HALDIMAND-NORFOLK

West Nile Virus Report

Acknowledgements

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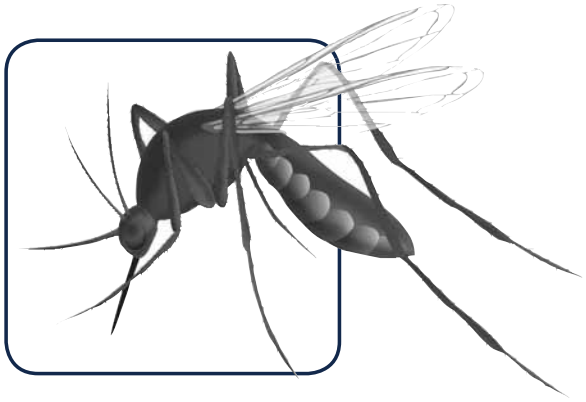

Introduction

West Nile virus (WNV) is a viral disease of wild birds that is transmitted to mammals, including humans through the bite of an infected mosquito.[1] The virus first appeared in North America in New York City in 1999. Prior to this, the virus was known to occur only in Africa, Europe and Asia.[2] In 2001, the virus was detected in Ontario and since that time the virus has increased its range and has spread rapidly to most provinces across Canada and the continental United States.[2] Today, WNV is established in Ontario and it is recognized as the first recorded large-scale mosquito-borne, Ontario-wide disease outbreak.[3]

The goal of Haldimand-Norfolk's WNV Control Program is to reduce the risk of transmission of WNV to humans through public education and a comprehensive surveillance and control program. In this effort, the Health Unit works with the Ontario Ministry of Health and Long-Term Care (MOHLTC) and other stakeholder groups in a coordinated approach. The WNV program consists of a number of components, including mosquito larvae monitoring, catch basin treatment, adult mosquito trapping and testing, bird collection and testing, human surveillance, source reduction, public inquiries and public education. This information assists the Health Unit in its efforts to prevent and control WNV illness in the community.

Background

West Nile virus normally cycles among wild birds and mosquitoes. Mosquitoes become infected with the virus when they feed on an infected bird.[4] Infected mosquitoes then transmit the infection to other birds.[4] In Ontario, the virus becomes active in the spring, and throughout the summer, the number of virus-infected birds and virus-infected mosquitoes increases through a cycle of transmission.[4] The mosquito species, *Culex pipiens* and *Culex restuans*, feed primarily on birds and are the primary vectors in the transmission of WNV infection in Ontario.[4] In late summer, the virus begins to infect other mosquito species that feed on both birds and mammals, known as bridge vector mosquitoes, increasing the risk of WNV transmission in people and other mammals.[4]

Most people who become infected with WNV will experience no symptoms or a very mild illness.[1] In a small number of cases, particularly the elderly and those with suppressed immune systems, WNV infection can result in serious illness.[1,2] As WNV infection in humans primarily occurs from the bite of an infected mosquito, the most effective way to reduce the risk of infection is to reduce exposure to mosquitoes and eliminate mosquito breeding sites on personal property.[2] People can take personal protective measures to protect themselves from mosquito bites, including avoiding times of day with high mosquito activity such as dawn and dusk, minimizing exposed skin by wearing long sleeves and long pants, and by using an effective mosquito repellent containing DEET when outdoors.[1] Mosquitoes need standing water to breed and eliminating areas of standing water on personal property on a regular basis is the most effective way to reduce mosquito populations.[1]

Public Education and Community Outreach

In 2006, public education and community outreach were key components of the WNV program in Haldimand and Norfolk Counties. The Health Unit's public education campaign focused on source reduction and personal protective measures. Educational information on WNV was distributed in the form of brochures, fact sheets, media releases and website updates. Residents were encouraged to reduce potential mosquito breeding sites around their homes and business by eliminating areas of standing water.

The Health Unit continued to provide a WNV hotline to answer public calls regarding WNV. To date, there is no standing water by-law in effect for either Haldimand or Norfolk counties. Health Unit staff investigated standing water complaints, dipped areas of standing water for mosquito larvae and enforced larviciding if required. The Haldimand-Norfolk Health Unit website was updated and maintained with current WNV information. A bi-weekly WNV update that outlined surveillance activities in the community (dead bird, mosquito, human) was updated on the website and sent to all politicians (Haldimand and Norfolk) and local news media. Media releases were used to advise the public of increases in WNV activity such as when a positive bird, mosquito pool or human case was confirmed, as well as to advise the public of the larviciding of catch basins within the community. A WNV student was responsible for the distribution of WNV educational materials throughout the season and Health Unit staff provided educational sessions as required by the public.

