

Mosquito Biology and Ecology

Chuck Lubelczyk, MPH

MaineHealth institute for Research

Scarborough, ME 04074

charles.lubelczyk@mainehealth.org



The Family Culicidae - Mosquitoes

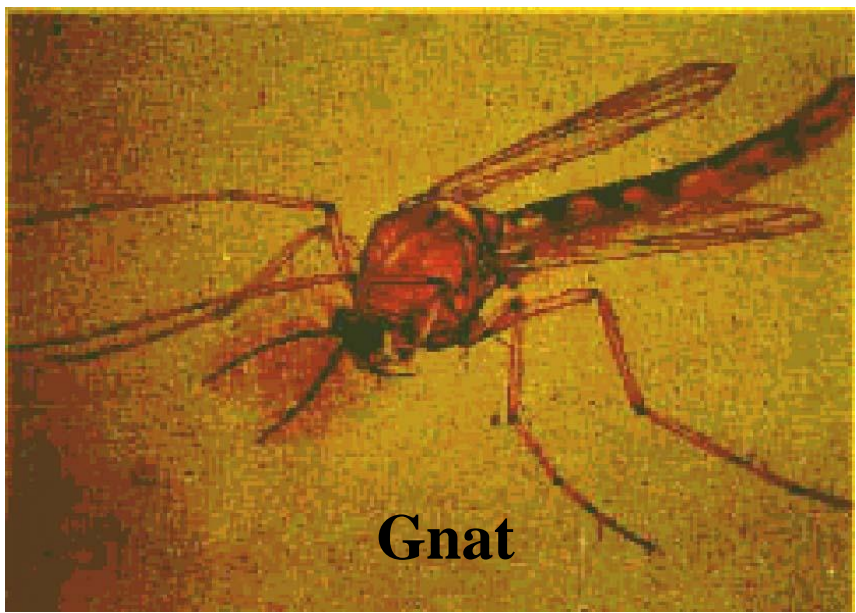
- Worldwide distribution
- > 3450 species and subspecies (38 genera)
- Great habitat diversity
- Approximately 40 million years older than humans (fossils from Eocene, 38-54 mya)
- **Anophelinae** (subfamily) - *Anopheles* (genus)
- **Culicinae** (subfamily) - *Aedes*, *Culex*, *Haemagogus*, *Mansonia*, *Ochlerotatus* and all other genera

Mosquito Characteristics

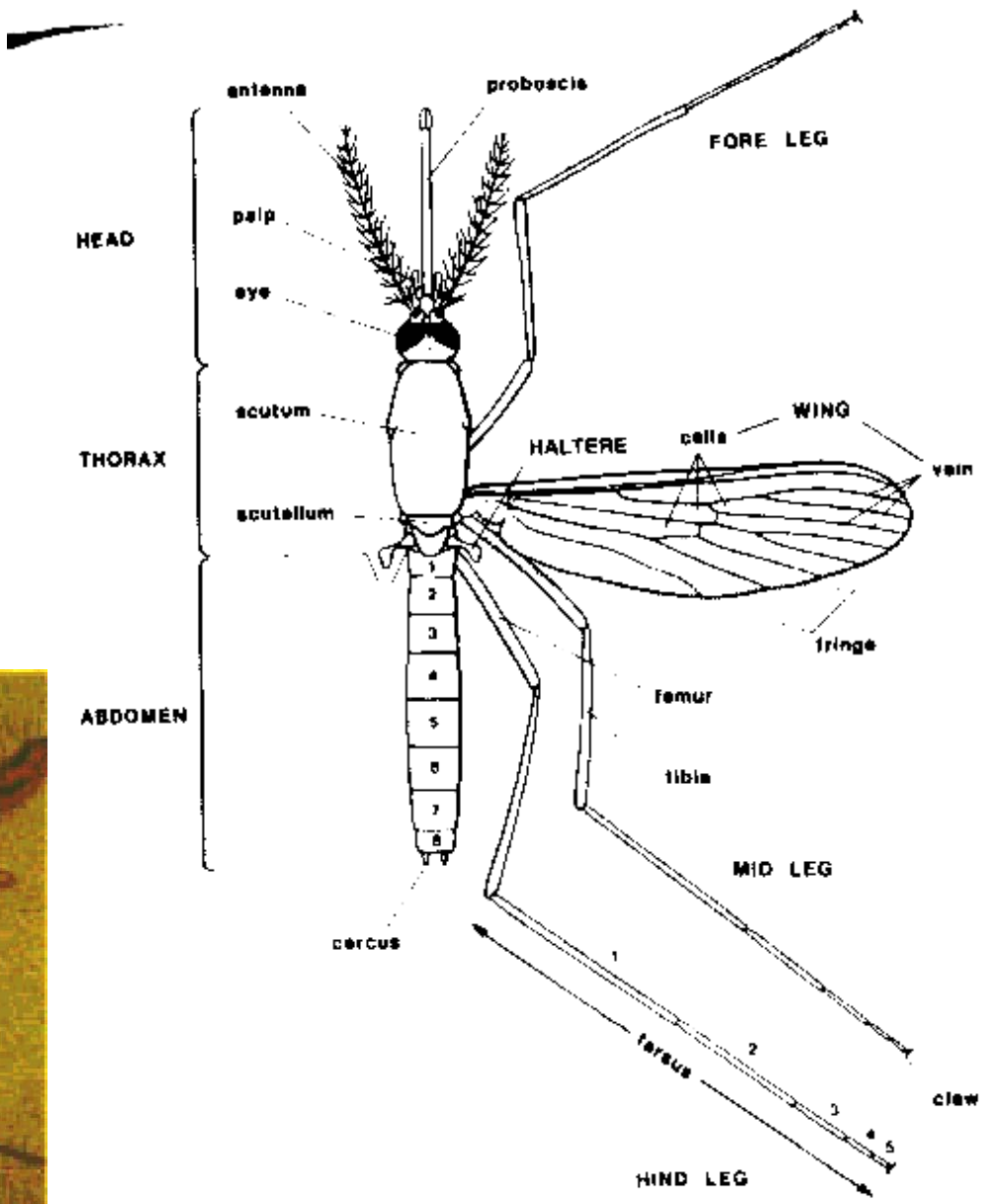
- Conspicuous proboscis - forward projecting
- Scales on thorax, abdomen, legs & wing veins
- A fringe of scales along the posterior margin of the wings

Mosquito Characteristics (note conspicuous forward projecting proboscis)

Non-biting Gnat (note proboscis curved under head)



Gnat



Mosquito Characteristics

- Bloodfeeding - only females take blood
- Males and females feed on plant sugars
- Gonotrophic cycle - feed, egg development, oviposition (half-gravid, gravid)
- Egg biology - oviposition location, type of egg, desiccation resistance, diapause
- Larval biology - aquatic, spiracle for breathing, filter-feeders, some cannibalistic, variable habitats

Mosquito Life Cycle



Eggs



Larva



Pupa



Adult



(1) Eggs – 3 strategies

- Singly on water surface
 - *Anopheles*
- Singly in a pile, on moist substrates
 - *Aedes/Ochlerotatus*
- Form of a raft, on water surface
 - *Culex*
 - *Culiseta*

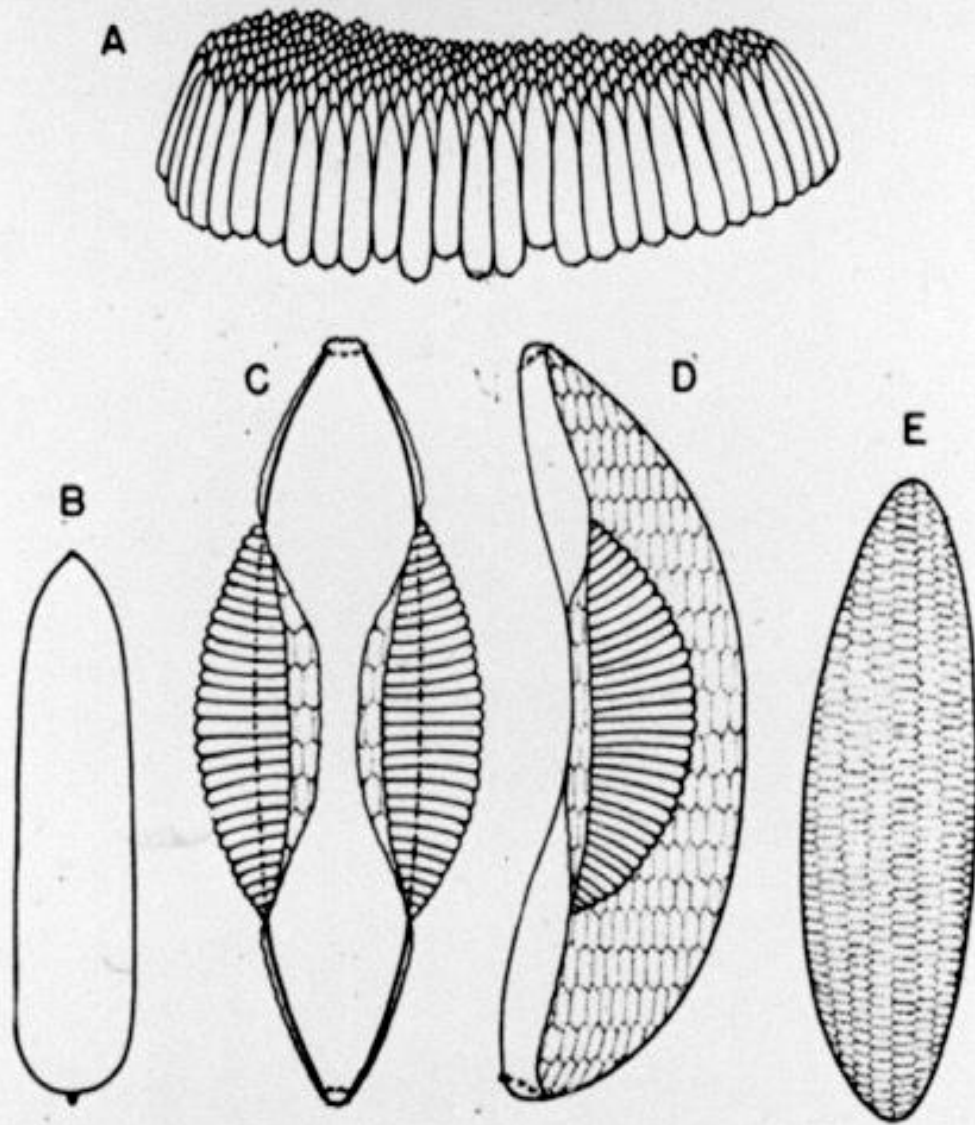


Fig. 23. Eggs of mosquitoes. A, Egg raft of *Culex*. B, Single egg of *Culex*. C, Egg of *Anopheles* (dorsal view). D, Egg of *Anopheles* (lateral view). E, Egg of *Aedes aegypti*.

Family Culicidae

Mosquito eggs:

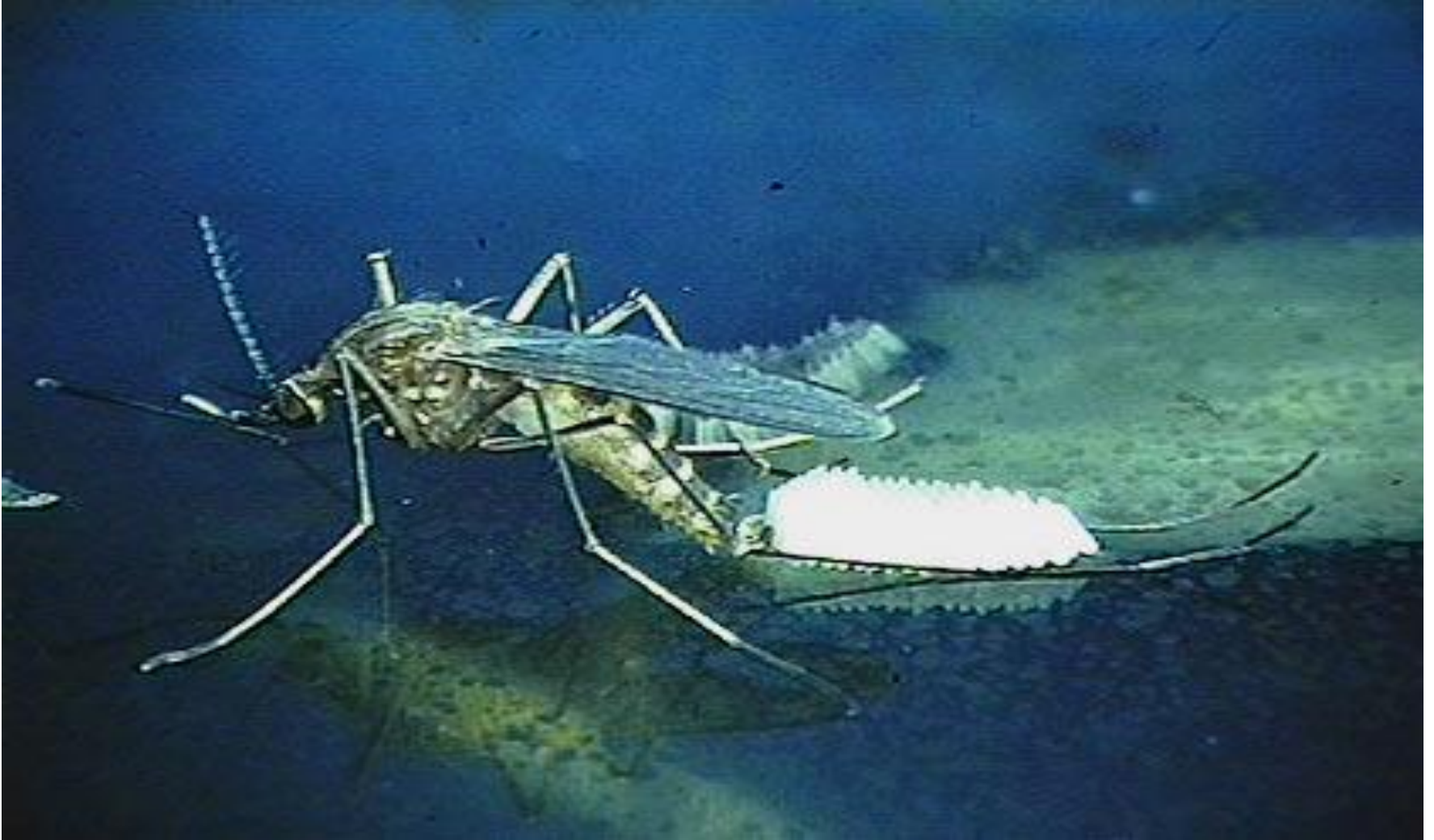
Culex egg raft

Anopheles egg
with 'floats'

Aedes egg

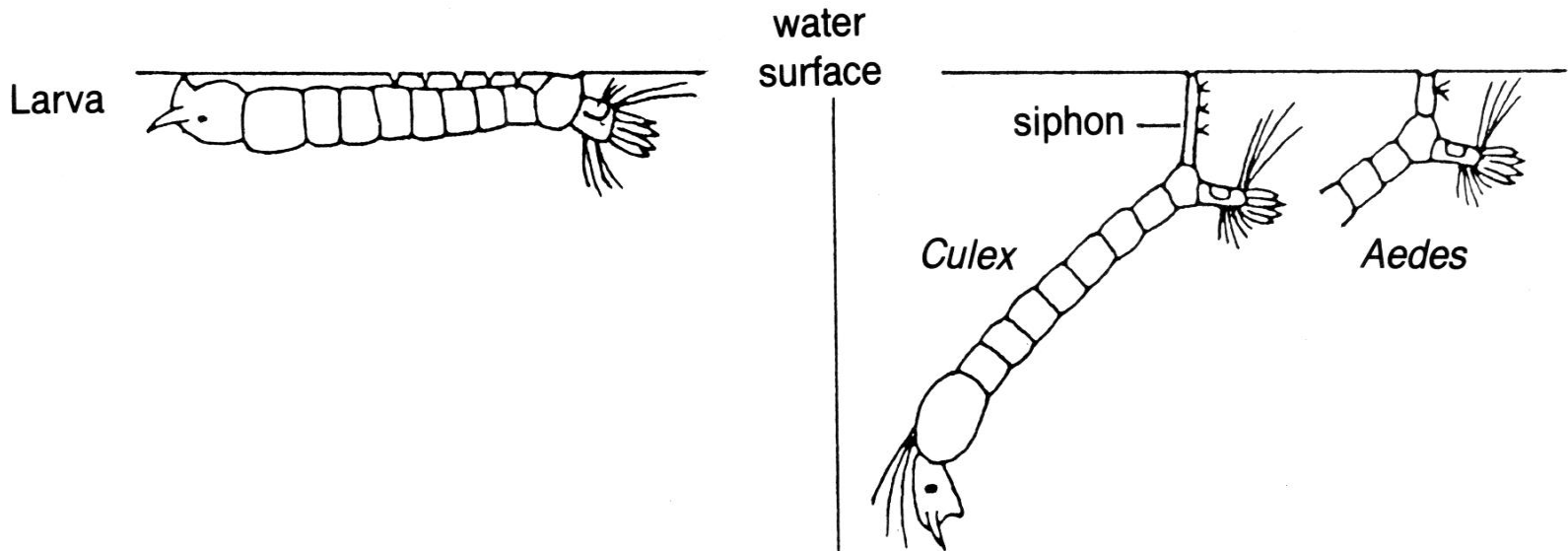
Patterns on the
external egg
surface are
species specific

