

Mosquitoes in Massachusetts: What Are We to Do?

Pam Rockwell, OARS Board of Directors

Here in Eastern Massachusetts we live with two rare but serious mosquito-borne illnesses, Eastern Equine Encephalitis (EEE) or “Triple E” and West Nile Virus (WNV). Recently the Zika virus, also spread by mosquitoes, has been in the news. Mosquitoes, a food source for fish, amphibians and birds, are an important player in our ecosystem. Traditional mosquito habitat control (draining or filling wetlands) is not an effective control for these mosquitoes, which thrive in our suburban environments. Pesticides are commonly used to control them, but can adversely affect other animals, especially bees. It’s high time to learn more.

Mosquito-borne Diseases in Massachusetts

Most of the 51 mosquito species found in Massachusetts do not cause disease. While we had malaria and yellow fever up until the 1940s, EEE and WNV are the two major diseases that are currently spread to people by mosquitoes in this state. However, our local ecology can still support mosquito-borne viruses and

parasites from the tropics, such as Zika. These are transmitted by a limited number of mosquito species, each of which has very specific habits and habitats.

Eastern Equine Encephalitis: Although rare, EEE is the deadliest New England mosquito-borne virus and there is no vaccine to prevent it. The only treatment is to provide supportive care until the infection passes. According to the Centers for Disease Control and Prevention (CDC), 33% of cases are fatal and many survivors have brain damage. According to the Massachusetts Department of Public Health (DPH) there have been 20 human cases of EEE in the state in the last 10 years. EEE is typically spread only between birds by *Culiseta* mosquitoes, which rarely bite mammals. Horses and humans, however, can get EEE from mosquitoes that bite both birds and mammals, like *Aedes*, *Coquilleltidia*, or *Culex* mosquitoes.

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Partners on the Hill

When Senator Mike Barrett visited OARS he asked: Who funds water quality monitoring of your rivers? When he learned that every year funding is pieced together from member donations and grants, he dedicated himself to having the State make a fair contribution. Thanks to Senator Barrett, Senator Eldridge, and our other watershed legislators and their colleagues, the FY17 state budget includes \$25,000 for water quality monitoring of our three rivers. This will ensure that water quality data continue to be collected to support sound, science-based decision-making. These funds were included in another significant achievement for our legislators—overturning the Governor’s Department of Environmental Protection (DEP) and Department of Conservation and Recreation (DCR) budget cuts in the last hours of the session, slowing somewhat the incessant reductions in key environmental budgets.

More good news: the Joint Committee on Environment, Natural Resources and Agriculture stopped a bill that would have moved water pollution permitting (NPDES) from the federal EPA to the state’s DEP. Investigative journalist Beth Daley interviewed OARS to uncover examples of DEP’s inability to keep up with water pollution control due to underfunding—case in point, MCI-Concord’s ongoing pollution of the Assabet River.

This account, published in regional papers, TV, and radio, was one of several examples of DEP’s current shortcomings that OARS, Mass. Rivers Alliance, Environmental League of Massachusetts, and other environmental advocates provided to legislators. The hard-won progress we have made on cleaning up our rivers, particularly the Assabet, is due in no small part to the EPA’s science-based permits and backbone to enforce them. Diluting these efforts by making permitting more susceptible to pressure by permittees is not going to result in cleaner or healthier rivers. OARS’ Executive Director Alison Field-Juma served on DEP’s NPDES Delegation Advisory Committee in 2013 and 2015/16 and will continue to advocate strongly for policies that serve our rivers and communities.

NECIR REPORT STATE

‘Dirty water’ rises again

Budget cuts disarm environmental fight

By Beth Daley
and Caitlin Bawn
The Eye (NECIR)

Basic environmental protections for Massachusetts residents have unraveled in the last 15 years as deep budget cuts and shifting political

priorities took hold.

The state has slashed bacterial testing of lakes, rivers and other surface water by more than two-thirds in the last decade, according to state-reported data analyzed by The Eye. Inspections of contaminated properties and waste and water sites have dropped 24 percent from fiscal 2001.

