BC Centre for Disease Control
An agency of the Provincial Health Services Authority

655 West 12th Avenue
Vancouver, BC V5Z 4R4
www.bccdc.ca

West Nile Virus Activity in British Columbia:

Surveillance Program Results
2014

Prepared by: Communicable Disease Prevention and Control Services, BCCDC
www.bccdc.ca/westnile

Provincial Health Services Authority
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Surveillance Results

Results at a Glance

During the 2014 West Nile virus (WNV) season in BC there were no positive indicators reported (Table 1).

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 2014.

Mosquito surveillance in 2014 was focused in Interior Health along the Okanagan River Valley in the South and Central Okanagan. In addition, the public still remained active in reporting dead birds online through the BCCDC website.

All female *Culex* mosquitoes were tested for WNV but no pools of *Culex tarsalis* tested positive for the virus. Temperature modeling indicated sufficient heat accumulation for the virus to start replicating in mosquitoes but no virus was found.

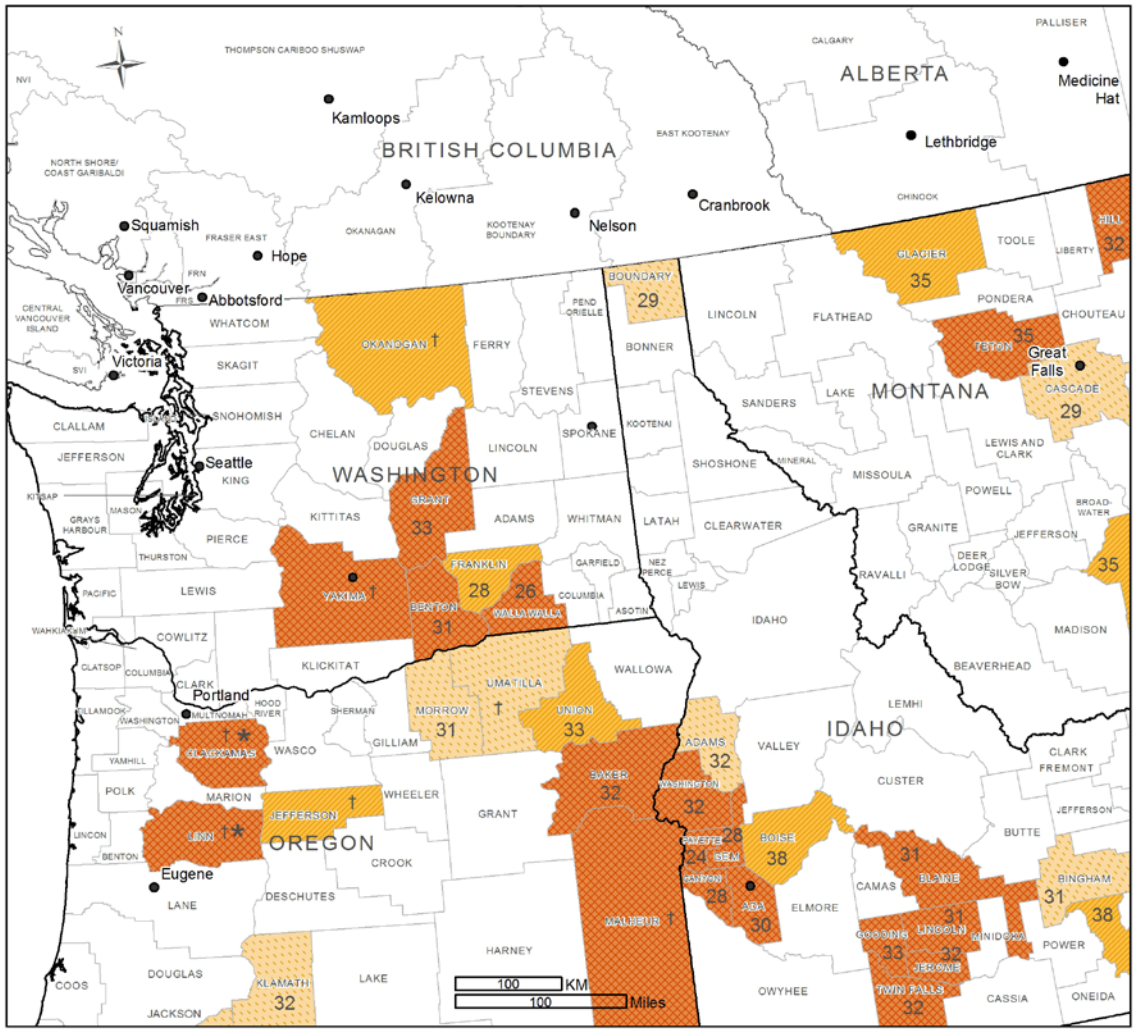
WNV activity was detected in American states south of British Columbia in 2014 (Figure 1). WNV positive mosquitoes and horses were identified in US Counties in Washington, Idaho and Montana bordering BC. As in previous seasons, south central Washington was the closest regions to BC to report WNV activity including human infections.

