

West Nile Virus Surveillance Report, 2023: September 23

Addendum to the Final Report (September 09)

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1. West Nile virus transmission risk (week ending Sept. 23, 2023)

- All *Culex* spp. mosquito pools tested this season have been negative for West Nile virus. Mosquito surveillance ended on September 09, 2023.
- A single human case of West Nile neuroinvasive disease was reported on September 11 in the mixed grass prairie ecoregion. This report and a total of eight WNV-positive human laboratory test results indicate WNV transmission in humans occurred this season.
- In total, ten WNV-positive equine cases have been reported this season. The CWHC¹ detected 25 WNV-positive birds this season.
- Mosquitoes will continue to actively bite on warmer evenings and throughout the night when temperatures are greater than 15°C. Possible transmission of WNV may occur until there is a widespread hard frost (i.e. two hours with temperatures below minus 2°C).

The risk of West Nile virus (WNV) infection in humans depends on various factors including time of year, number and location of infected *Culex tarsalis*, *Culex restuans*, and *Culex territans* mosquitoes, and number of days with sufficient heat. In Saskatchewan, *Culex tarsalis* is the main transmitter of WNV to humans. It is abundant in the southern areas of the province where it is hotter and drier. *Culex tarsalis* is rarely found in the northern forested areas.

The risk of WNV transmission is low in the spring but often rises through the early and midsummer period, reaching a peak during the latter part of July and August. Infected, overwintered *Culex tarsalis* females may pose a small risk of transmission in spring.

The WNV risk levels may vary from minimal, when *Culex* spp. mosquitoes are rare and the weather has not been conducive for virus cycling in mosquitoes and birds, to high when there are high numbers of WNV-infected mosquitoes and the weather and habitat conditions have been optimal for mosquito population growth, biting activity and transmission of the virus to humans.

Risk levels are determined in Saskatchewan through mosquito surveillance indicators such as *Culex* spp. numbers and infection rates, degree day or heat accumulation and other relevant weather factors such as precipitation. The level of risk in mosquitoes is determined by using infection rates in mosquitoes (expressed as the number of infected mosquitoes/1000) and risk index calculated as follows:

the infection rate X the average *Culex* spp. per trap night/1000).

Other relevant factors that help determine risk to humans include time of year, the status of mosquito larval populations, past and predicted weather patterns, adult mosquito population age and trend, proximity to populated areas and other indicators such as positive birds or horses.

West Nile Virus Risk

Minimal - The types of mosquitoes that carry WNV have not been detected in the surveyed communities. The accumulated degree day threshold required to observe *Culex* spp. activity (150-200 degree days) has not been met. This does not mean the risk is zero.

Low - The types of mosquitoes that carry WNV have been detected in small numbers but all mosquito pools are negative. The threshold of 150-200 degree days has been met. There is a low probability of being bitten by an infected mosquito.

Moderate - WNV positive mosquitoes have been detected in numbers where there is a moderate probability of being bitten by an infected mosquito. 250 to 300 degree days have been accumulated which will support the emergence of the second generation of *Culex* spp. mosquitoes.

High - High numbers of WNV positive mosquitoes have been identified and are widespread. There is an increasing and high probability of being bitten by an infected mosquito. There is increased *Culex* spp. activity and virus transmission is high.

¹ Information provided by the Western and Northern Region of the Canadian Wildlife Health Cooperative, Western College of Veterinary Medicine.

2. Degree day accumulation

- Information on degree day accumulation is not available for the week ending September 23, 2023.

Degree day: a measurement of heat accumulation from April 1. The threshold temperature below which WNV development and transmission is unlikely to occur in *Culex tarsalis* mosquitoes is 14.3°C. Degree days are calculated by subtracting the threshold or base temperature from the daily mean temperature each day. These are then summed to provide the total accumulation for the season.

Example: Mean daily temperature = 19.3°C; threshold temperature = 14.3°C; $19.3 - 14.3 = 5.0$ degree days.

Degree days are used in two ways. First, to predict *Culex tarsalis* development throughout the season by recording the total of accumulated degree days. On average, it takes approximately 250 to 300 degree days (base 14.3° C) before the second generation of *Culex tarsalis* emerges.

