North Bay Parry Sound District Health Unit

2007 West Nile Virus
Summary Surveillance Report
North Bay Parry Sound District Health Unit

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2007 West Nile Virus Summary Surveillance Report

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TABLE OF CONTENTS

LIST OF FIGURES and TABLES

EXECUTIVE SUMMARY

West Nile Virus (WNV) is a mosquito-borne "flavivirus" that first made its appearance in North America in 1999. It is a human, horse and bird neuropathogen that can result in encephalitis, meningitis and sometimes lead to death.

Surveillance information from birds, mosquitoes and horses provides an early warning of risk to human health and helps to guide control and education interventions. WNV has been detected in the North Bay Parry Sound District Health Unit (NBPSDHU) area since 2002.

In 2007, NBPSDHU conducted surveillance activities in the district involving dead birds, adult mosquitoes, larval mosquitoes, horses and humans. The data collected will help inform the development of the WNV Prevention and Control Plan for 2008.

Dead Bird Surveillance

By the end of the 2007 season, 110 dead crows, ravens and blue jays had been reported to the NBPSDHU. One (1) of the 35 crows, ravens and blue jays submitted for testing were found to be positive for WNV. In 2006, 7 of 44 birds submitted tested positive and in 2005, 2 of 43 birds submitted tested positive for WNV.

In 2007, the only WNV-positive bird in the NBPSDHU area was reported in the Town of Mattawa on August 28th.

Adult Mosquito Surveillance

In 2007, adult mosquito trapping started June 5 (week 23) and ended October 11 (week 41). One hundred thirty-five (135) traps were sent for testing, 76,424 mosquitoes were trapped, 10,109 females were speciated, 342 pools were viral tested and no mosquitoes were positive for WNV. Thirty (30) different species were identified in 2007 compared to 25 in both 2006 and 2005. No mosquitoes have ever tested positive for WNV in the North Bay Parry Sound District, the former North Bay and District or the former Muskoka Parry Sound District. According to the MOHLTC, the main amplification vectors in Ontario are *Culex (Cx.) pipiens* and *Culex* restuans. The main bridge vector species is *Aedes vexans vexans/Aedes vexans nipponi*.[9] Bridge vector mosquitoes accounted for 78% of the adult mosquitoes trapped in North Bay Parry Sound District. This compares to 61% in 2006 and 77% in 2005. Amplification vector mosquitoes accounted for only 4% compared to 6% in 2006 and 14% in 2005.

Larval Mosquito Surveillance

Larval surveillance provides crucial information to mosquito control interventions. In 2007, a total of 27 fixed and 138 temporary larval sampling sites were surveyed in the NBPSDHU area. A permanent fixed site was a site that was sampled 5 or more times.

Temporary sites were sampled less than 5 times. The presence of mosquito larvae was identified in 34% (47 of 138 temporary sites) of the potential breeding sites (catch basins, roadside ditches etc.). Larvae were captured in 78% (21 of 27 fixed sites) of the fixed larval sampling sites. A total of 2780 larvae were identified. Of the larvae that were speciated, 48% (79% in 2006 and 73% in 2005) were from the genus *Cx. (amplification vector)* whereas 30% (7% in 2006 and 11% in 2005) represented bridge vector mosquitoes. It is interesting to note that bridge vector, *Coquillettidia perturbans*, was the most collected adult mosquito species in the North Bay Parry Sound District Health Unit area but was not found in the larval stage. This is most likely due to their larval growth patterns, as the larvae tend to attach themselves to stems and roots of vegetation thereby avoiding larval surveillance.

Equine Surveillance

There were no equine cases of WNV in Ontario in 2007. In 2006, one horse tested positive in the Town of Rutherglen on August 25. This horse was not vaccinated for WNV. Provincially in 2006, 3 horses tested positive for WNV, one from the Waterloo region and one from the Niagara region. In 2005, there were no WNV positive horses reported to the NBPSDHU area, although five tested positive in the Province. In 2004, three horses in the former NBDHU area tested positive for WNV. Two of the horses were located in the Town of Corbeil and 1 horse was located in Town of Lavigne. One horse tested positive in 2004 in the former MPSHU area.

Human Case Surveillance

Mosquito-borne acquisition in Canada of WNV disease in humans occurred for the first time in 2002. In 2007, 15 residents of Ontario had laboratory confirmed WNV. This compares to 42 in 2006, 101 in 2005, 14 in 2004, 89 in 2003 and 394 in 2002. There were no human cases of WNV in 2007 however, for the first time in 2006, the NBPSDHU area had 2 laboratory confirmed human cases of WNV. One case occurred in the City of North Bay and the other occurred in the Township of McKellar. In 2004, in the former MPSHU area one human case was reported in Burk's Falls area. Identification of WNV in humans underscores the importance of active, hospital-based surveillance programs starting in July through October, as well as the need to consider WNV as a possible diagnosis when clinicians encounter patients with encephalitis, meningitis, acute flaccid paralysis or non-specific fevers occurring throughout this time period.

Conclusion

In the NBPSDHU area in 2007, the first indication of WNV activity was an infected bird collected in the Town of Mattawa August 28th. In 2006, for the first time ever in the NBPSDHU area, two confirmed human cases of WNV were reported. One human case occurred in the City of North Bay, which may be travel related, and the other human case occurred in the Township of McKellar. Adult mosquito surveillance and identification demonstrated the presence of amplification vector and bridge vector species, 4% and 78%, respectively. Larval speciation demonstrated the presence of amplification vector and bridge vector species, 48% and 30%, respectively. No mosquito pools were found to

be positive for WNV. Surveillance data is important in the assessment of risk for disease transmission to humans and the need to implement mosquito control plans. Therefore, in 2008, we will continue the surveillance program, as well as continued education about source reduction measures, elimination of standing water and personal protection measures for the public.

This report describes findings from the West Nile Virus surveillance activities conducted in the NBPSDHU area in 2007 and compares these data to data collected involving dead birds, adult mosquitoes, larval mosquitoes, horses and humans since the merger in 2005.

SECTION 1.0

INTRODUCTION

West Nile virus (WNV) is a mosquito-borne "flavivirus" that first made its appearance in North America in 1999. It is a human, horse and bird neuropathogen that can result in encephalitis, meningitis and even death.[1]

"West Nile" received the name because it was first isolated and identified in an infected person from the West Nile District of Uganda in 1937.[2] There have since been reported outbreaks of WNV in Africa, Asia, the Middle East and Europe. There was no known transmission of WNV in the Western Hemisphere until reports of humans with the mosquito-acquired infection occurred in New York City in 1999.

There are several theories as to how the virus arrived in North America. One theory suggests that the virus arrived in an infected migratory or imported bird; another suggests that mosquitoes infected with the virus were accidentally transported to North America with other cargo.[3]

In 2001, WNV was first detected in Canada in birds and mosquitoes collected in Ontario. By 2007, Canadian health authorities documented WNV activity in six provinces: Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan and Alberta. Meanwhile, the 2002 WNV epidemic in the United States saw activity reported in 44 states and the District of Columbia. The first cases in California, in a human with no travel history, and Washington, in a horse, meant that the sweep of the epidemic across the North American continent was complete after three years of being here.[4]

In 2007, 2353 probable and confirmed human cases were identified in Canada. This is compared to 151 probable and confirmed human cases in 2006 and 225 cases in 2005. Saskatchewan, Manitoba and Alberta accounted for 98.5% (2318 cases) of all Canadian human WNV cases (Appendix C). The United States had 3576 human cases.[5]

The WNV Transmission Cycle

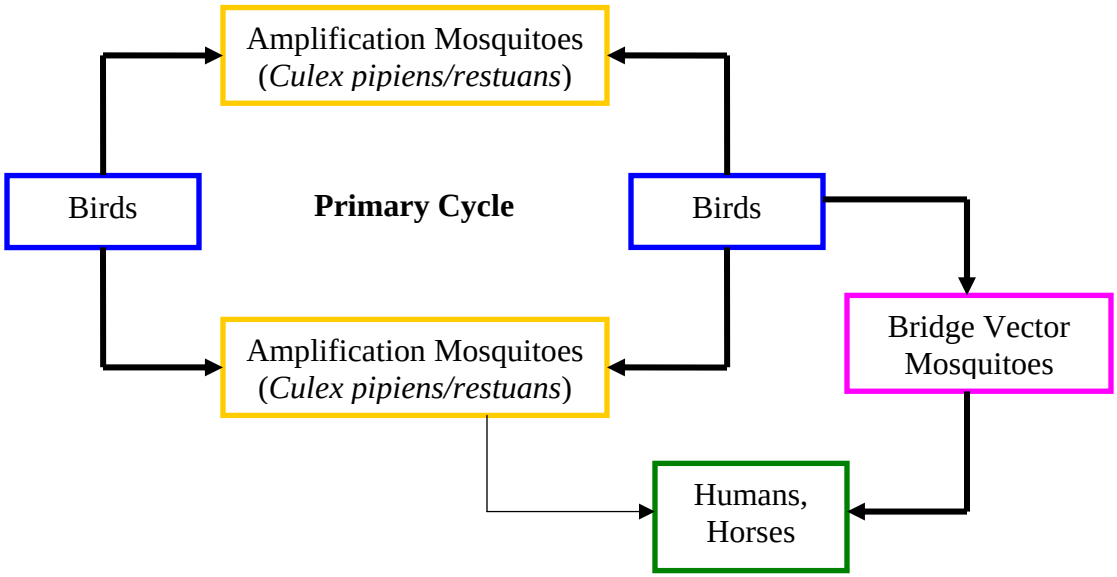
Evidence suggests that WNV can remain in an area over the winter months in infected birds and/or mosquitoes[6] or in un-hatched mosquito eggs.[3] A relatively small number of infected mosquitoes and/or birds would therefore be present within the region in early spring - this is when the virus begins to amplify. As certain types of female mosquitoes (*Cx. pipiens* and *Cx. restuans)* feed on birds to get their blood meal in order to breed, the virus is amplified throughout the population by being transmitted back and forth between the "vector" (the mosquito) and the reservoir "host" (the bird), causing an increasing number of both birds and mosquitoes to become infected.

Out of the 57 or so different mosquito species identified in Ontario, only a small number are important in the transmission of WNV to humans. Figure 1 outlines the WNV

transmission cycle. Although recent research shows that they are now known to feed on humans, mosquitoes from the genus *Cx.* are considered key "amplification vector species" as they prefer to feed on birds, the main reservoir of WNV, and are more common in urban and suburban settings. They are known as quick breeders and use standing or slow-moving water containing decaying organic materials to lay their eggs.

Cx. mosquitoes, specifically *Cx. pipiens* and *Cx. restuans* are the main amplification vector species found in the NBPSDHU area, and accounted for 4% of the adult mosquitoes identified in 2007. Towards late summer and early fall, after significant amplification of the virus has occurred, species such as *Ae. vexans vexans* and *Cq. perturbans* (adult species collected in the highest numbers in the area) become important in transmitting WNV to humans. These mosquitoes, termed 'bridge vectors', feed on both birds and mammals, thereby transmitting the virus to humans and horses after biting an infected bird. Hence, the period of greatest risk to humans and other mammals is in late summer or early fall when the level of WNV in birds and mosquitoes is at its highest.[2]

Figure 1. West Nile Virus Transmission Cycle



BIRD SURVEILLANCE

Introduction

To date, approximately 150 species of birds in North America are known to have been infected by WNV[3, 7,8]. In Canada, wild birds such as crows, ravens, blue jays, gray jays and stellar's jays have been found to be susceptible to WNV and often die from the infection due to inflammation of the brain and other organs.

The American crow (*Corvus brachyrhynchos*) has been found to be the most sensitive indicator of WNV activity. In 2002, in the United States, crows, blue jays and other members of the family *Corvidae* (called "Corvids") accounted for 90% of WNV-infected birds, with crows having the highest rate of WNV infection.[4] Consequently, it is crows that are most closely monitored by health authorities. The NBPSDHU also monitors ravens. Since 2004, blue jays have also been submitted for testing.

The wild bird surveillance program, operated by the Canadian Cooperative Wildlife Health Centre (CCWHC), has been in place since May 2000.[2] The program tests birds from the family *Corvidae* (e.g. crows, blue jays, gray jays, ravens and magpies). Across Ontario in 2007, 771 birds were tested by CCWHC and 79 (10%) tested positive. In 2006, 986 birds were tested and 256 (26%) tested positive. In 2005, 1290 birds were tested and 300 (23%) tested positive. Over the past three years the province has seen a gradual decline in the number of birds submitted and in the number that have tested positive for WNV. The 2006 surveillance season marked a first for Ontario health units; all 37 reported at least one positive bird for West Nile Virus. In 2007, 26 of 36 health units reported positive activity.[2]

Dead bird sightings were received from the public by a phone messaging system. The messaging system is monitored throughout the day by assigned staff. Information from the telephone calls helped staff determine which specimens were suitable to be shipped to CCWHC. CCWHC tests the specimens for the presence of the virus in their tissues.[2] Factors such as the density of the human population in a given area will affect the number of dead bird sightings in that area. Therefore, it is important to understand that the purpose of dead bird surveillance is not to monitor the status of bird health with respect to WNV, but rather to establish whether or not WNV is present in a given area.[9] CCWHC suggests that the presence of WNV in dead birds serves as an early warning of risk to human health.

Information about the presence of WNV is important for decision-making on WNV control measures. In any given year, once it has been established that WNV is present among the bird population within a given area; it is assumed that WNV infection exists throughout the flocks of birds in that area, and that any large "die-offs" are due to WNV. Therefore, further testing is not required in that given area.[10]

Methods

Starting May 1, 2007, members of the public were asked to report dead crow, raven or blue jay sightings to the NBPSDHU's bird reporting line, taking note of the location and condition of the bird. Environmental Technicians collected appropriate specimens and shipped the dead birds to the CCWHC laboratory in Guelph, Ontario starting on Monday, May 28, 2007. Dead bird surveillance ended October 12, 2007.

The NBPSDHU has specific criteria for submitting a bird specimen set out by the CCWHC, they included: 1) the correct species of bird, 2) the age and condition of the bird, 3) the geographic location of the bird, and 4) the signature of the person reporting the bird sighting. Information on the location of dead birds was collected by obtaining actual latitude and longitude measures using a hand-held Global Positioning System (GPS) device. The information on bird location, including date collected and test result, was entered into a Microsoft Access database.

Findings

A total of 110 dead crow, raven and blue jay sightings were reported. This compares to a total of 169 sightings in 2006 and 138 sightings in 2005. There was a peak in dead bird sightings in week 29 with 12 birds reported (Figure 2).

One hundred-ten (110) dead bird sightings were reported (Figure 3) in the NBPSDHU area. Thirty-five of those birds were suitable for testing with 2 birds sent on behalf of the First Nation Inuit Health Branch (FNIHB) (Figure 4). Of the 35 dead crows, ravens and blue jays submitted for testing, 1 (3.0% of total submitted for testing) was WNV positive (Figure 5). This was a substantial decrease from the 7 (15.9%) positive birds in 2006 and a slight decrease from the 2 (4.7%) positive birds in 2005. The positive bird was reported on the 28th of August in the Town of Mattawa. In 2006, 2 WNV positive birds were collected, one in the Town of Parry Sound and the other Town of Sturgeon Falls, both on August 1. In 2005, the first positive bird was found in the Township of Seguin on July 20.

