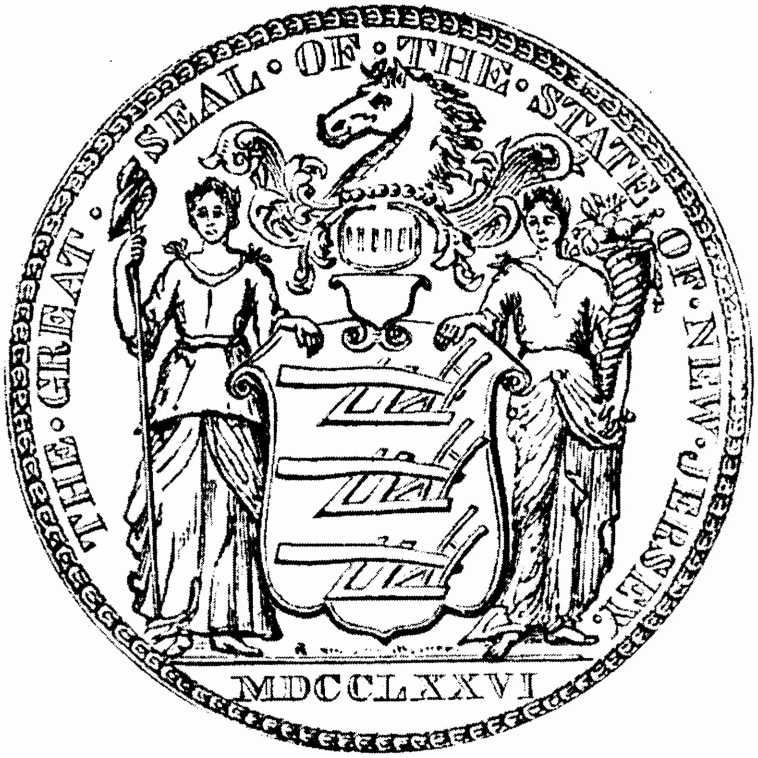
FIFTY FIFTH ANNUAL REPORT

OF THE

STATE MOSQUITO CONTROL COMMISSION

OF THE

STATE OF NEW JERSEY



For the Fiscal Year commencing July 1, 2010 and ending June 30, 2011

FIFTY FIFTH ANNUAL REPORT

NEW JERSEY STATE MOSQUITO CONTROL COMMISSION

2011

STATE OF NEW JERSEY
CHRIS CHRISTIE, GOVERNOR

N.J. DEPARTMENT OF ENVIRONMENTAL PROTECTION
BOB MARTIN, COMMISSIONER

Report prepared by the Office of
Mosquito Control Coordination,
N.J. Department of Environmental Protection
Robert Kent, Administrator
Claudia O'Malley, Principal Biologist
Steven Csorgo, Jr., Assistant Biologist
Kimberly Johnson, Secretary

State of New Jersey

CHRIS CHRISTIE
Govenor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE MOSQUITO CONTROL COMMISSION
PO BOX 420 TRENTON, NJ 08625-0400
TELEPHONE: 600-292-3649 FAX: 609-633-0650
KIM GUADAGNO
Lt. Govenor

BOB MARTIN
Commissioner

To: The Honorable Chris Christie, Governor
The Honorable Kim Guadagno, Lt. Governor
and members of the Senate and the
General Assembly of the State of New Jersey

In accordance with the provisions of Title 26 Chapter 9:12.6, we are pleased to submit the Fifty Fifth Annual Report of the State Mosquito Control Commission for the Fiscal Year covering the period from July 1, 2010 through June 30, 2011.

Respectfully,

John Sarnas, M.A., H.O., Chairman
Howard Emerson, H.O., Vice Chairman
Kenneth Bruder, Ph.D.
George Shivery,
John Surmay, R.Ph., H.O.
George Van Orden, Ph.D., H.O.
Mark Mayer, M.S.
Anthony Petrongolo, M.S.
Shereen Semple, M.S.
Mark Robson, Ph.D., M.P.H.

TABLE OF CONTENTS

MEMBERS OF THE STATE MOSQUITO CONTROL COMMISSION

John Sarnas, M.A., H.O., Chairman	Hudson County
Howard Emerson, Vice Chairman	Camden County
Kenneth W. Bruder, Ph.D.	Ocean County
George Shivery	Gloucester County
John Surmay, R.Ph., H.O.	Union County
George Van Orden, Ph.D., H.O.	Morris County
Bob Martin, Commissioner Ex Officio	N.J. Department of Environmental Protection
Mary E. O'Dowd, M.P.H. Commissioner Ex Officio	N.J. Department of Health & Senior Services
Douglas Fisher, Ph.D. Ex Officio	N.J. Department of Agriculture
Robert Goodman, Ph.D.	N.J. Agricultural Experiment Station, Rutgers University
Robert Kent, Secretary	N.J. Department of Environmental Protection

The following individuals served as representatives for the various ex officio members during the year:

Shereen Semple, M.S.	N.J. Department of Health & Senior Services
Anthony Petrongolo, M.S.	N.J. Department of Environmental Protection
Mark Mayer, M.S.	N.J. Department of Agriculture
Mark Robson, Ph.D., M.P.H.	N.J. Agricultural Experiment Station, Rutgers University

COMMISSION ACTIVITIES AND HIGHLIGHTS DURING FISCAL YEAR 2011

During the fiscal year 2010-2011, the State Mosquito Control Commission continued to monitor and address those issues, activities and legislation of importance to the mosquito control interests in New Jersey. Official meetings of the New Jersey State Mosquito Control Commission were held monthly during the year on the following dates and at the following locations:

DATE	LOCATION
July 20, 2010	NJ Division of Fish and Wildlife Management, Upper Freehold, NJ.
August 17, 2010	Conference Room in the Railroad Terminal Building, Jersey City, N.J.
September 21, 2010	Office of Mosquito Control Coordination, DEP, Trenton, N.J.
October 19, 2010	Office of Mosquito Control Coordination, DEP, Trenton, N.J.
November 16, 2010	Monmouth County Mosquito Commission Eatontown, NJ
December 2010	No Meeting Scheduled
January 18, 2011	Office of Mosquito Control Coordination, DEP, Trenton, N.J.
February 15, 2011	No Meeting Scheduled
March 15, 2011	Office of Mosquito Control Coordination, DEP, Trenton, NJ
April 19, 2011	Rutgers ECO Complex, Bordentown, NJ
May 17, 2011	No Meeting Scheduled
June 21, 2011	Middlesex County Mosquito Commission South Brunswick, N.J.

In addition to the regularly scheduled meetings, the commissioners participated in numerous committee meetings and conferences with local, state and federal officials regarding mosquito control related matters. All business meetings were announced and held in compliance with the Open Public Meeting Law. P.L. 1975. C231.

The following six reports detail major issues that were anticipated and addressed. The first three: Equipment Use, Mosquito Airspray and Biological Control were managed by the staff of the Office of Mosquito Control Coordination within NJ-DEP. By way of this work and through other contact with the county mosquito control agencies; this office helps keep the Commission informed of the mosquito problems throughout the state. The other three reports are based on Professional Services contracted with Rutgers the State University of NJ.

Please note in the Financial Statement that a Professional Service contract for Quality Control and Assurance is listed but no report is given. The work under this contract was just beginning during the time period of this Annual Report. The current work and pending report will help assure consistent, quality sampling and preparation of mosquitoes by the count agencies when they submit mosquitoes for disease testing.

State Equipment Use Program

The State Mosquito Control Commission has in its inventory 125 pieces of equipment available to the mosquito control community as part of its Equipment Use Program (Table 1). This programs purchases and assigns research, surveillance or operational control equipment to the requesting mosquito control agency on an as-needed basis. The equipment is used and maintained under the Department of Environmental Protection's Equipment Use Agreement and the State Mosquito Control Commission's "Guidelines for the Use and Repair of State-Owned Equipment". During fiscal year 2011, twenty of the twenty-one New Jersey county mosquito control agencies, as well as the New Jersey Agricultural Experiment Station at Rutgers University, the New Jersey Department of Environmental Protection's Division of Fish and Wildlife and the Office of Mosquito Control Coordination, utilized this equipment.

While no requests for new equipment were made during the course of the fiscal year, delivery of a climate-controlled insecticide storage building was taken in November of 2010. The prefabricated building was purchased with funds from the state's Capital Planning and Budget Commission. The building is housed at the Division of Parks and Forestry's Forest Fire Division C Equipment Maintenance Yard in Mays Landing, and will be used to store liquid formulations of insecticides used in the State Airspray Program.

A total of $42, 551.65 was expended for repairs to four pieces of state-owned equipment during the course of the fiscal year. This included $2,539.00 for emergency repairs to SMCC #3, the hydraulic rotary excavator assigned to the Atlantic County Office of Mosquito Control. The repairs were performed in order to strengthen eight weight-bearing supports on the machine. An additional $34,000.00 was allocated for repairs to the pontoons and to purchase of track chain for this hydraulic rotary excavator; these repairs had not yet been completed by the end of the fiscal year. $4,903.98 was spent on repairs to SMCC #49, the bulldozer/backhoe assigned to the Warren County Mosquito Control Commission, and $730.00 was expended on repairs to SMCC #83, the ultra-low temperature freezer also assigned to Warren County. It should be noted that the funds for the latter two repairs came from an encumbrance made in fiscal year 2008, which had not been fully expended. Finally, SMCC #125, the ultra-low temperature freezer assigned to the Cumberland County Department of Mosquito Control, was repaired at a cost of $378.67.

SMCC # 8, a long-reach hydraulic excavator assigned to Salem County Mosquito Control, was surrendered when that county's administration purchased a similar machine. The excavator was subsequently requested by and transferred to the Cape May County Department of Mosquito Control. The Mercer County Division of Mosquito Control surrendered SMCC #31, a stereo microscope no longer needed since Mercer County had purchased its own microscope. Similarly, the New Jersey Agricultural Experiment Station surrendered SMCC #27, an ultra-low temperature freezer which was no longer being used. Neither piece of equipment had been transferred by the end of the fiscal year.

Interagency cooperation has long been a hallmark of the State Commission's Equipment Use Program, and this fiscal year saw another example of this. The Monmouth County Mosquito Extermination Commission found itself in dire straights when one of their excavators was destroyed in a fire while working on a permitted water management project. The county's other small excavator happened to be down for extensive repairs at this time, and Monmouth County was in extreme need of a replacement excavator in order to complete work on the project. The State Mosquito Control Commission stepped into the breach, and arranged for the temporary transfer to the Monmouth County Mosquito Extermination Commission of SMCC # 7, a low ground pressure hydraulic excavator assigned to Salem County Mosquito Control. This enabled Monmouth County to complete work on the water management project, and the excavator was returned to Salem County prior to the end of the fiscal year.

Table 1. State Mosquito Control Commission Equipment

No.	Type of Equipment	Location
1	1992 Amphibious Hydraulic Rotary Excavator	Cape May
2	1987 Amphibious Hydraulic Rotary Excavator	Ocean
3	1995 Amphibious Hydraulic Rotary Excavator	Atlantic
4	2007 Amphibious Tracked Vehicle	State
5	2003 Long-Reach Hydraulic Excavator	Essex/Morris
6	2003 Low Ground Pressure Hydraulic Excavator	Warren
7	2003 Low Ground Pressure Hydraulic Excavator	Salem
8	1992 Long-Reach Hydraulic Excavator	Cape May
9		Vacant
10	1995 Amphibious Long-Reach Hydraulic Excavator	Salem
11	1986 Hydraulic Excavator	Div. Fish & Wildlife
12	2003 Low Ground Pressure Hydraulic Excavator	Cumberland
13	2002 Hydraulic Excavator	Atlantic
14	2002 All-Terrain Vehicle	Ocean
15	2002 All-Terrain Vehicle Trailer	Ocean
16	1983 Tracked Vehicle	Essex
17	1985 Widetrack Bulldozer/Backhoe	Salem
18	1972 17 Foot Boat	Atlantic
19	2002 Outboard Motor	Atlantic
20	2002 Boat Trailer	Atlantic
21	1988 13 Foot Boat	Burlington
22	1988 Boat Trailer	Burlington
23	2002 Outboard Motor	Burlington
24	1988 Stereo Microscope w/optics	Warren
25	2008 U.L.V. Machine	Warren
25	2008 Spray Recording /Vehicle Monitoring System	Warren
26	2008 U.L.V. Machine	Passaic
26	2008 Spray Recording /Vehicle Monitoring System	Passaic
27	1994 Ultra Low Temperature Freezer	Rutgers
28	1995 U.L.V. Machine	Salem
28	2007 Variable Flow Control	Salem
29	1995 U.L.V. Machine	Cumberland
30	1995 U.L.V. Machine	Sussex
30	2006 Spray Recording /Vehicle Monitoring System	Sussex
31	2003 Stereo Microscope w/optics	Mercer
32	1995 Turbine Sprayer	Cumberland
33	1995 U.L.V. Machine	Gloucester
34	1981 Phase-Contrast Microscope	Hudson
34	1981 Power Pak	Hudson
34	1981 Camera	Hudson
35		Vacant
36	2004 Incubator	Rutgers
37	1987 Stereo Microscope w/optics	Camden

38	1987 Stereo Microscope w/optics	Hudson
39	1992 U.L.V. Machine	Cumberland
40		Vacant
41	1988 Biosafety Cabinet	Rutgers
42	1977 Flatbed Truck	Sussex
43	2002 2WD Pickup Truck w/cap	Morris
44	1987 20-Ton Trailer	Salem
45	1976 Compound Microscope	State
46	1977 Compound Microscope	Rutgers
47	1977 Stereo Microscope	Rutgers
48	1977 Stereo Microscope	Rutgers
49	1980 Bulldozer/Backhoe	Warren
50	1980 Rotary Ditcher Attachment	Salem
51	2005 Tabletop Autoclave	Hunterdon
52	1984 Stereo Microscope w/optics	Monmouth
53		Vacant
54	2002 4x4 Pickup Truck w/cap	State
55	1985 Hydraulic Excavator	Essex
56	1988 6" Water Pump	Cape May
57	1989 Stereo Microscope w/optics	Atlantic
58	1989 All-Terrain Vehicle	Salem
59	1989 All-Terrain Vehicle Trailer	Salem
60	1990 Stereo Microscope w/optics	Sussex
61	1990 20-Ton Trailer	Warren
62	1996 All-Terrain Vehicle	Monmouth
63	1996 All-Terrain Vehicle Trailer	Monmouth
64	1997 Turbine Sprayer	Gloucester
65	1997 17 Foot Boat	Ocean
66	2007 Outboard Motor	Ocean
67	1998 Boat Trailer	Ocean
68	2000 Stereo Microscope w/optics	Hunterdon
69	2007 U.L.V. Machine	Hunterdon
69	2007 Spray Recording /Vehicle Monitoring System	Hunterdon
70	2007 U.L.V. Machine	Burlington
70	2007 Spray Recording /Vehicle Monitoring System	Burlington
71	2007 U.L.V. Machine	Essex
71	2007 Spray Recording /Vehicle Monitoring System	Essex
72		Vacant
73	2007 U.L.V. Machine	Atlantic
73	2007 Spray Recording /Vehicle Monitoring System	Atlantic
74	2007 U.L.V. Machine	Hunterdon
74	2007 Spray Recording /Vehicle Monitoring System	Hunterdon
75	2000 U.L.V. Machine	Gloucester
76	2001 Power Sprayer	Hunterdon
77	2000 U.L.V. Machine	Salem
78	2001 Ultra Low Temperature Freezer	Bergen

79	2001 Ultra Low Temperature Freezer	Middlesex
80	2001 Ultra Low Temperature Freezer	Monmouth
81	2001 Ultra Low Temperature Freezer	Morris
82	2001 Ultra Low Temperature Freezer	Salem
83	2001 Ultra Low Temperature Freezer	Warren
84	2001 Ultra Low Temperature Freezer	Camden
85	2001 Ultra Low Temperature Freezer	Sussex
86	2001 U.L.V. Machine	Sussex
86	2006 Spray Recording /Vehicle Monitoring System	Sussex
87	2001 Insecticide Applicator	Sussex
88	2004 Power Sprayer	Essex
89	2001 4x4 Pickup Truck w/cap	Atlantic
90	2002 17 Foot Boat	Ocean
91	2002 Outboard Motor	Ocean
92	2002 Boat Trailer	Ocean
93	2002 All-Terrain Vehicle	Gloucester
94	2002 All-Terrain Vehicle Trailer	Gloucester
95	2002 All-Terrain Vehicle	Essex
96	2002 All-Terrain Vehicle	Hunterdon
97	2002 All-Terrain Vehicle Trailer	Hunterdon
98	2002 4x4 Pickup Truck	State
99	2002 All-Terrain Vehicle	Sussex
100	2002 All-Terrain Vehicle Trailer	Sussex
101	2002 Acoustic Storm Drain System	Sussex
102	2002 Ultra Low Temperature Freezer	Rutgers
103	2002 All-Terrain Vehicle	Bergen
104	2002 All-Terrain Vehicle Trailer	Bergen
105	2002 U.L.V. Machine	Salem
106	2002 Ultra Low Temperature Freezer	Burlington
107	2002 Ultra Low Temperature Freezer	Mercer
108	2002 U.L.V. Machine	Cumberland
109	2002 U.L.V. Machine	Essex
110	2002 All-Terrain Vehicle	Union
111	2003 All-Terrain Vehicle Trailer	Union
112	2003 Microplate Reader	Rutgers
113	2003 Microplate Washer	Rutgers
114	2003 All-Terrain Vehicle	Mercer
115	2003 All-Terrain Vehicle Trailer	Mercer
116	2002 All-Terrain Vehicle	Ocean
117	2003 All-Terrain Vehicle Trailer	Ocean
118	2003 All-Terrain Vehicle	Cumberland
119	2004 All-Terrain Vehicle Trailer	Cumberland
120	2003 All-Terrain Vehicle	Hudson
121	2004 All-Terrain Vehicle Trailer	Hudson
122	2004 Ultra Low Temperature Freezer	Gloucester
123	2004 Ultra Low Temperature Freezer	Essex

124	2004 Ultra Low Temperature Freezer	Passaic
125	2004 Ultra Low Temperature Freezer	Cumberland
126	2004 Ultra Low Temperature Freezer	Union
127	2004 Ultra Low Temperature Freezer	Hudson
128	2008 Turbine Sprayer	Hudson
129	2007 Turbine Sprayer Trailer	Hudson
130	2009 Amphibious Tracked Vehicle Trailer	State

Program Director: Claudia O'Malley, Office of Mosquito Control Coordination, Department of Environmental Protection

State Airspray Program

Operationally, the Airspray Program performed 30 insecticide applications in 5 counties during fiscal year 2011, treating a total of 30,567 acres (Table 2). Although the program's primary focus continues to be the control of larval mosquitoes, 1 of the applications made was for adult mosquito control. This took place in Atlantic County during the early part of the calendar year 2011 mosquito season, and was necessitated by very high nuisance populations of the salt marsh mosquito *Aedes sollicitans*. Although rotary-wing aircraft were utilized to perform the 5 adulticide applications made in fiscal year 2010, the lone adulticide operation performed in fiscal year 2011 was made with the Air Tractor AT-602, with very good results. Of the 29 aerial larvicide applications, 79% were made to the Atlantic and Delaware Bayshore coastal salt marshes, as well as the Delaware Bayshore salt hay farms. Mosquito production within these areas is mainly influenced by monthly tidal cycles. The remaining 21% of the aerial larvicide applications were made to upland targets in the Passaic River floodplain where precipitation is the major factor affecting mosquito production. Additionally, 3 surveillance flights were performed in fiscal year 2011, all utilizing rotary-wing aircraft.

Aircraft available to the program included 2 single-engine, turbine Air Tractor AT-602 for high payload applications of both granular and liquid insecticide formulations, Cessna Skylanes for observation flights, and Bell Jet Ranger rotary-wing aircraft, for both larvicide applications and survey work. Several single-engine Grumman Ag Cats were also available for use; however, the Air Tractor AT-602 proved to be so efficient that the Ag Cats were not used.

The insecticides used in larval control operations included temephos in both a 5% granular formulation and an emulsifiable concentrate, methoprene in a 20% liquid formulation, and both granular and aqueous suspension formulations of *Bacillus thuringiensis* var. *israelensis*. Malathion was utilized for the lone aerial adulticide application.

Since fiscal year 1996, state aid has been provided to those Airspray Program counties that make insecticide applications for mosquito control to state-owned land within their corporate borders. This aid is made in the form of in-kind replacement of the insecticides applied. During fiscal year 2011, Cape May County was reimbursed with 6,500 pounds of Abate 5BG, and Ocean County was reimbursed with 1,056 gallons of Vectobac 12AS and 2,080 pounds of Vectobac CG.

Table 2. State Airspray Program acreage treated in FY2011 by mode and county.

County	Larviciding Acreage	Adulticiding Acreage	Total Acreage
Atlantic	14,014	3,868	17,882
Cumberland	5,293	- 0 -	5,293
Essex	3,490	- 0 -	3,490
Morris	3,370	- 0 -	3,370
Ocean	532	- 0 -	532
State Total	**26,699**	**3,868**	**30,567**

Program Director: Claudia O'Malley, Office of Mosquito Control Coordination, Department of Environmental Protection

State Biological Control Program

In keeping with its integrated pest management approach to mosquito control, the State Mosquito Control Commission continued to support the Biological Control Program during fiscal year 2011. This program was inaugurated in fiscal year 1992 and has played an important role as one of the Commission's state aid programs to the county mosquito control agencies since that time.

The Commission renewed its longstanding Memorandum of Agreement with the New Jersey Division of Fish and Wildlife for developing, maintaining and providing fishery stocks at the Charles O. Hayford Fish Hatchery at Hackettstown. Bureau of Freshwater Fisheries personnel raised stocks of fish for release into known mosquito production sites throughout New Jersey. The difficulties with overwintering *Gambusia* experienced in the past were not evidenced this fiscal year, and an ample supply of fish was available for the county mosquito control agencies throughout the mosquito breeding season.