Table 1: Summary of BC Surveillance, June 1-October 3, 2014[1]

	Human samples[2]	Corvids Submitted	Mosquito Pools[3]	Horse
# Tested	**836**	**0**	**236**	**n/a**
# Positive	**0**	**0**	**0**	**0**

1.Human surveillance began on June 1, 2014. Mosquito surveillance began on July 1, 2014.
2. The number of cases includes those classified as probable and confirmed.
3. A mosquito pool may contain up to 50 mosquitoes that are tested at one time.

Figure 1: Pacific Northwest Region West Nile Virus Activity, 2014



Surveillance of WNV in Humans

In 2014, 836 human specimens were tested by the BC PHMRL and there were no confirmed infections reported (Table 1).

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 July 2 and September 30, 2014, there were 31,353 collections of blood in BC and no positive WNV screening test results reported.

Between June 30 and September 30, 2014, 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 216 WNV diagnostic test requests received by BCCDC; of these, there were 18 (8.3% of 216 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 October 11, 2014, 18 human infections were reported in Canada. Infections were reported in Quebec (5), Ontario (10), Manitoba (3). Seven (39%) were classified as West Nile neurological syndrome.

As of November 4, 2014, 1820 human WNV infections and 66 deaths were reported in the US in 2014. The largest number of cases was reported from California. Twelve human infections were reported by Washington State and 8 human infections were reported from Oregon State.

In 2014, the number of human cases in Canada and the US decreased compared to previous seasons (Table 2).

Table 2: Human WNV Infections in North America, 2004-2014

	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Canada	25	225	151	2,215	36	13	5	101	428	110	18
United States	2539	3000	4269	3630	1356	720	1021	712	5387	2271	1820

(PHAC, 2014, CDC, 2014)

Surveillance of WNV in Corvids

During the 2014 season no corvids were collected for testing in British Columbia. Instead, online reporting of dead birds was encouraged as bird testing has been phased out of the WNV program.

A total of 140 dead birds were reported online by the public to BCCDC in 2014. A peak occurred in early July with 20 birds reported in week 27. In June and August there were generally less than 10 sightings per week and in September less than 6 per week. No unexpected die-offs were reported. Sightings were reported from all five of the health authorities in BC. Fraser Health (37%) and Vancouver Coastal Health (33%) represent the majority of birds reported, followed by Interior Health (20%), Island Health (8%) and Northern Health (2%).

