VECTOR BORNE DISEASE
FINAL REPORT 2013

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DISTRICT HEALTH UNIT

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VECTOR BORNE DISEASE FINAL REPORT 2013

EXECUTIVE SUMMARY

This report provides a summary of the Simcoe Muskoka District Health Unit (SMDHU) Vector Borne Disease (VBD) program activities including highlights and surveillance information collected during the 2013 season. The purpose of the VBD program is to prevent or reduce the burden of infectious diseases of public health importance within the jurisdiction of the SMDHU. Vector borne infectious diseases of importance include, but are not limited to, West Nile virus (WNV), Eastern Equine Encephalitis virus (EEEV) and Lyme disease.

In 2013, there were detections of WNV, Lyme disease and EEEV in Simcoe Muskoka. WNV was detected in two humans. These cases resided in the City of Barrie and in the Town of Bradford West Gwillimbury. Two positive mosquito pools were also identified in the City of Barrie and the Town of Bradford West Gwillimbury. Lyme was also detected in Simcoe Muskoka. One human case was confirmed in 2013 but was not deemed locally acquired. Out of the 45 ticks submitted for testing, none were found to be positive with the bacteria responsible for Lyme disease. With regards to EEEV, a horse was found positive in Simcoe County.

Local risk assessments are undertaken each season (and throughout the season) to direct VBD program activities. A local risk assessment process was used to identify areas for mosquito control activities relating to WNV. As an outcome of this process, a catch basin larviciding program was implemented to control WNV amplification vector populations in one municipality (City of Barrie). An additional 8 municipalities were identified for heightened surveillance activities and were advised to be prepared to implement a catch basin larviciding program should ongoing local surveillance data indicate an increased risk.

Risk assessments conducted for Lyme disease are based on locally acquired, passive surveillance data. Passive surveillance is the preferred approach to Lyme disease surveillance at SMDHU. As with 2012, no established tick population was detected within Simcoe Muskoka.

Public education to encourage the public to take personal protective measures continued to be a critical component of the VBD program in 2013. Other key messages regarding reducing mosquito breeding sites in conjunction with personal protection messages were communicated to the public through media interviews, media releases, public service announcements and the distribution of public education materials.

This report provides a summary of VBD program activities and surveillance data collected during the 2013 season. Additional information on VBD is available on-line at www.simcoemuskokahealth.org

INTRODUCTION

West Nile virus

West Nile virus (WNV) is a mosquito-borne virus that is transmitted through a bird-mosquito-bird cycle. Mosquitoes biting an infected bird may transmit the virus to other birds, or to other mammals such as humans and horses. Most people who contract WNV will be asymptomatic or experience only mild flu-like symptoms. However in some individuals, WNV infection can cause severe illness, and sometimes death. Since 2002, The Public Health Agency of Canada West Nile Virus Monitor reports that Ontario has seen almost 1000 clinical cases of WNV. However, it is important to note that the number of human cases per year in Ontario has been highly variable, with a range of 1 to 395 cases per year over the past 11 years.

Traditional WNV surveillance strategies may focus on the reservoir (birds), the vectors (mosquitoes) and incidental hosts (humans and horses) to identify the presence or extent of WNV in a geographic area. Mosquito surveillance provides information on the presence and abundance of mosquito species of concern and may identify high risk geographic areas. Surveillance data is also useful in assessing the need for and timing of interventions; and may provide information related to the use and effectiveness of control measures. Human surveillance programs provide information on the impact and trends of WNV morbidity and mortality in the human population.

There are two types of mosquito vectors involved in the WNV transmission cycle:

1) *Enzootic vectors*: Feed primarily on birds;
2) *Bridge vectors*: Feed on both birds and mammals, but primarily on mammals.

The major WNV enzootic vectors in Ontario are *Cx. pipiens* and *Cx. restuans*. They are both competent vectors of WNV however; *Cx. restuans* is an early season species and is replaced later in the season by *Cx. pipiens*. Early research indicates that *Cx. pipiens* may also serve as a bridge vector since it may be attracted to humans as well as to birds near the end of the season. According to Kilpatrick et al. (2005) data has shown that the risk of human disease increases in areas where large numbers of Culex mosquitoes are seen throughout the season. In addition, their analysis showed that *Cx. pipiens and restuans* are potentially responsible for up to 80% of human cases in the northeast United States (Kilpatrick et al., 2005).

The 2013 WNV surveillance program in Simcoe Muskoka was based on the program carried out in previous seasons. It focused on monitoring for WNV activity in mosquito populations and in incidental hosts such as humans and horses. The health unit was responsible for the surveillance activities relating to mosquito and human populations. The Ontario Ministry of Agriculture and Food and Rural Affairs (OMAFRA) was responsible for equine surveillance.

