West Nile Virus Surveillance in Washington Summary Report, 2011-2015

Five-year report on the state's West Nile virus environmental surveillance activities and findings.

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West Nile Virus Surveillance in Washington, 2011-2015

West Nile virus is transmitted to people and animals primarily through the bites of infected mosquitoes. Mosquitoes become infected when they feed on infected birds. Most people who become infected with West Nile virus will show no symptoms. About one in five people who are infected will develop fever with other symptoms such as headache, body aches, joint pains, nausea, diarrhea, or rash. Less the one percent of those infected will develop a serious neurologic illness such as meningitis, encephalitis, or acute flaccid paralysis. About ten percent of people who develop neurologic infection due to the West Nile virus will die.

Serious illness can occur in anyone. Those at greatest risk for severe disease, however, are people over 60 years of age. People with certain medication conditions such as cancer, diabetes, hypertension, kidney disease, and those who have received organ transplants are also at greater risk for serious illness.

CDC established a national surveillance system (ArboNET) to track West Nile virus activity. State health agencies report surveillance data on human disease cases, positive blood donors, veterinary disease cases, and West Nile virus infections detected in mosquitoes, birds, and sentinel animals.

Because of changing yearly patterns of transmission, outbreaks of West Nile virus prove difficult to predict. To date, Washington's largest West Nile virus outbreak occurred in 2009, resulting in 38 reported human cases and numerous environmental detections across the state, including 72 horses, 1 dog, 22 birds, and 364 mosquito samples from 15 counties.

Surveillance Activity and Findings

The Zoonotic Disease Program, partially funded by CDC, has maintained surveillance for early detection of West Nile virus in the environment since 2001. Surveillance efforts depend heavily upon a network of partners composed of local health jurisdictions, mosquito control districts, tribal, federal, and state agencies, and volunteers including the public.

Surveillance involves monitoring mosquito populations to identify potential West Nile virus vector species and testing vector mosquitoes for West Nile virus and occasionally for two other arboviruses, western equine encephalitis and St. Louis encephalitis viruses. Through the Program's online reporting system, it relies on public reporting of dead bird sightings to identify birds for testing, mainly corvids, like crows, ravens, jays, and magpies. Additionally, in coordination with the Washington State Department of Agriculture and the Washington Animal Disease Diagnostic Laboratory, the Program tracks veterinary reports of suspected cases of West Nile virus infection in horses and other animals. Notification of environmental detections alert local public health authorities to initiate or strengthen educational outreach and mosquito control responses in efforts to minimize the health impacts of this disease on communities.

Mosquito Surveillance

During 2011-2015, the Program field staff and surveillance partners collected adult mosquitoes from 20 counties, primarily using carbon dioxide traps. On occasion, mosquito larvae were collected and reared to adults. Seasonal surveillance resulted in a total of 13,666 trapping events; bringing in 1,588,824 mosquitoes for speciation.

Figure 1. Distribution of mosquito trapping events by county, Washington, 2011-2015

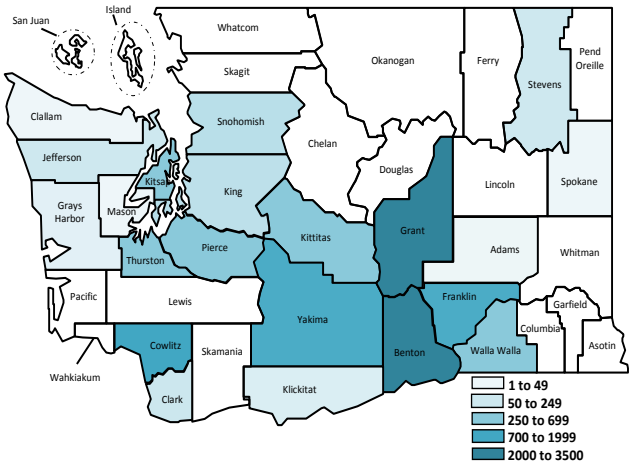

Figure 1 displays the state coverage and range of mosquito trapping events by county for the 2011-2015 surveillance seasons. The vast majority of trapping events occurred in counties where mosquito control districts routinely monitor and control mosquito populations. A limited number of trapping events occurred in the more populated western counties, King, Pierce, Snohomish, and Thurston.