CULEX Egg Raft

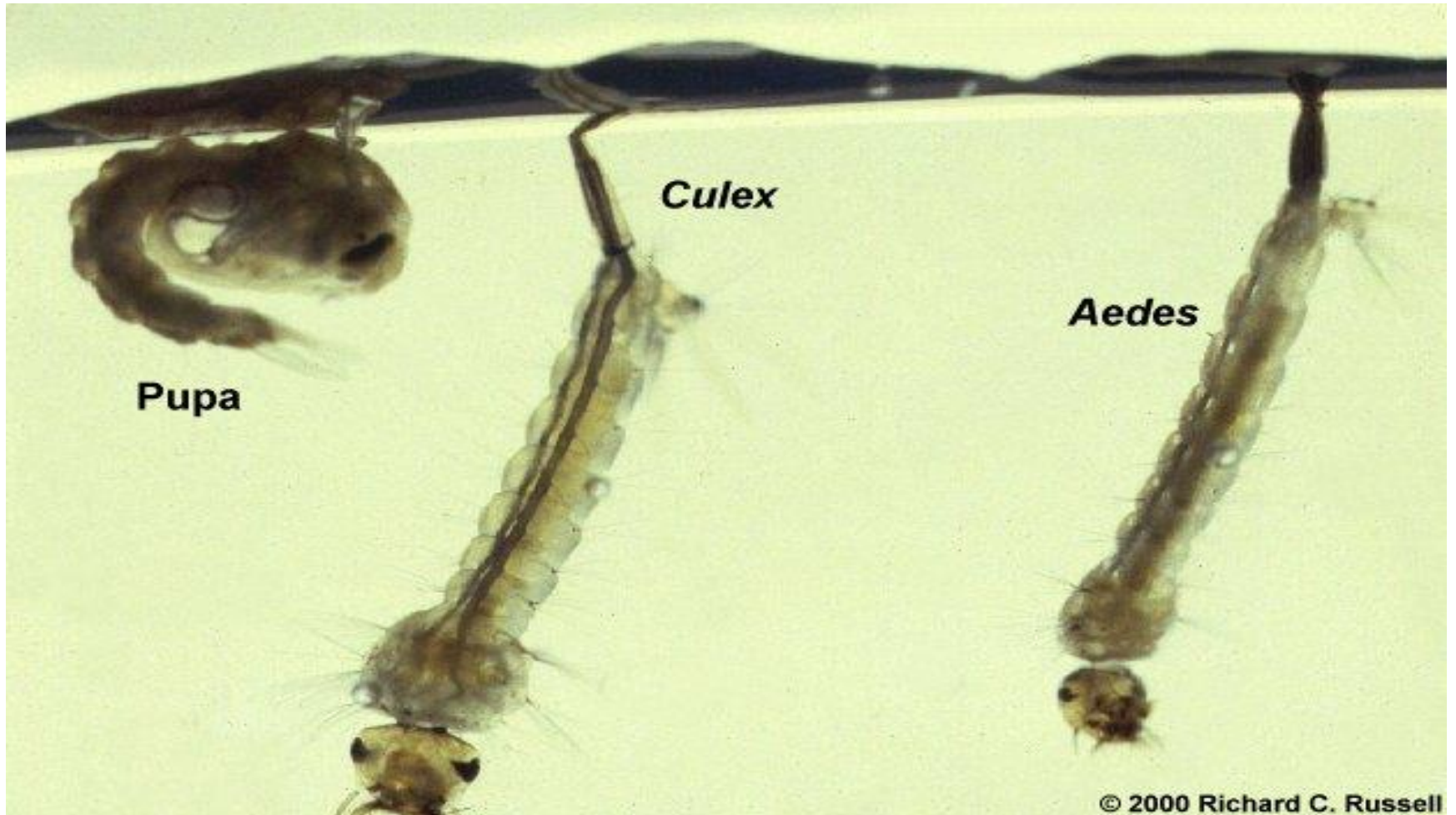


Larval Stage – Growth Stage

- Larval instars (4)
- Aquatic, Filter feeders
- Respiration



Mosquito Pupa and Larvae



Adults

- Emergence
- Mating
- Feeding

Adult Stage Comparison



Anopheline

Culicine



HABITAT



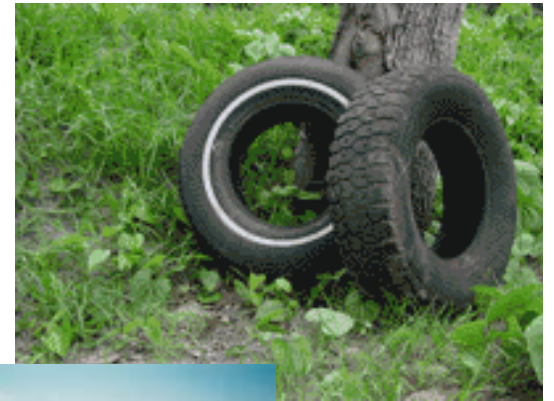


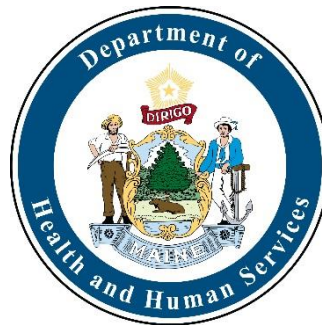
photo by Tim Deschamps



Mosquito-borne Disease Epidemiology

Haris Sohail

5/14/2024



*Maine Arboviral
Town Hall*

Objectives

- Provide an overview of the three viruses that can be spread by mosquitoes in Maine
- Look at historical and recent arbovirus activity
- Review what the health department does to address the risks associated with mosquito-borne diseases
- Highlight guidance and services available to towns

Arboviruses (Arthropod-borne viruses)



Local Mosquito-borne Arboviruses

Eastern Equine Encephalitis Virus (EEE)

Jamestown Canyon Virus (JCV)

West Nile Virus (WNV)



Disease Transmission

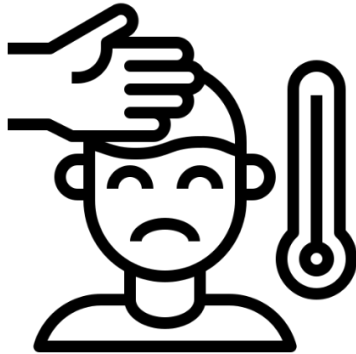
Most commonly spread to people through the bite of an infected mosquito

Rarely, these viruses may also spread through:

- Blood transfusions
- Organ transplants
- Breastfeeding
- From mother to baby during pregnancy



Mild Symptoms of Arboviral Illness



Fever and Chills



Head and Body Aches



Nausea



Swollen Glands



Feeling Very Tired



Diarrhea

Severe Symptoms of Arboviral Illness



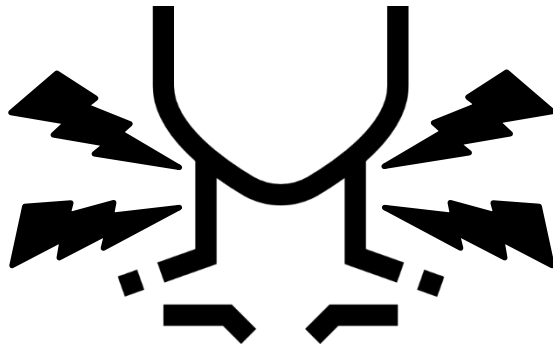
Disorientation



Muscle Weakness



Coma



Neck Stiffness



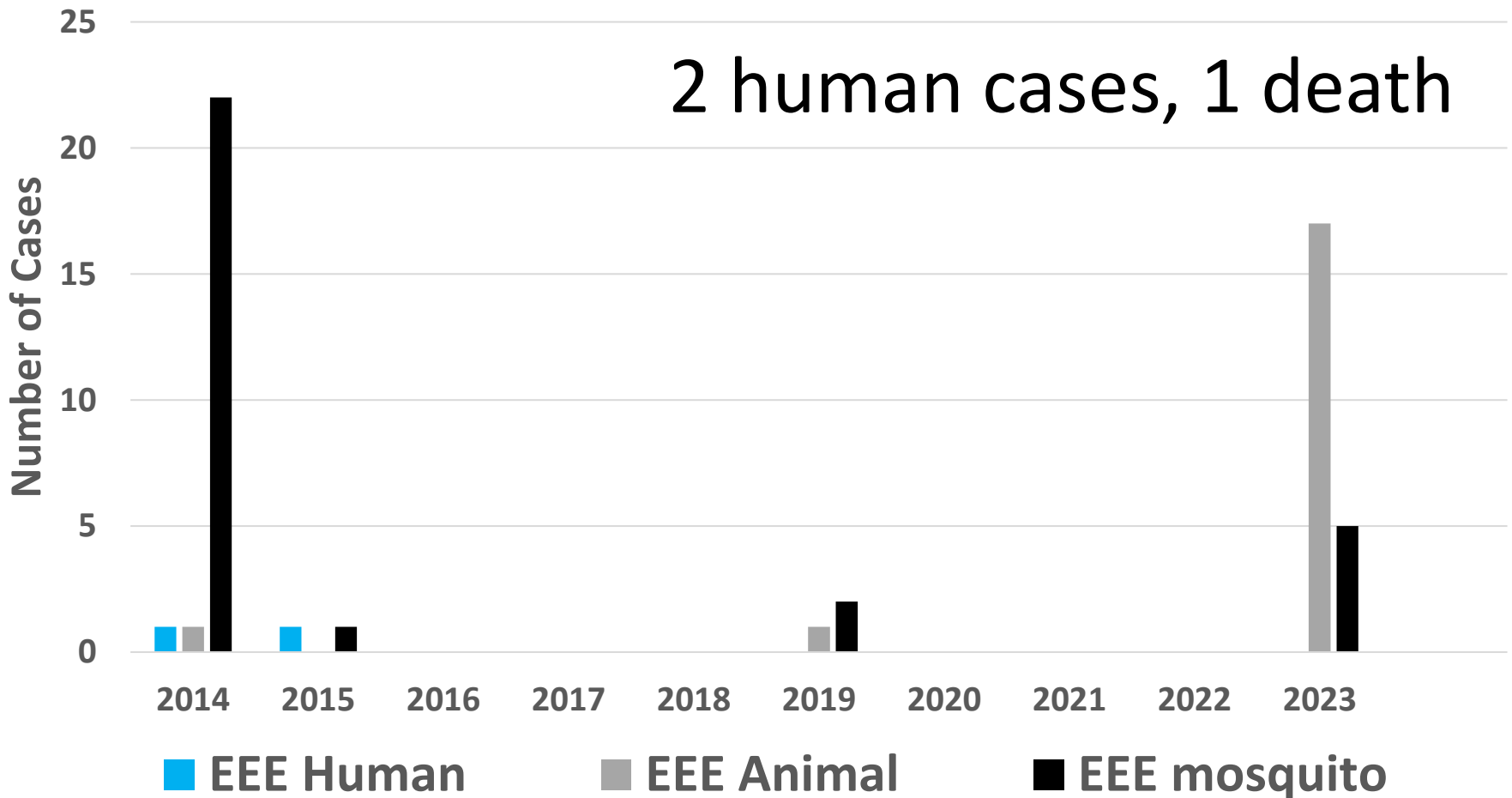
Inflammation of the Brain

Treatment

- There is no specific treatment for these diseases, but some symptoms can be treated with over-the-counter drugs
- Severe illness usually requires supportive treatment in the hospital

