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West Nile Virus Activity in British Columbia: Surveillance Program Results

2013



Table of Contents

Executive Summary	4
Surveillance Results	6
Results at a Glance	6
Surveillance of WNV in Humans	7
Surveillance of WNV in Corvids	8
Surveillance of WNV in Horses	8
Surveillance of WNV in Mosquitoes	8
Surveillance of Climatic Factors for WNV Risk	11
References	14
Acknowledgements	15
Tables:	
Table 1: Summary of BC Surveillance, June 1 - November 5, 2013	6
Table 2: Human WNV Infections in North America, 2005-2013	7
Figures:	
Figure 1: WNV Activity in the Pacific Northwest, 2013	5
Figure 2: Geographic Distribution of Mosquito Traps in BC, 2013	9
Figure 3: Water Levels at Osoyoos Lake, 2013 (Source: USGS, 2013)	10
Figure 4: 14 Day Moving Window of Cumulative Base 14.3°C Growing Degree Days up to August 31st, 2013	12
Figure 5: Accumulated Base 14.3°C Growing Degree Days in British Columbia up to August 31, 2013	13

Executive Summary

During the 2013 WNV season in BC positive indicators included: 1 human infection, 1 horse infection, 1 positive bird and 1 positive mosquito pool. All positive indicators were reported from Interior Health - in the Southern or Central Okanagan.

Human surveillance was done through diagnostic testing at the BC Public Health Microbiology and Reference Laboratories (PHMRL) to identify positive human cases and collaboration with Canadian Blood Services BC and Yukon Centre to provide timely and geographic representative information on blood donations. No positive donations were reported in BC in 2013.

Corvid and mosquito surveillance in 2013 was focused in Interior Health along the Okanagan Valley in the South and Central Okanagan. While the number of birds collected and tested has decreased a single positive bird was identified this year. In addition, the public still remain active in reporting dead birds online through the BCCDC website.

All female *Culex* mosquitoes were tested for WNV but only one pool of *Culex tarsalis* tested positive for the virus. Temperature modeling indicated sufficient heat accumulation for the virus to start replicating in *Cx. tarsalis* mosquitoes by the beginning of July.

The surveillance for WNV in BC continues to be an integrated and collaborative model.

Surveillance Results

Results at a Glance

Table 1: Summary of BC Surveillance, June 1 - November 5, 2013

	Human samples ¹	Corvids Submitted	Mosquito Pools ²	Horse
# Tested	862	5	290	n/a
# Positive	1	1	1	1

1. The number of cases includes those classified as probable and confirmed.

2. A pool may contain up to 50 mosquitoes that are tested at one time.

Surveillance of WNV in Humans

In 2013, 862 human specimens were tested by the BC PHMRL and 1 confirmed infection was reported (Table 1). The case experienced non-neurological symptoms and was reported from the Southern Okanagan.

Canadian Blood Services (CBS), BC and Yukon Centre provided BCCDC with aggregate, regional blood donor WNV testing updates for BC collections throughout the WNV season. This reporting provides geographically comprehensive and timely ongoing human WNV surveillance data to public health. Between May 29 and October 1, 2013, there were 45,594 collections of blood in BC and no positive WNV screening test results were reported.

Between June 1 and October 4, 2013, BCCDC provided daily reports to CBS BC and Yukon Centre of WNV test requests received by BCCDC. This enabled rapid identification of donors who may have recently donated potentially WNV infectious blood, so that a product recall could be carried out on donations made within the previous 14 days. CBS was advised of 367 WNV test requests received by BCCDC; of these, there were 23 (6% of 367 reports) unique blood donors registered with CBS. None of these donors had donated a whole blood unit within 14 days of WNV testing at BCCDC so no product recall of in-date products was required.

Further details on the collaboration for WNV planning, preparation and surveillance can be found at: www.pbco.ca

As of December 2, 2013, 110 human infections were reported in Canada. Infections were reported in Quebec (28), Ontario (52), Manitoba (3), Saskatchewan (5), Alberta (21) and BC (1). 40 (37%) were classified as West Nile neurological syndrome. Four deaths were reported.

As of November 19, 2013, 2,271 human WNV infections and 100 deaths were reported in the US in 2013. The largest number of cases was reported from California. One human infection acquired outside of State was reported from Washington State and 16 human infections were reported from Oregon State (3 acquired out of State). In 2013, the number of human cases in Canada and the US decreased compared to the active season reported in 2012 (Table 2).

Across Canada, WNV blood donor screening identified 6 WNV positive donors during 2013; CBS identified 4 from ON, 1 from SK and 1 was identified by HemaQuebec.