Larval Mosquito Surveillance and Control

The surveillance and control of mosquito larvae is a prevention measure that interrupts the transmission cycle of WNV by reducing vector mosquito populations. In 2006, the Haldimand-Norfolk Health Unit completed its fourth year of larviciding for the management of WNV. The Canadian Centre for Mosquito Management (CCMM), the pesticide company contracted by the Health Unit, used the pesticides methoprene and *Bacillus thuringiensis israelensis (Bti)* to treat catch basins and overland standing water sites to control mosquito larvae of concern regarding WNV.[6]

In 2006, larval surveillance and control was reduced by 50% from 2005. In 2006, only catch basins that were located in the large urban communities in Haldimand and Norfolk counties were monitored and larvicided. Catch basins provide ideal development sites for mosquitoes, especially *Culex* populations of mosquitoes that are the primary vectors of WNV. Canadian Centre for Mosquito Management dipped individual catch basins as part of a pre-treatment inspection to estimate mosquito densities. The pre-treatment inspection revealed development of *Culex restuans* and *Culex pipiens* mosquitoes in approximately 46% of the catch basins sampled.[6] These positive findings initiated the first round of catch basin treatment on June 29, 2006. In 2006, 6,402 municipal catch basins (3,695 in Norfolk County and 2,707 in Haldimand County) were treated with Altosid Pellets (methoprene) during each rounds of application.[6] A total of four rounds of application were scheduled at 21-day intervals between June and September. Post-treatment monitoring for methoprene efficiency was undertaken after each complete round of larviciding. The total amount of Altosid Pellets used during 2006 was 17.9 kg.[6] At each round of treatment, catch basins were marked with fluorescent spray paint for identification.

In addition to catch basins, overland standing water sites, including municipal drains, roadside ditches and storm water retention ponds, may provide significant mosquito development sites.[5] As in previous years, public complaints of standing water were investigated by Health Unit staff. Sites on private property were individually addressed through landowner education, property standard by-laws or public health legislation. Sites on public land that were confirmed positive for mosquitoes and could not be modified to reduce standing water were larvicided. Pre-treatment inspections preceded each larviciding application and only sites that were confirmed positive for mosquitoes were larvicided. A standard dip method of collection was used for site sampling. Health Unit staff conducted pre-treatment inspections and CCMM was responsible for larvicide applications and post-treatment analysis. In total, two sites in Haldimand and Norfolk were treated with *Bti*.[6]

Dead-Bird Surveillance

The objective of dead-bird surveillance is to provide a means of early detection of WNV activity in order to take measures to reduce the potential risk of transmission to humans.[5] West Nile virus has been found in more than 150 bird species in North America.[1] However, crow-family birds are used as an indicator species for the presence of WNV because they very sensitive to the virus and have high death rates when infected.[2] Surveillance data provides evidence that crow deaths precede an increased risk for human illness by two to six weeks.[7] To date, dead-bird surveillance provides the earliest and most effective method of detecting WNV activity in a community.[4]

In Ontario, the bird species tested for WNV are crows, blue jays and ravens. The Canadian Cooperative Wildlife Health Centre (CCWHC), in cooperation with Health Canada, provides WNV testing on birds. Public Health Units begin submitting birds to the CCWHC in the spring. Each Health Unit is allotted a fixed number of submissions per week for WNV testing. Once WNV is identified in the bird population within a local Health Unit, further bird testing is no longer necessary.[8]

Haldimand-Norfolk's dead-bird surveillance program involves dead-bird sightings, collecting dead-bird carcasses, dead-bird testing, and collecting and reporting data. This information assists the Health Unit in early detection of WNV activity in an area so that efforts can be taken to prevent and control WNV in the community. During the 2006 season, there were a total of 146 dead bird sightings. Eleven dead birds were collected and tested, of which four were positive for WNV. Of the four positive birds, three were reported in Norfolk County – in the towns of Delhi, Waterford and Simcoe and one was reported in Haldimand County in the town of Caledonia. See Maps 1 and 2 for the location of WNV-positive dead birds found in Haldimand and Norfolk Counties. The first WNV positive bird identified in Haldimand and Norfolk Counties was picked up on July 19, 2006, and sent to the CCWHC for testing. In 2005, there was only one WNV-positive bird confirmed in the Health Unit's jurisdiction. In Ontario, there were a total of 256 dead birds that tested positive for WNV in 2006.[9]

Adult Mosquito Surveillance

The purpose of adult mosquito surveillance is to assess the local density and seasonal dynamics of mosquito populations and identify WNV-positive species and mosquito infection rates to determine the risk of contracting WNV in the community.[10] Adult mosquito surveillance and viral testing can provide information to identify the immediacy of the risk from contracting WNV in an area.[5] This information is important for guiding appropriate prevention and control activities in each local Health Unit.[10]

In Ontario, more than 20 mosquito species have tested positive for WNV. However the primary mosquito vectors of WNV are *Culex pipiens* and *Culex restuans*.[5] Mosquito abundance and development is strongly influenced by weather conditions, including time of year, rainfall and temperature.[1] Favourable weather conditions (warm and wet) shorten mosquito development time as well as increase virus replication. This means that the number of vector mosquitoes infected with WNV can increase significantly in a short amount of time.[5]

As in previous years, the Haldimand-Norfolk Health Unit used the Centre for Disease Control (CDC) miniature light traps, baited with carbon dioxide, to trap adult mosquitoes. In 2006, adult mosquito surveillance involved setting mosquito traps at fixed locations on a weekly basis beginning in June and through to September. There were a total of 14 fixed trap sites (seven in Haldimand and seven in Norfolk) and six flexible traps reserved for identified "hot spot." See Maps 3 and 4 for the location of mosquito traps in Haldimand and Norfolk Counties. "Hot spots" are defined as identified areas where there is increased WNV activity, including WNV-positive mosquito pools, WNV-positive bird, WNV-positive human case or WNV-positive horse.[5] Three flexible traps were added during the period of surveillance on "hot spot" sites where WNV-positive birds were found. Health Unit staff were responsible for trapping and shipping mosquito samples. Mosquito collections were shipped weekly to GDG Environment, the service provider contracted by the Health Unit to identify adult mosquitoes by species and test for the presence of WNV.

