TO: Maine Town and City Health Officers

FROM: Stephen Sears, MD, MPH, State Epidemiologist

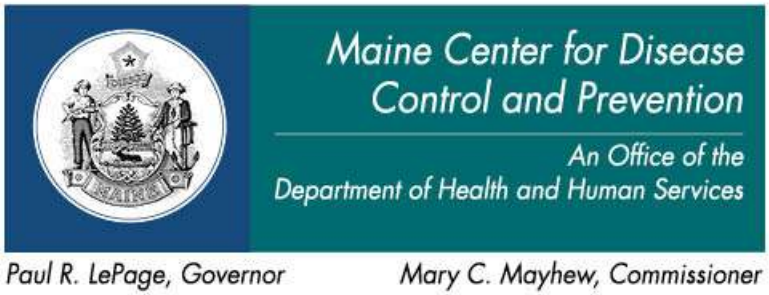
DATE: April 17, 2012

SUBJECT: Maine Arboviral (Mosquito-borne) Illness Surveillance, Prevention and Response Plan, 2012 Season

Please find enclosed the 2012 Maine Arboviral (Mosquito-borne) Illness Surveillance, Prevention and Response Plan. This plan provides guidance to communities on operational aspects of Eastern Equine Encephalitis (EEE) virus and West Nile virus (WNV) surveillance, prevention and response. The 2012 plan incorporates recommendations and comments from the State Vector-borne Work Group. I would like to bring to your attention several recommendations present in the 2012 plan:

- Discussion of the Maine Vector-borne (mosquito and tick) Work Group final report including findings and recommendations to improve state and local arboviral disease surveillance and control;
- Links to additional educational materials and suggestions for development of local mosquito integrated pest management programs;
- Throughout the arboviral (mosquito-borne) season (June through October) Maine CDC will monitor activity level to attempt to ascertain human risk levels for the State. The goal is to assist municipalities in responding to arboviral activity with the most appropriate prevention measures to reduce the risk of human disease.

We continue to improve upon our State plan and encourage feedback from all parties. Thank you in advance for your assistance in preventing arboviral (mosquito-borne) illness in Maine.



DEPARTMENT OF HEALTH & HUMAN SERVICES

MAINE CDC

State of Maine

Arboviral (Mosquito-Borne) Illness

Surveillance, Prevention and Response Plan

2012 Season

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INTRODUCTION

The 2012 Arboviral (Mosquito-borne) Illness Surveillance, Prevention and Response plan provides surveillance and phased response guidance for both West Nile virus (WNV) and Eastern Equine Encephalitis (EEE) virus. The purpose of the plan is to provide guidance on operational aspects of surveillance, prevention and response by the State and local communities responsible for the control of mosquito-borne disease and encourage proactive preparations for the 2012 season. This plan is the result of analysis and review of surveillance data and response plans for Maine, as well as from other State and Federal entities. Maine CDC will continue to seek advice from its partners and collaborators and modify the plan, as appropriate.

The Maine Vector-borne Work Group was formed in 1986 in anticipation of the increased threat posed by the emergence of vector borne diseases in Maine. The expertise provided by the group works to minimize the risk to Maine residents of being exposed to, and infected with, vector-borne diseases. The State Epidemiologist convenes this Work Group bimonthly to develop and collaborate on a statewide coordinated strategy to reduce the risk of vector-borne (mosquito and tick) diseases in Maine. The work group and its sub-groups meet more frequently as warranted with dialogue and updates continuing throughout the year. Information provided from the Maine Vector-borne Work Group meetings is contained herein and aims to guide proactive community planning and actions to reduce the risk of human disease from EEE virus and WNV. Key objectives contained in this plan provide for the monitoring of trends in EEE virus and WNV in Maine, supporting locally-based mosquito plan development and response, providing timely, detailed and summary information on the distribution and intensity of WNV and EEE virus in the environment, laboratory diagnostic testing of WNV and EEE for humans, horses and other animals, and communicating guidelines, advice and support on activities that effectively reduce the risk of disease. This document will be reviewed at least annually.

I. DISEASE BACKGROUND

The two main mosquito-borne viruses (also known as arboviruses, for **ar**thropod-**bo**rne **viruses**) recognized in Maine and known to cause human and animal disease are Eastern Equine Encephalitis (EEE) virus and West Nile virus (WNV). The first potentially Maine acquired human case of EEE was identified in 2008. No cases of indigenously acquired human cases of West Nile virus (WNV) have been reported in Maine, although Maine has isolated WNV in birds and mosquitoes since 2001. Different types of mosquitoes, with species-specific feeding habits (birds and/or mammals) and habitats carry these diseases. These differences are important in developing strategies for controlling the mosquitoes involved.

A. Eastern Equine Encephalitis Virus

EEE virus is an alphavirus, present in some passerine (perching song birds) bird species found in fresh-water swamp habitats. The virus is transmitted among wild birds in these areas primarily by *Culiseta melanura*, a mosquito species that prefers to feed on birds. EEE virus has a cycle of natural infection among wild bird populations with occasional infections of humans, non-human mammals (most often horses) and large domesticated birds (emus, ostriches, etc). Infected

mammals (e.g., humans, horses) are considered "dead-end" hosts for WNV and EEE. This is because mosquitoes that bite humans or equines infected with WNV or EEE don't pick up enough virus particles to transmit the disease to the next human or animal they bite. Risk of disease in humans is directly related to the amount of exposure to infectious mosquitoes. These bridge vectors (i.e., a mosquito species that is indiscriminant and will feed on birds or mammals) are responsible for transferring the EEE virus to humans.

Many people infected with EEE virus will not have symptoms of disease, while others may get only a mild flu-like illness with fever and headache. However, for people with infection of the central nervous system, a sudden high fever, severe headache, and stiff neck can be followed quickly by seizures, coma, and death. The cost of a single human case of EEE has been estimated to range from $21,000 for mild, transient illness, to as much as $3 million for individuals who suffer permanent neurologic damage. Human cases of EEE occur sporadically in the United States. Historically, clusters of human cases have occurred in sequential cycles of 2-3 years, with a hiatus of numerous years between outbreak and high-risk years. Between 1964 and 2009, 260 human cases of EEE were reported in the US, with an average of 6 cases per year. Most of the cases reported were from eastern states, primarily Florida (66 cases), Massachusetts (36 cases), Georgia (28 cases), and New Jersey (20 cases).

EEE activity documented in Maine since 2001 includes:

	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Humans	0	0	0	0	0	0	0	0*	0	0	0
Mosquito Pools	0	0	0	0	1	0	0	1	2	0	0
Horse	0	0	0	0	2	0	0	1	15	0	0
Birds	1	1	0	0	12	0	0	0	3**	1	10***
Other animals	0	0	0	0	0	0	0	0	1 (llama)	0	0

* a fatal case of EEE was diagnosed in a Massachusetts resident who may have acquired the infection while vacationing in Cumberland County
** 3 separate flocks diagnosed with EEE
***10 sero-positive wild turkeys

Updated information on arborviral activity in Maine can be found at http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/index.shtml.

The incidence of EEE infection in humans varies by geographic area. Human EEE disease is more common in areas that support dense populations of passerine birds and have favorable habitats for the larvae of the primary mosquito vector. In Maine, these areas consist mainly of large and mature white cedar and red maple swamps. EEE has never been reported in a Maine resident to date. However, in 2008 there was a fatal case of EEE diagnosed in a Massachusetts resident who may have acquired the infection while vacationing in Cumberland County. From 2001 to 2011, evidence of EEE infection was found in 13 of the 16 counties in Maine.

