2023 ANNUAL REPORT

TOWN OF SHELBURNE

Quick Summary Page

Targeted Primary Vector Species:

- Culiseta *melanura*, the primary vector for EEE, amplifies the virus within the bird population.
- Culex *pipiens* amplify WNV within the bird population and will feed on humans, creating a "bridge" for the virus.

Surveillance Data:

- 34 traps were strategically deployed across 12 sites in Shelburne.
- Two types of traps utilized: CDC Trap (attracts mammal-biting mosquitoes) and Gravid Trap (attracts primary WNV vector species).
- 32 pools submitted for testing, focusing on WNV and EEE detection. Majority of mosquito species submitted for testing: Culex *pipiens/restuans* and Culex *salinarius*.
- A total of 751 pools submitted for arbovirus testing district wide.
- Culex *pipiens/restuans*, Coquillettidia *perturbans*, and Culex *salinarius* identified as the most abundant species across the entire District.
- Over 40,000 mosquitoes were collected and sorted by PVMCD staff.

Arbovirus Detections Throughout the Pioneer Valley Region:

- Neither EEE nor WNV were found in Shelburne during the 2023 surveillance season.
- 17 WNV-positive pools detected in the Pioneer Valley Region, impacting many communities.
- 6 pools tested positive for EEE, mainly in Hampden County.
- Confirmation of 2 human cases of WNV in Hampden County.

Arbovirus Detections Throughout the Commonwealth:

- State Laboratory identified 128 WNV-positive mosquito pools across multiple counties. Counties affected: Berkshire, Hampshire, Hampden, Worcester, Bristol, Plymouth, Norfolk, Suffolk, and Middlesex.
- 28 EEE-positive pools found in Hampden, Worcester, Bristol, and Plymouth Counties. High-risk level in Hampden and Worcester Counties, suggesting likely human transmission.
- 2 new positives: Psorophora *ferox* and Aedes *cinereus* showed EEE positives for the first time based on historical data.
- 6 human cases of WNV reported throughout the state. No reported cases in humans or animals.

Weather Impacts and 2024 Outlook:

- Impact of weather conditions on Culiseta *melanura* populations: Wet weather throughout the year will likely contribute to greater numbers of this species.
- Prediction of a warm and wet winter by the National Oceanic and Atmospheric Administration.
- PVMCD's focus will be on early detection of EEE in Culiseta *melanura* mosquitoes during the upcoming season.
- Recommended that horse owners time the encephalitis vaccine to provide protection through October of 2024.

A comprehensive FAQ and detailed information about vector species can be found at the end of this report.

Introduction

The Pioneer Valley Mosquito Control District (PVMCD) surveillance summary provides an overview of arbovirus testing and mosquito surveillance efforts conducted in the Town of Shelburne. The surveillance testing period spanned from June 12 to October 12, focusing on the identification and monitoring of potential disease vectors, particularly those carrying West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE).

The comprehensive surveillance program not only involved the collection of mosquitoes but also emphasized the testing of targeted mosquito species to identify potential vectors of WNV and EEE. This proactive and targeted strategy contributes to public health efforts by providing valuable data for the early detection and monitoring of mosquito-borne diseases in the Pioneer Valley Region.

Primary Vector Species

Culiseta *melanura* feed primarily on avian species and are responsible for amplifying both EEE and WNV among the wild bird population. Culiseta *melanura* are multivoltine, meaning they have multiple generations throughout the warmer months. Climate plays a major role in how many generations *melanura* can produce each year. For instance, in southern states, *melanura* can produce three or more generations, whereas in Massachusetts, it can reach only two generations. However, this number may increase due to warming temperatures and the extended growing season. Adult *melanura* will die off with the first hard frost, and the larvae will overwinter in what is referred to as “crypts”, found in red maple and white cedar swamps.

Culex *pipiens* play a significant role in the transmission cycle of WNV by amplifying the virus within the wild bird population. Similar to *melanura* mosquitoes, *pipiens* prefer avian hosts; however, they will also feed on mammals around dusk. Culex *pipiens* have multiple generations throughout the warm season, and an extended growth season with warmer temperatures in September will result in more generations. Once temperatures begin to cool, adult female *pipiens* will typically seek out man-made structures such as houses, sheds, and discarded tire piles. Regarding habitat, *pipiens* prefer very stagnant water that can be found in catch basins, discarded tires, and “green” swimming pools.

Please see the Targeted Mosquito Species table on the last page of the report for more information regarding medical importance, habitat, and phenology.