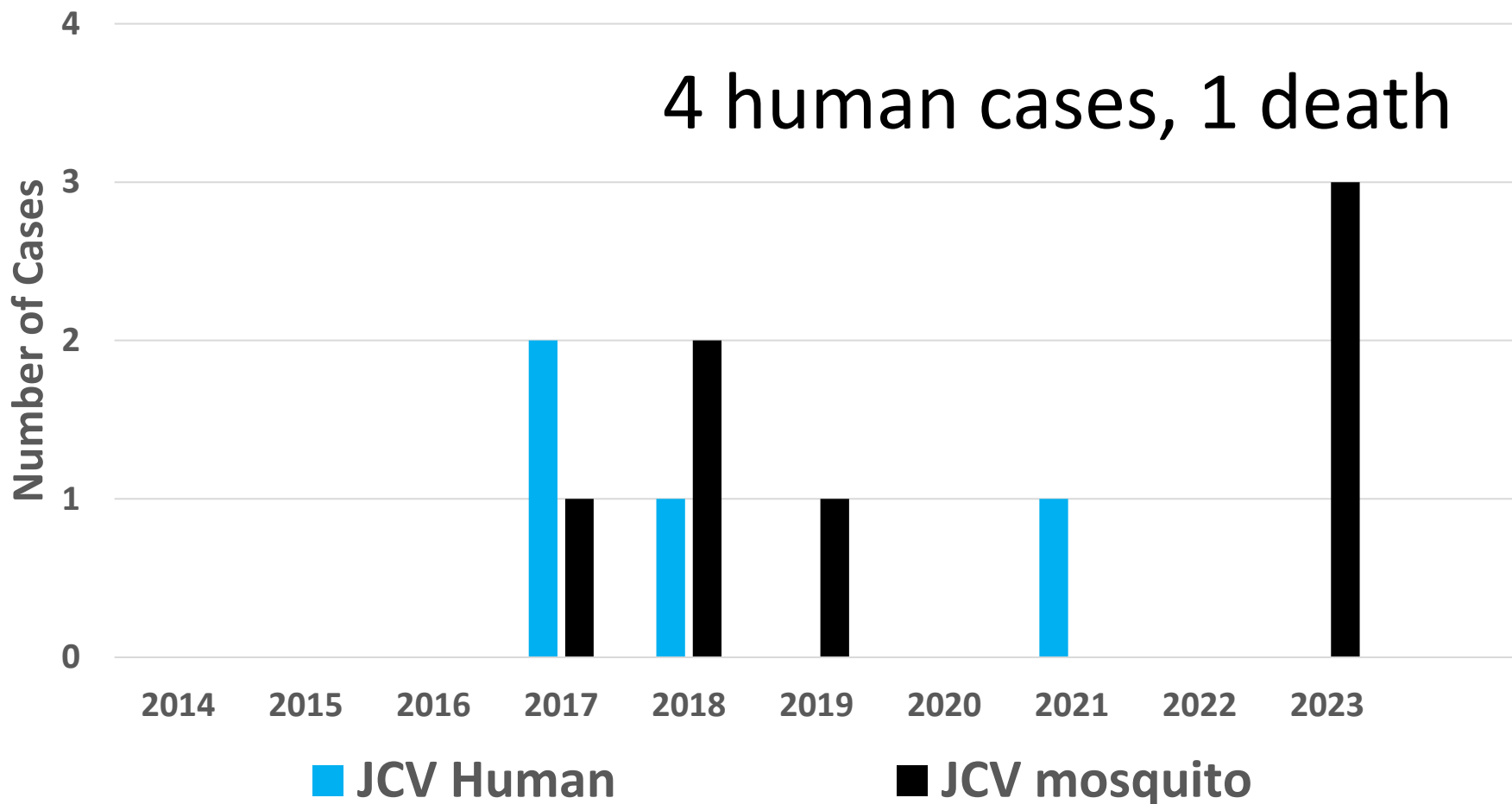


Reported Human and Non-Human Cases of EEE – Maine, 2014-2023*



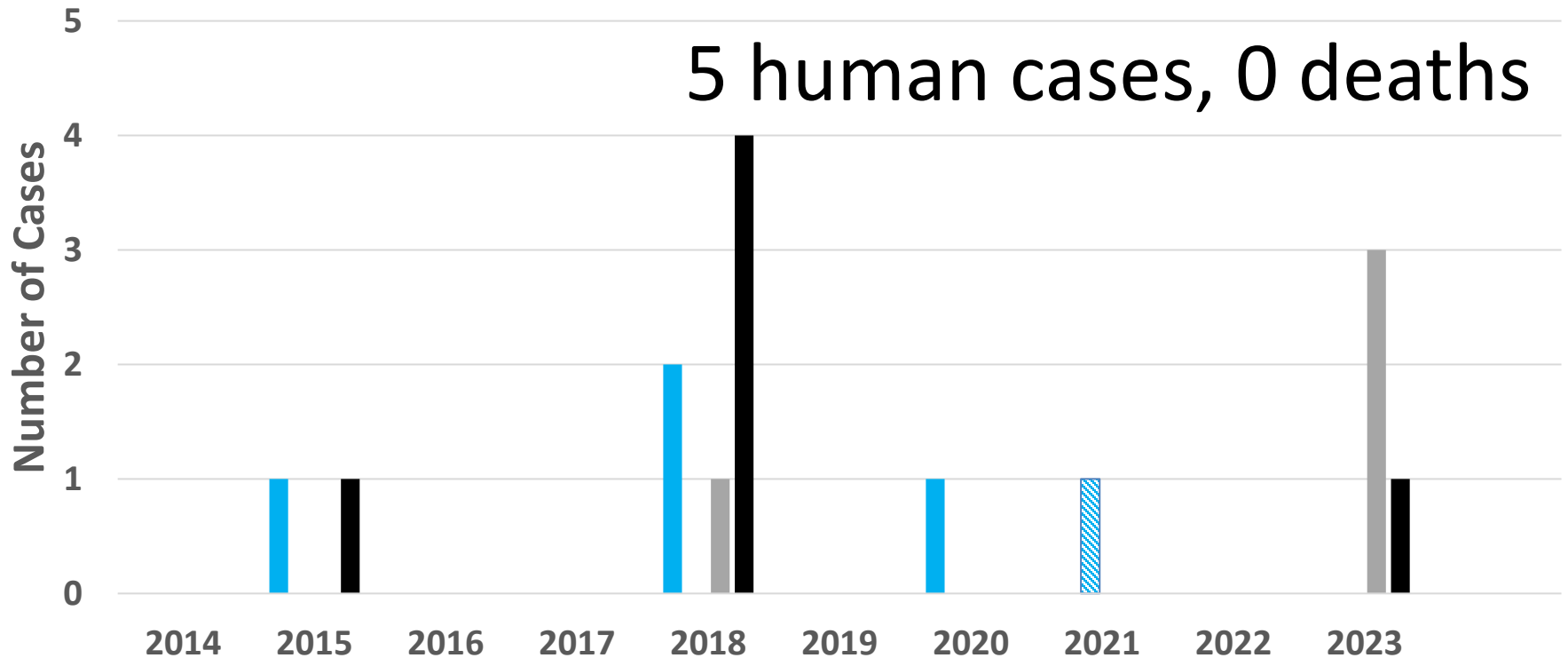
*data as of 3/13/2024

Reported Human and Non-Human Cases of JCV – Maine, 2014-2023*



*data as of 3/13/2024

Reported Human and Non-Human Cases of WNV – Maine, 2014-2023*



■ WNV Human ■ WNV PVD** ■ WNV Animal ■ WNV mosquito

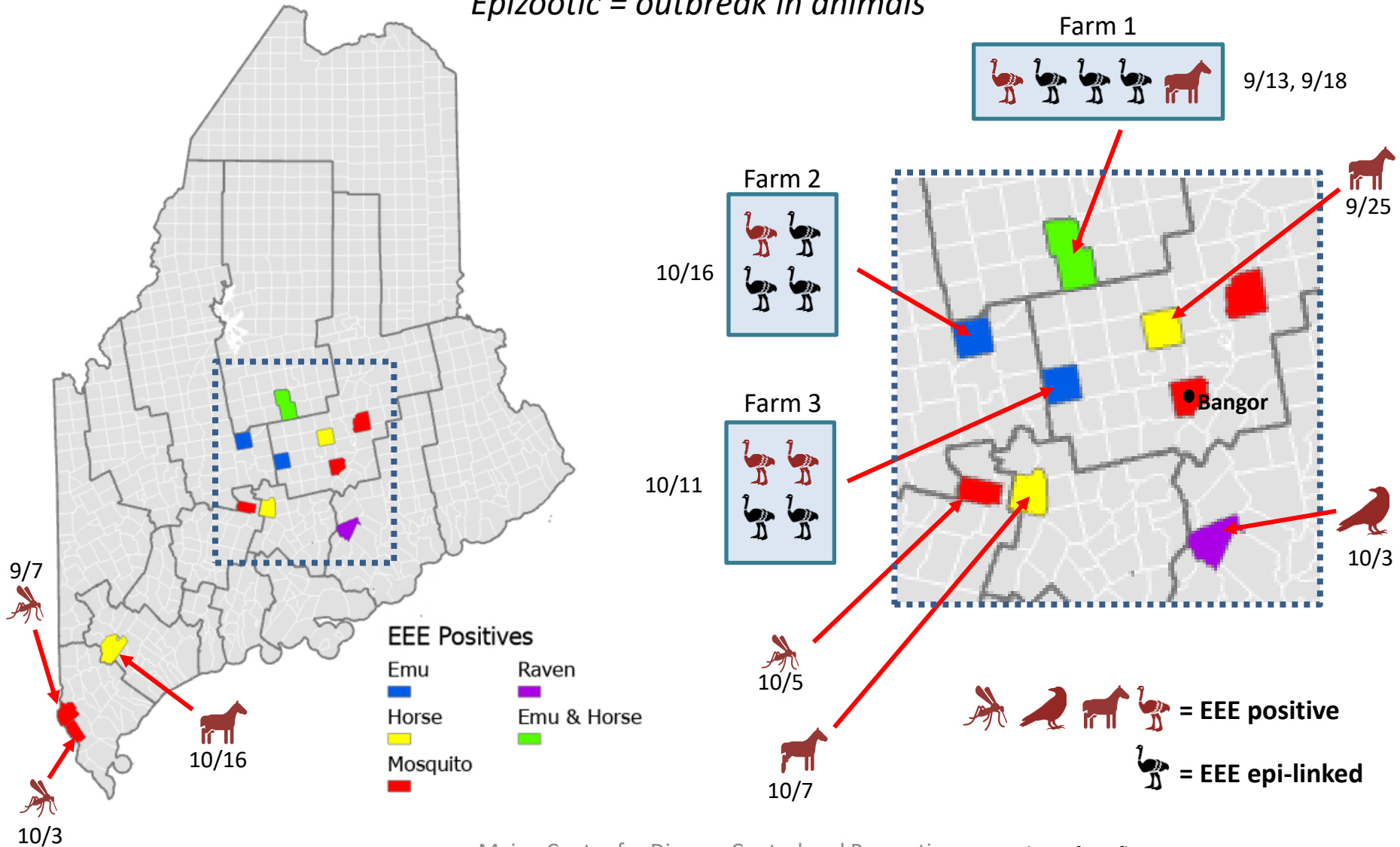
*data as of 3/13/2024

Maine Center for Disease Control and Prevention

** Presumptive Viremic Donor

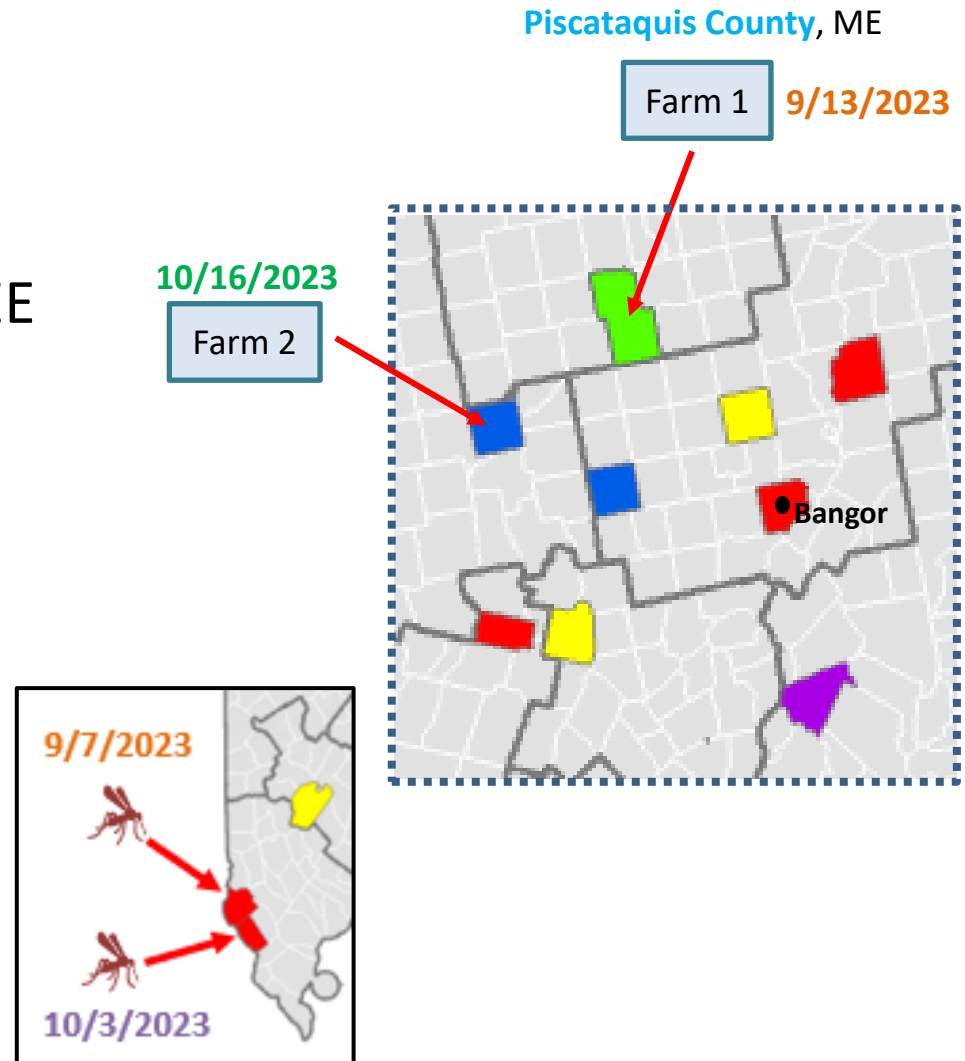
EEE Epizootic in 2023

Epizootic = outbreak in animals



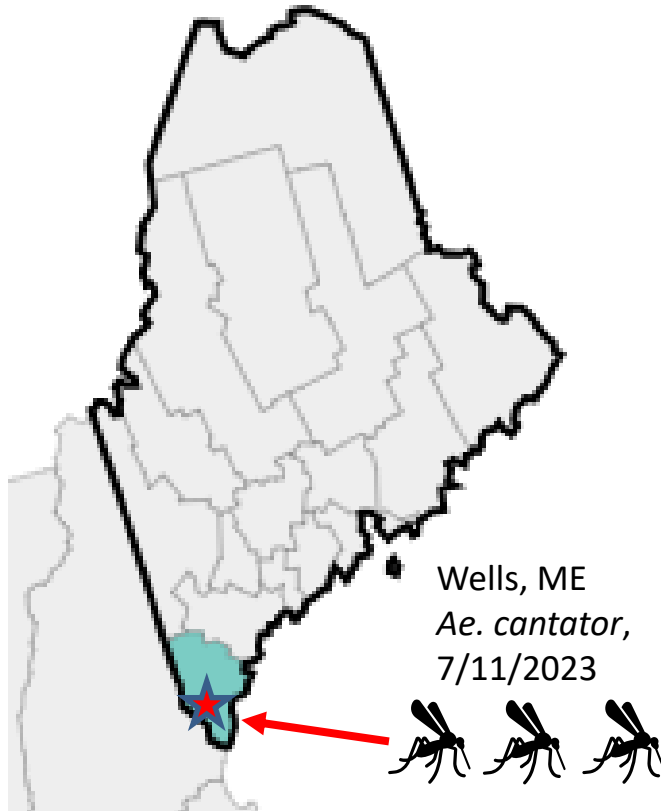
EEE Epizootic in 2023

- Furthest **north** active EEE virus detected in Maine
- **Latest in the year** active EEE virus detected in Maine
- EEE detected in north-central Maine **one week after** virus detected in southern Maine
- Risk of local transmission can **persist** for 1+ months



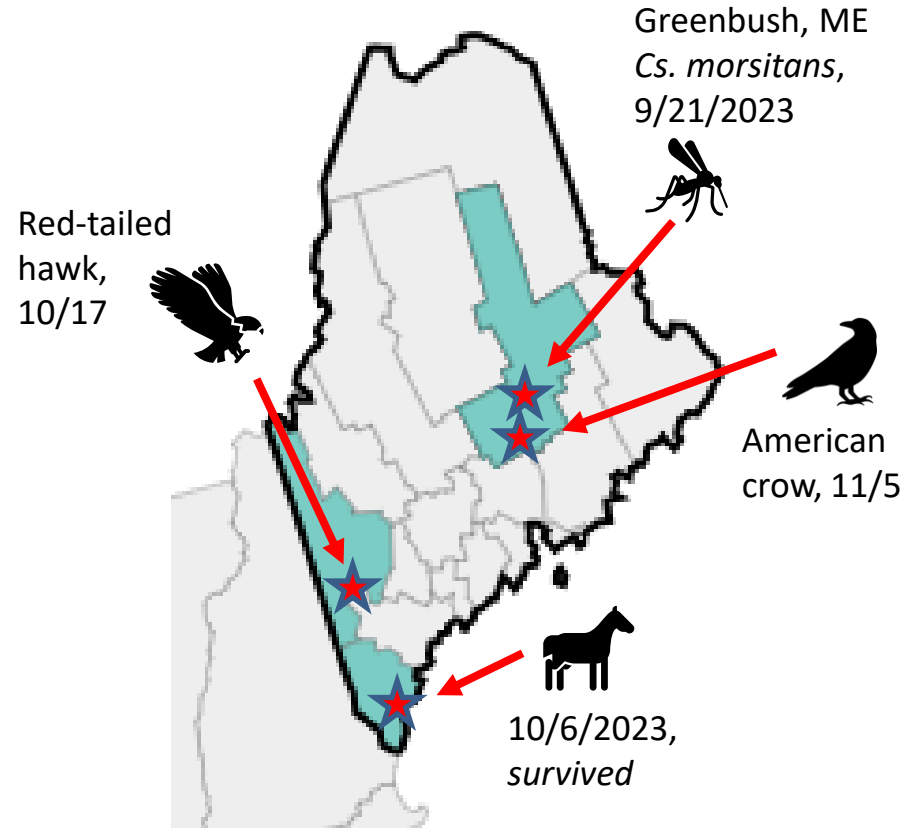
JCV & WNV Activity in 2023

Jamestown Canyon Virus



Non-human Jamestown Canyon virus (JCV) activity reported to ArboNET, by state — United States, 2023 (as of **November 18, 2023**)

West Nile Virus

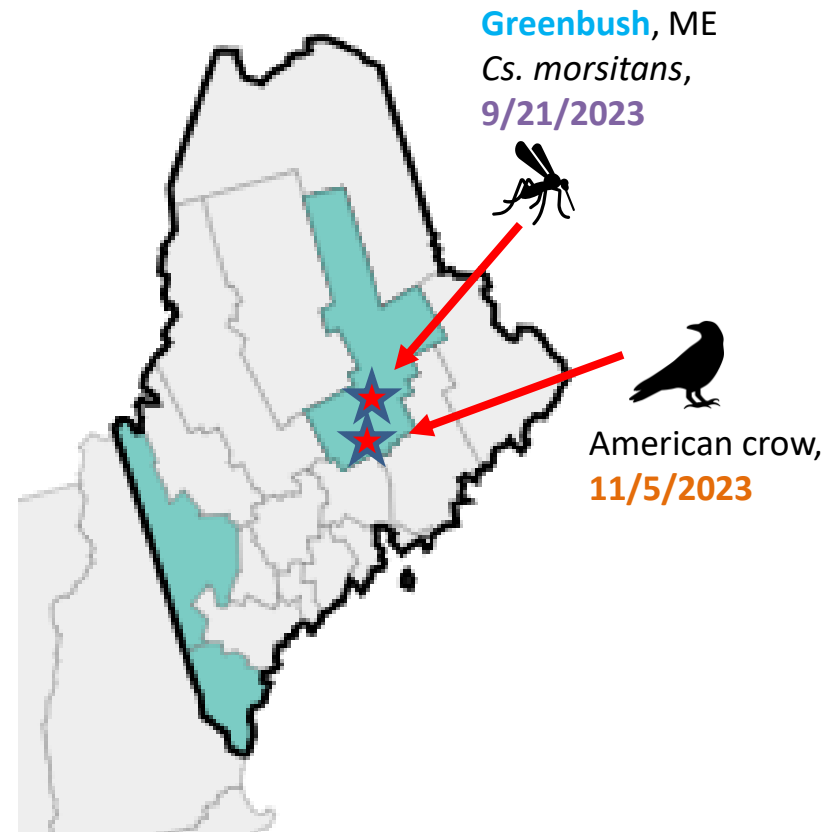


Non-human West Nile virus (WNV) activity reported to ArboNET, by state — United States, 2023 (as of **November 29, 2023**)

WNV Activity in 2023

- Furthest **north** active WNV detected in Maine
- First time active WNV detected in **November** in Maine
- Risk of local transmission can **persist** for 1+ months

West Nile Virus



Non-human West Nile virus (WNV) activity reported to ArboNET, by state — United States, 2023 (as of **November 29, 2023**)

Observations in 2023

- First year EEE, JCV, and WNV detected in local mosquitoes in a single surveillance season
- Highest number of Maine counties reporting local arboviral activity in a single season (9 out of 16 counties)

Cumberland County

Hancock County

Kennebec County

Oxford County

Penobscot County

Piscataquis County

Somerset County

Waldo County

York County

2024 Mosquito Season Outlook

- Seasonal temperature outlook: above average
- Seasonal precipitation outlook: above average

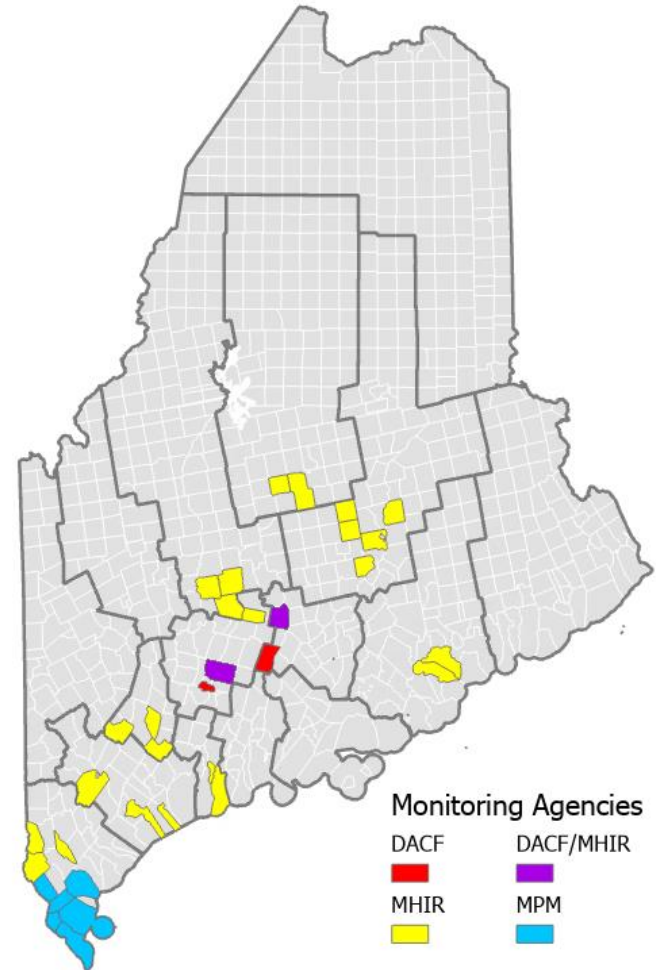


State Health Department Activities

- Mosquito surveillance
 - Routine surveillance
 - Rapid response
 - Arbovirus testing
 - Pesticide resistance monitoring
- Case and outbreak investigations
 - Humans, animals, and mosquitoes
- Consultation services
 - Healthcare providers, town officials, public
- Communications, education, and collaborations
 - Facilitate Maine Vectorborne Workgroup

Routine Mosquito Surveillance

- From May to October, mosquitoes are collected from different areas around the state and tested at the state lab
 - Early detection, early response
- In 2023, mosquitoes collected from 86 sites across 35 towns in 10 counties



Weekly Arboviral Surveillance Report

Maine Weekly Arboviral Surveillance Report

August 22, 2023



January 1, 2023 – August 19, 2023:

Local Arboviral Activity

Humans – Endemic arboviral illnesses

	Number Tested	WNV positive	EEE positive	JCV positive	POW positive
Current Week	1	0	0	0	0
2023 Year to Date	26	0	0	0	3

EEE, JCV, and WNV are endemic mosquito-borne arboviruses. POW is the only endemic arbovirus spread by ticks in Maine. Human arboviral testing performed at Maine's Health and Environmental Testing Laboratory (HETL). Testing may be performed year round. Confirmation testing performed at CDC Fort Collins

Humans – Travel-associated arboviral illnesses

	Chikungunya positive	Dengue positive	Zika positive
2023 Year to Date	0	0	0

Imported arboviral testing may be performed at HETL, CDC Fort Collins, or other national reference laboratories

Animals

	Number Tested	WNV positive	EEE Positive
Current Week	0	0	0
2023 Year to Date	0	0	0

Animal arboviral testing may be performed at HETL or through the National Veterinary Services Laboratory (NVSL); testing may be performed year round

Mosquitoes – Endemic arboviruses

	Pools Tested	WNV positive	EEE positive	JCV positive
Current Week	352	0	0	3
2023 Year to Date	460	0	0	3

Mosquito EEE and WNV testing performed at HETL; mosquito JCV testing performed at CDC Fort Collins; mosquito collection begins July 1 and continues through September 30

Only completed testing is included in this report.

EEE = Eastern Equine Encephalitis
 CHIK = Chikungunya
 DEN = Dengue
 JCV = Jamestown Canyon Virus

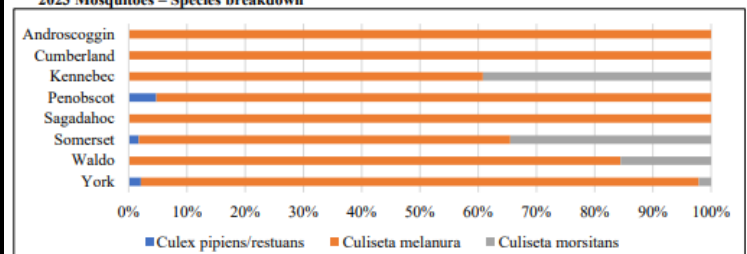
POW = Powassan
 SLE = Saint Louis Encephalitis
 WNV = West Nile Virus
 ZIK = Zika

2023 Maine positive results

Surveillance	Species	Collection Date	Town	County	Agent
Human		5/9/2023		Sagadahoc	POW
Human		6/18/2023		Kennebec	POW
Human		7/4/2023		Sagadahoc	POW

Mosquito	<i>Aedes cantator</i>	7/11/2023	Wells	York	JCV
Mosquito	<i>Aedes cantator</i>	7/11/2023	Wells	York	JCV
Mosquito	<i>Aedes cantator</i>	7/11/2023	Wells	York	JCV

2023 Mosquitoes – Species breakdown



Culiseta melanura, *Cx. morsitans*, *Culex pipiens*, and *Cx. restuans* are mosquito vectors of public health concern in Maine. *Cx. melanura* is the primary local vector of EEE virus and *Cx. pipiens* is the primary local vector of West Nile virus. *Cx. morsitans* and *Cx. restuans* also play a role in the transmission of these two viruses. Species information represents only mosquitoes captured through active surveillance and may not reflect the full diversity of local mosquito populations in each county

National Arboviral Activity

2023 Locally-acquired human cases – United States

	Dengue positive	Zika positive*
Florida	15	0
Texas	1	0

* There is no current local transmission of Zika virus in the continental United States

International Arboviral Activity

2023 CDC travel health notices

Level	Disease	Location
2	Yellow Fever	Nigeria
1	Dengue	Bangladesh, Cambodia, Laos, Malaysia, Maldives, Myanmar, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam
1	Dengue	Côte d'Ivoire, Egypt, Mauritius, Sudan
1	Dengue	Argentina, Columbia, Cuba, Guadeloupe, Guatemala, Martinique, Nicaragua, Panama, Peru
1	Chikungunya	Paraguay

More information on travel health notices is available here: <https://wwwnc.cdc.gov/travel/notices>.

