



West Nile Virus Surveillance

West Nile virus has continued to impact Colorado residents since its introduction into the state in 2002. Because human cases are often reported weeks after the time of infection, mosquito surveillance has been essential in accurately assessing the geographic distribution of West Nile virus to determine the human transmission risk and to implement control and prevention strategies.

West Nile Virus Human Infections

During 2018, Colorado identified 96 cases of human West Nile virus (WNV) infections. Of these, 44 (46%) had uncomplicated fever, 22 (23%) had meningitis, 30 (31%) had encephalitis (including meningoencephalitis). Two individuals (without symptoms of West Nile virus) were found to have the virus in their blood during blood donation (asymptomatic blood donors). Five WNV associated deaths were reported (1 from Adams County, 2 from Boulder County, 1 from Delta County, and 1 from Denver County). See Table and Figure 1.

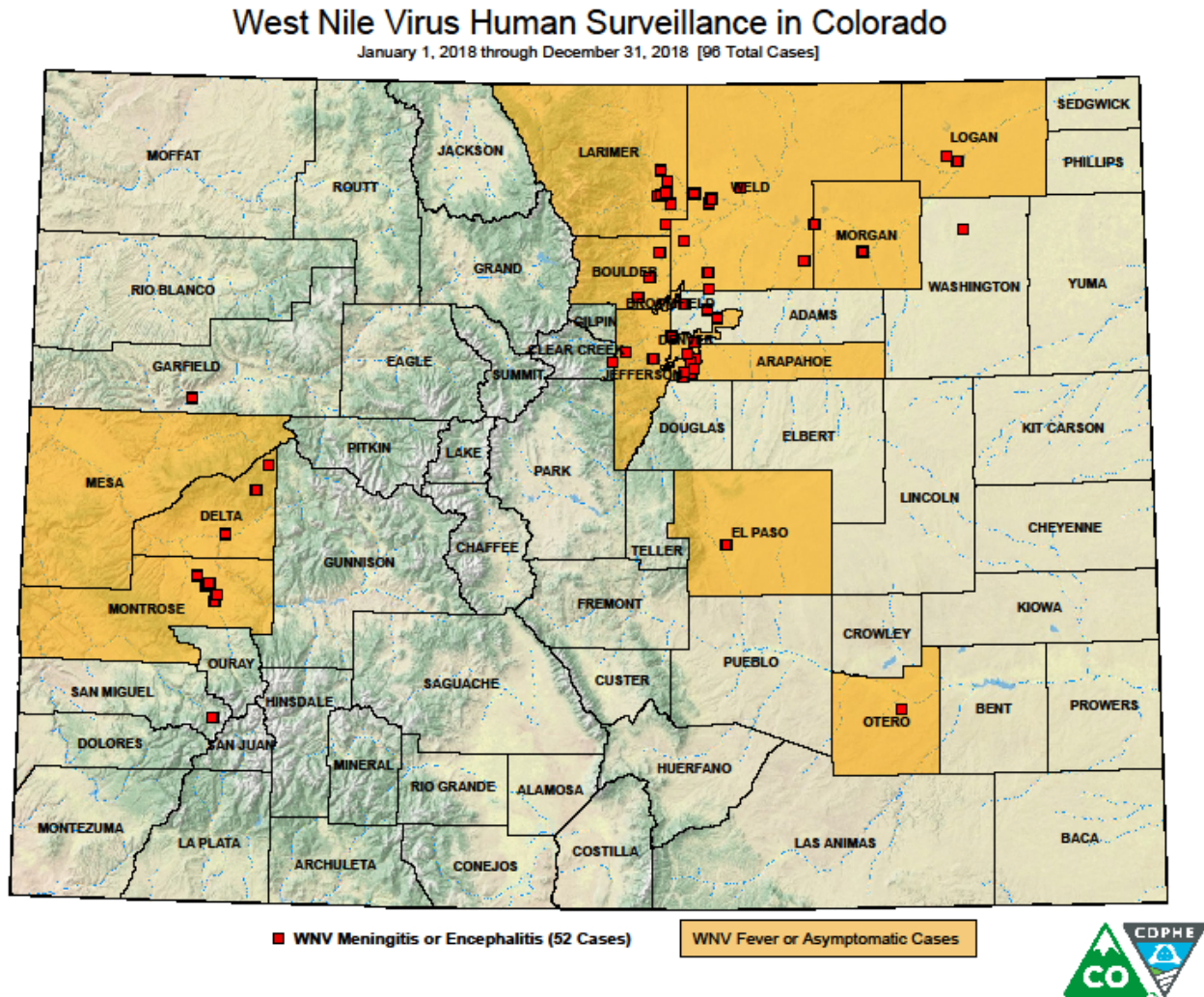
Table 1 Human West Nile Virus Infection Colorado, 2018