The seasonal distribution of the main species of adult mosquitoes found in Haldimand-Norfolk in 2006 is depicted in Figure 1. Many of the mosquito species targeted by the WNV program were found in Haldimand-Norfolk mosquito traps in 2006. More than 80% of the mosquitoes collected were identified as mosquito species that have

tested positive for WNV in Ontario.[11] The primary vectors of WNV, the group *Culex pipiens-restuans*, accounted for 12.5% of the total mosquitoes captured in the 2006 season.[11] Populations *Culex pipiens-restuans* were also higher in 2006 than the previous year.[11] The most dominant species found was *Aedes vexans*, an important bridge vector mosquito, representing 30.7% of the total mosquitoes captured.[11] Other mosquito species detected in traps include *Oc. stimulans-excrucians* (15.6%), *Cq. Perturbans* (14.7%), and *Anopheles* (8.8%).[11]

In 2006, there were a total of 182 WNV-positive mosquito pools identified in Ontario.[10] In Haldimand and Norfolk there were no positive mosquito pools detected. However, there were positive pools found in all neighbouring Health Units including Brant, Hamilton, Niagara, Oxford and Elgin-St. Thomas.[10] Although mosquito infection rates were maintained below detection levels in Haldimand and Norfolk, there were peaks of primary vectors (*Culex pipiens/restuans*) and high collections of bridge vectors (*Ae. vexans*) throughout the season.[11] More than 40% of mosquitoes collected in 2006 are able to transmit the virus to humans with a moderate to high capacity of transmission, according to the GDG 2006 WNV Report. An abundance of primary vectors and bridge vector mosquitoes increases the risk of WNV transmission to humans. Although the risk of WNV cannot be eliminated, the results of the 2006 mosquito surveillance show that prevention and control measures may have allowed the risk of West Nile virus to be kept at a minimum.[11]

Human-Case Surveillance

Human surveillance consists of collecting information from human cases of WNV to help understand the risk factors associated with contracting the disease and factors influencing the outcome of the disease.[12] Human-case surveillance also identifies where cases are occurring so that health care providers and the general public can be notified.[12] Human surveillance in conjunction with dead-bird and mosquito surveillance provides a comprehensive overview of WNV activity in a community. In addition, human surveillance assists in ensuring the safety of our blood supply. Canadian Blood Services (CBS) provides routine screening of blood donors for WNV and all human cases are investigated for recent blood transfusions and donations.[5]

In North America, the pattern of WNV human infection and disease appears to show that four out of five people (80%) infected do not exhibit any sign or symptoms of disease.[4] In 20% of infected people, West Nile virus may cause a mild flu-like illness, known as West Nile fever, with symptoms consisting of fever, headache, muscle aches, swollen lymph nodes and skin rash.[13] Less than 1%, of infected individuals will develop a serious and potentially fatal neurological disease that is marked by fever, neck stiffness, muscle weakness, stupor, disorientation, coma, and death.[13] The disease is usually more severe in the elderly or in those with weakened immune systems. The incubation period in people is usually two to 15 days.[13] To date, there is no vaccine for WNV for humans.

In order to identify WNV in human populations, it is important that local heath care providers are aware of the signs and symptoms of WNV infection. Diagnosis of WNV relies on a high index of clinical suspicion and obtaining specific laboratory tests.[3] Ontario's WNV case definition is based on the national case definition provided by the Public Health Agency of Canada.[6] The case definition is updated as new clinical manifestations and associated long-term conditions are identified.[6] WNV is both a reportable and communicable disease under Ontario Regulation 558/91 and 559/91 respectively and requires physicians and laboratories to report human cases to the local Medical Officer of Health.

In the spring of 2006, the Health Unit notified local infection-control practitioners of the upcoming human surveillance activities for the WNV season. Health care providers were advised to watch for symptoms of WNV infection in their patients and request appropriate laboratory tests when necessary. The Health Unit was notified of all probable or confirmed cases identified by hospitals and physicians. Health Unit staff conducted comprehensive case assessments of all reported probable and confirmed WNV cases which included travel history, recent blood donation/transfusion history, symptoms and laboratory results. Results of each case investigation were forwarded to the MOHLTC.

In Ontario, there were 42 confirmed WNV human cases reported in 2006, with no human cases identified in Haldimand and Norfolk.[12] However, four of the five neighbouring Health Units – Oxford, Hamilton, Brant and Niagara reported a total of nine WNV-positive human cases. See Map 5 for the human WNV illness cases in Ontario by Health Unit jurisdiction. The first human cases of WNV-related illness identified in Haldimand and Norfolk was in 2002. In that year, there were three confirmed cases of WNV.[14] There have been no other cases

of WNV identified in Haldimand and Norfolk since the start of human surveillance in 2000.[14] However, many human cases go undetected because WNV diagnosis relies on a high index of clinical suspicion and most people who become infected with WNV are asymptomatic.

Conclusions and Recommendations

The 2006 season concludes six years of WNV surveillance in Haldimand and Norfolk Counties. WNV activity was detected in both Haldimand and Norfolk with the identification of four WNV-positive birds in 2006. Although there were no WNV-positive mosquito pools or human cases identified, the presence of WNV in the community indicates that there is a potential risk to human health. Human surveillance cannot be used independently to determine the risk to human health as most cases of WNV are undetected. Therefore, the identification of the virus in bird and mosquito populations should be used to assess the risk of contracting WNV in the community and to advise local residents.