Weekly Arboviral Surveillance Report

Maine Weekly Arboviral Surveillance Report

August 22, 2023



January 1, 2023 – August 19, 2023:

Local Arboviral Activity

Humans – Endemic arboviral illnesses

	Number Tested	WNV positive	EEE positive	JCV positive	POW positive
Current Week	1	0	0	0	0
2023 Year to Date	26	0	0	0	3

EEE, JCV, and WNV are endemic mosquito-borne arboviruses. POW is the only endemic arbovirus spread by ticks in Maine. Human arboviral testing performed at Maine's Health and Environmental Testing Laboratory (HETL). Testing may be performed year round. Confirmation testing performed at CDC Fort Collins

Humans – Travel-associated arboviral illnesses

	Chikungunya positive	Dengue positive	Zika positive
2023 Year to Date	0	0	0

Imported arboviral testing may be performed at HETL, CDC Fort Collins, or other national reference laboratories

Animals

	Number Tested	WNV positive	EEE Positive
Current Week	0	0	0
2023 Year to Date	0	0	0

Animal arboviral testing may be performed at HETL or through the National Veterinary Services Laboratory (NVSL); testing may be performed year round

Mosquitoes – Endemic arboviruses

	Pools Tested	WNV positive	EEE positive	JCV positive
Current Week	352	0	0	3
2023 Year to Date	460	0	0	3

Mosquito EEE and WNV testing performed at HETL; mosquito JCV testing performed at CDC Fort Collins; mosquito collection begins July 1 and continues through September 30

Only completed testing is included in this report.

EEE = Eastern Equine Encephalitis
CHIK = Chikungunya
DEN = Dengue
JCV = Jamestown Canyon Virus

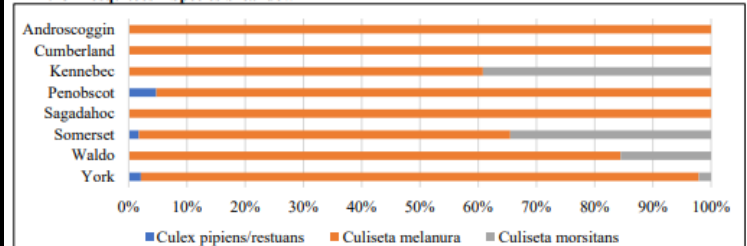
POW = Powassan
SLE = Saint Louis Encephalitis
WNV = West Nile Virus
ZIK = Zika

2023 Maine positive results

Surveillance	Species	Collection Date	Town	County	Agent
Human		5/9/2023		Sagadahoc	POW
Human		6/18/2023		Kennebec	POW
Human		7/4/2023		Sagadahoc	POW

Mosquito	<i>Aedes cantator</i>	7/11/2023	Wells	York	JCV
Mosquito	<i>Aedes cantator</i>	7/11/2023	Wells	York	JCV
Mosquito	<i>Aedes cantator</i>	7/11/2023	Wells	York	JCV

2023 Mosquitoes – Species breakdown



Culiseta melanura, *Cx. morsitans*, *Culex pipiens*, and *Cx. restuans* are mosquito vectors of public health concern in Maine. *Cx. melanura* is the primary local vector of EEE virus and *Cx. pipiens* is the primary local vector of West Nile virus. *Cx. morsitans* and *Cx. restuans* also play a role in the transmission of these two viruses. Species information represents only mosquitoes captured through active surveillance and may not reflect the full diversity of local mosquito populations in each county

National Arboviral Activity

2023 Locally-acquired human cases – United States

	Dengue positive	Zika positive*
Florida	15	0
Texas	1	0

* There is no current local transmission of Zika virus in the continental United States

International Arboviral Activity

2023 CDC travel health notices

Level	Disease	Location
2	Yellow Fever	Nigeria
1	Dengue	Bangladesh, Cambodia, Laos, Malaysia, Maldives, Myanmar, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam
1	Dengue	Côte d'Ivoire, Egypt, Mauritius, Sudan
1	Dengue	Argentina, Columbia, Cuba, Guadeloupe, Guatemala, Martinique, Nicaragua, Panama, Peru
1	Chikungunya	Paraguay

More information on travel health notices is available here: <https://wwwnc.cdc.gov/travel/notices>.

Rapid Response Surveillance

When a person, animal, or mosquito tests positive for an arbovirus in Maine, the state may deploy rapid response surveillance

- Notify city and town officials of the positive result
- Conduct site visits, as appropriate
- Conduct additional mosquito surveillance around or at the location with positive arboviral activity
- Coordinate training and lend expertise to local health officials

State Mosquito Testing Services

- The state public health lab tests mosquitoes for
 - EEE and WNV from July to October
 - JCV from May to October
- Any local municipality can submit mosquito specimens to HETL for arboviral testing (free of charge)
- Municipalities are responsible for trapping, collecting, identifying, and submitting mosquitoes
- Those interested in this service can contact Maine CDC

Public Health Threat or Emergency

- An Arboviral Public Health Threat or Emergency may be declared if certain conditions exist and if recommended by the arboviral emergency panel
 - A declaration may allow local jurisdictions the option to rapidly receive permits, help provide IPM authority, and implement other interventions
- Any local, county, or state official may request consideration of an arboviral public health threat or emergency
- Requests should be made to Maine CDC

Guidance for Maine Communities



Maine Department of Health and Human Services
Maine Center for Disease Control and Prevention

Arboviral (Mosquito-Borne) Illness
Surveillance, Prevention, and Response
Guidance
for Maine Towns and Communities

Last Reviewed 05/2024

TABLE OF CONTENTS

INTRODUCTION	4
DISEASE BACKGROUND	4
Eastern Equine Encephalitis (EEE) Virus	5
West Nile Virus (WNV)	5
Jamestown Canyon Virus (JCV)	6
Imported Arboviral Illnesses	6
GOALS OF PREVENTION	7
PREVENTION AND CONTROL	8
Prevention Through Public Education	8
Town Level Prevention Action Steps	9
Preventing Mosquito Breeding Opportunities	8
Personal Protective Measures	10
Mosquito Control Activities	10
Pesticide Control Board Regulations	14
Department of Environmental Protection Pesticide Rules	14
STATE SPONSORED SURVEILLANCE	15
Mosquito Surveillance	15
Communication of Surveillance Information	16
REFERENCES	18
APPENDICES	19
APPENDIX I. Arboviral Surveillance Responsibilities	19
APPENDIX II. Arboviral Public Health Threat or Emergency	20
APPENDIX III. Mosquito Collection and Testing	21

2

Summary

- Mosquitoes can spread three viruses in Maine: EEE, JCV, and WNV
 - Most infections are mild, but some people can get very sick and die
- Although Maine reports little arboviral activity most years, local outbreaks occur every few years; viruses are being found further north and later in the season
 - 2023 was a bad year for mosquito-borne diseases in Maine
 - 2024 is predicted to be another bad year
- The state conducts different activities to address the risk from mosquito-borne diseases, including surveillance and testing
 - Refer to the Weekly Arboviral Report to assess the risk in your area
- Municipalities interested in developing a mosquito management program, using state mosquito testing services, or declaring an arboviral threat or emergency should contact Maine CDC

Contact Information

Haris Sohail, MS, MPH

Vectorborne & Zoonotic Epidemiologist

haris.sohail@maine.gov

**Testing Service or Emergency
Declaration Requests:**

disease.reporting@maine.gov

1-800-821-5821

**Resources for
Municipalities:**

www.maine.gov/dhhs/vectorborne

(data, education, and resources)





Maine Department of Agriculture, Conservation, and Forestry

Animal Health

Arboviral Town Hall

Dr. Rachael Fiske

Amanda E. Beal
Commissioner

Randy Charette
Deputy Commissioner

Nancy McBrady
Deputy Commissioner

18 Elkins Lane
Augusta, ME 04333

(207) 287-3200
www.maine.gov/dacf

<https://www.maine.gov/dacf/php/index.shtml>

How to find
us

The screenshot shows the website for the Maine Department of Agriculture, Conservation & Forestry. The header includes the state logo and the department name. A navigation menu lists various areas: About, Animals & Plants, Forest, Geology, Recreation, Farming, Planning, and Licensing & Regulations. A breadcrumb trail indicates the current location: DACF Home → Bureaus & Programs → Bureau of Agriculture → Division of Animal and Plant Health. On the left, a sidebar menu lists: Division of Animal and Plant Health, About Us, FAQ, Laws & Rules, Programs, and Contact Us. The main content area is titled "Division of Animal and Plant Health" and is divided into four categories: Animal, Farm, Plant, and Pests and Pesticides. A blue arrow points from the Farm category to the Animal category. The Animal category includes links for Animal Health, Animal Welfare, and Help Fix ME. The Farm category includes links for Agricultural Compliance, Compost, Nutrient Management Program, and Got Pests?. The Plant category includes links for Apiary (Beekeeping), Arborist, Ginseng, Horticulture, Hemp, and Seed Potato Certification. The Pests and Pesticides category includes links for Cooperative Agricultural Pest Survey (CAPS), Integrated Pest Management (IPM), Board of Pesticides Control (BPC), and Got Pests?.

maine MAINE DEPARTMENT OF
Agriculture, Conservation & Forestry

About ▾ Animals & Plants Forest Geology Recreation Farming Planning Licensing & Regulations

DACF Home → Bureaus & Programs → Bureau of Agriculture → Division of Animal and Plant Health

Division of Animal and Plant Health

About Us

FAQ

Laws & Rules

Programs

Contact Us

Division of Animal and Plant Health

Animal
[Animal Health](#)
[Animal Welfare](#)
[Help Fix ME](#)

Farm
[Agricultural Compliance](#)
[Compost](#)
[Nutrient Management Program](#)
[Got Pests?](#)

Plant
[Apiary \(Beekeeping\)](#)
[Arborist](#)
[Ginseng](#)
[Horticulture](#)
[Hemp](#)
[Seed Potato Certification](#)

Pests and Pesticides
[Cooperative Agricultural Pest Survey \(CAPS\)](#)
[Integrated Pest Management \(IPM\)](#)
[Board of Pesticides Control \(BPC\)](#)
[Got Pests?](#)

Animal Health & VBD

- ME DACF AH works with veterinarians
- Testing support for vets and their clients
- EEE, WEE, WNV in horses is reportable immediately
- Report of suspected or confirmed arboviral disease in any livestock species is appreciated
- Mosquito positives and animal cases can drive human health actions



Maine Reportable Diseases

Toxic Substance Exposure that may threaten animal health, human health or food safety

Any unexplained increase in dead or diseased animals

All exotic or eradicated diseases

To report a disease go to – <http://www.maine.gov/agriculture/ahi/diseases/diseasereporting.html>

Bovine

Immediate Reporting

Bluetongue
Bovine Spongiform Encephalopathy
Brucellosis
Malignant Catarrhal Fever
Tuberculosis
Any Vesicular Disease

Monthly Reporting

Anaplasmosis
Johne's Disease
Trichomoniasis

Equine

Immediate Reporting

Contagious Equine Metritis
Eastern/Western Equine Encephalitis
Equine Herpes Myeloencephalitis
Equine Infectious Anemia
Equine Piroplasmiasis
Equine Viral Arteritis
Vesicular Stomatitis
West Nile Virus

Monthly Reporting

Equine Protozoal Myeloencephalitis
Potomac Horse Fever
Strangles

Porcine

Immediate Reporting

Brucellosis
Pseudorabies
Swine Influenza
Trichinellosis
Tuberculosis
Any Vesicular Disease

Monthly Reporting

Porcine Reproductive and Respiratory Syndrome

Caprine/Ovine

Immediate Reporting

Bluetongue
Brucellosis
Contagious Ecthyma
Scrapie
Tuberculosis
Any Vesicular Disease

Monthly Reporting

Johne's Disease
Toxoplasmosis

Poultry

Immediate Reporting

Avian Chlamydiosis
Avian Influenza
Avian Pox
Exotic Newcastle Disease
Pullorum Disease/Fowl Typhoid
Salmonella Enteritidis

Monthly Reporting

Duck Plague
Erysipelas
Fowl Cholera
Infectious Coryza
Infectious Laryngotracheitis
Mycoplasma Gallisepticum/Synoviae-MG/MS
Other Salmonellosis

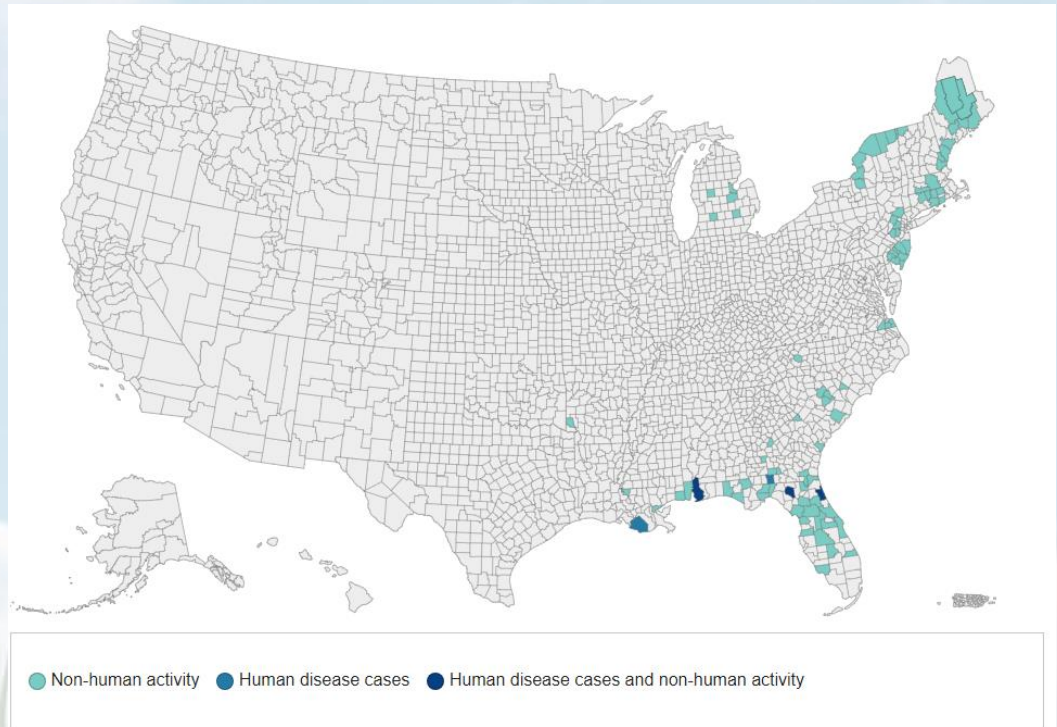
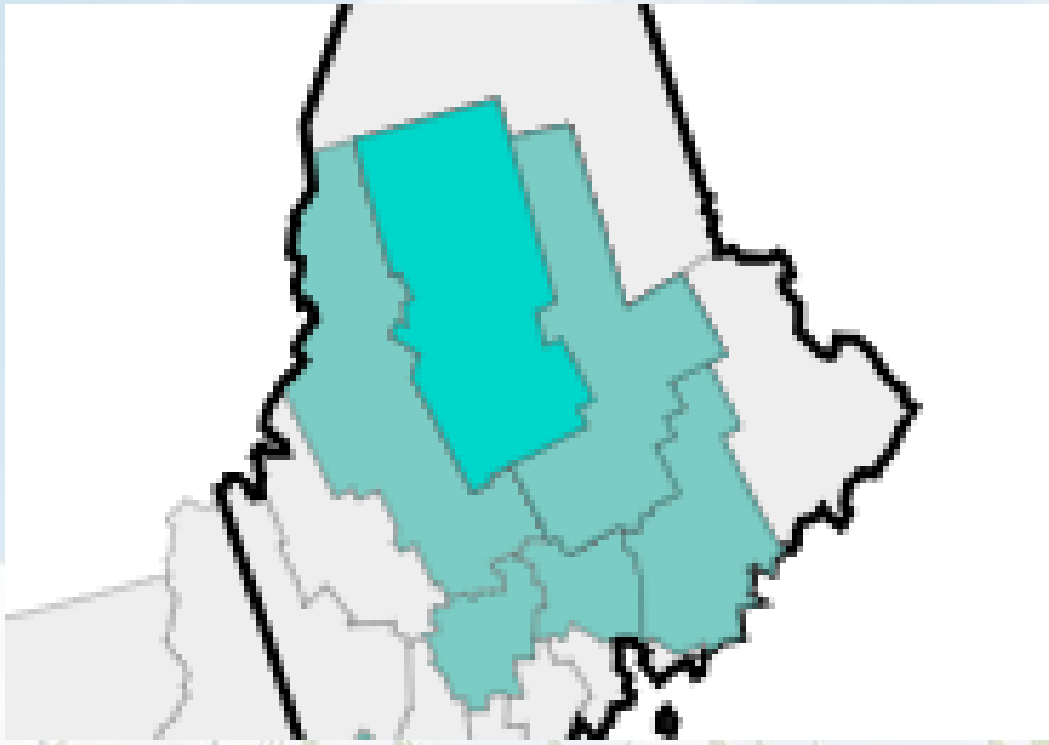
Multiple Species

Immediate Reporting

Anthrax
H1N1 Influenza in any species
Leptospirosis
Plague
Q Fever
Rabies
Tularemia

Monthly Reporting

Canine Influenza
Salmonellosis



Eastern equine encephalitis virus
non-human activity by county of
residence, 2023*

Arboviral Trends in Livestock in Maine

Ratites (emus and ostriches) and game birds like pheasants, are susceptible to mosquito-borne diseases (MBDs). Equines and camelids are also at risk for MBDs.