Additionally, the likelihood of mosquito exposure is a key factor in determining the risk of human EEE infection. The abundance of specific species of mosquitoes at critical periods during

the transmission season, in part determined by groundwater levels and the timing of rainfall during the mosquito season, is important in determining the likelihood of mosquito exposure. The use of personal protective measures (avoidance of mosquitoes, use of repellent) by people reduces their risk of exposure and infection.

B. West Nile Virus

WNV is a flavivirus. Similar to EEE, WNV is also maintained in the environment in a cycle that involves birds, with indiscriminant feeding mosquitoes infecting humans and other mammals. WNV causes sporadic disease in humans, and occasionally results in significant outbreaks. In 2010, 601 human cases of WNV neuroinvasive disease (West Nile meningitis and West Nile encephalitis) and WNV fever were reported nationwide to the Centers for Disease Control and Prevention (CDC).

WNV activity was first identified in Maine in September 2001. WNV activity documented in Maine since 2001 includes:

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Human	0	0	0	0	0	0	0	0	0	0	0
Mosquito Pools	0	1	2	0	0	0	0	0	1	1	0
Birds	6	60	98	1	22	11	0	0	0	0	0

Updated information on arborviral activity in Maine can be found at http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/index.shtml.

An estimated 80% of people who become infected with WNV never develop symptoms attributable to the infection. For those who do develop symptoms: severe symptoms can include high fever, headache, neck stiffness, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, and paralysis. These symptoms may last weeks, and neurological effects may be permanent. Up to 20 percent of the people who become infected will display symptoms of WNV fever, including fever, headache, body aches, and can include swollen lymph glands. Symptoms can last for days to months. People over 50 years of age are at a higher risk of developing serious symptoms of WNV.

West Nile virus activity varies from year to year. When there are a high proportion of infected mosquitoes in a relatively small geographic area the risk of transmission of virus to humans will increase. Maine discontinued dead bird testing in 2006, which accounts for the decrease in positive birds after that year.

II. PROGRAM GOALS

Timely and accurate information provided by Maine CDC may offer an early warning of increased risk of WNV and EEE virus infection of humans or non-human mammals. Based on

surveillance information, actions to reduce disease transmission can be implemented early when the impact can be lessened.

Maine CDC Specific Program Priorities

1. Active involvement in and maintenance of the Maine Vector-borne Work Group to provide expertise in proactively minimizing the risk to Maine residents of being exposed to and infected with mosquito-borne diseases.
2. Conducting surveillance including laboratory testing of human clinical specimens, and testing of mosquitoes, horses, and other animals to identify EEE virus and WNV.
3. Tracking trends in incidence and prevalence of EEE virus and WNV infections by geographic area.
4. Advising human and animal medical practitioners on the appropriate procedures for detecting and identifying infections and disease caused by mosquito-borne viruses.
5. Providing information to the public on mosquito-borne disease and disease risk, and how to take precautions to reduce the risk of infection.
6. Providing timely surveillance information to communities to assist in developing and implementing local mosquito control and response plans.
7. Participating in the national Arbovirus surveillance network (ArboNet) coordinated by the federal CDC.

Maine CDC works cooperatively with other state agencies, federal agencies, local communities and selected interest groups to identify and support the use of risk reduction and disease prevention methods that are specific to the cause of the diseases, that use the least intrusive and most appropriate prevention methods, and that support planning and practices that minimize the use of pesticides.

III. PREVENTION AND CONTROL

Ultimately, the key to reducing the risk of arboviral disease is education and outreach to the public regarding the need for mosquito-bite prevention and explaining how people can protect themselves from diseases such as EEE and WNV. The emergent public health threat posed by arboviral illness requires a vigilant outreach effort. As the state public health entity, Maine CDC will continue to take a lead role in providing public education efforts to promote prevention, by working with our partners to maximize the opportunity to alert our residents to the dangers posed by mosquito-borne illness. This will include working with the media, local communities, businesses and special populations such as schools, the homeless and others who spend considerable time outdoors, such as those who hunt and fish.

Maine CDC provides information to the public and communities to guide planning and actions to reduce the risk of human disease from EEE virus and WNV. Individuals can take a number of simple steps that will greatly reduce the risk of mosquito-borne viruses to them, their families, and their communities. Choosing to wear protective clothing (e.g., long pants, long-sleeve shirts), using effective mosquito repellants, and minimizing opportunities for mosquitoes to

breed are all important ways individuals can help prevent the spread of WNV and EEE in Maine. Community efforts, such as public education, mosquito surveillance, and integrated pest management (IPM) measures aimed at mosquito larvae may be necessary to decrease the local risk of EEE virus and WNV.

A. Prevention Through Knowledge

The goal of all mosquito-borne virus public information activities is to provide Maine's residents with helpful, accurate and specific advice and information in order to approach this problem with the appropriate level of caution.

Maine CDC's website includes general background information and surveillance updates as well as links to other informational websites including other state and federal agency sites. Printed materials can be ordered through this website http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/index.shtml.

Epidemiologists from Maine CDC are also willing to conduct trainings and give presentations on arboviral diseases.

B. Prevention Action Steps

1. Preventing Mosquito Breeding Opportunities: By reducing exposure to mosquitoes around their homes and by eliminating mosquito breeding grounds, Maine residents can greatly reduce their risk of mosquito-borne virus exposure. Many species of mosquitoes lay their eggs in standing water. Weeds, tall grass, and bushes may provide resting areas for the mosquitoes that are most often associated with WNV. Fresh water swamps and coastal areas provide larval habitat for the mosquito species commonly associated with EEE.

The Maine CDC recommends residents take the following steps to reduce opportunities for mosquito breeding:

- Eliminate artificial sources of standing water around residential and commercial areas by discarding outdoor artificial containers such as tin cans, plastic containers, glass bottles, or similar water-holding containers.
- Remove all discarded tires from your property. The used tire is the most common site for mosquito breeding in the United States.
- Dispose of or drill holes in the bottom of containers left outdoors, such as recycling containers or flowerpots. Drainage holes on the sides of containers will still allow enough water for mosquitoes to breed. Do not overlook containers that have become overgrown by aquatic vegetation.
- Make sure roof gutters drain properly. Clean clogged gutters in the spring and fall and as often as necessary to eliminate standing water.
- Clean and chlorinate swimming pools, outdoor saunas and hot tubs following disinfectant label directions. If not in use, keep them empty and covered. Do not allow these covers to collect standing water.

- Aerate ornamental pools or stock them with native fish. Water gardens become major mosquito producers if they are allowed to stagnate.
- Turn over wheelbarrows and plastic wading pools when not in use. Both provide breeding sites for domestic mosquitoes.
- Change water in birdbaths at least twice weekly.
- Remind or help neighbors to eliminate mosquito breeding sites on their property.
- Consult with local mosquito control companies licensed by the Maine BPC (go to http://www.maine.gov/agriculture/pesticides/public/mosquito_control_list.htm to see an updated list of licensed companies) for additional solutions to decrease mosquito-breeding activity in nearby areas. Products are available that can be used to reduce mosquito populations (see Mosquito Control Activities below).
- The management of ponds, marshlands, and wetlands is regulated under existing state law and administrative rule. Alteration may require the approval of state and possibly federal agencies. Contact the Maine Departments of Environmental Protection for further information http://www.maine.gov/dep/index.shtml.