The surveillance data from 2006 may indicate that the virus was maintained at a low activity due to larviciding and source reduction activities that may have reduced the number of vector mosquitoes. Catch basin larviciding, as part of a comprehensive mosquito management program, is an effective strategy for mitigating the risk of WNV transmission to humans. The MOHLTC WNV surveillance data has demonstrated that larviciding of standing water and catch basins are effective in reducing mosquito populations. The MOHLTC has also stated that the decrease in WNV activity observed since 2002 is due to larviciding activities.[15]

The surveillance data and information collected during the 2006 season supports the continuation of public education and WNV surveillance and control activities in Haldimand and Norfolk counties. To continue to successfully identify and respond to future WNV issues, and to enhance the effectiveness and efficiency of the program, the following recommendations are made for the 2007 WNV season:

- Enhance the public education campaign to increase public knowledge of WNV, including source reduction and personal protective measures.
- Increase mosquito surveillance to include additional trap sites in the communities of Delhi, Waterford and Jarvis. Increased surveillance is recommended due to the discontinuation of catch basin larviciding in Waterford and Jarvis in 2006, and the fact that the first WNV-positive birds reported in 2005 and 2006 were found in Delhi.
- Analysis of mosquito surveillance data for the 2007 season should include a detailed analysis of each trap site, including the seasonal distribution of mosquito species and the percentage of *Culex pipiens/restuans* collected at each site, so that prevention and control activities can be modified for each community.
- Conduct a comprehensive risk assessment, according to Ontario Regulation 199/03 - *Control of West Nile Virus*, to assist the Health Unit in prevention and control activities.
- Continue to maintain a mosquito management program, including catch basin larviciding with all larviciding decisions continuing to be based on the findings of regular larval surveillance.
- Develop a plan for regular overland surveillance and control using the information collected during the 2005 season by CCMM.
- Consult with local physicians to develop strategies to enhance the accurate and timely reporting of WNV-related illness to the Health Unit.

The emergence of WNV in Ontario has shown that public education, surveillance activities, and prevention and response measures are essential in the prevention and control of this mosquito-borne disease. In Ontario, surveillance data from 2006 reflects similar epidemiological trends seen in 2002-2005. It also shows a marked increase in the extent of regional activity of WNV. While WNV activity will vary from year to year, evidence has shown that the virus is established in Ontario and there is no way to predict the future prevalence of the disease. Therefore, it is important that Haldimand-Norfolk's WNV surveillance and control program continue to develop in order to respond to future WNV demands and decrease the risk of human disease across both counties.