After speciation, samples of the primary West Nile virus vectors, *Culex pipiens* and *Cx. tarsalis*, were tested at either the University of California, Davis-Center for Vectorborne Disease, Oregon State University-Veterinary Diagnostic Laboratory, or the U.S. Army Joint Base Lewis-McCord Washington-Public Health Command Region-West. The laboratories analyzed samples for West Nile, St. Louis encephalitis, and western equine encephalitis viruses using reverse transcriptase-polymerase chain reaction (RT-PCR). In addition, the Program and four mosquito control districts analyzed mosquito samples for West Nile virus using the commercial assay RAMP® (Rapid Analyte Measurement Platform, Response Biomedical Corp).

Over the five years, a total of 6,648 mosquito samples were tested for West Nile virus, 2,523 samples for St. Louis encephalitis, and 2,345 samples for western equine encephalitis. Of these, 265 samples were positive for West Nile virus, and no samples positive for either St. Louis encephalitis or western equine encephalitis virus.

The season's first environmental detections of West Nile virus in mosquitoes during 2011-2012 occurred in August in limited areas of south-central Washington. During 2013-2015, detections showed up one to two months earlier than previous years. The early establishment of West Nile virus under favorable conditions had led to its amplification in the environment resulting in the observed increase of positive mosquitoes and broader distribution (Table 1).

Table 1. First environmental detection of West Nile virus in mosquitoes by date, Washington, 2011-2015

Year	Date of First Detection	Total Positive Samples	County	Positive Samples
2011	August 16	5	Franklin	1
			Grant	3
			Yakima	1
2012	August 8	5	Yakima	5
2013	June 12	18	Benton	1
			Franklin	5
			Grant	2
			Spokane	1
			Yakima	9
2014	July 8	80	Benton	14
			Franklin	26
			Grant	34
			Walla Walla	5
			Yakima	1
2015	June 22	157	Benton	27
			Franklin	17
			Grant	107
			Walla Walla	1
			Yakima	5

Mosquito Species Findings

Surveillance increases our understanding of the distribution and abundance of vector mosquito populations. This helps pinpoint geographic areas of high risk for West Nile virus, and of new invasive mosquito species known as effective vectors of other diseases. Targeted prevention and control measures can then be implemented in these areas to reduce the threat of human infection.

During 2011-2015, surveillance identified new mosquito species findings in 12 counties. In western Washington, three species, *Aedes j. japonicus, Anopheles punctipennis,* and *Culiseta morsitans* were newly identified in Mason County. In Jefferson County, *Ae. togoi* and *Cs. morsitans* were identified for the first time as well as two species, *Ae. aloponotum* and *Ae. intrudens* in Snohomish County. In King County, *Culex salinarius* and in Kitsap County, *Ae. ventrovittis* were also found for the first time.

In eastern Washington, five species, *Ae. melanimon*, *Ae. c. canadensis*, *Ae. flavescens*, *Ae. provocans,* and *Ae. s. idahoensis* were identified for the first time in Stevens County. Three species, *An. earlei, An. occidentalis*, and *Cx. boharti* were found for the first time in Yakima County, and three species, *An. earlei*, *An. occidentalis*, and *Cs. minnesotae* in Walla Walla County. New county findings also included *An. earlei* and *Cx. territans* in Franklin County, *Ae. trivittatus* and *Ae. intrudens* in Kittitas County, *An. freeborni* and *An. punctipennis* in Klickitat County, and *An. occidentalis and Cx. territans* in Spokane County.