County	Fever	Meningitis	Encephalitis*	Total Cases**	Total Deaths
Adams	0	1	2	3	1
Arapahoe	1	0	4	5	0
Boulder	7	1	3	11	2
Broomfield	1	0	0	1	0
Clear Creek	0	1	0	1	0
Delta	5	0	3	8	1
Denver	1	3	2	6	1
El Paso	1	0	1	2	0
Garfield	0	0	1	1	0
Jefferson	3	2	0	5	0
Larimer	10	6	1	17	0
Logan	2	1	1	4	0
Mesa	2	0	0	2	0
Montrose	2	2	4	8	0
Morgan	1	0	2	3	0
Otero	1	0	1	2	0
San Miguel	0	1	0	1	0
Washington	0	0	1	1	0
Weld	7	4	4	15	0
Total	44	22	30	96	5

*Meningoencephalitis included in encephalitis

**Plus two asymptomatic blood donors

Figure 1



- To protect patient confidentiality: location of cases are not exact but are placed within the same county of residence

West Nile virus symptoms usually appear 3-14 days (average 7 days) after being bitten by an infected mosquito. No treatment or vaccine currently exists to treat or prevent West Nile virus infections. The best way to prevent WNV infection is to prevent being bitten by a mosquito infected with the virus.

Colorado Identified Infections and Susceptibility

CDC estimates that only 20% of people who are infected with WNV develop symptoms, leaving the remaining 80% of infections asymptomatic. It is also estimated that for every case of neuroinvasive disease reported there are 30 to 70 cases of uncomplicated fever (some are identified as WNV but most are not).

Clinical Diagnosis Associated with Human West Nile Virus Infections

Clinical disease ranges from a mild febrile illness to severe encephalitis. However, most WNV infections are asymptomatic. WNV antibody testing is conducted at the state health department laboratory and most commercial laboratories to determine whether a person with signs and

symptoms and a history of recent exposure consistent with WNV has an acute WNV infection. Antibody testing is not used for screening healthy people.

Nucleic acid amplification testing (NAAT) of blood donors for West Nile virus (WNV) is used as a screening tool throughout North America to protect the blood supply. NAAT can detect virus in the blood before symptoms start. If screened blood is NAAT positive for WNV, it is likely that the virus is present and that blood is not used for transfusion. Donors must be in good health at the time of donation and free of diseases transmissible by blood. Because of this, asymptomatic donors who test positive for WNV must wait a minimum of 120 days before donating again to avoid donating infected blood. Since the introduction of blood donation screening in 2003, Colorado has identified 126 asymptomatic blood donors infected with WNV.

For the purpose of surveillance and reporting, West Nile virus infection is categorized into three primary groups based on clinical presentation: neuroinvasive disease (meningitis or encephalitis), non-neuroinvasive disease (fever), and asymptomatic blood donors. 54% of the cases identified in 2018 had neuroinvasive disease resulting in 5 deaths (Table 2).

Table 2. Cases of Human West Nile Virus by Year and Clinical Diagnosis, Colorado 2013-2018

Year	Fever	Neuroinvasive		Asymptomatic Blood Donors*	Total Cases	Deaths
		Meningitis	Encephalitis			
2014	72	28	18	6	118	4
2015	44	29	28	7	101	3
2016	90	31	28	4	149	8
2017	39	12	17	3	68	4
2018	44	22	30	2	96	5
TOTAL	289	122	121	22	532	24

* Nucleic Acid Amplification Testing (NAAT) of blood donors for West Nile virus (WNV) was introduced as a screening tool in 2003. Blood donors are not counted as cases unless they develop symptoms consistent with WNV; they are infected with the virus but may not become ill.

West Nile Virus by Age Group & Gender

All persons are at risk of being infected with WNV but those over the age of 50 or with weakened immune systems are at greater risk of developing serious illness. Persons over the age of 50 represent 59 (61%) of the cases identified during the 2018 WNV season (Table 3).