The Bureau of Freshwater Fisheries continues to provide outstanding assistance to the Office of Mosquito Control Coordination and the participating county mosquito control agencies. All stocking is performed strictly in accordance with the guidelines and policy outlined in the Department Of Environmental Protection document "How to Use the State Bio-Control Program for Mosquito Control in New Jersey". During the course of fiscal year 2011, a total of 144,816 fish were stocked through the Biological Control Program in nine New Jersey counties (Table 3). Species stocked included the mosquitofish, *Gambusia affinis*, and the fathead minnow, *Pimephales promelas*. Since its inception in 1992, a total of 3,076,474 fish have been provided to the counties for mosquito control purposes through the State Commission's Biological Control Program, at no cost to them.

The Commission renewed its Memorandum of Agreement with the New Jersey Department of Agriculture's Phillip Alampi Beneficial Insect Laboratory so that the cyclopoid copepod project could continue through fiscal year 2011. Begun in fiscal year 2005, the project's purpose is to investigate the use of organisms other than fish as mosquito control agents, and has shown quite some promise. As has been the case since the inception of this project, Department of Agriculture staff has devoted a considerable amount of effort to ensure that an adequate supply of the copepod *Macrocyclops albidus* was available for use. In the previous fiscal year, mosquito production habitats under investigation included artificial containers, constructed woodland pools, natural woodland pools, and abandoned swimming pools. Based on the results obtained, it was determined that these organisms would best be used to control larval mosquito populations within artificial containers. As was the case in fiscal year 2010, ample stocks of copepods were available for distribution quite early in the mosquito season, and the program was made available to any New Jersey county mosquito control agency for use as biological control agents within artificial containers, at no cost to the counties. By the end of fiscal year 2011, ten county mosquito control agencies were participating in the program, including those of Atlantic, Bergen Burlington, Cape May, Cumberland, Gloucester, Hunterdon, Monmouth, Ocean, and Warren counties.

Table 3. Mosquitofish stocking by county and species during FY2011.

County	Species	Number of Fish
Bergen	*Gambusia*	22,000
Essex	Gambusia	5,000
Gloucester	Gambusia	5,000
Mercer	Gambusia	6,500
Monmouth	Gambusia	9,736
Ocean	Fathead minnows *Gambusia*	27,400 5,000
Passaic	Fathead minnows	1,680
	Gambusia	1,120
Sussex	Fathead minnows	10,000
	Gambusia	9,230
Warren	Fathead minnows	16,050
	Gambusia	26,100
Total		**144,816**

Program Director: Claudia O'Malley, Office of Mosquito Control Coordination, Department of Environmental Protection

Monitoring the Efficacy of Insecticides for Mosquito Control in New Jersey

Toxicities of spinosad to *Aedes sollicitans* larvae from Ocean, Atlantic, Cape May and Cumberland counties are reported. The toxicities remain in the single digit range and vary insignificantly between the years 2008, 2009, and 2010.
Toxicities of Bti to the larvae were essentially the same as in previous years with small differences in the data falling well within normal variation. Bti is generally less toxic to these mosquito larvae than spinosad. It takes 9 – 17 times more of Bti to achieve the same control as with spinosad.
Toxicities of temephos at the LC_{50} level to the larvae were, like those of spinosad, in the single digit range. The variation at the LC_{90} level looks greater than it probably is due to less precision in the discriminating dose data from 2008 and 2009 than in the full-range LC_{50} toxicity bioassays.
Toxicities of methoprene to the larvae were difficult to obtain. The compound is probably quite toxic to the larvae – single digit LC_{50} values for Ocean and Atlantic counties, but increasingly troublesome to work with, probably due to some formulation problem.
This progress report shows the details of:

Collection of *Aedes sollicitans* host-seeking females.
Toxicity data for Bti, spinosad, temephos, and methoprene to mosquito larvae from eggs from females collected in south New Jersey field sites May through October, 2010.
Data for etofenprox and prallethrin toxicities to larvae from Ocean County.

Host-seeking Ae. *sollicitans* females were collected in four locations in New Jersey: West Creek in Ocean County, Brigantine Island in Atlantic County, Sutton Lane in Cape May County, and East Point Lighthouse in Cumberland County. We made 19 collecting trips with our last trip for the season on October 29, 2010.
The female mosquitoes were brought back to the Headlee lab in New Brunswick and fed cattle blood, purchased from the Carteret Abattoir, with a Hemotek apparatus. After 4 feedings, the mosquitoes were left in the collecting cages supplied with a paper towel soaked with a 10% sugar solution for 2 or 3 days. They were then transferred to glass shell vials (2 females per vial) containing a moistened cotton ball and sealed with a piece of fabric screen (bridal tulle) through which they could drink a 10% sugar solution placed on top in a saturated paper towel. During transfer, whilst holding them in the glass transfer tube, each female was identified by inspection with a dissecting microscope. Females that were not *Ae. sollicitans* were discarded. The egg-containing shell vials were stored at RT for 3 weeks to allow development of the embryo and the serosal cuticle. After that, the vials were stored in plastic baskets with a wet paper towel on top and wrapped in a plastic bag. The baskets were stored at 24°C in a Percival environmental incubator set at a 16/8 day/night cycle, and the moisture level in the vials was monitored and adjusted weekly to 80 – 85%RH to avoid drying out of the eggs. The numbers of vials with eggs from each field site are shown in Table 1.
As Table 1 shows, far from all collected females actually laid eggs. The number of eggs in each vial was highly variable, ranging from fewer than 10 to well over 100. Not every egg hatched out

a larva. There are variations in each step of this series of events. This variability necessitates many collecting trips. This year, the number of eggs from Cape May and Cumberland Counties proved insufficient to obtain good solid data for insecticide response experiments.

Table 4 Summary of female *Ae. sollicitans* wild-caught at each field site in 2009.

County	Number of vials with eggs	Percent vials with eggs
Ocean	**358**	**55**
Atlantic	**301**	**62**
Cape May	**85**	**57**
Cumberland	**93**	**79**

Assays to Measure Toxicity

All assays were performed exactly as described in my final report for fiscal year 2009.
As in the previous year, this year's report includes "fold ratios" (FR) of toxicity of the insecticides between the years 2010 and 2009. The FR between years can indicate a trend, or lack thereof, in the physiological response in the larvae to an insecticide based on either a change in detoxification capacity or in molecular target site sensitivity, or both. A difference up to 3 – 4-fold can easily be the result of normal biological variation (if you look at any financial graph you will see similar variability in numbers). A larger and consistent difference should prompt close scrutiny of the population and how it is controlled as it could indicate incipient resistance evolution.

Toxicity data

Toxicity of spinosad to *Aedes sollicitans* larvae

A sample of spinosad marketed as Natular®, which is a 20.6% mixture of spinosyn A (major component) and spinosyn D in wintergreen oil (methyl salicylate) supplied by Clarke Mosquito Control Products, Inc., Roselle, IL, was used.
Mortality produced by spinosad was assessed after 3 days of incubation based on the progressive mortality observed and described in the 2008 Final Report for this project.
The 3-day mortalities from spinosad treatment to larvae from females collected in 2008, 2009, and 2010 are shown in Table 2.

Table 5 LC_{50} (ppb) with 95% confidence limits 3 days after treatment with spinosad in *Ae. sollicitans* larvae.

County	2008	2009	2010	FR (09/08)	FR (10/09)
Ocean	**2.4 (2.1 – 2.6)**	**5.4 (4.1 – 6.6)**	**3.2 (2.9 – 3.5)**	**2.2**	**0.6**
Atlantic	**1.5 (1.3 – 1.7)**	**5.8 (5.2 – 6.5)**	**1.8 (1.5 – 2;2)**	**3.3**	**0.3**
Cape May	**1.4 (1.2 – 1.7)**	**3.4 (3.0 – 3.8)**	**2.4 (2.0 – 2.9)**	**2.4**	**0.7**
Cumberland	**1.7 (1.3 – 2.2)**	**6.9 (6.3 – 7.4)**	**1.8 (1.5 – 2.1)**	**4.1**	**0.6**

All data in Table 5 are solid; the FR values between 2010 and 2009 data show increased toxicity in 2010 as opposed to decreased toxicity between the years 2009 and 2008. This is most likely due to normal biological variation. Several more years' worth of data are needed to determine any hard trend.

The toxicity of spinosad to *Ae. sollicitans* larvae is very high. By comparing the LC_{50} data for Bti and spinosad from 2010, it is clear that spinosad is more toxic than Bti: for Ocean, Atlantic, and Cape May counties, the difference is 9-fold in favor of spinosad; for Cumberland County, it is 17-fold in favor of spinosad. Bti is likely more expensive than spinosad. New Jersey *Ae. sollicitans* larvae are not resistant to spinosad and it should be perfectly feasible to rotate this insecticide with Bti.

Table 6 shows the LC_{50} (same as in Table 2) and LC_{90} data for spinosad to the mosquito larvae in 2010 (95% confidence limits) (ppb)

County	LC_{50}	LC_{90}	Slope
Ocean	**3.2 (2.9 – 3.5)**	**5.9 (5.2 – 6.6)**	**4.8**
Atlantic	**1.8 (1.5 – 2;2)**	**3.6 (2.9 – 5.3)**	**4.3**
Cape May	**2.4 (2.0 – 2.9)**	**4.9 (3.8 – 7.8)**	**4.0**
Cumberland	**1.8 (1.5 – 2.1)**	**3.7 (3.0 – 5.0)**	**4.1**

The slope of a regression line is taken to indicate the level of genetic heterogeneity/homogeneity of the population under study. The slopes of these regression lines indicate populations of average ("normal") genetic homogeneity. If plotted out, all these lines will have a slope of 45 degrees, more or less.

Toxicities of Bti to *Aedes sollicitans* larvae

The Bti preparation was a sample of VectoBac®, donated by the Hunterdon County Mosquito Control Agency, containing 11.61% active ingredient representing 1200 international toxic units per mg. There is no direct relationship between potency and the percent active ingredient by weight. It is unclear exactly what the 'active ingredient' really is. The toxic principle of Bti is a large, 144 kD protein, the δ-endotoxin, not the item quantified in this formulation.

The assays were performed as described in my 2009 final report. The LC_{50} from 2008, 2009, and 2010 are shown in Table .

Table 7 Mortalities of 4th instar larvae of *Ae. sollicitans* in 2008, 2009, and 2010 (95% lower - upper confidence limits of the LC_{50} value) 24 hours after treatment with Bti.

County	2008 LC_{50} (ppb)	2009 LC_{50} (ppb)	2010 LC_{50} (ppb)	FR (09/08)	FR (10/09)
Ocean	**21.6 (18.2 – 5.2)**	**15.2 (13.5 – 7.3)**	**27.5 (24.6 – 32)**	**0.7**	**1.8**
Atlantic	**21.6 (18.9 – 24.9)**	**26.4 (23.4 – 30.4)**	**17.8 (14.9 – 21.4)**	**1.2**	**0.7**
Cape May	**16.8 (14.8 – 19.1)**	**19.9 (16.5 – 24.6)**	**23.2 (20.7 – 26.4)**	**1.2**	**1.2**
Cumberland	**24.2 (21.7 – 27.4)**	**39.5 (32.8 – 49.3)**	**33.7 (30.2 – 37.8)**	**1.6**	**0.9**

All data in Table are solid. The variation in toxicity between the 3 years, 2008, 2009, and 2010 is insignificant, well within normal biological variation (all FR values are less than 2) indicating that Bti continues to be an excellent insecticide to use for the control of NJ salt marsh mosquitoes. To safeguard against resistance evolution to this valuable control agent it would be prudent to rotate it with spinosad (or even temephos as long as it's available) from time to time.

Table 8 shows the LC_{50} (same as in Table 4) and LC_{90} data for Bti to the mosquito larvae in 2010 (95% confidence limits) (ppb)

County	LC_{50}	LC_{90}	Slope
Ocean	**27.5 (24.6 – 32)**	**54.7 (46.3 – 68.9)**	**4.3**
Atlantic	**17.8 (14.9 – 21.4)**	**42.9 (33 – 66)**	**3.3**
Cape May	**23.2 (20.7 – 26.4)**	**48.8 (40.4 – 63.8)**	**3.9**
Cumberland	**33.7 (30.2 – 37.8)**	**58.5 (50.3 – 72.8)**	**5.3**

As before, the slope of a regression line is taken to indicate the genetic heterogeneity/homogeneity of the population under study. The slope data for Bti toxicity to the mosquito larvae indicate that the population from Cumberland County is slightly more genetically homogeneous (possibly more stressed with Bti) than the other populations and that the population from Atlantic County is slightly more genetically heterogeneous than other populations (less Bti stress). Considering that *Ae. sollicitans* is a strong flyer (has been recovered up to 50 miles from origin, personal communication with M. Romanowski), the level of homogeneity of any of the 4 south NJ *Ae. sollicitans* population can be expected to change depending on how the adult mosquitoes move between the 4 field sites; they are all within the range of adult flight capacity.

<u>Toxicities of temephos to *Aedes sollicitans* larvae</u>

Analytical grade, >99% pure, temephos (Abate®) was purchased from Chem Service, West Chester, PA. Temephos toxicity (dead larvae) was assessed 24 hours after application. The value of monitoring temephos toxicity is at least 2-fold: temephos is a remarkably effective mosquito larvicide and may be needed in the future if other control agents should fail, and being detoxified in *Ae. sollicitans* exclusively by carboxylesterases, temephos toxicities provide information about the condition of this defense mechanism in the mosquito larvae. Carboxylesterases are also responsible for the detoxification of pyrethroids, especially synergized pyrethroids.

Table 9 Toxicity data for temephos to 4th instar larvae of *Ae. sollicitans* from females collected in Ocean, Atlantic, Cape May, and Cumberland Counties in 2010. (95% confidence limits, when available) (ppb)

County	LC_{50}	LC_{90}	Slope	Approximate LC_{90} for 2008	Approximate LC_{90} for 2009
Ocean	**4 (3.6 – 4.4)**	**7.6 (6.7 – 8.9)**	**4.6**	**10**	**14**
Atlantic	**2.9 (2.5 – 3.2)**	**8.2 (6.8 – 10.5)**	**2.8**	**10**	**60**
Cape May	**4 (2.6 – 5.4)**	**11 (7.7 – 26)**	**2.9**	**8**	**13**
Cumberland	**2 (1.7 – 2.2)**	**3.9 (3.3 – 5.1)**	**4.2**	**19**	**10**

The data in Table are solid; they are better for Ocean and Atlantic Counties than for Cape May and Cumberland counties due to insufficient supplies of larvae from the latter counties. Because of lacking LC_{50} data for recent years when only discriminating dose data were sought, FR values would be largely meaningless. It is, however, obvious that temephos is an extraordinarily effective mosquito larvicide. The low slope values for Atlantic and Cape May counties indicate quite flat regression lines, which, in turn, indicate heterogeneous populations, perhaps a result of diminished use of temephos (lower selection pressure) in these counties in recent years.

Toxicity of methoprene to *Aedes sollicitans* larvae

The methoprene (Altosid®) was purchased from Chem Service, Inc., West Chester, PA. It was a racemic mixture of the R and S forms, containing mostly the S (bioactive) form.

The methoprene toxicity test was performed as described in the 2009 report for this project.

A full-range LC_{50} was attempted with populations from the 4 field sites. This succeeded only for the populations from Ocean, Atlantic, and Cumberland counties. There are no data at all available for Cape May larvae due to insufficient numbers of eggs as well as to lacking basic equipment, *viz*., a temperature-controlled bench-top incubator (previously, these monitoring experiments were performed with Dr Brattsten's research equipment purchased in 1987; equipment doesn't last forever, and despite repeated applications, a replacement incubator has not been provided by the SMCC for these experiments). The mortalities obtained in 2010 are shown in Table 7.

Table 10 Toxicity data for methoprene to 4th instar larvae of *Ae. sollicitans* from females collected in Ocean, Atlantic, and Cumberland Counties in 2010. (95% confidence limits when available) (ppb)

County	LC_{50}	LC_{90}	Slope	Approximate LC_{90} for 2008	Approximate LC_{90} for 2009
Ocean	**1.3 (0.8 – 1.8)**	**29.5 (17.2 – 73.7)**	**0.9**	**36**	**15**
Atlantic	**5.3 (3.3 – 7.5)**	**81.9 (46.3 – 226.6)**	**1.1**	**50**	**15**
Cape May	**NA**	**NA**	**NA**	**25**	**15**
Cumberland	**13.2 (7 – 26.2)**	**362 (105.2 – 14,013)***	**0.9**	**50**	**15**

*Extrapolated by the PoloPlus software; this value is absurd.

The data in Table are best regarded as preliminary. Although methoprene is probably considerably toxic to *Ae. sollicitans* larvae, it was very difficult to obtain data that were even close to reasonable, in light of previous experimental data with these populations. Perusal of the LC_{90} (form 2010) and the approximate LC_{90} data from previous years, indicates a significantly decreased toxicity, especially for Cumberland County mosquitoes. Methoprene is, at best, capricious to use, and it takes a real effort to obtain consistent and reliable data with this compound, even in bench-top *in vivo* toxicity bioassays with stringently controlled conditions. Because of lacking LC_{50} data for recent years, when only discriminating dose data were sought, FR values would be largely meaningless. The slope values for the three regression lines indicate extremely flat lines; it was difficult to discern a true dose-mortality relationship with methoprene.

Experiments with other insecticidal compounds

The recently introduced ether-pyrethroid adulticide **etofenprox** (ZENIVEX E20®) is toxic also to mosquito larvae. A preliminary LC_{50} of 3 ppb was obtained with mosquito larvae from females collected in Ocean County in 2009. This compound is not yet registered for use as a larvicide in New Jersey; it probably should be. When this compound is used as an adulticide in the vicinities of salt marshes, it will likely affect any larval populations present, as well. An **LC_{50} of 17.9 (15.9 – 20.8) ppb** was obtained with larvae from females collected in Ocean County in 2010. The value is solid; the toxicity is comparable to that of Bti. The **LC_{90} was 42.5 (35.6 – 54) ppb** and the slope of the regression line was 3.4 indicating "normal" genetic heterogeneity in the population.

Prallethrin, a recently introduced pyrethroid is formulated with another (old) pyrethroid, d-phenothrin and the synergist piperonyl butoxide, as Duet®, which is used on an observational basis in NJ for adulticiding. In experiments with prallethrin alone with larvae from females collected in Ocean County in 2010, an **LC_{50} of 20.9 (18.9 – 23.4) ppb** and an **LC_{90} of 30.8 (26.8 – 39.1) ppb** were obtained. The toxicity of this compound is also in the range of Bti toxicity. The slope for this regression line was 7.6, i.e., very steep, indicating a highly homogeneous population. This could very well be an effect of extensive use of other piperonyl butoxide-synergized pyrethroids exerting selection pressure. They are all detoxified by cytochrome P450 and carboxylesterases and they all have the same molecular target site, the axonal sodium channel.

Conclusion

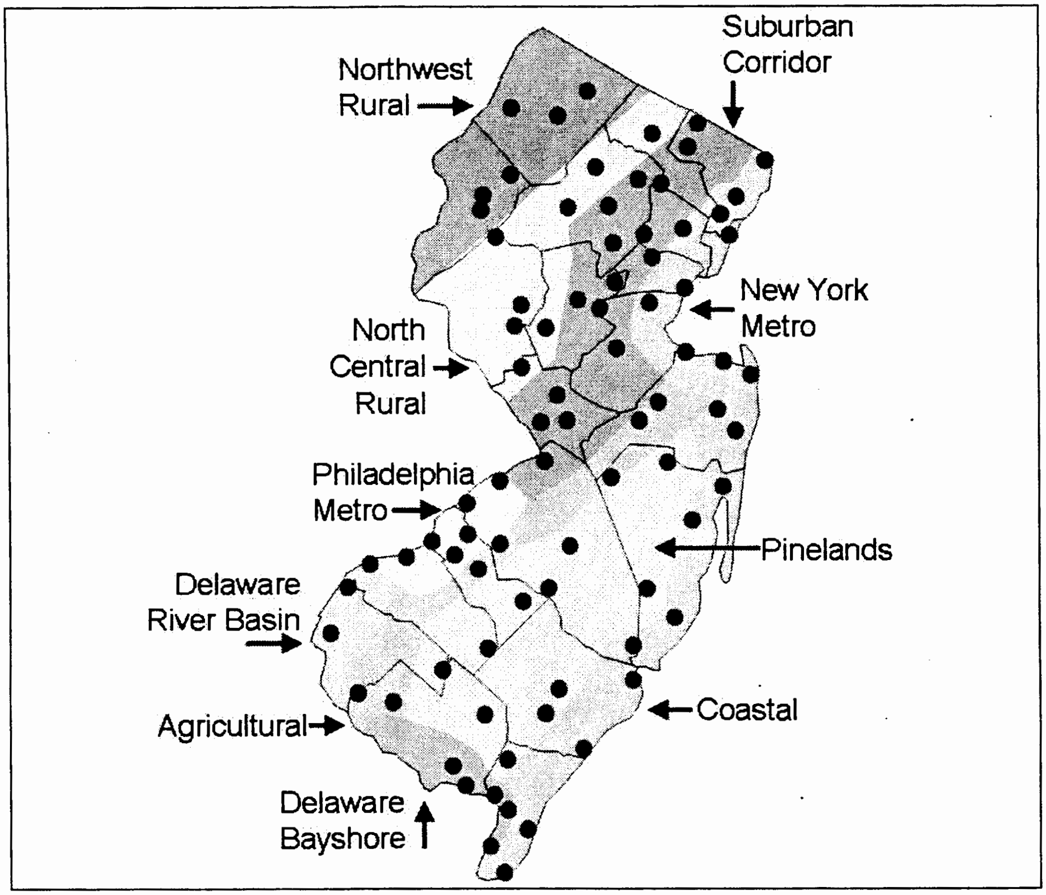
The overall conclusion based on the data presented above is that *Aedes sollicitans* larvae in the southern New Jersey salt marshes are still easily controlled with the insecticides monitored. This really should be true also for methoprene, which, however, tends to be increasingly difficult to use. This is probably rather related to a formulation problem than to physiological resistance in the mosquito larvae.