Surveillance Data

A total of 34 traps were strategically deployed across 12 trap sites to capture targeted mosquito species in Shelburne. Two distinct types of traps were utilized:

1. **CDC Trap:** This trap is baited with carbon dioxide (CO2) and designed to attract a variety of mammal-biting mosquitoes. The use of CO2 mimics the exhalation of potential hosts, making it an effective tool for capturing mosquitoes seeking blood meals from mammals.
2. **Gravid Trap:** Characterized by its unappealing aroma, the gravid trap is baited with hay-infused water. This unpleasant scent is specifically attractive to Culex *pipiens* mosquitoes, which are drawn to the trap for egg deposition. This targeted approach aids in the surveillance of a specific mosquito species known for its potential to transmit WNV.

A total of 32 pools (5-50 mosquitoes placed in a PCR tube), consisting of various mosquito species, were submitted for testing, focusing on the detection of WNV and EEE (see table 1). The species making up the majority of submitted pools included Coquillettidia *perturbans* (14 pools), and Culex *pipiens/restuans* (8 pools*).*

District-wide, there were 751 pools of mosquitoes submitted for arbovirus testing through PVMCD. Of those pools, the most abundant species were Culex *pipiens/restuans* with 245 pools, followed by Coquillettidia *perturbans* (172) and Culex *salinarius* (74). Over 40,000 mosquitoes were collected and sorted for testing by PVMCD staff.

Table 1: Submitted pools for testing. Note, trapping began the week of 6/5/23 and ended the week of 10/4/23 (testing ended the following week). Both CDC and Gravid traps were set up each week throughout the season. Not every trap produced enough targeted species to submit for testing each week. These traps are labeled NCR for no collection recorded or TF for trap failure. These data are not included in the table below but are available upon request.

Trap Set Date	Collection Date	Trap Type	Pool Size	Species	Result
6/5/2023	6/6/2023	CDC Trap	6	Coquillettidia perturbans	Negative
6/20/2023	6/21/2023	CDC Trap	48	Coquillettidia perturbans	Negative
6/20/2023	6/21/2023	CDC Trap	6	Ochlerotatus canadensis	Negative
7/3/2023	7/4/2023	Gravid Trap	12	Coquillettidia perturbans	Negative
7/10/2023	7/11/2023	CDC Trap	14	Coquillettidia perturbans	Negative
7/10/2023	7/11/2023	Gravid Trap	13	Culex pipiens/restuans	Negative
7/18/2023	7/19/2023	CDC Trap	50	Coquillettidia perturbans	Negative
7/18/2023	7/19/2023	CDC Trap	17	Coquillettidia perturbans	Negative
7/18/2023	7/19/2023	CDC Trap	7	Culex pipiens/restuans	Negative
7/18/2023	7/19/2023	Gravid Trap	23	Ochlerotatus japonicus	Negative
7/24/2023	7/25/2023	CDC Trap	50	Coquillettidia perturbans	Negative
7/24/2023	7/25/2023	CDC Trap	42	Coquillettidia perturbans	Negative
7/24/2023	7/25/2023	Gravid Trap	9	Culex pipiens/restuans	Negative
7/24/2023	7/25/2023	CDC Trap	10	Culex pipiens/restuans	Negative
7/31/2023	8/1/2023	Gravid Trap	14	Culex pipiens/restuans	Negative
7/31/2023	8/1/2023	Gravid Trap	5	Ochlerotatus japonicus	Negative
8/7/2023	8/8/2023	CDC Trap	42	Coquillettidia perturbans	Negative
8/7/2023	8/8/2023	Gravid Trap	5	Culex pipiens/restuans	Negative
8/7/2023	8/8/2023	CDC Trap	6	Culex salinarius	Negative
8/14/2023	8/15/2023	CDC Trap	50	Coquillettidia perturbans	Negative
8/14/2023	8/15/2023	Gravid Trap	13	Culex pipiens/restuans	Negative
8/21/2023	8/22/2023	CDC Trap	45	Coquillettidia perturbans	Negative
8/21/2023	8/22/2023	CDC Trap	8	Ochlerotatus canadensis	Negative
8/28/2023	8/29/2023	CDC Trap	50	Coquillettidia perturbans	Negative
8/28/2023	8/29/2023	CDC Trap	50	Coquillettidia perturbans	Negative
9/5/2023	9/6/2023	CDC Trap	8	Coquillettidia perturbans	Negative
9/5/2023	9/6/2023	Gravid Trap	11	Culex pipiens/restuans	Negative
9/5/2023	9/6/2023	CDC Trap	20	Culex salinarius	Negative
9/26/2023	9/27/2023	Gravid Trap	10	Ochlerotatus japonicus	Negative
9/26/2023	9/27/2023	CDC Trap	10	Ochlerotatus trivittatus	Negative
10/2/2023	10/3/2023	Gravid Trap	6	Ochlerotatus japonicus	Negative
10/2/2023	10/3/2023	CDC Trap	19	Ochlerotatus trivittatus	Negative