	2023	2022	2021	2020	2019	2018
EEE, Animal	16	0	0	0	1	0
WNV, Animal	1	0	0	0	0	1

Total Arboviral Surveillance, Maine, 2023		
	Emus	Horses
EEE+	4	4
EEE epi-linked	8	0
JCV+	0	0
POW+	0	0
WNV+	0	1





Precautions to Help Protect Livestock Animals

- Environmental modifications to eliminate mosquito pools
- Vaccinate horses and utilize a booster dose if >6 months since the previous vaccine
- Work with your veterinarian to discuss off-label vaccination of camelids and susceptible birds (e.g., emus)

Know the Signs of Mosquito-borne Disease in Animals

- Animals with arboviral infection (EEE, WNV, others) may experience neurological or musculoskeletal signs: staggering, incoordination, weakness, fever or sudden death
- Contact your veterinarian and reach out to DACF Animal Health office



AnimalHealth.AGR@maine.gov

207-287-3701

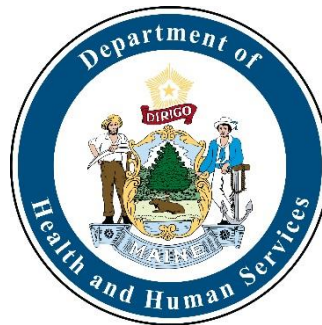
Fight the Bite!

Educational Resources for Mosquito-Borne Disease Prevention

Megan Porter, DVM

Health Educator

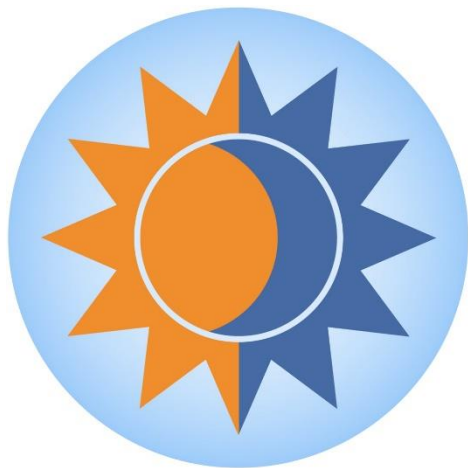
Maine CDC Arboviral Town Hall Meeting



Mosquito Bite Prevention - Before

- **Avoid outdoor activity during high mosquito activity**

- Mosquitoes in Maine are most active during dawn and dusk



- **Wear protective clothing**

- Long sleeves and pants
- Close-toed shoes



- **Treat clothes with permethrin**

- Not for use on skin



Mosquito Bite Prevention: EPA-Approved Repellents

EPA-approved repellents:

- DEET
- Picaridin
- IR3535 (Ethyl butylacetylaminopropionate)
- Oil of Lemon Eucalyptus
- Permethrin

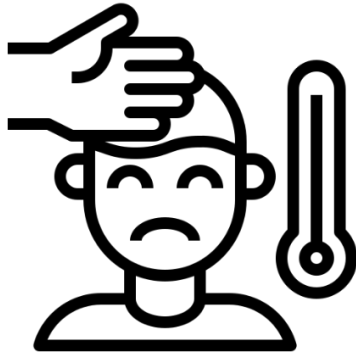
What does EPA-approved mean?

- The active ingredient works against mosquitoes
- The active ingredient is safe when used correctly



Symptoms of Arboviral Illness

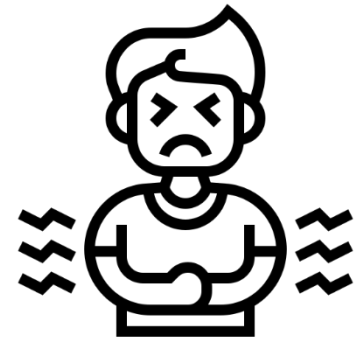
Symptoms range from mild to severe – mild symptoms



Fever and Chills



Head and Body Aches



Nausea



Swollen Glands



Feeling Very Tired



Diarrhea

Symptoms of Arboviral Illness

Symptoms range from mild to severe – severe symptoms



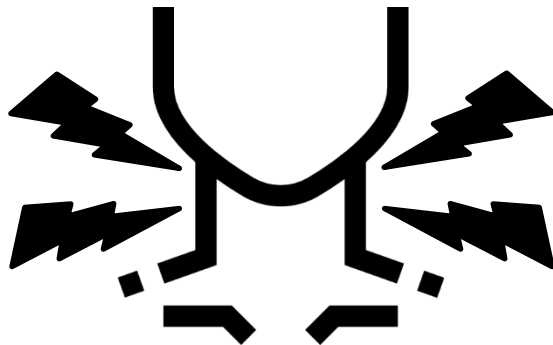
Disorientation



Muscle Weakness



Coma

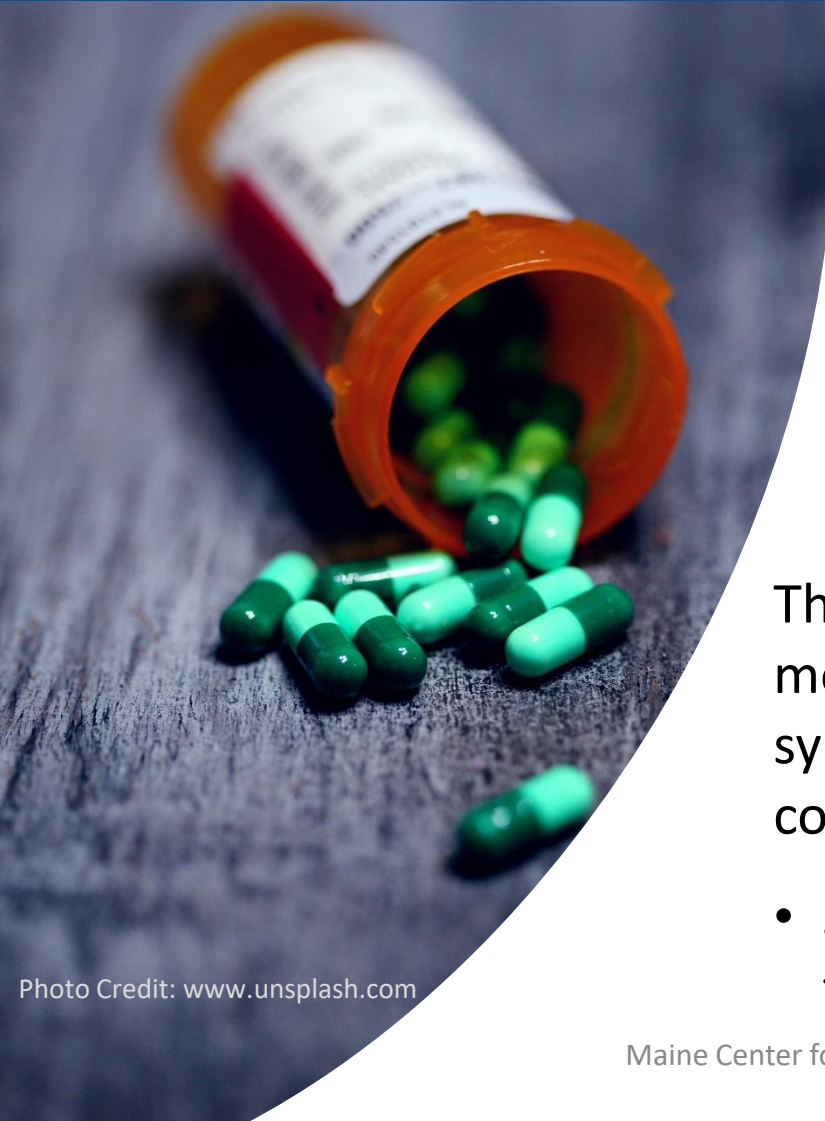


Neck Stiffness



Inflammation of the Brain

What if I start to feel sick?



Talk to a health care provider if you feel flu-like symptoms and mention recent mosquito bites

Health care providers usually take samples of blood and cerebrospinal fluid to test for these viruses

There is no specific treatment for most mosquito-borne diseases in Maine, but some symptoms can be treated with over-the-counter drugs

- Severe illness usually requires supportive treatment in the hospital

Photo Credit: www.unsplash.com

Available Resources – For the Town



**Maine Department of Health and Human Services
Maine Center for Disease Control and Prevention**

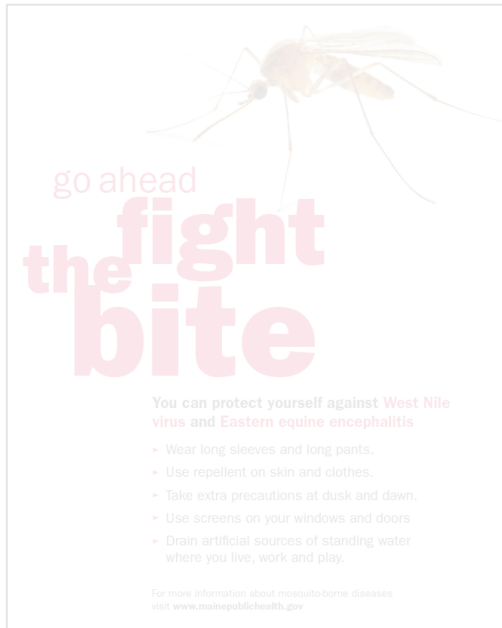
Arboviral (Mosquito-Borne) Illness

Surveillance, Prevention, and Response
Guidance

for Maine Towns and Communities

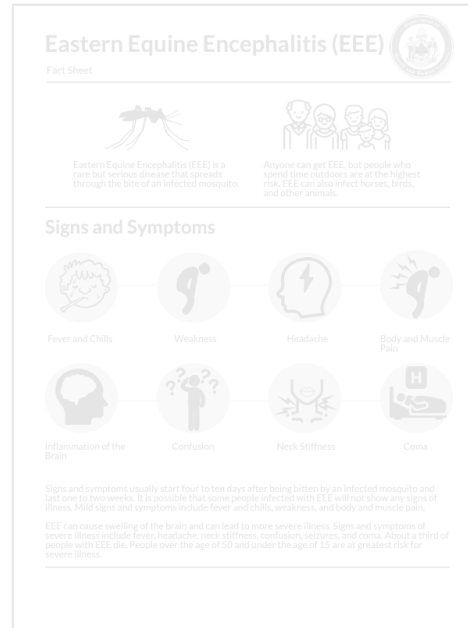
www.maine.gov/dhhs/vectorborne

Available Resources – Print and Digital



Posters

www.maine.gov/dhhs/order



Fact Sheets


www.maine.gov/dhhs/vectorborne



Checklists

www.maine.gov/dhhs/vectorborne

Available Resources – Print and Digital



go ahead
**the fight
bite**

You can protect yourself against West Nile virus and Eastern equine encephalitis

- ▶ Wear long sleeves and long pants.
- ▶ Use repellent on skin and clothes.
- ▶ Take extra precautions at dusk and dawn.
- ▶ Use screens on your windows and doors
- ▶ Drain artificial sources of standing water where you live, work and play.

For more information about mosquito-borne diseases visit www.mainepublichealth.gov

Posters

www.maine.gov/dhhs

Mosquito Bite Prevention: Checklist to Protect Your Home

Mosquitoes need standing water to breed. Follow these steps to get rid of mosquito habitat around your yard.

and remove man-made containers that hold water around your yard.

- ▶ Children's toys
- ▶ Kettles, jars
- ▶ Other containers
- ▶ Old garbage cans and lids

▶ All old tires from the yard. If you can't remove them, flip them so they do not hold water. Used tires are the common mosquito breeding site in Maine.

▶ Containers designed to hold water, empty and change water once a week.

▶ Water bowls

▶ Birdbaths

▶ Flip in the bottom of containers used outside, like: terracotta pots, large cans and recycling containers.

▶ Turn over wheelbarrows and children's pools when not in use.

▶ Mow lawns regularly and make sure they drain properly.

▶ Empty swimming pools, outdoor saunas, and hot tubs. Chlorinate following label directions. If not in use, empty them and keep covered. Do not let covers collect standing water.

▶ Ornamental ponds or stock them with native fish. If they don't, these can produce huge numbers of mosquitoes.

▶ Talk to your neighbors about getting rid of standing water on their property.

Learn more about protecting your home from mosquitoes at: www.maine.gov/dhhs/vectorborne



Checklists

[www.maine.gov/dhhs/
vectorborne](http://www.maine.gov/dhhs/vectorborne)

Available Resources – Print and Digital



go ahead
**the fight
bite**

You can protect yourself against West Nile virus and Eastern equine encephalitis

- Wear long sleeves and long pants.
- Use repellent on skin and clothes.
- Take extra precautions at dusk and dawn.
- Use screens on your windows and doors
- Drain artificial sources of standing water where you live, work and play.

For more information about mosquito-borne diseases visit www.maine.gov/dhhs

Posters

www.maine.gov/dhhs/or

Eastern Equine Encephalitis (EEE)



Fact Sheet



Eastern Equine Encephalitis (EEE) is a rare but serious disease that spreads through the bite of an infected mosquito.



Anyone can get EEE, but people who spend time outdoors are at the highest risk. EEE can also infect horses, birds, and other animals.

Signs and Symptoms



Fever and Chills



Weakness



Headache



Body and Muscle Pain



Inflammation of the Brain



Confusion



Neck Stiffness



Coma

Signs and symptoms usually start four to ten days after being bitten by an infected mosquito and last one to two weeks. It is possible that some people infected with EEE will not show any signs of illness. Mild signs and symptoms include fever and chills, weakness, and body and muscle pain.

EEE can cause swelling of the brain and can lead to more severe illness. Signs and symptoms of severe illness include fever, headache, neck stiffness, confusion, seizures, and coma. About a third of people with EEE die. People over the age of 50 and under the age of 15 are at greatest risk for severe illness.

Mosquito Bite Prevention: Checklist to Protect Your Home

Mosquitoes need standing water to breed. Follow these steps to get rid of mosquito habitat around your yard.

Empty and remove man-made containers that hold water around your yard.

- Tires
- Crockpots
- Birdbaths
- Children's toys
- Other containers

Empty, clean, and cover used garbage cans and lids.

Remove all old tires from the yard. If you can't remove them, punch holes in them so they do not hold water. Used tires are the most common mosquito breeding site in Maine.

Empty containers designed to hold water, empty and change water out once a week.

- Water bowls
- Bird baths

Empty wheelbarrows and children's pools when not in use.

Empty gutters regularly and make sure they drain properly.

Empty swimming pools, outdoor saunas, and hot tubs. Chlorinate following label directions. If not in use, empty them and cover them covered. Do not let covers collect standing water.

Empty ornamental ponds or stock them with native fish. If they stagnate, these can produce huge numbers of mosquitoes.

Coordinate with your neighbors about getting rid of standing water on property.

Learn more about protecting your home from mosquitoes at www.maine.gov/dhhs/vectorborne


For more information about mosquito-borne diseases visit www.maine.gov/dhhs

Checklists

www.maine.gov/dhhs/

[vectorborne](http://www.maine.gov/dhhs/vectorborne)

Available Resources – Print and Digital



go ahead
**the fight
bite**

You can protect yourself against **West Nile virus** and **Eastern equine encephalitis**

- Wear long sleeves and long pants.
- Use repellent on skin and clothes.
- Take extra precautions at dusk and dawn.
- Use screens on your windows and doors
- Drain artificial sources of standing water where you live, work and play.

For more information about mosquito-borne diseases visit www.mainepublichealth.gov

Posters

www.maine.gov/dhhs/o

Mosquito Bite Prevention: A Checklist to Protect Your Home

Mosquitoes need standing water to breed. Follow these steps to get rid of mosquito habitat around your yard.

- Empty and remove man-made containers that hold water around your yard.
 - Buckets
 - Cans, bottles, jars
 - Unused garbage cans and lids
 - Children's toys
 - Other containers
- Remove all old tires from the yard. If you can't remove them, drill holes in them so they do not hold water. Used tires are the most common mosquito breeding site in Maine.
- For containers designed to hold water, empty and change water at least once a week.
 - Pet water bowls
 - Bird baths
- Drill holes in the bottom of containers used outside, like:
 - Flower pots
 - Garbage cans and recycling containers
- Turn over wheelbarrows and children's pools when not in use.
- Clean gutters regularly and make sure they drain properly.
- Clean swimming pools, outdoor saunas, and hot tubs. Chlorinate them following label directions. If not in use, empty them and keep them covered. Do not let covers collect standing water.
- Aerate ornamental ponds or stock them with native fish. If they are stagnant, these can produce huge numbers of mosquitoes.
- Talk with your neighbors about getting rid of standing water on their property.

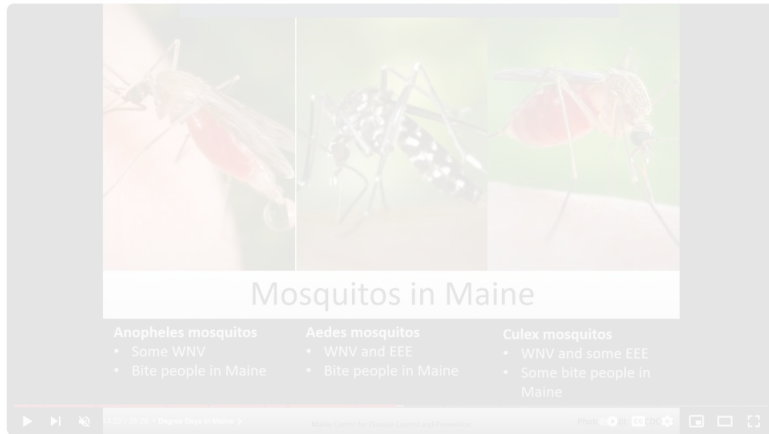
Learn more about protecting your home from mosquitoes at: www.maine.gov/dhhs/vectorborne