Females of the second generation are most numerous and are largely responsible for transmission of WNV to humans. A total of 109 degree days are required for virus development to be completed within a particular population and for potential transmission to occur.

The second use of degree days is to determine the WNV transmission risk of infected mosquitoes. The risk of WNV transmission increases with increasing degree day accumulation. Moreover, consistently warmer temperatures will significantly shorten virus development time in the mosquitoes. This increases the potential risk of WNV transmission, if the virus is present and other conditions are favourable.

3. Mosquito surveillance results, 2023

*Note: Mosquito surveillance ended on Sept. 09, 2023. The results below are from the final week of surveillance (Sept. 03 – Sept. 09)

- Small numbers of *Culex* spp. mosquitoes continue to be detected in surveyed communities. With above-average temperatures predicted for fall, mosquitoes will likely remain active well into September.
- Mosquitoes will continue to actively bite on warmer evenings and throughout the night when temperatures are greater than 15°C. With dusk occurring earlier at this time of year, *Culex tarsalis* mosquitoes will become active earlier in the evening.
- While WNV-infected *Culex* mosquitoes have not been detected in traps this season, they may be present at a low rate.

Number of *Culex* spp. mosquitoes

Table 1: Average* number of *Culex* spp. mosquitoes captured by ecological risk area, community, and date, 2023

Week ending	(1) Boreal Forest ¹	(2) Boreal Transition ¹	(3) Moist Mixed-Grass Prairie/Aspen Parkland							(4) Mixed Grass Prairie		
			Estevan	Moosomin	Regina	Saskatoon	Rosetown	Weyburn	Yorkton	Assiniboia	Moose Jaw	Swift Current
Jun 17			0	0	0	0	0	N/A	0	0	0	1.75
Jun 24			0	0.50	0.56	0	0	0	0.25	0	0	0
Jul 01			0	2	0.10	0	0	0	0.50	0	0	0
Jul 08			0.33	0.50	1	0	0	1	0	4	0	3
Jul 15			0.50	0	0.56	0	3	0.50	0	0	0.17	3.25
Jul 22			1.17	0	0.38	0.60	2	0	0	0.50	0	2.50
Jul 29			3.83	0	2.60	1.11	2	1	0.50	1	1.67	1
Aug 05			2.17	2	4.30	0.30	0	3	1	4	2.50	7
Aug 12			6.83	8.50	2.78	1.20	2.50	3	2	2.50	0.33	6
Aug 19			1.17	0	2.33	1.10	2	0	0.50	0	0.67	4
Aug 26			0.83	0.50	0.20	0.13	0	0	0	0.50	0	3.75
Sep 02			0.50	0	0.30	0.88	0.50	0	0.50	0	1	0
Sep 09			0	1	0	0	0	0	0	0	0.5	0
Average			1.44	1.15	1.16	0.37	0.92	0.65	0.35	0.96	0.60	2.69

Notes:

*Averages are determined by dividing the total number of *Culex* spp. mosquitoes caught by the total number of trapping nights.

¹ *Culex* spp. activity is rare in the Boreal Forest and Boreal Transition ecological risk areas. Mosquito surveillance is currently not conducted in these ecoregions; however, if *Culex* spp. activity increases significantly this summer, mosquito traps may be operated in these areas.

N/A – data not available

Number of mosquito pools testing positive

Table 2: Number of WNV positive mosquito pools*, percent positive pools and total number of pools tested by date and ecological risk area, 2023

Week Ending	(1) Boreal Forest ¹	(2) Boreal Transition ¹	(3) Moist Mixed Grassland/Aspen Parkland			(4) Mixed Grass Prairie			Weekly Totals		
			Positive	Tested	%	Positive	Tested	%	Positive	Tested	%
Jun 17			0	0	0	0	4	0	0	4	0
Jun 24			0	5	0	0	0	0	0	5	0
Jul 01			0	6	0	0	0	0	0	6	0
Jul 08			0	13	0	0	11	0	0	24	0
Jul 15			0	13	0	0	7	0	0	20	0
Jul 22			0	13	0	0	8	0	0	21	0
Jul 29			0	40	0	0	11	0	0	51	0
Aug 05			0	40	0	0	26	0	0	66	0
Aug 12			0	48	0	0	16	0	0	64	0
Aug 19			0	29	0	0	9	0	0	38	0
Aug 26			0	8	0	0	7	0	0	15	0
Sep 02			0	14	0	0	3	0	0	17	0
Sep 09			0	2	0	0	3	0	0	5	0
Total			0	231	0	0	105	0	0	336	0

