

VECTOR BIOLOGY BOOT CAMP TOOLKIT

NORTHEAST REGIONAL CENTER FOR EXCELLENCE IN VECTOR-BORNE DISEASES
CORNELL UNIVERSITY DEPARTMENT OF ENTOMOLOGY

Program Background

The Vector Biology Boot Camp is a program offered by the Northeast Regional Center for Excellence in Vector-Borne Diseases to provide hands-on learning opportunities in vector surveillance and control program operations. The program is designed for vector-borne disease professionals working in the Northeast region of the United States and covers tick and mosquito species of medical importance to this region. The program was initially developed by Laura Harrington, Emily Mader, and NEVBD colleagues, and was first hosted in 2018. The program has been held on an annual basis since this time, excluding calendar year 2022.

The purpose of this toolkit is to share operational details of the Vector Biology Boot Camp with others, with the intention to support those who may start a similar program. Examples of learning outcomes, materials and supplies, and evaluation instruments are provided in this guide.

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Vector Biology Boot Camp Program Administration

- **Program Principal Institution / Investigator:** Cornell University Department of Entomology
- **Partner Host Institution:** Variable. Partners must have adequate faculty/instructor expertise to develop and host yearly program.
- **Program Administrative Support:** Cornell University / NEVBD-TEC Program Manager
- **Venue:** Variable. Consideration should be made to place the venue in a centrally accessible location for the target audience. For NEVBD, it must be located in New England or Mid-Atlantic regions of the US and have adequate facilities to host the program.
- **Dates:** Program hosted annually.
 - **Preferred:** mid- to late-May. Hosting the training program in mid- to late-May avoids attendee work conflicts with the active vector surveillance season (for most Northeast surveillance and control programs) while also allowing early-season mosquito and tick vectors to become active in the environment.
 - **Secondary:** early October. While not ideal, early October may be an alternative period to host the training program while tick and mosquito vectors remain active in the environment. However, attendee work conflicts are likely during this time of year.
- **Cost:** There is no cost to register. Attendees must cover their own travel to the event site. Accommodations and meals are offered at no cost to attendees.
 - Annual program budget approximately \$45,000 – \$60,000, dependent upon venue.
- **Materials and Supplies:** Provision of materials and supplies are shared between NEVBD-TEC administration and the Partner Host Institution. (see: *Vector Biology Boot Camp Materials & Supplies List*)

Registration and Attendance

- **Target Audience.** This program is designed for professionals working in the field of vector-borne diseases who have a specific focus on the collection, processing, testing, and/or reporting of mosquito and tick vectors for public or privately funded surveillance and control programs.
 - This program is not designed for academics (faculty or students/trainees).
- **Minimum Attendance.** Maximum attendance capacity is based on local venue restrictions. The target is to accommodate a minimum of 20 trainees per event.
- **Application and Registration.** Registration typically opens in February and utilizes an online program application form (see: *Vector Biology Boot Camp Application and Confirmation Forms*). This is optimally timed to allow attendees to secure travel approvals from their respective employers. Volunteers from within the administrative team review the applications using the following criteria to prioritize acceptance:

- Works in public sector on vector-borne disease and/or vector surveillance and control
- Work duties include one or more of the following:
 - Direct collection and processing of vector specimens
 - Direct implementation of vector control activities
 - Supervision of vector surveillance program operations
 - Data collection and entry for vector surveillance and/or control program
- Works in jurisdiction within NEVBD catchment area

Attendees are issued acceptance letters and asked to confirm their intention to attend the training program (see: *Vector Biology Boot Camp Application and Confirmation Forms*). Applications are reviewed on a rolling basis until 20 individuals have been selected to attend and/or deadlines for event logistics require a final head count (i.e., hotel reservations, catering). Up to five applicants can be kept on a program wait list in the event accepted attendees do not receive travel approvals to attend the training program.

- **Accommodations.** Vector Biology Boot Camp attendees will have no-cost accommodations provided, either directly at the training venue or a nearby hotel. NEVBD supports local transportation to and from the accommodation to the training site, if needed. Attendees must cover their own travel expenses to arrive at the training location.
 - Instructors who are members of the NEVBD-funded investigative team should cover costs of participating in the event through their subaward budgets. Instructors from the NEVBD network who are not affiliated with subaward institutions will have travel expenses covered through the primary Cornell University budget or partner host institution budget.
- **Meals:** All meals are covered for attendees and instructors during the dates of the event.