In the Appendix, matrices 1 and 2 represent a distribution checklist of 45 species of mosquitoes endemic in Washington, and an additional 6 species that are rarely reported. The checklist provides species by county for western and eastern Washington and highlights new findings resulting from annual surveillance. It illustrates the progression of first collections of mosquito species in counties through time.

Bird Surveillance

During the 2011-2015 surveillance seasons (May through October) the Program's online dead bird reporting system received 1,974 reports from the general public of 2,688 dead birds. More than half of the dead birds sighted were reported from the state's most populous counties, including 358 birds reported in Pierce (13%), 341 in Snohomish (13%), and 1,020 in King (38%). Reporting is likely greater in these counties due to awareness and availability of a large population to observe dead bird sightings.

Over the five years, oral swabs or tissue specimens of 121 West Nile virus susceptible birds, primarily corvids, were submitted to the Washington Animal Disease Diagnostic Laboratory in Pullman, Washington or USGS National Wildlife Health Center in Madison, Wisconsin for testing. The majority of these birds originated from western Washington (97, 80%), mainly King County (39, 32%). For years, 2011-2014, no birds tested positive for the virus. In 2015, seven positive birds were found in the eastern Washington counties, Benton (5), Grant (1), and Kittitas (1). Two positive birds from Benton County had been detected in January. These winter detections however are not considered representative of the season's West Nile virus activity.

In 2012, despite the lack of West Nile virus detection in birds, the Program's online dead bird reporting system helped identify unusually high mortality among crow populations and determine the distribution of crow mortality. This alerted the Washington State Department of Fish and Wildlife, whose investigation found corvid reovirus circulating among local crow populations in Pierce County and suspected circulation in adjacent counties as well. Although this reovirus is particularly deadly to crows, it is not considered harmful to people.

Veterinary Surveillance

Specimens from 135 suspected West Nile virus equine cases were submitted by local veterinarians to the Washington Animal Disease Diagnostic Laboratory in 2011-2015. Forty-four of the cases were confirmed positive for the virus. All of the cases were found in eastern Washington counties, Adams (1), Benton (6), Columbia (1), Douglas (1), Franklin (4), Grant (8), Kittitas (8), Lincoln (1), Okanogan (1), Walla Walla (3), and Yakima (10). Most of the cases involved horses that had not been vaccinated for West Nile virus.

Thirty-six of the 44 (82%) confirmed West Nile virus equine cases occurred in 2015. By comparison only five cases were identified the year before, in 2014.

Summary tables of West Nile virus environmental detections by county for years, 2011-2015 are in the Appendix.

Human Surveillance

Each year since 2005, West Nile virus activity has been detected in Washington. In 2009, the largest West Nile virus outbreak resulted in 38 human cases including the state's first death from the disease. Since then, however, the state has experienced lower levels of West Nile virus activity, particularly in people and animals until 2014. Two human cases of West Nile virus infection acquired in-state were reported in 2012, with exposure most likely occurring in Benton and Yakima counties. In 2014, 10 in-state acquired cases were reported. Exposure of these case likely occurred in Benton (7), Grant (1), Walla Walla (1), and Yakima (1) counties. The following year, 2015, proved to be another active West Nile virus season ending with 22 in-state acquired cases. Exposure of these cases likely occurred in Benton (13), Franklin (2), Grant (4) and Yakima (2). In addition, one case had potential exposure attributed to more than one county in eastern Washington.

Future Surveillance Needs

Since 2001, the Zoonotic Disease Program has worked to secure partners in an effort to expand mosquito and bird surveillance activities statewide. Surveillance serves as early warning of West Nile activity in localized areas aiding local health jurisdictions and other authorities to target a timely response and control. This effort also generates baseline data on the distribution of mosquito species in counties which provides a better understanding of where vector species are known to exist or be newly introduced. Continued funding is necessary to maintain state West Nile virus surveillance.