The state Department of

hasn’t collected water-quality data on the Neponset River since 2009, the agency confirmed. The Neponset River Watershed Association and other environmental groups say they are worried boaters and swimmers across the state are being exposed to high levels of bacteria or other contaminants.

An illegal discharge from a pipe connected to the state prison in Concord, first

ordered to be fixed six years ago by DEP, was still apparently leaking into the Assabet River in Concord in December, when state tests found the pipe spilling elevated levels of *E. coli* bacteria, often a marker for sewage. DEP spokesman Joe Ferson said the agency is working with the prison to solve the problem.

SEE STORY ON



Protecting, preserving, and enhancing the Assabet, Sudbury, and Concord Rivers, their tributaries and watersheds for the purposes of public recreation, water supply, and wildlife habitat.

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Blue Skies, Dry Streams

It's summertime, and not just any summertime. This time we are in year two of a drought and the fish aren't exactly jumping, nor is the corn high. Our rivers have been at record low flows for days at a time, which brings challenges for people and wildlife alike. Looking at the dry streambeds we can see how important it is for fish and other riverine life to be able to find refuge in the small cool springs and not be blocked by perched culverts or dams. People start to think about how they share the water and where it comes from: will turning off the lawn sprinkler help the fish? Even if I have my own well? (Yes, we share the same water.)



River recreation also suffers as the boats scrape bottom—and it is just awfully hot out there. That has not stopped our faithful summer staff from paddling (or walking) down our rivers mapping water chestnut, pulling it out, and teaching the young 'uns about the water cycle and our rivers in Water Wise Workshops. OARS volunteers have also been pulling water chestnut in Framingham and Maynard and building trails along the river in Acton. Bravo to them all!

Summertime also means being outside sharing time with lots of insects—including mosquitoes! While the buzzing in our ears and the bites are a nuisance, a few of the 51 local species can transmit diseases and be a public health problem. This newsletter provides information that we hope will help you protect your own health and advocate for the most effective methods of mosquito management that also protect our rivers. In the old days thousands of acres of wetlands were drained and filled. Now we have better ways to manage water—if we choose to use them. We have more information and links on our website for you to peruse.

The busy legislative session on Beacon Hill has run its course and river and environmental advocates succeeded in maintaining the EPA's role in Clean Water Act permitting. A hastily filed bill by the Governor to devolve pollutant permitting to the state received significant scrutiny. OARS and others made the case that the state should adequately fund DEP's clean water permitting, monitoring and enforcement work first, before adding a large and costly program that the EPA currently runs at no cost to the state. Such a major change should not be approved without first showing that it will benefit our water resources and rivers! This summer's drought illustrates once again that our rivers' improved health is not assured.

May you all find rejuvenation in our beautiful landscape,

Alison Field-Juma
Executive Director

Nashoba Brook in West Concord

August 4, 2016



Meet our Summer Environmental Assistants and Interns!



Sue Flint, Staff Scientist, works with Nate Nichipor and David Lipinsky, mappers, and Nick Tepper and Christian Boisvert, Rapid Response Team, to plan out the week's water chestnut mapping and pulling work.



Christian pulling water chestnut in Stow on the Assabet River.



Nick with a snapper he uncovered in Hudson.

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Every chestnut matters!
.....

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—Rapid Response Team motto
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Top: Nina Prakash and Dana Siskind collect macro-invertebrates in Hudson to prepare for the “Water Bugs Mystery” Water Wise Workshops.

Bottom: Nina and Dana with Hudson Boys & Girls Club campers at Great Meadows National Wildlife Refuge on the Sudbury River.

OARS' Board Members Receive River Steward Awards

On June 17, Allan Fierce of Stow and Dick Lawrence of Hudson received 2016 River Steward Awards from the Wild and Scenic River Stewardship Council and the League of Women Voters.