The number of dead bird sightings and the number of adult amplification vector mosquitoes collected by week during the 2007 surveillance season are displayed in Figure 6. Please note that adult mosquito surveillance did not begin until Week 23 (Appendix A). A peak in bird sightings was observed during week 29, whereas adult amplification vector mosquitoes peaked in weeks 31 and 34. The increased presence of amplification vector mosquitoes can be a good indicator of the potential threat of WNV activity in the area, especially if there are positive birds identified. The only positive bird in the district was collected during week 35, one week after a sudden increase in amplification vector mosquitoes collected. However, there was fewer dead bird sightings reported when adult amplification vector mosquitoes were at their peak.

Figure 2. Dead Bird Sightings by Week in the NBPSDHU area, 2005 – 2007

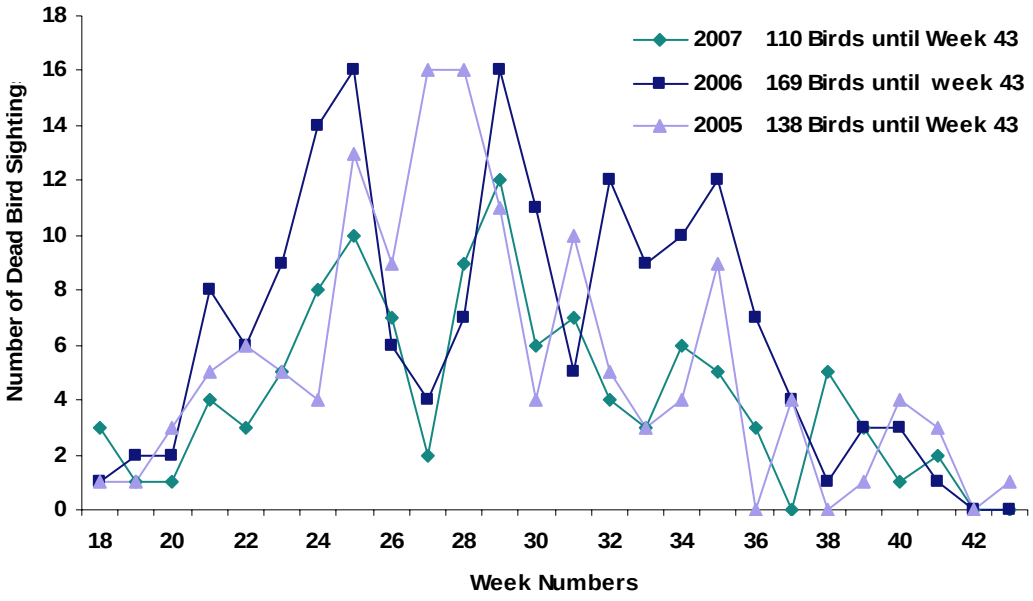


Figure 3. Dead Birds Reported - 2007 NBPSDHU WNV Surveillance

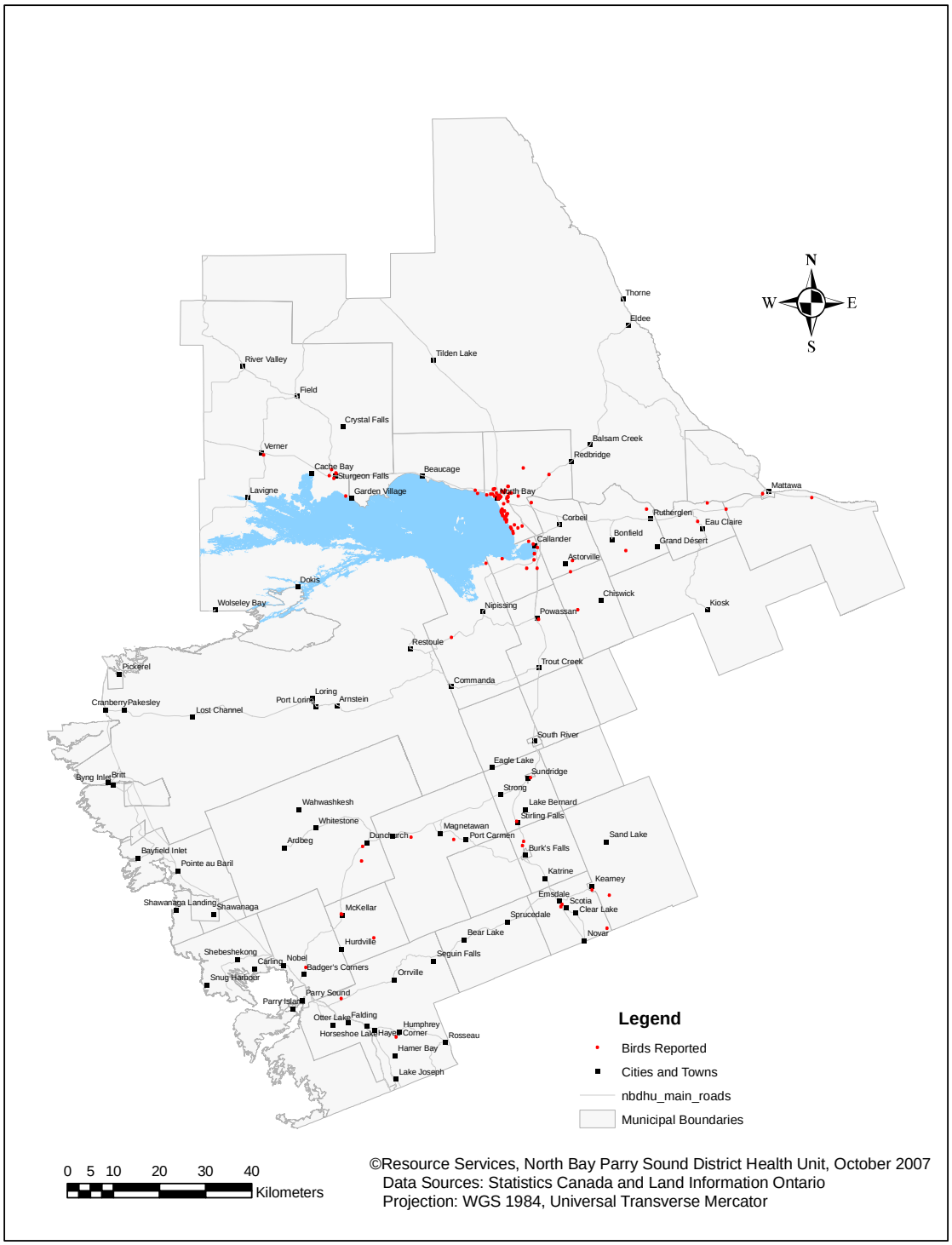
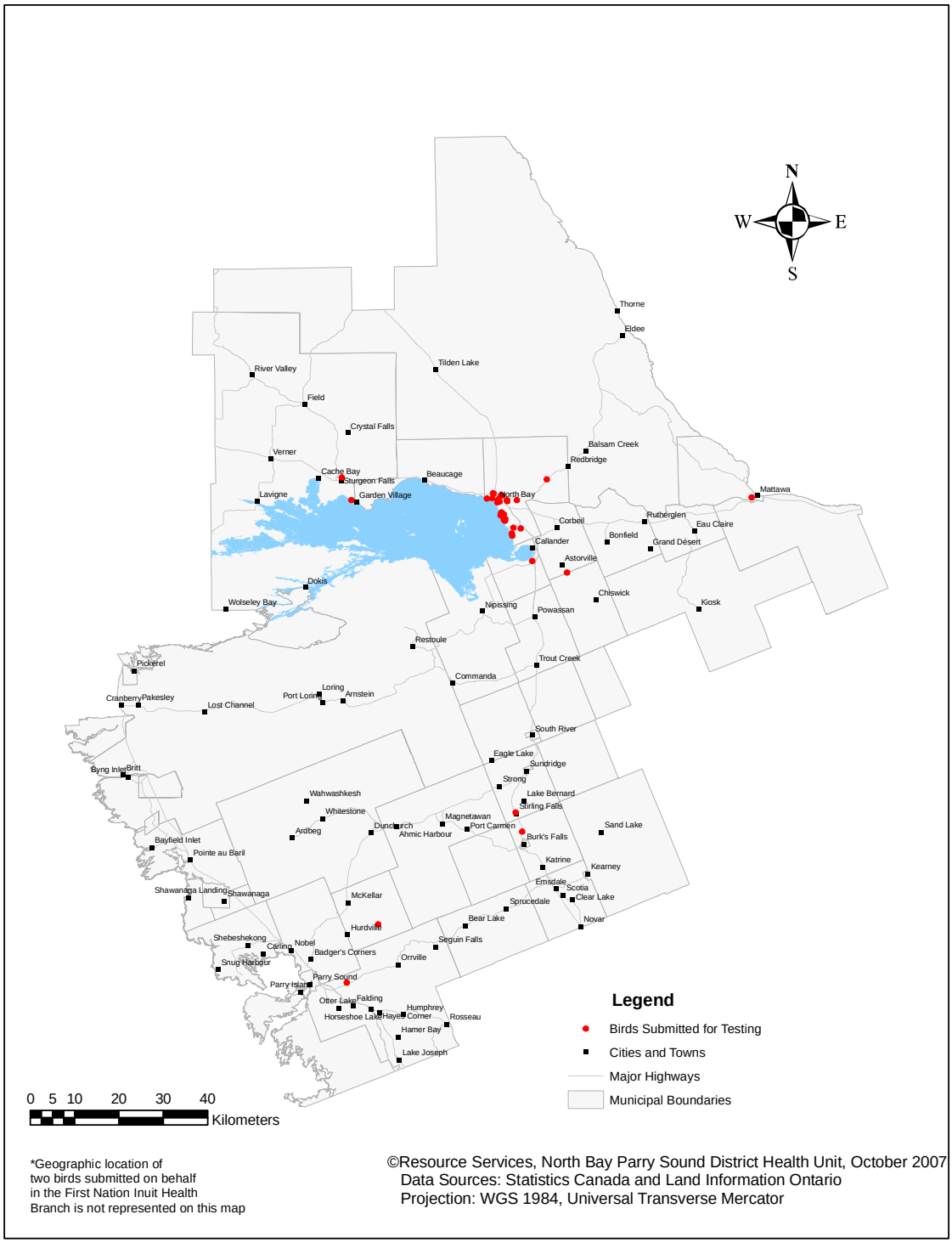


Figure 4. Birds Submitted for Testing - 2007 NBPSDHU WNV Surveillance



*Geographic location of two birds submitted on behalf in the First Nation Inuit Health Branch is not represented on this map

Data Sources: Statistics Canada and Land Information Ontario
Projection: WGS 1984, Universal Transverse Mercator

Figure 5. West Nile Virus Positive Bird - 2007 NBPSDHU WNV Surveillance

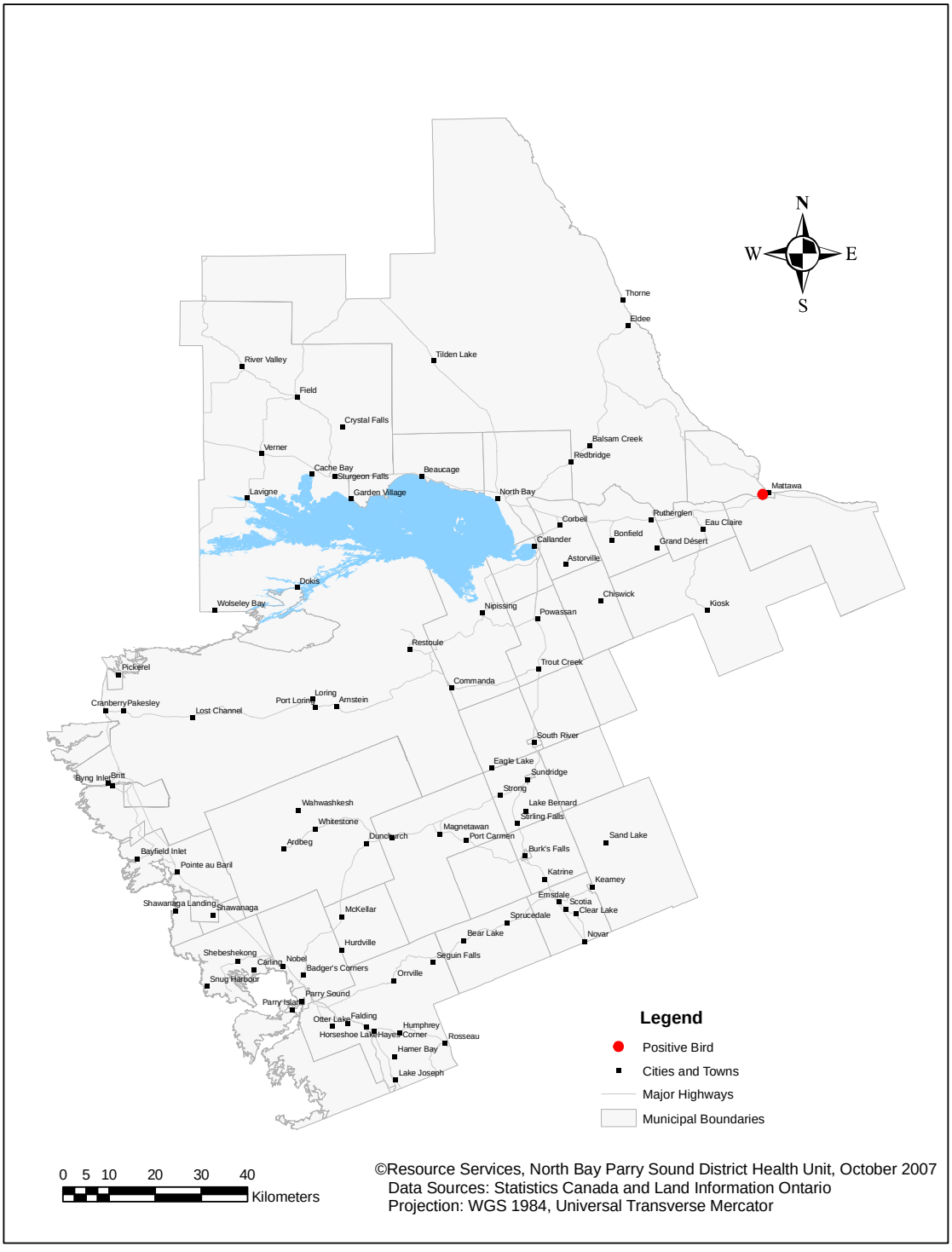
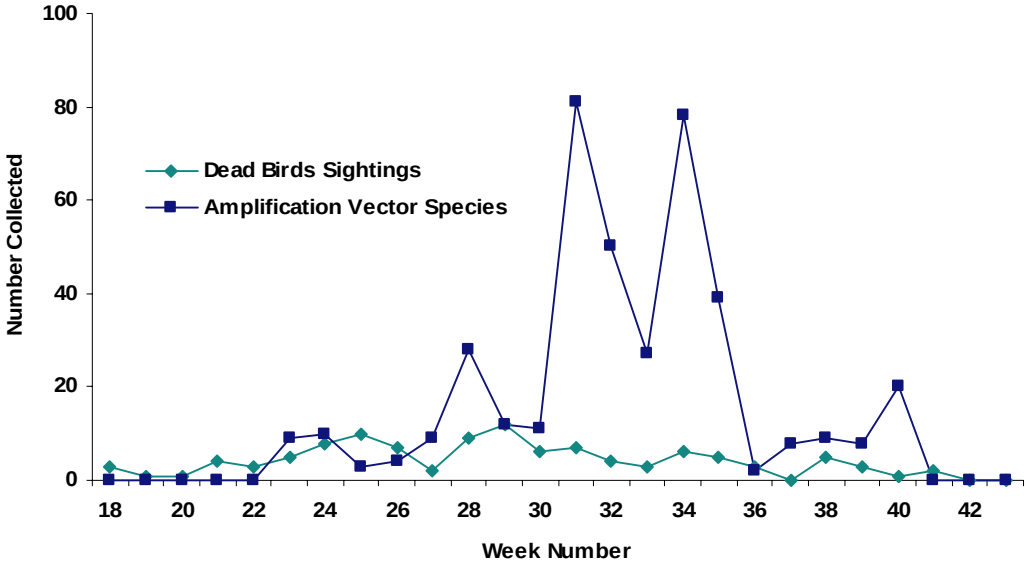


Figure 6. Dead Bird Sightings and Amplification Adult Mosquitoes Collected by Week in the NBPSDHU area, 2007



ADULT MOSQUITO SURVEILLANCE

Introduction

The WNV survives by circulating between bird and mosquito populations. An adult female mosquito can acquire the infection by obtaining a blood meal from an infected bird and after a two to three week incubation period, can then pass the infection by injecting its saliva into another host (bird, horse, human or other animal) when it takes a blood meal.[10] Once in the new host, the virus can multiply causing illness and possibly death.