Despite practical problems and lack of operating support, it is imperative that the available control agents be used in rotation every year to avoid potential resistance evolution in some situations. To do otherwise is destructive not only to the enduring effectiveness of the materials but also to the ecology and biology of the environment. Rotation of insecticides is one method accepted as part of IPM strategies. Another important option is the use of mixtures of insecticidal compounds (as opposed to simply synergized insecticides) as is routinely practiced in drug treatment of infectious diseases, *e.g.*, AIDS. This option is currently impossible (except perhaps by surreptitious use of several insecticides in a really short time period) with pesticides due to lack of research of pesticide interactions *in situ* and the ensuing lack of EPA-approved products. Yet another possibility is the use of refugia where sensitive populations can survive and, presumably, exit from to "dilute" resistant population gene pools. It may not be necessary to kill every mosquito everywhere. In the absence of the practice of any of these methods, mosquito control in New Jersey cannot be claimed to be conducted according to IPM practices.

Despite diminishing options for insecticides to use, and diminishing resources to use them with, there are likely many compounds already on the market for other types of control that could be registered for use in mosquito control if the required information were available. With such new possibilities, as well as with established mosquito control insecticides it is important to understand how the mosquito responds, as the mosquito remains the key factor.

Project Director: Lena Brattsten, Ph.D. Department of Entomology, Rutgers University

NEW JERSEY STATEWIDE ADULT MOSQUITO SURVEILLANCE



Data from more than 80 New Jersey light traps contributed by county mosquito control agencies are used to calculate trends in mosquito populations for species of nuisance or health concerns.

Calculations are based on regional distributions, with emphasis on mosquito habitat and land use. Trends will allow a statewide evaluation of changing mosquito populations, in response to control and/or changes in habitat.

The State Surveillance Program Overview
In New Jersey, county-level mosquito control agencies use New Jersey light traps to monitor certain nuisance and health-risk mosquito species. Agencies have many years worth of experience in the placement, use, and interpretation of light traps and their data as monitoring mosquito populations is an essential part of an integrated pest management approach. But county agencies are limited to county data, and a landscape-wide view of changing mosquito trends is not available. The purpose of this program is to cover that gap and provide information of nuisance and health-risk mosquito populations on a regional level.

The 2011 Season: Nineteen of the 21 county mosquito control agencies participated in this program during the season. Most agencies provided data in a timely matter. However, at times, most agencies were occasionally pressed to get the data to Headlee Labs.

During 2011, 36 mosquito species were identified out of the 113,755 individual mosquitoes caught in the statewide surveillance light trap network throughout New Jersey. The total number of mosquitoes trapped was on the low end of the range from recent years (between 100,000 and 300,000 individuals). As in 2009, no *Anopheles earlei* were trapped. Additional species with less than 10 individuals trapped (not included in the total number caught) for the entire season included *Aedes atropalpus, Ae. barberi, Ae. excrucians, Ae. mitchellae, Ae. thibaulti, Culex tarsalis, Culiseta inornata, Cs. minnesotae, Orthopodomyia signifera* and *Psorophora howardii.*

The Agricultural and Coastal regions collected a wider variety of mosquitoes than did other regions. This year, neither the number of species nor the number of mosquitoes caught in each region correlated with the number of traps ($r = 0.35$, $df = 8$, $p > 0.05$; $r = 0.42$, $df = 8$, $p > 0.05$, respectively) such that those with fewer traps caught neither fewer species nor fewer number of mosquitoes. Thus, while the Agricultural region had only a moderate number of traps, it had the highest diversity (number of species) but only the second lowest number of mosquitoes caught. Similarly, there was no correlation between the number of species caught and the total number of mosquitoes caught per region ($r = 0.45$, $df = 8$, $p > 0.05$).

Table 11 Number of county traps used in each region with the number of mosquito species identified in the traps.

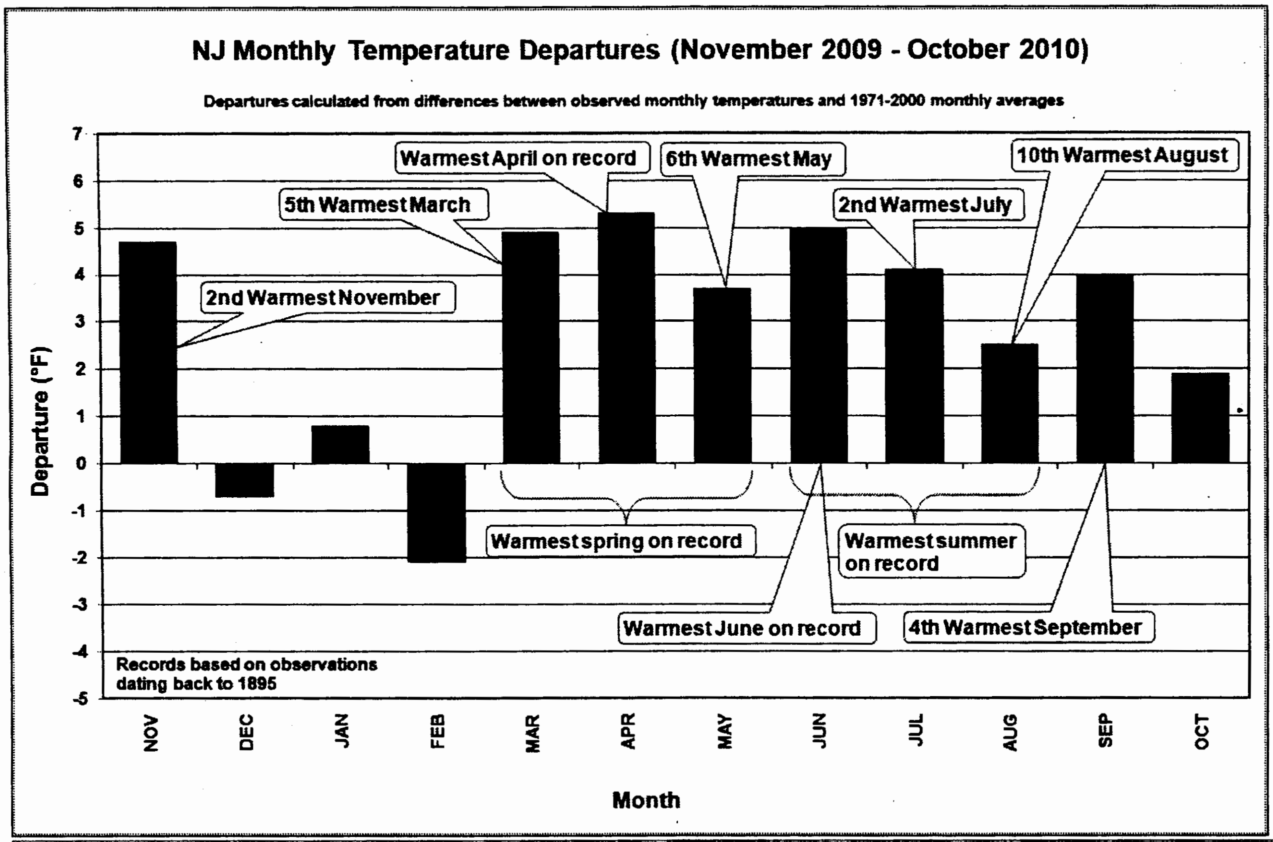
Region	***Number of Traps***	***Number of Species***	***Number of Mosquitoes***
Agricultural	6	30	6,044
Coastal	9	29	19,916
Delaware Bayshore	6	24	27,834
Delaware River Basin	2	19	2,880
New York Metro	10	23	9,880
North Central Rural	7	17	994
Northwestern Rural	6	26	8,963
Philadelphia Metro	5	23	7,376
Pinelands	10	27	10,780
Suburban	17	26	19,088
Statewide Total	82	36*	113,755

*not including the least common species.

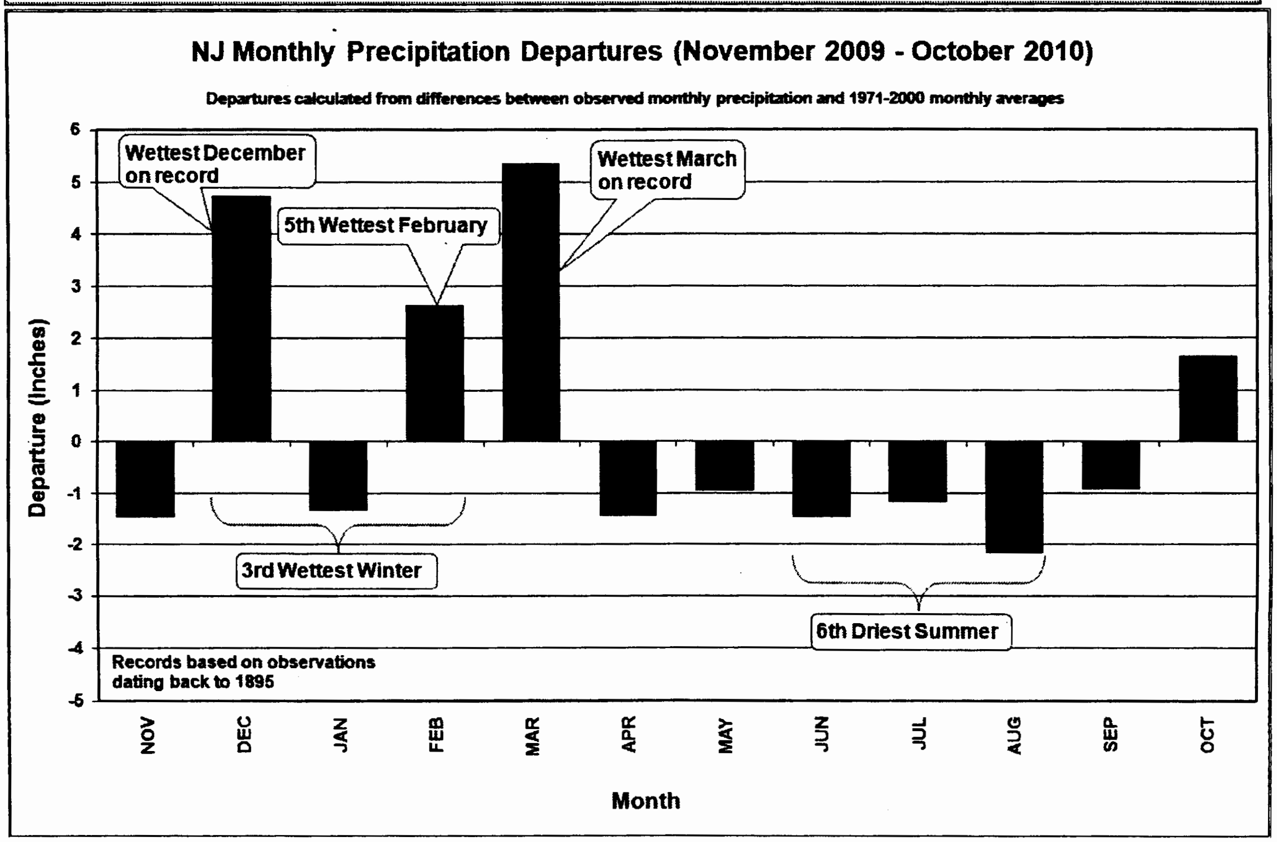
The most abundant species caught statewide were the *Culex* Mixed (including *Cx. pipiens, Cx. salinarius* and *Cx. restuans*), *Aedes vexans, Anopheles bradleyi, Ae. sollicitans, An. quadrimaculatus, Cs. melanura, Coquillettidia perturbans* and *Ae. cantator* (Figure 4) . In 3 of the 10 regions (Figures 5-14), the Mixed *Culex* populations were in greatest number. In 4 of 10 regions, *Ae. vexans* was the predominant species. *Ae. sollicitans* was dominant in the Coastal region, *An. bradleyi* in the Delaware Bayshore and *Cs. melanura* in the Pinelands.

Weather effects: New Jersey experienced an unusual set of temperature and precipitation events both in the spring prior to the beginning of light trap collections and again during the summer. The Office of the New Jersey State Climatologist recorded the monthly temperature and precipitation departures against averages from 1971 – 2000 as well as against records kept from 1895. They recorded numerous instances that resulted in a very wet spring followed by a dry summer as well as a warm spring and summer.

Monthly temperature and precipitation departures from normal, Office of the New Jersey State Climatologist.



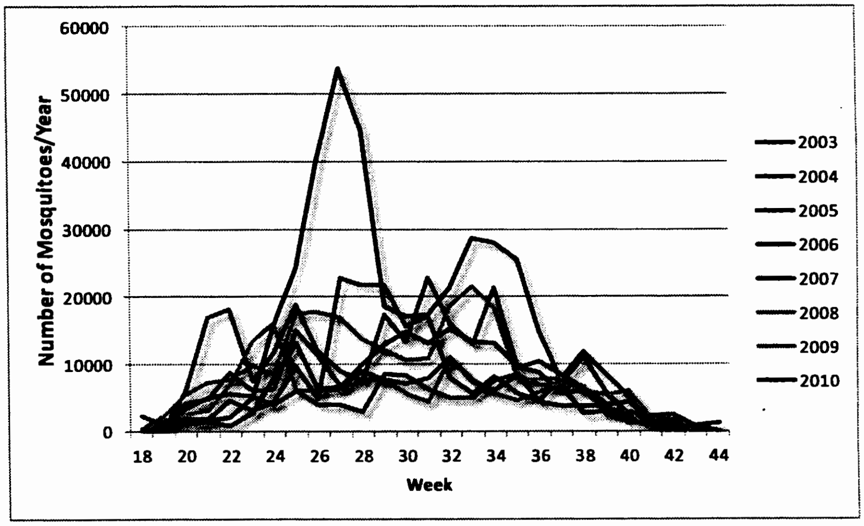
NJ Monthly Temperature Departures (November 2009 - October 2010)
Departures calculated from differences between observed monthly temperatures and 1971-2000 monthly averages
Departure (°F)
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
Warmest April on record
6th Warmest May
10th Warmest August
5th Warmest March
2nd Warmest July
2nd Warmest November
Warmest spring on record
Warmest summer on record
Warmest June on record
4th Warmest September
Records based on observations dating back to 1895
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
Month



NJ Monthly Precipitation Departures (November 2009 - October 2010)
Departures calculated from differences between observed monthly precipitation and 1971-2000 monthly averages
Departure (Inches)
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
Wettest December on record
Wettest March on record
5th Wettest February
3rd Wettest Winter
6th Driest Summer
Records based on observations dating back to 1895
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
Month

These effects likely contributed to some of the low population patterns observed. Wet warm springs can increase the survivability of mosquito populations (particularly those that overwinter as larvae), allowing them to emerge earlier and in greater numbers. Subsequent drought conditions can affect floodwater species by eliminating habitat that normally appears through the summer. Drought, when extensive, can reduce or eliminate normally "permanent" waters, reducing even more stable populations such as for *Culex* species. See species summaries.

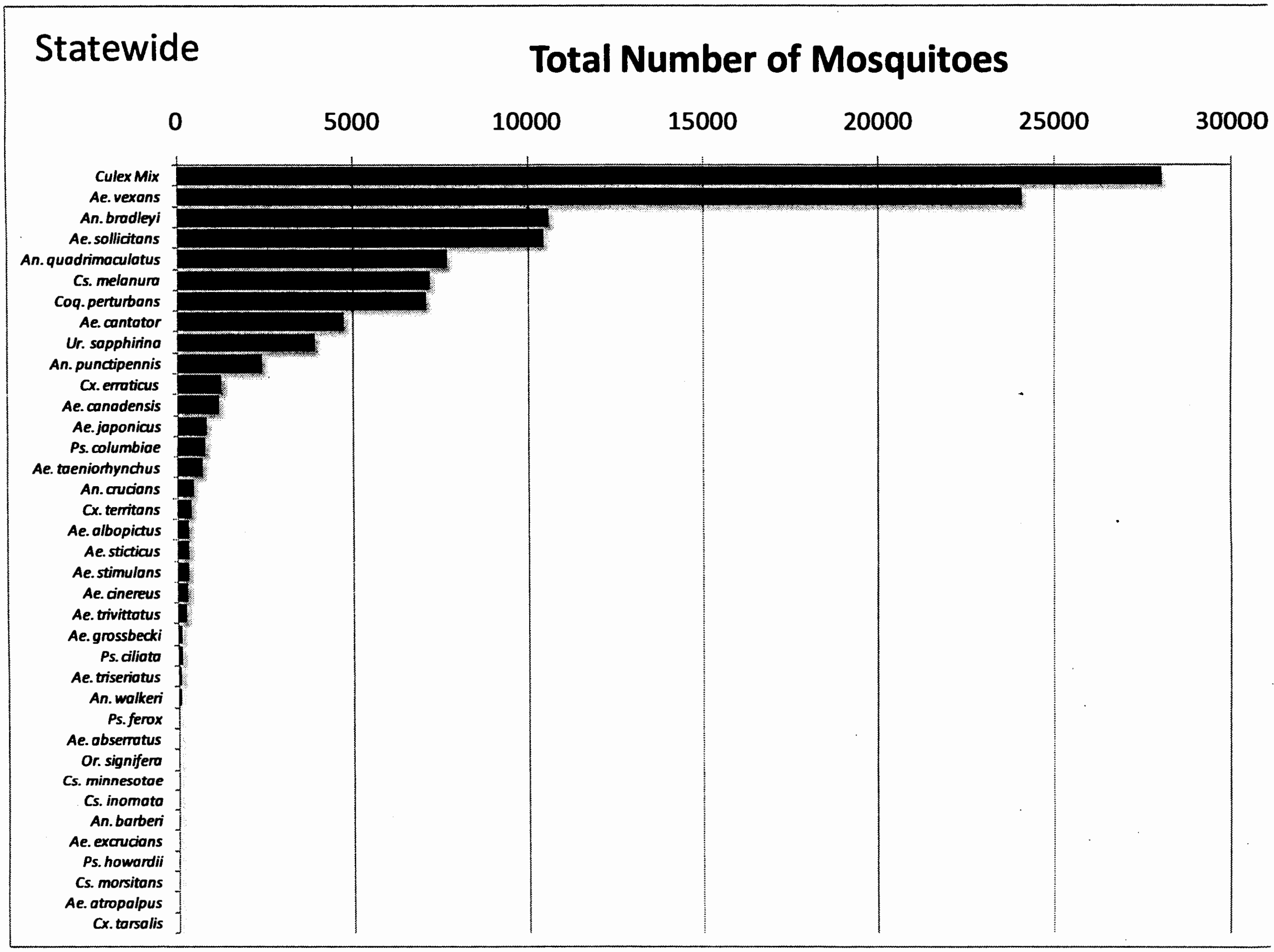
Weekly total mosquitoes collected in statewide light trap program from 2003-2010.

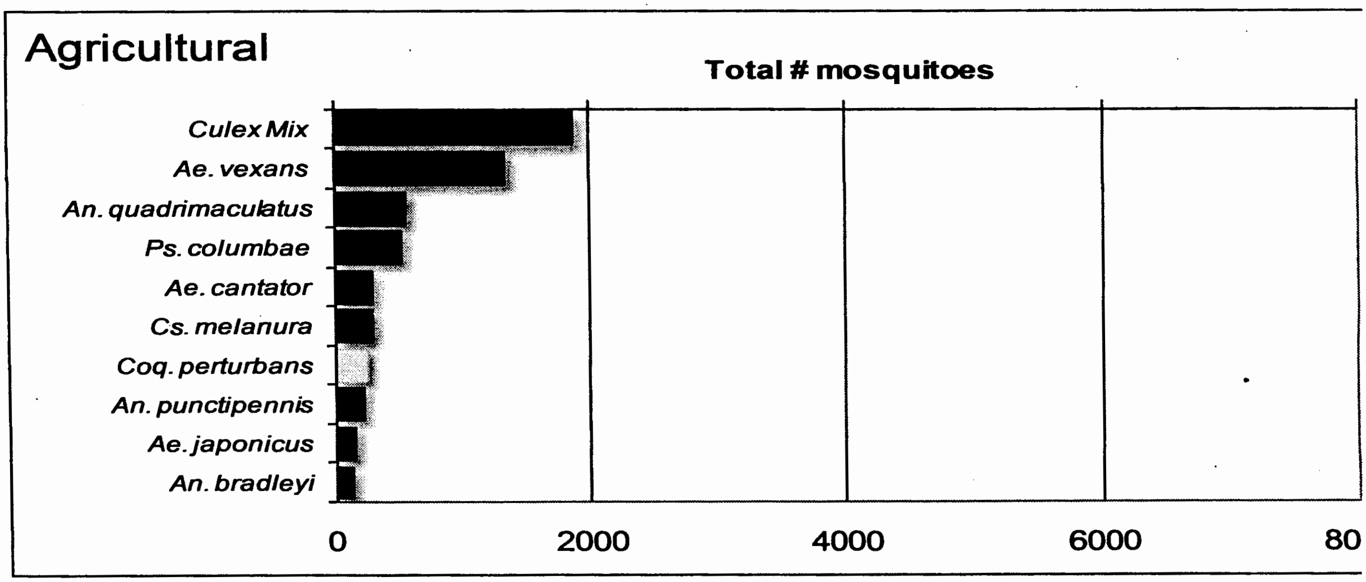


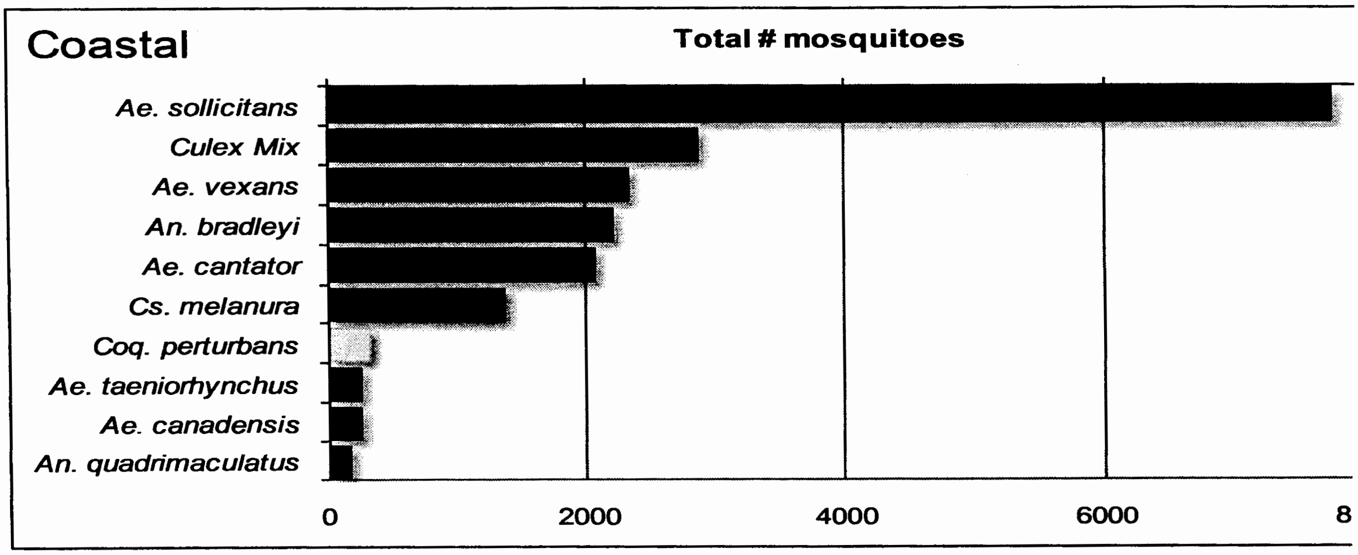
An online calibration class is offered to any county that wished to learn about the proper maintenance and calibration of light traps (http://www.rci.rutgers.edu/~vbcenter/video/ovi.htm). Cleaned and calibrated traps confer compatibility of the datasets.