Checklists

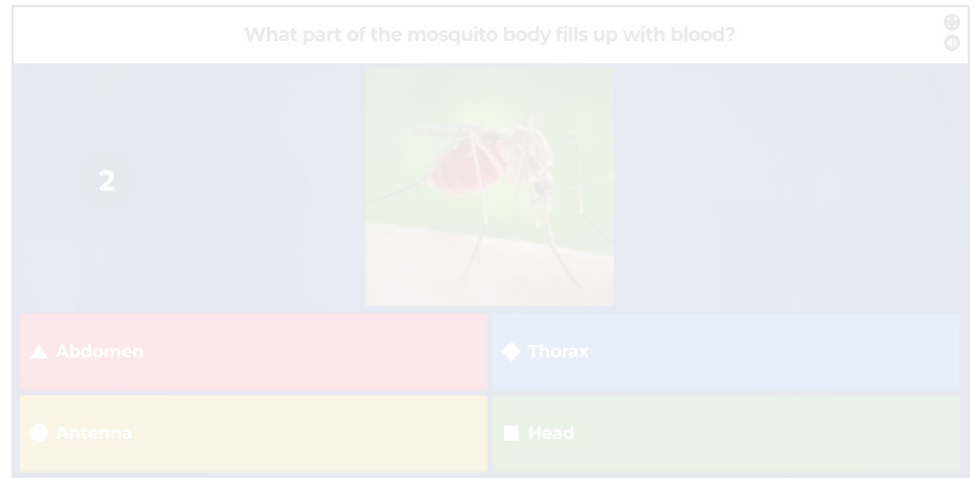
www.maine.gov/dhhs/vectorborne

Available Resources – Print and Digital



Maine CDC YouTube Channel

<https://www.youtube.com/@MainePublicHealth>



Mosquito and Tick School Curriculum

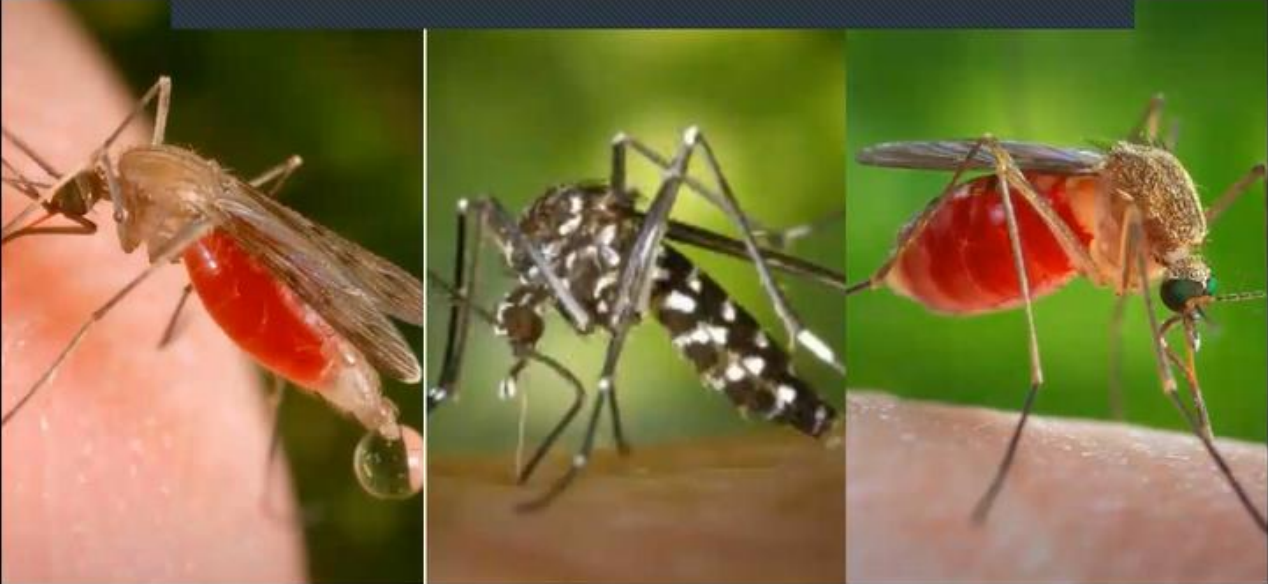
www.maine.gov/dhhs/schoolcurricula



Vectorborne Disease Youth Workbook

www.maine.gov/dhhs/schoolcurricula

Available Resources – Print and Digital



Mosquitos in Maine

Anopheles mosquitos	Aedes mosquitos	Culex mosquitos
<ul style="list-style-type: none">• Some WNV• Bite people in Maine	<ul style="list-style-type: none">• WNV and EEE• Bite people in Maine	<ul style="list-style-type: none">• WNV and some EEE• Some bite people in Maine

14:22 / 28:26 • Degree Days in Maine > Maine Center for Disease Control and Prevention Photo Credit: CDC

Mosquito-Borne Diseases in Maine 2023

Maine Center for Disease Control and Prevention 1.23K subscribers

Subscribed

2

Share

Download

Clip

Save

Available Resources – Print and Digital

What part of the mosquito body fills up with blood?



2



▲ Abdomen

◆ Thorax

● Antenna

■ Head

A Workbook for Kids to
Fight the Bite!

5

6

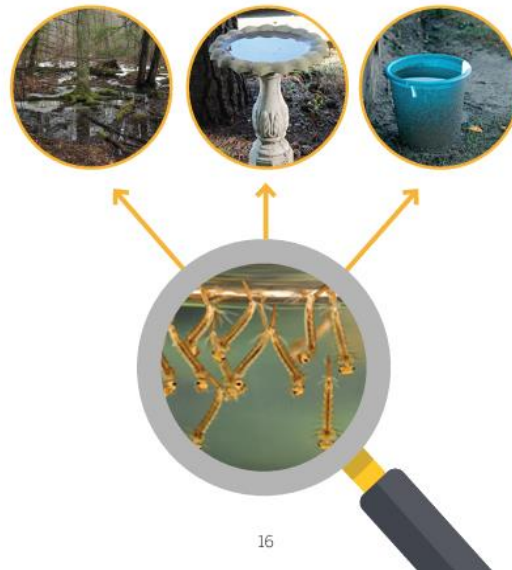
Available Resources – Print and Digital



Where do mosquitoes live?

Mosquitoes need water to lay eggs and grow. Some mosquitoes use water around our yards. This might be in puddles from rain or melting snow or in man-made containers that fill with water around the yard.

Examples of man-made containers are: buckets, flower pots, old tires, pools, and birdbaths. What others can you think of?



16

What part of the mosquito body fills up with blood?

Mosquito hotspots

Can you circle all 7 differences between the top and bottom pictures to get rid of the mosquitoes? Which yard is protected against mosquitoes?



19

Available Resources – Social Media

Coming Soon! Social Media Toolkit!

www.maine.gov/dhhs/vectorborne



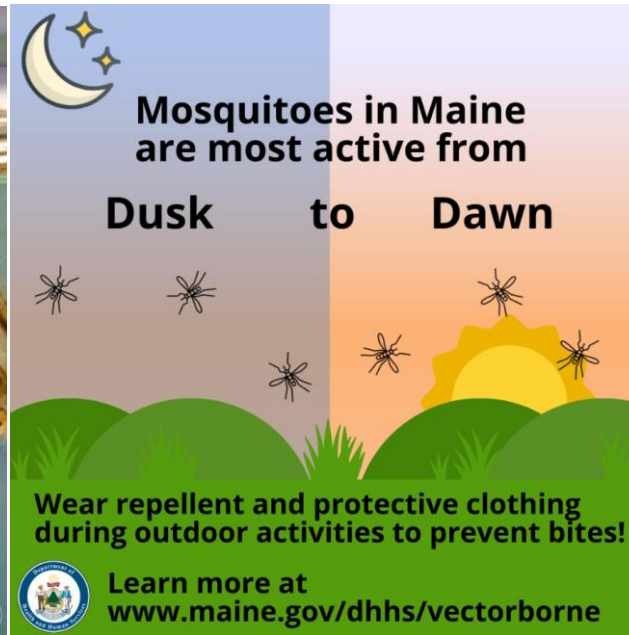
Pretty gross, right?

Mosquitoes need standing water to grow.

Even a capful of water is enough!

www.maine.gov/dhhs/vectorborne

Photo credit: US CDC



Mosquitoes in Maine are most active from **Dusk to Dawn**

Wear repellent and protective clothing during outdoor activities to prevent bites!

Learn more at www.maine.gov/dhhs/vectorborne



Dump it out to fight the bite!

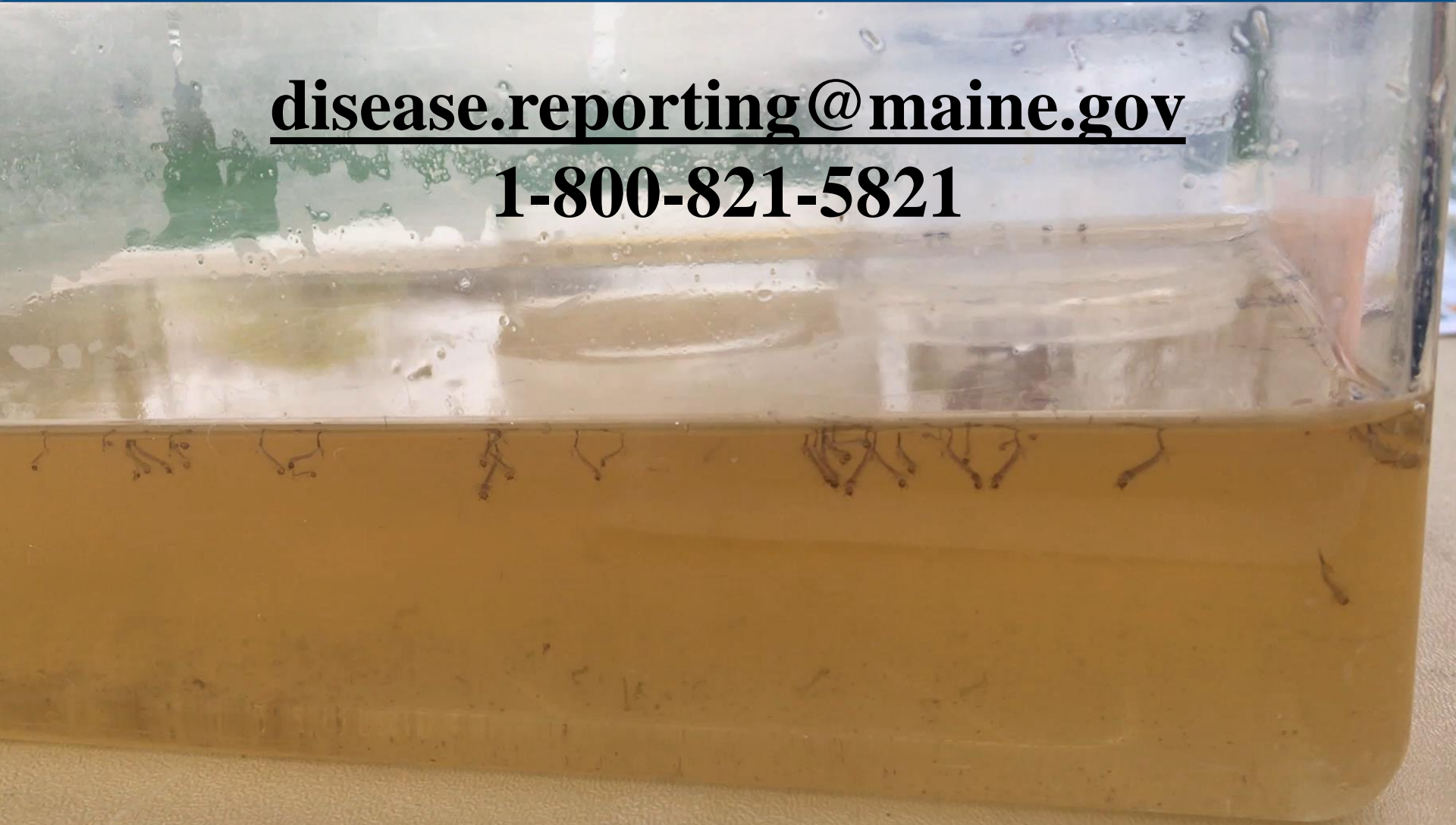
Remove or dump out any containers that hold water **at least once each week** to fight the bite!

For more information, visit www.maine.gov/dhhs/vectorborne.

Questions?

disease.reporting@maine.gov

1-800-821-5821



Municipal Mosquito IPM

Gary Fish

Maine Department of Agriculture,
Conservation and Forestry

gary.fish@maine.gov

www.maine.gov/ipm





Integrated mosquito management

- ▶ Monitoring,
- ▶ Disease surveillance,
- ▶ Source reduction,
- ▶ Public education,
- ▶ Community involvement,
- ▶ Control of all mosquito life stages, and
- ▶ Evaluation of actions taken



Monitoring is the IPM foundation

- ▶ Proper monitoring allows the municipality/district to:
 - ▶ Find breeding sites
 - ▶ Identify what mosquito species are present
 - ▶ Determine if any of those species are disease vectors
 - ▶ Set thresholds for when management is necessary
 - ▶ Determine when and if treatments are necessary
 - ▶ Evaluate the effectiveness of interventions



Natural Mosquito Breeding Habitats

Tree holes and red maple swamps

Disease surveillance

- ▶ Municipalities or Districts should partner with Maine CDC, DACF, Maine Health, or commercial mosquito control companies to collect mosquitoes and have them analyzed for vector-borne diseases like;
 - ▶ West Nile virus
 - ▶ Eastern equine encephalitis
 - ▶ Jamestown Canyon virus, and
 - ▶ Other diseases that move into Maine due to climate change



Source reduction

- ▶ Restoring tidal flow in salt marshes
- ▶ Proper construction and maintenance of stormwater retention basins and engineered wetlands
- ▶ Public sanitation efforts to remove breeding sites at neglected or abandoned properties (swimming pools, etc.)
- ▶ Public education campaigns to inform residents of the need to reduce breeding habitat

PREVENT

Eliminate breeding sites

- ◆ Every week, dump and scrub containers that hold standing water
- ◆ Keep rain gutters free of debris
- ◆ Keep decorative fountains operational or drain the water
- ◆ Change water in animal watering dishes often
- ◆ Make sure yard drain pipes are not clogged and collecting water

PROTECT

- ◆ **Cover up:** Wear long sleeves and pants when outdoors
- ◆ **Screens:** Make sure doors and windows have screens that fit tightly and do not have holes
- ◆ **Use insect repellent:** Apply repellent with active ingredients DEET, picaridin, IR3535 or oil of lemon eucalyptus to exposed skin and/or clothing (as directed on the product label)



ELIMINATE MOSQUITO BREEDING SITES AROUND YOUR HOME!

- ◆ Discarded cans/bottles
- ◆ Garden tools
- ◆ Tree holes
- ◆ Flower pots
- ◆ Old tires
- ◆ Toys
- ◆ Buckets
- ◆ Rain drums/barrels
- ◆ Pet dishes

Anything that holds water!





Recognize Mosquito Breeding Sites



Culex Breeding Sites



- Prefer standing water rich in decomposing organic material
 - dead leaves, grass clippings, and algae break down to produce an attractive organic infusion
- Flooded wooded areas, catch basins, storm sewers, cisterns, and flood water pools



Aedes Breeding Sites

- Primarily man-made containers - cans, jars, cisterns, fountains, planters, plastic food containers, used tires, and tarps.
- Prefer fairly-clean water
- Need only 1/4" of water - even bottle caps or puddles can be used



Is Your Structure Breeding Mosquitoes?

- Rain gutters
- Flat roofs
- Garbage cans and dumpsters without proper drainage
- Tarps



Clogged / Damaged Stormwater Drainage Systems

- Standing water = prime larval habitat
- Problems occur when drainage is blocked
- Long standing puddles, potholes



Tires and Sports Equipment

- Truck tires for football practice
- Perfect breeding area for *Aedes*
- Drill holes to drain water



Toys and children's play
also equipment collect
water



Community outreach is essential

Fight the Bite

PROTECT YOURSELF AGAINST WEST NILE VIRUS.
EMPTY ALL WATER AROUND YOUR HOME
WHERE MOSQUITOS CAN BREED.

gutters, window box, tree hole, flower pot, planter, boat, wheel barrow, kiddie pool, bird bath, trash can, puddle

CALL 503-988-NILE FOR MORE INFORMATION
www.mchealth.org/vector

MULTNOMAH COUNTY

모기에 물리지 맙시다!

웨스트 나일 바이러스(West Nile Virus) 균의 감염을 막읍시다. 모기가 번식할 수 있는 집 주위 각 곳에 물이 고이지 않도록 합니다.

천마 물받이, 나무의 구멍, 창틀 확보 상자, 보트, 화분, 화초 상자, 티이어, 일륜차, 어린이용 수영 조, 수면, 쓰레기통, 용접이

보다 자세한 자료는 503-988-NILE 로 연락하십시오.
www.mchealth.org/vector

MULTNOMAH COUNTY

Lucha Contra las Picaduras de Mosquito

PROTEGASE CONTRA EL VIRUS DEL NILO OESTE.
VACIE TODO EL AGUA ALREDEDOR DE SU CASA
DONDE LOS MOSQUITOS PUEDEN PROLIFERAR.

desagüadero, agujero en el árbol, asiento de ventana, Maceta para flores, barca, espacio para plantar, Ruedas, Carretilla, Piscina para bebés, Estanque para pájaros, Contenedor de basura, Charco

PARA MAS INFORMACION LLAME AL 503-988-NILE
www.mchealth.org/vector

CONDOMIO DE MULTNOMAH

An example of multi-lingual posters (in English, Korean, Spanish) from Multnomah County Vector Control in Oregon.

Community outreach is essential

PREVENT
MOSQUITO BREEDING
AROUND YOUR HOME

ONE ALBUQUE RQUE environmental health

Check these objects *after it rains* and *dump standing water* to prevent mosquito breeding

1 old tires	7 construction blocks	14 discarded toys
2 laundry tanks	8 bottles	15 roof guttering
3 uncovered tanks/cisterns	9 discarded tin cans	16 bromeliad plants
4 drums/barrels	10 tree holes and bamboo	17 garden containers & tools
5 discarded buckets & other containers	11 bottle pieces on top of walls	18 brick holes
6 pet dishes	12 old shoes	19 unmaintained wading/swimming pool
	13 flower pots	



You can protect yourself against **West Nile virus** and **Eastern equine encephalitis**

- ▶ Wear long sleeves and long pants.
- ▶ Use repellent on skin and clothes.
- ▶ Take extra precautions at dusk and dawn.
- ▶ Use screens on your windows and doors
- ▶ Drain artificial sources of standing water where you live, work and play.