Table 3

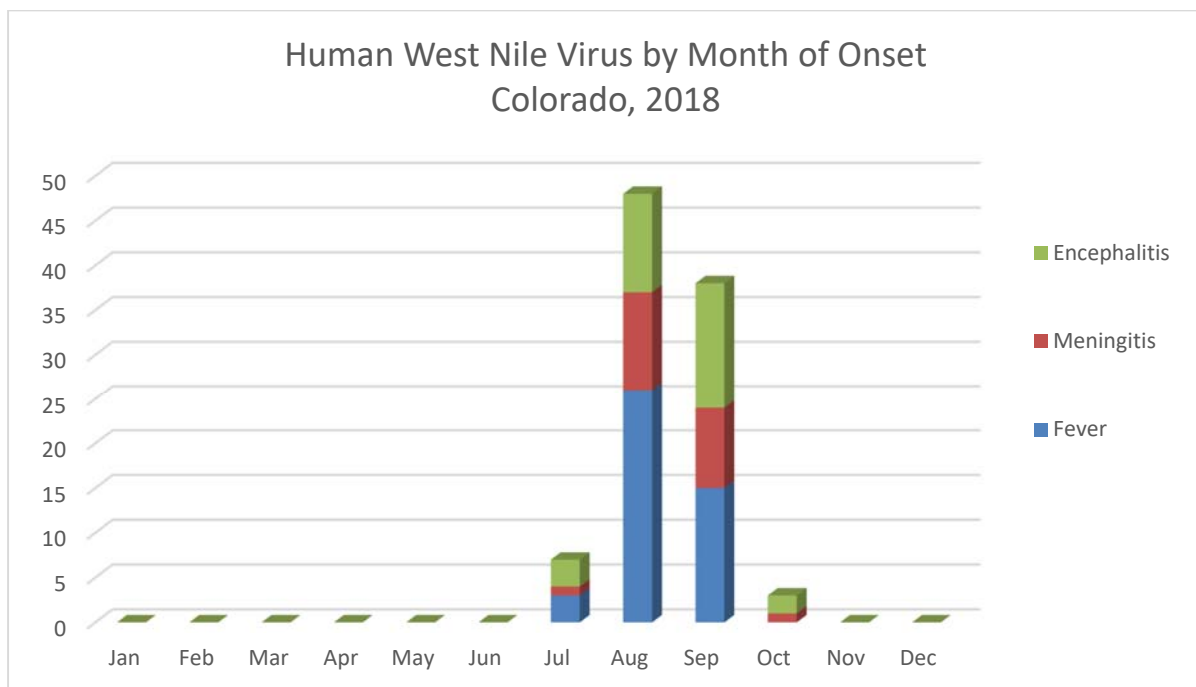
Age Distribution of Human WNV cases Colorado, 2018

Age Group	Gender		Total
	Male	Female	
0-9	0	0	0
10-19	1	1	2
20-29	3	2	5
30-39	6	3	9
40-49	9	12	21
50-59	7	3	10
60-69	14	5	19
70-79	14	7	21
80-89	4	4	8
>90	0	1	1
TOTAL	58	38	96

Human West Nile Virus Infections by Month of Onset

In Colorado, WNV human cases can be identified as early as May and as late as December of each year with the vast majority of cases identified in August and September (Figure 2). The majority of people will be exposed to WNV during the warm summer months when mosquitoes are more active. However, other modes of WNV transmission have been described: organ transplant, receipt of blood products, breastfeeding, and intrauterine transmission. These other modes of transmission are rare (Figure 2).