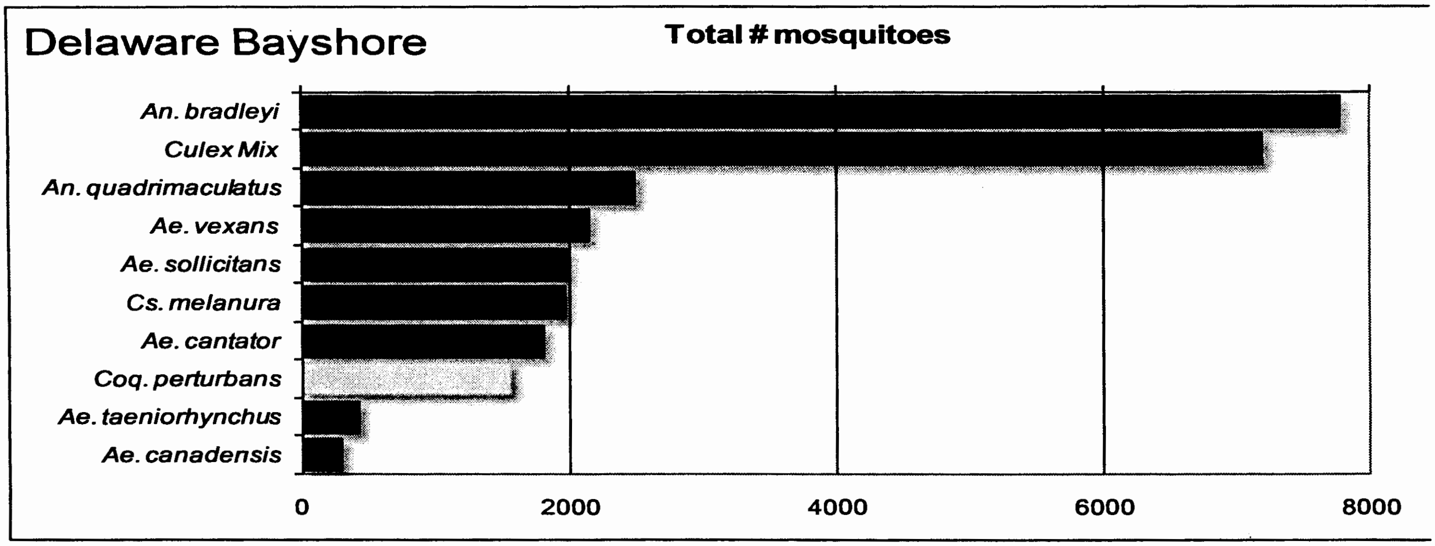
The following figures are the cumulative totals statewide and for each region for 2010. Figures after those are the species summaries for those species that have 500 or more individuals caught, or are of public-health interest. They are listed alphabetically, with information on how they are classified according to life cycle types (Crans 2004 A Classification System for Mosquito Life Cycles: Life Cycle Types for Mosquitoes of the Northeastern United States) Journal of Vector Ecology pp1-10.) plus written summary.

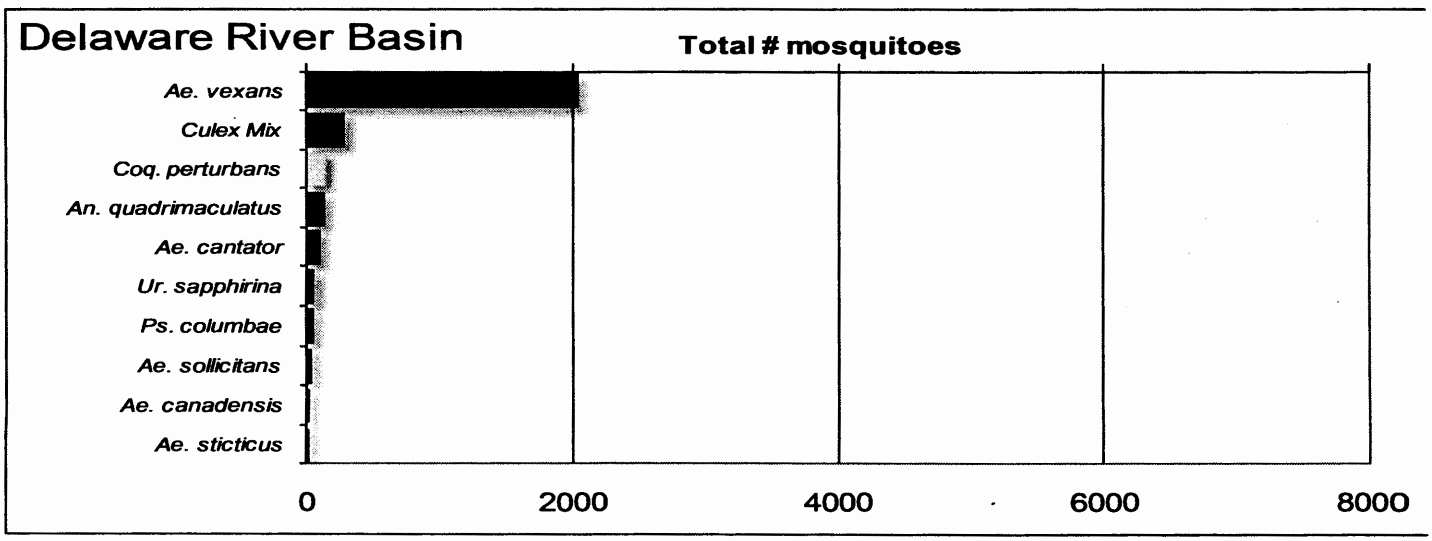
Cumulative totals for light trap species statewide and Top Ten for each region, 2010.

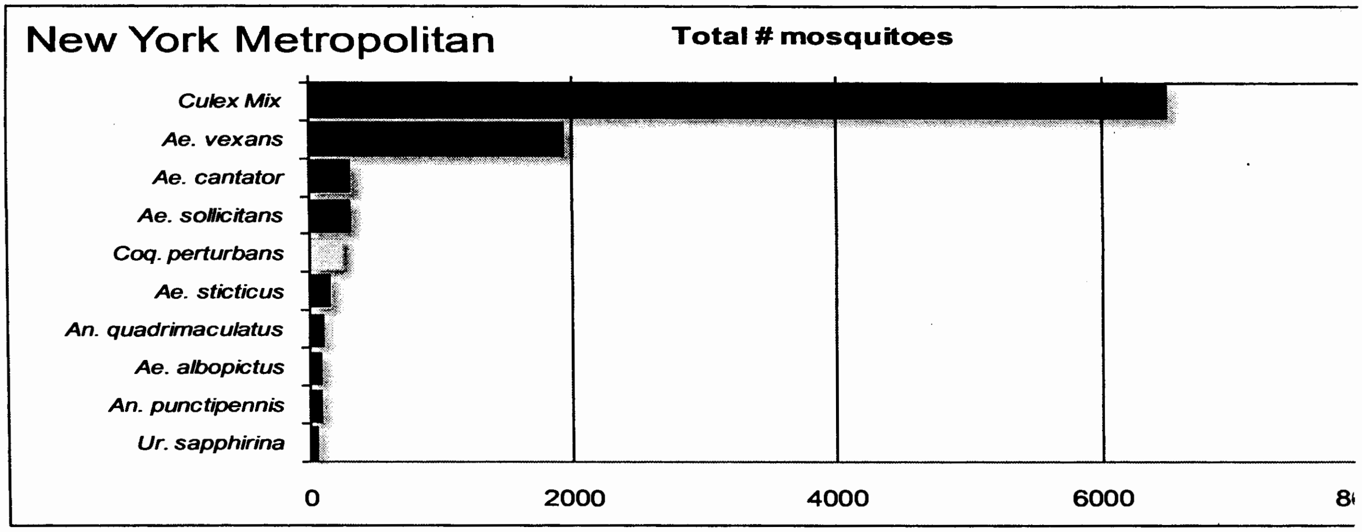


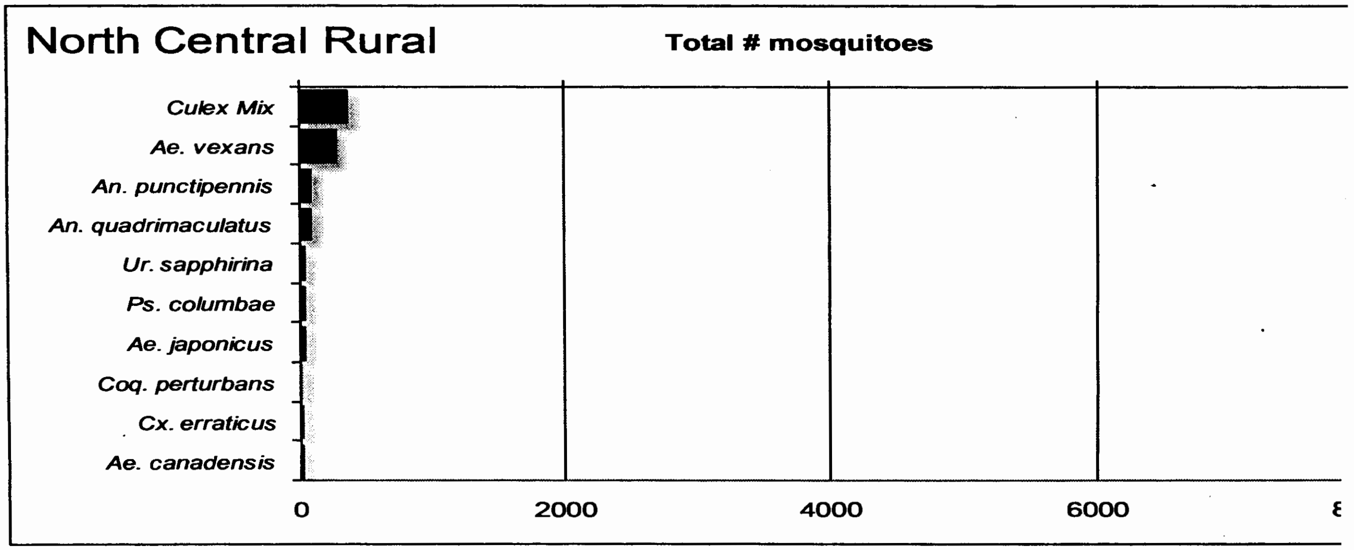

Agricultural
Total # mosquitoes
Culex Mix
Ae. vexans
An. quadrimaculatus
Ps. columbae
Ae. cantator
Cs. melanura
Coq. perturbans
An. punctipennis
Ae. japonicus
An. bradleyi
0
2000
4000
6000
80

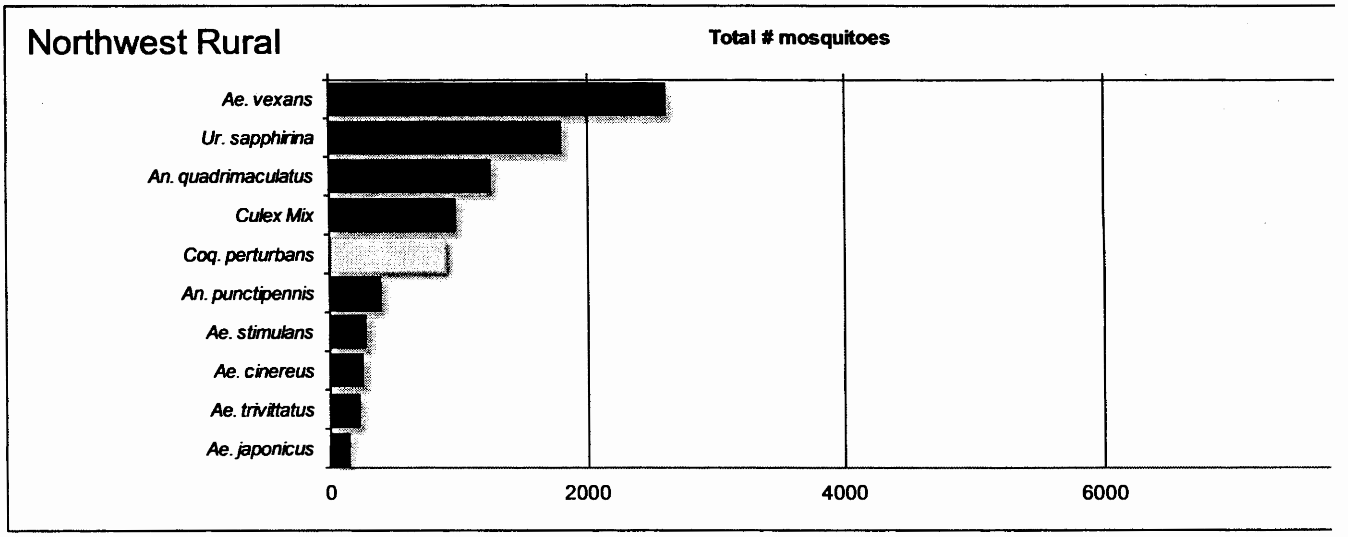

Coastal
Total # mosquitoes
Ae. sollicitans
Culex Mix
Ae. vexans
An. bradleyi
Ae. cantator
Cs. melanura
Coq. perturbans
Ae. taeniorhynchus
Ae. canadensis
An. quadrimaculatus
0
2000
4000
6000
8

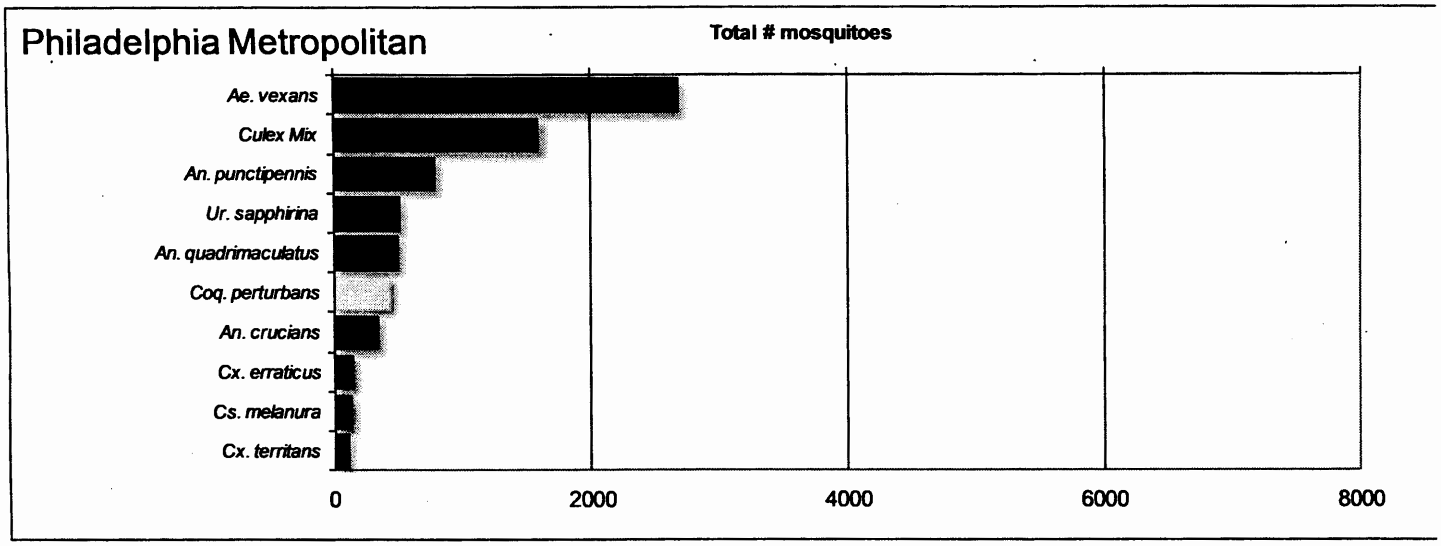

Delaware Bayshore
Total # mosquitoes
An. bradleyi
Culex Mix
An. quadrimaculatus
Ae. vexans
Ae. sollicitans
Cs. melanura
Ae. cantator
Coq. perturbans
Ae. taeniorhynchus
Ae. canadensis
0
2000
4000
6000
8000


Delaware River Basin
Total # mosquitoes
Ae. vexans
Culex Mix
Coq. perturbans
An. quadrimaculatus
Ae. cantator
Ur. sapphirina
Ps. columbae
Ae. sollicitans
Ae. canadensis
Ae. sticticus
0
2000
4000
6000
8000

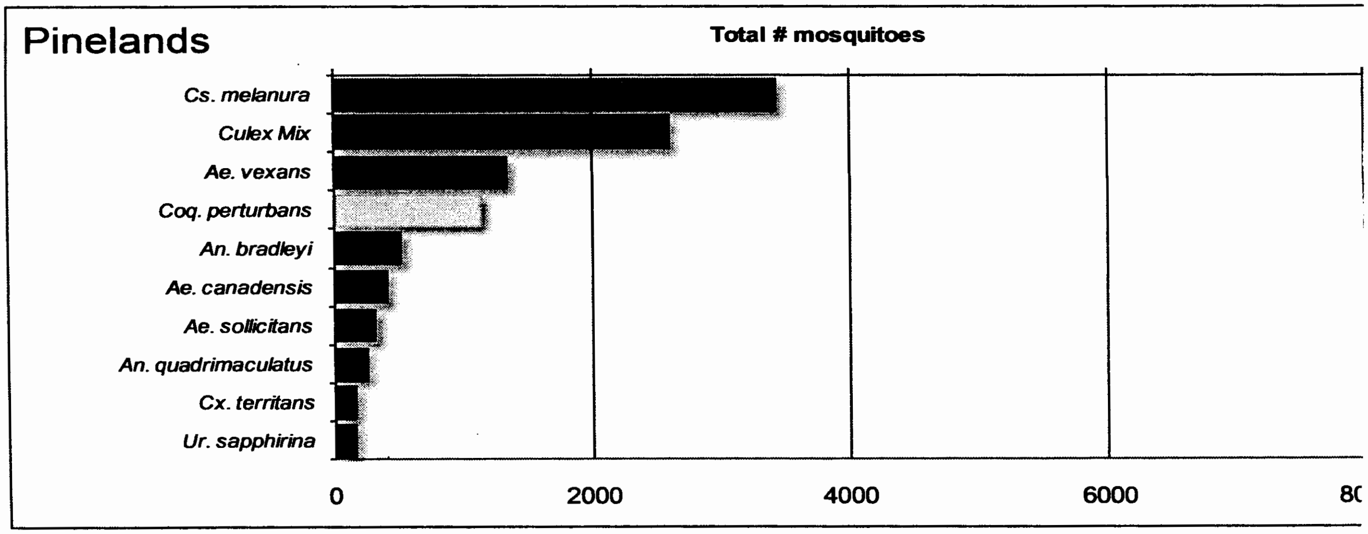

New York Metropolitan
Total # mosquitoes
Culex Mix
Ae. vexans
Ae. cantator
Ae. sollicitans
Coq. perturbans
Ae. sticticus
An. quadrimaculatus
Ae. albopictus
An. punctipennis
Ur. sapphirina
0
2000
4000
6000