For more information about mosquito-borne diseases visit www.mainepublichealth.gov



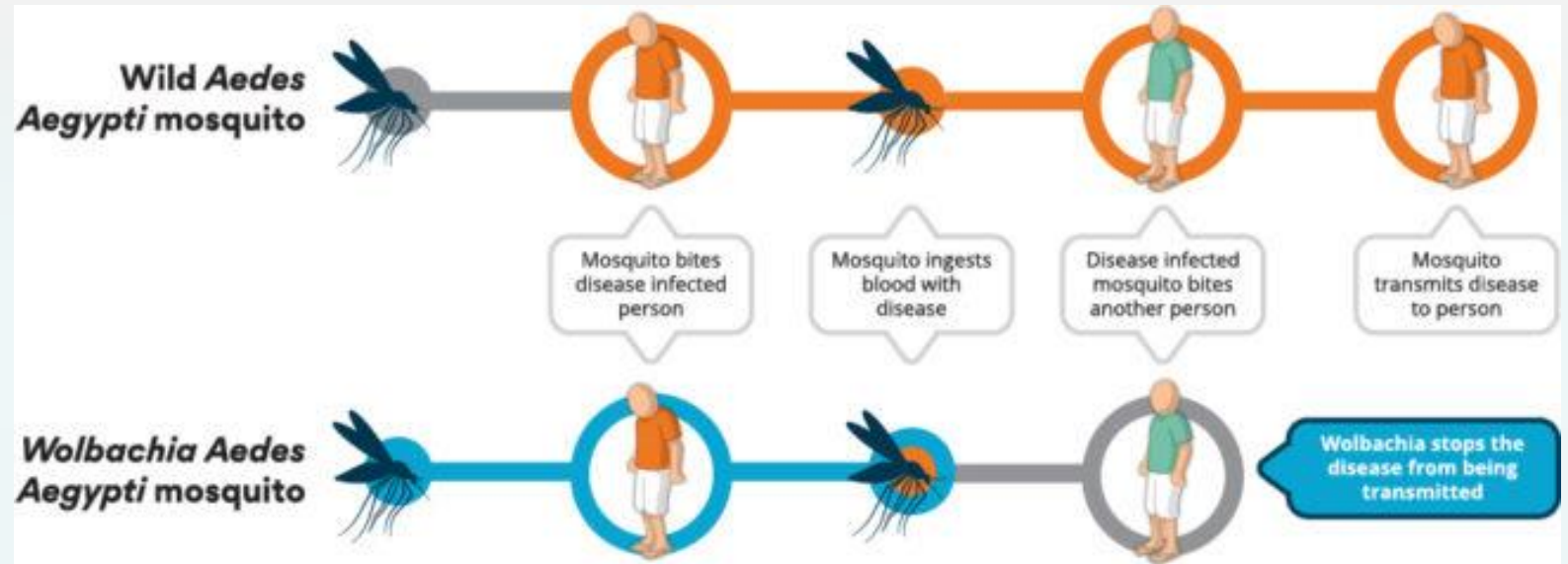
Mosquito management “control”

► Biological

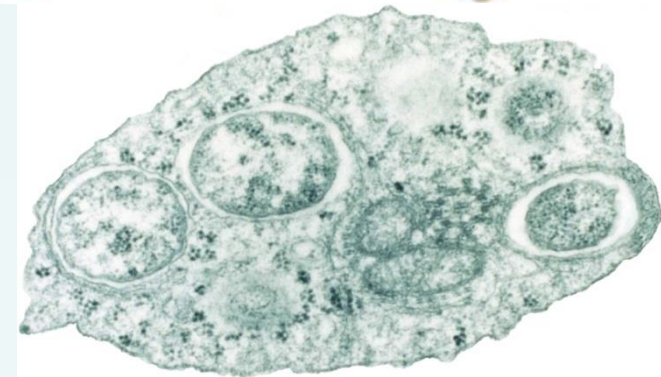
- Unfortunately, the only effective “biological” controls we have are registered insecticides. *Bacillus thuringiensis* Israelensis or Bti and *Bacillus sphaericus* are effective on the disease vectoring mosquitoes, but must be applied according to the DEP and BPC rules.
- The use of dragonflies is not recommended because:
 1. they have not been proven effective
 2. the available nymphs that come from North Carolina and Massachusetts are not 100% native species
 3. the water the nymphs are shipped in could contain invasive plants or microorganisms
- Native copepods have been used in other states but not in Maine.
 - Efficacy in Maine unknown.

New Technologies for Mosquito Management

- 1) Sterile male mosquitoes –
 - Wolbachia bacteria
- 2) Genetically engineered sterile mosquitoes- Oxitec (Friendly Mosquitoes)TM



Wolbachia



Eliminate or Treat Mosquito Breeding Sites

- *No person, firm, corporation, or other legal entity shall, for the purpose of controlling aquatic pests, apply any pesticide to or in any waters of the state as defined in 38 M.R.S.A. §361-A(7) without approval of the Maine Department of Environmental Protection.*
- *Also requires a commercial master pesticide applicator license*
- Using something like Bti (Mosquito dunks) is only allowed in shallow puddles that are not connected to streams or ponds.



Mosquito management “control”

- ▶ Mechanical/physical

- ▶ Window screens
- ▶ Source reduction
- ▶ CO2 traps

- ▶ Insecticides

- ▶ Larvicides

- ▶ Application to proper breeding sites can be controlled and confined to those sites

- ▶ Adulticides

- ▶ Greater risk of off-target effects
- ▶ Pesticide drift is a concern
- ▶ Only effective in disease management when applied to wide areas

Differences Between *Aedes* and *Culex* Mosquitoes

Culex

Resting sites
8–10 feet
high

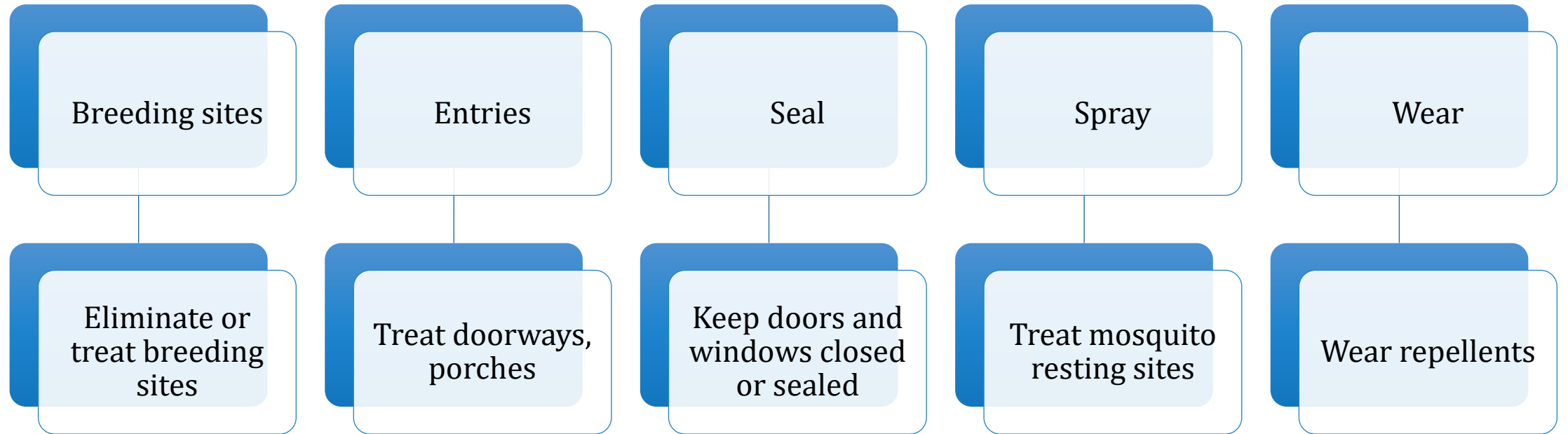
Aedes

Resting sites
typically close
to the ground



Treat the building entrance





Mosquito Deterrents

Resources

- Maine Department of Agriculture, Conservation and Forestry - IPM Specialist, Hillary Peterson, hillary.Peterson@maine.gov

The screenshot shows the website for the Maine Department of Agriculture, Conservation & Forestry. The page is titled "Integrated Pest Management (IPM)" and is part of the "Division of Animal and Plant Health" section. The website features a navigation menu with categories like "Animals & Plants", "Forest", "Geology", "Recreation", "Farming", "Planning", "Licensing & Regulations", and "Bureaus & Programs". The main content area includes a sidebar with a list of services, a central section with images and text about IPM, and a right-hand sidebar with featured topics and related links. The featured topics include "JOB ANNOUNCEMENT", "Ticks and Mosquitoes - Maine CDC", "Forest and Tree Health - Maine Forest Service", and "CMBG IPM Presentations". The related links section lists "Got Pests?", "University of Maine Cooperative Extension IPM Programs", "Northeastern IPM Center", "Maine Organic Farmers and Gardeners Association", and "Sustainable Agriculture Research and Education". The program contacts section provides the name and contact information for Hillary Peterson.

maine.gov | Agencies | Online Services | Help | Search Maine.gov

MAINE DEPARTMENT OF Agriculture, Conservation & Forestry

Online Services | Subscribe | Contact Us | News

Search DACF SEARCH

About ▾ Animals & Plants Forest Geology Recreation Farming Planning Licensing & Regulations Bureaus & Programs ▾

DACF Home → Bureaus & Programs → Division of Animal and Plant Health → Integrated Pest Management

Division of Animal and Plant Health

About Us

FAQ

Laws & Rules

Programs

Agricultural Compliance

Animal Health

Animal Welfare

Apiary (Bees)

Arborist

Board of Pesticides Control (BPC)

Compost

Ginseng

Hemp

Horticulture

Integrated Pest Management (IPM)

Nutrient Management

Pest Survey (CAPS)

Seed Potato Certification

Contact Us

Integrated Pest Management (IPM)

What is IPM?

Integrated Pest Management, or IPM, is an environmentally sound approach to managing pests such as insects, weeds, plant pathogens, and wildlife on farms and forests, in our communities, and in our homes. IPM relies on proper pest identification, monitoring, and combinations of pest avoidance and management strategies to protect people, crops, and the environment while minimizing reliance on pesticides.

- ▶ IPM Toolbox for Everyone
- ▶ Agriculture and Horticulture IPM
- ▶ School IPM Program
- ▶ Teacher Educational Resources
- ▶ IPM Resources for Professionals
- ▶ IPM Council

FEATURED TOPICS

- [JOB ANNOUNCEMENT](#)
- [Ticks and Mosquitoes - Maine CDC](#)
- [Forest and Tree Health - Maine Forest Service](#)
- CMBG IPM Presentations**
- [Lawns & Trees \(PDF\)](#)
- [Fruits & Veggies \(PDF\)](#)
- [Insect ID & IPM \(PDF\)](#)

RELATED LINKS

- [Got Pests?](#)
- [University of Maine Cooperative Extension IPM Programs](#)
- [Northeastern IPM Center](#)
- [Maine Organic Farmers and Gardeners Association](#)
- [Sustainable Agriculture Research and Education](#)

PROGRAM CONTACTS

Hillary Peterson
Division of Animal and Plant Health
28 State House Station
Augusta, ME 04333
phone: (207) 215-4793
fax: (207) 287-7548

Questions?

▶ gary.fish@maine.gov

▶ 207-287-7545



New York Times

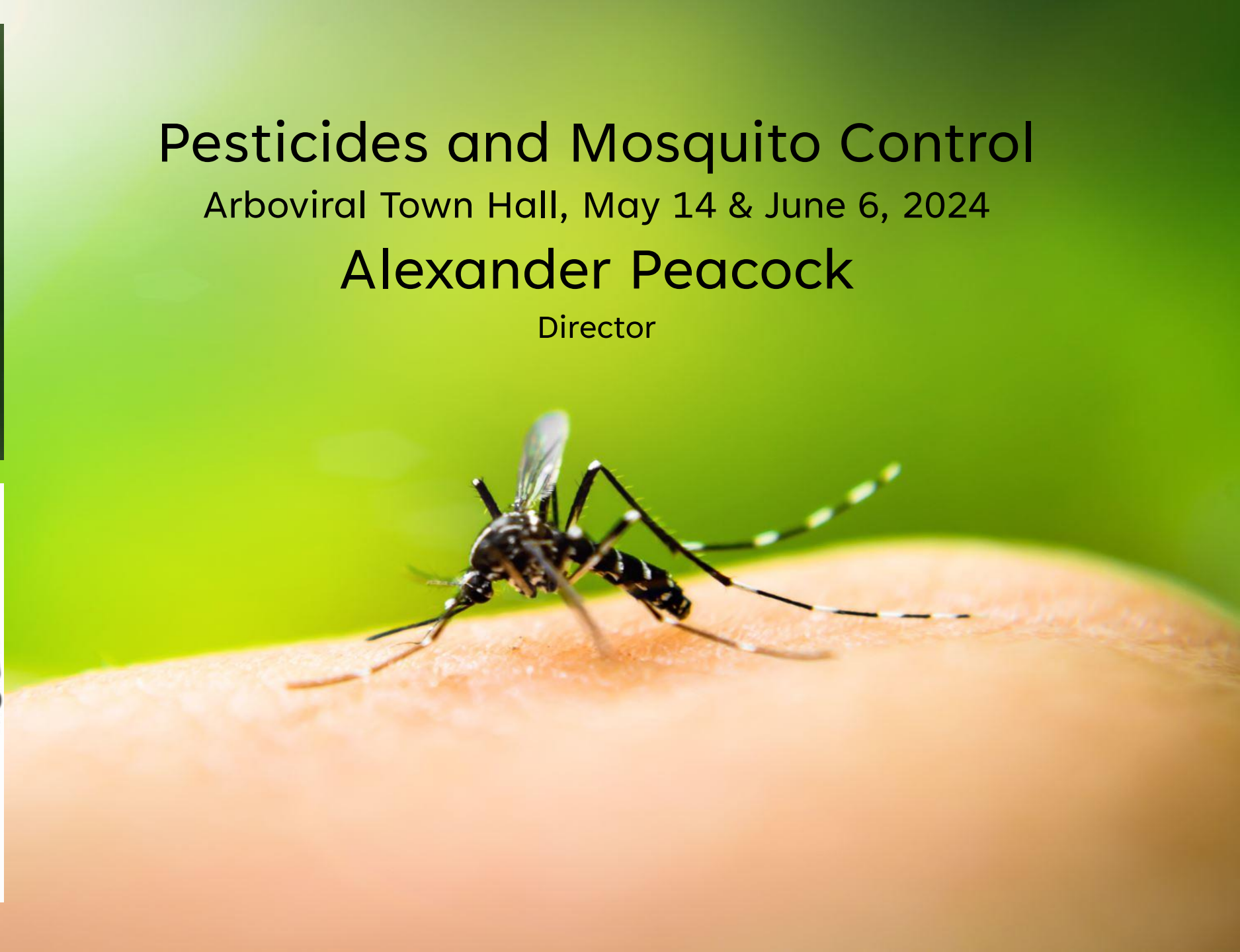


Pesticides and Mosquito Control

Arboviral Town Hall, May 14 & June 6, 2024

Alexander Peacock

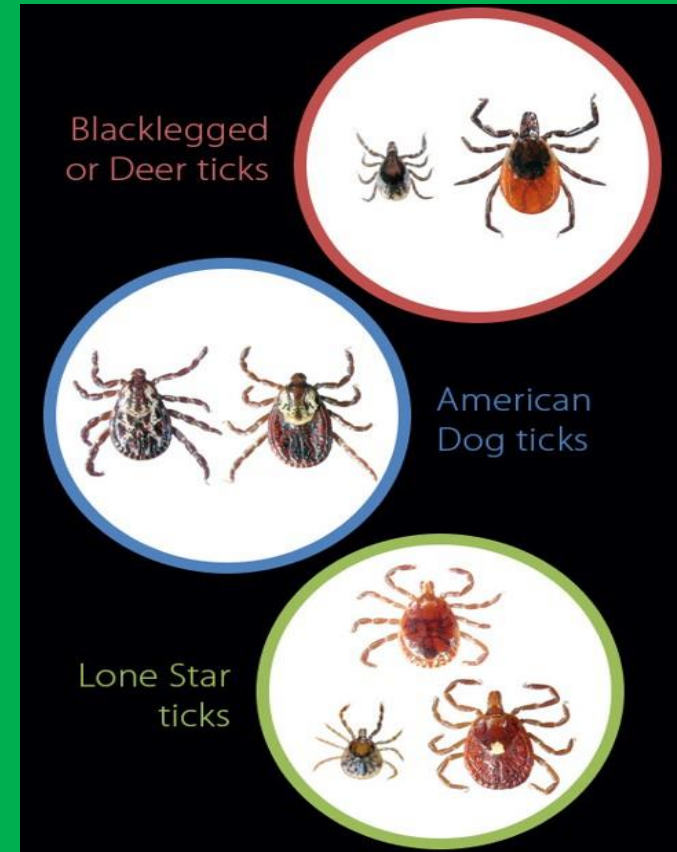
Director



"Pesticide" means any substance or mixture of substances intended for **preventing, destroying, repelling or mitigating any pest**; any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant.

"Spray Contracting Firm" means any person, including a corporation, employed or contracted to conduct a public or private custom application of one or more pesticides.

"Custom application" means an application of a pesticide under contract or for which compensation is received, pesticide application to area open and accessible to the public, in food/eating establishment or application as government employee.



"Commercial applicator/Master" (CMA) means a commercial applicator who is responsible for the major pest control decisions including, but not limited to, identifying unusual pests and choosing the appropriate pest control strategies and techniques, establishing policies relating to the operating practices of others applying pesticides within the company or agency including equipment maintenance and calibration, training, safety and hygiene, pesticide and container disposal, accident mitigation and ensuring that applications are conducted in compliance.

"Commercial applicator/Operator" (COA) means a commercial applicator who applies or directs the application of a pesticide according to the instructions of the commercial master applicator.

An **unlicensed applicator** may make pesticide applications under the direct supervision of a CMA or COA.



Licensed Applicators 2024

Company Licenses 7E 80

- **Commercial Master Applicator (CMA) 159**
- **Commercial Operator Applicator (COA) 339**



Applicator Categories

Categories

- 1A Agricultural Animal
- 1B Agricultural Plant
- 1B1 Commercial Blueberry
- 1B2 Chemigation
- 1B3 Agricultural Fumigation
- 1B4 Post Harvest Treatment
- 2 Forest Pest Management
- 3A Outdoor Ornamentals
- 3B Turf
- 3C Indoor Ornamentals
- 4 Seed
- 5A Aquatic Pest Control
- 6A Right of Way Management
- 6B General Vegetation Mgt
- 7A Structural Pest
- 7B Structural Fumigation
- 7C1 Disinfectant and Biocide
- 7C2 Swimming Pool and Spa
- 7C3 Mold Remediation
- 7D Wood Preserving
- 7E Biting Fly and Other
- 7F Termites
- 8A Public Health – Biting Fly
- 8B Public Health – Other
- 9 Regulatory Pest Control
- 10 Demonstration & Research
- 11 Aerial

Licensed Applicators 2024

**Companies Licensed for 7E (biting fly),
5A (Aquatics) & 11 (Aerial) - 1**



Why is confirming pesticide registration in Maine important?

Chapter 20: SPECIAL PROVISIONS

Section 1. Registered Pesticides

B. The use of any pesticide not registered by the Maine Board of Pesticides Control in accordance with M.R.S. Title 7 § 607 is **prohibited** except as otherwise provided in this chapter or by FIFRA, Section 2(ee).

2024 Registered Pesticides for Mosquito Control

Total Products labeled for Mosquitoes – 1,270

Mosquito Control Outdoors – 622

Mosquito Control in Aquatic Areas

Larvicide – 50

Adulticide – 39

Common active ingredients for mosquito adult control:

Synthetic pyrethroids:

Bifenthrin

Permethrin

Deltamethrin

Cypermethrin

Organophosphates and Carbamates:

Malathion

Carbaryl

25b products (minimal risk pesticides, exempt from EPA registration)

Rosemary oil

Peppermint oil

Cedarwood oil

Common active ingredients for mosquito larvae control:

Bacterial Insecticides:

Bacillus thuringiensis israelensis

Bacillus sphaericus

Organophosphate Insecticide:

Temephos (None registered for use in Maine)

Source: U.S.E.P.A.

01 DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY

026 BOARD OF PESTICIDES CONTROL

Chapter 20: SPECIAL PROVISIONS

Section 4. Aquatic Applications

No person, firm, corporation or other legal entity shall, for the purpose of controlling aquatic pests, apply any pesticide to or in any waters of the state as defined in 38 M.R.S.A. §361-A(7) without approval of the Maine Department of Environmental Protection.



Contacts
Permits, Licenses, Certifications
Laws
Monitoring and Reporting
Programs
Rules
Publications and Resources

Aquatic Pesticides

Introduction

The Department has developed a general permit for the application (discharge) of aquatic pesticides for the control of mosquito-borne diseases. This general permit covers discharges of authorized aquatic pesticides by a licensed applicator to Classes AA, A, B, C, SA, SB, SC and waters having a drainage area of less than 10 square miles, that constitute breeding habitat for mosquito species known to be potential disease vectors and that meet the other provisions identified in the General Permit.