2. Personal Protective Measures: Residents can take simple steps to minimize mosquito bites. Such steps are critical in reducing the risk of WNV and EEE infections. The Maine CDC recommends that residents take the following steps to protect themselves, particularly from June to October, when mosquitoes are most active:

- If outside during evening, nighttime and dawn hours, or at any time mosquitoes are actively biting, children and adults should wear protective clothing such as long pants, long-sleeved shirts, and socks, and consider the use of personal repellent.
- EPA approved repellents include: DEET, Picaridin (KBR3023), IR3535, and Oil of Lemon Eucalyptus. The length of time a repellent is effective varies with ingredient and concentration. Always follow the manufacturer's instructions on the label.
- Do not allow young children to apply repellent themselves and do not apply repellent directly to children. Apply to your own hands and then put it on the child's skin.
- Infants and children should be protected by placing mosquito nets over strollers in the evening, nighttime and dawn hours or at any time mosquitoes are actively biting.
- After returning indoors, wash treated skin with soap and water or bathe. Also, wash treated clothing before wearing again.
- Store repellent out of reach of children.
- For additional information about chemicals contained in repellents, visit the National Pesticide Information Center (NPIC) website at http://npic.orst.edu/repel.html. or contact the Maine Board of Pesticides Control at 207-287-2731.
- Make sure that doors and windows have tight-fitting screens. Repair or replace all screens in your home that have tears or holes.
- Vitamin B, ultrasonic devices, incense and bug zappers have not been shown to be effective in preventing mosquito bites.

3. Mosquito Control Activities: The objective of public health mosquito control is to prevent transmission of mosquito-borne disease to humans. Reduction of mosquito species is not carried out by Maine public health agencies. It is important to emphasize that local communities make the final decision regarding mosquito control activities. Communities are responsible for

developing, maintaining and financing local mosquito control programs. The Maine CDC, Department of Agriculture, Board of Pesticides Control, and the Department of Environmental Protection are available to provide guidance and recommendations to assist municipalities in plan development and when faced with response decisions.

All discussion regarding pesticide applications discussed in this plan will be in accordance with the principles of Integrated Pest Management (IPM). IPM is a sustainable approach to managing mosquitoes by combining biological, physical and chemical tools in a way that minimizes economic, health and environmental risks. IPM involves preventive control and suppressive control, including:

- Source reduction (remove, cover, drain, fill) of larval habitats that are not environmentally sensitive or protected
- Mechanical control (the use of barriers such as screens to prevent the movement of mosquitoes and the use of traps)
- Chemical / Biological Pesticide control (the use of registered pesticides, according to label directions that act against mosquitoes)

Chemical /Biological pesticide controls can be further divided into the application of products aimed at mosquito larvae (larvicide) and those aimed at adult mosquitoes (adulticide). Larvicide involves the application of chemicals or natural bacteria to surface waters (such as ponds or in storm drains) to kill mosquito larvae. Larviciding is a proactive measure that can be useful in reducing the risk of mosquito-borne disease throughout the season. The intent of a larvicide program is to control generations of targeted mosquito species before they reach the adult stage, when they are able to transmit diseases such as WNV and EEE. Larvicide programs typically begin in early spring and continue throughout the season, and may help reduce the potential for human exposure to pesticides. These applications require DEP permits when the "waters of the state" are involved (see DEP pesticide Rules section below).

Adulticides involve the application of fine "mists" of pesticide over a relatively broad area to bring about the rapid reduction of adult mosquitoes. Adulticiding occurs in response to current surveillance activity. Adulticiding can quickly reduce existing, biting adult mosquitoes throughout a spray area, but its effects are relatively short lived, raising the possibility of repeat applications. In addition, adulticide spray sites are most likely to be areas of high human population density increasing the potential for human pesticide exposure. Comprehensive mosquito control programs may utilize both of the control methods, larviciding and adulticiding, if indicated by surveillance data.

Pesticides may pose their own risk to the health of humans, animals, plants, and the environment. Thus pesticides are only one component of a coordinated effort to control mosquitoes. Pesticide treatments and other IPM strategies may be appropriate in certain situations, while each strategy alone may not be adequate.

IPM dictates that control efforts should be tied to thresholds. This means simply that a certain defined risk needs to exist before particular control methods are recommended. Different responses may be made as different levels of risk are identified. These levels of risk are

discussed under the Phased Response section of this plan. In an ideal IPM program, non-chemical methods should be employed to keep pest levels below the risk level that might trigger a pesticide response, meaning that pesticides are a last, rather than first response to a WNV or EEE problem.

Suggested Options for Mosquito Control Activities

Once a community has identified the need for an organized response to the risk of a mosquito-borne disease, it is necessary to decide on the type of response and the magnitude of the effort. These decisions will be impacted by a variety of considerations, such as the severity of the problem, the financial resources of the community, public perceptions and attitudes, and the availability of technical expertise. Listed below are suggested options for local mosquito control programs. It is important to remember mosquito control is a year-round activity; many of these activities can be performed during the "off season." Communities interested in developing or enhancing their mosquito control programs should review the document "Public Health Confronts the Mosquito" available at http://www.astho.org/WorkArea/DownloadAsset.aspx?id=2333

- Institute a public information program emphasizing personal responsibility, ways in which people can prevent mosquito breeding, and how they can reduce the risk of being bitten by observing personal protection measures.

- Stay up-to-date on statewide and regional virus activity and recommendations by visiting http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/index.shtml.

- Contact insect repellent manufacturers to determine the availability of community or municipal discounts for bulk purchases of repellent products.

- Encourage local reporting to town officials of suspected areas where mosquitoes may be breeding (larval habitats). Such areas may then be evaluated by mosquito control personnel.

- Institute community cleanup programs to eliminate larval habitats from backyards, commercial sites and abandoned premises. Efforts may be aimed at removing, covering, or draining such artificial habitats.

- If needed, develop provisions in the local ordinances to deal with public health nuisances (e.g., unmaintained swimming pools that may serve as mosquito breeding habitat).

- Define the scope of the mosquito control program.
    - Create a clearly defined statement of services or deliverables, and a clear performance evaluation document.
    - Establish what activities will be performed.
    - Determine what resources (equipment, staff, insecticides, etc.) will be needed and what is available.
    - Decide where, when, and how often activities are to occur.

- Emphasize public education and source reduction, augmented by larval and adult mosquito control, if appropriate.
- Ensure that all staff are appropriately trained and licensed (see commercial pesticide applicator licensing requirements at http://www.maine.gov/agriculture/pesticides/cert/questions.htm#commercial.
- Investigate training opportunities to develop local expertise, such as in mosquito trapping and identification and/or pesticide application.

- Institute basic mosquito population monitoring to define the problem. Monitoring species, abundance, and virus infection rates in adult mosquitoes provides critical early, predictive data for surveillance and control.

- Consider coordinating mosquito control efforts with neighboring jurisdictions.

- Once these decisions have been made, create a community-specific mosquito control plan.