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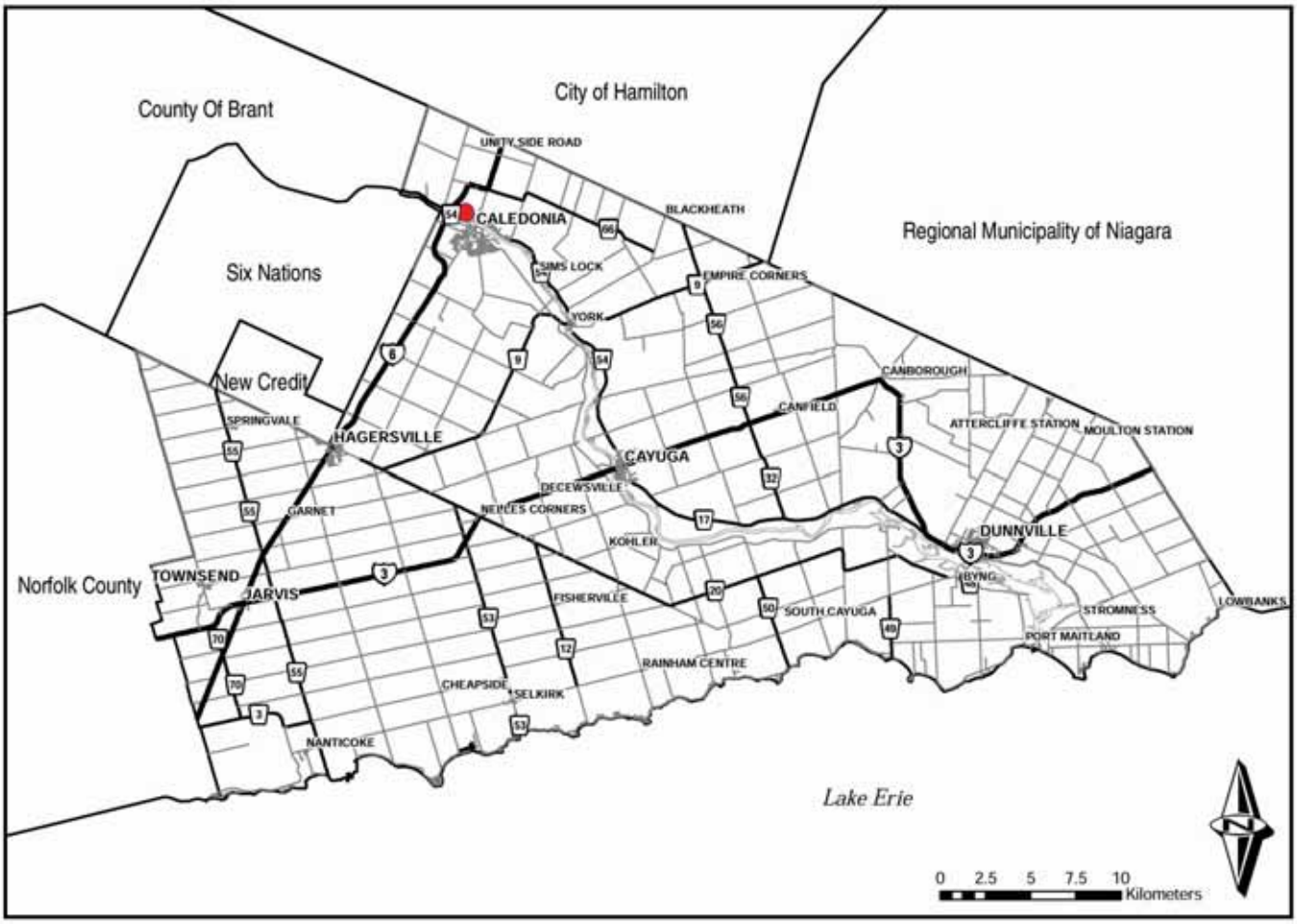
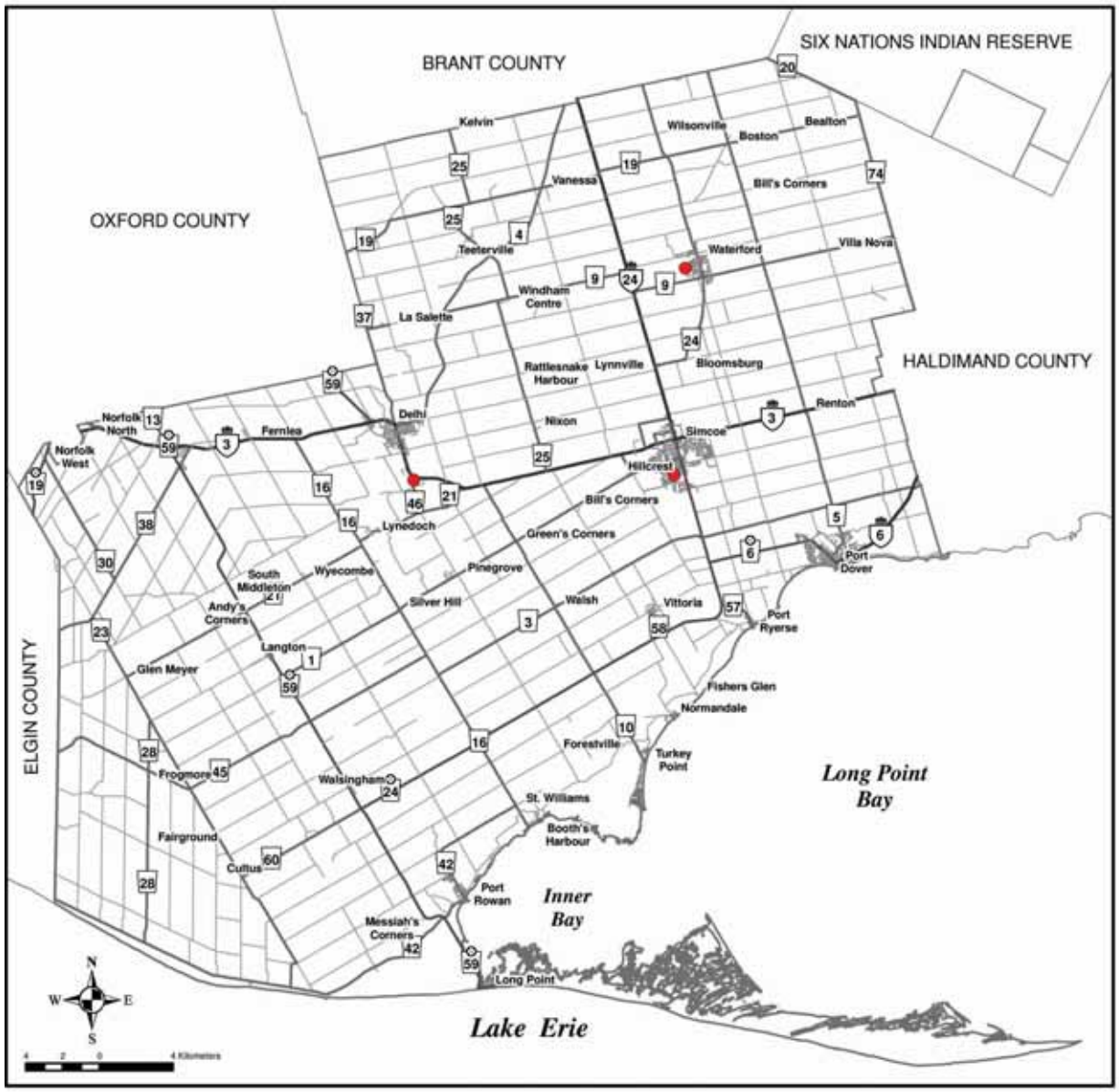
Map 1: Location of WNV positive dead birds, Haldimand County, 2006