Arbovirus Detections Throughout the Pioneer Valley Region

Neither EEE nor WNV were detected in the Town of Shelburne during the 2023 surveillance season. A total of 17 WNV positive pools were detected in the Pioneer Valley Region (see figure 1 for general locations). Impacted communities included Amherst, Deerfield, East Longmeadow, Granby, Hadley, Holyoke, Northampton, Palmer, South Hadley, Springfield, and West Springfield (see figure 2). Additionally, 6 pools tested positive for EEE positive pools detected in the Pioneer Valley Region, mainly in Hampden County. The affected communities included Brimfield, Chicopee, East Longmeadow, and Wilbraham. The Massachusetts Department of Public Health confirmed 2 human cases of WNV in Hampden County.

Figure 1: General locations where WNV was detected in Pioneer Valley.

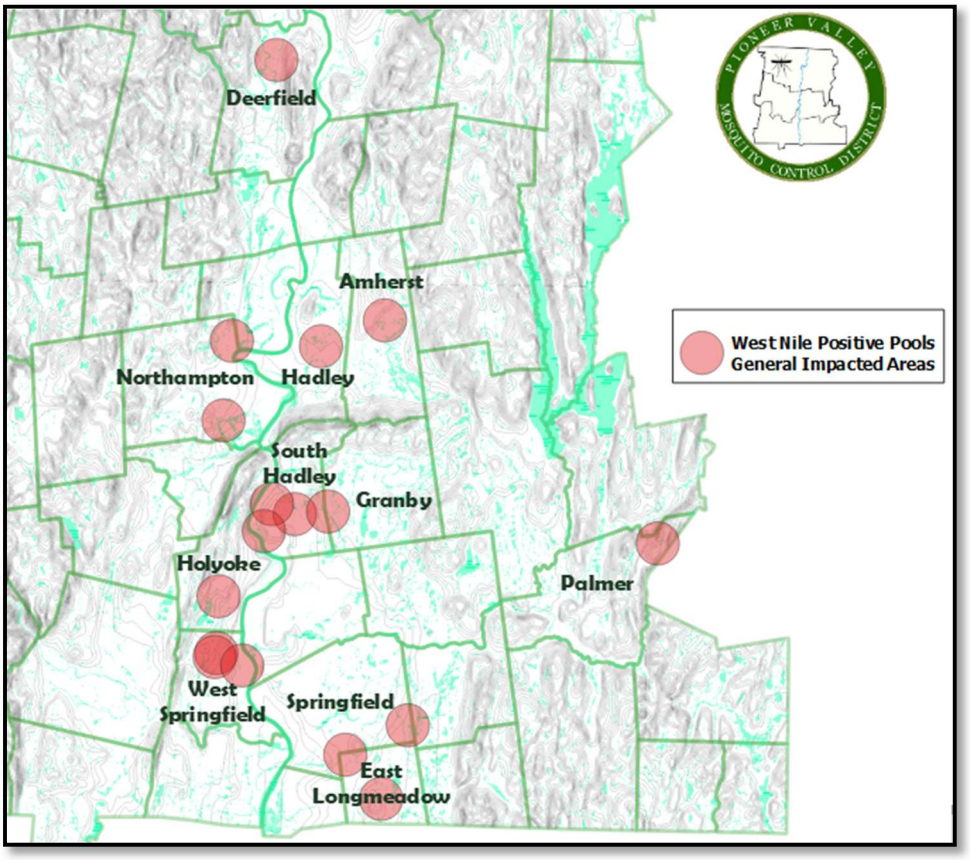
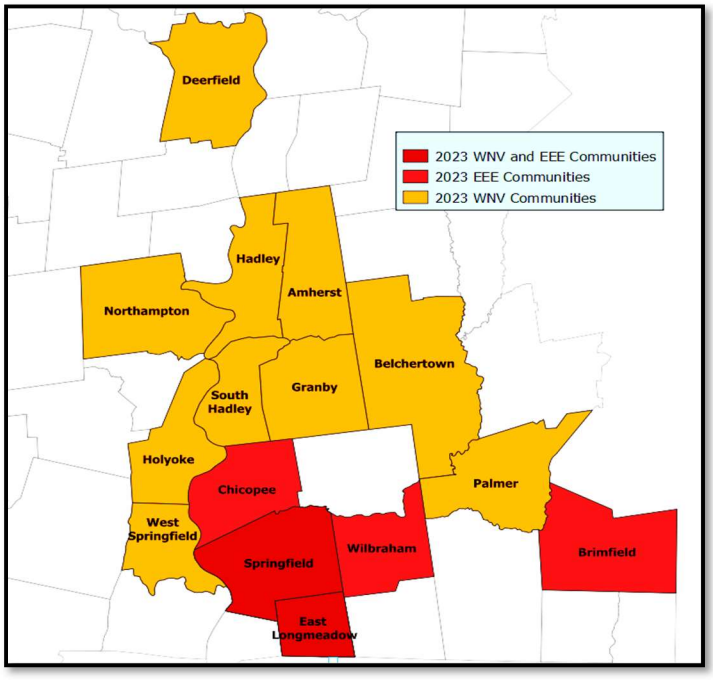