C. Pesticide Control Board Regulations

The use of pesticides in Maine is governed by state law 22MRSA§1471 A-2 and 7MRSA§ 601-625 and by the Administrative Rules of the Board of Pesticides Control, CMR**01-026**. Chapters 10 – 90. These statutes and rules require people applying pesticides, other than homeowners on their own property, hold licenses issued by the Maine Board of Pesticides Control. Municipal employees must be licensed as a commercial pesticide applicator if the use of a pesticide is part of their official duties, and they may only apply pesticides to municipal properties. Municipal entities needing licenses include municipal and quasi-municipal organizations like Parks and Recreation Departments, Public Works, Cemetery Maintenance, Water & Sewer Districts, Housing Authorities, etc.

The Board of Pesticides Control also requires licensing whenever pesticides are applied in areas open to the public. These areas could include parks, campgrounds, apartment or condominium grounds, common areas of apartment buildings and many other areas. If a municipality hires an outside company to do pest control, that municipality must be sure the applicator company has the appropriate commercial pesticide applicator licenses. We recommend obtaining proof of licensure even before entertaining a bid from an outside pest control company.

Pesticides covered by these rules include insecticides to kill mosquito larvae like *Bacillus thuringiensis* (*var. israelensis*) (Bti), *Bacillus sphaericus* (Bs), methoprene, and temephos, and insecticides to kill adult mosquitoes like malathion, naled and the pyrethroids, or any other pest control products both organic and synthetic.

Pesticide applicator licenses are required to handle and apply even the over-the-counter product varieties -like mosquito dunks or natural and organic products - when applications are performed by government employees or in public areas because of the greater potential for public exposure and the added liabilities resulting from that use. PERSONAL USE OF REPELLENTS DOES NOT REQUIRE A LICENSE

D. Department of Environmental Protection Pesticide Rules

Although certain pesticide products are available for sale in the marketplace to control mosquito larvae, application of these products to any surface waters in Maine is governed through permits obtained from the Maine Department of Environmental Protection. Questions regarding how to apply for such special permits should be directed to the Maine Department of Environmental Protection at 287-7688 (http://www.maine.gov/dep/).

In the event an EEE or WNV threat has been identified, the Commissioner of Health and Human Services may declare a Public Health Emergency and instruct the Department of Environmental Protection to commence the expedited special permit process – that is, provide an application form and other pertinent information to the appropriate town official(s) through the local health officer. The special permit will be issued with the greatest possible speed, preferably within seventy-two (72) hours.

Pesticide Applicator Licenses
A listing of the current Maine licensed pesticide applicators certified to control mosquitoes can be requested from the Maine Board of Pesticides Control (BPC) (287-2731, pesticides@maine.gov or http://www.maine.gov/agriculture/pesticides/public/mosquito_control_list.html.) Successful applications require in-depth knowledge of the community's planned pesticide use for mosquito control. Communities may also decide to license their own staff to apply pesticides. The licensing process for commercial applicators is described on the BPC website at http://www.maine.gov/agriculture/pesticides/cert/questions.htm#commercial

IV. SURVEILLANCE

Arboviral testing available through Maine's Health and Environmental Testing Laboratory (HETL) is outlined below. All laboratory test results should be considered in conjunction with both clinical symptoms and epidemiologic findings. All samples sent for arboviral testing must first be approved by an epidemiologist before the test will be performed.

Sample	West Nile virus (WNV)	Eastern Equine (EEE)	St. Louis (SLE)	LaCrosse (LE)	Powassan virus
Human serology (IgM)	X	X	X	X*	X*
Human cerebrospinal fluid (IgM)	X	X	X	X*	
Bird tissue (PCR)	X	X			
Mosquitoes (PCR)	X	X			
Non-Human Mammal tissue (PCR)	X**	X**			
Horse serology (IgM)	***	***			

* = Testing is not performed at HETL, but can be forwarded on to the federal CDC upon

request. Federal CDC is also able to perform IgG testing if warranted.
** = A rabies test must be performed on mammal specimens before PCR for WNV/EEE can be done. Animals testing positive for rabies will not be tested for WNV/EEE
*** = Testing is not performed at HETL, but is offered by private laboratories
PCR = polymerase chain reaction

Note: The USDA National Veterinary Services Laboratory (NVSL) or CDC Laboratory will be used as a confirmatory reference laboratory for results as needed.

A. Mosquito Surveillance for West Nile virus and Eastern Equine Encephalitis

Mosquitoes are the best early indicator of human risk for arboviral disease. The objective of a mosquito surveillance program is to determine the presence of arboviruses, including WNV and EEE, in mosquito species common to our area. An effective program begins by targeting mosquito species considered to be important in transmitting disease among birds (primary vector) and transmitting disease from birds to humans (bridge vectors). Monitoring mosquito abundance is accomplished through various surveillance methods including but not limited to measuring larvae (dip counts) and adult mosquitoes (use of light/CO2 baited traps, gravid traps and resting boxes). Results must be evaluated by mosquito species, as each species has unique biological characteristics that should be incorporated into control decisions (see Appendix I). Maine CDC uses a comprehensive and flexible strategy that modifies certain surveillance activities in response to trends in disease risk.

Based on historic and current epidemiology in Maine and the United States, Maine CDC may test only particular mosquito species for EEE virus and WNV. Testing decisions will be based on the most current knowledge and fiscal considerations. It is the intent to ensure a rapid, robust surveillance system. Such decisions will be announced to Town Officers and mosquito contractors well in advance. Regardless of testing decisions, communities financing mosquito surveillance are encouraged to utilize surveillance from July 1 through October 1 in order to evaluate the relative abundance of particular mosquito species. Mosquito larvae and adult abundance, arboviral testing results, and coverage of mosquito surveillance efforts play a critical decision-making role in overall need, scope, and method of control.

Activities for mosquito surveillance for the 2012 season will consist of routine and rapid response surveillance.

1. Routine Mosquito Surveillance: Maine CDC is the lead agency responsible for mosquito surveillance activities. Maine CDC will work with its partners in coordinating efforts for appropriate placement of traps, collection, packaging and transport of mosquito specimens.

Routine, fixed long-term trap sites provide the best baseline information for detecting trends in mosquito abundance, virus prevalence and estimating the risk of human infection from WNV and EEE. Maine CDC works together with contract employees to determine long term trap sites. If your town or community has interest in collecting mosquitoes locally for testing, please consult with Maine CDC for more information on collection requirements and testing ability.

2. Rapid Response Mosquito Surveillance: In the case of a positive test of an arbovirus in non-human mammals, mosquitoes, or humans, State sponsored activities may include:

- Notifying city and town municipal officials of positive virus isolation or a confirmed case of a mosquito-borne disease.
- Provide for short-term mosquito surveillance and laboratory specimen preparation in the absence of a local health department surveillance or local mosquito control program in predetermined selected areas.
- Coordinating training and lending expertise to local health officials and state personnel.
- Evaluating current trap locations based on criteria including habitats conducive to mosquito breeding and bridge vector collection, and level of human use (e.g., schools, parks, athletic fields).
- Reviewing and determining the need for expanding trapping in the area surrounding the positive identification.

B. Avian Surveillance for West Nile virus and Eastern Equine Encephalitis

National and local analysis suggests dead bird testing for WNV is becoming less useful for early detection and evaluation of WNV risk. Most birds infected with EEE do not succumb to severe disease and do not provide useful data for disease surveillance and response in Maine. For these reasons, Maine has discontinued wild bird testing. Wild bird surveillance is useful in understanding the ecology of arboviruses, and as such, other agency partners (i.e., MMCRI, Wildlife Services, etc.) may conduct surveillance among wild bird and mammal populations to address specific research questions.