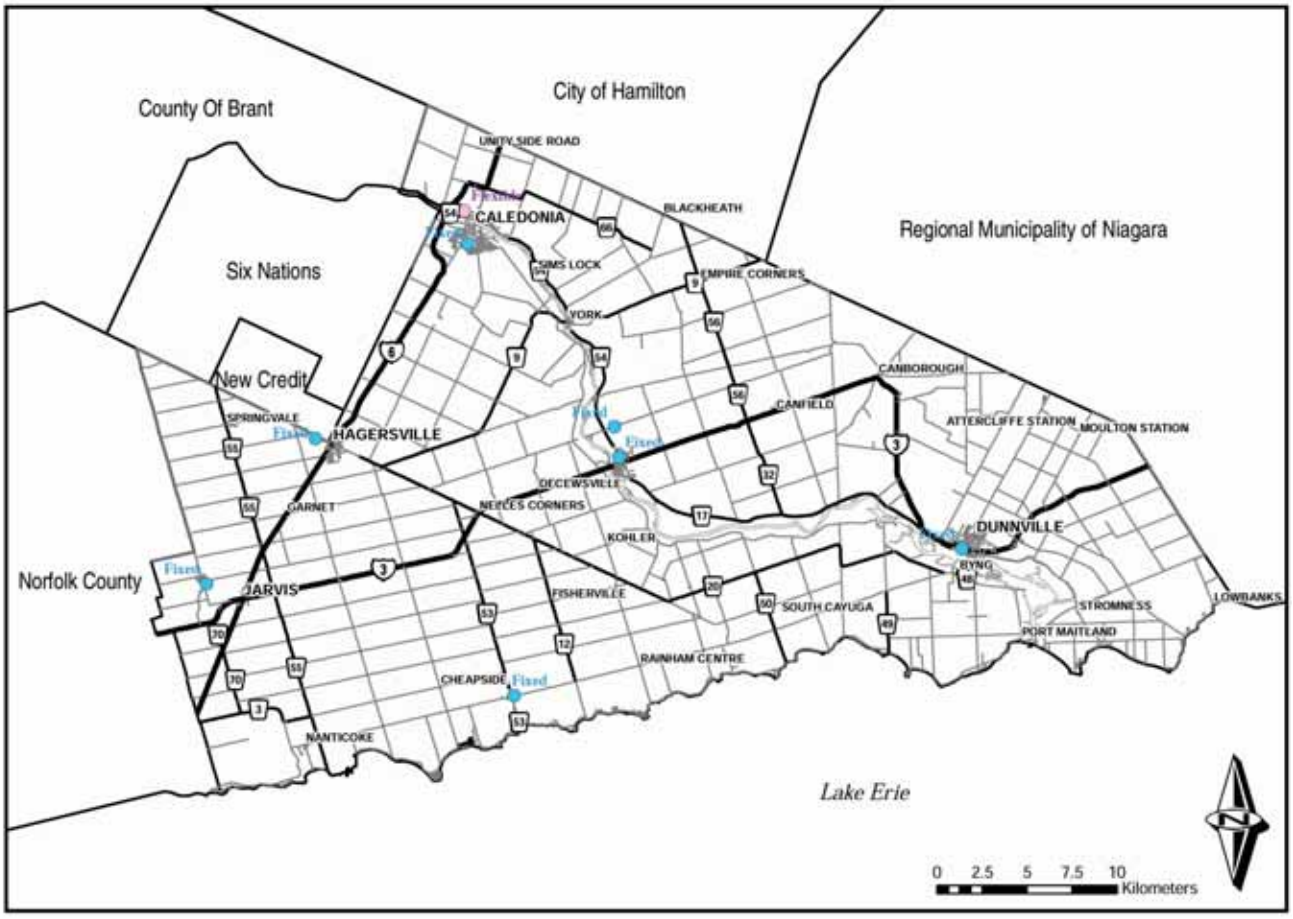
Data Source: Planning Department, Haldimand County.