In 2008, the health unit conducted a critical review and evaluation of the WNV program, and developed a mosquito control decision-making framework which included more detailed analysis of local surveillance data in determining areas for larviciding. In 2013, the need for municipal larviciding programs was assessed by reviewing the frequency of positive indicators in previous seasons and taking into consideration key background information about WNV. Local risk of West Nile virus transmission was assessed and monitored on an ongoing basis throughout the season. Local risk assessment inputs included presence of positive indicators, weather conditions, and local vector trap index results.

As a result of this evaluation municipalities were assigned to one of three tiers for WNV control actions. The three tiers are:

- Tier I: Larviciding Actions;
- Tier II: Heightened Surveillance – Larviciding Standby;
- Tier III: Ongoing Monitoring.

(*Note: Additional information regarding this risk assessment and tier levels is provided later in this report*).

Municipalities receiving notice to larvicide in catch basins had two options; a single treatment of the briquet formulation of methoprene or three treatments of the pellet formulation of methoprene. The briquet formulation provides up to 150 days efficacy and the pellet formulation provides 21 days efficacy.

Larviciding of surface waters, such as ditches and storm water management ponds, is a component WNV contingency planning. If a local risk assessment indicates an increased risk of human infections in an area and larvae surveillance data indicates a prevalence of WNV vectors in local sites, larviciding may occur. To date, the Medical Officer of Health has not directed larviciding of surface waters for WNV control in Simcoe or Muskoka. Municipalities may submit permit applications each season to the Ministry of the Environment to larvicide surface waters in their areas as a contingency planning strategy.

Eastern Equine Encephalitis Virus

In Ontario, a secondary mosquito surveillance program focusing on *Culiseta melanura* mosquitoes, the vector for Eastern Equine Encephalitis virus (EEEV) runs concurrently with the WNV mosquito surveillance program. This additional component provides information to support the Medical Officer of Health in decision-making on control strategies, as well developing a local understanding of the entomology around EEEV.

Most people who contract EEEV will be asymptomatic or will experience only mild flu-like symptoms. However in some individuals, EEEV infection can be severe leading to encephalitis and sometimes death. In Ontario, the risk of being infected with Eastern equine encephalitis is very low. Infections in people have been reported in several U.S. states bordering Ontario; however, no human cases in Ontario have been confirmed to date. In Ontario, occasional outbreaks of EEEV have taken place among horses. The Eastern equine encephalitis virus was found in mosquitoes in Ontario for the first time in 2009. This occurred in Wahta First Nations Community where mosquito pools tested positive for the virus. Since the virus is now in Ontario, individuals should be encouraged to practice personal protective measures.

Lyme disease

Lyme disease is an infection caused by the corkscrew-shaped bacteria, *Borrelia burgdorferi*. In Ontario, these bacteria are spread by the bite of blacklegged ticks (formerly called deer ticks), *Ixodes scapularis*. The blacklegged tick can be found sporadically throughout the province. After being bit by a tick, early symptoms of Lyme disease usually occur within one to two weeks, but can occur as soon as three days or as long as a month. Symptoms generally include fever, headache, muscle and joint pain, fatigue and a skin rash, especially one that looks like a red bull's eye (called erythema migrans).

In Ontario, blacklegged ticks are more commonly found in areas along the north shores of Lake Erie, Lake Ontario, and the St. Lawrence River. Locations with established blacklegged tick populations infected with the Lyme disease agent, include: Long Point Provincial Park, Turkey Point Provincial Park, Rondeau Provincial Park, Point Pelee National Park, Prince Edward Point National Wildlife Area, Wainfleet Bog Conservation Area, and in the St. Lawrence Islands National Park area. The precise boundaries of these established tick populations are difficult to define but it is anticipated that some of these populations will continue to expand into neighbouring areas. Blacklegged ticks are also known to feed on migratory birds and as a result, they can be transported throughout the province. Therefore, while the potential is low, it is possible for people to encounter blacklegged ticks, or to be infected with Lyme disease from the bite of an infected blacklegged tick, almost anywhere in the province. In general, blacklegged ticks infected with Lyme disease are much more common in the United States along the Atlantic seaboard from Maine to Virginia and in Minnesota and Wisconsin than they are in Ontario.

SMDHU participates in passive tick surveillance to understand the risk of Lyme disease infection locally. The information collected can help identify and establish local tick populations and conduct local risk assessments. Multiple tick submissions from a specific area, over multiple years or finding multiple ticks from a single location may be indicative of an established or a new population of ticks and should be monitored. Passive surveillance is also used as a guide to assess the need for, timing of and location of active surveillance.

HUMAN CASE SURVEILLANCE

West Nile Virus

Highlights

In the 2013 season, Ontario experienced a decrease in WNV activity. A total of 56 confirmed and probable human cases were reported in the province. Of the 56 cases reported, 2 of the cases were residents of Simcoe Muskoka. It is important to note that the number of human cases in Ontario has been highly variable with a range of 1 to 395 cases per year over the past 11 years.

Number of cases

There were 2 confirmed human cases of WNV in Simcoe Muskoka in 2013. The cases occurred in the City of Barrie and Town of Bradford West Gwillimbury.