Figure 2: Communities impacted by WNV and EEE in the Pioneer Valley Region during 2023.



Arbovirus Detections Throughout the Commonwealth

The State Laboratory detected a total of 128 WNV-positive pools of mosquitoes throughout the state in the following counties: Berkshire, Hampshire, Hampden, Worcester, Bristol, Plymouth, Norfolk, Suffolk, and Middlesex (see figure 3). The communities affected by WNV had a moderate risk level, indicating that WNV infection had either occurred or was highly probable. For EEE, 28 pools tested positive across Hampden, Worcester, Bristol, and Plymouth Counties (see figure 4). Communities in Hampden and Worcester Counties had a high-risk level, meaning that human transmission was likely. Mosquitoes that tested positive for EEE consisted of Culiseta *melanura* (19), Aedes *cinereus* (3), Coquillettidia *perturbans* (2), Culex *salinarius* (1), Aedes *canadensis* (1), Psorophora *ferox* (1), Uranotaenia *sapphirina* (1). Based on historical arbovirus data, this year produced EEE positives for the first time in Psorophora *ferox* and Aedes *cinereus*. In total, there were 6 human cases of WNV throughout the state, with no cases of EEE reported in either humans or animals.

Figure 3: 2023 Arbovirus Risk Map. (Image credit: The Massachusetts Department of Public Health)

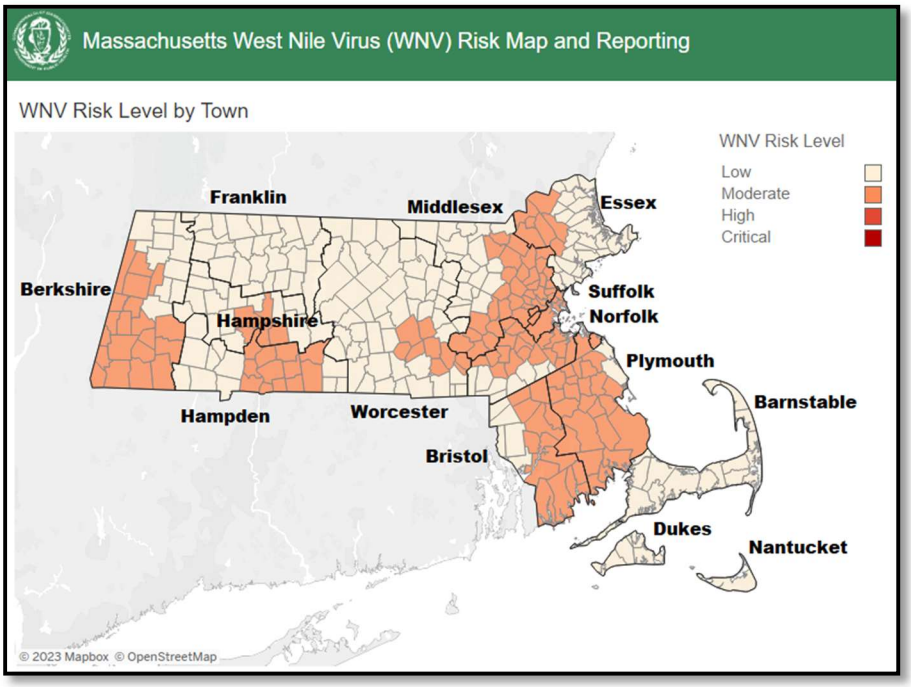
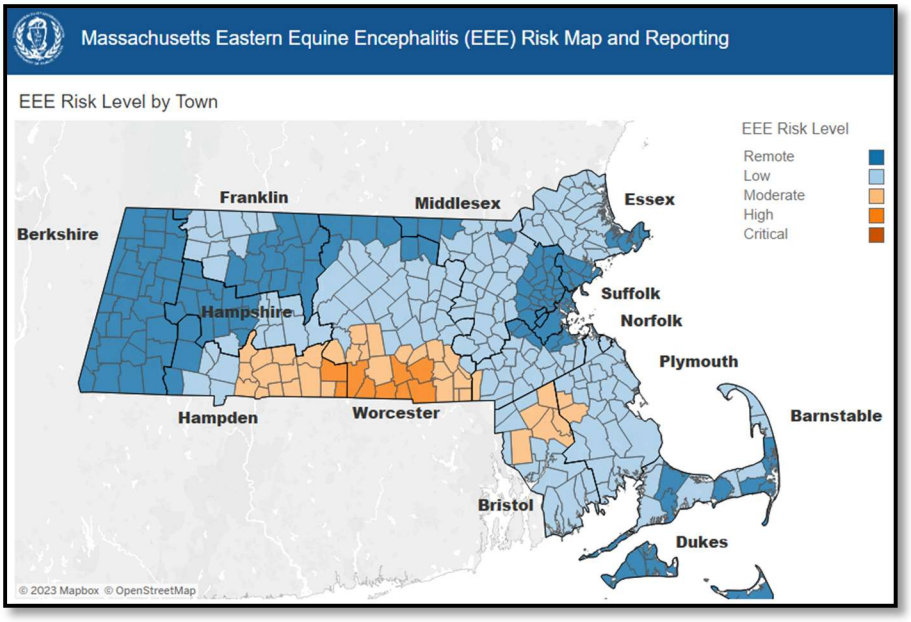