For disease prevention information, visit:

- DOH, West Nile Virus, www.doh.wa.gov/wnv
- CDC, West Nile Virus, www.cdc.gov/westnile

Appendix

Tables

1. West Nile virus environmental detections by county, Washington, 2011
2. West Nile virus environmental detections by county, Washington, 2012
3. West Nile virus environmental detections by county, Washington, 2013
4. West Nile virus environmental detections by county, Washington, 2014
5. West Nile virus environmental detections by county, Washington, 2015

Matrices

1. Distribution of Mosquitoes of Washington State - Western Counties
2. Distribution of Mosquitoes of Washington State - Eastern Counties

Table 1. West Nile virus environmental detections by county, Washington, 2011

County	Horse/Other Mammal		Bird		Mosquito Sample	
	Tested	Positive	Tested	Positive	Tested	Positive
Adams	0	0	0	0	0	0
Asotin	0	0	0	0	0	0
Benton	2	0	0	0	192	0
Chelan	1	0	1	0	0	0
Clallam	0	0	0	0	0	0
Clark	1	0	2	0	29	0
Columbia	0	0	0	0	0	0
Cowlitz	0	0	0	0	56	0
Douglas	0	0	0	0	0	0
Ferry	0	0	0	0	0	0
Franklin	0	0	0	0	243	1
Garfield	0	0	0	0	0	0
Grant	1	0	3	0	260	3
Grays Harbor	0	0	0	0	4	0
Island	0	0	0	0	0	0
Jefferson	0	0	0	0	2	0
King	2	0	37	0	0	0
Kitsap	0	0	0	0	26	0
Kittitas	4	0	1	0	13	0
Klickitat	0	0	0	0	0	0
Lewis	0	0	0	0	0	0
Lincoln	0	0	0	0	0	0
Mason	0	0	1	0	0	0
Okanogan	1	0	0	0	0	0
Pacific	0	0	0	0	0	0
Pend Oreille	0	0	0	0	0	0
Pierce	0	0	3	0	7	0
San Juan	0	0	0	0	0	0
Skagit	0	0	0	0	0	0
Skamania	0	0	0	0	0	0
Snohomish	1	0	7	0	23	0
Spokane	0	0	0	0	0	0
Stevens	1	0	0	0	20	0
Thurston	0	0	0	0	22	0
Wahkiakum	0	0	0	0	0	0
Walla Walla	2	0	0	0	9	0
Whatcom	1	0	1	0	0	0
Whitman	1	0	0	0	0	0
Yakima	3	0	0	0	189	1
Totals	***21***	***0***	***56***	***0***	***1,095***	***5***

Table 2. West Nile virus environmental detections by county, Washington, 2012

County	Horse/Other Mammal		Bird		Mosquito Sample	
	Tested	Positive	Tested	Positive	Tested	Positive
Adams	0	0	0	0	0	0
Asotin	0	0	0	0	0	0
Benton	4	1	0	0	157	0
Chelan	1	0	0	0	0	0
Clallam	0	0	0	0	0	0
Clark	1	0	1	0	38	0
Columbia	0	0	0	0	0	0
Cowlitz	0	0	0	0	86	0
Douglas	0	0	0	0	0	0
Ferry	0	0	0	0	0	0
Franklin	0	0	0	0	252	0
Garfield	0	0	0	0	0	0
Grant	0	0	0	0	453	0
Grays Harbor	0	0	0	0	0	0
Island	0	0	0	0	0	0
Jefferson	0	0	0	0	5	0
King	4	0	0	0	0	0
Kitsap	0	0	0	0	10	0
Kittitas	1	0	4	0	17	0
Klickitat	0	0	0	0	0	0
Lewis	0	0	0	0	0	0
Lincoln	0	0	0	0	0	0
Mason	0	0	2	0	0	0
Okanogan	1	0	0	0	0	0
Pacific	0	0	0	0	0	0
Pend Oreille	0	0	0	0	0	0
Pierce	0	0	6	0	1	0
San Juan	0	0	0	0	0	0
Skagit	0	0	0	0	0	0
Skamania	0	0	1	0	0	0
Snohomish	3	0	3	0	27	0
Spokane	0	0	0	0	0	0
Stevens	0	0	0	0	20	0
Thurston	0	0	0	0	15	0
Wahkiakum	0	0	0	0	0	0
Walla Walla	1	0	0	0	44	0
Whatcom	0	0	1	0	0	0
Whitman	1	0	0	0	0	0
Yakima	3	0	0	0	335	5
Totals	***19***	***1***	***19***	***0***	***1,460***	***5***