Yearly trends/comparison

In 2013, SMDHU experienced no significant change in WNV activity compared to previous seasons. Prior to 2013, SMDHU experienced a total of 8 confirmed cases of WNV (Refer to Table 1 below).

Table 1: Number of Confirmed WNV Cases in SMDHU, 2002-2013

Number of Confirmed WNV Cases: SMDHU, 2002-2012												
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
No. of Cases	1	1	0	0	1	0	0	0	0	2	3	2

Eastern Equine Encephalitis Virus

Highlights

There are no highlights to report on EEEV human surveillance.

Number of cases

There were no confirmed human cases of EEEV in Simcoe Muskoka in 2013. In addition, no case investigations were warranted.

Yearly trends/comparison

Not applicable, SMDHU has not experienced any human cases of EEEV nor has investigated any human cases.

Lyme disease

Highlights

There are few highlights to report regarding Lyme disease in SMDHU. Numbers for passive tick surveillance increased slightly last season (from 36 to 45 submissions). Of the 45 ticks submitted, 9 were identified as *Ixodes scapularis* ticks (associated with humans) and were submitted for viral testing and all returned negative for *Borrelia spp.*

Number of cases

There was one confirmed human case of Lyme disease investigated in Simcoe Muskoka in 2013. This case was not deemed locally acquired.

Yearly trends/comparison

In Simcoe Muskoka the number of Lyme disease cases remains relatively low. From 2000-2012, SMDHU experienced 29 Lyme disease cases. The health unit has seen an average of 3 cases of Lyme disease per year from 1999-2011. In 2013, SMDHU had one confirmed, non-locally acquired case of Lyme disease.

WILDLIFE SURVEILLANCE

West Nile Virus

Highlights

In 2013, there were no reports of equine cases of WNV in Simcoe Muskoka.

Number of cases

No information to report.

Yearly trends/comparison

SMDHU does not undertake wildlife surveillance for WNV. Reports for wildlife surveillance are received by SMDHU from partner agencies and the information is used in local risk assessments.

Eastern Equine Encephalitis Virus

Highlights

In the 2013 surveillance season, SMDHU received notification of one positive case of EEEV in a horse.

Number of cases

In 2013, one horse was found positive for EEEV. This horse was located in the County of Simcoe.

Yearly trends/comparison

OMAFRA is responsible for collecting information about equine neurological disease in Ontario. This surveillance includes WNV and EEEV. Intermittent equine cases of EEEV have been identified in Simcoe Muskoka since 1994. During the last 9 years, a total of 10 EEEV equine cases have been reported. In 2009, Ontario experienced its first detection of EEEV within the mosquito population. Several positive pools were discovered in the Wahta First Nations Community, which is bounded by Muskoka District. During that time and in subsequent seasons, additional mosquito surveillance occurred in surrounding communities.

Lyme disease

Highlights

There have been no established black-legged tick populations identified in SMDHU to date. Therefore, no wildlife testing has been undertaken.

Number of cases

To date, SMDHU has not received notification of any wildlife testing positive for Lyme disease.

Yearly trends/comparison

To date there is no local data to compare since no wildlife have been reported positive for Lyme disease to SMDHU.

VECTOR SURVEILLANCE

West Nile Virus/Eastern Equine Encephalitis Virus

Larvae Surveillance

Highlights

Sites capable of holding stagnant water for longer than one week are considered potential mosquito breeding sites. Important larval habitats include: roadside ditches, storm water retention basins and ponds, catch basins, waste water lagoons, and a broad range of artificial containers found in residential, commercial and industrial yards.

The presence of either bridge or amplification vectors is a significant input to the risk assessment process. The relative abundance of each vector type is used as a variable in the risk assessment process to determine the need for appropriate control strategies.

The SMDHU larvae surveillance program provides information on the presence and abundance of mosquito populations and can identify geographic areas of high risk. Larvae surveillance was conducted in selected catch basins, natural sites/ditches, and storm water management ponds in Simcoe Muskoka during the 2013 season.

Duration

Larvae surveillance began in June 2013 in catch basins, storm water management (SWM) ponds and natural sites such as ditches. Larvae surveillance was discontinued in catch basins in the Town of Bradford West Gwillimbury where catch basin larvicide treatment programs were initiated on July 2, 2013. Surveillance in the remainder of catch basin sites continued until late August. Surveillance at SWM ponds and natural sites was discontinued the week of August 30th, 2013.

At SWM ponds and natural sites, each sample to a maximum of 20 larvae were collected and submitted to a consulting laboratory for speciation. Speciation of larvae was not conducted from catch basin samples due to historical findings of a predominance of *Culex* species larvae in this setting.

Locations

Sites were selected in consultation with municipal staff to provide geographic representation, proximity to human population and presence of larvae habitat. In addition, the larvae surveillance program has been successfully used as a tool to alleviate public concerns about particular sites and has been a key component of the building of municipal partnerships in the VBD program. In 2013, 4 new surveillance sites were selected to replace traditionally dry natural sites. Each of these sites were selected by municipal staff in respective areas taking into consideration the above criteria.