Figure 4: 2023 EEE Risk Map. (Image credit: The Massachusetts Department of Public Health)



Weather Impacts and 2024 Outlook

As mentioned earlier in the report, Culiseta *melanura* mosquitoes are the primary vector for EEE. *Melanura* rely on a permanent water source to breed during the summer and overwinter in the larval phase. The significant rainfall experienced this past season triggered a resurgence in *melanura* populations throughout the entire state. It was not until EPI week 35 that PVMCD started to detect larger numbers of *melanura* throughout the District (see figure 5). The delay in their appearance in surveillance traps can be attributed to the previous year's extreme drought which had reduced *melanura* numbers considerably.

A wet summer, winter, and spring will likely lead to higher populations of *melanura* next season. The National Oceanic and Atmospheric Administration is predicting a warm and wet winter from December to February (see figures 6 and 7). If EEE is present in the bird population, then it will likely be amplified earlier in the season by the 1st generation of *melanura* mosquitoes.

Due to weather impacts affecting next season's EEE outlook, PVMCD will be heavily focusing on establishing vector habitat during the early spring for the purpose of early detection of EEE in Culiseta *melanura* mosquitoes. Moreover, *Melanura* population data and any incidence of virus will be promptly communicated with local Boards of Health, and public outreach/education materials will be available for distribution. Lastly, it is highly recommended that horse owners speak to their veterinarians about the encephalitis vaccine and establishing an appropriate vaccine schedule that ensures protection through October of 2024.