There are 74 known species of mosquitoes in Canada;[3] 57 of these have been identified in Ontario. As of 2006, Health Canada states that at least 10 species have been found to be infected by WNV in this country.[3] Species responsible for amplifying the virus between the mosquito and bird population in Ontario are thought to be *Cx. pipiens* and *Cx. restuans*. "Bridge vector" mosquitoes, which bite both birds and other mammals, including humans, are highly dependant on local conditions and include *Cq. perturbans* and *Ae. vexans vexans*.

The purpose of a mosquito surveillance program is to monitor mosquito populations associated with WNV, to determine the level of WNV activity among these species and to use this information to make decisions regarding the risk of transmission to humans and the need to implement mosquito control plans.

In 2004, the Ministry of Health and Long-Term Care invited health units to participate in a pilot project that used Gravid mosquito traps. Gravid mosquito traps target female mosquitoes that have had at least one blood meal. Although the pilot project had been discontinued by the Ministry of Health and Long-Term Care, the NBPSDHU continues to use Gravid mosquito traps along with CDC Light Traps, to capture adult mosquitoes.

Methods

Centers for Disease Control (CDC) Light Traps and Gravid Traps were used to capture adult mosquitoes. CDC Light Traps use carbon dioxide (dry ice) and fluorescent black lights as bait to attract host-seeking adult female mosquitoes looking for a blood meal. Gravid Traps use stagnant water and organic material as bait to attract adult female mosquitoes that have had at least one blood meal and are seeking a location to deposit their eggs.

Weather can have a great effect on adult mosquito collection. Although rain can increase the number of larval mosquitoes present, heavy rains can limit the catch of adult mosquitoes. Intense wind and cool temperatures may also determine the number of mosquitoes captured. Warmer temperatures can contribute to an increase in the number of adults collected.

Traps were deployed in the NBPSDHU area at fixed (13 sites – Figure 7) and temporary locations (19 sites – Figure 8) across the area from June 5 (Week 23) to October 11 (Week 41). Fixed sites were located in densely populated residential areas throughout the district and were sampled more than 5 times throughout the surveillance season. Temporary sites were randomly selected due to habitat type (bushy area or close to stagnant water) and also included areas where WNV-positive birds, horses and humans had been identified.

Adult mosquitoes were collected each week from the mosquito traps, refrigerated and transported alive, via courier, to a private lab, Entomogen Inc. in St. Catharines, Ontario. At this centre, the trap contents were counted and separated into males (which feed on nectar and do not take blood meals) and females. The females were separated into species, recounted and then "pooled" by species, date of collection and location for testing. Pools are generally numbered less than or equal to 50 adult female mosquitoes. After the female mosquitoes had been separated and counted the mosquito pools were tested for the presence of WNV.

When species could not be distinguished, they were either classified as a group (e.g. *Cx. pipiens/restuans)* or to the level of genus (e.g. *Cx. spp.)* Some mosquitoes ended up being classified as unknown or "extras", likely because the specimens were either unusable due to the natural aging process, or were damaged during collection, shipping or storage, making them difficult to identify.

Counts of mosquitoes by species, date collected, trap type and site were entered into a web based database by staff at Entomogen Inc. The database was then accessed via the internet by staff at the health unit.

Upon notification of laboratory evidence of a WNV-positive bird or horse and human in the NBPSDHU area, CDC Light Traps and Gravid Traps were set up in the immediate area to better monitor the risk of human infection in that area.

Figure 7. Fixed Adult Trap Sites – 2007 NBPSDHU WNV Surveillance

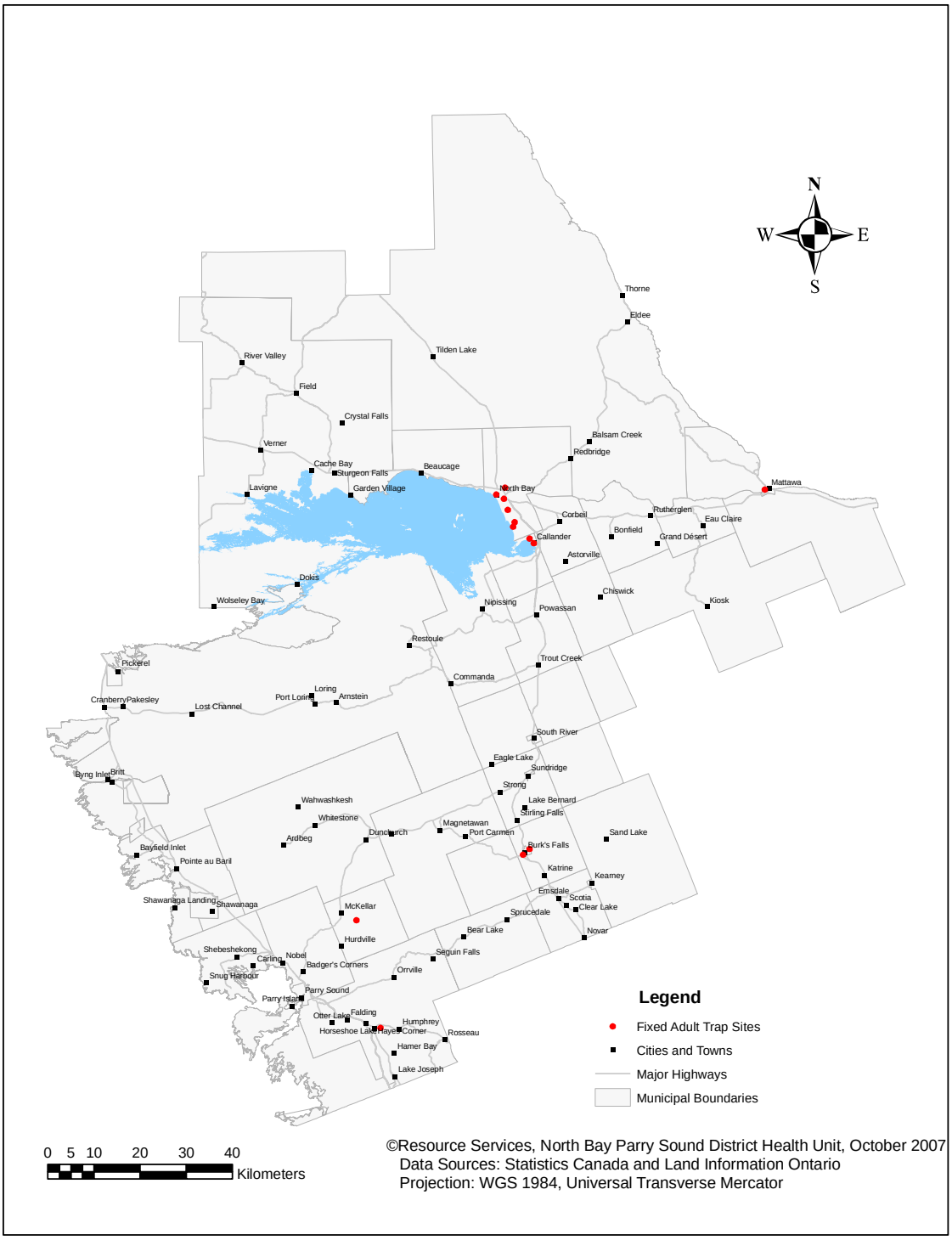
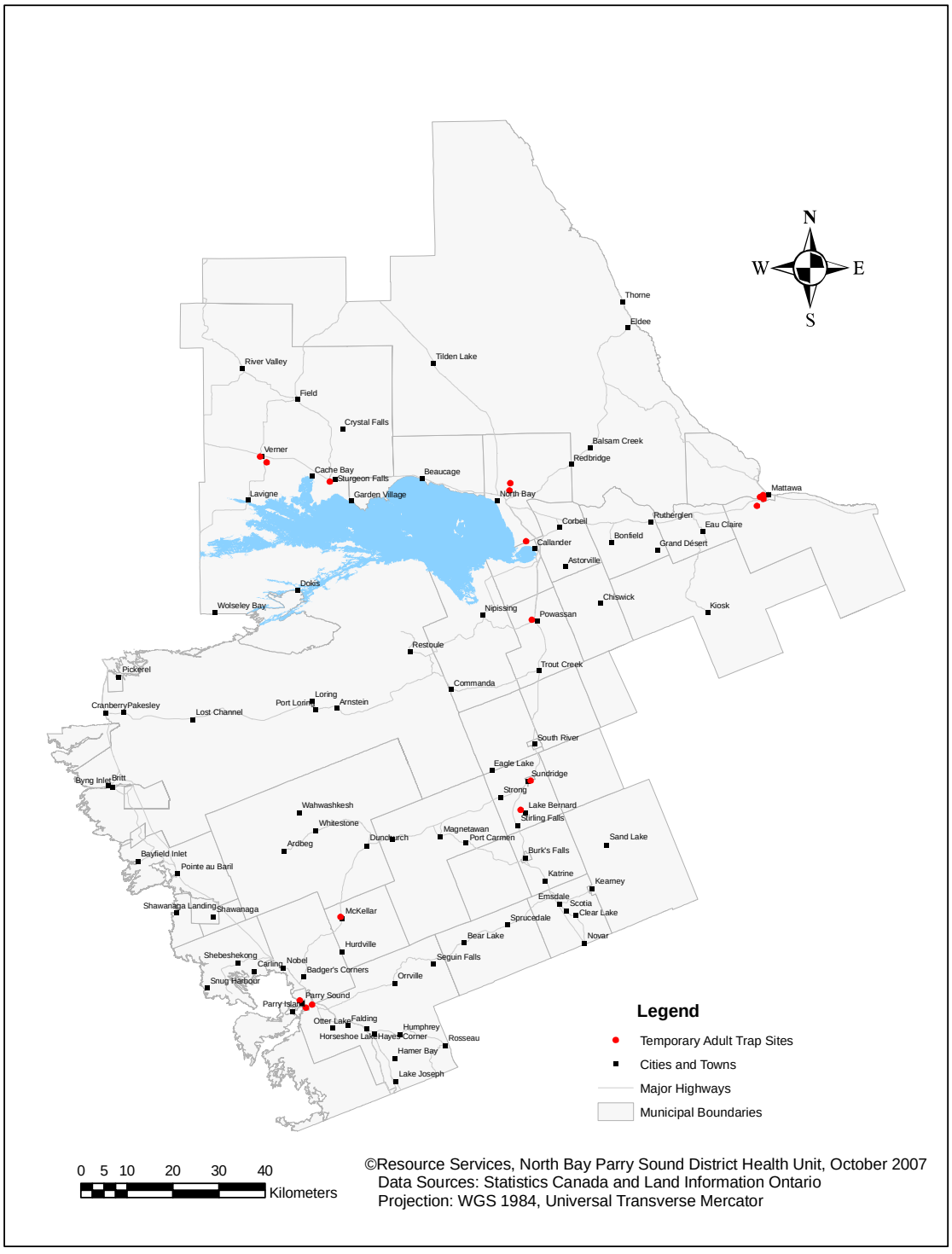


Figure 8. Temporary Adult Trap Sites – 2007 NBPSDHU WNV Surveillance Season



Findings

The overall trend in Ontario shows a decrease in the number of positive mosquito pools identified since 2005. In 2007, 51 mosquito pools tested positive for WNV in 9 different health units (Appendix B). This compares to 182 (26 health units) in 2006 and 291 (21 health units) in 2005.[9] No positive mosquito pools have been found in the NBPSDHU area since the WNV surveillance program started in 2002.

Adult mosquito trapping began in Week 23 (June 05) and ended in week 41 (October 11). In the NBPSDHU area, 76,424 mosquitoes were collected over the course of the surveillance season, of those collected only 10,109 were suitable to be speciated and 5313 were suitable for testing for the presence of WNV (Table 1). A total of 30 different mosquito species were collected. No mosquito pools from the NBPSDHU area tested positive for WNV.

Of the adult female mosquitoes identified, *Cx. pipiens*/*restuans*, *Cx. pipiens and Cx. restuans*, considered to be key "amplification" vector species, accounted for only 4% (408) of the total identified, down from the 6% (642) identified in 2006 and 14% (1054) in 2005 (Figure 9). The presence of amplification vector species peaked during week 32, compared to a peak during week 25 in 2006 and week 31 in 2005. An overall trend displays a decline in the number of amplification vector species identified from 2005 to 2007 (Figure 10). This decline is a potential indicator of lower activity in the area, thus meaning that the risk of contracting the virus is lower, however surveillance in the area will continue to monitor this trend to see if any changes occur.