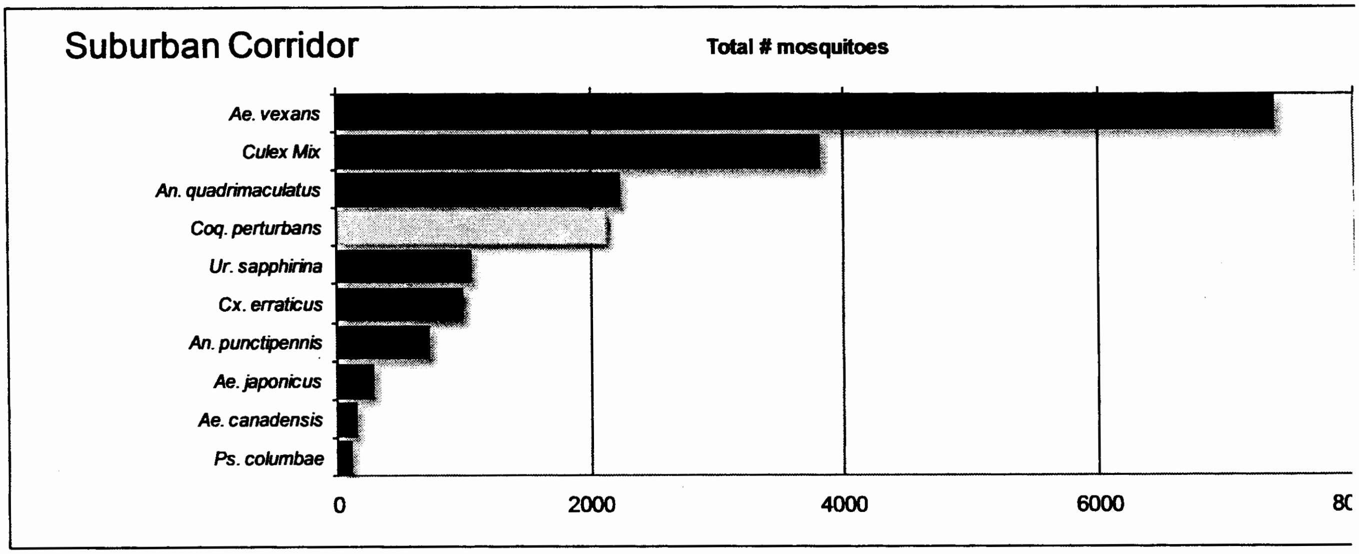

North Central Rural
Total # mosquitoes
Culex Mix
Ae. vexans
An. punctipennis
An. quadrimaculatus
Ur. sapphirina
Ps. columbae
Ae. japonicus
Coq. perturbans
Cx. erraticus
Ae. canadensis
0
2000
4000
6000


Northwest Rural
Total # mosquitoes
Ae. vexans
Ur. sapphirina
An. quadrimaculatus
Culex Mix
Coq. perturbans
An. punctipennis
Ae. stimulans
Ae. cinereus
Ae. trivittatus
Ae. japonicus
0
2000
4000
6000



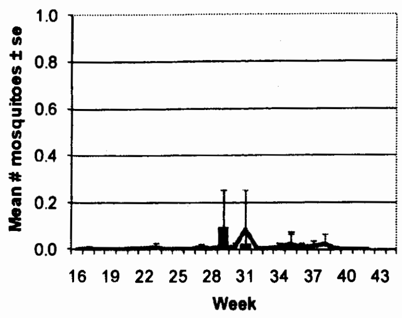
Philadelphia Metropolitan
Total # mosquitoes
Ae. vexans
Culex Mix
An. punctipennis
Ur. sapphirina
An. quadrimaculatus
Coq. perturbans
An. crucians
Cx. erraticus
Cs. melanura
Cx. territans
0
2000
4000
6000
8000


Pinelands
Total # mosquitoes
Cs. melanura
Culex Mix
Ae. vexans
Coq. perturbans
An. bradleyi
Ae. canadensis
Ae. sollicitans
An. quadrimaculatus
Cx. territans
Ur. sapphirina
0
2000
4000
6000

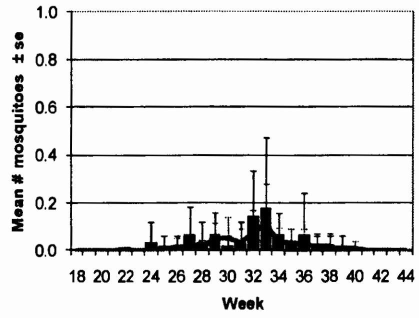

Suburban Corridor
Total # mosquitoes
Ae. vexans
Culex Mix
An. quadrimaculatus
Coq. perturbans
Ur. sapphirina
Cx. erraticus
An. punctipennis
Ae. japonicus
Ae. canadensis
Ps. columbae
0
2000
4000
6000

Aedes albopictus – Multivoltine Aedine (*Aedes triseriatus* Type)

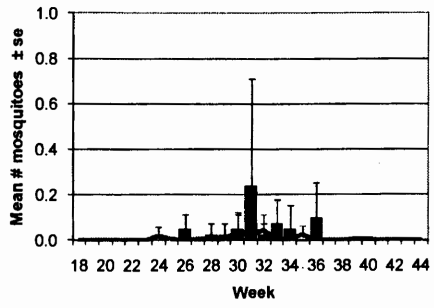
Agricultural



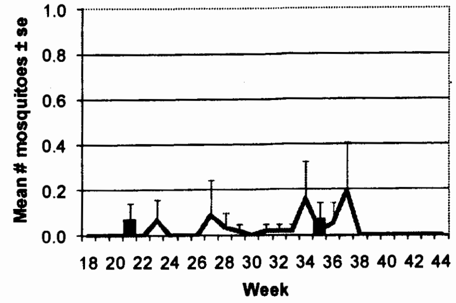
Coastal



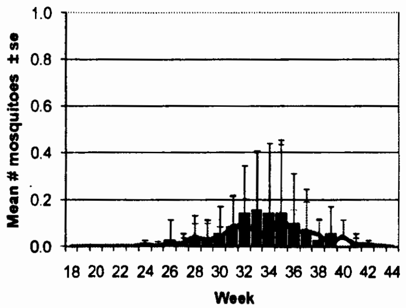
Delaware Bayshore



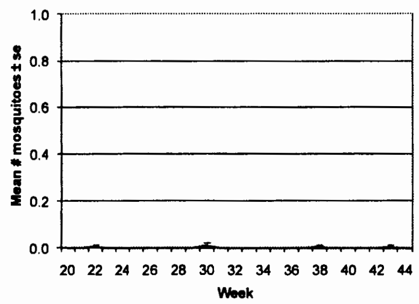
Delaware River Basin



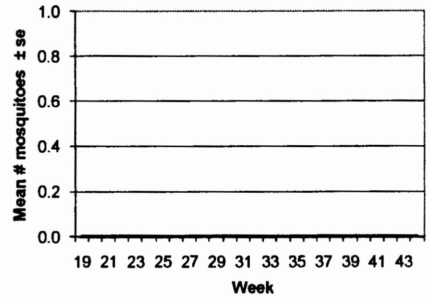
New York Metro



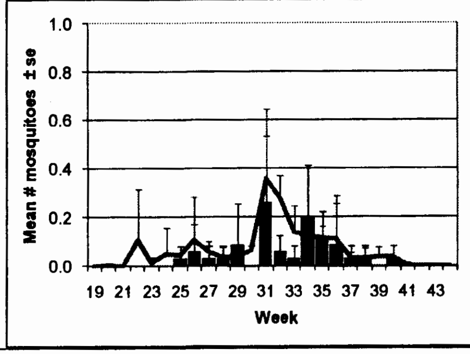
North Central Rural



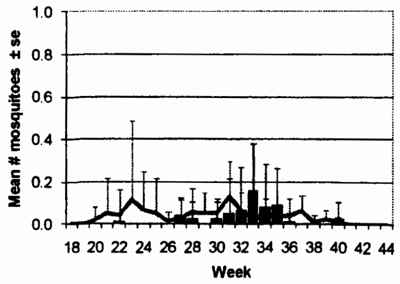
Northwestern Rural



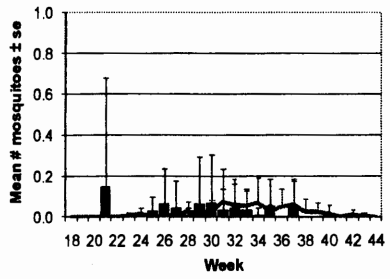
Philadelphia Metro



Pinelands



Suburban Corridor

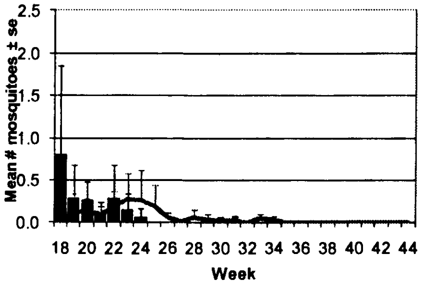


Comments

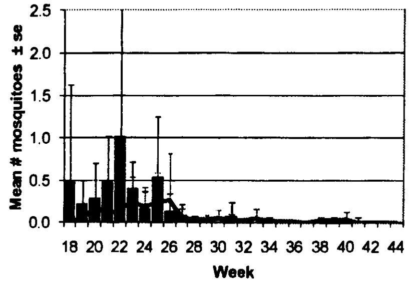
Aedes albopictus made its first appearance in New Jersey in 1995, ten years after the initial US invasion in Texas. In New Jersey, all counties but those in the Northwestern Rural region have reported populations, some with significant numbers. In 2010, populations in the Delaware Bayshore region were higher than historical values during the mid-season. Other populations were at about historical levels. The Suburban Corridor experienced an early emergence of this temperature-restricted species at the same time the Delaware River Basin experienced their first emergence. This species is an excellent vector of numerous arboviruses, including West Nile.

Aedes canadensis – Univoltine Aedine (*Aedes canadensis* Type)

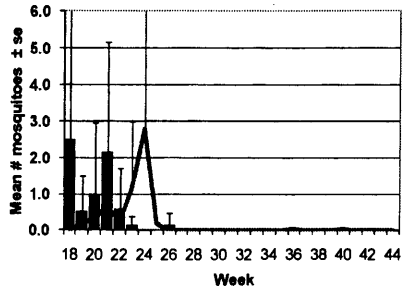
Agricultural



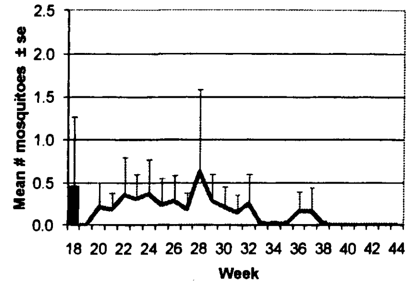
Coastal



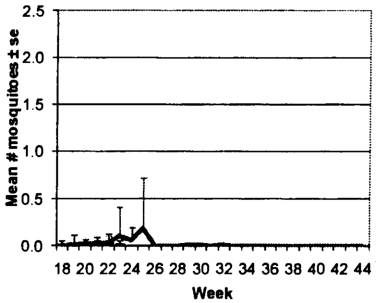
Delaware Bayshore



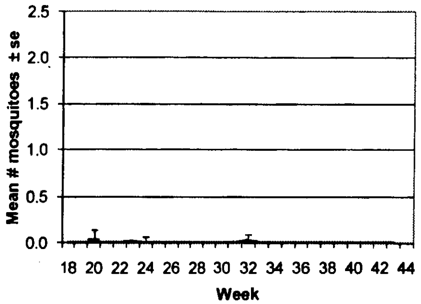
Delaware River Basin



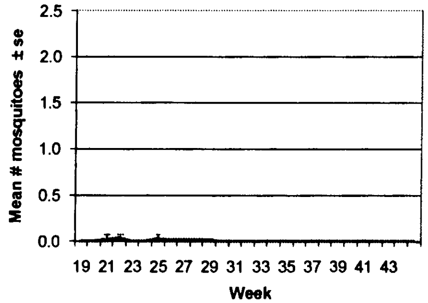
New York Metro



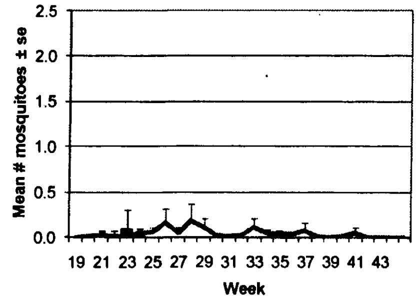
North Central Rural



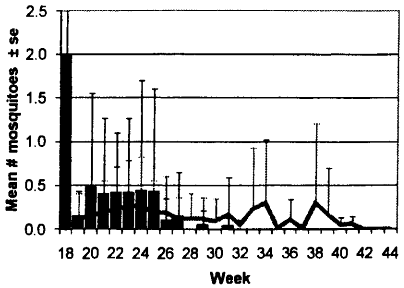
Northwestern Rural



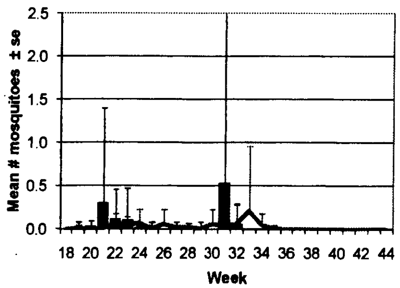
Philadelphia Metro



Pinelands



Suburban Corridor

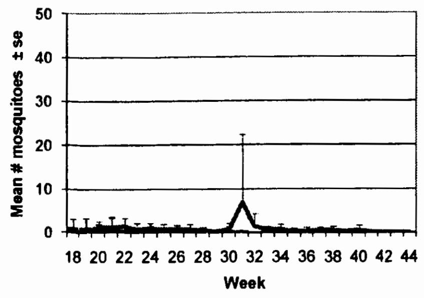


Comments

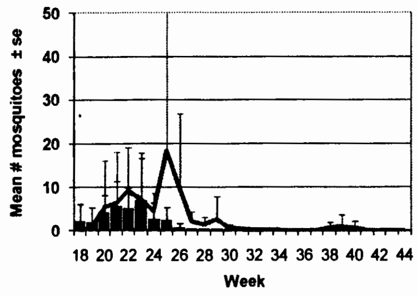
Aedes canadensis canadensis is an early season univoltine mosquito found throughout New Jersey, often with a late season emergence. After heavy spring rains and warming temperatures, this species emerged as it often does before the commencement of the trapping period. Population abundance was above historical averages early and then decreased as the drought of the summer became extended (Pinelands, for example). Curiously, the Suburban Corridor showed a late season emergence during the height of the drought from one locale.

Aedes cantator – Multivoltine Aedine (*Aedes sollicitans* Type)

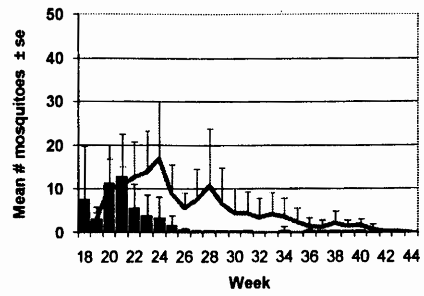
Agricultural



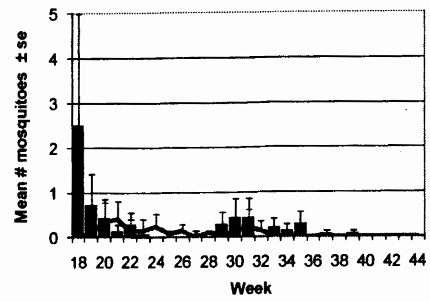
Coastal



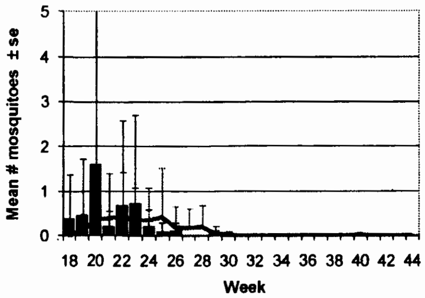
Delaware Bayshore



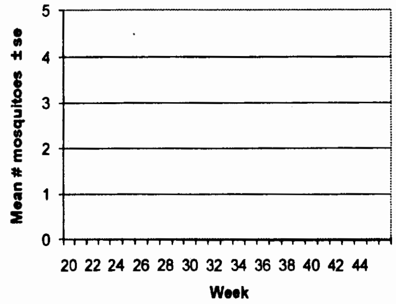
Delaware River Basin



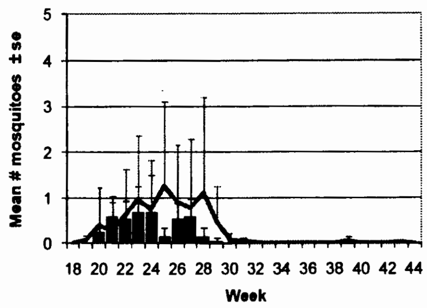
New York Metro



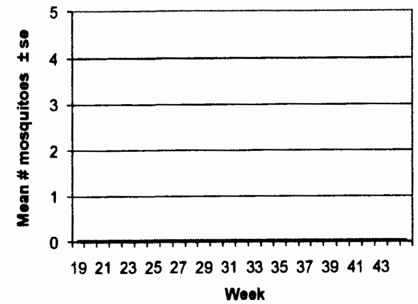
North Central Rural



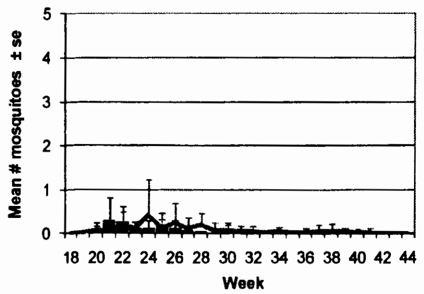
Northwestern Rural



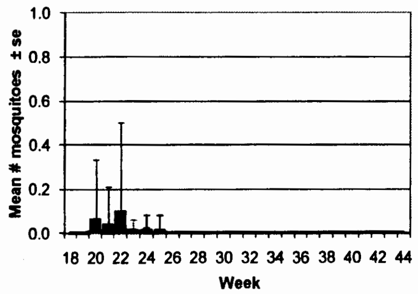
Philadelphia Metro



Pinelands



Suburban Corridor

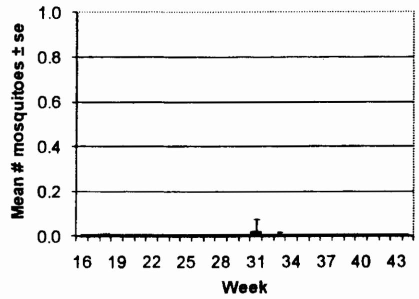


Comments

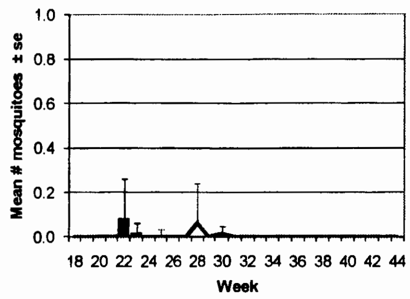
Aedes cantator is a facultative salt marsh floodwater species that can exploit both natural and anthropogenic sources of saline habitat, ranging from coastal marine habitats to areas with higher salinity due to winter salt applications to roadways or other anthropogenic applications. The Northwestern Rural has an obvious population due to the past presence of a textile company. This year, early season activity occurred in the Delaware River Basin, the New York Metro and the Suburban Corridor. Some late season declines were observed in the Coastal and Delaware Bayshore as well as the Northwestern Rural. Larger populations such as the Coastal and Delaware Bayshore also showed a decline in the latter portions of the season.

Aedes cinereus – Univoltine Aedine (*Aedes canadensis* Type)

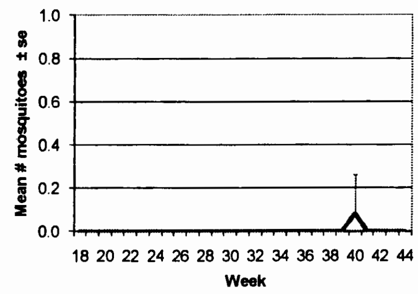
Agricultural



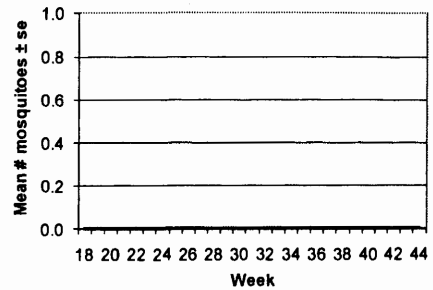
Coastal



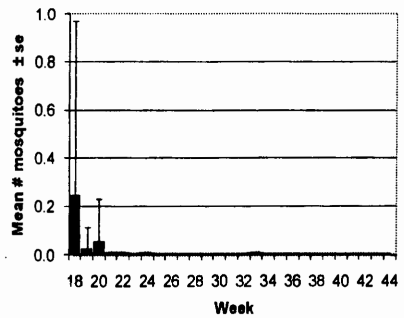
Delaware Bayshore



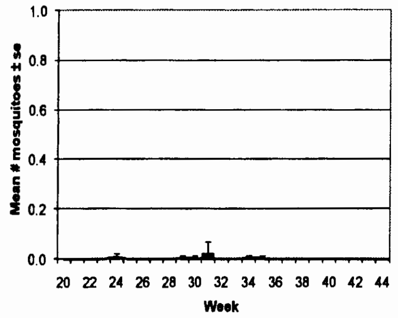
Delaware River Basin



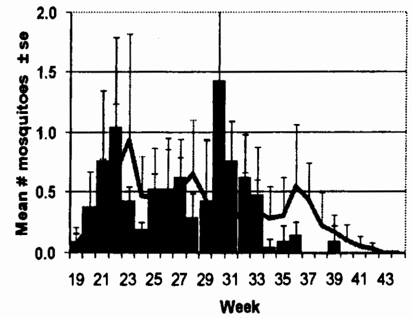
New York Metro



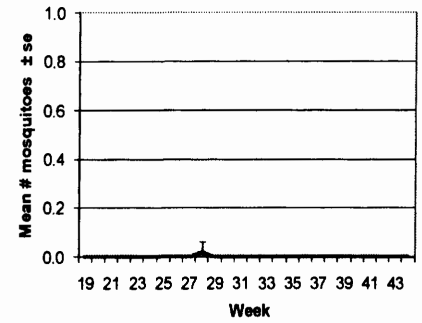
North Central Rural



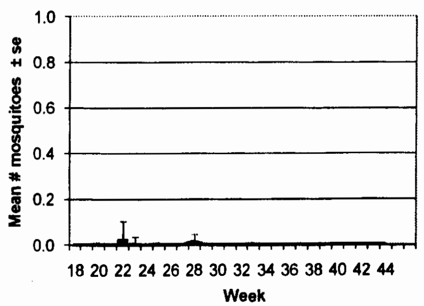
Northwestern Rural



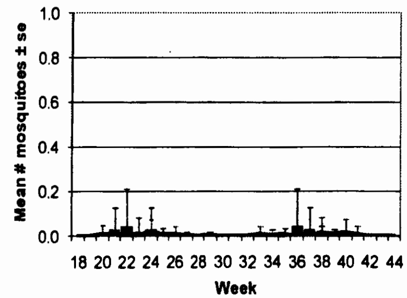
Philadelphia Metro



Pinelands



Suburban Corridor

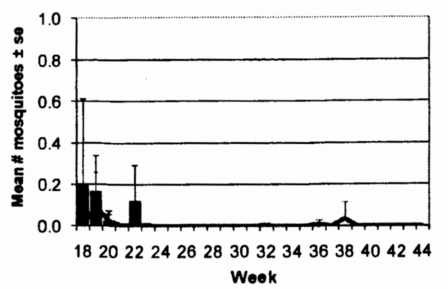


Comments

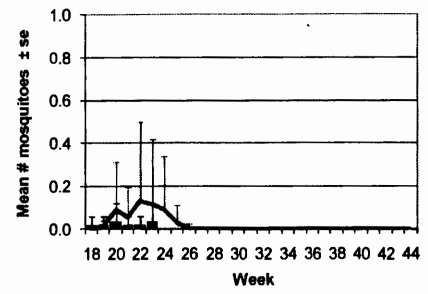
Aedes cinereus is a moderately early-season species that appear after species such as *Ae. excrucians* or *Ae. fitchii*. As with some other floodwater species such as *Ae. canadensis*, later emergences can occur from eggs located higher up on terrain not previously flooded. *Ae. cinereus* is very cold-tolerant, with a range that extends into Canada and up through Alaska and can tolerate the early season temperatures. This year, *Ae. cinereus* populations in the Northwestern Rural varied around historical values, with mid-season numbers higher than average, and with a subsequent population crash late season.