Figure 5

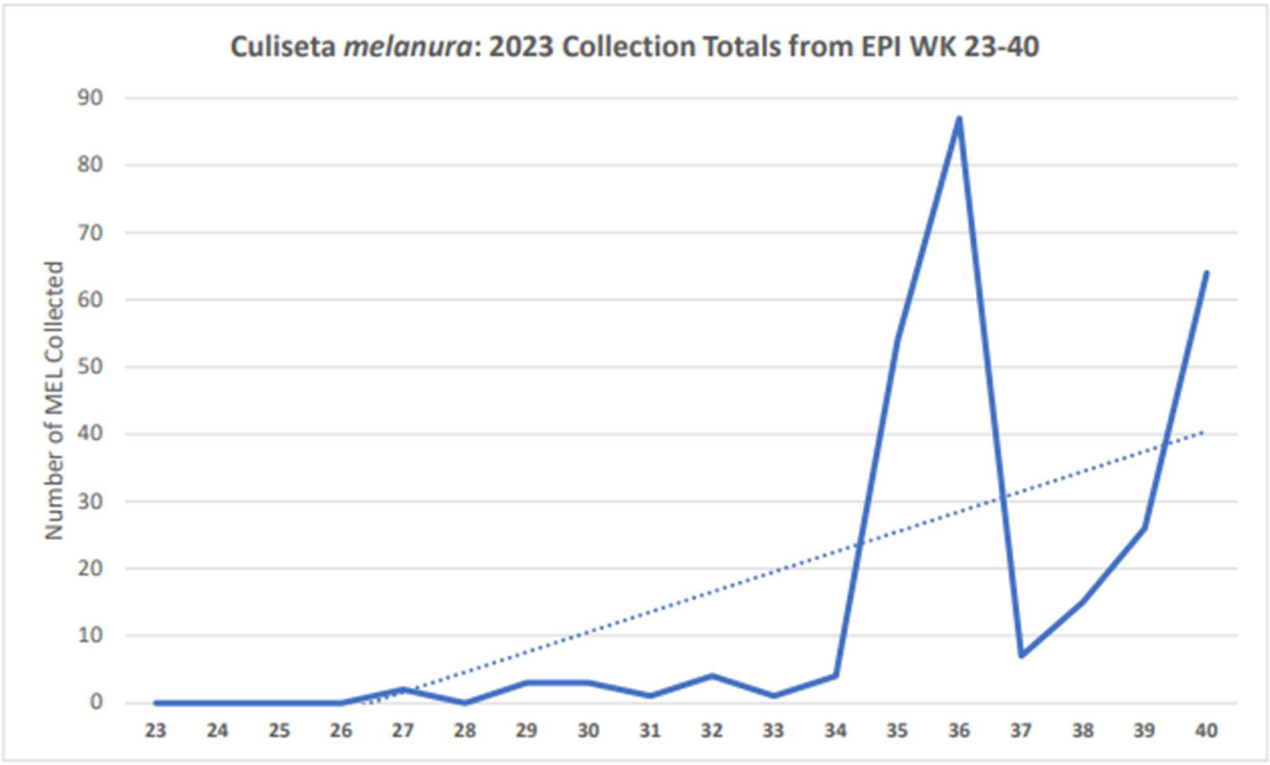


Figure 6: 2023-2024 Winter Temperature Outlook map. (Image credit: NOAA)