Table 3. West Nile virus environmental detections by county, Washington, 2013

County	Horse/Other Mammal		Bird		Mosquito Sample	
	Tested	Positive	Tested	Positive	Tested	Positive
Adams	0	0	0	0	0	0
Asotin	0	0	0	0	0	0
Benton	3	0	0	0	162	1
Chelan	0	0	1	0	0	0
Clallam	0	0	0	0	0	0
Clark	0	0	1	0	48	0
Columbia	0	0	0	0	0	0
Cowlitz	0	0	0	0	47	0
Douglas	0	0	0	0	0	0
Ferry	0	0	0	0	0	0
Franklin	2	1	0	0	346	5
Garfield	0	0	0	0	0	0
Grant	0	0	0	0	331	2
Grays Harbor	0	0	0	0	1	0
Island	0	0	0	0	0	0
Jefferson	0	0	0	0	0	0
King	1	0	0	0	0	0
Kitsap	1	0	0	0	0	0
Kittitas	1	0	0	0	50	0
Klickitat	0	0	0	0	0	0
Lewis	1	0	0	0	0	0
Lincoln	0	0	0	0	0	0
Mason	0	0	1	0	0	0
Okanogan	1	0	0	0	0	0
Pacific	0	0	0	0	0	0
Pend Oreille	0	0	0	0	0	0
Pierce	0	0	2	0	4	0
San Juan	0	0	1	0	0	0
Skagit	0	0	0	0	0	0
Skamania	0	0	0	0	0	0
Snohomish	0	0	9	0	46	0
Spokane	2	0	0	0	19	1
Stevens	0	0	0	0	23	0
Thurston	0	0	1	0	29	0
Wahkiakum	0	0	0	0	0	0
Walla Walla	0	0	0	0	205	0
Whatcom	0	0	1	0	0	0
Whitman	0	0	0	0	0	0
Yakima	3	1	0	0	393	9
Totals	***15***	***2***	***17***	***0***	***1,704***	***18***

Table 4. West Nile virus environmental detections by county, Washington, 2014

County	Horse/Other Mammal		Bird		Mosquito Sample	
	Tested	Positive	Tested	Positive	Tested	Positive
Adams	0	0	0	0	0	0
Asotin	0	0	0	0	0	0
Benton	2	1	0	0	149	14
Chelan	0	0	0	0	0	0
Clallam	0	0	0	0	0	0
Clark	0	0	2	0	50	0
Columbia	0	0	0	0	0	0
Cowlitz	1	0	1	0	32	0
Douglas	0	0	0	0	0	0
Ferry	0	0	0	0	0	0
Franklin	4	1	0	0	151	26
Garfield	1	0	0	0	0	0
Grant	4	1	0	0	471	34
Grays Harbor	0	0	2	0	5	0
Island	0	0	0	0	0	0
Jefferson	0	0	1	0	1	0
King	1	0	2	0	24	0
Kitsap	0	0	0	0	7	0
Kittitas	3	0	1	0	24	0
Klickitat	0	0	0	0	0	0
Lewis	0	0	0	0	0	0
Lincoln	0	0	0	0	0	0
Mason	0	0	2	0	0	0
Okanogan	1	1	0	0	0	0
Pacific	0	0	0	0	0	0
Pend Oreille	0	0	0	0	0	0
Pierce	2	0	0	0	7	0
San Juan	0	0	0	0	0	0
Skagit	1	0	0	0	0	0
Skamania	0	0	0	0	0	0
Snohomish	0	0	3	0	14	0
Spokane	0	0	0	0	0	0
Stevens	0	0	0	0	0	0
Thurston	1	0	0	0	21	0
Wahkiakum	0	0	0	0	0	0
Walla Walla	0	0	0	0	153	5
Whatcom	1	0	0	0	0	0
Whitman	0	0	2	0	0	0
Yakima	1	1	1	0	138	1
Totals	***23***	***5***	***17***	***0***	***1,247***	***80***