Catch basin surveillance is recommended as a component of the MOE larviciding permit process prior to application of larvicide. To achieve this objective, a small number of catch basins were maintained in municipalities where larviciding programs were anticipated.

Numbers and trends

The majority of the mosquito larvae population in 2013 (~92%) identified from SMDHU were enzootic and bridge vectors, 72.8% and 18.9% respectively. Larvae species which act as amplification vectors were first identified in surveillance sites during Week 23 (June 2 – June 8) and bridge vectors in Week 30 (July 21 – July 27). The total number of larvae found peaked in Week 30 (July 23 - 29).

Larvae found at each site were enumerated over a series of dips using a standard larvae dipper. Based on the total number of larvae found, sites were ranked as either high (51 or greater), moderate (26-50) or low (25 or less). Of the total larvae surveillance events (n=697) sites were most frequently ranked as low (660, 94.69%), and rarely ranked as moderate (11, 1.58%) and high (26, 3.73%).

i. *Catch Basins*:
Within Simcoe Muskoka a total of 28 catch basins were monitored weekly beginning in June and continuing until late August. In municipalities where larviciding was directed, larvae surveillance was discontinued once larviciding activities began. Following the initiation of larviciding programs in the Town of Bradford-West Gwillimbury a total of 22 catch basins were monitored.

ii. *Natural Sites and Ditches*:
A total of 30 selected natural sites and ditches throughout Simcoe Muskoka, were monitored weekly from June to end of August 2012. Natural sites were monitored a total of 278 times.

iii. *Storm Water Management Ponds*:
Selected storm water management (SWM) ponds were monitored for larvae weekly from June to August 2013. In addition to the enumeration of larvae, additional information was gathered during the 2013 season. Information included weather conditions, water quality, and pond characteristics. A total of 20 SWM ponds were selected for monitoring and a total of 184 monitoring events occurred. SWM ponds ranked low on all but 2 dipping events, these two dipping events ranked high.

Mosquito Surveillance

Highlights

An adult mosquito surveillance program provides information on the type, number and distribution of adult mosquito populations and allows for the identification of high-risk geographic areas. In jurisdictions that have active vector control programs, mosquito surveillance can also identify the need for and timing of intervention programs. In addition, female mosquito specimens can be grouped by species and these 'pools' can be tested for the presence of WNV and EEEV.

Fixed trap locations allow for the development of a database over time which allows for the comparison of mosquito population data to previous years and for spatial analysis. Targeted or "hot spot" surveillance locations are created in response to natural events occurring throughout the season i.e.) receiving notification of a WNV or EEEV infected horse or human. Centers for Disease Control (CDC) light traps baited with carbon-dioxide were used for VBD surveillance in Simcoe Muskoka.

Fixed trap site locations were identified in key populated areas. Factors considered in determining trap placement and location included the presence of mosquito habitats and/or breeding sites, proximity to human population or areas of human activity during peak mosquito activity and trap security. Efforts were made to retain trap sites used in previous seasons to allow for data consistency and to allow for comparisons of mosquito populations between

seasons. As in previous seasons, trap sites were predominantly located in residential backyards. Targeted surveillance locations were determined based on surveillance data, reports of positive human and/or equine cases.

In 2011, Ontario initiated a secondary adult mosquito vector surveillance program focusing on *Culiseta melanura* which is the main enzootic vector of EEEV. The surveillance for these vectors was incorporated into the WNV surveillance programming across Ontario.
While Ontario has never had a human case of EEE, sporadic equine and emu incidences have occurred in recent years. EEE is regarded as an important mosquito-borne human disease because it continues to appear south of the Ontario border in the United States. As a surveillance strategy for EEEV, *Culiseta melanura* mosquitoes collected through WNV surveillance activities were tested for the presence of EEEV during the 2013 season.

Duration

Mosquito traps were set on a weekly basis beginning in Week 24 (June 9 – June 15) and continuing until Week 38 (September 15 – September 21). On average, 20 mosquito traps were set each week in various locations throughout Simcoe Muskoka. The number of traps set per week varies due to the use of variable trap locations and the inclusion of targeted traps where needed.

Locations

Mosquito trap locations for fixed, variable and targeted sites were predominantly located in private residential back-yards. In 2013, an exception to this was a trap placed on City of Barrie property for the purpose of targeted surveillance. Detailed information on trapping site locations has not been provided in this report to respect the confidentiality of the property owners.

Numbers and Trends

A total of 12618 adult mosquitoes were collected in Simcoe Muskoka from June to September 2013 from 301 trapping events (Table 2). The adult mosquito surveillance program continued to demonstrate the presence of bridge and amplification vectors at sites throughout the health unit jurisdiction (Table 3).