In some circumstances, dead birds may be tested for WNV and EEE by the state if the situation warrants (e.g., unusual large die-offs without a known cause). It is the responsibility of the local community to arrange for the transportation of dead birds to the HETL. Birds must be approved for testing prior to delivery by calling the Maine CDC disease reporting line (1-800-821-5821).

Testing and surveillance of domestic birds (e.g., emus) will follow the procedures listed below for mammal (non-human) surveillance.

C. Mammal (Non-human) Surveillance for West Nile virus and Eastern Equine Encephalitis (EEE) virus

Under the auspices of the State Veterinarian, Maine Department of Agriculture, HETL may conduct testing of horses and other domestic animals (e.g., llamas, alpacas) that have severe neurological disease suspected of being caused by EEE virus or WNV infection. On an annual basis, a letter from the State Veterinarian (Maine Department of Agriculture) describing the case definition, clinical signs of disease, prevention measures, and reporting process will be sent to all licensed veterinarians in the state of Maine. This serves as a reminder to investigate and report neurological illness in animals. Parameters for the evaluation and testing of ill animals will include the following:

- Domestic animals with neurologic signs will initially be referred to private veterinarians for evaluation.

- Veterinarians wishing clinical consultation or information on encephalitic disease testing procedures should contact the State Veterinarian at the Maine Department of Agriculture.
- Necropsy specimens, such as animal heads, must be sent to the Maine HETL for processing.
- The State Veterinarian will assure appropriate collection of specimens for diagnostic testing.

Mammals Submitted for Rabies Testing

Unlike an arbovirus, rabies can be transmitted to humans through the bite of an infected animal. It is important that all mammals with neurological symptoms that have had contact with humans, pets, or domestic animals, and that meet guidelines for rabies testing, be submitted for testing in accordance with HETL guidelines. Animals testing positive for rabies will not be tested for WNV and EEE virus.

D. Human Surveillance

1. Passive surveillance: Maine CDC is the lead agency for the conduct of human case surveillance for arboviral encephalitis, meningitis, and meningoencephalitis. Arboviral testing is available at HETL, and requires a "Human Arboviral Specimen Submission Form." Instructions on submitting samples and the Submission form can be found online at http://www.maine.gov/dhhs/mecdc/public-health-systems/health-and-environmental-testing/micro/submitting_samples.htm.

Health care providers who suspect arboviral disease should submit the following specimens for testing (when possible, serum and CSF should be submitted together) along with the Human Arboviral Specimen Submission Form:

- CSF for testing by IgM Multiplex Immunoassay (MIA). All spinal fluid submission must be accompanied by a corresponding serum sample.

- Sera, both acute and convalescent, for testing by IgM Multiplex Immunoassay (MIA).

Note: Severe neurological disease due to an arboviral infection has occurred in patients of all ages. Year-round transmission is possible in some areas of the country. Therefore, arboviral disease should be considered in persons with unexplained encephalitis and meningitis with consistent travel history.

HETL's normal viral testing protocol for arboviruses includes human serology and cerebrospinal fluid assays for WNV, EEE, and SLE (St. Louis Encephalitis). Testing for LAC (LaCrosse Encephalitis) and Powassan virus is referred to the federal CDC for testing if requested.

Maine CDC promotes human surveillance activities by:

- Alerting Maine hospitals and clinicians about the importance, criteria, and requirements for reporting, along with instructions for submission of appropriate laboratory specimens (CSF, acute and convalescent sera for arboviral encephalitis).

- Providing Maine hospitals, neurologists and infectious disease physicians with clinical and epidemiologic information about human cases of WNV and EEE and criteria for reporting and laboratory testing.

All suspect human cases should be reported to Maine CDC at 1-800-821-5821.

2. Enhanced surveillance: If surveillance data indicate an increased risk of human disease, active surveillance or enhanced passive surveillance may be instituted in high-risk areas. This consists of contacting health care providers and facilities surveying for potential cases. Additionally, death records and other available surveillance systems will be utilized to screen for possible human cases of arboviral encephalitis, meningitis, or meningoencephalitis.

E. Communication of Surveillance Information

1. Routine Information: Arboviral information will be available on Maine CDC's website at http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/index.shtml.

2. Positive EEE Virus & WNV Findings: Maine CDC ensures the rapid and accurate dissemination of positive test results. Following an EEE or WNV positive mosquito pool, bird, non-human mammal or human, an investigation will be initiated and the field epidemiologist will notify the Town Manager or Selectman as well as the district liaison for that area. The Town Manager or Selectman should notify all pertinent local officials, including high-level elected and appointed officials and, as warranted, the municipal Emergency Management Director and Animal Control Officer.

3. Press Releases/ Health Alerts: Maine CDC may issues press releases or health alerts to inform the public of conditions that may warrant additional precautions to reduce the risk of disease. The Health Alert Network (HAN) will be utilized by the Maine CDC to disseminate information to health care providers in the State. All HANs are posted to http://www.maine.gov/dhhs/mecdc/.

V. RECOMMENDATIONS FOR A PHASED RESPONSE TO EEE VIRUS AND WNV SURVEILLANCE DATA

The recommendations provided here are based on current knowledge of risk and appropriateness of available interventions to reduce the risk for human disease. Multiple factors contribute to the risk of mosquito-transmitted human disease. Decisions on risk reduction measures should be made after consideration of all surveillance information for that area at that time.

Recommendations regarding the WNV and EEE phased response plan (Table 1) incorporates several components presented in the CDC document "Epidemic/Epizootic West Nile virus in the United States: Guidelines for Surveillance Prevention, and Control", 3rd Revision, 2003, as well as results of analyses of surveillance data collected in Maine and throughout the northeastern United States.

Public awareness of what can be done to reduce risk of infection is of utmost importance. The level of EEE virus and WNV activity may occasionally present a potential for increased virus transmission to humans. Typically, risk is expected to be relatively low, and the routine precautions taken by individuals may be sufficient to avoid infection. These guidelines take into consideration the complexity of reducing risk of human disease from EEE virus and WNV infection and form a framework for decision-making. They are not a set of specific prescriptions.

1. Phased Response: General guidelines are provided for an array of situations that are noted in the Surveillance and Response Plan Tables that follow. Specific situations must be evaluated and options discussed before final decisions on particular actions are made. The assessment of risk from mosquito-borne disease is complex and many factors modify specific risk factors. Maine CDC works with public health districts, community administrators, health officers, and mosquito control contractors to develop the most appropriate prevention activities to reduce the risk of human disease. There is no single indicator that can provide a precise measure of risk, and no single action that can assure prevention of infection.

When recommending the use of mosquito larvicides or adulticides, Maine CDC works to identify and support the use of risk reduction and disease prevention methods that are specific to the cause of disease, that use the least intrusive and most appropriate prevention methods, and that support planning and practices that reduce the use of pesticides. Technical support from the Board of Pesticides Control will be provided upon request. Ultimately, the decision to apply pesticides is left to the community. Communities that would like to consider pesticide use should identify licensed personnel or locate licensed contractors and consult with the Maine Board of Pesticides Control to determine that the pesticide chosen is properly registered for use in Maine.