Table 2: Human WNV Infections in North America, 2005-2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Canada	25	225	151	2,215	36	13	5	101	428	110
United States	2539	3000	4269	3630	1356	720	1021	712	5387	2271

Source: (PHAC, 2013, CDC, 2013)

Surveillance of WNV in Corvids

During the 2013 surveillance season, 5 corvids were collected and 1 positive result was reported. All birds tested were collected from Interior Health and the positive bird was collected from the Central Okanagan.

A total of 155 dead birds were reported online by the public to BCCDC in 2013. In June and July there were approximately 10-20 sightings reported each week. The number of sightings reported each week decreased in August and September. There was no spike or localized increase in sightings throughout the season. Sightings were reported from four of the five health authorities in BC (Fraser Health, Island Health, Vancouver Coastal and Interior Health).

The number of birds collected and tested has decreased as our surveillance has become more focused over time. While the number of sightings reported by the public also decreased, this data continues to demonstrate public awareness and interest in surveillance for WNV.

Surveillance of WNV in Horses

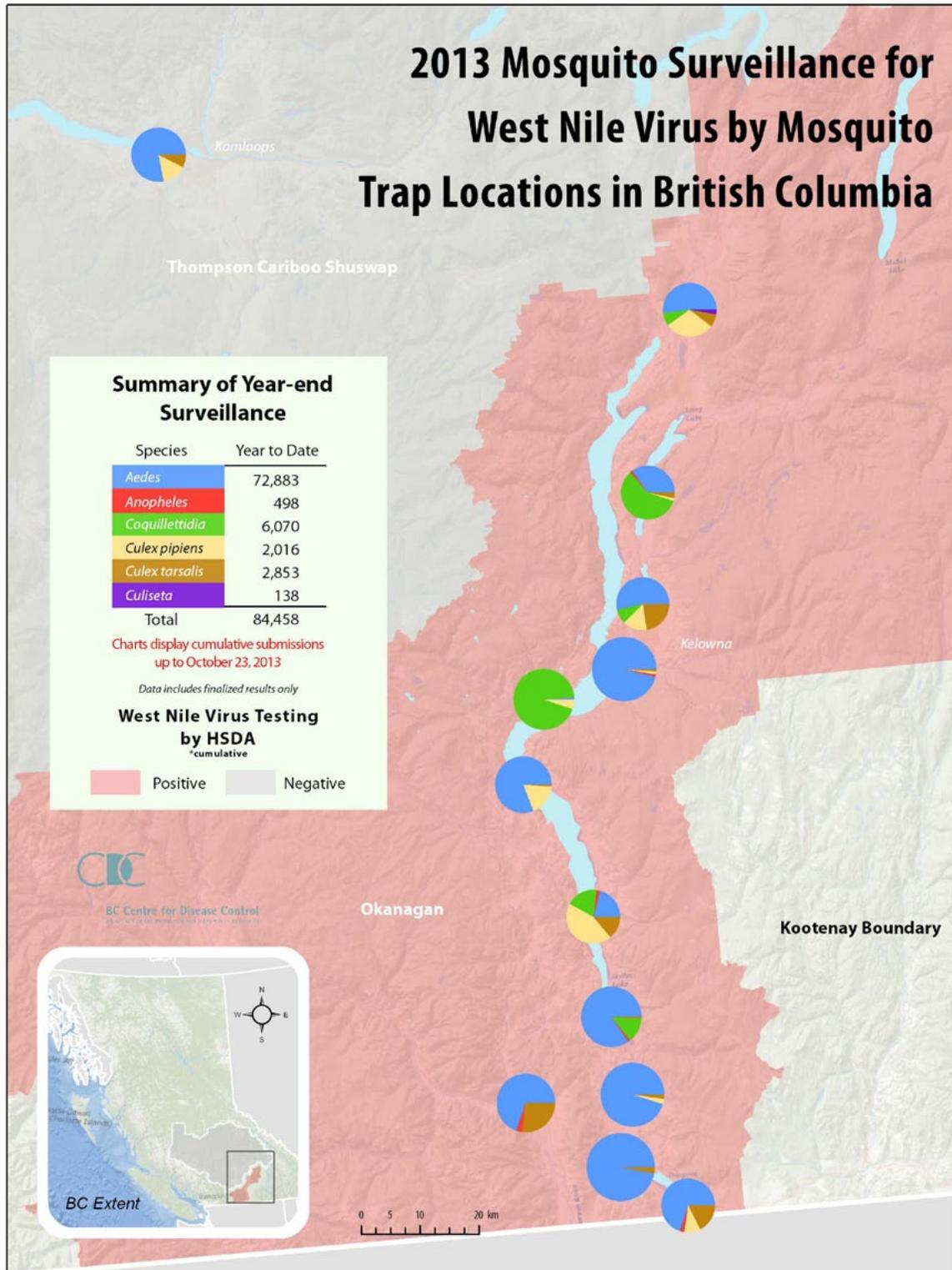
In 2013, 1 case of WNV in a horse was reported. The horse was from the Central Okanagan.