Curriculum Development

- **Instructor Team.** The lead instructors for the Vector Biology Boot Camp are members of the NEVBD Leadership Team and key collaborators in vector surveillance and control from the NEVBD network. Instructors have ownership over the content covered in their respective modules.
- **Core Program Modules.** The following subject areas comprise the Vector Biology Boot Camp content each year. The curriculum may emphasize one area over another from year to year based upon the background and interests of the admitted program attendees.
 - Arthropod Biology, Ecology and Behavior
 - Major Regional Diseases and Emerging Threats
 - Surveillance Roles and Responsibilities
 - Diagnostics and Pathogen Testing
 - Collection and Processing Methods (hands-on components)

- Taxonomy and Identification of Ticks and Mosquitoes (hands-on components)
 - Vector Control for Ticks and Mosquitoes
 - Pesticide Resistance Monitoring (hands-on components)
 - Data Management, Vector-Borne Disease Metrics, Spatial Analysis, and Mapping (hands-on components)
 - Vector-Borne Disease Communication Approaches
- Attendees are given access to a subfolder on a secure cloud-based file sharing platform that contains all reference materials covered during the Vector Biology Boot Camp. Attendees are also provided with a USB drive that contains the same reference materials from the training program.
- Learning outcomes are mapped to the core program modules (see: *Vector Biology Boot Camp Learning Outcomes*)
- **Pesticide Applicator Recertification Credits.** Program organizers may apply to state-based boards and agencies to secure continuing education credits (CEUs) for this training program for pesticide applicator license holders. The type of credits sought each year should be determined by the responses of attendees to the application and confirmation forms.
- **Completion Certificates.** Attendees will receive a completion certificate (signed, hard copy) after completing the post-knowledge assessment on the last day of the program. It is recommended that any CEUs accredited to the yearly program be incorporated into the certificate.

Program Evaluation

- **Knowledge Assessments.** Pre- and post-knowledge assessments are administered to program attendees to gauge program impact on key competencies covered in the curriculum. The knowledge assessment is updated each year to reflect the topics covered in the curriculum; however, questions linked to most core learning outcomes remain the same (see *Vector Biology Boot Camp Learning Outcomes*). This facilitates comparisons across program cohorts. Instructors are asked to review and update questions applicable to their content areas. Attendees are asked to complete a pre-knowledge assessment in the week prior to the Vector Biology Boot Camp. Attendees complete the post-knowledge assessment on the last day of the program. Attendees receive a copy of their knowledge assessment results.
 - *Example knowledge assessments are not made available in this toolkit in an effort to preserve question items for future use.*
- **Event Evaluations.** NEVBD administration uses an anonymous event evaluation form to review delivery of the Vector Biology Boot Camp program (see: *Vector Biology Boot Camp*

Evaluation Forms). Event evaluations are completed by attendees on the last day of the program.

- **One-Year Follow Up Survey.** Program attendees are contacted at the one-year mark post-training to complete an anonymous survey measuring the impact of this training event on their current work and professional development (see: *Vector Biology Boot Camp Evaluation Forms*). Survey results are analyzed every 3 years and shared as a brief report to NEVBD Leadership and CDC partners.
- **Program Report.** NEVBD administration analyzes the pre-post knowledge assessments and event evaluations at the conclusion of each Vector Biology Boot Camp. A final report detailing the results of these assessments is disseminated to the instructor team, NEVBD Leadership team, and CDC funders at the end of each training event.

Program Implementation Timeline

Activity	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Curriculum Development								
Finalize program host partner and venue agreements								
Initiate Vector Biology Boot Camp planning calls								
Review working agenda and prior year feedback								
Finalize agenda and disseminate for travel approvals								
Confirm instructors for each module								
Submit applications for CEUs								
Finalize teaching materials								
Post materials to cloud environment for instructors & attendees (before boot camp training begins)								
Registration and Attendance								
Open applications using online form								
Review applications and issue acceptance letters								
Close applications								
Secure room block at local hotel								
Assign attendees to accommodations and process check-in / check-out								
Materials and Supplies								
Order necessary supplies for field and lab exercises								
Order USB drives, notepads, and other attendee materials								
Source mosquito and tick specimens								
Complete attendee welcome packets								
Print and sign attendee completion certificates								
Evaluation								
Finalize event evaluation form								
Finalize attendee knowledge assessment form								

Activity	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Disseminate pre-knowledge assessment (prior to boot camp training)								
Disseminate event evaluation & post-knowledge assessment (after boot camp training ends)								
Analyze knowledge assessments & event evaluations								
Draft summary report and disseminate to NEVBD Leadership team								
Send attendee feedback on knowledge assessment performance								
Distribute one-year follow up survey to prior attendees								