Motivated by their love for the river, Allan and Dick have led the volunteer water chestnut control efforts on the Assabet River since 2010. They have organized OARS volunteers in collecting the plants, loading the invasives into Dick's little yellow pickup truck and hauling them off for composting. Without Allan and Dick's efforts it is likely the water chestnuts would not be largely under control on the Assabet River.

Allan and Dick are water chestnut heroes — totally dedicated and hard working and a joy to work with!



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Infected mammals do not have a high enough level of virus in their blood to spread the virus to another mosquito. Birds do not usually die from EEE infection, so monitoring is currently limited to trapping mosquitoes and evaluating infections of humans and horses.

West Nile Virus: According to the CDC most people with West Nile do not show any symptoms, but 1% develop neurological illness similar to EEE, and 10% of those die. There is no specific treatment or vaccine. Like EEE, WNV circulates between mosquitoes and birds, and only infects mammals by chance. According to DPH, the virus is most often carried by *Culex* mosquitoes, which feed primarily on birds, but are more likely to feed on humans and other mammals than the *Culiseta* mosquitoes. During the first years of the WNV outbreak, blue jays and crows often died from the infection, and DPH monitored dead birds to look for outbreaks. But in just 17 years, these birds have developed a tolerance for West Nile, and now DPH limits surveillance to trapping mosquitoes and tracking human cases.

Weather conditions favorable for development of elevated WNV risk include hot, generally dry weather with rain occurring as downpours rather than light precipitation.

Zika Virus: So far, the only cases of Zika fever in Massachusetts are from travelers returning from infected areas, but scientists are watching for signs that this virus could develop a local transmission cycle, as it now has in Florida. According to the CDC, most people recover quickly from the mild symptoms

of Zika, which is why prior outbreaks elsewhere have only been detected incidentally. In 2015, however, a widespread outbreak of Zika in Brazil was associated with a severe birth defect, microcephaly, and in February 2016 the World Health Organization declared Zika virus to be a world health emergency. According to the CDC's Arboviral Diseases Branch, as of June 2016, 60 countries reported continuing mosquito-borne transmission of Zika. In the past year, CDC has developed tests to identify Zika fever, which appears to be transmissible between people through sexual contact, from mother to fetus, or through blood transfusions.

There are signs that Zika virus transmission could potentially occur in Massachusetts. Zika is typically spread by *Aedes* mosquitoes, which are active during the day, not just at dawn and dusk. *Aedes* mosquitoes bite mammals, particularly humans. Unlike EEE, it appears that a mosquito that bites an infected person can then pass on Zika to other people – in other words, Zika's natural host includes human beings, not birds. The good news is that right now, *Aedes* mosquitoes are not normally found quite as far north as Massachusetts.

By planning ahead, we can encourage the most effective mosquito-borne illness control strategies that cause little or no environmental damage. Reducing mosquito breeding areas near our homes, protecting our bodies, and using pesticides are all methods in our toolbox.

How to Reduce Mosquito Habitats

Reducing artificial mosquito breeding habitats is the best way to prevent mosquito-borne disease and reduce the need to use toxic

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How to Protect Yourself From Mosquito-borne Diseases

Prevent mosquito bites by covering up, going inside when the mosquitoes are out, and using insect repellent. Wear long-sleeved shirts and long pants, and use mosquito netting if you are sitting or sleeping outside. EEE and West Nile are transmitted by mosquitoes that are active from dusk to dawn, so going inside in the evening will reduce your exposure.

Reduce your exposure to insect repellents by applying them to your clothing rather than your skin. The DPH recommends using a repellent with DEET, permethrin, picaridin, IR3535, or oil of lemon eucalyptus and offers this advice:

- *When used as directed on the product label, insect repellents containing DEET, picaridin, and IR3535 are safe for pregnant women.*
- *If you are also using sunscreen, apply sunscreen prior to using repellent.*
- *DEET products should not be used on infants under two months old and should be used in concentrations of 30% or less on older children.*
- *Oil of lemon eucalyptus should not be used on children under three years old.*
- *Permethrin products are intended for use on items such as clothing, shoes, bed nets and camping gear and should not be applied to skin.*