Surveillance of WNV in Mosquitoes

In 2013, there was a total of 154 submissions from miniature CDC mosquito light traps baited with dry ice (to produce CO₂), resulting in 290 pools being tested. A total of 84,458 mosquitoes were collected by Interior Health. In 2013, favourable weather for the virus produced one positive mosquito pool (Table 1). Traps were in the same location as in 2012 and over the same time period of the year. In 2012, there were 155 submissions with a total of 117,007 mosquito specimens.

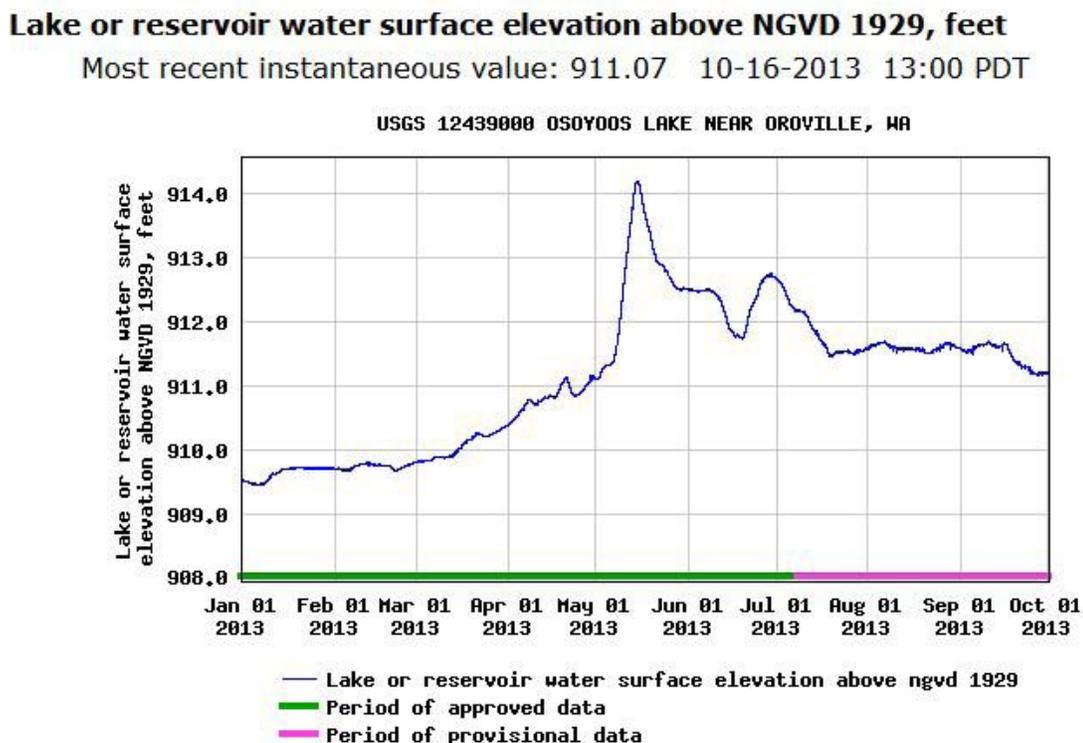
Figure 2 depicts the geographic distribution of adult mosquito traps in 2013. This region has had positive indicators in previous years. These traps were located in the Okanagan Valley and one trap in the Thompson River Valley. Mosquito surveillance started in the second week of June and ended by the second week in September. This window of time covers the period when WNV is most active in Canada.

Figure 2: Geographic Distribution of Mosquito Traps in BC, 2013



The flow of water in the Okanagan Valley is south through Okanagan Lake and eventually through Osoyoos Lake. Water level usually sits between 911 and 912 feet above sea level; in 2013 the lake rose to above 914 in the middle of May (Figure 3). The high water flooded the wetlands and low lying areas at the north end of the lake. One trap in this location (IHA 11) accounted for 40,873 of the mosquitoes in our surveillance program.