Vector Biology Boot Camp Materials & Supplies Checklist

Surveillance Methods / Field Collections of Vector Specimens

Supply	Purpose	Quantity
Disposable coveralls	Personal protective equipment	25 ^a
DEET / insect repellent	Personal protective equipment	5 cans
Lint rollers	Personal protective equipment	5 rolls
Fine tipped tweezers	Personal protective equipment	5 ^b
Tick drag / flag	Tick collection	5
CO ₂ trap	Tick collection	1
Dry ice	Tick collection	5 lbs.
Vials	Tick collection	30
Ethanol	Tick collection	1 liter
Forceps	Tick collection	30
Gravid trap	Mosquito collection	1-2
CDC light trap	Mosquito collection	2
New Jersey trap	Mosquito collection	1-2
Resting boxes	Mosquito collection	Up to 5
Prokopak-style aspirator ^c	Mosquito collection	1
Cooler for sample storage	Mosquito collection	1-2
Bilge pump	Mosquito collection	1
Buckets ^d	Mosquito collection	3 (5 gallon)
Larval dippers	Mosquito collection	5
Turkey basters	Mosquito collection	5
Dry ice	Mosquito collection	5 – 8 lbs.
Plastic bags	General	30
Datasheets	General	5
Clipboards	General	5
Water bottles	General	30
Cooler – attendee refreshments	General	1

- Quantity based on number of attendees. A variety of sizes should be provided.
- Can also provide each attendee a tick removal kit with PPE: tweezers, tick ID card, magnifying glass.
- For some target audiences, a vegetation aspirator may be demonstrated as well.
- Buckets should only be used if suitable larval sampling locations are not available. Buckets should include appropriate water and pre-collected larval specimens for mock larval dipping and bilge pumping.

Laboratory Sessions

Supply	Purpose	Quantity
Forceps	Vector ID	30
Petri dishes	Vector ID	30
Dissecting microscopes and light sources	Vector ID	20 ^a
Tick teaching specimens	Vector ID	See note ^b
Mosquito teaching specimens	Vector ID	See note ^c
Wheaton bottles	Adult bottle bioassay	20 ^d
Volumetric Pipets	Adult bottle bioassay	20
Pipettors	Adult bottle bioassay	4 (one per group)
Tape	Adult bottle bioassay	1 roll
Permethrin (bioassay)	Adult bottle bioassay	1 ampule
Acetone	Adult bottle bioassay	100 ml

Supply	Purpose	Quantity
Paper towels	Adult bottle bioassay	Two rolls
Aspirators	Adult bottle bioassay	4 (one per group)
Mosquitoes from colony (live)	Adult bottle bioassay	400
Gloves	Adult bottle bioassay	1 box of each size
Bench paper	Adult bottle bioassay	1 roll
Timers	Adult bottle bioassay	4 (one per group)
Ethanol	General	1 liter

- Quantity based on number of attendees. Ideally each attendee should have their own microscope and a fiber optic light source.
- Ideally there will be enough specimens for each attendee to receive their own specimen of the following species: *Amblyomma americanum*, *Dermacentor variabilis*, *Ixodes scapularis*, *Haemaphysalis longicornis*. Additional specimens of interest that can be incorporated into the tick ID lab include: *Amblyomma maculatum*, *Ixodes cookei*, *Rhipicephalus sanguineus*. If available, specimens at various levels of engorgement should be made available for attendee review as well as males and females and different life stages.
- Ideally there will be enough specimens for each attendee to receive their own specimen of the following species: *Aedes albopictus*, *Aedes sollicitans*, *Aedes taeniorhynchus*, *Culex pipiens*, *Culiseta melanura*, *Anopheles* spp. (such as *An. punctipennis* or *An. quadrimaculatus*) and *Coquillettidia perturbans*. A broader range of specimens can be made available for attendees with advanced ID skills.
- Wheaton bottles can be pre-treated with pesticide if a fume hood is not available. Quantity of supplies based on number of attendees. Amounts listed in this table are for four groups of attendees working together on the hands-on adult bioassay exercise.

General Supplies

Supply	Purpose	Quantity
Nametag holders	General Registration	25 ^a
Nametags	General Registration	25 ^a
Folders	General Registration	25 ^a
Notepad	General Registration	25 ^a
Pens	General Registration	25 ^a
USB flash drive	General Registration	25 ^a
General printing	General Registration	25 ^a
Optional: event swag	General Registration	25 ^a

- Quantity based on number of attendees.

Vector Biology Boot Camp Application & Confirmation Forms

NEVBD Vector Biology Boot Camp Application Form

Thank you for your interest in attending the 2024 Vector Biology Boot Camp program. Please complete this brief application form for consideration for this year's program.

1. Please complete the following:
 - First name
 - Last name
 - Work organization
 - Job title
 - Contact address
 - Phone
 - Email
2. Please indicate the sector and jurisdiction that most closely match your place of work:
 - a. Sector:
 - ☐ Academic
 - ☐ Public
 - ☐ Private
 - b. Jurisdiction:
 - ☐ County/Municipal
 - ☐ State
 - ☐ National
3. In which state do you currently work?
 - ☐ Connecticut
 - ☐ Delaware
 - ☐ District of Columbia
 - ☐ Maine
 - ☐ Maryland
 - ☐ Massachusetts
 - ☐ New Hampshire
 - ☐ New Jersey
 - ☐ New York
 - ☐ Pennsylvania
 - ☐ Rhode Island
 - ☐ Vermont