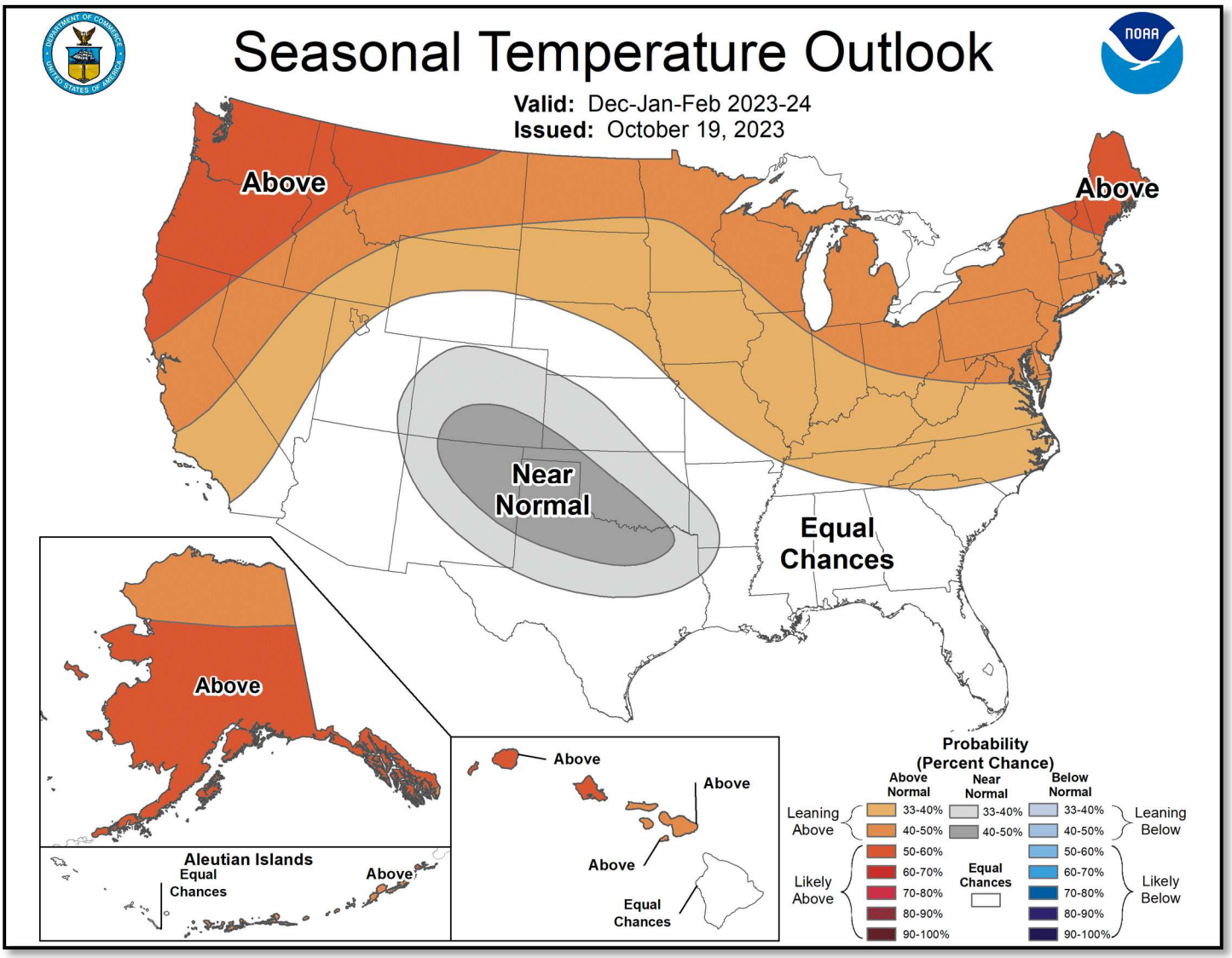
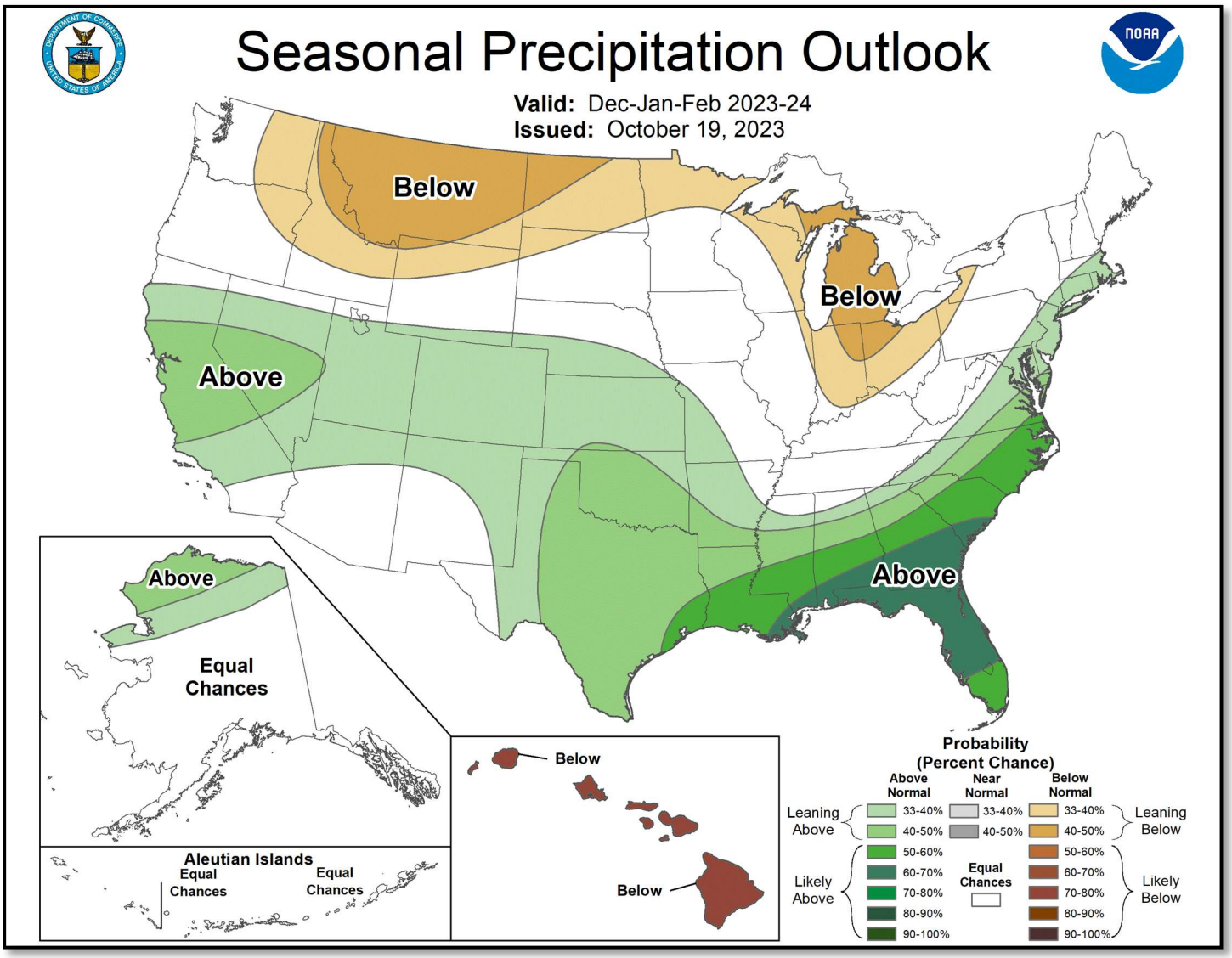