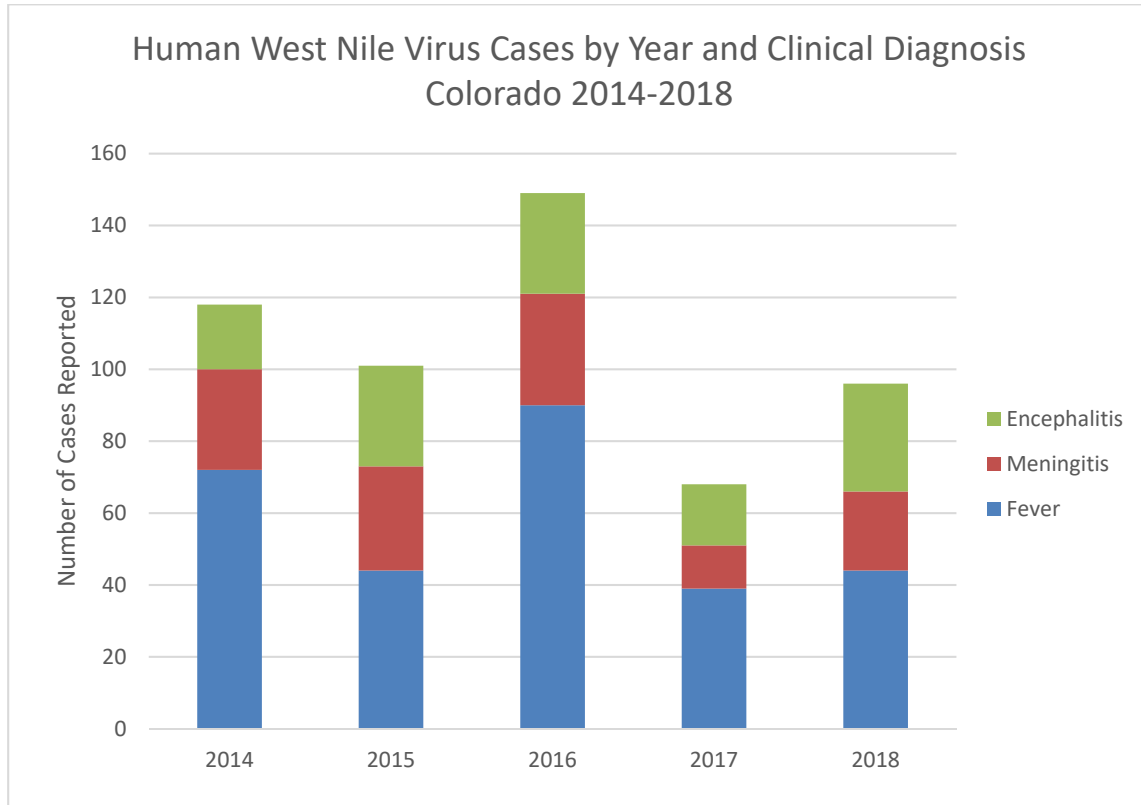
Figure 2



West Nile Virus Seasonal Fluctuation

The number of human cases of WNV (and other vector-borne diseases) fluctuates every season because WNV is transmitted by insects and the weather influences the numbers of insects present in the environment (See Figure 3). Temperature, humidity, and rainfall all influence the amount of disease seen from season to season.

Figure 3. Human West Nile Virus Cases, Colorado, 2014-2018



West Nile Virus Disease Prevention and Mosquito Control

One public health response to increasing risk for human WNV disease is to implement mosquito control in threatened communities. A variety of products are available to control mosquitoes in the environment. If you are interested in learning about mosquito control larvicides, adulticides, synergists and repellents please visit the [National Pesticide Information Center's website](#).

For more information on WNV and mosquitoes please visit the [CDC's website](#).

Mosquito Surveillance for West Nile virus

CDPHE sponsors mosquito surveillance beginning in mid-June through the end of August. Some counties begin larval identification in March and April. Not all counties in Colorado collect and test mosquitoes for WNV, but mosquitoes can be found everywhere in Colorado. Mosquitoes in your area may carry WNV even if your county does not perform testing. It is best to assume you have some risk for WNV if there are mosquitoes present in your area. Since mosquitoes can fly it is also not safe to think that only areas that have positive mosquitoes might be at risk.