More information on choosing and using repellents safely is included in the Mass. DPH Mosquito Repellents fact sheet.

chemicals. Mosquitoes that carry disease can reproduce in less than two weeks in stagnant fresh and brackish water. This means they thrive in junkyards, open containers that collect rainwater, catch basins and clogged drainage ditches. Some of the best practices to control mosquitoes are the same ones that protect our rivers and watershed:

- Eliminate outdoor trash and containers that might collect water: tires, toys, old cans and bottles, poorly draining flower pots, trashcans and old buckets. Be sure that window boxes have drainage holes. Mosquito eggs can stick to the sides of containers and remain attached until they are covered by water and hatch, so empty and scrub containers that can refill.
- Clean out clogged gutters: be sure that paths from gutter to ground are clear and properly positioned to prevent water pooling. Corrugated plastic gutter extensions create hidden mosquito habitats.
- Change the water in birdbaths every few days.
- Position awnings, umbrellas, pool covers, and other outdoor fabrics so they don't collect water.
- If you have a surface vent for your septic system or sump pump, or have a rain barrel, be sure to cover the opening with a screen mesh small enough to block mosquitoes.
- Be sure that sand and sediments from driveways and roads do not block the drainage of stormwater runoff. Repair pavement so there are no water collection points, including where the pavement meets your garage floor. One more good reason to use permeable surfaces on your property!
- And don't forget inside your house: adult mosquitoes can rest indoors – repair your window screens to keep them out!



Rain gardens allow stormwater runoff from roofs, driveways, walkways, parking lots and other impervious surfaces to be absorbed into the ground.

Finally, remember that mosquito habitat reduction harmonizes with good water management practices. Support community stormwater management projects, such as vegetated swales and raingardens—when properly built, these will drain quickly. Removing dams will improve stream flow, and creating a healthy environment for mosquito predators will also help—from fish and amphibians to birds and bats.

Using Pesticides to Prevent Mosquito-borne Diseases

Carefully targeting the type and timing of pesticide applications can reduce the risks to the local ecology by limiting the total exposure to pesticides. Using chemicals that break down quickly so they do not persist in the environment, avoiding times when beneficial insects are active, and targeting mosquito larvae will help us do more good than harm.

Larvicides. Mosquito eggs hatch in still water and mosquito larvae spend up to two weeks growing until they pupate and fly away. Larvicides are pesticides that are added directly to water to kill the larvae. The most common larvicides are bacteria: *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* make a toxin that kills the larvae when they eat the bacteria. The toxin is specific to mosquitoes and a few closely-related insects like black flies and midges, but is not toxic to bees or fish.

Bti can knock down mosquito breeding at an application site within 24 hours, but it must be applied directly to the water that larvae live in. It is available in briquettes (like Mosquito Dunks©) and powders for use in rain barrels and catch basins. Bti can be sprayed from a truck, but it will only be effective if it actually lands in the water. Bti is only effective for a short time, which is why slowly-dissolving briquettes are preferable. Spraying inaccessible wetlands from helicopters in the early spring has questionable effectiveness for disease control.

Growth regulators like methoprene (Altosid©) can also be used. Methoprene acts like a hormone and prevents mosquito larvae from developing into adults, but it has been shown to be toxic to amphibians and shellfish. Like Bti, methoprene is available in a briquette, so it is important to check the label to distinguish whether you are getting the bacteria-based larvicide or the more broadly toxic growth regulator. Methoprene lasts longer in the environment than Bti, which is why many communities use it in catch basins. Alternating bacteria and growth regulators can prevent the development of resistant larvae.

Adulticides, such as sumithrin (Anvil©), other pyrethroids, and malathion are very effective at killing flying insects, especially adult mosquitoes. But they also are toxic to bees, dragonflies, and fish. In high concentrations, they are also neurotoxic to human beings. Typically, adulticides are sprayed by handheld sprayers or trucks. When you see a truck spraying insecticide on a summer evening, it is most likely spraying an adulticide like sumithrin.

