

EXECUTIVE SUMMARY

Introduction

West Nile Virus (WNV) is a virus transmitted primarily through the bite of infected mosquitoes. The virus is relatively new to North America, having made its first known appearance in the summer of 1999 during an outbreak in New York City. Since then, West Nile virus has spread rapidly across the continent. In 2004, WNV human, bird, equine or mosquito activity was reported in five Canadian provinces (Quebec, Ontario, Manitoba, Saskatchewan and Alberta) and all of the continental United States with the exception of Washington State.

In 2001, WNV was detected for the first time in Peel Region in birds and mosquitoes. The following year locally acquired human cases occurred for the first time in Peel Region. In 2003, Peel Public Health developed a WNV Prevention Plan. The goal of this plan was to minimize the impact of WNV through region-wide surveillance that directed integrated pest management based mosquito reduction activities at a level commensurate to the risk of human illness. In 2004, Peel Public Health's WNV Prevention Plan continued to follow the blueprint developed the previous season. Surveillance activities and a mosquito larvae reduction program continued to be conducted in all of the three local municipalities in Peel Region.

This report is the third report in which WNV surveillance information has been compiled and published by Peel Public Health. The previous reports dealt with surveillance information collected in 2002 and 2003. This report describes the findings of our surveillance program in 2004. Comparisons between findings from the 2002 and 2003 WNV seasons are provided when appropriate. In addition, activities relating to the larval reduction program are reviewed. Analyses of these data sources will assist in evaluating Peel Public Health's West Nile Virus surveillance and reduction programs.

Dead Bird Surveillance

In total, 110 dead crow or blue jay sightings were reported to Peel Public Health in 2004, of which 60 were tested and 16 were found positive. Thirty-two per cent of the crows (13/41) and 16% of blue jays (3/19) tested positive. In addition, a hawk that was submitted for study purposes tested positive for the virus.

All three municipalities reported positive dead birds in 2004. Five positive crows were found in Caledon, four in Brampton and four in Mississauga. Two positive blue jays were found in Mississauga and one in Caledon. The positive hawk was found in Mississauga.

The increase in positive birds from 12 in 2003 to 17 in 2004 can be attributed to Peel continuing to submit carcasses throughout the entire WNV season. In

previous years the agency that conducted the testing, the Canadian Cooperative Wildlife Health Centre, suspended submissions from a health unit when four positive birds were identified in a jurisdiction, and resumed receiving samples in the fall.

Adult Mosquito Surveillance

Mosquitoes were collected weekly from mosquito traps at 30 permanent and two temporary locations throughout Peel. A total of 53,556 female mosquitoes comprised of 38 species were identified in Peel in 2004; however, as in previous years only a small number were likely to be important in the transmission of the virus to humans. Three species from the genus *Culex* accounted for all four positive mosquito batches. Two positive batches were found in both Brampton and Mississauga. As in previous years, no positive mosquito batches were found in Caledon.

In 2004, calculations showed that the West Nile Virus infection rates in the *Culex* species were lower when compared to 2003 and 2002 data. The analysis of trapping results demonstrated lower proportions of *Culex* mosquitoes were collected than in previous years. This may be due to larval reduction measures which targeted primarily *Culex* mosquitoes.

Larval Mosquito Surveillance

Larval surveillance served many important functions. It was used to determine the specific aquatic habitats that supported mosquito populations throughout Peel. When specimens were identified and counted, the information was used to determine species composition and vector abundance in an area. The information was also used to project the optimal times to conduct larval reduction measures. In 2004, approximately 2,300 breeding sites were surveyed: 75% in Mississauga, 17% in Brampton and 8% in Caledon. Ditches, culverts, field and woodland pools were the site types where mosquito larvae were found most frequently.

A total of 20 different species were identified from the 12,981 larvae specimens collected. Approximately 76% of those collected were from the *Culex* species: *Culex pipiens* were the most predominant species accounting for 52% and *Culex restuans* accounted for 24% of the mosquito larvae collected and identified.

Larval Mosquito Reduction

The larval mosquito reduction program in 2004 involved several approaches, some of which were more efficacious than others.

Four rounds of methoprene pellets were applied to the roadside catch basins in Peel, with the number of treatments totalling 297,110.

An additional 1,863 methoprene pellet treatments were conducted to catch basins on Peel owned and/or operated properties, one catch basin in a public park and 37 backyard catch basins.

A random sample of catch basins was evaluated and results showed that methoprene pellets were effective in reducing the emergence of viable adult mosquitoes, with an efficacy rate of over 90%.