Surveillance of WNV in Horses

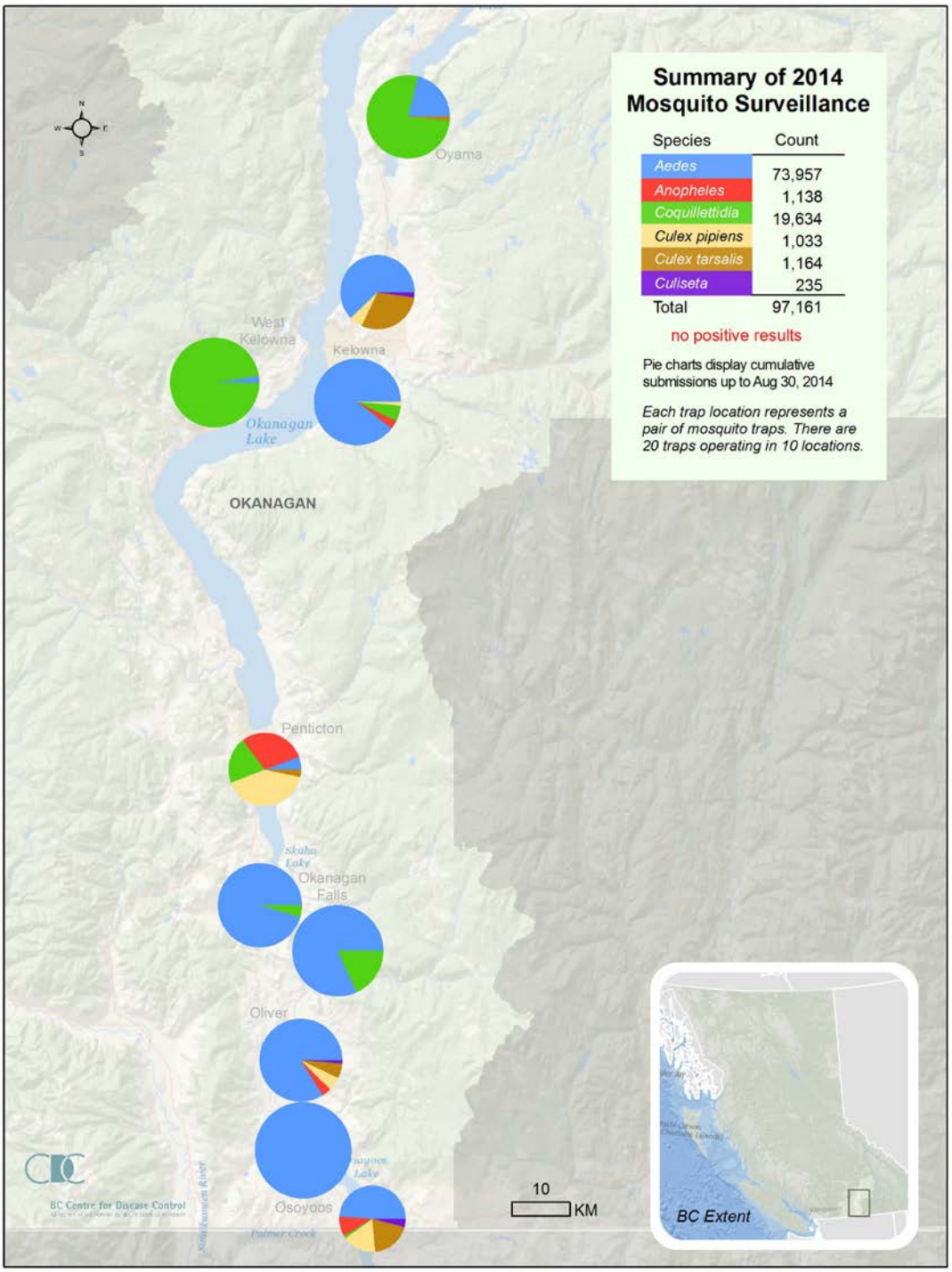
In 2014, no horses that met the confirmed case definition were reported.

Surveillance of WNV in Mosquitoes

In 2014, there was a total of 175 submissions from miniature CDC mosquito light traps baited with dry ice (to produce CO_2) resulting in 236 pools being tested (Table 1) with no positive results. Twenty (20) traps in 10 different locations operated in the Okanagan Valley of Interior Health for 9 weeks from the beginning of July to the end of August (Figure 2). A total of 97,061 mosquitoes were collected. This region has had positive indicators in previous years so it was selected as the focus of mosquito surveillance for July and August when WNV is most active in BC.