Figure 3: Water Levels at Osoyoos Lake, 2013 (Source: USGS, 2013)



Two primary vector species were collected in our surveillance. *Culex pipiens* is more abundant in urban sites because they use artificial containers to develop their young, especially storm-water, catch basins which are common in urban centres. Kelowna is the largest population centre and traps there usually catch this species. The warm weather favours this species so the result of our warm season is we caught 3 times more than in the cold 2012 season. We had an average of 13.1 *Cx. pipiens* trapped per night in 2013 versus 4.3 in 2012. *Cx. pipiens* is a preferential bird biting species and the greater number this season may have contributed to the virus circulating in the zoonotic cycle causing WN in birds.

Cx. tarsalis is the other primary vector species collected in our surveillance. We had 18.5 *tarsalis* trapped per night in 2013 compared to 22.9 in 2012. The warmer temperature did allow the virus to develop in these mosquitoes, and one sample collected on August 1, tested positive from the south end of the Okanagan Valley. In general, more *Cx. tarsalis* are collected in the traps located in the south end of the Okanagan and Similkameen River valleys. The adult female is not an aggressive biter like *Aedes* which can reach extremely high numbers in this region. Public communication about using repellent from the middle of July to the end of August is a good proactive measure to protect from this vector.

Surveillance of Climatic Factors for WNV Risk

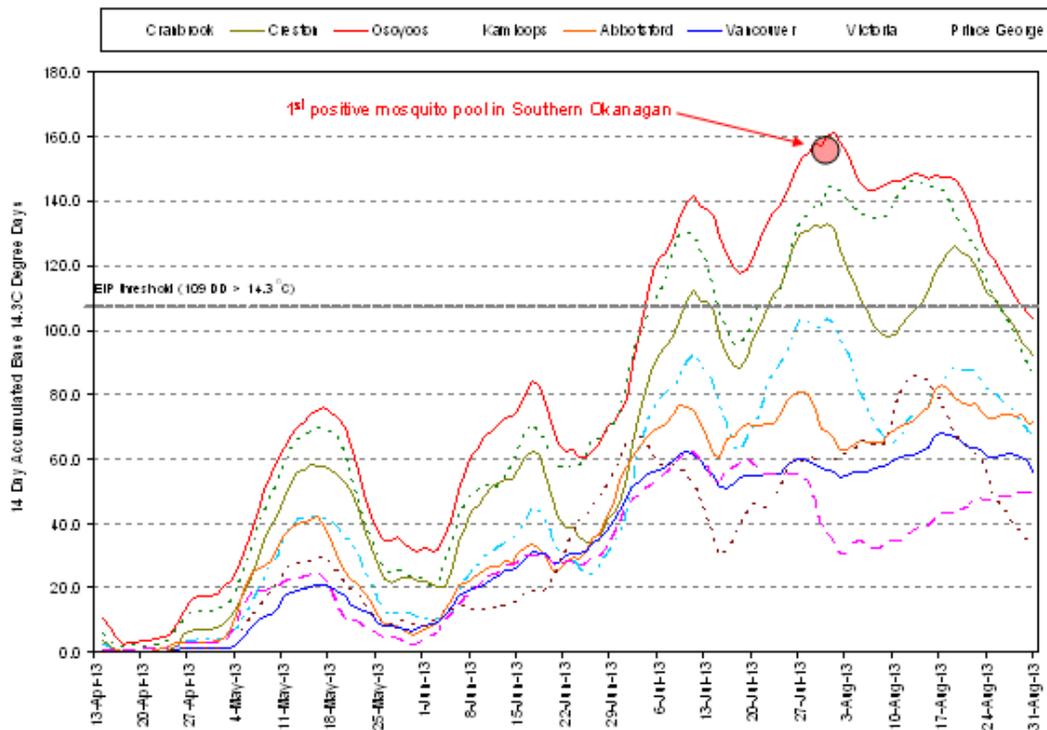
Temperature plays a key part in WNV biology, ecology and epidemiology. WNV amplification and rate of mosquito development occurs more rapidly with warmer temperatures, resulting in development of multiple generations of *Culex* mosquitoes and a larger number of infectious mosquitoes during the season. Warmer temperatures also increase mosquito biting activity, thereby increasing the risk of transmission to humans.

A base 14.3°C growing degree days model is used to forecast *Cx. tarsalis* mosquito development and corresponding WNV risk in BC. The concept of growing degree days involves the amount of accumulated heat required for mosquitoes to complete their growth and development. Growing degree days are used to track when a female mosquito imbibing an infectious bloodmeal is able to transmit WNV – the extrinsic incubation period (EIP) threshold for *Cx. tarsalis* is 109 base 14.3°C degree days (Reisen et al. 2006).