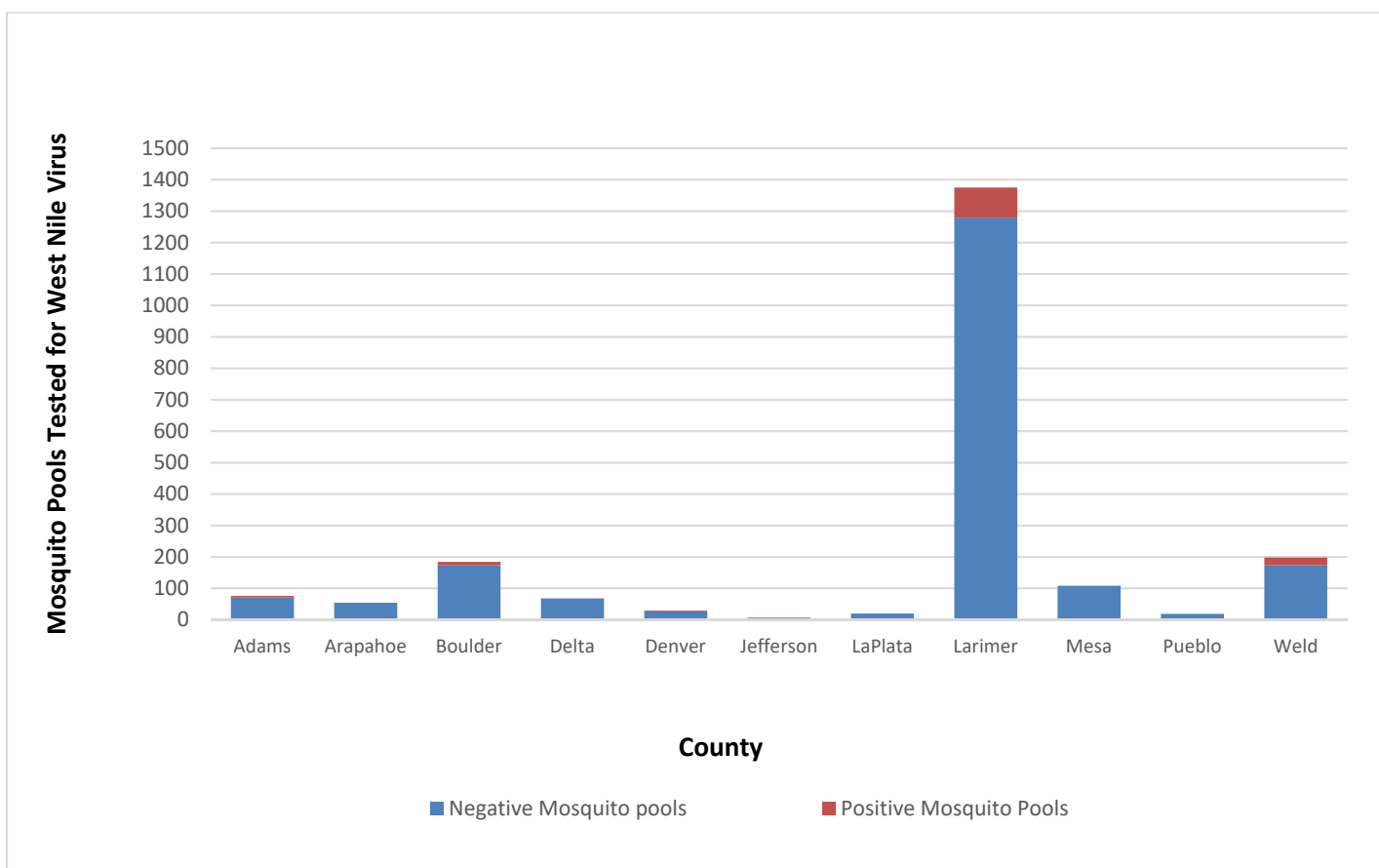
Mosquito surveillance consists of capturing mosquitoes in traps set out overnight. The traps catch a sample of the mosquitoes flying around in an area at the time the traps are present. Many species of mosquitoes are caught in traps, but only *Culex* species mosquitoes are tested for WNV, as these

are the mosquitoes that carry WNV. Typically only a few mosquitoes in the population will be infected with WNV. Nonetheless, the relatively few WNV positive mosquitoes can bite people and transmit WNV infection.

Birds and horses with illnesses consistent with WNV infection (neurological symptoms) can also be tested for WNV. Not all sick birds and horses are tested, however, so there is no way of knowing how many birds and horses are infected with WNV with any certainty.

A total of 2,138 mosquito pools were tested for WNV in 2018 with 139 pools testing positive (Figure 4). Positive mosquito pools were collected in Adams (5), Boulder (11), Denver (2), Larimer (96), and Weld (25) counties. Seven horses from Adams (1), El Paso (2), Larimer (1), Montrose (1), Weld (2) and two alpacas from Larimer County, as well as 26 raptors from Larimer (21) and Weld (5) Counties tested positive for West Nile virus.