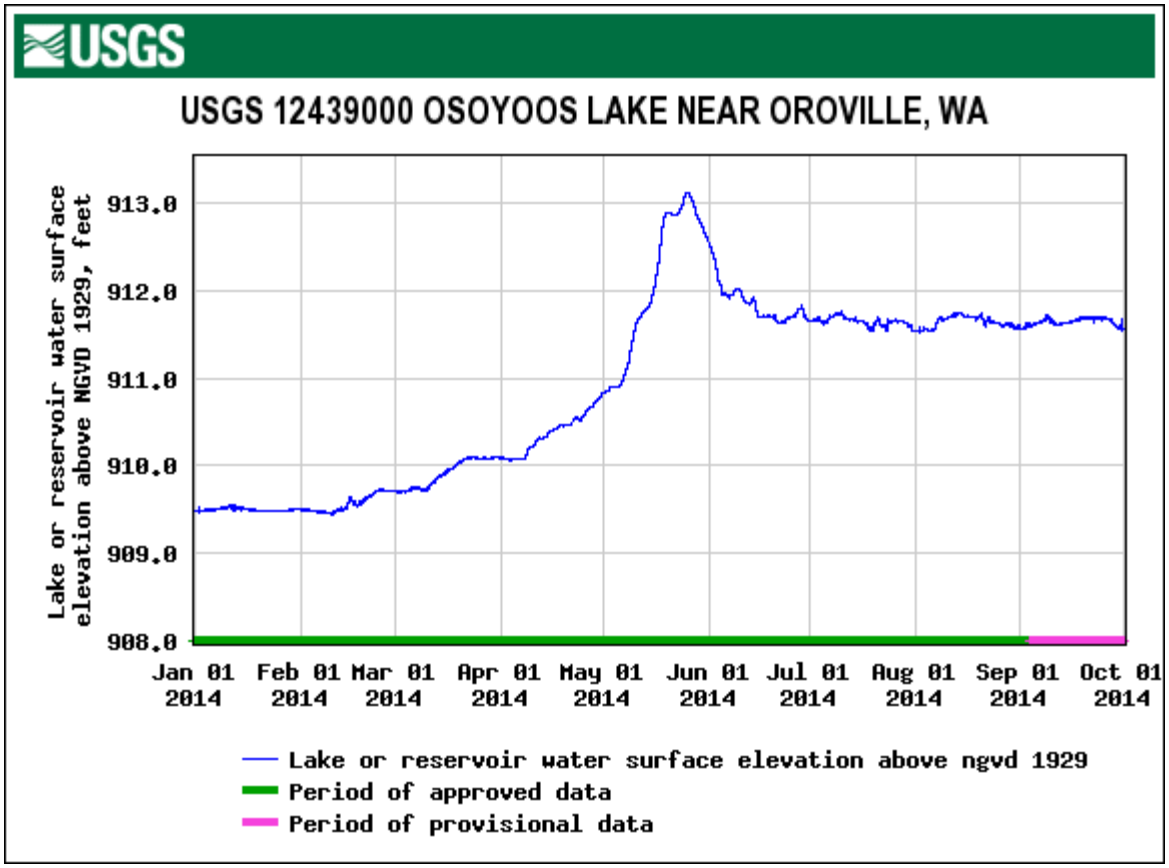
Two primary vector species were collected in our surveillance. *Culex pipiens* is more abundant in urban areas because they use artificial containers for their young to develop (e.g., storm water sewer, catch- basins). We caught the most *Cx. pipiens* in urban areas of Penticton, Kelowna and Osoyoos where catch basins are concentrated. The warm weather favours this species but we caught very few specimens this season. We had an average of 5.9 *Cx. pipiens* trapped per night in 2014 versus 13.1 in 2013. *Cx. tarsalis* is the other primary vector species collected in our surveillance. We had 6.6 *tarsalis* trapped per night in 2014 compared to 18.5 in 2013. More *Cx. tarsalis* are collected in the traps located in the south end of the Okanagan River Valley.