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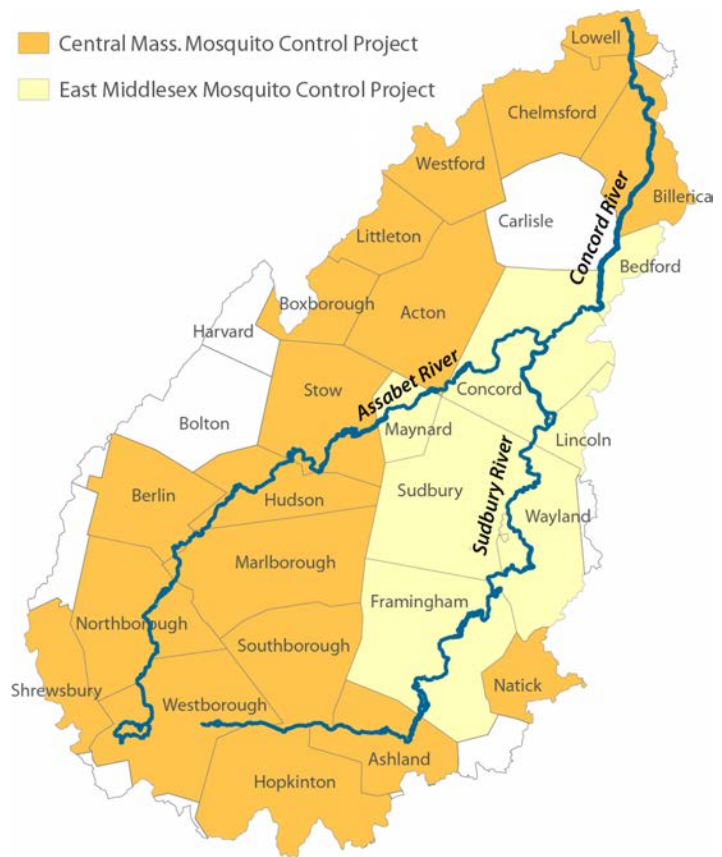
Previous generations of adulticides, like DDT, persisted in the environment and killed fish and birds, but modern adulticides break down fairly quickly in sunlight and do not become a persistent problem. Still, they are neurotoxins, and can affect fish, and in higher concentrations, birds and mammals. They should not be sprayed directly on water. To prevent pollinators from being harmed, mosquito adulticides are often sprayed after dusk when mosquitoes, but not bees, are active. However, some beneficial insects are active at night. Bees and other pollinating insects will be out at dawn landing on flowers that may have residue before the sun has broken it down.

Entomologist Dr. Anthony Kiszewski of Bentley University, questions whether spraying adulticides has a significant effect on the disease-carrying mosquito populations in Massachusetts: “These chemicals break down so quickly. They will only have an effect if a mosquito is actually touched by the chemical, and the trucks only have access to the spaces directly adjacent to the road.” The quick breakdown of pyrethroids means that they need to be sprayed between dusk and 11pm when mosquitoes are active. While that might have a small impact on the mosquitoes that carry EEE and West Nile, the *Aedes* mosquitoes that carry Zika are most active during the day so they would be less affected. Even when the local adult population is reduced, new mosquitoes will hatch within days.

Mosquito Control Projects. Most towns do not have the resources to assess when there is a public health need to control mosquitoes. The Mass. Dept. of Agricultural Resources oversees mosquito surveillance programs in districts across the state.



Dr. Kiszewski collects a sample from one of 50 mosquito egg traps that he monitors in Concord and in the Boston area. Half-filled water cups with paper liners attract mosquitoes of many species to lay eggs. The papers are collected regularly and taken to the laboratory where the eggs are counted and hatched and then sorted by species. Adult mosquito traps, like the one on the right, allow scientists to look specifically for viruses and monitor for specific health concerns.



Individual towns join their local Mosquito Control Project, which monitors mosquitoes, maintains ditches, and educates the public. The Control Projects also apply pesticides: adding larvicide to catch basins, doing aerial spraying with larvicides over waterways that have been identified as mosquito breeding grounds, and sending out trucks to spray adulticides.