Table 2: Mosquito Surveillance Testing Summary, 2013

Mosquito Surveillance Item	Total Number
Total Number of Traps	301
Total Number Mosquitoes Collected	12618
Number of Pools Viral Tested for WNV	154
Number of WNV Positive Pools	2
Number of Pools Viral Tested for EEEV	299
Number of EEEV Positive Pools	0

Data courtesy of Entomogen Inc. (2013)

In 2013, adult mosquito surveillance data showed that adult mosquito counts peaked in Week 29, declined, and then increased in Week 37. The bridge vector population was higher than the amplification vector population throughout the season and peaked in Week 29. The amplification vector population was low and sustained throughout the season with a peak in Weeks 27 and 29. Out of the 8942 adult mosquitos identified in 2013 season, the predominant species identified within Simcoe Muskoka were *Coquilletidia perturbans (36.77%), Aedes vexans vexans (19.56%) and Ochlerotatus Canadensis (10.59%), all EEE vectors. Culex pipiens/restuans (WNV enzootic vectors) were reported at 8.61%* for the 2013 season.

Table 3: Mosquito Surveillance Results, June – September 2013

Reporting Week	Total # Traps	Total # Mosquitoes	Total Bridge Vector Mosquitoes	Total Amplification Vector Mosquitoes
Week 24	22	895	480	25
Week 25	18	699	336	46
Week 26	21	1595	607	38
Week 27	15	1277	957	121
Week 28	22	1295	766	28
Week 29	22	3284	1311	173
Week 30	22	987	588	94
Week 31	21	666	497	70
Week 32	14	640	441	51
Week 33	22	315	140	67
Week 34	24	284	146	46
Week 35	25	175	103	16
Week 36	18	61	53	1
Week 37	23	445	188	0
Week 38	12	0	0	0
Total	301	12618	6613	776

Lyme Disease

Highlights

SMDHU participates in passive tick surveillance to understand the risk of Lyme disease infection in the local area. The information collected can help identify establishing tick populations. An important aspect of passive surveillance is having multiple tick submissions from a specific area over multiple years. Finding multiple ticks from a single location may be indicative of an established or establishing population and should be monitored. Passive surveillance is also used as a guide to assess the need for, timing of and location of active surveillance.

Duration

SMDHU will accept ticks for passive surveillance year round.

Locations

The majority of the ticks submitted to SMDHU were from within the health unit jurisdiction (26/45). The remaining ticks submitted were from outside SMDHU jurisdiction (within the Province and the United States) or the location was deemed unknown.

Numbers and Trends

A total of 45 ticks were submitted to the health unit by the public in 2013. The number of ticks submitted has steadily increased since the beginning of the surveillance program in 2007 (Figure 1). SMDHU receives several different species of tick submitted each year. Of the 45 ticks submitted 9 were identified as blacklegged ticks (*Ixodes scapularis)* (Figure 2). No ticks tested positive for the Lyme disease agent *Borrelia burgdorferi* in 2013. Since the start of the tick surveillance program in 2007, SMDHU has only had one blacklegged tick test positive for Lyme disease.