Map 2: Location of WNV positive dead birds, Norfolk County, 2006



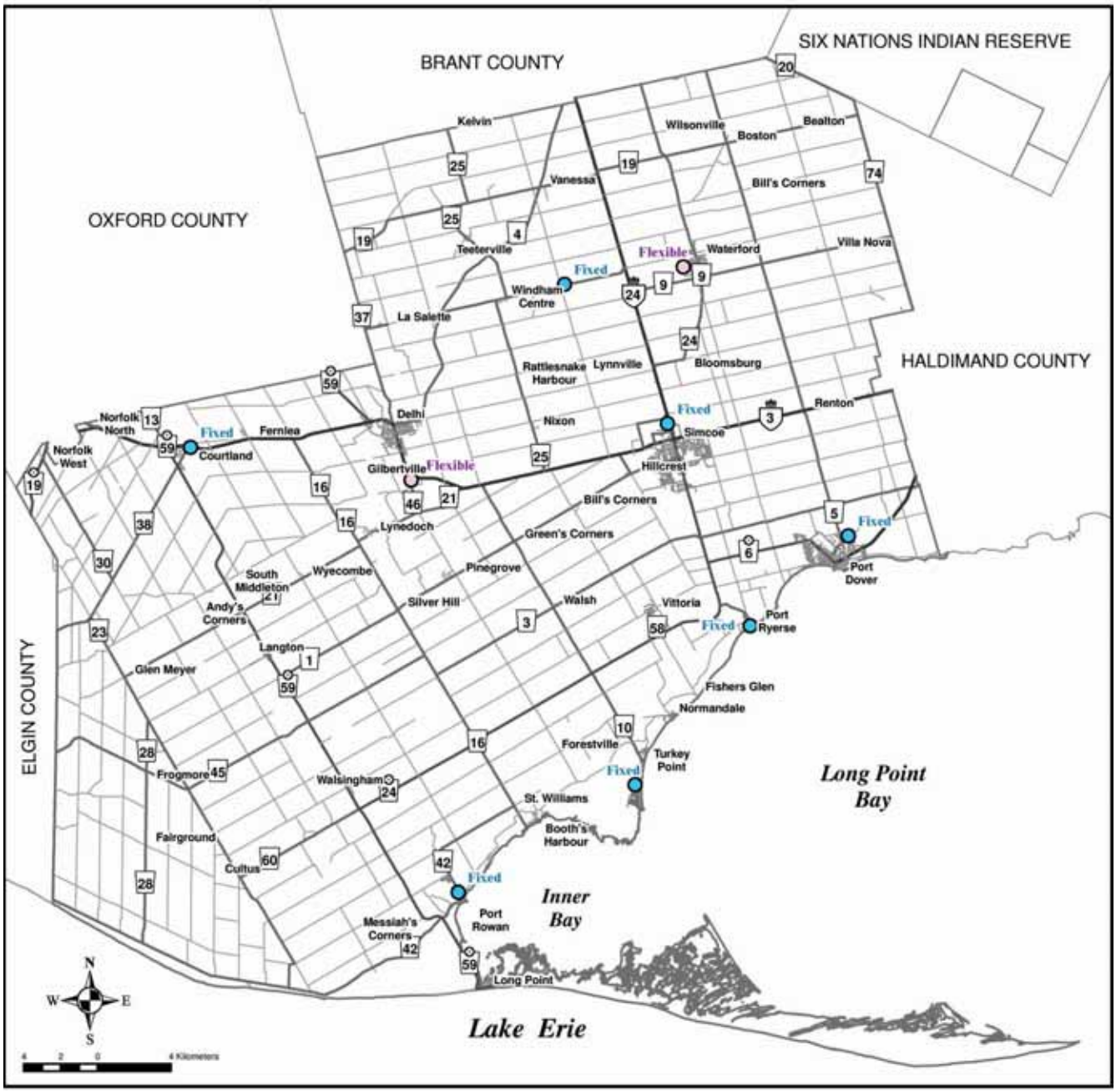
Data Source: Planning Department, Norfolk County.

Map 3: Location of mosquito traps, Haldimand County, 2006



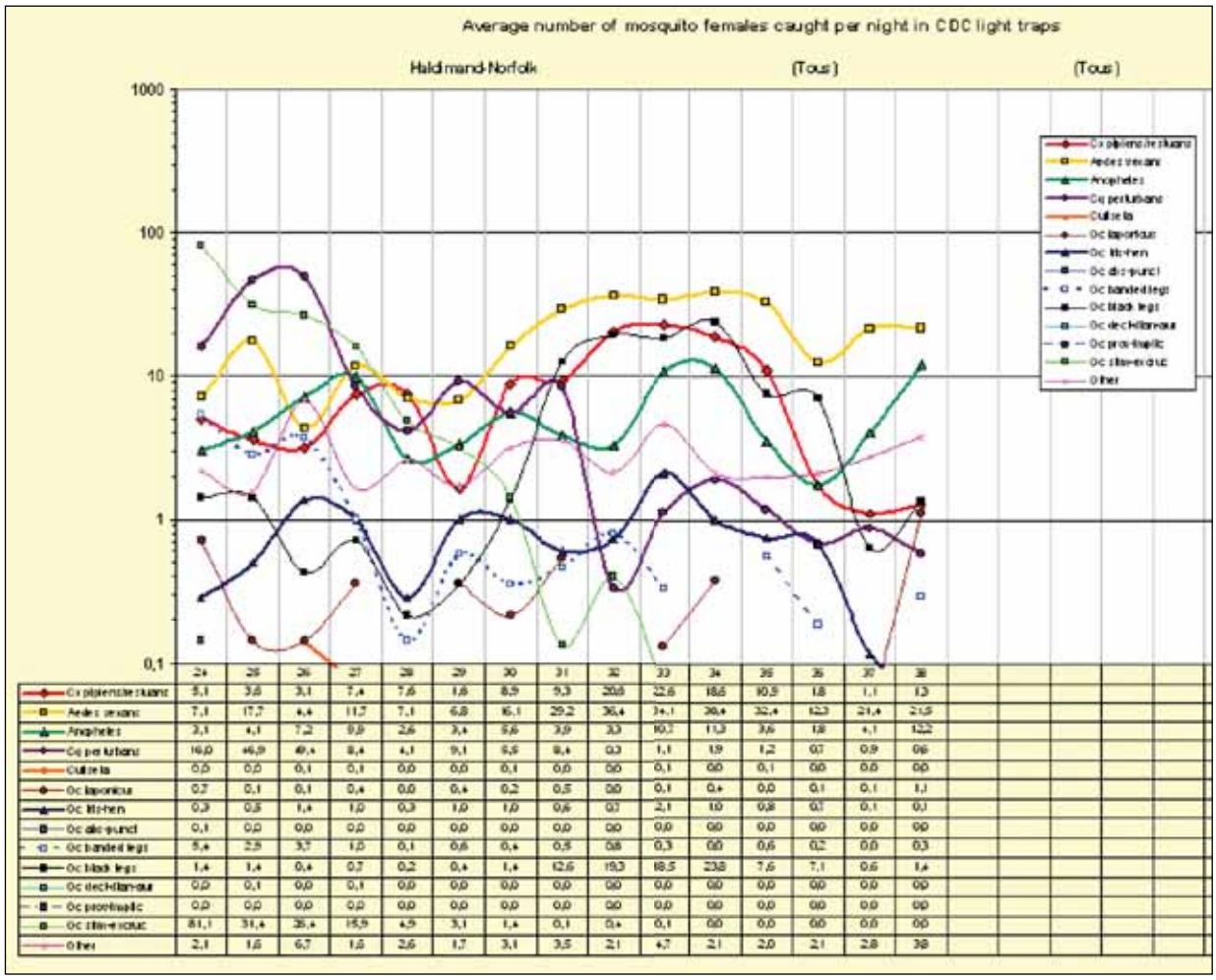
Data Source: Planning Department, Norfolk County.