- ☐ Virginia
 - ☐ West Virginia
 - ☐ Other (please specify):
4. Please indicate the number of years you have worked in vector-borne disease and/or public health:
- ☐ Less than 2 years
 - ☐ 2 to 5 years
 - ☐ 6 to 10 years
 - ☐ More than 10 years
5. Please indicate which of the following activities you do **most often** as part of your regular duties: (select all that apply)
- ☐ Direct collection and processing of vector specimens
 - ☐ Direct implementation of vector control activities (e.g., larvicide applications, spraying)
 - ☐ Collection and processing of human disease case reports
 - ☐ Supervision of vector surveillance program operations
 - ☐ Supervision of vector control program operations
 - ☐ Data collection and entry for surveillance and/or control program
 - ☐ Data analysis and/or generating reports for surveillance and/or control program
 - ☐ Developing education materials for the public
 - ☐ Hosting or participating in community education events
 - ☐ Other (please describe):
6. *[Display if response to Q5 includes 'Data analysis and/or generating reports for surveillance and/or control program']* What type of data do you report? (select all that apply)
- ☐ Maps
 - ☐ Season trends
 - ☐ Basic summary statistics
 - ☐ Other (please specify):
7. *[Display if response to Q5 includes 'Data analysis and/or generating reports for surveillance and/or control program']* Which software program(s) do you most frequently use to analyze data? (select all that apply)
- ☐ Microsoft Excel
 - ☐ Microsoft Access
 - ☐ SPSS

- ☐ R
- ☐ Stata
- ☐ SAS
- ☐ ArcMap
- ☐ QGIS
- ☐ Epi Info
- ☐ Vendor software (please list):
- ☐ Other (please specify):

8. Please write a brief summary of why it would be useful for your position to attend the NEVBD Vector Biology Boot Camp (max characters: 500):
9. Please rank how interested you are in gaining skills in the areas listed below:

	High Interest – I need more skills in this area	Medium Interest – I am curious, but do not need these skills for my job	Low Interest – This topic area is not applicable to me
Field techniques for tick surveillance			
Field techniques for mosquito surveillance			
Taxonomic identification of tick specimens			
Taxonomic identification of mosquito specimens			
Data entry and management best practices			
Data analysis techniques			
GIS mapping			
Epidemiology of vector-borne disease threats for the Northeast region			
Arthropod biology & behavior			
Pesticide resistance monitoring techniques			
Available tools & resources for control of ticks			
Available tools & resources for control of mosquitoes			
Best practices for public communication & education			
Using data to inform public health decisions			

10. Have you participated in any previous offerings of the Vector Biology Boot Camp, including the online lecture series hosted in 2020 and 2021? Please select all that apply:

- ☐ Yes, I have attended an in-person offering

☐ Yes, I have participated in an online lecture series

☐ No

11. We have a limited number of spaces for this program. If you are not selected for attendance this year, would you be interested in the program next year?

☐ Yes

☐ Maybe

☐ No

Please take a moment to review your responses to the Vector Biology Boot Camp application form. If you are satisfied with your responses, please select 'Submit' to complete your application.

Vector Biology Boot Camp Attendance Confirmation Form

1. Please complete the following form fields to confirm your attendance at the [year] Vector Biology Boot Camp, supported through the Northeast Regional Center for Excellence in Vector-Borne Diseases.

- First Name
- Last Name
- State
- Job Title/Occupation
- Organization
- Contact Email

2. Please indicate if you plan to attend the [year] Vector Biology Boot Camp:

☐ Yes

☐ No

3. *[Display if response to Q2 is 'Yes']* Do you have dietary restrictions?

☐ Yes (please describe):

☐ No

4. *[Display if response to Q2 is 'Yes']* A portion of our Boot Camp program will involve walking outside on unpaved surfaces. Will you require accommodations for mobility limitations/other disabilities?

☐ Yes (please describe):

☐ No

5. We will be securing pesticide applicator recertification credits for this event from [insert list of states] state regulatory agencies. Do you plan to claim pesticide recertification credits after participation?

☐ Yes

☐ No

6. [*Display if response to Q5 if 'Yes'*] Please include the following information to help us process your pesticide applicator recertification credit document:
- Pesticide Applicator License / ID Number
 - Date of Birth

Vector Biology Boot Camp Learning Outcomes

Module: Arthropod Biology, Ecology & Behavior

Learning Outcomes	Assessment Method
Describe the different body systems of arthropods (structure, digestion, respiration, feeding, excretion, etc.) in the context of vector control and disease transmission	Final knowledge assessment
Explain how arthropods survive winter	Final knowledge assessment
Understand the many ways temperature and other environmental factors influence vectors and vector-borne disease	Final knowledge assessment
Outline some important aspects of mosquito behavior in relation to disease transmission	Final knowledge assessment
Outline some important aspects of tick behavior in relation to disease transmission	Final knowledge assessment
Describe the lifecycle and reproductive biology of ticks and mosquitoes	Final knowledge assessment
Explain in general how pathogens/parasites replicate and are transmitted by arthropods	Final knowledge assessment