Figure 1: Tick Submissions: 2007-2013

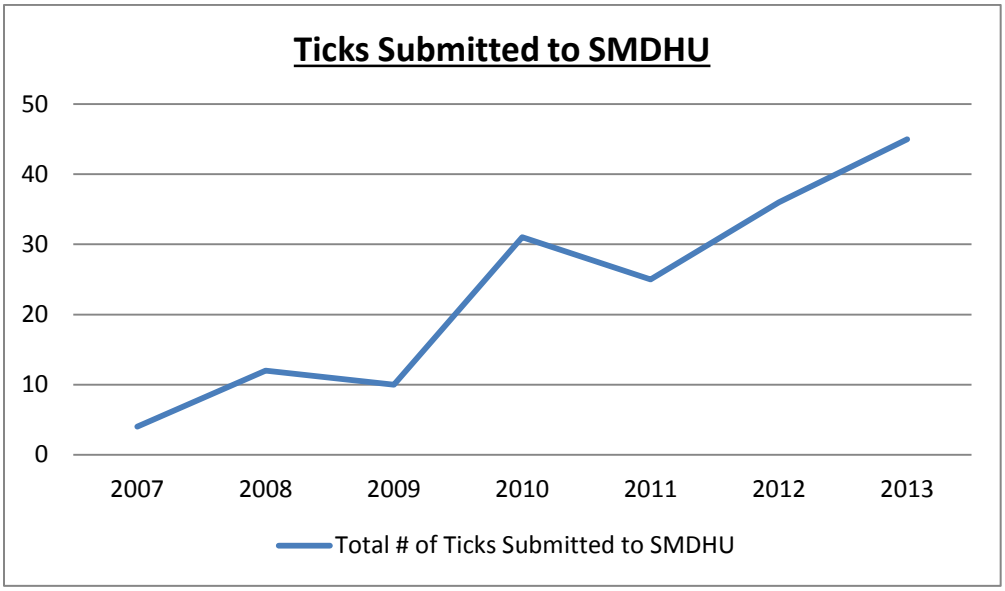
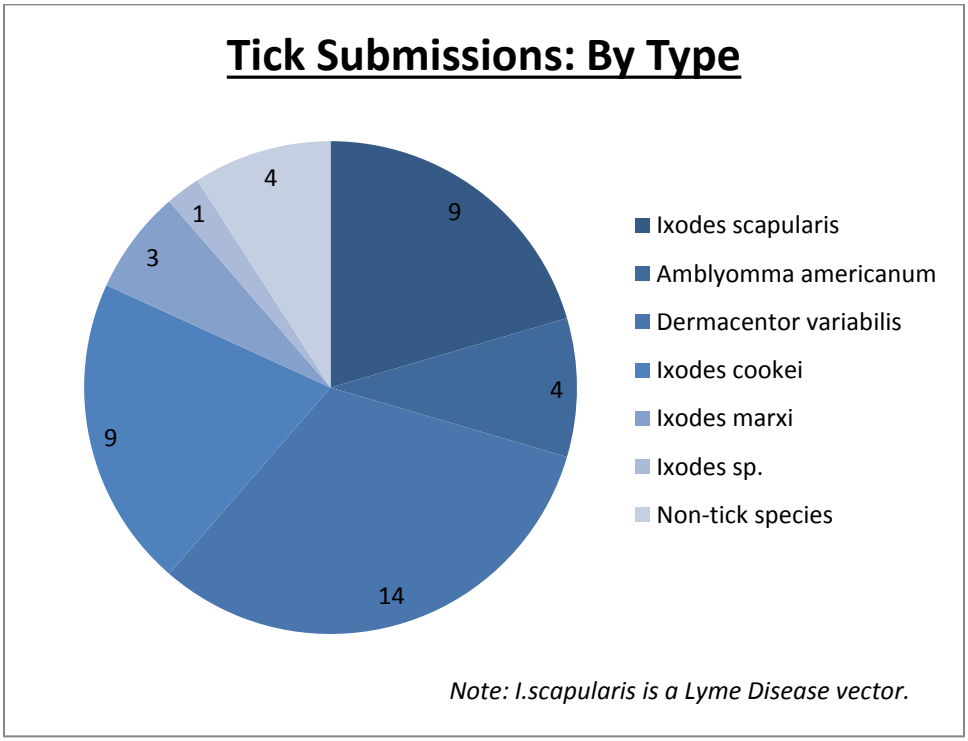


Figure 2: Tick Submissions: By Type, 2013



PUBLIC HEALTH RISK ASSESSMENT

Risk Assessment Foundations

Risk assessment is a process for determining the risk to the public resulting from an exposure to a specific agent. There are two critical variables that must be understood and considered in the risk assessment process*: the characteristics of the agent*, and *the extent or potential of exposure to the agent.* A risk assessment becomes a critical step in determining measures that can be taken to mitigate or manage a risk to the public.

It is important to apply these risk assessment principles while considering WNV strategies. There are characteristics of the virus itself that are critical in a risk assessment:

i. the virus can be transmitted only by an infected mosquito,
ii. the virus is not transmitted from person-to-person except in exceptional circumstances,
iii. the virus is not generally considered to be virulent,
iv. most people exposed to WNV will not experience any symptoms,
v. a few will develop West Nile Non-Neurological syndrome, and only a few of those will develop West Nile Neurological Syndrome,
vi. any age group can become infected,
vii. the elderly are most susceptible to the virus.

The other variable to be considered in the risk assessment process is the potential for human exposure to WNV. It is important to determine whether WNV has been identified in a community. Surveillance data from within the county, district and from neighbouring jurisdictions is critical information and essential to our risk assessment process. The time of year is also important and will determine the prevalence of different mosquito species. Mosquito life cycles are completed in differing time through the spring, summer and fall. It is important to know which amplification and bridge vector species are prevalent at a given time. The location of human populations in relation to mosquito habitats is also a factor in assessing the risk of exposure.

Entomological, microbiological and environmental information is reviewed in the risk assessment. At times during a risk assessment there may be variables that remain unknown. In the past, for example, the effect of weather, on both the mosquito population and the intensity of viral activity, required further research. Current research supports the use of degree days as an indicator of WNV activity. Increased temperatures influence how quickly a mosquito moves through its lifecycle and the speed at which the virus replicates inside a mosquito. Risk

assessments are completed using the information and knowledge that is available at the time it is conducted.

Risk assessments provide the basis to consider what, if any, interventions need to be implemented to control WNV. In this report, the particulars of the SMDHU risk assessment process have been described, as it is has been used as the basis for decision-making for WNV control activities in our health unit area.

Local Risk Assessment Process

A local risk assessment and decision-making process for the Simcoe Muskoka area was developed in 2006. This framework was reviewed and revised in 2008 following additional analysis of surveillance data and in consultation with the Ministry of Health and Long-Term Care Vector-Borne Disease Unit. The 2008 framework was used to assess the need for larviciding programs in municipalities in the upcoming season. The framework considers the presence and abundance of *Culex pipiens/restuans* mosquito populations in previous surveillance seasons, the presence of multiple WNV positive indicators, excluding avian specimens, within the vicinity in the previous seasons and in consideration of the guiding principles as outlined above.