Notes:

* **Mosquito Pool** - Mosquitoes of the same species, collected from the same trap on the same date are pooled together for the purposes of laboratory testing. *Culex* mosquitoes (including *Culex tarsalis*, *Culex restuans* and *Culex territans*) collected from one trap on a given night are placed in pools of 1 - 50 mosquitoes for WNV testing. Other species, most notably *Culiseta inornata*, are occasionally placed in pools and tested as well. When more than 50 mosquitoes are collected from the same trap, multiple pools are tested. A positive pool refers to the detection of WNV in one or more mosquitoes collected from a given trap.

¹ *Culex* spp. activity is rare in the Boreal Forest and Boreal Transition ecological risk areas. Mosquito surveillance is currently not conducted in these ecoregions; however, if *Culex* spp. activity increases significantly this summer, mosquito traps may be operated in these areas.

Percent positive pools are calculated as follows:

$$\frac{(\text{Number of positive pools})}{(\text{Total number tested})} \times 100 = \text{Percent positive pools}$$

4. West Nile virus animal cases, 2023

Infections in animals such as horses are seasonal and often occur later in the season. The virus is well established in mosquito vectors in Saskatchewan. As WNV infections in horses lag behind infections in mosquitoes, mosquito surveillance provides more timely information about the risk to the public. Infections in horses can provide an indication that infections in humans may be occurring as well.

Table 3: Number of WNV positive horses by date and ecological risk area, June 11 2023 to week ending September 23 2023

Week ending	(1) Boreal Forest	(2) Boreal Transition	(3) Moist Mixed-Grass Prairie/Aspen Parkland	(4) Mixed-Grass Prairie	Weekly totals
Jun 17	0	0	0	0	0
Jun 24	0	0	0	0	0
Jul 01	0	0	0	0	0
Jul 08	0	0	0	0	0
Jul 15	0	0	0	0	0
Jul 22	0	0	0	0	0
Jul 29	0	0	0	0	0
Aug 05	0	0	0	0	0
Aug 12	0	0	0	0	0
Aug 19	0	0	0	1	1
Aug 26	0	0	0	1	1
Sep 02	0	0	1	1	2
Sep 09	0	0	0	4	4
Sep 16	0	0	1	0	1
Sep 23	0	0	0	1	1
Total	0	0	2	8	10

5. West Nile virus human cases, 2023 and 2003–2022

As with horses, human infections are seasonal and are often not detected until later in the season. Mosquito surveillance and other environmental risk indicators provide a more timely indication of risk.

Table 4: WNV surveillance in humans, June 11 2023 to the week ending September 23 2023

Number of WNV Positive Lab Tests*	WNV Neuroinvasive Disease ‡	WNV Deaths
8	1	0

Notes:

*These include tests done by the Roy Romanow Provincial Laboratory (RRPL) and Canadian Blood Services (CBS).

‡The most useful indicator for the burden of disease in the general population is WNV neuroinvasive disease. For every case of WNV neuroinvasive disease, there are approximately 150 WNV infections in humans. The vast majority of people with WNV infections do not seek medical care. The 2023 human neuroinvasive case counts are preliminary.

Table 5: Human WNV neuroinvasive cases and deaths in Saskatchewan 2003–2022*

Year	Neuroinvasive Cases	Deaths
2003	63	7
2004	0	0
2005	6	3
2006	3	0
2007	76	6
2008	1	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0
2013	7	1
2014	1	0
2015	0	0
2016	0	0
2017	1	1
2018	3	1
2019	0	0
2020	0	0
2021	1	0
2022	0	0
Total	162	19

Note: *Deaths are included in WNV neuroinvasive case numbers except for 2003 when two deaths occurred in people with non-neuroinvasive West Nile virus.