Table 5. West Nile virus environmental detections by county, Washington, 2015

County	Horse/Other Mammal		Bird*		Mosquito Sample	
	Tested	Positive	Tested	Positive	Tested	Positive
Adams	2	1	0	0	10	0
Asotin	0	0	0	0	0	0
Benton	5	4	3	3	168	27
Chelan	2	0	0	0	0	0
Clallam	0	0	0	0	0	0
Clark	0	0	1	0	48	0
Columbia	1	1	0	0	0	0
Cowlitz	0	0	0	0	54	0
Douglas	1	1	0	0	0	0
Ferry	0	0	0	0	0	0
Franklin	2	2	0	0	208	17
Garfield	0	0	0	0	0	0
Grant	10	7	2	1	320	107
Grays Harbor	0	0	2	0	3	0
Island	0	0	0	0	0	0
Jefferson	0	0	0	0	1	0
King	0	0	0	0	0	0
Kitsap	0	0	0	0	6	0
Kittitas	8	8	1	1	9	0
Klickitat	3	0	0	0	0	0
Lewis	0	0	0	0	0	0
Lincoln	1	1	0	0	0	0
Mason	0	0	0	0	0	0
Okanogan	2	0	0	0	0	0
Pacific	0	0	0	0	0	0
Pend Oreille	0	0	0	0	0	0
Pierce	0	0	0	0	27	0
San Juan	0	0	0	0	0	0
Skagit	0	0	0	0	0	0
Skamania	0	0	0	0	0	0
Snohomish	2	0	0	0	22	0
Spokane	0	0	1	0	0	0
Stevens	1	0	0	0	2	0
Thurston	2	0	0	0	52	0
Wahkiakum	0	0	0	0	0	0
Walla Walla	6	3	0	0	2	1
Whatcom	0	0	0	0	0	0
Whitman	0	0	0	0	0	0
Yakima	13	8	0	0	211	5
Totals	***61***	***36***	***10***	***5***	***1,142***	***157***

*Two Benton County crows collected January 15, 2015 by WDFW tested positive. Testing was performed by the USGS National Wildlife Health Center. Findings are not considered representative of this season's viral activity, therefore not included.