A study by Andreadis et al. found the incidence of human cases to be closely correlated with the number of viral isolations from mosquitoes. The same study found that the majority of human cases were identified in areas with multiple positive mosquito isolations. This evidence, when considered in relation to the infrequent and random level of detection of WNV in Simcoe Muskoka indicates low risk of human infection. Single isolated positive mosquito pools are not considered an indication of increased risk of human outbreaks of West Nile virus.

Mosquito Control Risk Assessment and Decision-making Framework

The WNV Risk Assessment tier framework was developed in 2008 and applied again as a decision-making tool in the 2013 season. Municipalities were assigned to one of three tiers for control actions.

WNV Risk Assessment Tier Framework, 2008

Tier I – Larviciding Action: Notice to larvicide catch basins will be issued by the Medical Officer of Health to these municipalities. This tier consists of those municipalities which have received direction to larvicide from the Medical Officer of Health in previous seasons and have evidence of:

- sustained Culex pipiens/restuans populations throughout the season, and
- multiple positive WNV indicators in the previous season(s)

Tier II – Heightened Surveillance, Larviciding Standby: Notices to larvicide will not be issued by the Medical Officer of Health at this time. Heightened surveillance activities will be implemented in these municipalities to monitor the presence and abundance of mosquito populations of concern, primarily Culex pipiens/restuans. As a component of WNV contingency planning, these municipalities shall complete the Ministry of Environment Permit application process and be on standby to larvicide catch basins on short notice should the current season surveillance data indicate the need for control measures. This tier consists of those municipalities which have received direction to larvicide from the Medical Officer of Health in previous seasons but do not have:

- sustained Culex pipiens/restuans populations throughout the season, and/or
- multiple positive WNV indicators in the previous season(s)

Tier III – Ongoing Monitoring: This tier consists of those municipalities which have not received direction from the Medical Officer of Health to larvicide in previous seasons. Surveillance strategies will continue in these areas. It is recommended that these municipalities, as a component of their WNV contingency planning, review the MOE permit application guide and gather the necessary information to complete the permit application process on short notice.

Ongoing Local Risk Assessment

Local risk of West Nile virus transmission was assessed and monitored on an ongoing basis throughout the season. Local risk assessment inputs included presence and/or absence of positive indicators, weather conditions (which included local calculation of accumulated degree days), and determination of Cx. species per trap per night compared to baseline data from 2012. In several instances additional surveillance for larvae or adult mosquitoes was conducted to support local risk assessments. No additional vector control activities were directed as a result of risk assessments conducted in 2013.

VECTOR CONTROL

Pre and post-treatment studies

Pre-treatment studies

The Ministry of Environment permit applicant guide does not require pre-monitoring of catch basins to be treated with methoprene. However, pre-larvicide monitoring of catch basins is recommended to “determine larval counts and evaluate a need to apply methoprene (Ontario Ministry of Environment, 2008).”

In accordance with this recommendation, SMDHU, with assistance from municipal staff, conducts weekly monitoring of selected catch basins in populated areas. In 2013, selected catch basins were monitored weekly during June until larviciding commenced.

Post-treatment studies

Post-treatment studies to assess larval presence in catch basins treated with methoprene are not an effective measure for efficacy of this particular pesticide. In order to assess efficacy of methoprene, pupa must be collected and reared to assess adult emergence. Trials to evaluate the efficacy of methoprene on adult emergence from treated catch basins were conducted by the Ministry of Environment in 2003 and 2004. Selected catch basins from Simcoe County were included in this study. Methoprene efficacy trials were not conducted in Simcoe Muskoka in 2013.

Treatments Used

A local risk assessment process was utilized to determine need for mosquito control interventions in municipalities in the County of Simcoe and District of Muskoka in 2013. Based on this risk assessment, municipalities were assigned to one of three tiers. Those municipalities assigned to Tier 1 received a 'Notice to Larvicide' from the Medical Officer of Health. These municipalities were directed to commence larviciding of catch basins upon receipt of the Ministry of Environment permit and following the required public notification. If using the pellet formulation of methoprene, three consecutive larviciding treatments were to be conducted, with the first treatment beginning in late June early July, and subsequent treatments implemented approximately 21 days following the previous larviciding treatment. If the briquette formulation of methoprene was used, a single treatment was to be conducted in late June.

Treatment Locations

Following the local risk assessment process, the Town of Bradford West Gwillimbury was assigned to Tier 1 – Larviciding Action. In late May 2013, the Medical Officer of Health issued a 'Notice to Larvicide' to this municipality. In early July 2013 larviciding began in the settlement area of the municipality.

The mosquito control portion of the West Nile virus program is conducted in collaboration with local municipalities. Municipal staff assists with pre-treatment larvae surveillance of catch basins, licensed municipal staff conduct catch basin larviciding, and municipalities support an IPM approach to mosquito control by supporting appropriate activities to reduce mosquito breeding habitat.