Key "bridge vector" species, including *Cq. perturbans* and *Ae. vexans vexans,* accounted for 78% (7897) of those identified, compared to 62% (6651) in 2006 and 77% (5839) in 2005 (Figure 9, Figure 11). *Cq. perturbans* were the most common, comprising 41% of all mosquitoes collected (Table 1). The presence of bridge vector species collected occurred during week 31 compared to week 26 in 2006 and week 29 in 2005. All adult mosquitoes collected during week 41 were bridge vectors. The increase of bridge vector mosquitoes identified each season creates some concern due to the fact that they transmit the virus ("bridge the gap") between birds and other mammals, including humans and horses

Table 1. Number and Percentage of Adult Mosquitoes Collected by Species: Adult Mosquito Vector Surveillance – 2007 North Bay Parry Sound District

Species Name	Type of Vector	Number Collected	Percentage of Total
Cq. perturbans	Bridge	5016	49.62
Ae. vexans vexans	Bridge	2639	26.11
Oc. black-legged	Other	827	8.18
Cx. pipiens/restuans	Amplification	406	4.02
Oc. canadensis	Other	281	2.78
Ae. /Oc. spp.	Other	172	1.70
An. punctipennis	Bridge	135	1.34
Oc. broad-banded	Other	127	1.26
Cs. spp.	Other	82	0.81
Ae. cinereus	Other	76	0.75
Oc. excrucians	Other	72	0.71
Cs. morsitans	Other	58	0.57
Oc. stimulans	Bridge	53	0.52
Cs. melanura	Other	23	0.23
Oc. dorsalis	Other	23	0.23
An. walkeri	Bridge	22	0.22
Oc. triseriatus	Bridge	22	0.22
Ae. vexans/cantator	Other	22	0.22
An. earlei	Other	17	0.17
Oc. provocans	Other	12	0.12
Oc. trivittatus	Bridge	7	0.07
Ae. vexans nipponi	Bridge	3	0.03
Cq. perturbans (pale legs)	Other	3	0.03
Cx. territans	Other	3	0.03
Cx. spp.	Amplification	2	0.02
Oc. japonicus	Other	2	0.02
An. quadrimaculatus	Other	1	0.01
An. spp.	Other	1	0.01
Cs. inornata	Other	1	0.01
Cs. minnesotae	Other	1	0.01
	Total	**10109**	
		Percentage Amplification Vectors	**4.04**
		Percentage Bridge Vectors	**78.12**
		Percentage Others	**17.85**

Figure 9. Total Percentage of All Adult Mosquito Species Speciated in the NBPSDHU Area 2005 - 2007

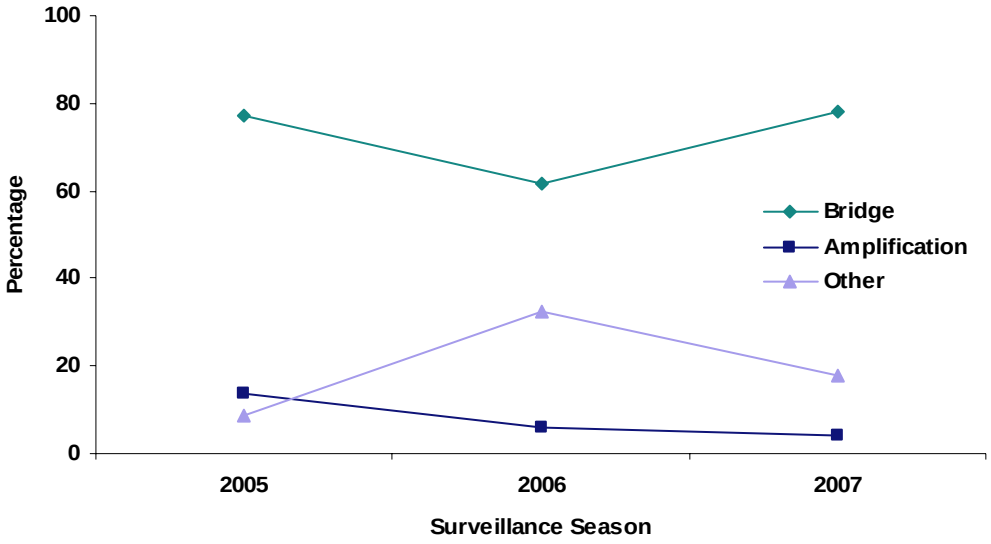
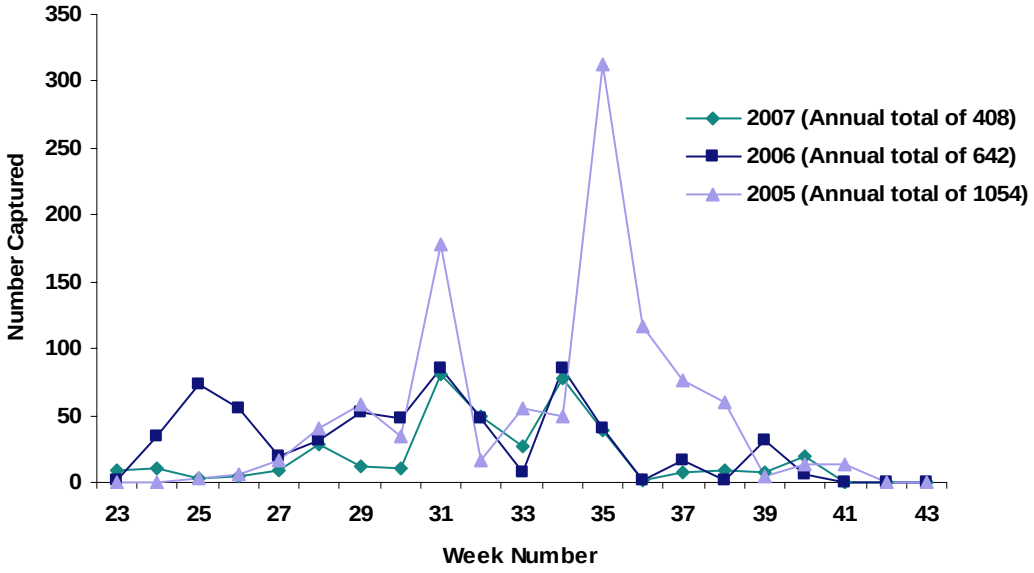
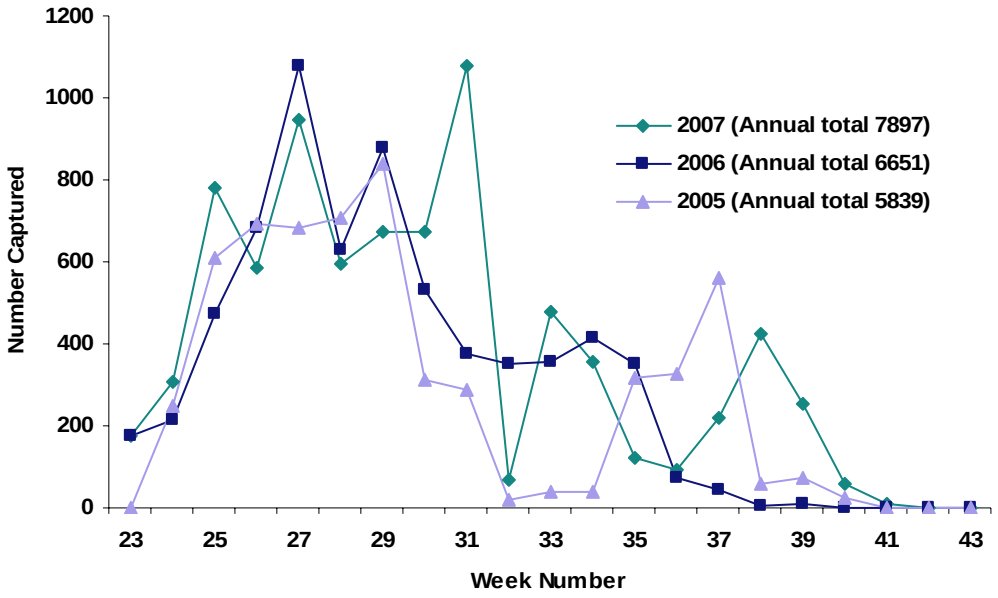


Figure 10. Adult Mosquito Surveillance - Amplification Vector Species Captured by Week in the NBPSDHU Area* 2005 - 2007



*Amplification vector mosquitoes (adult) include: *Cx. pipiens*, *Cx. restuans*, *Cx. pipiens/restuans* and *Cx. spp.*

Figure 11. Adult Mosquito Surveillance - Bridge Vector Species Captured by Week in the NBPSDHU Area* 2005 - 2007



*Bridge vector mosquitoes (adult) include: *Cq. perturbans, Anopheles walkeri, Ochlerotatus triseriatus, Anopheles punctipennis, Ochlerotatus trivittatus, Ochlerotatus stimulans, Cx. salinarius, Ae. vexans nipponi* and *Ae. vexans vexans.*

LARVAL MOSQUITO SURVEILLANCE

Introduction

The life cycle of a mosquito includes four stages: egg, larval, pupal and adult. Three of these stages often take place in water. Many mosquito species lay their eggs in or near water, where the eggs then hatch into larvae and grow into pupae.[10] The pupae become adults, which are able to take flight. In preparation for breeding, females seek a blood meal from a mammal, avian or amphibian source, depending on their feeding preferences.

Larval surveillance is useful in determining potential location, species, and population densities of mosquitoes. Potential breeding sites were surveyed for the presence of mosquito larvae throughout the NBPSDHU area. Potential breeding sites were also identified and surveyed in areas where positive birds, horses and humans had been identified.

In order to ascertain the anticipated volume of adult mosquitoes in an area, as well as to identify their stage of development, standing water sites were also selected for larval surveillance. Standing water sites included: roadside ditches, woodland pools, sewage lagoons, marshes, tires and swimming pools.

Methods

Fixed (Figure 12) and temporary sites (Figure 13) were surveyed throughout the district. When a dead bird was reported as positive for WNV the properties surrounding these areas were surveyed for standing or slow-moving water. After sites were identified, samples, or "dips", were collected from the site using a larval dipper. Mosquito larvae were collected, counted and an attempt was made to identify their stage of development.

Larval surveillance results can be affected by weather, particularly rain and temperature. Heavy rains can flush out catch basins and displace mosquito larvae. Rain can also increase numbers, as more standing water is available for breeding sites. Temperature also affects larval development. The warmer the temperature the quicker the larvae develop and mature into adult mosquitoes.

Figure 12. Fixed Larval Dip Sites – 2007 NBPSDHU WNV Surveillance

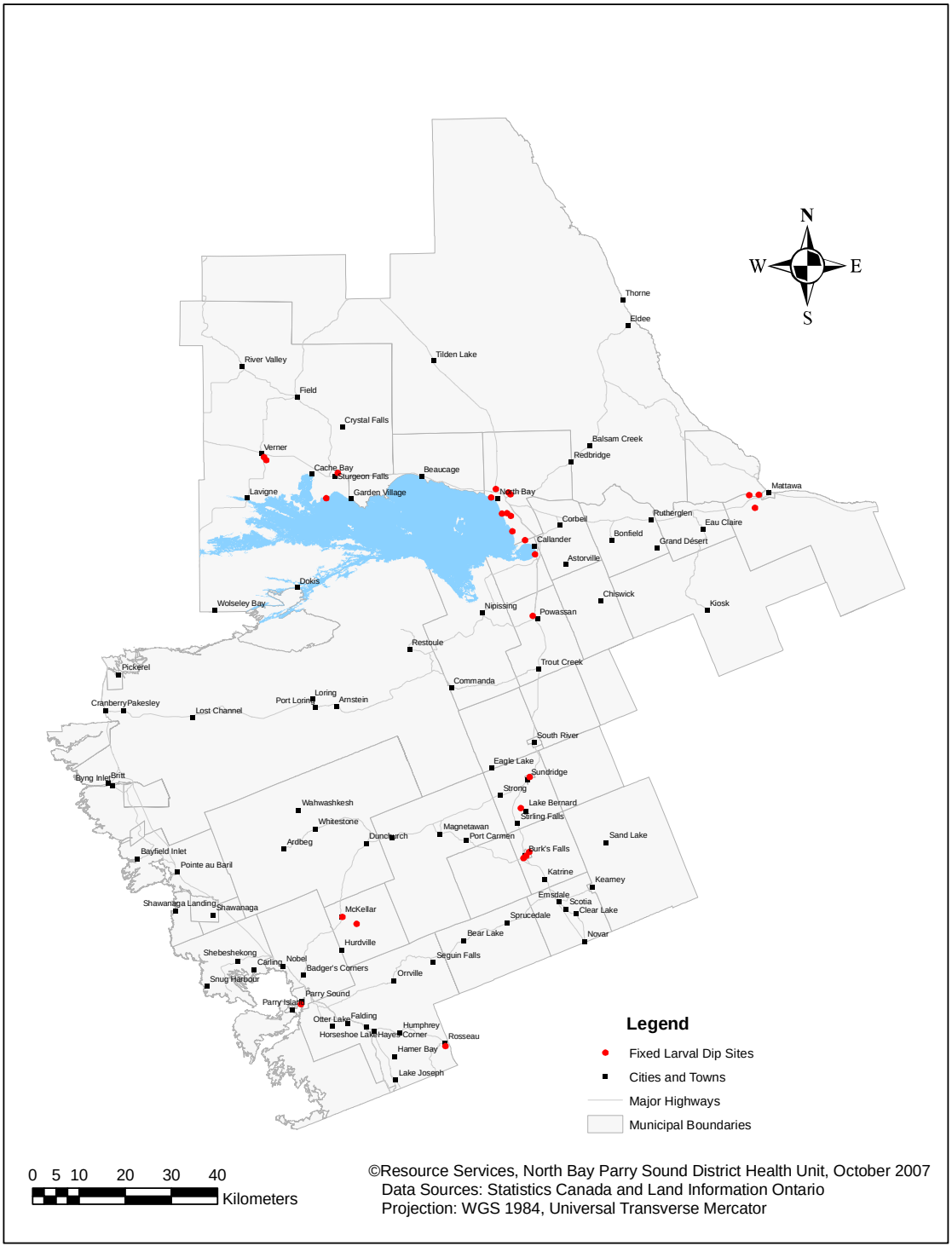
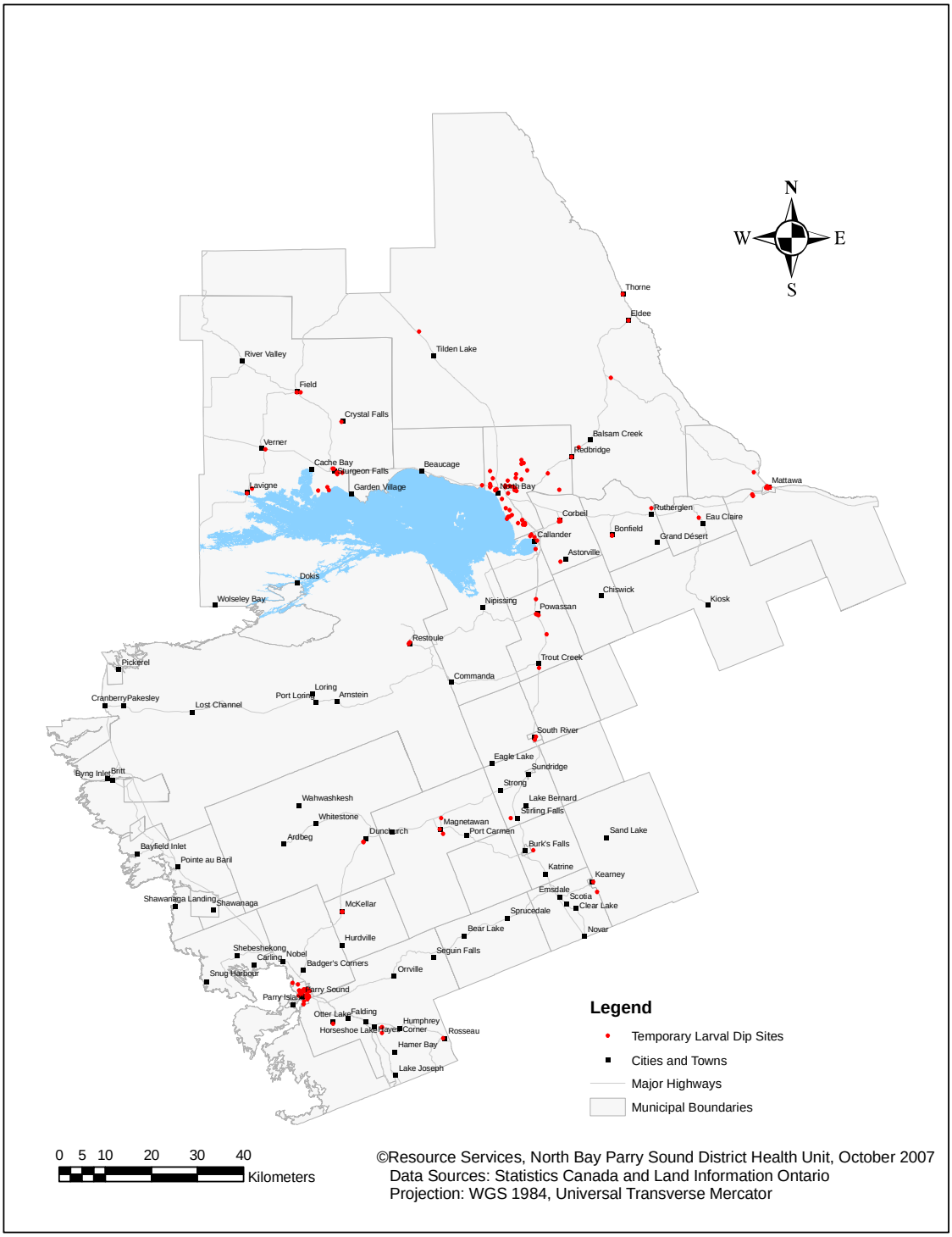


Figure 13. Temporary Larval Dip Sites – 2007 NBPSDHU WNV Surveillance



Mosquito larvae were collected from larval dips and packaged in vials of isopropyl alcohol. The vials were shipped to Cosray Technology Centre in Deep River, Ontario. The larvae were speciated and the results were returned to the NBPSDHU.