Historical local surveillance data is critical in making informed decisions regarding risk and appropriate actions. Communities are urged to review and enhance local surveillance activities to aid in decision-making and early detection of arboviral activity.

2. Maine CDC Guidance: Throughout the arboviral season, Maine CDC will monitor activity in an attempt to ascertain risk levels as outlined in the phased response tables of this plan. Risk levels are defined for focal areas. "Focal Areas" may incorporate multiple communities, towns, or cities. Factors considered in the determination of human risk in a focal area include: mosquito habitat, mosquito abundance, current and historic virus activity, timing of recent isolations of virus in mosquitoes, current and predicted weather and seasonal conditions needed to present risk of human disease. Known/suspected location of exposure is used for human and non-human animal cases and not necessarily town of residence.

Table 1. Guidelines for Phased Response to WNV and EEE Surveillance Data

Risk Category	Probability of Human Outbreak	Definition for a Focal Area*	Recommended Response
1	Remote	All of the following conditions must be met: Prior Year No activity detected in a community or focal area. AND Current Year No current surveillance findings indicating WNV or EEE activity in the focal area.	1. Educational efforts directed to the general public on personal protection, such as use of repellents, and source reduction. 2. Routine human and non-human mammal surveillance;. 3. Assess local ecology for mosquito abundance. 4. Consider larval and adult mosquito monitoring with routine collection and testing of mosquitoes.
2	Low	Prior Year (WNV) Virus activity detected in mosquitoes. Prior 2 Years (EEE) Virus activity detected in mosquitoes during either of both of the past two years. OR Current Year WNV or EEE identified in a single mosquito trap location AND No non-human mammal or human cases	Incorporates previous category response, plus: 1. Expand community outreach and public education programs focused on risk potential and personal protection, emphasizing source reduction. 2. Assess mosquito populations, monitor larval and adult mosquito abundance, submit samples to HETL for virus testing. 3. Use larvicides at specific sources identified by entomologic survey and targeted at vector species. If appropriate, consider source reduction techniques. 4. Enhance surveillance of human and non-human mammal surveillance.
3	Moderate	Prior Year Confirmation of human and/or non-human mammal case(s) OR Sustained WNV or EEE activity in mosquitoes. OR Current Year Multiple WNV or EEE mosquito isolates AND No non-human mammal or human cases.	Incorporates previous category response, plus: 1. Increase larval control, source reduction, and public education emphasizing personal protection measures. 2. Actions to prevent disease may include targeted larviciding at likely vectors, and if current year activity, possibly ground adulticiding targeted at likely bridge vector species. 3. Enhance human surveillance and activities to further quantify epizootic activity.

* Focal area: May incorporate multiple towns or cities. Designation based on factors including mosquito habitat, current and historic virus activity, timing of current virus activity, current weather and seasonal conditions. Known/suspected location of exposure is used for human and non-human animal cases and not necessarily town of residence.

4	High	Current Year Surveillance of increasing WNV or EEE activity in mosquitoes OR A single confirmed non-human mammal case of WNV or EEE OR A single confirmed human case of WNV or EEE.	Incorporates previous category response, plus: 1. Intensify public education on personal protection measures a. Utilize multimedia messages including press releases, local newspaper articles, cable channel interviews, etc. b. Actively seek out high-risk populations (nursing homes, schools, etc.) and educate them on personal protection. c. Issue advisory information on adulticide spraying. 2. Consider intensifying larviciding and/or adulticiding control measures as indicated by surveillance. 3. Maine CDC will confer with local health officials to determine if the risk of disease transmission threatens to cause multiple human cases. If surveillance indicates a continuing risk of human disease and potential for an outbreak, intensified ground-based adult mosquito control may be recommended.
5	Critical	Current Year More than 1 confirmed human case of WNV or EEE in a community or focal area OR Multiple confirmed WNV or EEE non-human mammal cases.	Incorporates previous category response, plus: 1. Continued highly intensified public outreach messages through community leaders and the media emphasizing the urgency of personal protection. 2. If risk of outbreak is widespread and covers multiple jurisdictions, Maine CDC will confer with local health officials and Vectorborne Work Group to discuss the use of intensive mosquito control methods. A State of Emergency may be declared pursuant to Title 37-B Chapter 13 Subchapter 2 §742. The declaration of an emergency may trigger application of mosquito adulticide. Maine CDC may define targeted treatment areas for vector control following the declaration of an emergency. 3. Ground-based adulticide applications may be repeated as necessary to achieve adequate control.

APPENDIX I

BIOLOGY, ARBOVIRAL ACTIVITY, AND CONTROL CONCERNS OF SELECTED MAINE MOSQUITO SPECIES

Below is a review of the main products used for mosquito control and descriptions of the principle mosquito species likely responsible for West Nile virus (WNV) and Eastern Equine Encephalitis (EEE) virus transmission in Maine. The unique biological features pertinent to control and prevention of each species are discussed. Information was obtained from federal, state, and local publications (see reference list below) and results from the Maine and other New England state arboviral testing programs.

Control of Mosquitoes in Maine

Deciding which product and method of application to use will depend on environmental conditions, targeted species, and state/local regulations. For information regarding pesticide rules and regulations, contact the Maine Board of Pesticides Control (BPC) at 287-2731. For legal use, larvicide and adulticide products must be registered in the State of Maine. To check registration status, please contact the BPC at 287-2731 or go to http://state.ceris.purdue.edu/doc/me/stateme.html. To gauge the relative risk of larvicides or adulticides go to the BPC web site at http://www.maine.gov/agriculture/pesticides/wnv/index.htm.

Larviciding. Larviciding is a proactive measure that can be useful in reducing the risk of mosquito-borne disease throughout the season and tends to be more effective at reducing mosquito populations than adulticiding. Larviciding occurs in response to larval mosquito surveillance and habitat identification. The intent of a larvicide program is to control generations of targeted mosquito species before they reach the adult stage, when they are able to transmit diseases such as WNV and EEE. Several materials in various formulations are labeled for mosquito larviciding. Items can be classified as bacteriologic, insect growth regulators, surface films, and organophosphates. Most are effective during particular stages of mosquito development, thus timing of application is important.

(1) Bacteriologic Control: *Bacillus thuringiensis israelensis* (*Bti*) and *Bacillus sphaericus* (*Bs*) are naturally occurring bacteria used as larvicides. When ingested by mosquito larvae, they alter gut permeability killing the larvae. They are believed to pose a minimal risk to non-target species.
(2) Insect Growth Regulators: Methoprene (e.g., Altosid) mimics the action of a mosquito growth-regulating hormone and prevents the larvae from maturing into adults. It has low toxicity to birds and fish.
(3) Surface Films: Petroleum derivatives (e.g., Golden Bear Oil) produce a thin film on the surface of the water that prevents the transfer of oxygen causing the mosquito larvae/pupae to drown. Ethoxylated Alcohols (e.g., Agnique) produce a thin surface film, making it difficult for mosquito larvae, pupae, and emerging adult to attach to the water's surface, causing them to drown. The window of opportunity for use of these agents is limited by the mosquito life cycle,

especially when dealing with species that require little or no surface contact for breathing. These agents also prevent the natural transfer of oxygen into the water body. There are potential impacts to non-target species that rest on the water surface.
(4) Organophosphates: Temephos is the only organophosphate with larvicidal use and inhibits nerve signal transmission. Although it presents relatively low risk to birds and terrestrial species, available information suggests that it is more toxic to aquatic invertebrates than alternative larvicides.