Module: Major Regional Diseases and Emerging Threats

Learning Outcomes	Assessment Method
Name the mosquito and tick species of medical importance in the Northeast/mid-Atlantic	Final knowledge assessment
Describe the ecology and epidemiology (incidence and human health impact) of several mosquito and tick-borne pathogens in the region	Final knowledge assessment

Module: Surveillance Roles & Responsibilities

Learning Outcomes	Assessment Method
Describe the primary components of a mosquito surveillance program	Final knowledge assessment
Describe the primary components of a tick surveillance program (active and passive)	Final knowledge assessment

Module: Diagnostics and Pathogen Testing

Learning Outcomes	Assessment Method
Outline methods for testing ticks and mosquitoes	Final knowledge assessment
Explain how to interpret the results of pathogen testing	Final knowledge assessment
Explain the important limitations of pathogen testing	Final knowledge assessment
Describe best practices for storing samples prior to testing and tracking samples from field to lab	Final knowledge assessment

Module: Collection and Processing Methods

Learning Outcomes	Assessment Method
Describe the appropriate use and pros/cons of several traps to collect adult mosquitoes regionally	Final knowledge assessment Hands-on demonstration
Explain the methods for larval mosquito collections and the appropriate use depending on target species	Final knowledge assessment Hands-on demonstration
Demonstrate the methods for collecting tick vectors and best surveillance practices depending on target species and program goals	Final knowledge assessment Hands-on demonstration

Module: Taxonomy and Identification of Ticks and Mosquitoes

Learning Outcomes	Assessment Method
Recognize the key differentiating features of regional adult mosquito vectors to the genus level	Final knowledge assessment Hands-on demonstration
Identify differences between male and female mosquitoes	Final knowledge assessment Hands-on demonstration
Recognize the key differentiating features of hard and soft ticks and regional hard tick vectors to the species level	Final knowledge assessment Hands-on demonstration
Identify the different tick life stages and sexes	Final knowledge assessment Hands-on demonstration

Module: Vector Control for Ticks and Mosquitoes

Learning Outcomes	Assessment Method
Explain how vector surveillance data inform control decisions	Final knowledge assessment
Describe different components of mosquito and tick control as well as pros and cons for different strategies	Final knowledge assessment
Define important vector control terms (IVM, ULV, source reduction, insecticide classes)	Final knowledge assessment

Module: Pesticide Resistance Monitoring

Learning Outcomes	Assessment Method
Able to conduct a bottle and larval resistance assay	Hands-on demonstration
Understand how to interpret the results of these bioassays	Final knowledge assessment Hands-on demonstration
Know where to get additional support/help for resistance monitoring	Engage in peer and instructor discussions

Module: Data Management, Vector-Borne Disease Metrics, Spatial Analysis, and Mapping

Learning Outcomes	Assessment Method
Explain what data and data types are essential to collect for epidemiology summaries and data analysis	Final knowledge assessment
Explore methods for improving accuracy, quality, and streamlining data collection/recording	Hands-on demonstration
Describe how to calculate sampling effort	Final knowledge assessment
Explain best practices for recording and sharing geospatial data	Final knowledge assessment

Module: Vector-Borne Disease Communication Approaches

Learning Outcomes	Assessment Method
Describe how scientific literacy and numeracy impact communication and outreach	Final knowledge assessment
Explain how to understand an audience and ensure acceptability and relevance of materials	Final knowledge assessment
Identify various ways of connecting with an audience	Final knowledge assessment
Understand how an audience's readiness to change informs strategy for a communication campaign	Final knowledge assessment
Identify universal motivators that are relevant for behavior change	Final knowledge assessment
Understand the role of emotion and fact in decision making	Final knowledge assessment

Vector Biology Boot Camp Evaluation Forms

Event Evaluation Form

The following question items refer to your experiences at the [year] Vector Biology Boot Camp.

Please indicate your level of agreement with the following statements (**circle one number for each item**).