Figure 4. Mosquito Pools Tested for West Nile Virus, by County*
Colorado, 2018

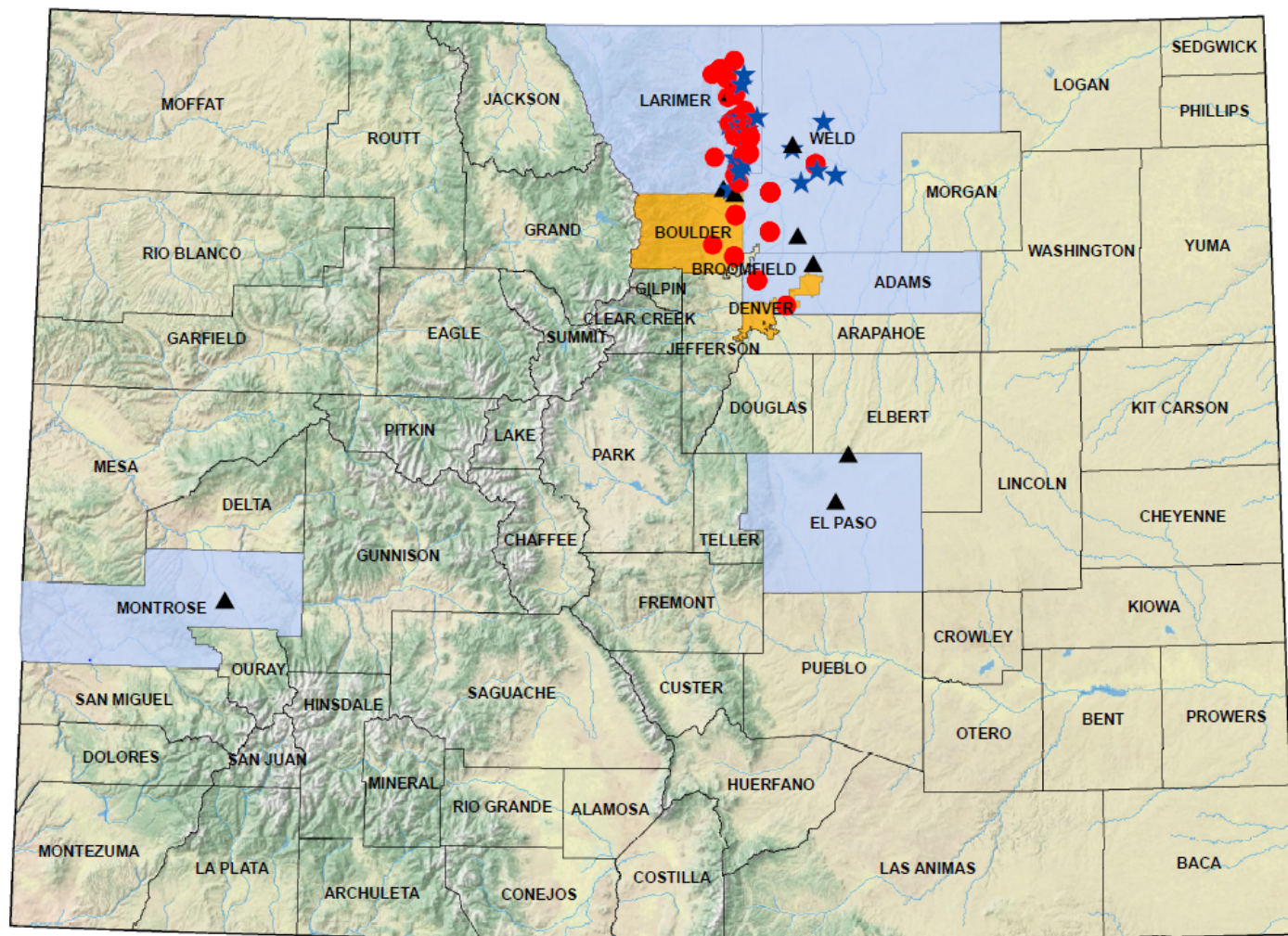


*Professional mosquito control agencies may provide local mosquito WNV testing by using the Rapid Analyte Measurement Platform or RAMP test as an alternative to WNV Polymerase Chain Reaction (PCR) testing done at the CDPHE laboratory. This alternative testing is not tracked or analyzed by CDPHE so may be positive in local areas, but is not included in this West Nile Virus Annual Report.

Results for WNV testing of mosquitoes and animals in Colorado are depicted in the map below.

West Nile Virus Mosquito and Animal Surveillance in Colorado

January 1, 2018 through December 31, 2018



174 West Nile Virus Positive Specimens

● Mosquito ★ Bird ▲ All Other Specimens

Counties Testing Mosquitoes Only
Counties Testing Specimens