PUBLIC COMMUNICATIONS

Public Education Campaign

As in previous seasons, public education about VBD was accomplished through dissemination of print materials, mass media, presentations, website information and the provision of information to key stakeholders.

2013 West Nile virus Public Education Key Messages

Information about WNV: including the method of transmission and the risk to human health.

Source reduction strategies: for reducing mosquito breeding by eliminating standing water sites (tires, buckets, and other water-holding objects); changing the bird bath water weekly; cleaning and chlorinating swimming pools or draining and covering if not in use; preventing water from accumulating in pool-covers; unclogging gutters and down spouts and cutting back brush and growth from around the house.

Personal protective measures: that can be taken to avoid mosquito bites, such as ensuring that screens fit tightly in doors and windows and are free of holes, wearing protective clothing (long pants, long-sleeved shirts, and socks) and appropriate use of insect repellents.

Signs and symptoms of WNV: (headache, high fever, muscle pain, weakness and disorientation) and public awareness about the nature of mosquito borne disease.

Mosquito control: larviciding and the product that would be used and how the larviciding procedure is effective.

2013 Lyme disease Public Education Key Messages

Information about Lyme disease: including the method of transmission and the risk to human health.

Personal protective measures: that can be taken to avoid contact with ticks, such as wearing protective clothing (long pants, long-sleeved shirts, and socks), checking for ticks on one's person if frequenting an area with ticks, and appropriate use of insect repellents.

Appropriate removal and submission of ticks: for laboratory testing when attached to a person.

Signs and symptoms of Lyme disease: (headache, high fever, muscle pain, weakness and disorientation) and public awareness about the nature of mosquito-borne diseases.

The fact sheets, posters, counter cards and pamphlets were distributed to over 450 local businesses including golf courses, general stores, information centres, hardware stores, retirement homes, campgrounds, hospitals and garden centres.

Media

During the 2013 season, there were at total of 20 media related calls (14 WNV, 6 Lyme disease, and 0 EEEV) and 33 media reports (28 WNV and 5 Lyme disease). These came to the health unit from various print, radio and television media sources. A combination of both proactive and reactive strategies were undertaken to raise awareness of VBD issues, reinforce

key messages, respond to public concern, correct misunderstandings or misinformation and maintain perspective on the issue. Components included interviews, editorials, a Medical Officer of Health (MOH) column and the direct printing of media releases.

Public Information Services were also utilized during the 2013 season. Health Connection, the health unit's telephone information line, is staffed by public health professionals from 8:30am to 4:30pm. Calls received ranged from basic VBD questions, complaints of illness, pesticide use and stagnant water complaints.

Key Stakeholders

Municipalities are a critical partner in WNV prevention and control efforts. When requested, a WNV informational display board was made available to community groups and organizations for use at community events. To accompany the display board, a quantity of WNV fact sheets and information materials would be provided. A list of key stakeholders is provided in Appendix A.

EVALUATION

Several large-scale formal and multi-sectoral evaluations of the West Nile virus program have been conducted in previous seasons. No formal evaluation was completed this season. However, ongoing program reviews and assessments are conducted to provide inputs into operational planning and implementation decisions. In addition, the risk assessment and decision-making tool is used annually to determine the need for mosquito control programs.

CONCLUSION

It is important to acknowledge the continued support and assistance of the municipalities for their continued active involvement and cooperation in the VBD surveillance program and related activities.

Illnesses transmitted by vectors were detected locally from a number of sources this season. This highlights the importance of the vector surveillance, vector control and educational programs aimed at personal preventive measures for vector borne diseases. Further data analysis will be conducted to gather evidence to guide decision-making regarding the 2014 surveillance and control programs.

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APPENDIX A

Key Stakeholders

Adjala Tosorontio Township

Canadian Forces Base Borden

Bradford West-Gwillimbury

Entomogen

Canadian Cooperative Wildlife Health Centre

Canadian National Railways

Canadian Pacific Railways

City of Barrie

Clearview Township

Town of Collingwood

Corrections Canada - Beavercreek and Fenbrook Institutions (Gravenhurst)

County of Simcoe

District of Muskoka

Essa Township

Georgian Bay Island National Park

Township of Georgian Bay

Town of Gravenhurst

Health Canada-First Nations and Inuit Health Branch

Town of Huntsville

HydroOne Networks Inc.

Town of Innisfil

Lake Simcoe Conservation Authority

Township of Lake of Bays

Town of Midland

Township of Muskoka Lakes

Ministry of Agriculture, Food and Rural Affairs

Ministry of Health and Long-Term Care

Ministry of Natural Resources

Ministry of the Environment

Ministry of Transportation

Town of New Tecumseth

Nottawasaga Valley Conservation Authority

Ontario Reality Corporation

City of Orillia

Oro-Medonte Township

Town of Penetanguishene

Praxair

Ramara Township

Severn Sound Environmental Action

Severn Township

Spills Action Centre

Springwater Township

Tay Township

Tiny Township

Town of Wasaga Beach