Mosquito & Tick Biology, Disease Transmission, and Vector-Borne Disease Threats to the Northeast	Agree	Neutral	Disagree
I can name the mosquitoes of medical importance to the Northeast	1	2	3
I can name the ticks of medical importance to the Northeast	1	2	3
I can describe the incidence of several mosquito-borne diseases in my state and region.	1	2	3
I can describe the incidence of several tick-borne diseases in my state and region.	1	2	3
I understand the lifecycle of medically significant tick species	1	2	3
I understand the habitat conditions favorable to important mosquito vectors	1	2	3
I understand general aspects of mosquito and tick physiology, behavior and life history	1	2	3
Arthropod Morphology & Taxonomy	Agree	Neutral	Disagree
I can identify the major components of arthropod morphology	1	2	3
I can classify mosquitoes to Genus	1	2	3
I can classify ticks to Genus	1	2	3
I am comfortable using taxonomic keys to identify ticks	1	2	3
I am comfortable using taxonomic keys to identify mosquitoes	1	2	3
Vector Surveillance & Control	Agree	Neutral	Disagree
I know the methods for using several traps used to collect adult mosquitoes	1	2	3
I can describe the methodology for field collections of ticks	1	2	3
I understand the role of sentinel animals in disease surveillance	1	2	3
I can describe the primary components of a mosquito surveillance program	1	2	3
I can describe the primary components of a tick surveillance program	1	2	3
I can explain important limitations to pathogen testing	1	2	3
I understand the methods available to detect resistance in mosquitoes	1	2	3
I feel comfortable using data from resistance bioassays to inform my mosquito control program	1	2	3
Data Collection, Management, and Communication	Agree	Neutral	Disagree
I can explain several ways in which vector surveillance data informs decisions for vector control	1	2	3
I can explain several ways in which vector surveillance data informs public health messaging	1	2	3
I can identify several approaches to address health literacy in public health communication	1	2	3
I am comfortable using basic statistics to analyze vector surveillance data	1	2	3
I understand the types of data that must be collected to construct a usable database	1	2	3
I am able to identify several considerations for quality control of data	1	2	3
I am able to identify several tools commonly used for recording field data	1	2	3

One-Year Follow Up Survey

The following questions will ask about your experiences from the [year] Vector Biology Boot Camp, hosted by the Northeast Regional Center for Excellence in Vector-Borne Diseases and [partner institution]. We are interested in hearing from our program attendees how you have been able to use what you learned through the Vector Biology Boot Camp in your current work, as well as hear your feedback on what we can do to improve our training opportunities.

Your responses to this survey will remain confidential. We anticipate it will take 5 to 10 minutes to complete this form.

We greatly appreciate your feedback.

1. In which state do you work?
2. Please select the jurisdiction level that most closely matches your place of work:
 - ☐ Local/municipal
 - ☐ County/district
 - ☐ State
 - ☐ Federal
3. Please list your current job title:
4. Please rank on a scale of 1 to 5 how impactful the [year] Vector Biology Boot Camp was for you:
 - ☐ 1 – Extremely
 - ☐ 2 – Very
 - ☐ 3 – Moderately
 - ☐ 4 – Slightly
 - ☐ 5 – Not at all
5. To what degree did your knowledge or skills related to **mosquitoes** improve as a result of attending the [year] Vector Biology Boot Camp?

	Greatly improved	Moderately improved	Did not improve
Mosquito biology & behavior			
Regional mosquito-borne diseases			
Mosquito trapping			
Mosquito ID			
Mosquito control methods			
Mosquito-borne disease diagnostics			
Communicating with the public			
Data management best practices			
Using surveillance data to inform decision making			

6. To what degree did your knowledge or skills related to **ticks** improve as a result of attending the [year] Vector Biology Boot Camp?

	Greatly improved	Moderately improved	Did not improve
Tick biology & behavior			
Regional tick-borne diseases			
Tick surveillance methods			
Tick ID			
Tick control methods			
Tick-borne disease diagnostics			
Communicating with the public			
Data management best practices			
Using surveillance data to inform decision making			

7. Please indicate how much you agree with the following statements regarding the [year] Vector Biology Boot Camp:

	Agree	Neutral	Disagree
Information covered in the Vector Biology Boot Camp was directly applicable to my work			
Attending the Vector Biology Boot Camp helped me grow my professional network			
The Vector Biology Boot Camp introduced me to new resources available to vector-borne disease professionals			

8. To what degree have you been able to incorporate skills learned at the [year] Vector Biology Boot Camp into your routine activities?

- ☐ A great deal
☐ A lot
☐ A moderate amount
☐ A little
☐ None at all

9. Have you been able to expand the scope of your work activities using skills from the [year] Vector Biology Boot Camp?

- ☐ Yes
☐ No

10. [If response to Q9 is 'yes'] Please describe how attending the [year] Vector Biology Boot Camp has expanded your work activities.

11. Have you shared information from the [year] Vector Biology Boot Camp with colleagues in your organization?

☐ Yes

☐ No

12. [If response to Q11 is 'yes'] Please describe how you have shared information from the [year] Vector Biology Boot Camp with colleagues in your organization:

13. Have any of the listed barriers or roadblocks limited your ability to incorporate skills from the [year] Vector Biology Boot Camp into your work activities?

	Major barrier	Minor barrier	Not a barrier
Lack of funding to incorporate skills/activities			
Lack of time to incorporate skills/activities			
Lack of priority within my organization to incorporate skills/activities			
Skills/activities remain above my training level			
My work activities do not require skills from the Boot Camp			
Other (please describe):			

14. Since attending the [year] Vector Biology Boot Camp, have you accessed additional resources to improve your knowledge or performance in vector surveillance and/or control?