Figure 2: Geographic Distribution of Mosquito Traps and Species Trapped in BC, 2014



Water flow in the Okanagan Valley is from north to south, through Okanagan Lake, eventually exiting Canada at Osoyoos Lake. Water level usually sits at normal operating level at 277.83 metres (911.5 feet) above sea level (IOLBC, 2014). In 2014, the lake rose to just above 278 metres in the middle of May but dropped to normal operating levels by the beginning of June and remained at that level throughout the season (Figure 3). High water levels can cause flooding and seep in low lying areas, which can become a mosquito development site. In 2014, this occurred only early in mosquito season which may have led to less suitable habitat and decreased the overall number of mosquitoes which can spread this disease.

Figure 3: Water Levels at Osoyoos Lake, 2014 (Source: USGS, 2014)



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.

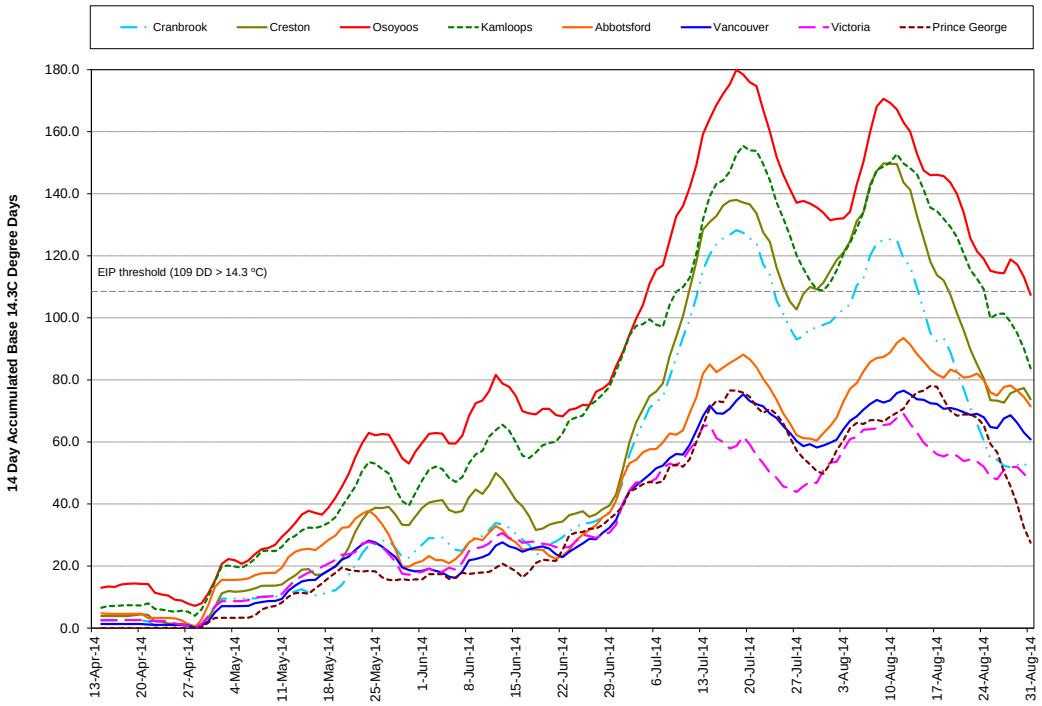
A base 14.3^{o}C growing degree days model is used to forecast *Cx. tarsalis* mosquito development and corresponding WNV risk in BC. The concept of growing degree days involves the amount of accumulated heat required for mosquitoes to complete their growth and development. Growing degree days are used 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^{o}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).