Information about the location of potential mosquito breeding sites, including address or latitude/longitude coordinates and type of physical feature, was recorded along with the date of collection. Once the results were obtained, this information was entered into a Microsoft Excel spreadsheet for tracking purposes and also into Microsoft Access for analysis and charting. ArcGIS software was used to spatially view the geographic distribution of species of concern allowing for enhanced risk assessment.

Findings

Starting May 9 (Week 19) until October 3 (Week 40), a total of 165, (27 fixed, 138 temporary) sites were surveyed in the NBPSDHU area. The presence of mosquito larvae was identified in 33% of all sites surveyed and in 78% of the fixed larval sampling sites. A total of 2780 mosquito larvae were speciated down from 6919 in 2006 and 7499 in 2005.

Sites Surveyed

Throughout the 2007 surveillance season, the three most frequent breeding sites sampled were: roadside ditches (228), catch basins (189), and sewage lagoons (69). In total, there were 571 sites sampled and larvae were found at 188, or 32.9%, of those sites. In 2006, monitoring of sewage lagoons for the presence of larvae was intensified due to results from 2005. In 2007, 69 samples were taken from sewage lagoons with larvae being present in just 10 (14.5%) samples compared to 91 samples taken with larvae being present in 50 (55%) of those samples (Table 2).

Table 2. Types of Potential Larval Breeding Sites and Number of Times each was Sampled for Larvae: Larval Mosquito Vector Surveillance – 2007 North Bay Parry Sound District

Types of Potential Mosquito Breeding Sites	Number With Larvae Present	Total Sites Sampled	Percentage of Sample with Larvae Present
Roadside Ditch	86	228	37.7
Catch Basin	59	189	31.2
Sewage Lagoon	10	69	14.5
Right-of-Way Ditch	8	27	29.6
Tire	9	14	64.3
Culvert	4	12	33.3
Flooded Depression	5	12	41.7
Woodland Pool	1	6	16.7
Retention Pond	1	6	16.7
River/Creek	2	3	66.7
Pond	2	2	100.0
Standing Water (fabricated)	0	1	0.0
Artificial Container	0	1	0.0
Wetland	1	1	100.0
Total	**188**	**571**	**32.9**

Larval Speciation

The total number of mosquitoes collected and speciated in the NBPSDHU area has decreased each year since the merger in 2005 (2780 in 2007, 6919 in 2006, and 7499 in 2005). The amplification vector species: *Cx. pipiens*, *Cx. restuans*, and *Cx. spp.* accounted for 47.8% (1330 total speciated) of mosquito larvae speciated down from the 80% (5501) in 2006 and 73% (5462) in 2005 (Figure 14). The number and percentage of larval mosquitoes collected by species in 2007 are displayed in Table 3. Amplification vector species *Cx. pipiens*, *Cx. restuans*, and *Cx. spp.*, accounted for 48% of mosquito larvae speciated. The bridge vector species *Ae. vexans vexans, Ochlerotatus triseriatus, and Anopheles punctipennis*, accounted for 30% of the larvae speciated. Other species accounted for 23% of the total larvae speciated. *Cx. restuans* was the most common larval species collected at 29% of the total and *Ae. vexans vexans* was next at 28%.

Figure 15 displays the number of larval amplification vector species captured by week during the 2005, 2006 and 2007 surveillance seasons. In 2007, the presence of amplification vector species peaked during week 30 (mid season) compared to the same week 30 in 2006 and week 33 in 2005. A total of 1330 larval amplification vector species were captured; a significant difference to the 5501 in 2006 and 5462 in 2005. According to the graph, over the past 3 surveillance seasons, the optimal time period for collecting amplification vector species occurs between weeks 27 and 35.
Figure 16 displays the number of larval bridge vector species captured by week during the 2005, 2006 and 2007 surveillance seasons. The presence of bridge vector species peaked during week 24, one week earlier than both 2006 and 2005. In 2007, a total of 822 larval bridge vector species were captured compared to 491 in 2006 and 829 in 2005.

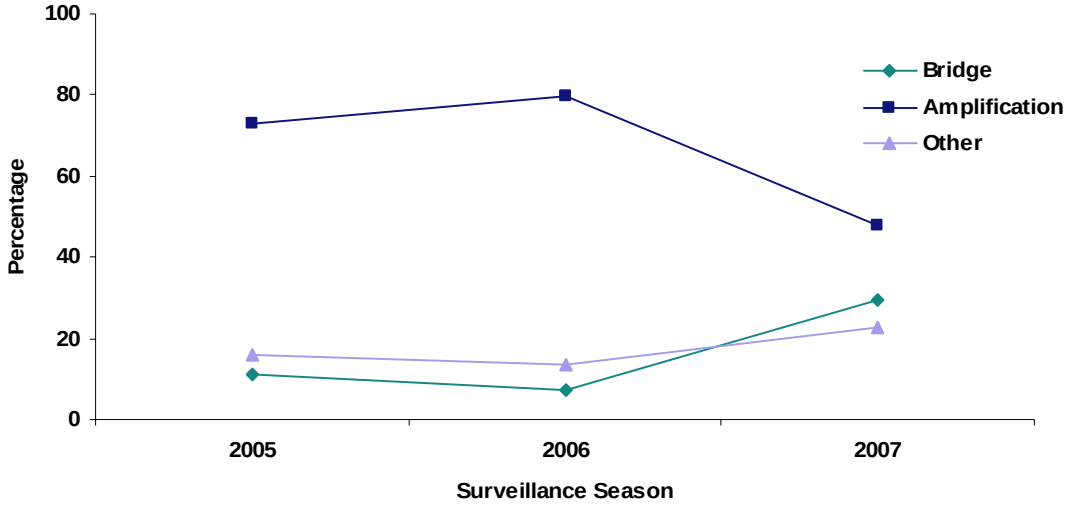
According to the graph, over the past 3 surveillance seasons, the optimal time period for collecting amplification vector species occurs between weeks 24 and 33.

Please refer to the Weather Analysis section of this report for a more in depth analysis of weather data for the NBPSDHU area.

Table 3. Number and Percentage of Larval Mosquitoes Collected by Species: Larval Mosquito Vector Surveillance – 2007 North Bay Parry Sound District

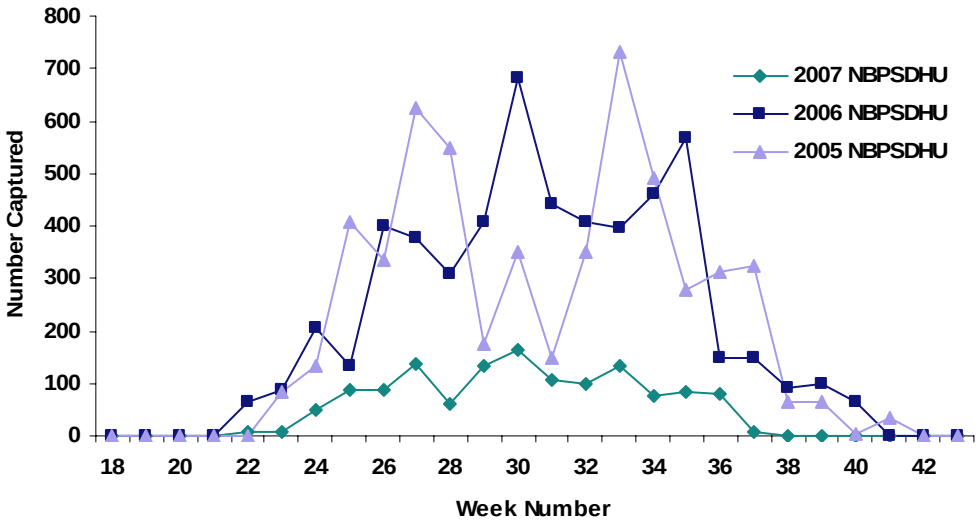
Species Name	Type of Vector	Number Collected	Percentage of Total
Cx. restuans	Amplification	809	29.10
Ae. vexans vexans	Bridge	777	27.95
Cx. pipiens	Amplification	521	18.74
Cx. territans	Other	297	10.68
Oc. canadensis	Other	140	5.04
Ae. cinereus	Other	137	4.93
Oc. triseriatus	Bridge	34	1.22
An. spp.	Other	15	0.54
An. punctipennis	Bridge	11	0.40
An. earlei	Other	11	0.40
Oc. excrucians	Other	11	0.40
Cs. impatiens	Other	3	0.11
Cs. inornata	Other	3	0.11
Oc. diantaeus	Other	3	0.11
An. quadrimaculatus	Other	2	0.07
Oc. dorsalis	Other	2	0.07
Oc. punctor	Other	2	0.07
Oc. aurifer	Other	1	0.04
Oc. communis	Other	1	0.04
Total		**2780**	
Percentage Amplification Vectors			**47.84**
Percentage Bridge Vectors			**29.57**
Percentage Others			**22.59**

Figure 14. Total Percentage of All Larvae Mosquito Species Speciated in the NBPSDHU Area, 2005-2007



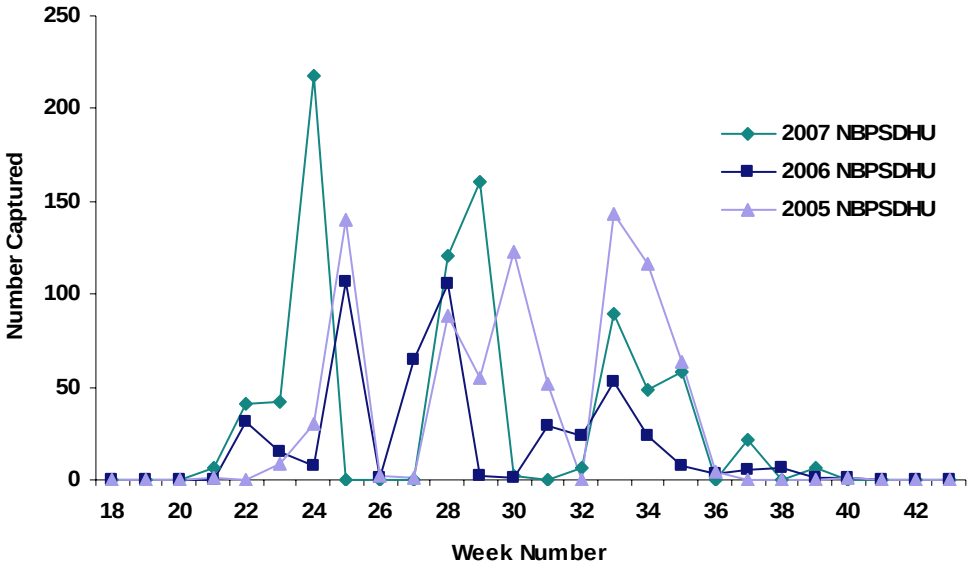
	2005		2006		2007	
Larval Species	**Total**	**Percentage**	**Total**	**Percentage**	**Total**	**Percentage**
Bridge	829	11.1	491	7.1	822	29.6
Amplification	5462	72.8	5501	79.5	1330	47.8
Other	1208	16.1	927	13.4	628	22.6
Total Speciated		7499		6919		2780

Figure 15. Larval Amplification* Vector Species Captured by Week in the NBPSDHU Area, 2005 - 2007



*Amplification vector mosquitoes (larvae) include : *Cx. pipiens*, *Cx. restuans*, *Cx. pipiens/restuans* and *Cx. species*.

Figure 16. Larval Bridge Vector* Species Captured by Week in the NBPSDHU Area, 2005 - 2007



*Bridge vector mosquitoes (larvae) include: *Cq. perturbans*, *An. walkeri*, *Oc. triseriatus*, *An. punctipennis*, *Oc. trivittatus*, *Oc. stimulans*, *Cx. salinarius*, *Ae. vexans nipponi* and *Ae. vexans vexans.*

HUMAN CASE SURVEILLANCE

Introduction

As of May 01, 2003, WNV illness became both a Reportable and Communicable Disease under the *Health Protection and Promotion Act, Regulations 558/91 and 559/91 respectively* (http://www.canlii.org/on/laws/sta/h-7/index.html). West Nile Virus illness consists of WNV Non-Neurologic Syndrome (formerly WNV Fever), WNV Neurologic Syndrome and WNV Asymptomatic Infection.

In 2007 there were no reported human cases of WNV in the NBPSDHU area. In 2006, two (2) human cases were reported in the NBPSDHU area. Case one (1) was reported on August 25th and was classified as West Nile Neurological Syndrome. This person resided in the City of North Bay but had travelled outside of the district during part of the incubation period. Case two (2) was reported on September 8th and was classified as West Nile Neurological Syndrome. This person resided in the Township of McKellar and did not travel outside the district during the incubation period.