Distribution of Mosquitoes in Washington State

Western Washington Mosquito Species by County

County	*Aedes aboriginis*	*Aedes aloponotum*	*Aedes campestris*	***Aedes c. canadensis****	*Aedes cataphylla*	***Aedes cinereus****	*Aedes communis*	***Aedes dorsalis****	*Aedes excrucians*	***Aedes fitchii****	*Aedes flavescens*	*Aedes hexodontus*	*Aedes impiger*	*Aedes implicatus*	*Aedes increpitus*	*Aedes intrudens*	***Aedes j. japonicus****	***Aedes melanimon****	*Aedes nevadensis*	***Aedes nigromaculis****	*Aedes pionips* †	***Aedes provocans**** †	*Aedes pullatus*	*Aedes punctor* †	*Aedes sierrensis*	*Aedes s. idahoensis*	***Aedes sticticus****	*Aedes togoi*	***Aedes trivittatus**** †	*Aedes ventrovittis*	***Aedes vexans****	*Anopheles earlei*	***Anopheles freeborni****	*Anopheles occidentalis*	***Anopheles punctipennis****	***Coquillettidia perturbans****	***Culex apicalis****	*Culex boharti*	***Culex erythrothorax**** †	***Culex pipiens****	***Culex salinarius****	***Culex stigmatosoma****	***Culex tarsalis****	***Culex territans****	***Culiseta impatiens****	***Culiseta incidens****	***Culiseta inornata****	*Culiseta minnesotae*	***Culiseta morsitans****	***Culiseta particeps****	***Orthopodomyia signifera**** †
Western Washington																																																		
Clallam		X						X	X	X					8			2					X		X		2				X		X																		
Clark						X			2						2										X	X	X				X		X		X																
Cowlitz	4	4	X			X	4	X		5					X	X	6								2	X	X				X		X		X	X	2	2		X		X	X	X	X	X	4		2	
Grays Harbor	X					10		X		3					3										5		4				X				X	3	X					X	X	4	X	8	5	3	3	
Island	X	2				X		1		X					X			3		10					3		X	2			3		X		X	2				X			2	X		X	X	3	2	2	
Jefferson	5					X	X	X	X	X	X				X								X		X		5	14			X				4	3		X		X	10		X	X	X	X	5		11	X	X
King	X	X				X	X	X	X	X		X			2		1						X		X		X				4		1		X	X	X	4		X	14	X	X	1	X	X	X	X	5	2	
Kitsap	X	X						X	X	X		X			X										X					15	3				X	2				X			X	3	X	X	3	7	X	4	
Lewis	X					X	X			X		X	X												X						8				X				X		X	X	X	X	X	7		6	
Mason	X	X				X		X	X	X					X		14								X						X				X	12	3				6			7	X	X	X		11		
Pacific	X					X		X		X					X			2							X		X				X				X		X				X			X	X	2	X	7	3	3	2	
Pierce	X	X				X	X	X	X	X	X	X	X	X	X	X	3		X	X			X		X		X			X	X			X	X	2		4	X	X	4	X	1	X	X	X	4	3	2	
San Juan	3							X		X					X										X			X			3				3	3				3			3	3		X	3			3	
Skagit	X	X						2	X	X		X		X	X				X				X		X		X	X			X				7	3				X			X	X	X	X					
Skamania	X					X	X		X	X		X	X	X	X							X	X		X		X				X		X		X	3		3		X			X	3	X	X	X				
Snohomish	X	11				X	6	4	X	X					X	11	3								2		X				X	4	5	3	X	2	X	6		X			X	X	X	X	X	4	X	3	
Thurston	X	X				X		X	X	X					X			12							X		3				7		7		X	X				X			X	X	6	X	1	7	1	3	
Wahkiakum	5									5					7										5						8		5		5	5				5			X			X	5	5	8	5	
Whatcom	X	X				X	X	X	X	X		X	X		X	X									3		X	2			X		X	X	X	X		4		X			X	X	X	X	X	3	3	6	

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New Findings for: 1-2001 | 2-2002 | 3-2003 | 4-2004 | 5-2005 | 6-2006 | 7-2007 | 8-2008 | 9-2009 | 10-2010 | 11-2011 | 12-2012 | 13-2013 | 14-2014 | 15-2015

The matrix shows the known distribution of mosquito species by county for western Washington through 2015. Previous findings are based upon mosquito surveillance conducted by Washington State Department of Health in the 1960s and 1970s. In addition, previous findings were updated to reflect historical findings as presented in the revised *Distribution of Mosquitoes in Washington State,* William J. Sames et al. Journal of the American Mosquito Control Association, 23(4):442-448, 2007. New findings following the initiation of West Nile virus surveillance in 2001 are presented by surveillance year 2001 through 2015 based upon the earliest collection information for the species.