Adulticiding. Adulticide involves the application of fine "mists" of pesticide over a relatively broad area to bring about the rapid knockdown of adult mosquitoes. Adulticiding occurs in response to current adult mosquito surveillance activity. Adulticiding can quickly reduce existing, biting adult mosquitoes throughout a spray area, but its effects are relatively short lived, raising the possibility of repeat applications. In addition, adulticide spray sites are most likely to be areas of high human population density.

Mosquito adulticides are dispersed either by truck-mounted equipment, backpack, or from aircraft. Barrier treatments, using compounds with residual characteristics, may also be used. Adulticides labeled for mosquito control include natural pyrethrins, synthetic pyrethroids, and organophosphates. Insecticide selection and timing of application should be based on the distribution and behavior of the target mosquito species.

- Pyrethrum: A derivative from chrysanthemum flowers that has a relatively low toxicity.
- Synthetic pyrethroids: Synthetic chemical pesticides (e.g. Permethrin, Resmethrin and Sumithrin aka D-phenothrin) that act in a similar manner to pyrethrins. They are relatively low in toxicity. Most break down rapidly in sunlight. Pyrethroids used in mosquito control are typically mixed with a synergist compound, such as Piperonyl Butoxide, which enhances the effectiveness of the active ingredient to kill adult mosquitoes on contact.
- Organophosphates: Organic compounds (e.g., Malathion and Naled) that function as nerve toxins, with the purpose of killing adult mosquitoes. There is potential for acute, and chronic risks to freshwater invertebrates and possibly other species.

Pesticides may pose their own risk to the health of humans, animals, plants, and the environment. Thus pesticides are only one component of a coordinated effort to control mosquitoes.

MAINE MOSQUITO SPECIES OF CONCERN FOR EEE AND WNV

There are 45 mosquito species present in Maine, however only a few of these are considered to be likely vectors for EEE virus and WNV. Given the short history of arboviral surveillance in Maine, it is difficult to know the specific role each mosquito species plays in EEE and WNV disease transmission. In general, species are identified as vectors based on their local abundance, demonstrated vector competence in the laboratory, and frequent infection with the virus as documented by arboviral surveillance programs. Based on these criteria, the following species are considered to be vectors of concern for EEE virus and/or WNV in Maine or the surrounding region:

- EEE virus: *Aedes vexans, Aedes cinerus, Coquillettidia perturbans, Culex salinarius, Culex pipiens, Culex restuans,Culiseta melanura Culiseta morsitans,Culiseta inornata,Ochlerotatus*

canadensis, Ochlerotatus japonicus, Ochlerotatus triseriatus, Ochlerotatus sollicitans, Psorophora ferox

- WNV: *Anopheles punctipennis, Anopheles walkeri, Aedes vexans, Aedes cinerus, Coquillettidia perturbans, Culex pipiens, Culex restuans, Culex salinarius, Culesita melanura, Ochlerotatus canadensis, Ochlerotatus cantator. Ochlerotatus japonicus, Ochlerotatus sollicitans, Ochlerotatus triseriatus*

Information pertaining to the biology and specific control concerns for these species is provided below.

Aedes cinerus

Larval habitat: Wooded snowmelt pools, semi-permanent bogs and swamps. There are several generations per year.
Overwintering stage: Egg.
Host preference: Mammals. Adults readily bite humans.
Biting times: Dusk to dawn and daytime in wooded areas. Adults rest in shaded areas and will bite if disturbed.
Flight range: 100 to 1000 feet.
Virus isolations: Maine WNV. New Hampshire EEE and WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.

Aedes vexans

Larval habitat**:** A floodwater species found in a wide variety of temporary freshwater pools and depression areas (e.g., flooded fields, retention ponds, roadside puddles). There are several generations per year.
Overwintering stage**:** Egg.
Host preference: Mammals. Adults are aggressive human biters. This species will also feed on birds.
Biting times: Dusk to dawn; may also bite during the day.
Flight range: 1-5 miles; some sources cite flight ranges > 15 miles.
Virus isolations: New Hampshire EEE, Maine WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: Thought to be an important bridge vector (able to transmit virus from a bird to a mammal) of EEE and possibly WNV. At warm temperatures (i.e., 77F), larval development is rapid, 4-6 days, followed by a short pupal stage (2 days); this process is longer at cooler temperatures. Hence, the window for effective larval/pupal control is narrow.

Anopheles punctipennis

Larval habitat: Confined bodies of water with aquatic vegetative edges and artificial containers. There are several generations per year.
Overwintering stage: Adult.
Host preference: Birds and Mammals. Major summer pest.
Biting times: Dusk to dawn and daytime. Adults rest in shaded areas and will bite if disturbed.
Flight range: 1 to 2 miles.
Virus isolations: New Hampshire WNV. WNV Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.

Anopheles walkeri

Larval habitat: Confined bodies of water with aquatic vegetative edges. There are several generations per year.
Overwintering stage: Egg.
Host preference: Mammals.
Biting times: Dusk to dawn and daytime. Adults rest in shaded areas and will bite if disturbed.
Flight range: 1 to 2 miles.
Virus isolations: New Hampshire WNV.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred. Usually collected during spring and early summer.

Coquillettidia perturbans

Larval Habitat: Permanent bodies of water with muddy substrates and abundant emergent vegetation (e.g., cattails). This species has only one generation per year.
Overwintering stage: Larvae.
Host preference: Birds and mammals. This species readily enters houses and bites humans.
Biting times: Adults readily bite humans in the early morning, at dusk, and in the evening. Adults rest in shaded vegetation during the day and will bite if disturbed.
Flight range: 1-5 miles.
Virus isolations: New Hampshire EEE. WNV and EEE isolations have been found in other northeastern states.
Maine Surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: This species is an important bridge vector of EEE. Larvae and pupae obtain air by attaching themselves to the roots and stems of emergent plants. When disturbed, they detach and burrow in the mud making them difficult to monitor and control. Larvicides, such as *Bti* and Temephos, might not satisfactorily control this species.

Culex pipiens

Larval habitat: Artificial containers (e.g., catch basins, flower pots, discarded tires) and stagnant, temporary pools with a high organic content. There are several generations per year.
Overwintering stage: Adults overwinter in damp, protected human-made structures.
Host preference: Birds and occasionally mammals.
Biting times: From dusk to dawn. Adults can be found during the day in dark, damp shelters.
Flight range: ¼ - ½ mile.
Virus isolations: Maine EEE, New Hampshire EEE and WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: This species is an important primary vector for WNV, amplifying WNV in the bird population.

Culex restuans

Larval habitat: Natural and artificial containers (e.g., tree holes, catch basins), woodland and temporary pools. There are several generations per year.
Overwintering stage: Adults overwinter in well-protected natural and manmade enclosures.
Host preference: Birds and occasionally mammals, including humans.
Biting times: Dusk to dawn.
Flight range: 1-2 miles.
Virus isolations: New Hampshire WNV and EEE. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: This species is an important primary vector for WNV, amplifying WNV in the bird population.