While most human WNV infections are without symptoms, about one in five people infected develop a mild illness. According to Health Canada, the incubation period is estimated to be 3 to 14 days, with symptoms lasting approximately three to six days. The mild form of WNV infection is described as a sudden onset of fever that is often accompanied by malaise, headache, nausea, vomiting, anorexia, eye pain, myalgia, and less commonly, rash and/or swollen lymph nodes (West Nile Non-Neurologic Syndrome).[11]

Approximately one case in 150 infections develops severe neurologic disease, with encephalitis being reported more often than meningitis. The greatest risk factor for developing severe WNV disease is increased age.[11] Symptoms among those with severe disease include: fever, muscle weakness, gastrointestinal symptoms and a change in mental status. Some cases also experience a rash on their neck, body, arms or legs. A small number of patients experience severe muscle weakness and paralysis. Other symptoms include: seizures, optic nerve involvement, cranial nerve abnormalities and ataxia.[11]

Diagnosis is made through the detection of antibodies to WNV found in blood samples. As there is no cure for WNV, treatment is supportive in nature and involves hospitalization, administering intravenous fluids, providing respiratory support and preventing secondary infections for patients with severe disease.[11]

The 2002 WNV epidemic in North America included the first documented cases of person-to-person WNV transmission through organ transplantation,[12] blood and blood product transfusion and perhaps breastfeeding, as well as a case of intrauterine infection.[13] A poliomyelitis-like syndrome was recognized among some West Nile patients with the onset of acute flaccid paralysis (AFP) during the early stages of infection in the United States.[14] Parkinsonism and Rhabdomyolysis were also seen in

rare instances.[15] Modifiable risk factors for WNV include known travel in an area previously identified as having WNV activity, having received blood, blood products or organ transplants from an infected donor, or acquiring the infection through occupational exposure.[12]

Methods

In June 2007, the NBPSDHU updated physicians and other health care providers district-wide about the importance of immediately reporting all suspected cases of WNV illness, viral encephalitis and viral meningitis and to submit appropriate laboratory samples to determine if the cause is a mosquito-borne virus. Enhanced passive surveillance for WNV encephalitis and viral meningitis through local hospitals was also implemented.

The NBPSDHU provided the provincially approved criteria for reporting of WNV illness and the submission of appropriate laboratory specimens for WNV testing.

In July 2007, the NBPSDHU implemented the WNV activity report with the five acute care facilities located in the district; North Bay General Hospital (NBGH); Mattawa General Hospital (MGH); West Nipissing General Hospital (WNGH); Muskoka Algonquin Health Centre Burk's Falls (MAHCBF) and West Parry Sound Health Centre (WPSHC). The report provides current information on WNV activity locally, provincially, nationally and in the United States. The first report was issued July 7th and was provided bi-weekly with the last report issued on October 17th. Local hospitals were requested to submit the numbers of specimens tested for WNV on a weekly basis.

Findings

During the 2007 surveillance period, a total of 30 samples were submitted for testing to the Ontario Provincial Public Health Laboratory, as compared to 46 (2 positives) in 2006 and 56 (0) in 2005. There were no positive tests for WNV from human samples in 2007. Figure 17a displays the WNV active human surveillance in the NBPSDHU area in 2007. Thirty (30) people were tested for the presence of WNV. Figure 17b displays the WNV active human surveillance in NBPSDHU area hospitals from 2005 to 2007. The number of samples submitted for testing has declined from 2005 to 2007. In 2007, Human case surveillance in Ontario revealed 13 laboratory confirmed WNV cases compared to 42 in 2006 and 101 in 2005 (Appendix D).

Figure 17a. Human Active Surveillance for WNV at NBPSDHU Area Hospitals, 2007

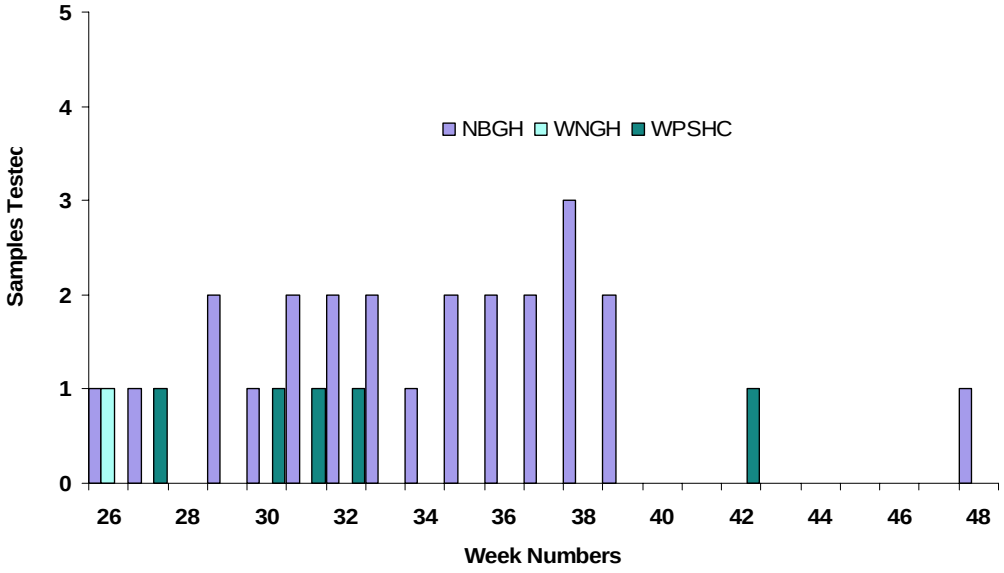
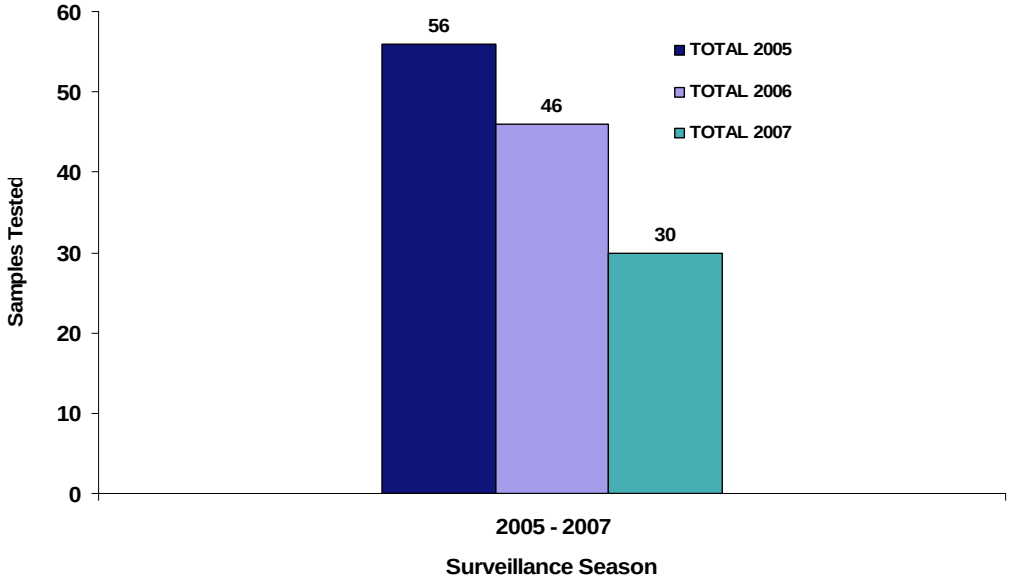


Figure 17b. Human Surveillance for WNV at NBPSDHU Area Hospitals 2005 – 2007



ANIMAL SURVEILLANCE

Introduction

WNV is not limited to the human and bird populations, it can also infect many animals including horses. WNV infection in horses often occurs concurrently, or sometimes just prior to human infection. Due to the high intensity of mosquito exposure frequently experienced by horses, equine surveillance is considered important, particularly in rural settings, as an indicator of WNV activity and of human risk. However, the fact that the cost of testing is usually borne by the horse owner together with the increasing vaccination of horses against WNV infection, the usefulness of equine surveillance may become limited.

A vaccine manufactured in the United States has been available in Canada since September 2001 to protect horses from disease caused by WNV. Initially allowed for use under an "emergency use permit system", the vaccine was licensed and registered for use in Canada as of February 2003. The number of infected horses would be expected to decline with increased use of the vaccine. Horses require re-vaccination on a yearly basis.

Equine practitioners can send serum or tissue samples to the Animal Health Laboratory in Guelph, Ontario, or to other private veterinary diagnostic laboratories for analysis. While there is no federal policy for action on equine WNV, laboratories must notify the Canadian Food Inspection Agency (CFIA) of any positive test result for equine WNV.

Provincially, the Ontario Ministry of Agriculture and Food is to notify the local health unit of any positive test result for equine WNV.

Findings

In 2007, there were no reported cases of WNV in the equine population in all of Ontario. In 2006, Ontario had 3 reported cases of WNV in the equine population; one of those cases was reported within the NBPSDHU area in the Town of Rutherglen. In 2005, there were no reports of WNV infection in horses in the NBPSDHU area. There were 5 positive WNV cases identified in horses in 2005. [19]

WEATHER ANALYSIS

Introduction

The trapping of mosquito populations can vary with weather conditions, particularly rain (which increases their numbers due to availability of standing water and thus breeding sites), wind (which tends to decrease numbers collected), and temperature (the warmer the temperature the quicker mosquito larvae develop into mature adult mosquitoes). Based on the above weather phenomena, it is important to monitor weather data throughout the WNV surveillance season.

Weather data was collected from Environment Canada for the 2007 season as trapping of adult and larval mosquito populations can be a function of weather conditions. Weather conditions can affect the growth of mosquito species of concern and increase or decrease potential mosquito breeding sites, ultimately affecting the number of mosquitoes captured.

Degree Days

Temperature controls the developmental rate of many organisms[17]. Plants and invertebrate animals, including insects and nematodes, require a certain amount of heat to develop from one point in their life cycle to another. This measure of accumulated heat is known as physiological time. Physiological time is often expressed and approximated in units called degree-days (°D) [17].

Upper and lower developmental thresholds have been determined for some organisms through carefully controlled laboratory and field experiments[17]. The lower developmental threshold for an organism is the temperature below which development stops. The upper developmental threshold is the temperature above which the rate of growth or development begins to decrease or stop.

The total amount of heat required, between the lower and upper thresholds, for an organism to develop from one point to another in its life cycle is calculated in units called degree-days (°D) [17]. One degree-day is one day (24 hours) with the temperature above the lower developmental threshold by one degree. For instance, if the lower developmental threshold for an organism is 18°C and the temperature remains 19°C (or 1°C above the lower developmental threshold) for 24 hours, one degree-day is accumulated.

Each species requires a defined number of degree-days to complete its development[17]. The accumulated degree-days from a starting point can help predict when a developmental stage will be reached. In the case of *Cx. spp.* mosquitoes, the lower developmental threshold is 18.3°C. The number of degree days above 18.3°C is determined by Environment Canada. The accumulated degree-day threshold for *Cx. spp.* is 388 days.

Findings

The following figures provide an overview of the weather conditions during the 2005, 2006 and 2007 WNV surveillance seasons. Data for all figures were taken from Environment Canada's website. www.climate.weatheroffice.ec.gc.ca/climatedata

The average minimum and maximum temperatures are important to monitor because they are used to determine cooling degree-days. Figure 18 displays the average maximum and minimum temperatures per month during each WNV surveillance season. When comparing the data for the 2005 to 2007 surveillance seasons, a similar trend is occurring from year to year.

Cooling degree-days are important to monitor because they indicate the number of optimum days for mosquito growth. Figure 19 displays the number of cooling degree days during each WNV surveillance season. As explained above, the lower developmental threshold for *Cx. spp*. Is 18.3°C and the accumulated degree-day threshold is 388. In 2007, there were 159 cooling degree days compared to 138 in 2006 and 243 in 2005; all well below the developmental threshold for the main species of concern, the *Cx. spp*.

Temperature is important to monitor because it directly influences the growth of mosquito larvae – higher temperatures usually equal higher numbers of mosquitoes present and vice versa. However, this is not always true if precipitation rates are low. Figure 20 displays the average temperature per month during each WNV surveillance season. The average monthly temperature follows a similar trend from 2005 to 2007. In 2007, July and August demonstrated the highest average monthly temperatures, however with a low precipitation rate August was not an overly productive month for mosquito collection.

Precipitation data is important to monitor because it directly influences the growth of larvae by increasing the amount of standing water available. In order for standing water to be productive, the temperature must be high enough for sufficient breeding. Figure 21 displays the total precipitation per month during each WNV surveillance season. In 2007, the NBPSDHU area received 582mm of rain from May-October compared to 741mm in 2006 and 442mm in 2005. Overall, precipitation levels were highest in 2006 compared to 2005 and 2007. In 2007, precipitation rates were highest in June and July, and coincidentally, the number of amplification (*Cx. spp.)* larval and adult species collected was highest during this time.

Figure 18. Average Minimum and Maximum Temperatures (in ^{0}C) per Month During the WNV Surveillance Season in the NBPSDHU Area, 2005 - 2007

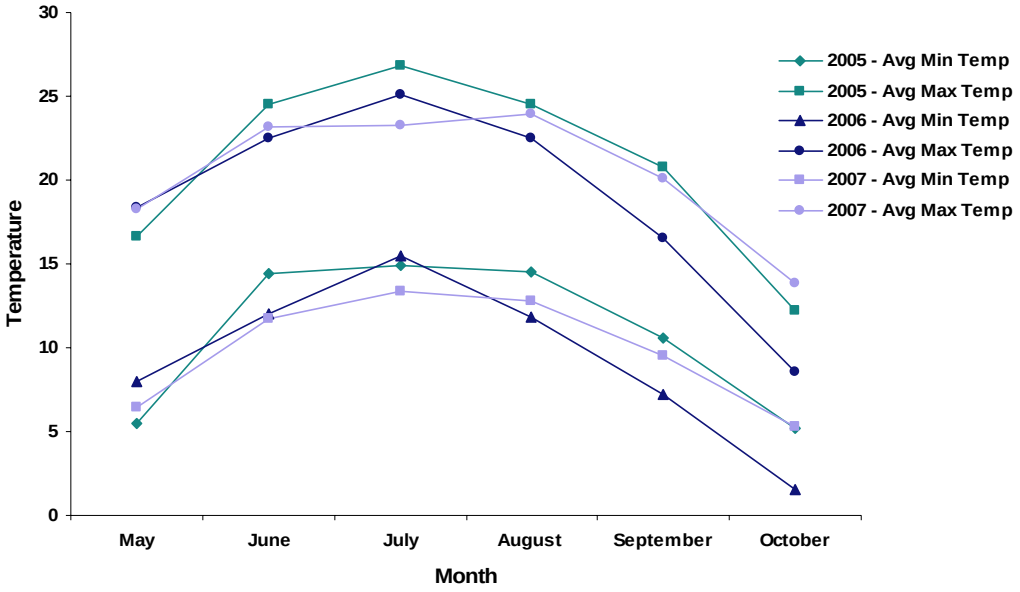


Figure 19. Number of Cooling Degree Days (in ^{0}C) per Month During the WNV Surveillance Season in the NBPSDHU Area, 2005 - 2007