Aedes grossbecki – Univoltine *Aedine* (*Ae. stimulans* Type)

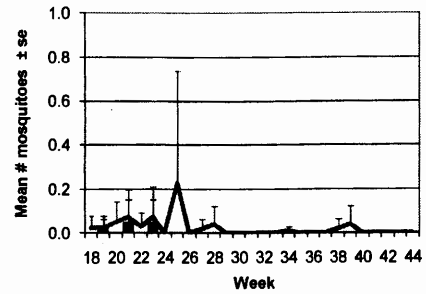
Agricultural



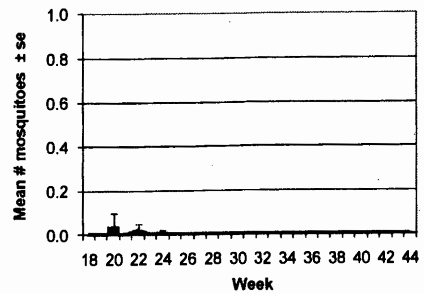
Coastal



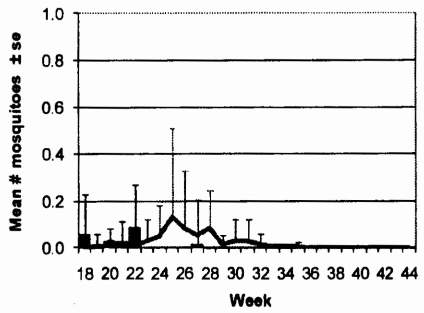
Delaware Bayshore



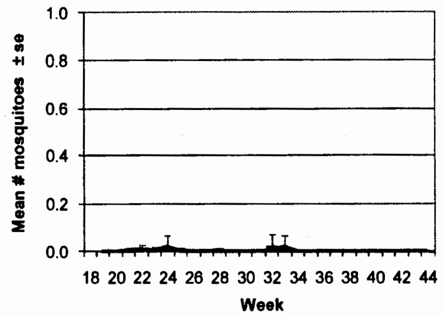
Delaware River Basin



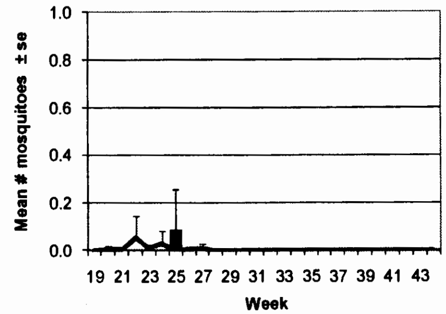
New York Metro



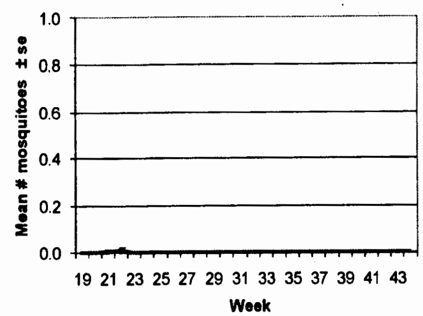
North Central Rural



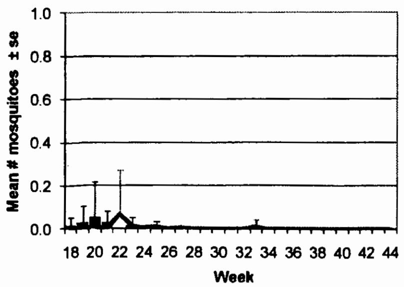
Northwestern Rural



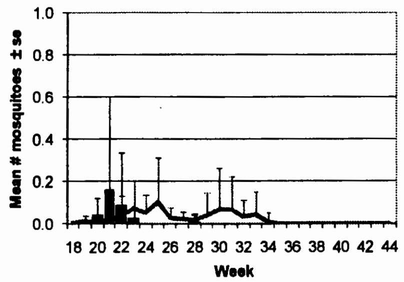
Philadelphia Metro



Pinelands



Suburban Corridor

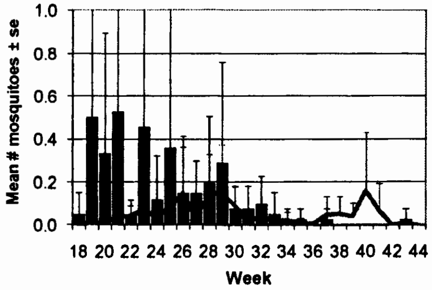


Comments

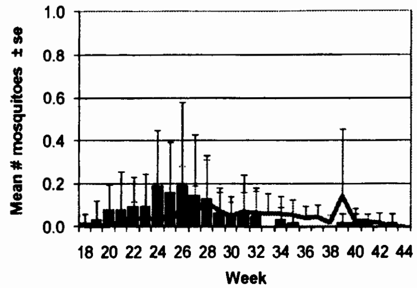
Aedes grossbecki, an early to mid-season mosquito, is found in all regions of New Jersey in varying amounts. Early emergence is suggested by the Agricultural region. This year, populations in most regions appeared to be depressed or attenuated, with a mid-to late season disappearance in the Delaware Bayshore, New York Metropolitan and Suburban Corridor regions. This large mosquito is not well attracted to light traps, as evident by the low numbers captured.

Aedes japonicus – Multivoltine Aedine (*Aedes triseriatus* Type)

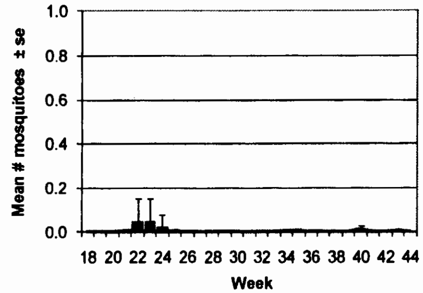
Agricultural



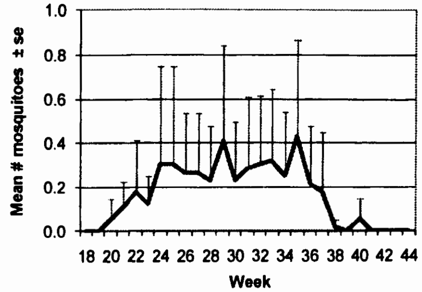
Coastal



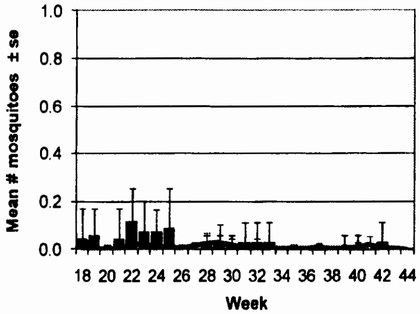
Delaware Bayshore



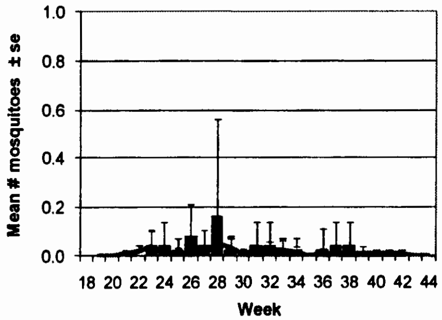
Delaware River Basin



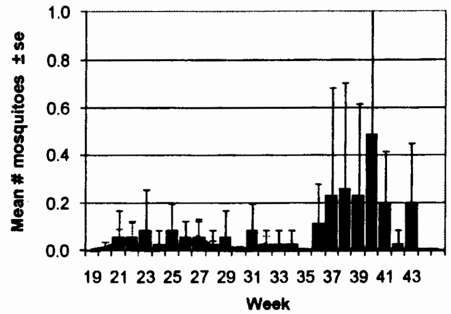
New York Metro



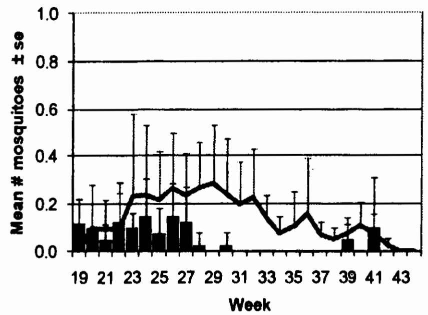
North Central Rural



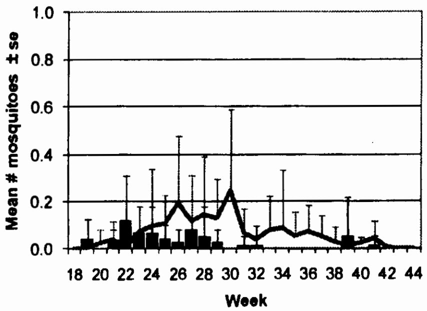
Northwestern Rural



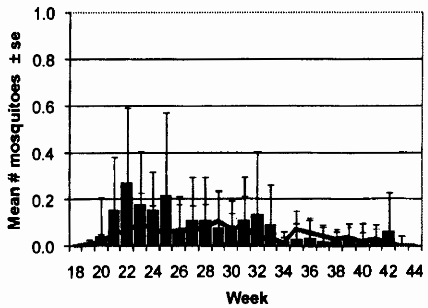
Philadelphia Metro



Pinelands



Suburban Corridor

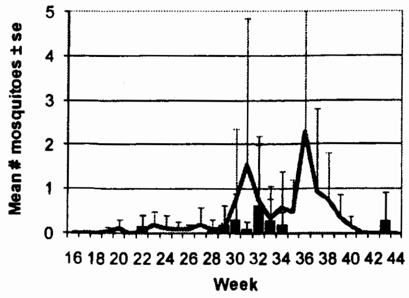


Comments

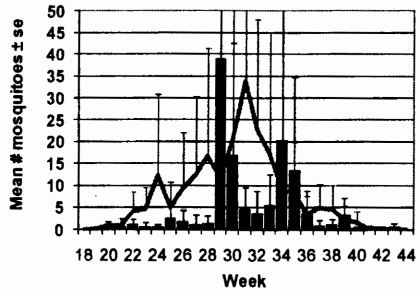
Aedes japonicus, a cold-tolerant invasive species, as shown varying abundances for different regions throughout the years. For the past two years, numbers have been higher at some time during the season for the Agricultural and Northwestern Rural. Populations declined in the Pinelands and the Philadelphia Metro regions while in the Delaware River Basin, there were no records of *Ae. japonicus* after previously health populations recorded there. The Suburban Corridor continued to show similar population levels from the previous year, suggesting that containers that may provide larval habitat might not loose water as quickly as more natural habitats (either nonporous material or lack of plant competition for water).

Aedes sollicitans – Multivoltine Aedine (*Aedes sollicitans* Type)

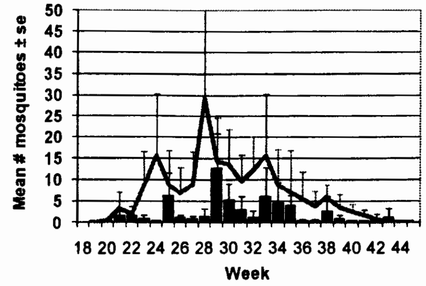
Agricultural



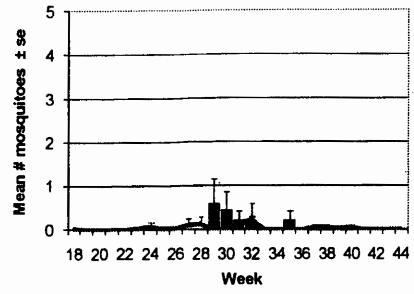
Coastal



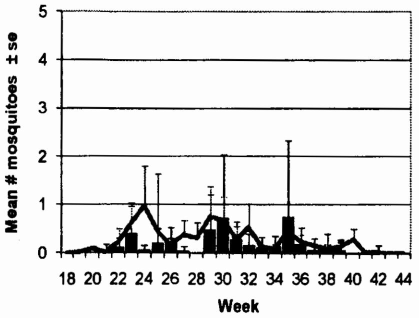
Delaware Bayshore



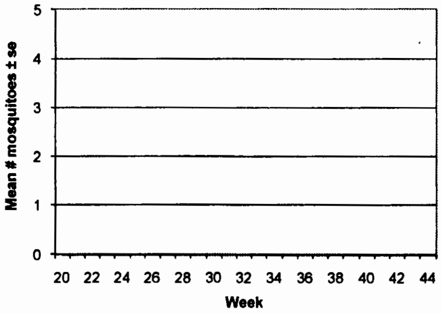
Delaware River Basin



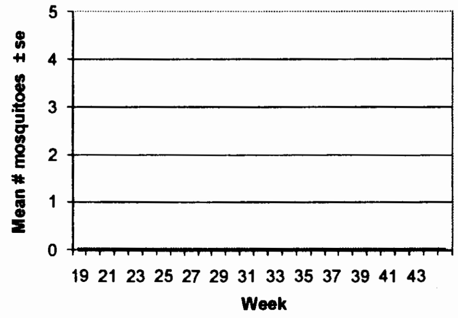
New York Metro



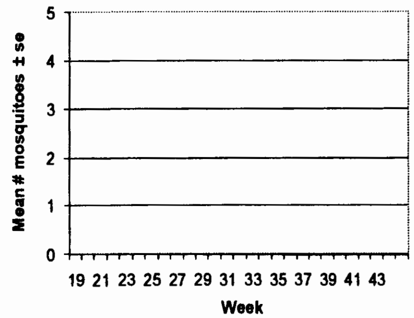
North Central Rural



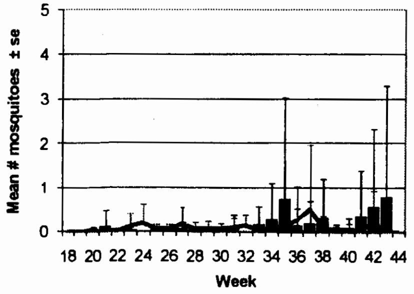
Northwestern Rural



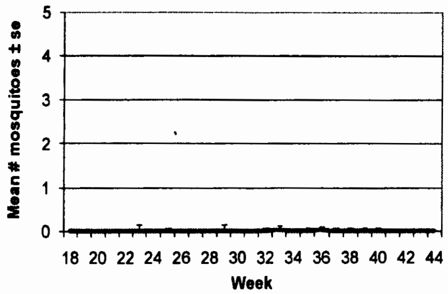
Philadelphia Metro



Pinelands



Suburban Corridor

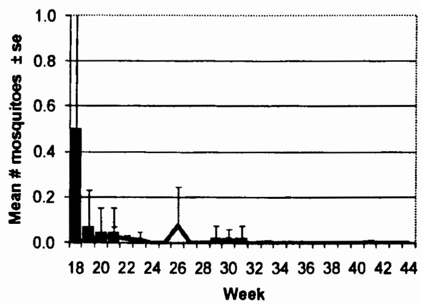


Comments

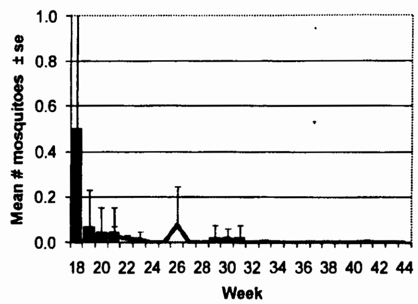
Aedes sollicitans is the significant salt marsh floodwater mosquito along the eastern half of the US, and one of the motivations for the early attentions paid to mosquito control in New Jersey. This long-flying mosquito can generate nuisance complaints far from its natal habitat. Most abundance comes from the Coastal and Delaware Bayshore regions. Both these regions saw significant declines in populations, illustrating the effects that freshwater precipitation (or lack of) can have on these saline species. There appeared to be five emergences over the season.

Aedes sticticus – Univoltine Aedine (*Aedes canadensis* Type)

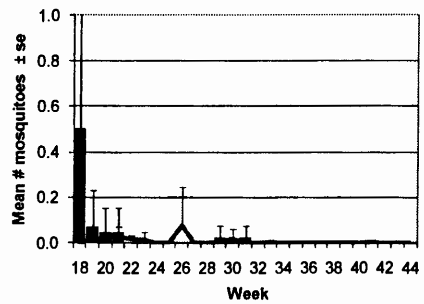
Agricultural



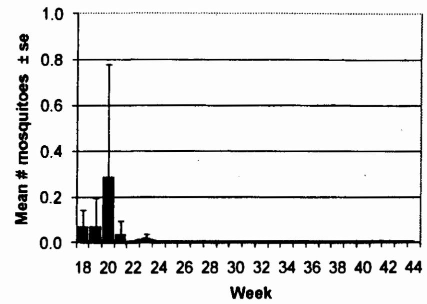
Coastal



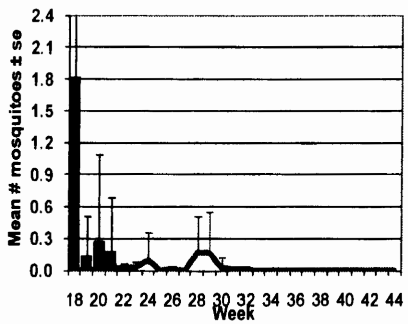
Delaware Bayshore



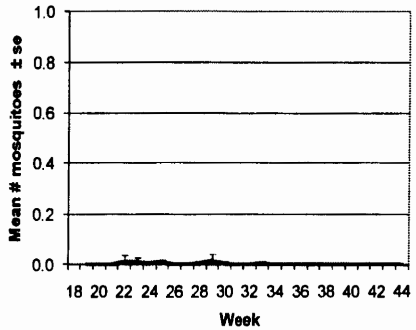
Delaware River Basin



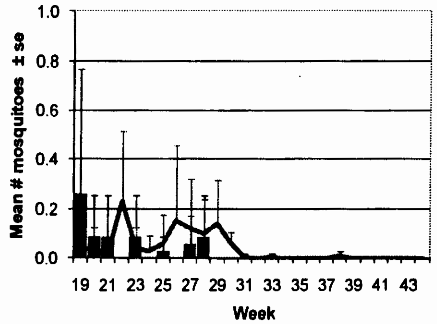
New York Metro



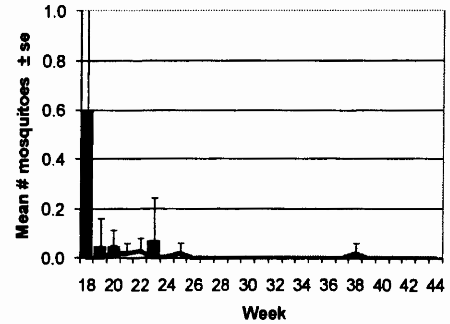
North Central Rural



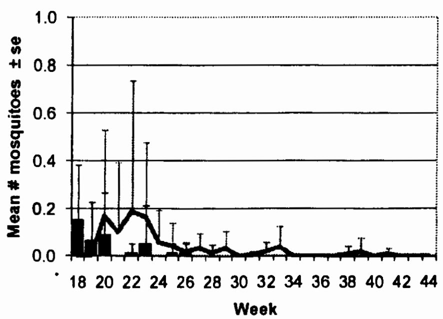
Northwestern Rural



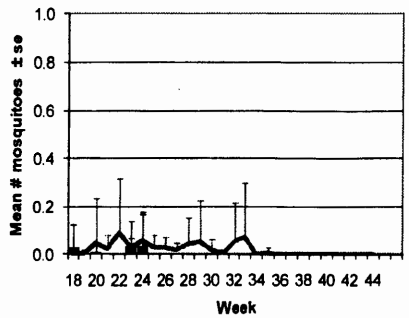
Philadelphia Metro



Pinelands



Suburban Corridor



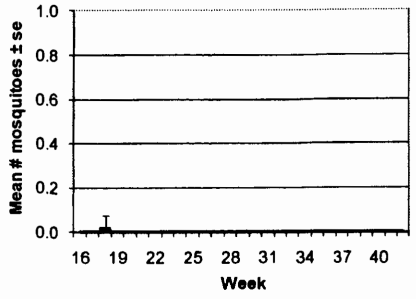
Comments

Aedes sticticus is an early-season univoltine aedine mosquito with re-occurrence patterns similar to *Aedes canadensis*. This species appears before the beginning of the adult mosquito surveillance program, and so its highest numbers are usually not recorded. Populations for all regions were affected by the drought conditions with the second, mid-summer emergence being minimal or not occurring. *Ae. sticticus* can fly 10 km from their larval habitat (Brust 1980). Living in urban areas such as along the Passaic River, mid-season emergences (when they occur) can generate complaints from the surrounding communities.