The Department has also developed general permits for the application of herbicides for the control of invasive aquatic plants and application of piscicides for the control of invasive fishes.



Contact (licensing)

- [Gregg Wood](#) (207) 287-7693, or call 287-7688 and ask to speak to someone in the "Waste Discharge Program".

Text

- [General Permit, Application of Aquatic Pesticides for the Control of Mosquito-borne Diseases](#), April 21, 2015 (PDF)

Forms

- [Notice of Intent \(NOI\)](#)

Finding an Applicator

Maine.gov Agencies | Online Services | Help | Search Maine.gov Select Language

MAINE DEPARTMENT OF Agriculture, Conservation & Forestry Online Services | Subscribe | Contact Us | News

Search DACF

About ▾ Animals & Plants Forest Geology Recreation Farming Planning Licensing & Regulations Bureaus & Programs ▾

DACF Home → Bureaus & Programs → Bureau of Agriculture → Division of Animal and Plant Health → Board of Pesticides Control

Division of Animal and Plant Health

Board of Pesticides Control

- About Us
- Information for the Public
- Public Meetings
- Pest Management Resources
- Licensing, Applicators and Distributors
- Applicator Resources
- Pesticide Registration
- Water Quality Program
- Pesticide Laws, Regulations & Policies
- Publications & Forms
- Contact Us

ASK the EXPERT

Board of Pesticides Control

2023 Registered Pesticides List

[2023 Registered Pesticides List \(XLSX\)](#) - This list was generated March 22, 2023 at 8:00 AM. Please recognize that registrations are being submitted continuously and this list will become out of date almost immediately. Check back for an updated list.

An additional three week extension from CMR01-26 Chapter 20, Section 1 (F) is being provided to accommodate registrant requested changes to the BPC registration portal. The extension end date is March 21, 2023. This extension will allow for the continued distribution of products registered in 2022 by those registrants who intend to renew their product registrations for 2023.

Trending Topics: [COVID-19 & Disinfectants](#) / [Browntail Moth](#) / [Cannabis](#) / [Pollinators](#) / [Neonicotinoids](#) / [Aquatic Herbicides](#)

Public Meetings

- [The next Board meeting will be April 7, 2023](#)
- [BPC Meetings, Schedules, Agendas, and Minutes](#)

Events

- Spring Structural Recertification Meeting on April 11, 2023- [Pre-registration Required](#)
- [Credit calendar - upcoming recertification meetings](#)

News

- [LD 8: An Act to Increase Support for the Modernization of the](#)

ONLINE SERVICES

- [BPC Portal Login](#)
- [Need Credits?](#)
- [Search Maine Registered Products](#)
- [Complaints](#)
- [Subscribe for News](#)

Finding an Applicator

NEWS

- [LD 8: An Act to Increase Support for the Modernization of the Board of Pesticides Control by Increasing the Annual Pesticide Registration Fee](#)

[More News +](#)



For the Public

[Information for the Public](#)
[Environmental & Human Health](#)
[Pesticide Notification](#)
[Water Quality Program](#)
[School IPM](#)
[Identify a Pest](#)
[Find a Licensed Applicator or Company](#)
[Environmental Risk Advisory Committee](#)
[National Pesticide Information Center](#)
[University of Maine Cooperative Extension](#)



For Registrants

[Product Registration](#)
[Product Submission Instructions](#)
[Creating a Login](#)
[Creating a Company Profile](#)
[Adjuvant Registrations](#)
[CSF Submission Portal](#)
[Neonicotinoids](#)



For Applicators & Distributors

[Applicator Licensing](#)
[Distributor Licensing](#)
[Applicator Resources](#)
[2023 Non-Agricultural Pesticide Notification Registry \(PDF\) / \(Excel\)](#)
[Critical Pesticide Control Areas](#)
[Standards for Indoor Pesticide Applications](#)
[Municipal Ordinances](#)
[Special Local Needs Registrations](#)
[Container Recycling](#)

Credits

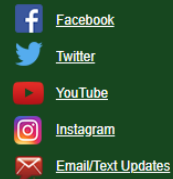


Copyright © 2021
Image Credits
All rights reserved.

Information

[Maine.gov](#)
[Site Policies](#)
[Accessibility](#)
[Document Viewers - including PDF and Word](#)
[Jobs @ DACF](#)
[Grants & Loans](#)
[Educational Resources](#)
[DACF Home](#)
[Sitemap](#)

Connect with Us



[Email/Text Updates](#)
[Meeting & Event Calendar](#)
[See more social media](#)

Support DACF Programs

[Maine State Park Passes](#)
[Volunteer](#)
[Specialty License Plates](#)
[Outdoor Heritage Fund Lottery Ticket](#)
[Donations & More](#)

Contact Information

Department of Agriculture, Conservation & Forestry
22 State House Station
18 Elkins Lane
Augusta, ME 04333
Phone: (207) 287-3200
Fax: (207) 287-2400
TTY: Maine Relay 711
dacf@maine.gov
[More Contacts](#)

Division of Animal and Plant Health
Board of Pesticides Control
About Us
Information for the Public
Public Meetings
Pest Management Resources
Licensing, Applicators and Distributors
Applicator Resources
Pesticide Registration
Water Quality Program
Pesticide Laws, Regulations & Policies
Publications & Forms
Contact Us


Board of Pesticides Control

Information for the Public

Pesticides can be important tools which, in the hands of an informed applicator, offer many potential benefits. But pesticides can also pose risks if improperly used. That's why the Maine Board of Pesticides Control (BPC) works hard to help people outsmart pests by arming them with the best available pest management science.



On this Page:

- [Pesticide Resources for the Public](#)
- [What is a pesticide?](#)
- [How to read a label](#)
- [Pesticide poisoning](#)
- [Pesticide spills](#)
- [Pesticide storage and disposal](#)
- [Hire a professional](#)
- [Using insect repellents](#)
- [Aquatic herbicides](#)
- [Vectorborne Disease Management, Public Health and Pesticides](#)

Pesticide Resources for the Public

- [Pollinator Protection](#)
 - [Grubs got your lawn? Before you act, read this!](#)
 - [Pesticide Notification: Your Rights and Responsibilities](#)
 - [Obsolete Pesticide Collection](#)
- [Have a problem with a pesticide application? How to file a complaint](#)

LICENSED COMPANIES

- [For Hire Pesticide Application Companies](#)
- [Licensed Companies Offering Mosquito and Tick Control](#)
- [Licensed Companies Offering Bat Proofing](#)
- [Licensed Commerical Applicators](#)
- [Tick and Mosquito Companies](#)
- [Terrestrial Invasive Plants Companies](#)
- [Browntail Moth, Hemlock Woolly Adelgid and/or Other Pests \(PDF\)](#)
- [Arborists That Prune Browntail Winter Webs \(PDF\)](#)

PEST MANAGEMENT RESOURCES

- [Master Gardeners](#)
- [Maine YardScaping Partnership](#)
- [Integrated Pest Management \(IPM\)](#)
- [School IPM](#)
- [Got Pests?](#)

Regulations to take into consideration:

Chapter 20: SPECIAL PROVISIONS

Chapter 22: STANDARDS FOR OUTDOOR APPLICATION OF PESTICIDES BY POWERED EQUIPMENT IN ORDER TO MINIMIZE OFF-TARGET DEPOSITION

Chapter 29: STANDARDS FOR WATER QUALITY PROTECTION

Chapter 31: CERTIFICATION AND LICENSING PROVISIONS/COMMERCIAL APPLICATORS

Chapter 51: NOTICE OF AERIAL PESTICIDE APPLICATIONS



**READ
THE
LABEL!**



Complaints / Inquiries

To submit a complaint or inquiry
please contact the BPC at:

pesticides@maine.gov

207-287-2731





Thank You

Questions?

Alexander Peacock
Alexander.r.peacock@maine.gov
www.thinkfirstspraylast.org



26

Mosquito Control at the Municipal Level in Maine

Michael Morrison , BS Entomology

Aquatic Entomologist

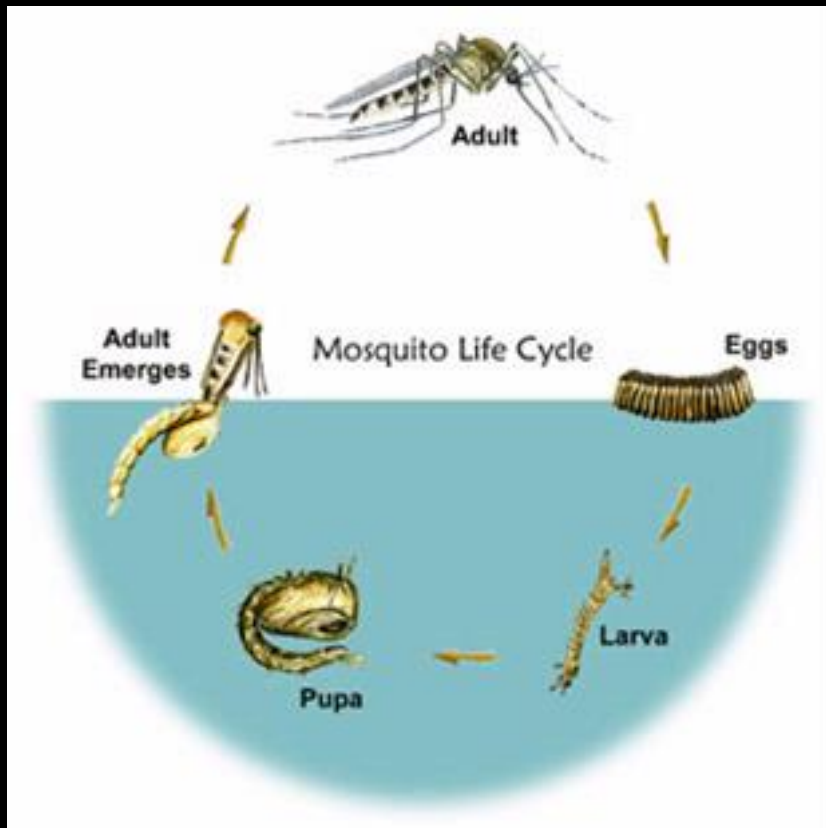
Municipal Pest Management Services, Inc

TEL: 603-231-1271 Mobile

e-mail:mummichog@comcast.net

Http://www.swamp-inc.com

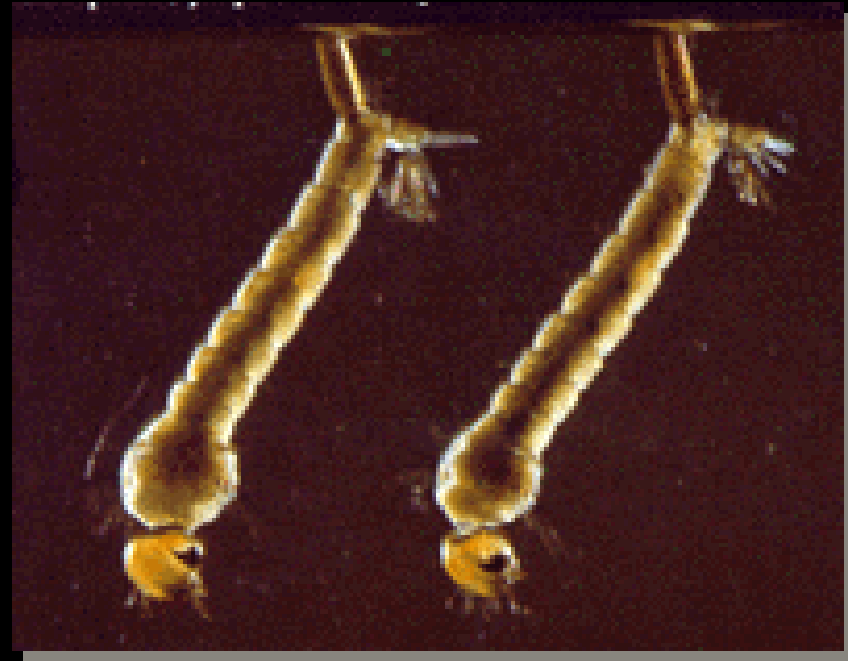
Life Cycle



- Life cycle consists of egg, larval, pupal, and adult stages
- All mosquitoes require water for complete development
 - Natural Containers
 - Artificial Containers

Larval Stage

- Also called “wigglers”
- Must have water to complete development
- Stagnant water is ideal
- 4 developmental stages “larval instars”
- Air tube for breathing called a “siphon” that penetrates the surface of the water
- Feed on microorganisms and organic debris in water column



Adult Stage

- Newly emerged adults rest on the water surface while wings dry and harden
- Average adult lives from 2 to 3 weeks, over-wintering adults live 6 to 8 months
- Only females search for a blood meal
- Many mosquitoes stay very close to their breeding site
- Blood meal is used for egg development
- First batch of eggs in spring may be produced autogenously (without a blood meal)
- Males live only long enough to mate and do not feed on blood
- Females can lay as many as 200 eggs with each blood meal



Current Mosquito Control Programs in Maine

York and Kittery

Vector Control Program Together?

Larviciding primarily

Larval and Adult Surveillance

Why Mosquito Control ?

- Public Health
 - West Nile Virus (WNV)
 - Eastern Equine Encephalitis (EEE)
 - Jamestown Canyon Virus
 - Potential for occurrence of other introduced diseases
- Nuisance Reduction
 - Coastal Areas- salt marshes; flat topography
 - Urban
 - Residential
 - Recreational Facilities
 - Golf Courses
 - Ball Parks

Mosquito Control Myths

- Birds
- Bats
- Dragonflies
- Fish
- Plants
- Garlic Spray
- “Magnets”
- Ultrasonic Devices
- Catch Basin Vacuuming
- Mosquito Dunks
- Adulticiding Only
- No neighboring control program

HOW ?

Integrated Pest Management (IPM)

A pest management approach that reduces mosquitoes (disease vectors) by integrating both chemical and non-chemical control options.

Emphasis is placed on identifying mosquito species, monitoring mosquito populations, mapping breeding habitats and control applications.

IPM Components

- Arbovirus Testing
- Mosquito Biology
- Mosquito Breeding and Habitat Identification
- Mosquito Species Identification
- Ecological Monitoring and Surveillance
- Human Risk Assessment
- Appropriate Mosquito Control Options
- Wetland/ Salt Marsh restoration
- Emergency Contingency Planning and implementation



Surveys and Surveillance

- **Essential component in an IPM based mosquito control program**
- **Mosquito Survey versus Mosquito Surveillance**
 - Larvae and Adults
 - Species Identification
 - Mapping of larval mosquito habitat
 - Disease presence in the adult mosquito population
 - What species are common and what type of wetland habitats are present

Pesticide Control

- Larviciding
- Adulticiding

Larviciding

- Treatments dependant on species and stage of development
- Equipment
- Ground applications
- Organic- Bacterium (Bti, Bs)
- Catch basins
- Red maple swamps
- Salt marshes
- EEE crypts



Adulticiding

- Barrier and Perimeter treatments
- Ground ULV
- Identification of non target/sensitive areas
- Aerial- state declared emergencies

Operations

- Cost Variables
- Off-season Activities
- Funding Strategies
- Personnel
- Equipment & Vehicles
- Recordkeeping
- Public Relations
- Security
- Pesticide Storage & Handling
- Insurance
- Mosquito species, plant species and habitat identifications
- Survey and Surveillance
- Consolidation of other municipal services
 - Sidewalk weed control, turf management, aquatic plant control, invasive plant control, poison ivy control and structural pest control

Source Reduction

- Tire Ordinances
- Public awareness programs
 - Clogged gutters
 - Stagnant water-holding containers
- Filling and grading depressions
- Clearing clogged drainage ditches
- Vegetation control in storm water basins

Water Management

- Storm Water Basins
- Beaver Dams
- Roadside Ditches & Swales
- Stream Corridor Clearing
- Invasive/ Vegetation Control
- Wetland Restoration
- Partnerships & Grants
- Equipment



LGP Dump Carriers



Positrack LGP Mower



Cat 307C LGP Wetland Excavator

Off Season Activities

- Spray equipment maintenance and over wintering
- Truck fleet and heavy equipment maintenance
- End of year summaries and reports
- Budget preparation for next season activities
- Wetland management/ restoration projects
- Landowner permission
- Develop EEE/WNV contingency plans
- School outreach
- Licensing and Permit applications
- Identify and larvicide EEE mosquito habitats
- Mapping
 - New streets and developments
 - catch basins
 - Red maple, sphagnum bogs
 - Salt Marshes

Emergency Contingency Planning

- Written Plans with Annual Updates
- Off Season Meetings and Year-end Summaries
- Roles of Town and City Departments
 - Recreation Department
 - Health Department/ officer
 - Administration
 - School Departments
 - Buildings and Grounds
 - Highway/public works departments
 - Police and fire departments
 - Emergency Management Teams
- Roles of State and Federal Agencies

Cost Variables

- Topography
- Wetland Type and Size
- City/ Town Size (square miles)
- Number of Catch Basins
- Urban vs. Rural Environment
- Typical Meteorological Conditions
- Human Population Density
- Human Demographics
- Pest vs. Disease Programs

Typical Costs for a Disease Surveillance Program

- Labor intensive
- Adult mosquito surveillance for arboviral testing
 - Transportation
 - Supplies
 - Light traps
 - Gravid Traps
 - Resting Boxes
 - Dry Ice
 - Batteries
 - Labor
 - Microscopic mosquito species identification
 - Laboratory preparation of specimens
 - Mapping
 - Data Collection
 - Trap placement
 - Approximately \$700 per week (2 traps) from July 1st to October 15th

Typical Costs for a Disease Control Program

- Larviciding

- Typical-April 1 to December 31 (39 weeks)
- EEE (crypt and cattail) areas can be treated off season
- Labor intensive
- Transportation
- Supplies and control materials
- Low end cost: \$1,000- \$2,000 per week

Source reduction/ water management

- Grants

- Adulticiding

- Barrier
 - Schools, parks, recreational fields)

Regulatory

- Maine
 - Board of Pesticide Control- Adulticiding and pesticide licensing
 - MDEP- Larviciding
 - Treatment justification/ mosquito monitoring/species specific
 - Bacterial larvicides only
- Sensitive Areas
 - Public and private water supplies
 - Ground water
 - Wetlands
 - Beekeepers
 - No-Sprays
- Water Management
 - State and Federal permit agencies
- Homeowner No No's
 - Overdosing
 - Lawn/barrier treatments without “mosquito” or “treatment area” on label
 - Larviciding
- Unlicensed Remedies (motor oil, kerosene, bleach, Lysol, mosquito dunks)
- Water Draining and Wetland Filling

Consolidation With Other Municipal Services Vector Control Programs

- Storm Water Management- ditches, basins
- Wetland Maintenance and Restoration
- Vegetation Control- invasives, poison ivy, sidewalks
- Turf Management- European chafer
- Pest Control- buildings, stinging insects, biting flies
- Shade Trees- disease and insect control
- Tick Management- strategies on public properties
- GIS Mapping