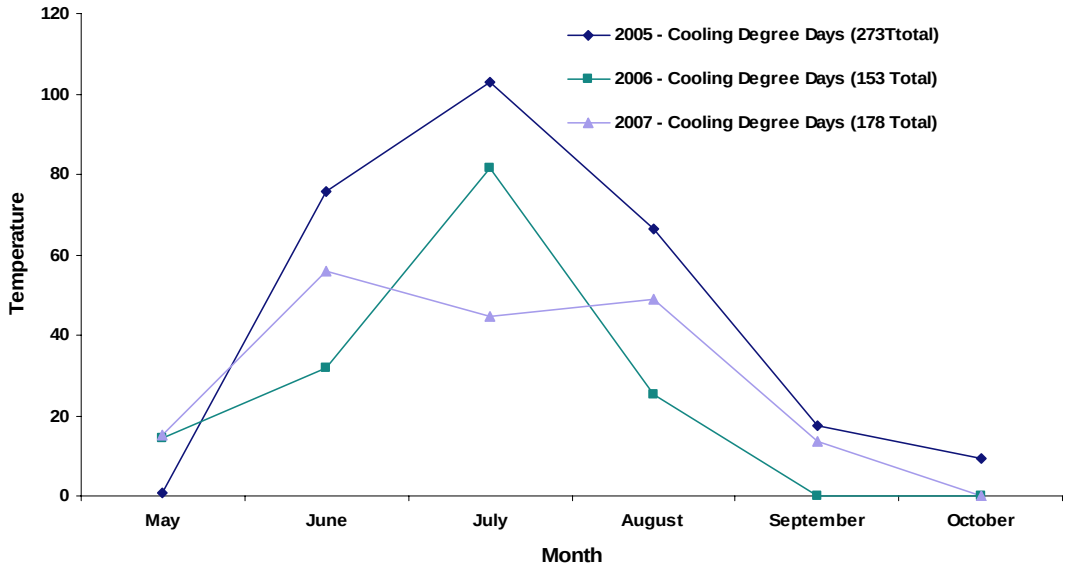


Figure 20. Average Temperature (in ^{0}C) per Month During the WNV Surveillance Season in the NBPSDHU Area, 2005 - 2007

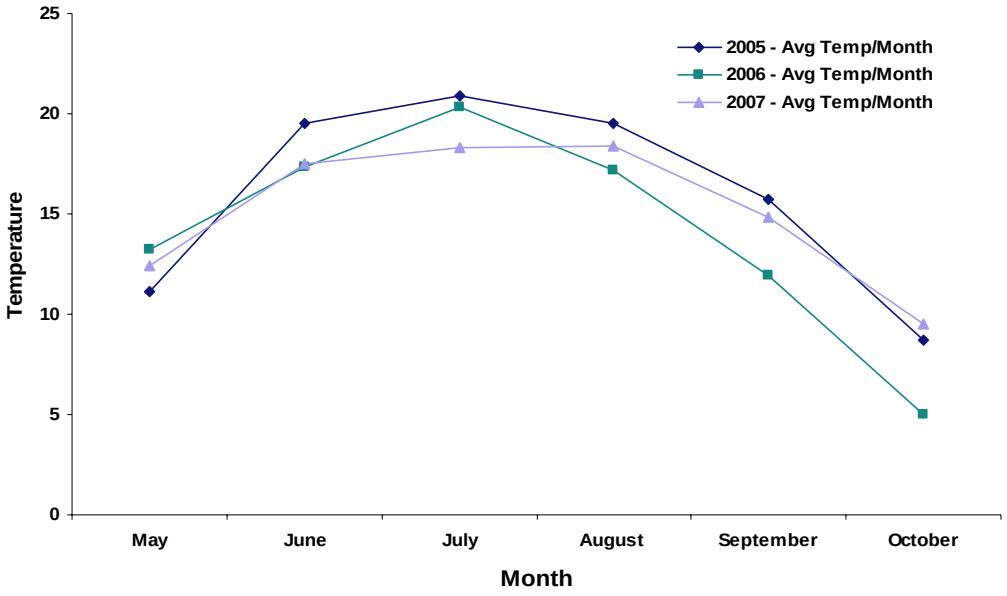
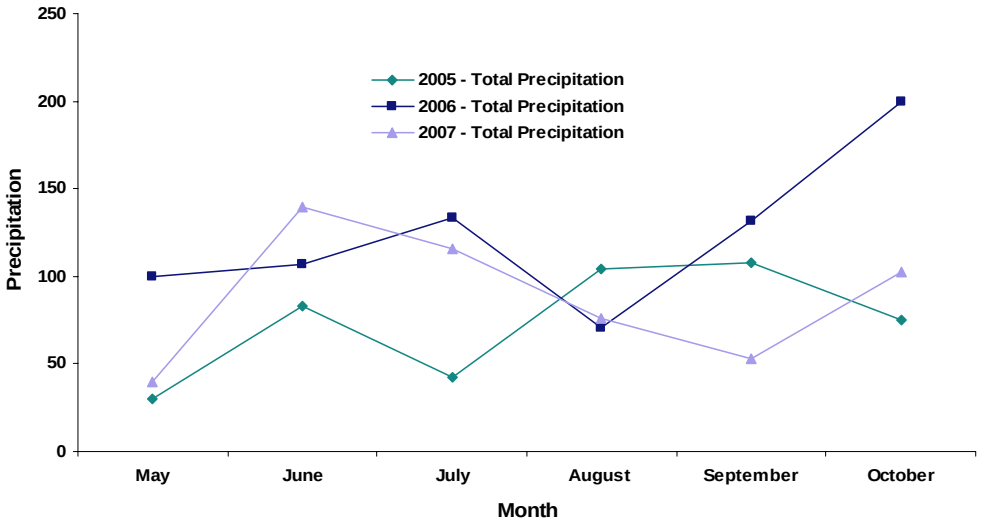


Figure 21. Total Precipitation (in mm) per Month During the WNV Surveillance Season in the NBPSDHU Area, 2005 - 2007



PUBLIC EDUCATION, COMMUNICATION AND OUTREACH

Based on our key learning's from West Nile Virus (WNV) awareness activities conducted in 2006, the NBPSDHU WNV 2007 communication plan focused on two main messages, offering a common-sense approach to minimizing the risk associated with WNV:

- Early in the mosquito season, the risk to humans is low. The most important precaution all residents and business owners in the district can take is to ensure that potential mosquito breeding sites are eliminated from their properties. Reducing the mosquito population reduces the risk of West Nile Virus.

- Personal protective measures become more important as the season progresses. Avoid mosquito bites by wearing long-sleeved tops and long pants, socks and shoes. Stay away from areas with high mosquito populations, and avoid being outdoors at dusk and dawn, when mosquito activity is higher. Use an inset repellent containing DEET, and follow Health Canada recommendations for its use, especially on children.

The communication plan addressed a wide variety of target audiences using a number of communication vehicles. The plan was proactive, making use of established messages as noted above, yet flexible in order to respond to developments as the season progressed. Messaging was in line with that of the MOHLTC WNV plan.

On May 25, 2007, a Stakeholder/Municipal Day was held in Sundridge, Ontario, to inform all on our past experiences, lessons learned and our 2007 plan of activities.

Communication vehicles used in 2007 included: media releases and advisories, mosquito trap demonstrations, paid newspaper, bi-weekly report to physicians, the website, fact sheets and posters, stakeholder meetings, and displays. A media conference was not required. A list of media releases follows and the full text of the releases can be found on the Health Unit website at www.healthunit.biz in the 'Media Releases' section.

The plan was evaluated using the number and nature of calls to the WNV hotline, the public health inspectors and Community Information Services, the amount and nature of media coverage, and feedback from stakeholders and the public. A summary of this activity follows.

West Nile Virus Media Releases

These media releases can be found in the 'Media Releases' section of the Health Unit website at www.healthunit.biz.

Date	Heading
May 1	Health Unit Opens West Nile Virus Dead Bird Reporting Line
August 29	Crow Tests Positive for West Nile Virus
October 16	West Nile Virus Completed for Another Year

Media Releases	3
Media Inquiries	26
Telephone Contacts West Nile Virus Hotline – to report dead bird sightings 'of concern'	110
Community Information Services Primarily from pregnant women and parents concerned About the use of insect repellents containing DEET on their children.	11

All media in the district provided coverage of Health Unit activities and news. Advertising by way of Newspaper, Radio and Television was done by the MOHLTC and was not formally tracked. There was no duplication of the MOHLTC advertising by the NBPSDHU.

STANDING WATER COMPLAINTS

In 2007, the NBPSDHU responded to 10 standing water complaints from the public. This compares to 14 in 2006 and 7 in 2005. When a complaint was received the following information was collected: date received, person reporting the standing water, location of standing water, and property owner. All reports were assessed by a Public Health Inspector and a site visit was made by an Environmental Technician if deemed appropriate.

During a site visit the presence of standing water was confirmed, GPS coordinates were collected, digital photographs were taken and the site was sampled for mosquito larvae when possible. No visits were made onto private property without permission of the property owner. Private property owners were provided with educational material outlining the reasons for reducing standing water. Local municipalities were informed of a complaint on municipal property. An inventory of all standing water complaints was maintained in the event that the Medical Officer of Health MOH determined that mosquito control activity was required in the area.

DISCUSSION

It is public health's mandate to monitor the health of the community through surveillance. Health surveillance is the forecasting of any health event or health determinant through the continuous collection of high-quality data, the integration, analysis and interpretation of those data into surveillance products (i.e. reports, advisories, warnings) and the dissemination of those surveillance products to those who need to know.

A surveillance program for dead birds attempts to establish the presence of WNV in the bird population, which serves as an early warning of risk to human health. By the end of the 2007 mosquito surveillance season, 110 dead crows, ravens and blue jays had been sighted in the NBPSDHU area. A peak in dead bird sightings occurred in week 29 following the trend from the previous 2 surveillance seasons.

In conjunction with the CCWHC, the testing of 35 dead crow, raven and blue jay specimens established that WNV was present in the NBPSDHU Unit area. One (1) of the 35 dead birds submitted for testing was found to be positive for WNV. Research has shown that the presence of dead birds found to be positive for WNV precedes an increased risk for human illness by a period of two to six weeks.[18]

No WNV-positive pools of mosquitoes were found in the NBPSDHU area in 2007. Although 30 species of adult mosquitoes were found in the NBPSDHU area in 2007, only a small number (4% of total collected) of the amplification vector mosquitoes, which are important in the transmission of WNV from birds to mosquitoes, were collected. While other species of mosquitoes are more likely to bite people, control of the main amplification vector, *Cx. spp*., is one of the most important strategies to reduce the risk of WNV transmission to humans.[4]

Larval surveillance provides important information for mosquito control interventions. A total of 165 sites were surveyed for mosquito larvae in the NBPSDHU area. The presence of mosquito larvae was identified in 33% of the potential breeding sites (catch basins, roadside ditches etc.) from which samples were taken and in 77% of the permanent larvae sampling sites. *Cx. pipiens*, *Cx. restuans* and *Cx. spp.* accounted for only 4% of the all the adult mosquitoes identified whereas 48% of the mosquito larvae identified were *Cx. pipiens/restuans* and *Cx. spp.*

Cq. perturbans accounted for 49% of the all the adult female mosquitoes speciated but were not identified during larval surveillance. *Cq. perturbans* larvae attach themselves to the stems and roots of emergent vegetation to obtain oxygen, and do not need to swim up and down in the water column to feed and breathe. This makes it difficult to perform larval surveillance for this species.

Temperature and density of larvae can result in changes in the population density of the mosquito species.[16] The small number of mature *Cx.* mosquitoes may be the result of a

number of factors, including temperature, larval density, rain, and location of larvae versus placement of adult mosquito traps. On average, the 2005 WNV season was warmer than the 2006 and 2007 surveillance seasons. The warmer season in 2005 led to more degree days and therefore, a longer optimal growth time for mosquitoes. The data supports this statement as more amplification vector species, larval and adult, were captured in 2005 compared to 2006 and 2007.

Identification of WNV in humans emphasizes the importance of active, hospital-based human surveillance programs, as well as the need to consider WNV as a possible diagnosis when clinicians encounter patients with encephalitis, meningitis, acute flaccid paralysis or non-specific fevers occurring throughout this time period.[4,10] A human vaccine against WNV is under development by several commercial manufacturers. However, presently, there is no vaccine available for use in humans.[8] There were no human cases reported in the NBPSDHU area in 2007. In 2006, 2 human cases were reported in the NBPSDHU area.

CONCLUSION

WNV is a threat to the population of the NBPSDHU area as evidenced by the continued finding of infected birds and the presence of mosquito species of concern. In 2007 there were no human cases of WNV identified in the NBPSDHU area. In 2006, two (2) human cases of WNV were identified. We continue to identify WNV positive birds throughout the area with one in 2007, 7 in 2006, and 2 in 2005. The continuous identification of WNV positive birds, and of two human cases during the 2006 surveillance season, indicates that the virus is being effectively transmitted throughout the Corvids population and to humans in our area. Human illness experienced and the changing ecology supports the need for the public health unit to continue active surveillance and public education efforts in regard to WNV.

Surveillance activities have the potential to predict human risk from WNV. The information collected during surveillance activities permit the local MOH to determine if action is required by a municipality to decrease the risk of WNV to the human population within the public health unit area served by the MOH. The surveillance for mosquito data is not restricted to WNV, many other vector borne diseases are transmitted by the bite of an infected mosquito such as, Dengue Fever, Malaria and Yellow Fever to name a few. All these diseases have the potential of surfacing, or resurfacing as in the case of Malaria, in North America just like WNV.

This report has demonstrated the need for continued detailed WNV surveillance. It is one of the three essential pillars in a full WNV prevention and control program along with public education and source reduction.

RECOMMENDATIONS

The health unit will continue to conduct surveillance and protection activities as well as a public education campaign.

Bird Surveillance

A surveillance program for dead birds consists of making note of the location of dead bird sightings and the collection of suitable specimens for testing. As previously mentioned, a surveillance program attempts to establish the presence of WNV in the bird population, which serves as an early warning of risk to human health. For this reason, it is recommended that the bird surveillance component is continued for the 2008 WNV surveillance season.

Adult Mosquito Surveillance

It is recommended that the number of flexible traps be maintained in order to respond to dead bird reports, positive equine cases and positive human cases. In 2008, to further analyze the distribution of adult mosquito species, and to ensure that the health unit is making every effort to identify potential areas of risk, the health unit will perform a canopy trap study. This trap will be set at a height of 12 feet in the tree as opposed to the height of 6 feet that terrestrial traps are set.

Larval Mosquito Surveillance

It is recommended that both fixed and temporary sites be monitored for mosquito larvae. The health unit will attempt to strengthen their larval surveillance by using underwater traps for sewage lagoons and retention ponds.

Other Animal Surveillance

Following the identification of a WNV positive horse, mosquito surveillance and control strategies as outlined in the 2007 plan will be implemented.

It is also recommended that communication with large animal veterinarians be maintained in the district in order to allow communication in the event of a positive WNV equine case.

Weather

The health unit will also continue in efforts to collect and analyze weather data. The number of degree days in a given summer may help to predict the severity of WNV human infection. The highest number of human WNV cases in Ontario occurred in 2002. Although, the summer of 2005 had the highest number of degree days compared to all other years since 2002.