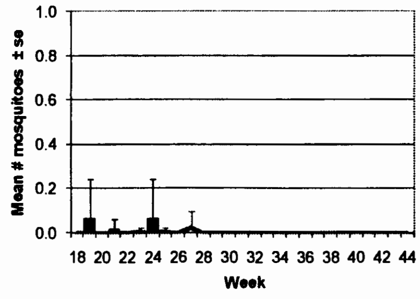
Brust, R.A. 1980 Dispersal behavior of adult *Aedes sticticus* and *Aedes vexans* (Diptera: Culicidae) in Manitoba. Canadian Entomologist, 112: 31-42.

Aedes stimulans – Univoltine *Aedine* (*Ae. stimulans* Type)

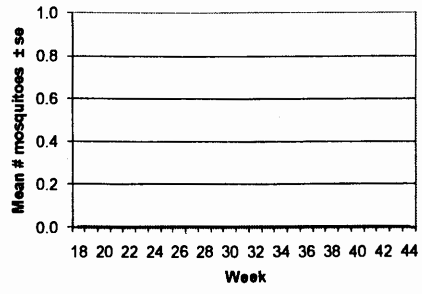
Agricultural



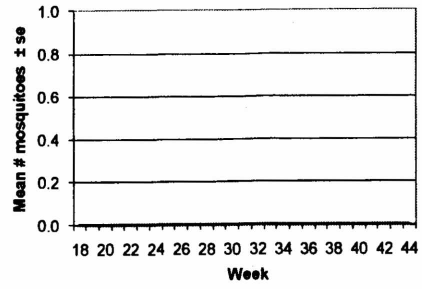
Coastal



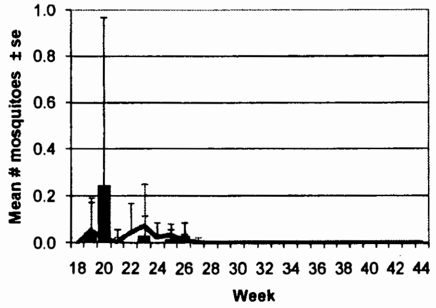
Delaware Bayshore



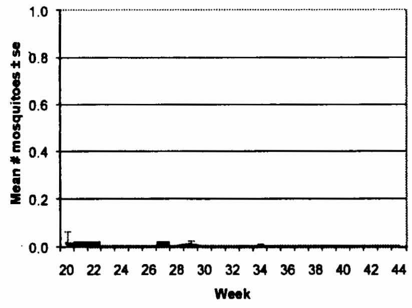
Delaware River Basin



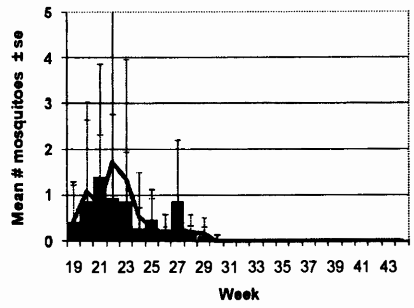
New York Metro



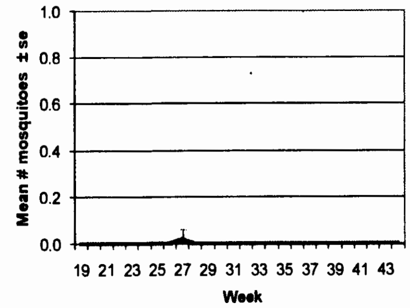
North Central Rural



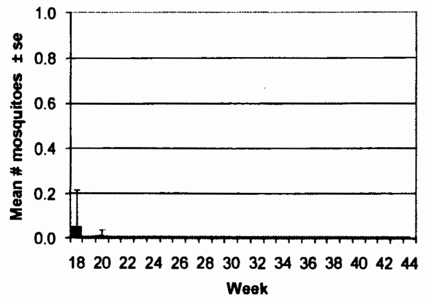
Northwestern Rural



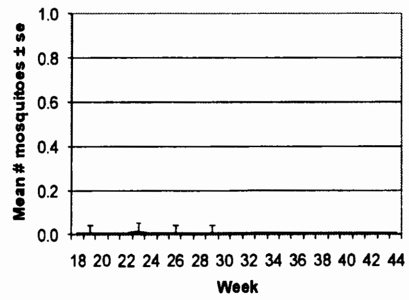
Philadelphia Metro



Pinelands



Suburban Corridor

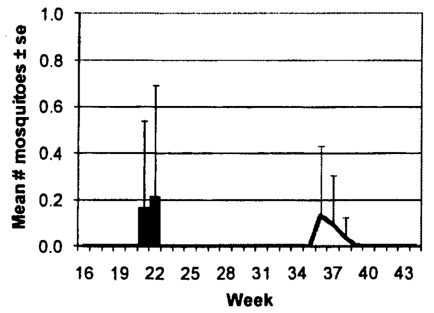


Comments

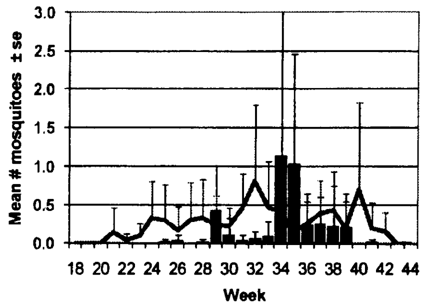
Aedes stimulans, found in woodland pools of the northeastern US and southwestern Canada, is a cold tolerant mosquito that develops from overwintering eggs in pools until in early spring when surrounding woodland trees develop leaves and subsequently drain the pools, forcing an emergence. Thus, it may be on the wing before this surveillance program begins. The current year pattern in the Northwestern Rural region is typical for this species. The New York Metropolitan region also shows up in generally predictable numbers, although last year they did not appear in those traps.

Aedes taeniorhynchus – Multivoltine Aedine (*Aedes sollicitans* Type)

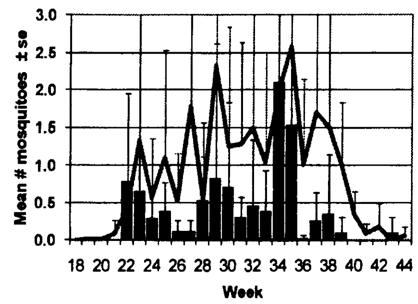
Agricultural



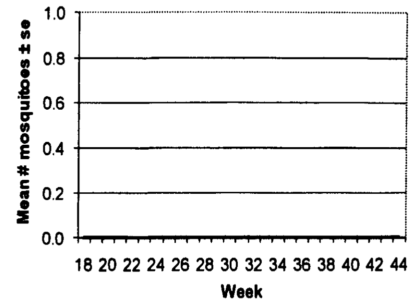
Coastal



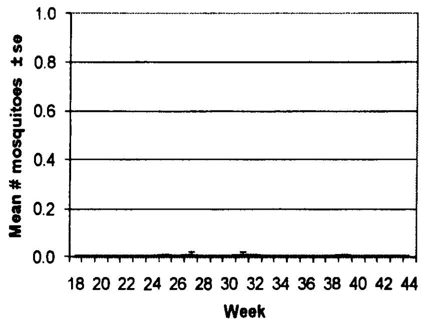
Delaware Bayshore



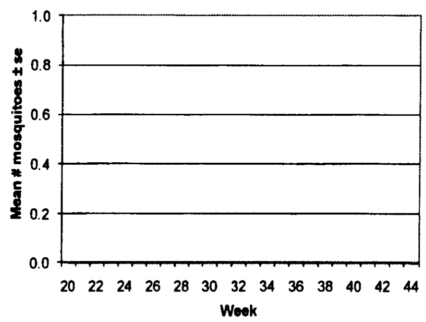
Delaware River Basin



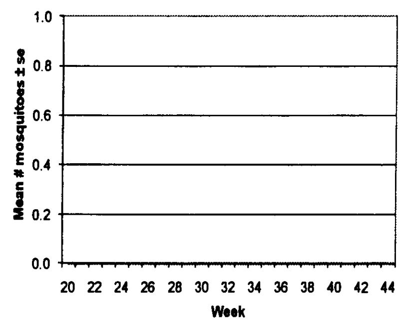
New York Metro



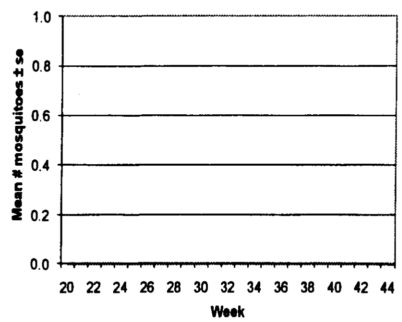
North Central Rural



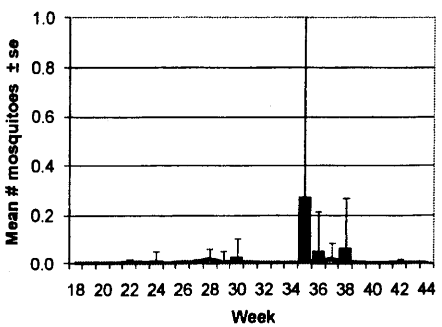
Northwestern Rural



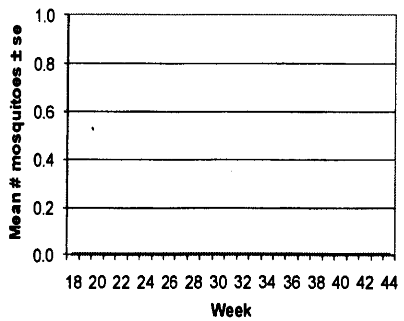
Philadelphia Metro



Pinelands



Suburban Corridor

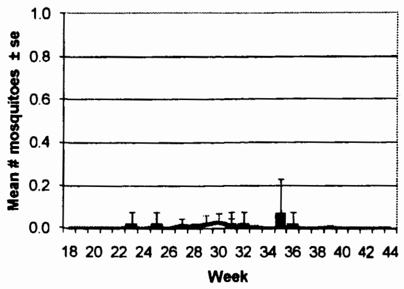


Comments

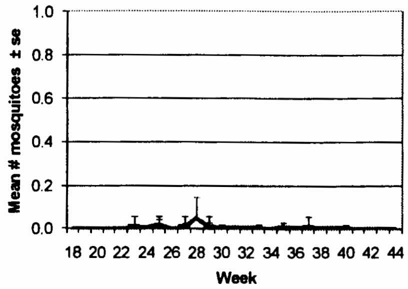
Aedes taeniorhynchus is a floodwater species found primarily in coastal salt water habitats with the largest populations along the Delaware Bayshore region. It can produce considerable complaints. Fortunately, *Ae. taeniorhynchus* is not an efficient vector or either EEE or WNV. Migration flights are not as long as *Ae. sollicitans* and this mosquito is usually not seen far from either the Delaware Bayshore or Coastal regions. This year, the populations in both the Coastal and Delaware Bayshore appeared to be affected by the lack of additional freshwater precipitation, similar to *Ae. sollicitans*.

Aedes triseriatus – Multivoltine Aedine (*Aedes triseriatus* Type)

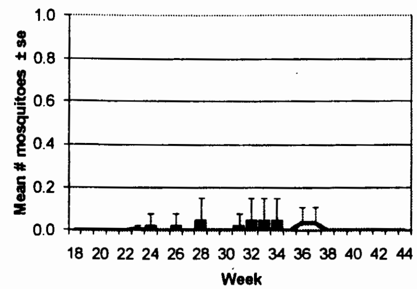
Agricultural



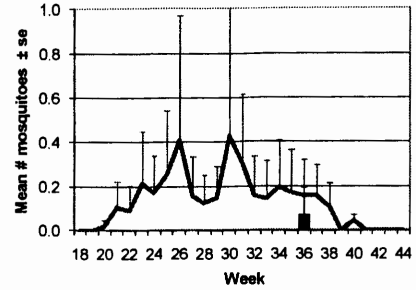
Coastal



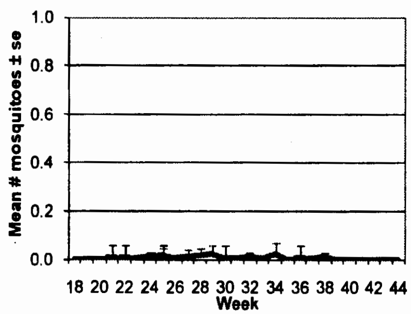
Delaware Bayshore



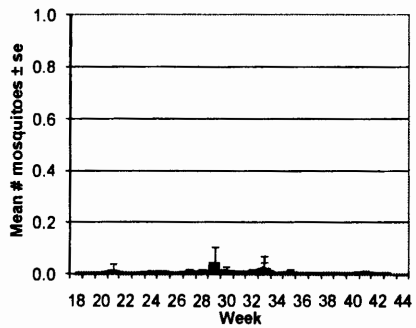
Delaware River Basin



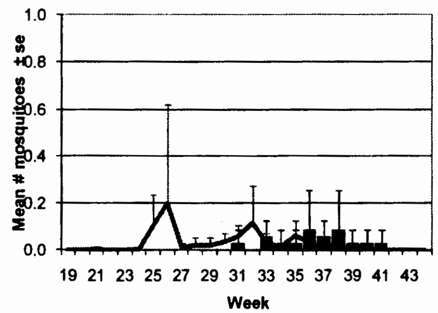
New York Metro



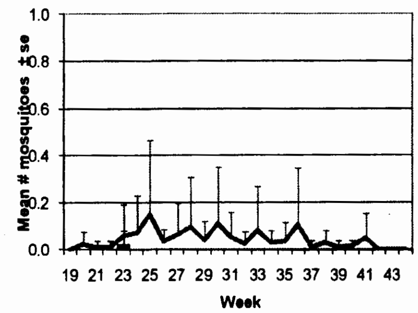
North Central Rural



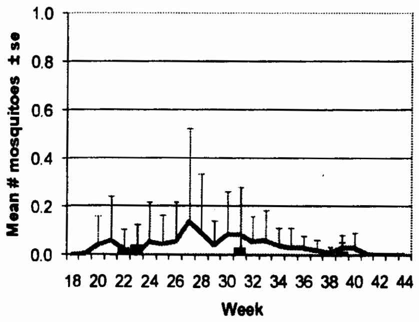
Northwestern Rural



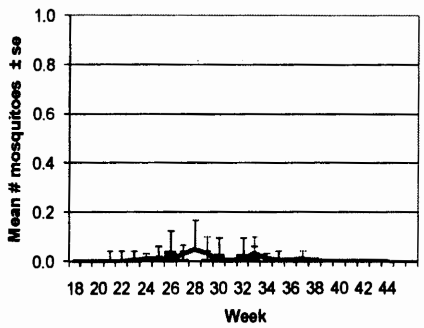
Philadelphia Metro



Pinelands



Suburban Corridor

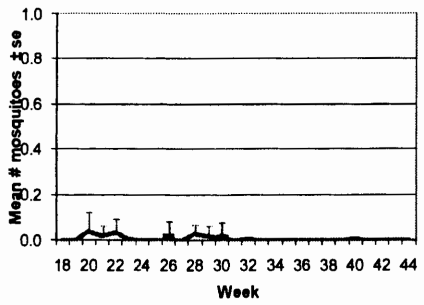


Comments

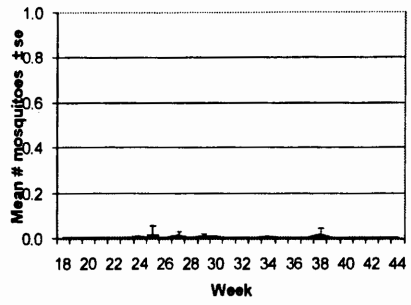
Aedes triseriatus, the Eastern Treehole mosquito, is a known vector of La Crosse encephalitis virus. Transmission to the following year is through overwintering eggs (vertical transmission) that develop into infected adults. Amplification is through small vertebrates such as chipmunks and tree squirrels. The CDC reports 3 known cases of La Crosse in New Jersey, all occurring during the mid 1970's. This species is not well attracted to light traps. This year produced populations similar to last year, with few seen in the Delaware River Basin, the Philadelphia Metropolitan and Pinelands regions. The occurrence in the Northwestern Rural was similar to last year, but at a lower abundance. This species, while attracted to anthropogenic habitat, requires more organic material than other container species, such as *Ae. japonicus* and may be more affected by drying treeholes.

Aedes trivittatus – Multivoltine *Aedine* (*Ae. vexans* Type)

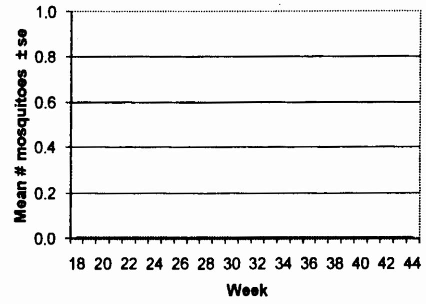
Agricultural



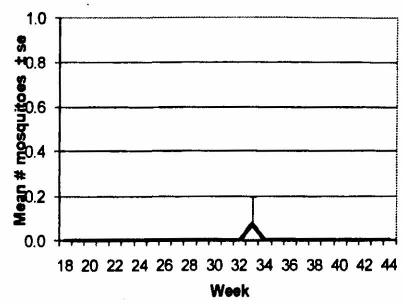
Coastal



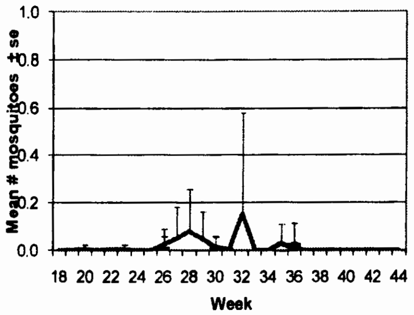
Delaware Bayshore



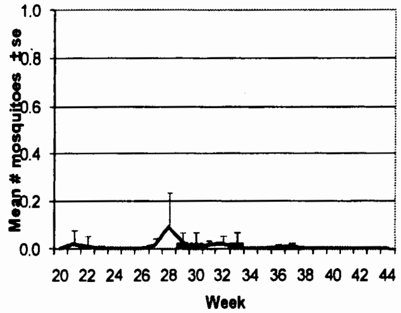
Delaware River Basin



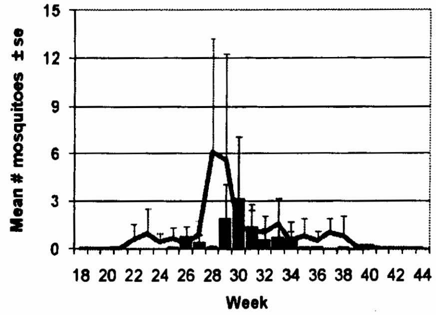
New York Metro



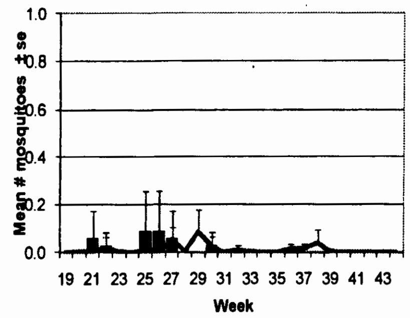
North Central Rural



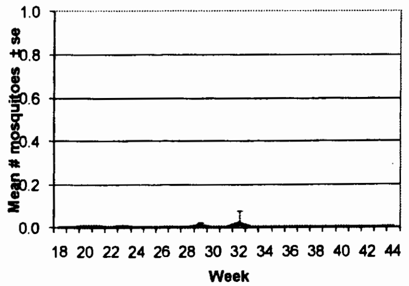
Northwestern Rural



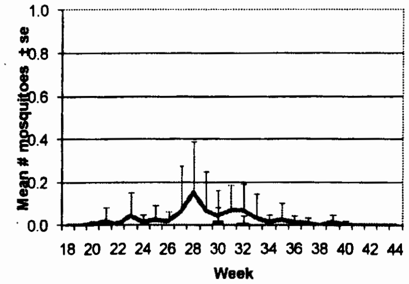
Philadelphia Metro



Pinelands



Suburban Corridor

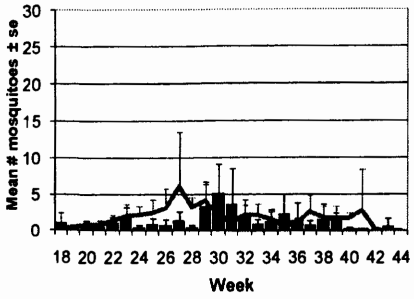


Comments

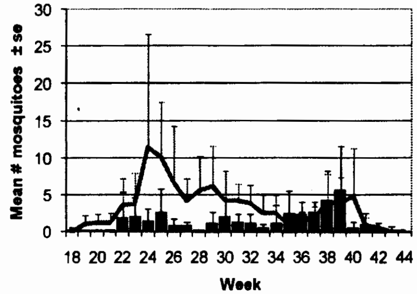
Aedes trivitattus, a multivoltine floodwater species, can generate a number of complaints from residents after flooding events. This aggressive, persistent biter is most abundant in the Northwestern Rural region. This year, that population was significantly lower than the previous year. Other severely reduced populations were the New York Metropolitan and Suburban Corridor, as compared to the previous year. There was some activity in the Philadelphia Metropolitan region early in the season. This species can transmit both trivittatus virus (unknown activity in New Jersey) and West Nile.