Washington State Department of Health
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Distribution of Mosquitoes in Washington State

Eastern Washington Mosquito Species by County

County	*Aedes aboriginis*	*Aedes aloponotum*	*Aedes campestris*	***Aedes canadensis****	*Aedes cataphylla*	***Aedes cinereus****	*Aedes communis*	***Aedes dorsalis****	*Aedes excrucians*	***Aedes fitchii****	*Aedes flavescens*	*Aedes hexodontus*	*Aedes impiger*	*Aedes implicatus*	*Aedes increpitus*	*Aedes intrudens*	***Aedes j. japonicus****	***Aedes melanimon****	*Aedes nevadensis*	***Aedes nigromaculis****	*Aedes pionips* †	*Aedes **provocans**** †	*Aedes pullatus*	*Aedes punctor* †	*Aedes sierrensis*	*Aedes s. idahoensis*	***Aedes sticticus****	*Aedes togoi*	***Aedes trivittatus**** †	*Aedes ventrovittis*	***Aedes vexans****	*Anopheles earlei*	***Anopheles freeborni****	*Anopheles occidentalis*	***Anopheles punctipennis****	***Coquilletidia perturbans****	***Culex apicalis****	*Culex boharti*	***Culex erythrothorax**** †	***Culex pipiens****	***Culex salinarius****	***Culex stigmatasoma****	***Culex tarsalis****	***Culex territans****	***Culiseta impatiens****	***Culiseta incidens****	***Culiseta inornata****	*Culiseta minnesotae*	***Culiseta morsitans****	***Culiseta particeps****	***Orthopodomyia signifera**** †
Eastern Washington																																																	
Adams								X										4		X									4			4			4				X			X							
Asotin																																							7			X							
Benton			X		5		X	X		X					X			X		X					X		X			X		X	X	X				X			X	X		X	X	X	10		
Chelan	X	7			X	X	X	X	X	X	X	X	X	X	X	X		7	X				X	X	X	X	X			X	X		X		6				X			X	X	X	X	X	1		
Columbia															X										8						X		X		8							X	8		8	8				
Douglas								X			7							X													X											X			X	X				
Ferry	X			X		X	X			X		X	X	X	X	X					X					2				X		X			X							X		2					
Franklin			5	6				4			X				1			X		X					3		X				4	15	3	X	4	4				X			X	15		X	X				
Garfield																																			X										X					
Grant			X	X		X	X	X		X	X				X			X		X					X	2				1		X		10	X				X			X	X		X	X	8		
Kittitas	X				X	X	X	X	X	X		X			X	12		10		X					9	X	X		13	X	X		X		X	X				X			X	X	X	X	X	9	
Klickitat	X							7				X			3			7		7					3		7				X		14		14	7				3			X			3	3	7			
Lincoln							X	10	X	X	X				X										3						X							X							10	X	3				
Okanogan			X	X		X	X	X	X	X	X	X	X	X	X			X					X		X	X	X				X	X	X	X	X	3				X			X	X		X	X				
Pend Oreille	9			X		X	X		X	X		X	X	X	X	X						X	X	X		X	X				X	X	X	X		9				X			X	X				X			
Spokane	X		X	6		X		5	X	X	X				X			3					X		4		4			X	X	3	X	12	X	2				X	4		X	12		1	X	5	4		
Stevens	10		12	X	X	X	X	X		X	12				X			13	X	X		11			3	12	10				X	X	X	X	10	10				X			X		X	X	X	10	10	10	
Walla Walla	X		8			X		X							X			2		X					3		2				X	12	X	12	X	3				X		X	X	1	1	X	X	12	6		
Whitman	3		X							3					X										X		4				X		X		X	X				X									
Yakima	X	X	6			X	X	X	X	X	X	X	X	X	X	X		X	X	X		X			X	X	X		4		X	11	X	11	X	X	11			X		X	X	X	X	X	X	X	X	

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