Surveillance programs collect mosquitoes in member towns with CO₂-baited traps, and identify the number and species collected. This is particularly important since most of the mosquito species in Massachusetts do not cause disease. The program also identifies mosquito breeding grounds, and interfaces with the DPH to identify disease presence in mosquito populations. Surveillance can help distinguish between mosquitoes that harbor arbovirus (mosquito-borne virus) and innocuous species that are just a nuisance.

Mass Audubon Senior Policy Analyst Heidi Ricci points out that, “One of the biggest flaws in the state mosquito control system is that communities can’t get mosquito testing services unless they are part of a district, but then they often are forced to sign on to a program that allows homeowners to request neighborhood spraying based on an individual’s perception of mosquito nuisance.” Members of the Central Mass. Mosquito Control Project do not get to pick which services they get. The Project applies larvicides in catch basins early in the season, and decides

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when adulticides will be applied. A detailed adulticide spraying schedule is published on the Project's website.

However, not all projects operate by the same rules. East Middlesex Mosquito Control Project (EMMCP) superintendent Dr. David Henley points out that his Project provides more flexible services, allowing members to select whether they want only larvicides or, at a greater cost, comprehensive adulticide applications. Dr. Kiszewski, the Concord EMMCP representative, points out that Concord has limited its pesticide use to larvicides in catch basins and mosquito breeding sites. But Concord's restraint is just one end of the pest management spectrum. According to the EMMCP website, Sudbury and Bedford were sprayed with sumithrin this summer.

Environmentalists like Ms. Ricci would like to see public health be the focus of the mosquito control projects. This could be facilitated by adding representatives from the Departments of Public Health and Fisheries and Wildlife to the control project management, and adding local public health official representation to the regional districts. Surveillance could be expanded to look for impacts of pesticide use on wildlife, especially pollinators, fish, and birds. Management techniques should be continually updated to incorporate the best scientifically-validated methods.

In the meantime, it is up to individuals to support the most environmentally-friendly practices in their own towns by making their opinions known to their town representative. Homeowners who wish to opt out of pesticide applications need to file a request with their town clerk by March 1st and mark their property with orange tape. If they want to opt out after the season has started, they should contact their Control Project superintendent directly—most towns will respect a late request and a posted sign like a paper plate that says “no spray.” During a public health emergency it is unlikely that an individual homeowner will be able to opt out of spraying.

Homeowners can contract with pest control companies to spray pesticides on their property, but buyer beware: you pay these companies to apply chemicals, not prevent disease. They may plan to apply pesticides when it is convenient, not when mosquitoes are active. And their treatment may not distinguish the disease-carrying mosquitoes from the nuisance of the many disease-free mosquito species. Pesticides that are over-used can also lead to pesticide resistance.

For a more detailed version of this article and links to sources go to: oars3rivers.org.

What Will Global Warming Bring?

Warm temperatures increase the rate of both mosquito development and virus replication within mosquitoes and therefore act to increase the amount of virus in the environment overall...

Additionally, warmer winter temperature conditions may result in larger numbers of Culex species overwintering as adults, with resulting increases in early season Culex abundance...

Weather conditions favorable for development of elevated WNV risk include hot, generally dry weather with rain occurring as downpours rather than light precipitation. Weather conditions favorable for development of elevated EEE risk include increased rainfall in the preceding fall and/or spring and mild winters or those with insulating snow cover.

Source: Mass. DPH 2016 Arbovirus Surveillance and Response Plan.



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OARS

OARS is your local river conservation organization. Established in 1986 to protect the Assabet River, OAR added the Sudbury and Concord Rivers to its mission in 2011 and became OARS.

OARS depends on its members, a dedicated board of directors, a small professional staff, and a large corps of active volunteers. Our work benefits all communities in the Assabet-Sudbury-Concord watershed.

Please visit us at www.oars3rivers.org

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Assabet-Sudbury-Concord Watershed