Map 4: Location of mosquito traps, Norfolk County, 2006



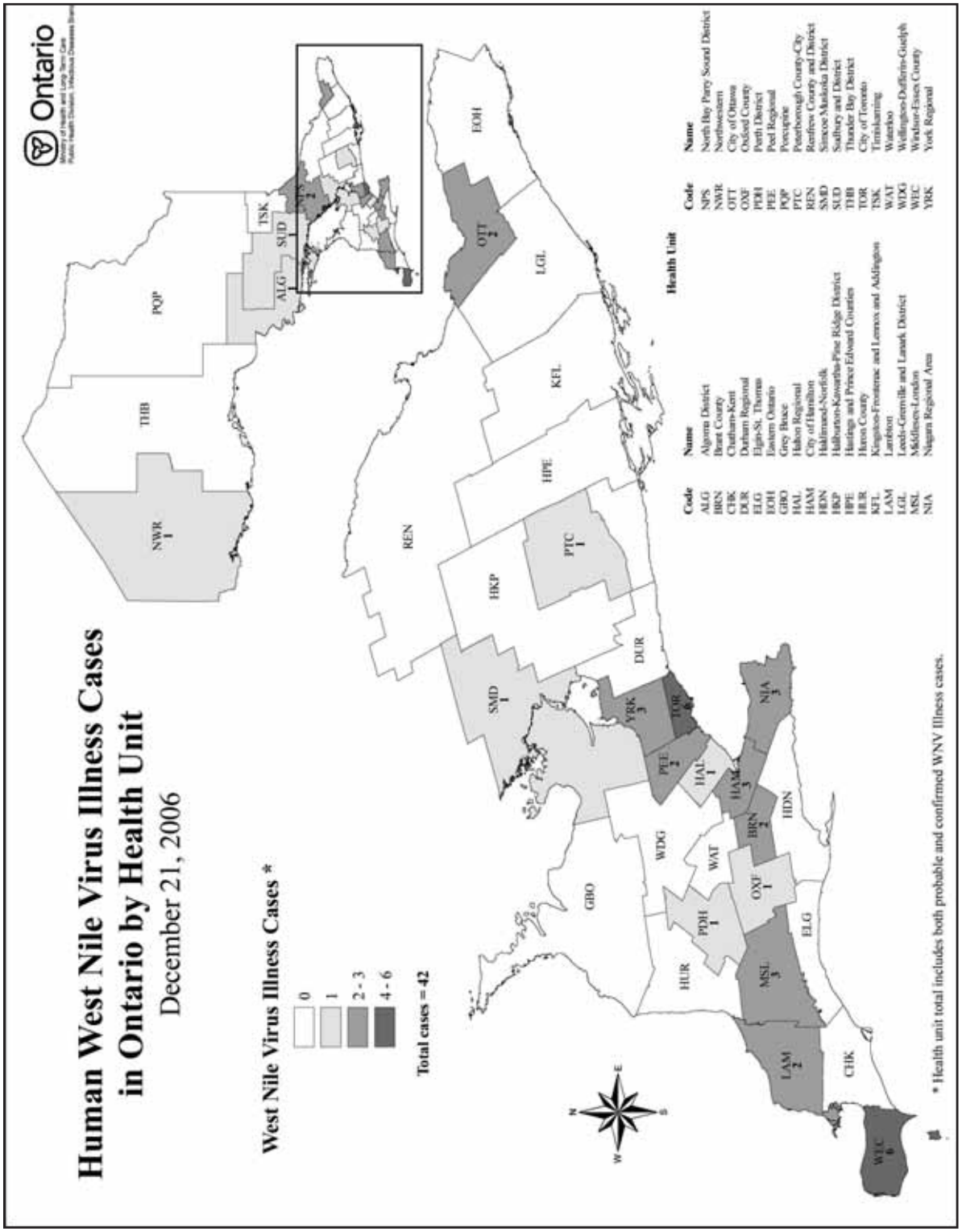
Data Source: Planning Department, Norfolk County.

Figure 1: Seasonal distribution of the main species of adult mosquitoes in Haldimand-Norfolk, 2006



Data Source: GDG Environment 2006 Final Report.

Map 5: Human WNV illness cases in Ontario by Health Unit, 2006



Data Source: Ontario ministry of Health and Long-Term Care.

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