A total of 1,463 Altosid® Briquets (methoprene ingots) were applied to catch basins in public parks, on Peel owned or operated properties, and in private back yards. Preliminary results from a joint study with the MOE determined that a one-time application of briquets was not as effective as expected, with efficacy rates of 45-75% lasting for a total of 60 days, rather than the 150 days stated by the manufacturer.

One hundred and fifty-one catch basins that drained directly into sensitive areas were treated by the Larvasonic® device that uses ultrasound to kill the mosquito larvae. This device was found to have an efficacy of approximately 91%.

A total of 226 Bti (*Bacillus thuringiensis israelensis*) applications were performed at 138 surface water sites throughout Peel. Bti is a biological pesticide which kills mosquito larvae before they develop into adults. There was an increase in the number of surface water sites treated in 2004 compared to 2003. The increase in the total number of sites treated can be attributed to an enhanced referral process, as some sites were referred for treatment prior to larval species identification. The efficacy of Bti was determined to be between 76-100%, based on pre- and post-treatment larval counts.

Peel Public Health undertook a pilot project to attempt to biologically reduce mosquito larvae in a storm water management pond in Caledon. This site supported WNV vector mosquito larvae in 2003 and was larvicided on two occasions in 2003. In May 2004, Peel Public Health stocked this site with fathead minnows. In late July, an increase of larval activity was noted which coincided with a reduction of fathead minnows being observed in the shallow waters. Tests by the local conservation authority revealed that the majority of the adult fish had died, likely because of over abundance of aquatic vegetation which led to low levels of dissolved oxygen. Since the fish were not present the entire season the efficacy of using fathead minnows could not be ascertained.

The efficacy studies indicated that pellets, Bti, and Larvasonic® were effective in controlling mosquito larvae, while the briquet efficacy study indicated that the residual effect of this product may only last for 60 to 70 days instead of 150 days.

Human Surveillance

Human surveillance for West Nile Virus in 2004 showed that the level of WNV activity in humans was much lower than in previous years. Locally acquired human illness occurred for the first time in Peel in 2002, with 112 residents having laboratory evidence of WNV (55 suspect cases, 20 probable cases and 37 confirmed cases, including two deaths). In 2003, there were 10 residents in Peel who had laboratory evidence of WNV infection, nine of whom were confirmed as having West Nile Fever (WNF) and one having a diagnosis of West Nile Neurological Manifestations (WNNM). There were no deaths in 2003 from WNV. In 2004, there were no residents of Peel Region who had laboratory evidence of WNV infection stemming from the 2004 WNV season.

Conclusion

Surveillance information collected during the 2004 mosquito season showed a reduction in West Nile Virus activity in Peel compared to 2002 and 2003. The number of positive mosquito batches and human cases declined substantially over the last three years. However, the number of positive birds in Peel did increase from 12 in 2003 to 17 in 2004. This can be attributed to Peel continuing to submit carcasses throughout the entire 2004 WNV season. In previous years the agency that conducted the testing, the Canadian Cooperative Wildlife Health Centre, suspended submissions from a health unit when four positive birds were identified in a jurisdiction; later in the fall they would permit additional submissions.

Although approximately 40 species of mosquitoes are found in Peel only a few are important in the transmission of WNV. The vectors most responsible for the bird – mosquito amplification cycle in Peel are members of the genus *Culex*. Because of their importance, *Culex* species numbers were analysed comparing adult mosquito trap data for 2002, 2003 and 2004. The analysis of trapping results demonstrated that *Culex* mosquitoes accounted for 30% of the mosquitoes collected in 2002, 13% in 2003 and 8% in 2004. The downward trend in *Culex* mosquito activity can be attributed to the larviciding program undertaken in both 2003 and 2004 which was primarily directed at the reduction of *Culex* mosquitoes. Other factors that may have impacted *Culex* numbers were breeding site source reduction and weather conditions.

An analysis of the West Nile Virus infection rates in *Culex* mosquitoes was also conducted. The calculations showed that the West Nile Virus infection rates in *Culex* mosquitoes have declined in each of the past three years. When there is a lower prevalence of WNV in the mosquito population, there is a lower risk of humans contracting the disease. In 2004, Peel had no reported human cases; this can be attributed primarily to the low infection rates in Peel's mosquito population.

Analysis of the West Nile virus program data indicates that information collected from bird and mosquito surveillance is valuable in identifying the presence of the virus in a community and can serve as an "early warning system" of the risk to human health. This information can also be used to enhance mosquito reduction activities and public education.

It is appropriate that Peel's 2005 West Nile Virus Prevention Plan continues to focus on surveillance, mosquito reduction and education activities. Source reduction and larviciding should continue to focus on *Culex pipiens* and *Culex restuans* mosquitoes, the main vectors of WNV in Peel.