SECTION 2.0

2007 WNV SURVEILLANCE EXPENDITURES

WEST NILE VIRUS	EXPENSES $	BUDGET $	VARIANCE $
WNV Travel	23,971.54	17,000.00	6,971.54
WNV Planning & Training	901.48	1,000.00	(98.52)
WNV Public Ed & Communications	10,878.97	15,000.00	(4,121.03)
WNV Speciation Contract	4,590.50	14,000.00	(9,409.50)
WNV Larviciding	0.00	1,000.00	(1,000.00)
WNV Adult Mosquito Test	15,979.00	25,000.00	(9,021.00)
WNV Expenses	1,062.02	6,621.00	(5,558.98)
WNV Ontario Reg 199\03	0.00	0.00	0.00

TOTAL Cost Shared	57,383.51	79,621.00	(22,237.49)

3.0 REFERENCES

1. Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report. *Laboratory-Acquired West Nile Virus Infections – United States, 2002.* December 20, 2002:51 (50):1133-1135. [cited 2008 Mar 3]:[3 screens]. Available from URL: http://www.cdc.gov/mmwr/pdf/wk/mm5150.pdf

2. Leighton F. *West Nile Virus in Canada 2003*. [cited 2008 Mar 3]:[6 screens]. Available from URL: http://wildlife.usask.ca/bookhtml/arbovirus/arbown.htm

3. Health Canada. *Fact Sheet #2 – West Nile Virus: General Overview*. 2003 April. [cited 2008 Mar 3]:[3 screens]. Available from URL: http://www.hc-sc.gc.ca/pphbdgspsp/publicat/info/pdf/WNV2003-generaloverview.pdf

4. Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report. *Provisional Surveillance Summary of the West Nile Virus Epidemic – United States, January-November 2002.* December 20, 2002:51 (50):1129-1133. [cited 2008 Mar 3]:[5 screens]. Available from URL: http://www.cdc.gov/mmwr/pdf/wk/mm5150.pdf

5. Centers for Disease Control and Prevention. *Statistics, Surveillance, and Control*. [cited 2008 Mar 5]:[1 screen]. Available from URL: http://www.cdc.gov/ncidod/dvbid/westnile/surv&controlCaseCount07_detailed.htm

6. Leighton F. *St. Louis Encephalitis Virus*. [cited 2008 Mar 3]:[3 screens]. Available from URL: http://wildlife.usask.ca/bookhtml/arbovirus/arbosle.htm

7. Centers for Disease Control and Prevention. West Nile Virus Basics – Prevention: Avoid Mosquito Bites to Avoid Infection. [cited 2008 Mar 3]:[4 screens]. Available from URL:http://www.cdc.gov/ncidod/dvbid/westnile/index.htm

8. Canadian Cooperative Wildlife Health Centre. *What is West Nile Virus?* [cited 2008 Mar 3]:[2 screens]. Available from URL: http://www.wildlife.usask.ca/WestNileAlertHTML/WestNileAlertEng2.htm

9. Ontario Ministry of Health and Long-Term Care. *Public Information: West Nile Virus 2007*. 2008 March. [cited 2008 Mar 3]:[1 screen]. Available from URL: http://www.health.gov.on.ca/english/public/program/pubhealth/westnile/wnv_mn.html.

10. Region of Peel. *Region of Peel West Nile Virus Prevention & Control Plan 2003*. February 2003

11. Centers for Disease Control and Prevention. *West Nile Virus (WNV) Infection – Information for Clinicians*. 2002 August 20. [cited 2008 Mar 3]:[2 screens]. Available from URL: http://www.cdc.gov/ncidod/dvbid/westnile/resources/fact_sheet_clinician_082102_0802.pdf

12. Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report. *Update: investigations of West Nile Virus infections in recipients of organ transplantation and blood transfusion – Michigan, 2002.* October 4, 2002:51 (39):879. [cited 2008 Mar 3]:[3 screens]. Available from URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5139a2.htm

13. Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report. *Possible West Nile Virus Transmission to an Infant through Breastfeeding – Michigan, 2002*. October 4, 2002:51 (39):877-878. [cited 2008 Mar 3]:[3 screens]. Available from URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5139a1.htm

14. Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report.

Intrauterine West Nile Virus Infection – New York, 2002. December 20, 2002:51 (50):1135-1136. [cited 2008 Mar 3]:[2 screens]. Available from URL: http://www.cdc.gov/mmwr/pdf/wk/mm5150.pdf

15. Sejvar J. *Emerging clinical syndromes of West Nile Virus Infection.* Presentation at the Fourth National Conference on West Nile Virus in the United States, New Orleans, Louisiana, February 9-11, 2003. Available from URL: http://www.cdc.gov/ncidod/dvbid/westnile/conf/pdf/Sejvar_4th03.pdf

16. Ontario Ministry of Health and Long-Term Care. *Public Information: West Nile Virus 2007-Horses*. 2007 April [cited 2008 Apr 3]:[1 screen]. Available from URL: http://www.health.gov.on.ca/english/providers/program/pubhealth/westnile/wnv_07/wnv_horses.html

17. State wide IPM Program, Agriculture and Natural Resources, University of California. *How to Manage Pests: Degree Days.* [cited 2008 Apr 3] Available from URL: http://www.ipm.ucdavis.edu/WEATHER/ddretrieve.html

18. Canadian Cooperative Wildlife Health Centre. *West Nile Virus Surveillance Program 2003: Looking For West Nile Virus in Dead Corvids*. [cited 2008 Mar 3]:[1 screen]. Available from URL: http://wildlife1.usask.ca/WestNileAlertHTML/WestNileAlertEng1.htm

19. Olejnicek, J. and Gelbic, I. *Differences in response to temperature and density between two strains of the mosquito, Culex pipiens molestus Forskal.* Journal of Vector Ecology. 2000 25 (2):136-145 [cited 2008 Mar 3] Available from URL: http://www.sove.org/Journal%20PDF/dec2000/Dec2000%20ToC.htm

20. Centers for Disease Control and Prevention. *West Nile Virus: Questions and Answers – Prevention.* [cited 2008 Mar 3]:[2 screens]. Available from URL: http://www.cdc.gov/ncidod/dvbid/westnile/qa/prevention.htm

North Bay Parry Sound District Health Unit (2007). *2006 West Nile Virus Summary Surveillance Report.* North Bay, ON: North Bay Parry Sound District Health Unit.

Middlesex London Health Unit. *West Nile Virus Report: Surveillance and Control Activities for 2006.* London, Ontario: Middlesex London Health Unit

Region of Peel – Peel Public Health. 2006 – *WNV in the Region of Peel.*

4.0 APPENDICES

Appendix A - West Nile Virus Surveillance Week Codes for 2006 and 2007

Week # (Sun to Sat)	**2006**	**2007**
18	Apr 30 - May 6	Apr 29 - May 5
19	May 7 - May 13	May 6 - May 12
20	May 14 - May 20	May 13 - May 19
21	May 21 – May 27	May 20 – May 26
22	May 28 - Jun 3	May 27 - Jun 2
23	Jun 4 - Jun 10	Jun 3 - Jun 9
24	Jun 11 - Jun 17	Jun 10 - Jun 16
25	Jun 18 - Jun 24	Jun 17 - Jun 23
26	Jun 25 - Jul 1	Jun 24 - Jun 30
27	Jul 2 - Jul 8	Jul 1 - Jul 7
28	Jul 9 - Jul 15	Jul 8 - Jul 14
29	Jul 16 - Jul 22	Jul 15 - Jul 21
30	Jul 23 - Jul 29	Jul 22 - Jul 28
31	Jul 30 - Aug 5	Jul 29 - Aug 4
32	Aug 6 - Aug 12	Aug 5 - Aug 11
33	Aug 13 - Aug 19	Aug 12 - Aug 18
34	Aug 20 - Aug 26	Aug 19 - Aug 25
35	Aug 27 - Sep 2	Aug 26 - Sep 1
36	Sep 3 - Sep 9	Sep 2 - Sep 8
37	Sep 10 - Sep 16	Sep 9 - Sep 15
38	Sep 17 - Sep 23	Sep 16 - Sep 22
39	Sep 24 - Sep 30	Sep 23 - Sep 29
40	Oct 1 - Oct 7	Sep 30 - Oct 6
41	Oct 8 - Oct 14	Oct 7 - Oct 13
42	Oct 15 - Oct 21	Oct 14 - Oct 20
43	Oct 22 - Oct 28	Oct 21 - Oct 27

Appendix B - WNV Positive Mosquito Pools - Adult Mosquito Surveillance for WNV by Health Unit, Ontario, 2005 to 2007

Health Unit	Total Positive Pools 2007	Total Positive Pools 2006	Total Positive Pools 2005
Algoma	0	3	1
Brant County	0	2	0
Chatham-Kent	4	4	4
Durham Region	0	7	3
Elgin-St. Thomas	0	1	2
Haldimand Norfolk	1	0	1
Haliburton-Kawartha-Pine Ridge	0	1	2
Halton Region	8	17	24
Hamilton	3	14	2
Hastings & Prince Edward Counties	0	1	0
Lambton County	0	5	3
Middlesex-London	0	6	12
Niagara Regional	1	7	10
Northwestern	1	4	0
Ottawa Public Health	0	3	2
Oxford County	0	3	3
Peel	3	14	24
Perth	0	1	2
Peterborough	0	1	7
Porcupine	0	1	0
Simcoe - Muskoka	0	1	2
Sudbury	0	13	0
Toronto	17	47	142
Waterloo Region	0	1	1
Wellington-Dufferin-Guelph	0	1	0
Windsor-Essex County	13	14	30
York Region	0	10	14
ONTARIO TOTAL	**51**	**182**	**291**

Source: Ontario Ministry of Health and Long-Term Care (see Internet site: http://www.health.gov.on.ca/english/providers/program/pubhealth/westnile/wnv_05/wnv_surveillance.htm)

Appendix C - WNV Human Case Surveillance by Health Unit, 2005 to 2007

Health Unit Region	Total Cases* 2005	Total Cases* 2006	Total Cases* 2007
Algoma	0	1	0
Brant County	0	2	0
Chatham-Kent	5	0	0
Durham Region	0	0	1
Eastern Ontario	2	0	0
Grey Bruce Health Unit	3	0	0
Haliburton-Kawartha-Pine Ridges	2	0	0
Halton Region	5	1	2
Hamilton	1	3	1
Huron County	0	0	1
Lambton	2	2	0
Middlesex-London	3	3	1
Niagara Regional	3	3	0
North Bay Parry Sound	0	2	0
Northwestern	0	1	0
Ottawa	3	2	0
Oxford County	1	1	0
Peel Regional	3	2	1
Perth	0	1	0
Peterborough	1	1	0
Simcoe - Muskoka	0	1	0
Sudbury	0	1	0
Toronto	38	6	4
Waterloo Region	1	0	0
Windsor-Essex County	23	6	2
York Region	5	3	0
ONTARIO TOTAL	**101**	**42**	**13**

Source: Public Health Agency of Canada - see Internet site: http://www.phac-aspc.gc.ca/wnv-vwn/mon-hmnsurv_e.html

Please note:

- Totals include both probable and confirmed WNV cases.
- Total clinical cases: is the sum of WNV Neurological Syndrome + WNV Non-Neurological Syndrome + WNV Unclassified/Unspecified.
- Totals include some cases related to travel outside the province/ territory

Appendix D - WNV Human Clinical Cases in Canada: 2005 to 2007

Province/Territory	2005 Total	2006 Total	2007 Total
Newfoundland and Labrador	1	0	0
Prince Edward Island	1	0	0
Nova Scotia	1	0	1
New Brunswick	4	1	0
Quebec	95	42	2
Ontario	55	50	13
Manitoba	58	19	576
Saskatchewan	10	39	1422
Alberta	0	0	320
British Columbia	0	0	19
Yukon	0	0	0
Northwest Territories	0	0	0
Nunavut	0	0	0
Total	**225**	**151**	**2353**

Source: Public Health Agency of Canada - see Internet site for more detail: http://www.phac-aspc.gc.ca/wnv-vwn/mon-hmnsurv_e.html

Please note:

- Totals include both probable and confirmed WNV cases
- Total clinical cases: is the sum of WNV Neurological Syndrome + WNV Non-Neurological Syndrome + WNV Unclassified/Unspecified
- Totals include some cases related to travel outside the province/ territory.

Appendix E - Glossary of Terms

adulticide	a type of pesticide used to control or eradicate adult mosquitoes
ataxia	difficulty coordinating movement or body functions
amplification vector	an arthropod (in this case, a specific species of mosquito) that is involved in the main transmission of West Nile virus between bird species.
ArcGIS (Geographic Information System)	computer based system for the integration and analysis of geographic data
bridge vector	arthropod (in this case, a specific species of mosquito) that serves as a main transmission of virus between the reservoir (birds) and a dead end host (humans).
catch basins	grates seen at street corners and in other properties for water run-off.
Culex pipiens	species of mosquito, the primary known vector for West Nile Virus, commonly found in urban areas; breeds in fresh but stagnant water such as backyard containers and storm drains.
DEET	DEET (chemical name, N, N-diethyl-meta-toluamide) is the active ingredient in many insect repellent products.
depression	any natural or man-made condition on property that is capable of holding water but does not include a municipally-owned storm water management facility.
encephalitis	inflammation of the brain, which can be caused by numerous viruses, including West Nile Virus.
enhanced passive surveillance	not actively participating in surveillance activities however, actively tracking all cases reported.
flavivirus	the genus in which the WNV is classified. WNV is a single-stranded RNA virus of the family *Flavivirdae*
GPS (Global Positioning System)	a navigation system that uses a series of 24 satellites of known position in space to determine a position on the earth's surface.
host	an animal or plant having received a parasite which then resides within the animal or plant
instar	stage in life of an insect, including shedding or casting off of outer skin or shell
larvae	immature mosquitoes; stage which hatches from the egg, prior to adult stage.
larvicide	a type of pesticide used to eradicate immature mosquitoes (larvae).
malaise	Bodily discomfort, especially without development of a specific disease
meningitis	Inflammation of the lining of the brain or spinal cord

meningoencephalitis	Inflammation of brain, lining of the brain or spinal cord
mosquito breeding site	a location where mosquitoes lay eggs, usually in stagnant water with organic material.
mosquito pools	a group of mosquitoes collected in one area and combined at the laboratory for testing for the presence of West Nile and related viruses.
myalgia	muscle soreness or pain.
natural body of water	a creek, stream, bog, marsh, river, pond or lake created or maintained by the forces of nature, which contains water and include spring fed man-made ponds.
neuropathogen	an agent which causes disease of the nervous system.
other vectors	Certain species of mosquitoes that are not known to transmit West Nile virus.
outbreak	an unexpected increase in frequency or distribution of a disease.
pesticide	Substance used to kill pests such as insects, mice and rates; an insecticide is a form of pesticide.
sepsis	blood poisoning
seroprevalence	testing blood for the presence or absence of an antibody within the blood. When a person has been exposed to a virus, their immune system will create antibodies to try to combat the virus.
source reduction	the removal or reduction or larval mosquito habitats.
standing water	any water which is not continuously filtered and in movement by mechanical means that is found either on the ground or in any object or debris as defined above but does not include a natural body of water that exists on a permanent basis or is contained within a municipally owned drain or storm water management facility.
vector	an organism (an insect in most cases) capable of carrying and transmitting a disease-causing agent from one host to another.
vector control	mechanism instituted to control and reduce the vector population.
West Nile Virus Illness	**West Nile Virus illness can present in a wide spectrum of illnesses consisting of WNV neurological manifestations, WNV fever, and WNV asymptomatic infection**