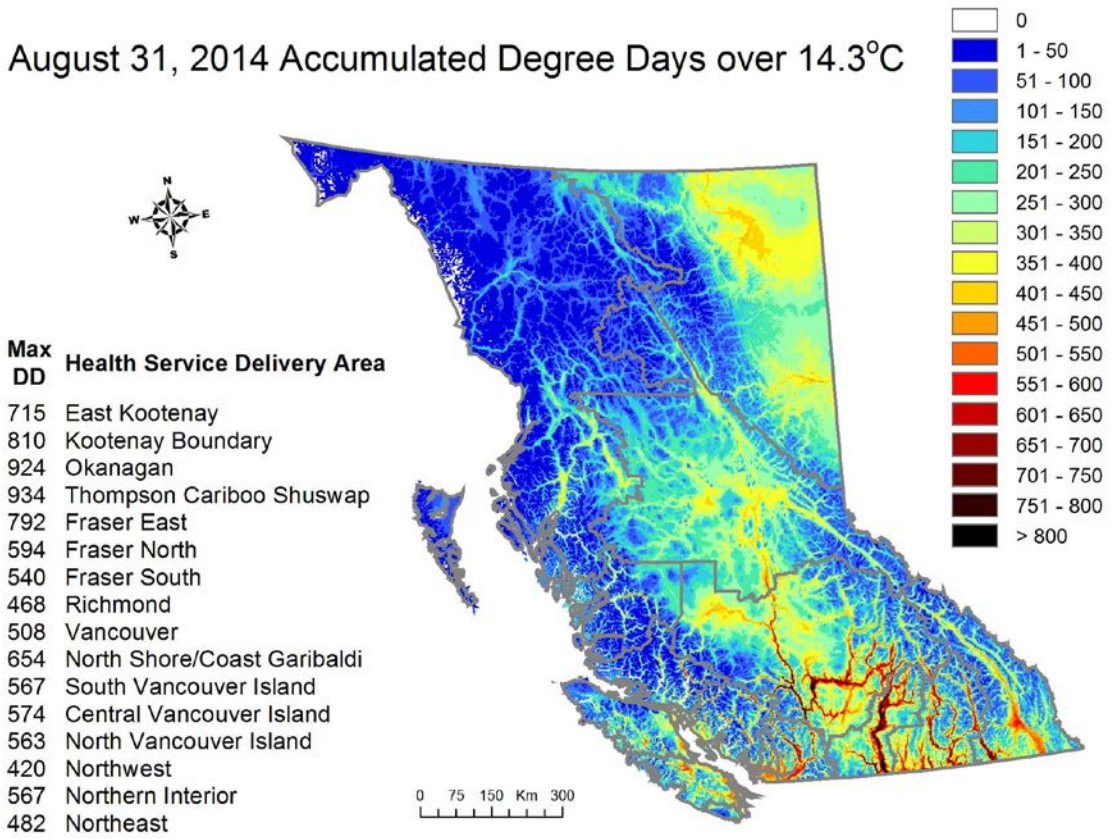
The accumulated heat experienced in 2014 was above the 10 year average as monitored by the WNV Program for most regions of the province. Osoyoos, Kamloops, Creston and Cranbrook accumulated >109 base 14.3^{o}C degree days over 14-day periods during July and August – exceeding the extrinsic incubation period threshold for *Cx. tarsalis* (Figure 4). However, no WNV activity was detected in 2014.

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 typically characterized by hot, dry summers with maximum daily temperatures often exceeding 35^{o}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 4: 14 day moving window of cumulative base 14.3°C growing degree days for select communities up to August 31, 2014, BC



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.



Max DD	Health Service Delivery Area
715	East Kootenay
810	Kootenay Boundary
924	Okanagan
934	Thompson Cariboo Shuswap
792	Fraser East
594	Fraser North
540	Fraser South
468	Richmond
508	Vancouver
654	North Shore/Coast Garibaldi
567	South Vancouver Island
574	Central Vancouver Island
563	North Vancouver Island
420	Northwest
567	Northern Interior
482	Northeast

Conclusion

In BC. there was no WNV activity detected in 2014. This is similar to previous years where no or very low activity has been reported.

This lack of WNV activity was unexpected since we experienced warm temperatures particularly in the southern Interior. However, low water levels and limited mosquito activity may have impacted circulation of the virus this season. Information from this season and ongoing experience with WNV in BC will be taken into account for future surveillance activities.

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Acknowledgements

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