☐ Yes

☐ No

15. [If response to Q14 is 'yes'] Please list the additional resources you have accessed:

16. What subject areas do you wish had been covered in more detail at the [year] Vector Biology Boot Camp?

17. Please provide any additional feedback you have on how NEVBD can support your professional development in the field of vector-borne disease and public health:

Vector Biology Boot Camp Outcomes

Summary outcomes from the pre-post knowledge assessments of Vector Biology Boot Camps hosted by NEVBD from 2018 to 2024 are summarized in the tables below; no program was hosted in 2022.

2018 Vector Biology Boot Camp, Attendee Pre/Post Knowledge Assessment Cumulative Performance

Competency Area	Pre-Assessment Average Score	Post-Assessment Average Score	Change in Average Score	T-Value (sig.)
Arthropod Biology, Ecology & Behavior	10.05 / 14 points	12.00 / 14 points	+ 1.95 points	-5.04 (<0.001)
Major Regional Diseases	8.15 / 12 points	8.4 / 12 points	+ 0.25 points	-1.10 (0.283)
Surveillance & Control	6.57 / 9 points	7.10 / 9 points	+ 0.53 points	-1.60 (0.126)
Taxonomy & Arthropod ID	1.52 / 3 points	2.19 / 3 points	+ 0.67 points	-2.73 (0.013)
Testing	4.67 / 7 points	5.76 / 7 points	+ 1.09 points	-2.75 (0.012)
Communication	10.24 / 12 points	11.75 / 12 points	+ 1.51 points	-3.86 (0.001)
Data Management	1.05 / 3 points	1.10 / 3 points	+ 0.05 points	-0.25 (0.803)
TOTAL	42.25 / 60 points	48.30 / 60 points	+ 6.05 points	-4.79 (0.016)

2019 Vector Biology Boot Camp, Attendee Pre/Post Knowledge Assessment Cumulative Performance

Competency Area	Pre-Assessment Average Score	Post-Assessment Average Score	Change in Average Score	T-Value (sig.)
Arthropod Biology, Ecology & Behavior	13 / 17 points	14.75 / 17 points	+ 1.75 points	-3.317 (0.004)
Major Regional Diseases	6.67 / 10 points	7.63 / 10 points	+ 0.97 points	-2.308 (0.032)
Taxonomy & Arthropod ID	7.85 / 13 points	10.3 / 13 points	+ 2.45 points	-3.995 (0.001)
Mosquito & Tick Surveillance	5.35 / 8 points	6.55 / 8 points	+1.2 points	-3.134 (0.005)
Control & Resistance	10.8 / 17 points	13.3 / 17 points	+ 2.5 points	-4.898 (<0.001)
Communication	2.6 / 4 points	2.92 / 4 points	+ 0.32 points	-1.124 (0.275)
Data Collection & Management	2.3 / 4 points	3.2 / 4 points	0.9 points	-5.107 (<0.001)
TOTAL	48.57 / 73 points	58.65 / 73 points	+ 10.08 points	-5.443 (<0.001)

**2020 Virtual Vector Biology Boot Camp, Attendee Pre/Post Knowledge Assessment
Cumulative Performance**

Lecture: Competency Area (N)*	Pre-Assessment Average Score	Post-Assessment Average Score	Change in Average Score	T-Value (sig.)
Lecture 1 (N=13)	23.82 / 38 points	32.90 / 38 points	+9.08 points	-9.37 (0.000)
<i>Arthropod Biology & Behavior</i>	<i>12.23 / 17 points</i>	<i>14.85 / 17 points</i>	<i>+ 2.62 points</i>	<i>-6.28 (0.000)</i>
<i>Major Regional Diseases</i>	<i>11.59 / 21 points</i>	<i>18.05 / 21 points</i>	<i>+ 6.46 points</i>	<i>-7.80 (0.000)</i>
Lecture 2: Diagnostics (N=12)	9.88 / 21 points	13.43 / 21 points	+ 3.55 points	-2.96 (0.013)
Lecture 3: Collection & Processing (N=10)	3.30 / 4 points	3.30 / 4 points	+ 0.00 points	0.00 (1.00)
Lecture 4: Communication (N=9)	3.00 / 4 points	3.44 / 4 points	+ 0.44 points	-1.32 (0.225)
Lecture 5: Taxonomy (N=11)	7.36 / 13 points	10.27 / 13 points	+ 2.91 points	-4.20 (0.002)
Lecture 6: Vector Control (N=11)	9.82 / 12 points	9.27 / 12 points	- 0.55 points	1.11 (0.294)
Lecture 7: Data Collection & Management (N=8)	1.63 / 4 points	2.38 / 4 points	+ 0.75 points	-1.66 (0.142)

* Attendance per lecture was variable due to the virtual format of this year's program

