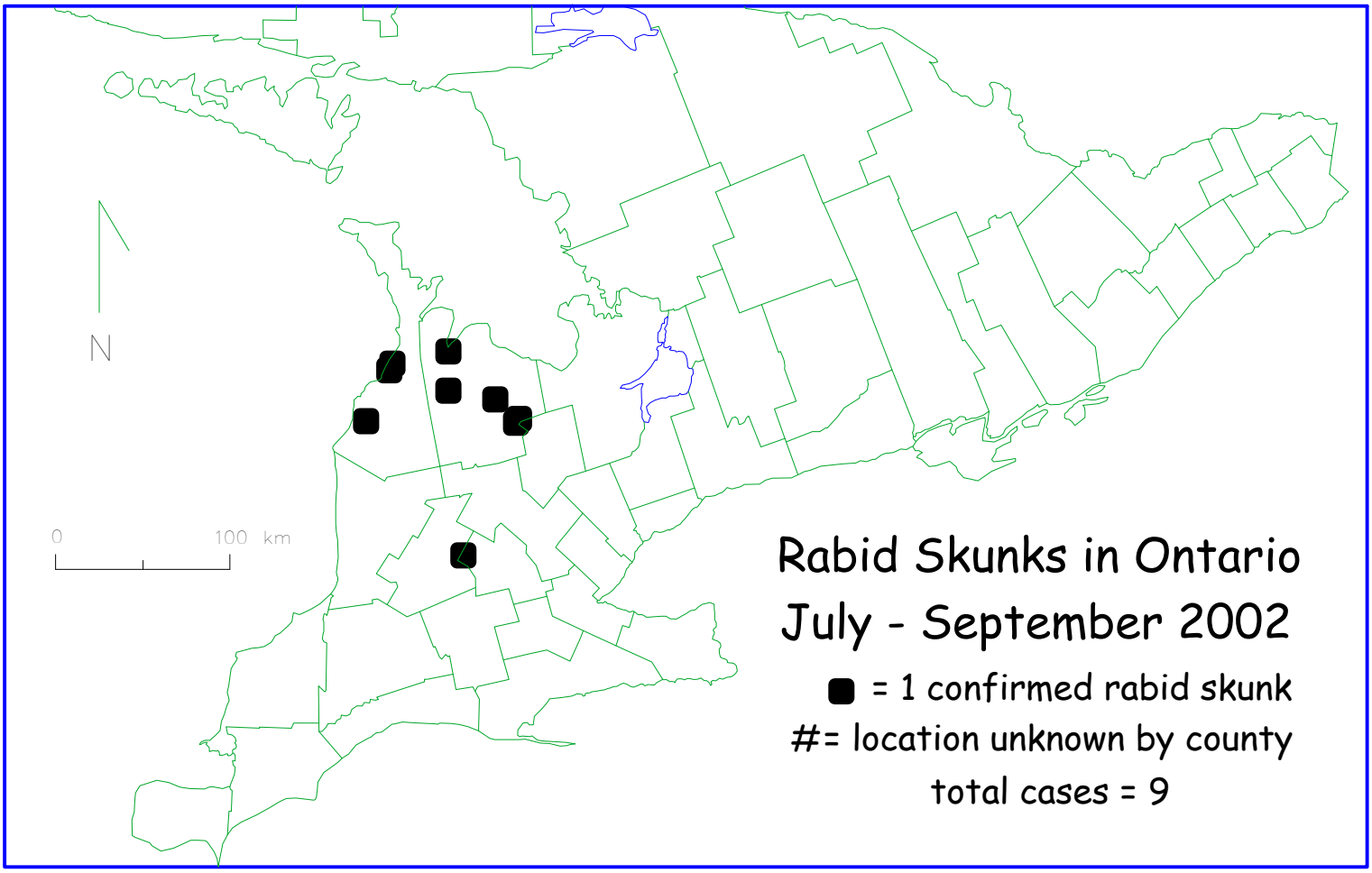
GIS Lab, Queen's University

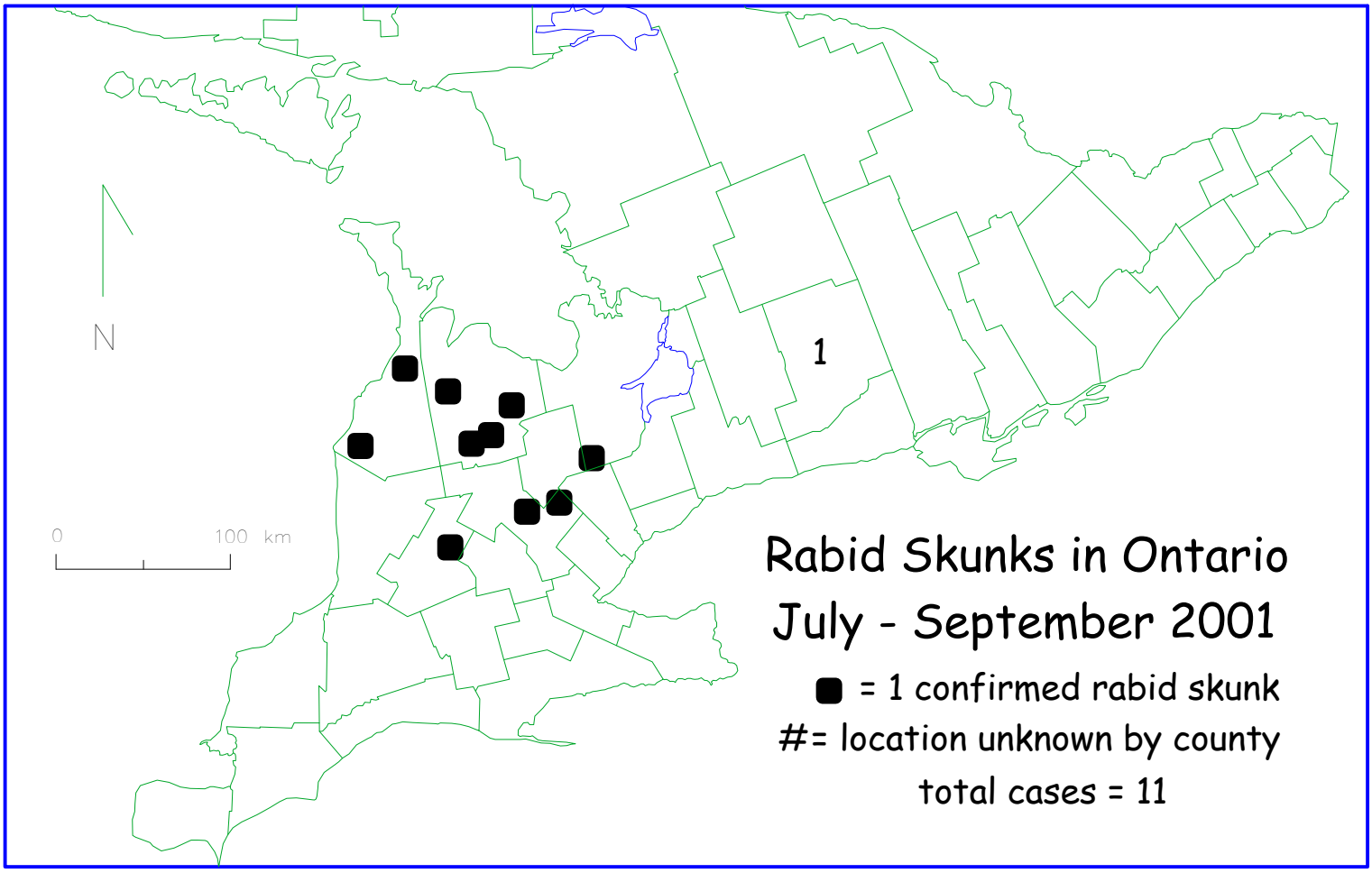
Data Source: Ontario Laboratory-Fallowfield (CFIA)





GIS Lab, Queen's University
Data Source: Ontario Laboratory-Fallowfield (CFIA)





GIS Lab, Queen's University
Data Source: Ontario Laboratory-Fallowfield (CFIA)