Figure 7: 2023-2024 Winter Precipitation Outlook map. (Image credit: NOAA)



FAQ

FAQ	Answer
What is a primary vector?	A primary vector is a species of mosquito that plays a significant role in the virus cycle.
What is a bridge vector?	Once EEE and/or WNV are amplified enough in the bird population, spill over into other mosquito species will occur. Species that are competent vectors and feed on both birds and humans will create a "bridge" for virus transmission to occur.
How long do mosquitoes live?	Lifespan varies from a few weeks to several months depending on species, environmental conditions, and resource availability. Additionally, some species can lay multiple batches of eggs while others will lay a single batch and die shortly after.
What is an instar phase?	Mosquito larvae go through 4 instar phases where they molt. The 4th instar phase is when larvae stop eating and molt into pupae. It is important to understand these phases when applying larvicide products that have one mode of action via ingestion.
How long does it take mosquitoes to develop?	This period of development will vary in the spring depending on environmental conditions. In the summer, however, it typically takes a week for mosquitoes to develop from egg to adult.
What are mosquito pools?	A pool consists of 5-50 mosquitoes placed into a PCR tube for arbovirus testing.
What is a Gravid trap?	A gravid trap is one of the two main traps used by PVMCD. The trap primarily targets "gravid" Culex mosquitoes (WNV vector) seeking out suitable habitat to lay their eggs. Culex species look for bacteria rich (foul smelling and stagnant) water to lay their eggs. The Gravid trap essentially replicates an artificial container habitat.
What is a CDC trap?	A CDC trap is the second main trap used by the PVMCD. It is used to target mosquitos that feed on mammals and are capable of transmitting EEEV or WNV to humans. The CDC trap utilizes CO2, which mimics the breath of a potential blood meal.
Why are there pools submitted from one trap but not the other?	Not every trap yields enough targeted vector species to submit for testing. Factors influencing this are weather, habitat, and equipment failures.
What is a "trap failure" (TF)?	Sometimes faulty parts or wear from regular use result in trap failures. Trap failures are inevitable but do not occur that often.
What does "no collection recorded" (NCR) mean?	A "no collection recorded" or "NCR" means no mosquitoes were collected from a trap deployed in the field. This will occur throughout the season but tends to be more frequent during the earlier and later parts of the season.
Does PVMCD offer control services?	PVMCD will have a facility in early 2024 and will likely implement control services in the coming years at a practical level of capacity. Control services will consist of targeting vector species habitat via larvicide granule formulations primarily in the spring to mitigate arbovirus.
What is Bti?	Bti stands for *Bacillus thuringiensis israelensis* and is naturally occurring soil bacteria that is used to control larval mosquito populations. Bti is safe for humans, animals, and the environment when used as directed. It is effective in reducing mosquito larvae that are feeding during the first 3 instar phases. The timing of application is imperative to Bti's effectiveness in controlling mosquito populations.

Targeted Mosquito Species

Species Name	Description	Habitat	Months Active
Culiseta *melanura*	*Melanura* mosquitoes are a primary vector for EEE. *Melanura* feed mainly on avian species and are responsible for amplifying the virus to the point that it spills over into bridge vectors	Tree root cavities or "crypts" covered by peat moss in red maple and cedar swamps.	May-December Peak: July-August and mid-September
Culex *pipiens* and *restuans*	These two mosquito species are also very abundant in Massachusetts and are capable of amplifying WNV in the wild bird population and infecting humans. While *pipiens* have been implicated more so in WNV transmission, both *pipiens* and *restuans* are grouped together because there is no way to differentiate between the species with 100% reliability.	Artificial containers such as "green" swimming pools, catch basins, discarded tires, buckets, etc.	May-October Peak: July-August
Coquillettidia *perturbans*	Cq. *perturbans* are one of the most abundant species of mosquito in Massachusetts and are implicated as a bridge vector for both EEE and WNV. *Pertubans* will feed on both birds (reservoir for EEE) and mammals, which is why it is considered a bridge vector.	Permanent bodies of water with emergent vegetation such at cattails.	May-September Peak: July
Ochlerotatus (Aedes) *canadensis*	Another common species in Massachusetts, *canadensis* can transmit both EEE and WNV to humans.	Woodland/vernal pools.	May-October Peak: June
Culex *salinarius*	*Salinarius* are considered bridge vectors for both EEE and WNV, readily feeding on mammals.	Brackish and freshwater swamps.	May-November Peak: August
Other species	There are many other species that we send into the Arbovirus Surveillance Laboratory at DPH for testing. These species are considered potential vectors or "suspects" in transmitting arboviruses. All other non-vector species are not submitted for testing.		

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