**2021 Virtual Vector Biology Boot Camp, Attendee Pre/Post Knowledge Assessment
Cumulative Performance**

Lecture: Competency Area (N)*	Pre-Assessment Average Score	Post-Assessment Average Score	Change in Average Score	T-Value (sig.)
Lecture 1 (N=30)	25.20 / 38 points	31.80 / 38 points	+ 6.60 points	-7.59 (0.000)
<i>Arthropod Biology & Behavior</i>	<i>11.73 / 17 points</i>	<i>14.03 / 17 points</i>	<i>+ 2.30 points</i>	<i>-5.03 (0.000)</i>
<i>Major Regional Diseases</i>	<i>12.90 / 21 points</i>	<i>17.77 / 21 points</i>	<i>+ 4.87 points</i>	<i>-6.07 (0.000)</i>
Lecture 2: Collection & Processing (N=29)	2.72 / 4 points	3.10 / 4 points	+ 0.38 points	-3.29 (0.005)
Lecture 3: Data Collection & Management (N=15)	2.40 / 4 points	3.07 / 4 points	+ 0.67 points	-2.87 (0.012)
Lecture 4: Taxonomy (N=22)	8.14 / 13 points	11.14 / 13 points	+ 3.00 points	-5.20 (0.000)
Lecture 5: Vector Control (N=23)	7.78 / 12 points	9.22 / 12 points	+ 1.44 points	-5.00 (0.000)
Lecture 6: Communication (N=22)	7.14 / 10 points	8.27 / 10 points	+ 1.13 points	-4.15 (0.000)
Lecture 7: Diagnostics (N=21)	12.33 / 20 points	14.10 / 20 points	+ 1.77 points	-3.51 (0.002)
Lecture 8: Resistance (N=22)	7.41 / 11 points	8.27 / 11 points	+ 0.86 points	-2.82 (0.036)
Lecture 9: Monitoring Ticks (N=22)	3.41 / 6 points	4.32 / 6 points	+ 0.91 points	-2.49 (0.021)

* Attendance per lecture was variable due to the virtual format of this year's program

2023 Vector Biology Boot Camp, Attendee Pre/Post Knowledge Assessment Cumulative Performance

Competency Area	Pre-Assessment Average Score	Post-Assessment Average Score	Change in Average Score	T-Value (sig.)
Arthropod Biology, Ecology & Behavior	12.96 / 19 points	14.88 / 19 points	+ 1.92 points	-4.33 (<0.001)
Major Regional Diseases	16.72 / 26 points	17.46 / 26 points	+ 0.74 points	-0.85 (0.403)
Taxonomy	5.92 / 12 points	7.52 / 12 points	+ 1.60 points	225.5 (0.007)
Collection & Processing Methods	2.68 / 4 points	3.08 / 4 points	+ 0.40 points	67 (0.019)
Diagnostics	5.00 / 9 points	6.44 / 9 points	+ 1.44 points	-3.15 (0.002)
Vector Control	5.96 / 11 points	8.12 / 11 points	+ 2.16 points	207 (<0.001)
Pesticide Resistance	4.96 / 10 points	6.20 / 10 points	+ 1.24 points	223.5 (0.008)
Communication	7.56 / 10 points	8.96 / 10 points	+ 1.40 points	141 (0.002)
Data Management & Analysis	1.88 / 5 points	3.32 / 5 points	+ 1.44 points	206.5 (<.001)
TOTAL	63.64 / 106 points	75.98 / 106 points	+ 12.34 points	-6.39 (<0.001)

2024 Vector Biology Boot Camp, Attendee Pre/Post Knowledge Assessment Cumulative Performance

Competency Area	Pre-Assessment Average Score	Post-Assessment Average Score	Change in Average Score	Z (sig.)
Arthropod Biology, Ecology & Behavior	13.00 / 19 points	15.75 / 19 points	+ 2.75 points	-3.121 (0.002)
Major Regional Diseases	14.56 / 24 points	17.03 / 24 points	+ 2.47 points	-2.64 (0.008)
Taxonomy	5.5 / 12 points	9.5 / 12 points	+ 4.00 points	-3.223 (0.001)
Collection & Processing Methods	2.88 / 4 points	3.44 / 4 points	+ 0.56 points	-2.179 (0.029)
Diagnostics	2.00 / 4 points	3.00 / 4 points	+ 1.00 points	-2.546 (0.011)
Vector Control	6.81 / 11 points	7.81 / 11 points	+ 1.00 points	-3.025 (0.002)
Pesticide Resistance	4.38 / 10 points	5.19 / 10 points	+ 0.81 points	-1.655 (0.098)
Communication	7.38 / 9 points	8.13 / 9 points	+ 0.75 points	-2.142 (0.032)
Data Management & Analysis	2.50 / 6 points	3.75 / 6 points	+ 1.25 points	-2.796 (0.005)
TOTAL	59.00 / 99 points	72.50 / 99 points	+ 13.50 points	-3.518 (<0.001)