Culex salinarius

Larval habitat: Brackish salt marshes and freshwater wetlands; occasionally collected from artificial containers (e.g., catch basins, discarded tires). There are several generations per year.
Overwintering stage: Adults overwinter in natural and man-made structures.
Host preference: Birds, mammals, reptiles, and amphibians. Adults readily attack humans, often entering houses.
Biting times: Dusk to dawn. Adults can be found during the day in cool, shaded sites.
Flight range: ¼ - 5 miles.
Virus isolations: New Hampshire EEE and WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October).
Control concerns: This species is thought to be a bridge vector for EEE and possibly WNV.

Culiseta inornata

Larval habitat: Wooded snowmelt pools, marshes, bogs, swamps. There are several generations per year.

Overwintering stage: Adult
Host preference: Mammals (humans).
Biting times: Dusk to dawn.
Virus isolations: Maine EEE. WNV and EEE isolations have been found in other states.
Maine surveillance: Collected throughout the arboviral season (June-October) in southern coastal areas.

Culiseta melanura

Larval habitat: Underground aquatic crypts or sheltered bodies of water among tree roots in acidic Red maple and Atlantic White Cedar swamps. There are several generations per year.
Overwintering stage: Larvae.
Host preference: Almost exclusively birds, rarely mammals (humans).
Biting times: Dusk to dawn.
Flight range: Sources vary from ½ - 5 miles.
Virus isolations: New Hampshire and Maine both EEE and WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: *Culiseta melanura* is an important primary vector for EEE, amplifying EEE in the bird population. There may be multiple adult emergence peaks during the season, depending on temperature and rainfall conditions. Crypts where larvae develop are not interconnected and often have only small openings making them difficult to treat.

Culiseta morsitans

Larval habitat: Permanent and semi-permanent bogs, swamps, tree root cavities, and boggy margins of lakes. One generation per year.
Overwintering stage: Egg.
Host preference: Almost exclusively birds, rarely mammals (humans).
Virus isolations: New Hampshire EEE. EEE and WNV isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: This species can be an important primary vector for EEE, amplifying EEE in the bird population.

Ochlerotatus canadensis

Larval habitat: Temporary leaf-lined woodland pools, drainage ditches, and freshwater swamps. It has one large generation in late spring, and then a partial second generation in late summer, depending on the amount of rainfall.
Overwintering stage: Egg.
Host preference: Mammals, birds, reptiles, and amphibians. Adults readily bite humans.
Biting times: Dusk to dawn. Adults rest in shaded areas and will bite if disturbed.
Flight range: Up to ¼ mile.

Virus isolations: New Hampshire EEE and WNV, Maine WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: Possibly a bridge vector for EEE, especially during intense viral activity. Control of this species is difficult because the water bodies in which it breeds are isolated from each other.

Ochlerotatus cantator

Larval habitat: Temporary saline and brackish pools in coastal salt marshes. There are several generations per year.
Overwintering stage: Egg.
Host preference: Mammals (humans), birds.
Biting times: Dusk to dawn and during the day. Adults rest on vegetation during the day and will actively bite if disturbed.
Flight range: 5-40 miles.
Virus isolations: Maine WNV. WNV and EEE Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October).
Control concerns: This species may be a bridge vector of EEE and WNV.

Ochlerotatus japonicus

Larval habitat: Natural and artificial containers including tree holes, catch basins, bird baths, and discarded tires. There are several generations per year.
Overwintering stage: Egg.
Host preference: Birds and mammals.
Biting times: Dusk through dawn and during the day.
Flight range: Less than 1 mile.
Virus isolation in Maine: Maine and New Hampshire WNV. WNV and EEE isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October) from all counties in which surveillance occurred.
Control concerns: This species may be a bridge vector of EEE and WNV. As this species is relatively new to New England, better guidance will be provided pending accumulation of more information about its role in EEE and WNV transmission.

Ochlerotatus sollicitans

Larval habitat: Temporary saline pools in coastal salt marshes. There are several generations per year.
Overwintering stage: Egg.
Host preference: Almost exclusively mammals, rarely birds.
Biting times: Dusk to dawn and during the day. Adults rest on vegetation during the day but will bite if disturbed.

Flight range: 5-40 miles.
Virus isolations: Maine WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October).
Control concerns: This species may be a bridge vector for EEE.

Ochlerotatus triseriatus

Larval habitat: Tree holes, catch basins, tires, buckets, gutters, other natural and artificial containers. There is one generation per year.
Overwintering stage: Egg.
Host preference: Mammals, birds and reptiles.
Biting times: Dusk to dawn. Adults rest on vegetation and containers during the day but will bite if disturbed.
Flight range: ½ to 1 mile.
Virus isolations: New Hampshire EEE and WNV. Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (June-October).

Psorophora ferox

Larval habitat: Wooded temporary ground pools, flood-water areas. There is one generation per year.
Overwintering stage: Egg.
Host preference: Mammals (humans).
Biting times: Dusk to dawn. Adults rest on vegetation in wooded areas during the day and will bite if disturbed.
Flight range: Up to 1 mile.
Virus isolations: New Hampshire EEE. WNV and EEE Isolations have been found in other northeastern states.
Maine surveillance: Collected throughout the arboviral season (July-October).

Appendix II

Mosquito Testing at Maine Department of Health and Human Services, 2012

Please find below information pertaining to mosquito testing through Maine's Health and Environmental Testing Laboratory (HETL) during 2012. Mosquitoes will be tested for Eastern Equine Encephalitis (EEE) virus and West Nile virus (WNV).

1. Mosquito pools may contain a maximum of 50 mosquitoes. Please be careful not to exceed the 50-mosquito pool size, as there may not be remaining space for adding the necessary reagents. HETL will REJECT for testing any pools that they cannot process due to excessive pool size. These pools will be held at HETL.

2. Please be sure to include detailed information on trap location. Trap location may be used for GIS mapping as well as analyzing location-specific changes over time. Both uses require detailed address information to ensure consistent results and tracking.

3. The mosquito season will begin on July 1, 2012 and go through October 1, 2012. Testing will be performed in the following manner:

a. Phase I - July 1 through October 1, 2012 or first Maine EEE or WNV detection (dates pertain to date of collection):

i. *Ae. vexans, Cs. inornata,Cs. melanura, Cx. pipiens, Cx. restuans, Cx. pipiens/restuans* and *Cq. perturbans :* Only these species will be tested. Any pool size may be submitted for testing but pool size cannot exceed 50 mosquitoes. As soon as EEE or WNV is detected in Maine, mosquito submissions will follow phase II.

ii. Other mosquito species: During the mosquito season, please discard (or hold internally if interested) any mosquitoes that are not *Ae. vexans, Cs. inornata,Cs. melanura, Cx. pipiens, Cx. restuans, Cx. pipiens/restuans* or *Cq. perturbans.* Other mosquito species may be tested on a case by case basis, as resources and time allow. As soon as EEE or WNV is detected in Maine, mosquito submissions will follow phase II.

b. Phase II - First Maine EEE or WNV detection through October 1, 2012 (dates pertain to date of collection):

i. If presence of either EEE or WNV detected in Maine, the testing criteria will be reevaluated and additional species may be tested.

ii. Other mosquito pools not meeting the above criteria: Other mosquito species may be tested on a case by case basis, as resources and time allow. Otherwise, please discard (or hold internally if interested) any mosquitoes that do not meet the above criteria.

RESOURCES

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