Accumulated growing degree days were monitored on a weekly basis for select BC communities from various parts of the province (Figure 4). A spatial model was also developed to create a continuous surface map for the entire province (Figure 5).

The accumulated heat experienced in 2013 was above the 10 year average as monitored by the WNV Program for most regions of the province. Osoyoos, Kamloops and Creston accumulated >109 base 14.3°C degree days over 14-day periods during July and August – exceeding the extrinsic incubation period threshold for *Cx. tarsalis*. The first reported positive indicator of WNV activity in 2013 was a positive *Cx. tarsalis* mosquito pool collected August 1st in the south Okanagan region (Figure 4).

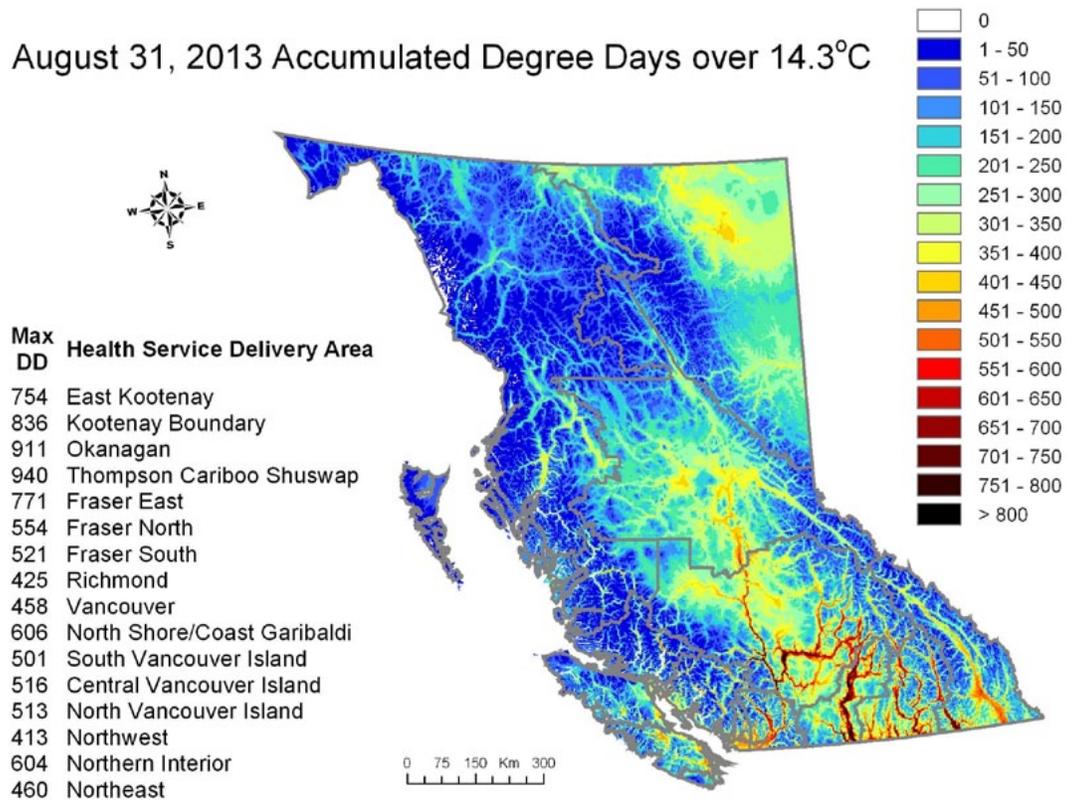
Figure 4: 14 Day Moving Window of Cumulative Base 14.3°C Growing Degree Days up to August 31st, 2013



Note: Degree days calculations beyond August 31st are not meaningful for WNV risk prediction for newly emerged *Culex* because these mosquitoes will likely enter diapause (a state where they do not seek a blood meal) by this time, and therefore the effect of temperature on mosquito development and viral replication after this date does not contribute to WNV risk.

The Okanagan and Thompson Cariboo Shuswap regions consistently experience the greatest accumulation of degree days (i.e. heat) in BC (Figure 5). These regions are characterized by hot, dry summers with maximum daily temperatures often exceeding 35°C and less than 100 mm of total precipitation between June and August. The Kootenay Boundary, East Kootenay and Fraser Valley regions also experience sufficient accumulated degree days to support multiple generations of *Culex* mosquitoes, however to date activity in these regions has not occurred or been rare.

Figure 5: Accumulated Base 14.3°C Growing Degree Days in British Columbia up to August 31, 2013



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