Aedes vexans – Multivoltine *Aedine* (*Ae. vexans* Type)

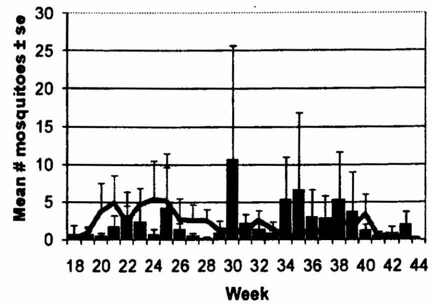
Agricultural



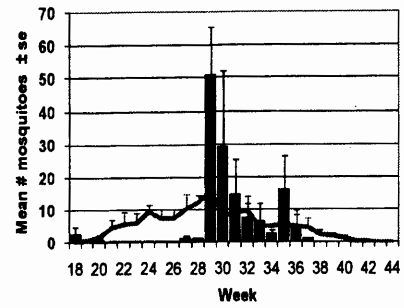
Coastal



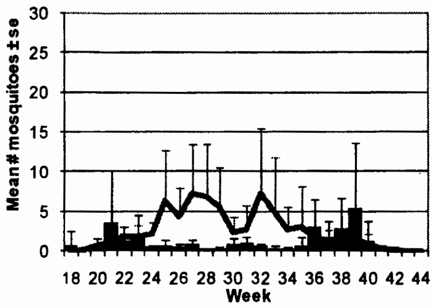
Delaware Bayshore



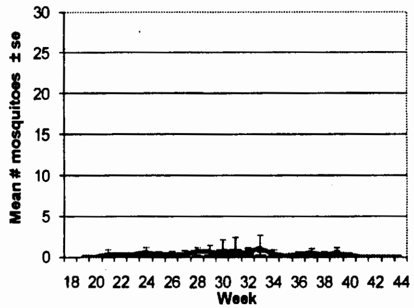
Delaware River Basin



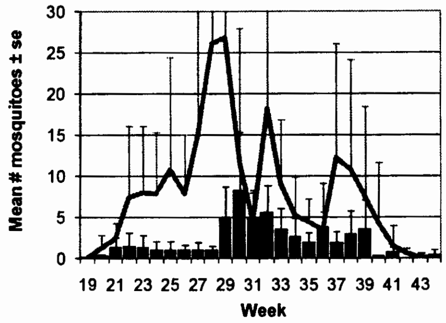
New York Metro



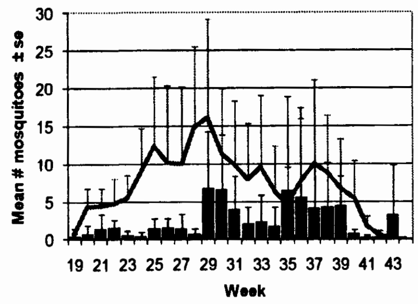
North Central Rural



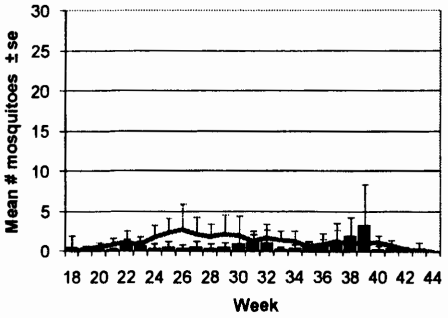
Northwestern Rural



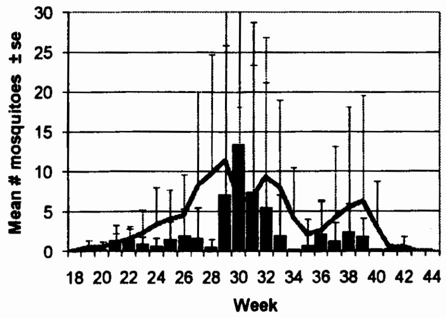
Philadelphia Metro



Pinelands



Suburban Corridor

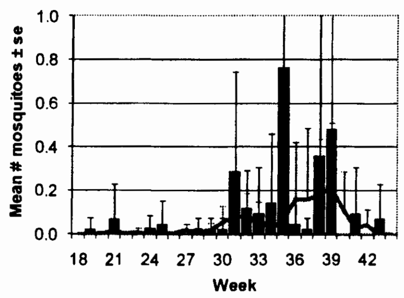


Comments

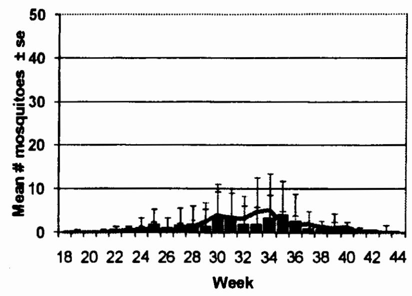
Aedes vexans is the model for the fresh floodwater mosquito that produces multiple generations a year. Populations are very dependent on local conditions, although some areas can be influenced by distant conditions, such as floodwater from streams that overflow banks despite no local rains. Large populations are typical for the Delaware River Basin (due to dredge spoils) and the Northwestern Rural region (due to the confluence of three streams). Not surprisingly, this year's populations at most of the sites were significantly reduced due to drought conditions at some point during the season. Only in the Delaware Bayshore and River Basin regions were there significantly higher populations for a few weeks.

Anopheles bradleyi – Culex/Anopheles (*Cx. salinarius* Type)

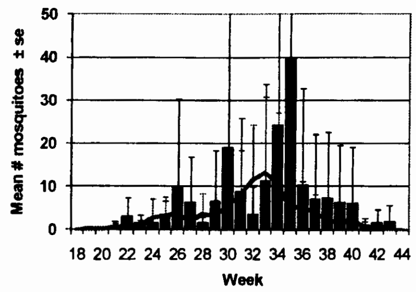
Agricultural



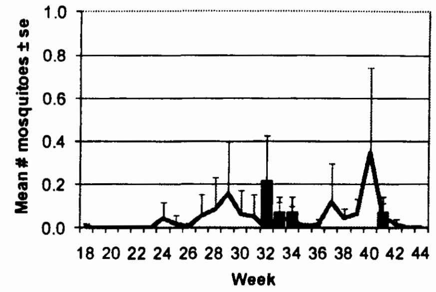
Coastal



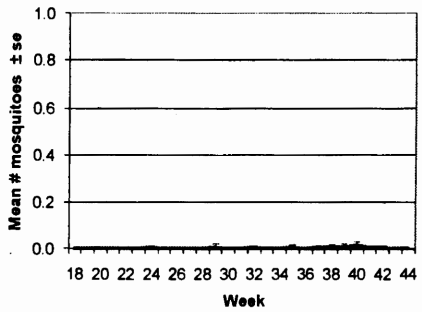
Delaware Bayshore



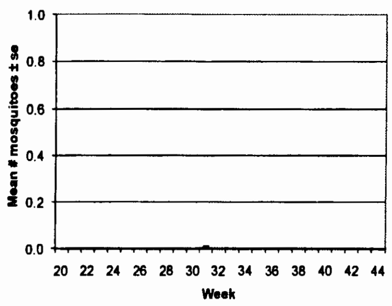
Delaware River Basin



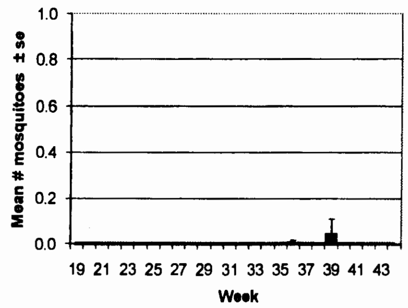
New York Metro



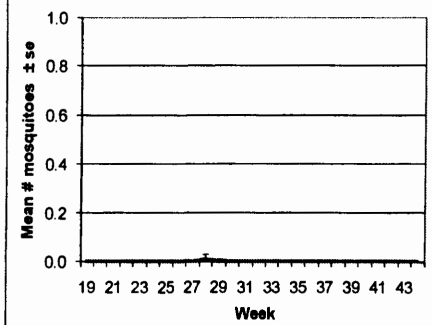
North Central Rural



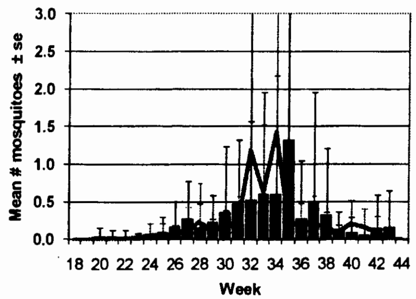
Northwestern Rural



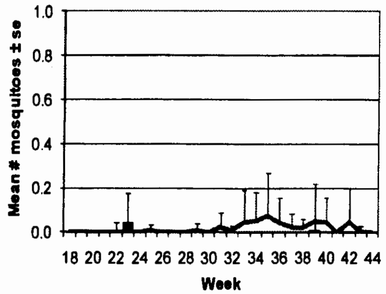
Philadelphia Metro



Pinelands



Suburban Corridor



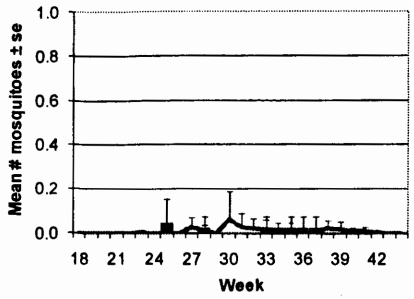
Comments

Anopheles bradleyi is a salt tolerant floodwater species that exploits more brackish water areas near salt marshes. Its largest populations are found in the Coastal and particularly in the Delaware Bayshore, where prodigious populations can be produced. Surprisingly low populations have been found in the Delaware River Basin, where dredge spoil impoundments have produced significant populations in earlier years (Slaff and Crans 1982). This year, higher abundances were observed in the Agricultural and Delaware Bayshore regions. Last year's populations in the Suburban Corridor did not show up this year.

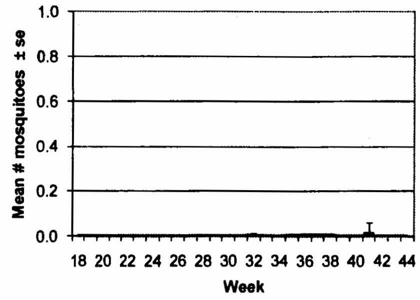
Slaff, M., and W.J. Crans. 1982. Impounded water as a major producer of *Culex salinarius* (Diptera: Culicidae) in coastal areas of New Jersey, USA. Journal of Medical Entomology. 19: 185-190.

Anopheles crucians – Unique (*Cs. melanura* Type)

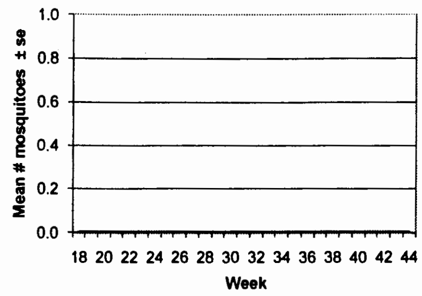
Agricultural



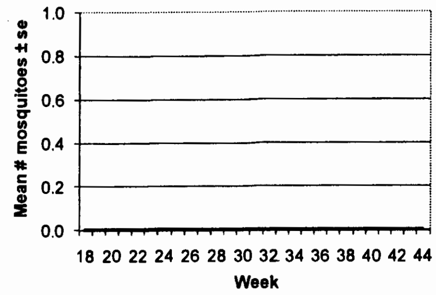
Coastal



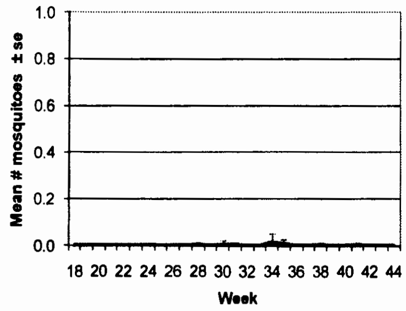
Delaware Bayshore



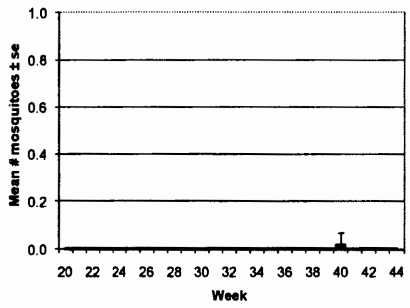
Delaware River Basin



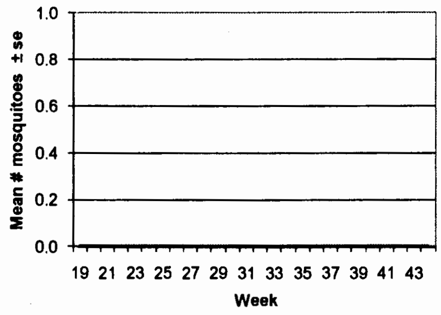
New York Metro



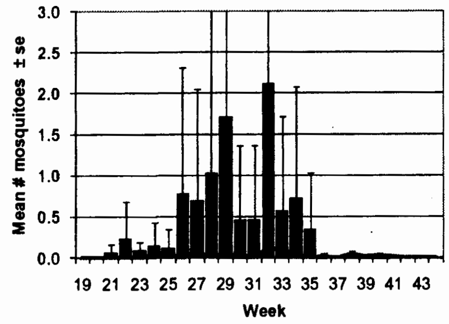
North Central Rural



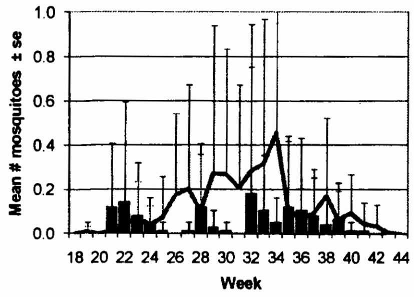
Northwestern Rural



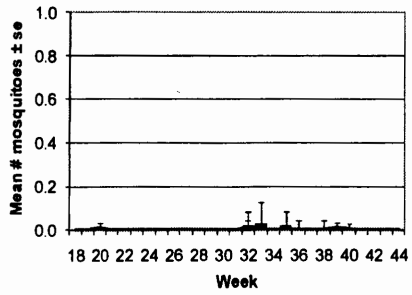
Philadelphia Metro



Pinelands



Suburban Corridor

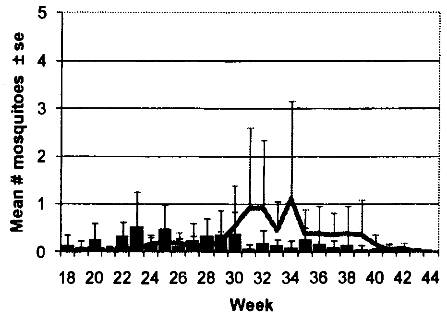


Comments

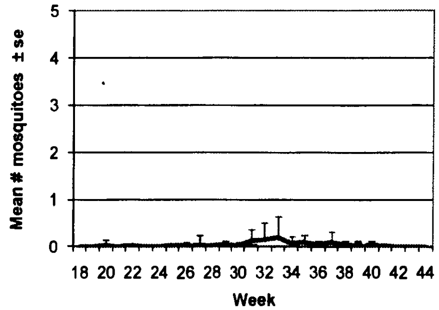
In 2009, abundances in the Pinelands and Philadelphia Metro regions of *Anopheles crucians* were high enough to warrant graphing in the 10 regions. The same holds true for this year, with even higher population abundances recorded in the Philadelphia Metropolitan region. The Pinelands region's abundance was decreased from the previous year. *An. crucians* is similar to *Cs. melanura* with overwintering larvae that likely spend time burrowed in bottom sediment. It can apparently exploit habitats with varying amounts of mineral salts not tolerated by other species. But caution must be taken as this species can be confused with *Anopheles bradleyi* – one that is truly found in more saline environments.

Anopheles punctipennis – Culex/Anopheles (*Cx pipiens* Type)

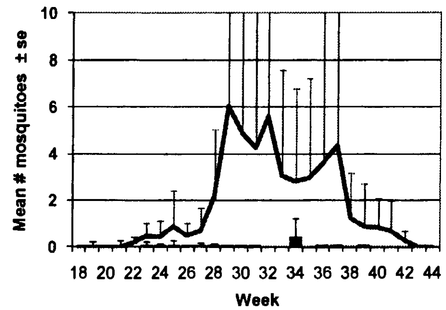
Agricultural



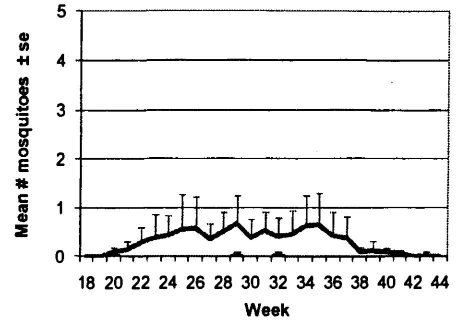
Coastal



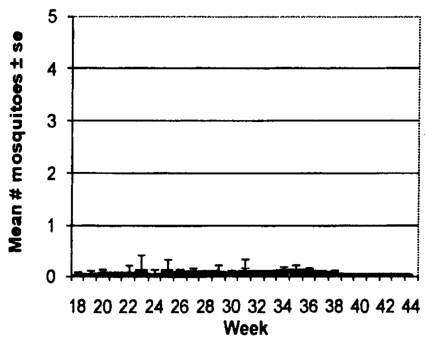
Delaware Bayshore



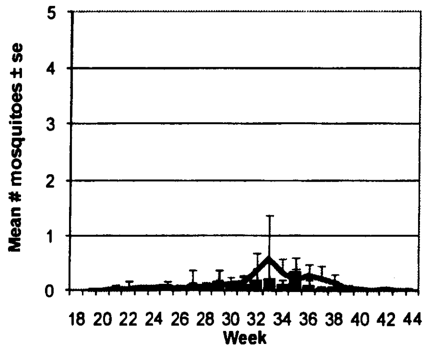
Delaware River Basin



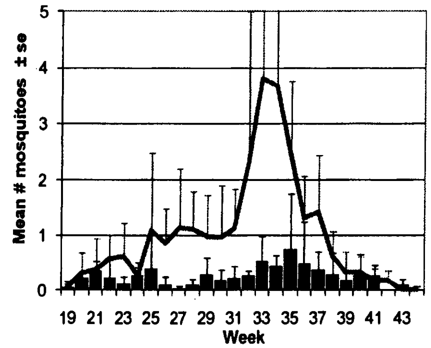
New York Metro



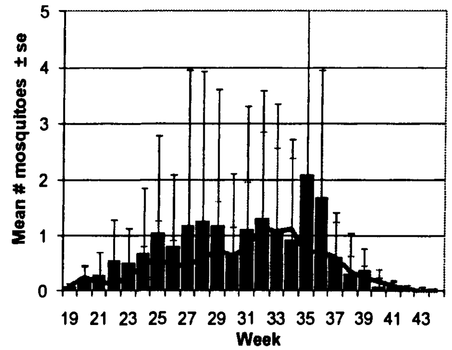
North Central Rural



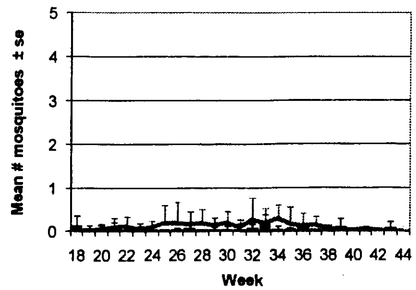
Northwestern Rural



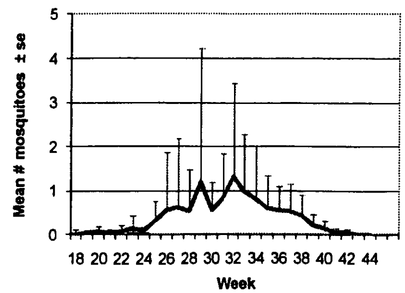
Philadelphia Metro



Pinelands



Suburban Corridor

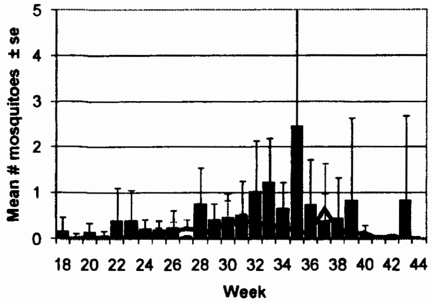


Comments

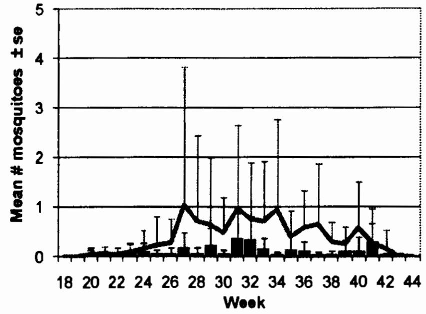
Anopheles punctipennis population abundances were lower than historical trends in the Delaware Bayshore, Delaware River Basin, Northwestern Rural and the Suburban Corridor. Last year, except for the Northwestern Rural region, the others also experienced similar low abundances. Last year in the Northwestern Rural, *An. punctipennis* peaked with a weekly average greater than 10 mosquitoes/night while this year no week average was greater than one. Yet the Philadelphia Metropolitan region maintained populations at or above historical trends.

Anopheles quadrimaculatus – *Culex/Anopheles* (*An. quadrimaculatus* Type)

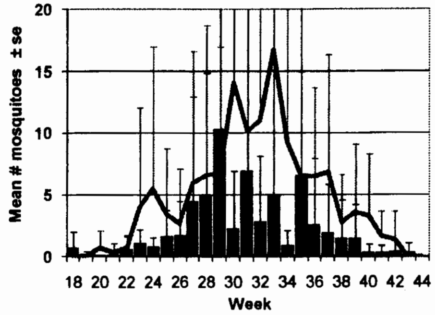
Agricultural



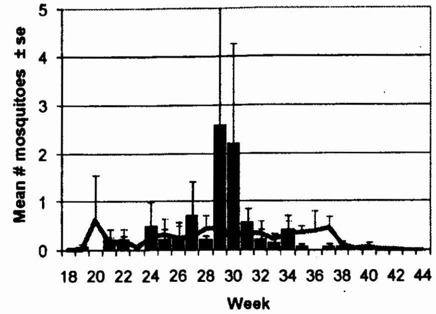
Coastal



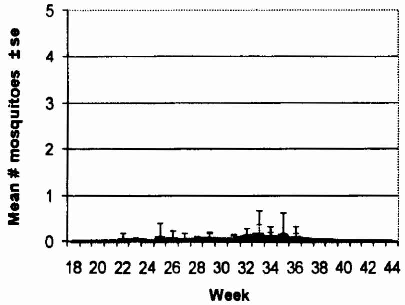
Delaware Bayshore



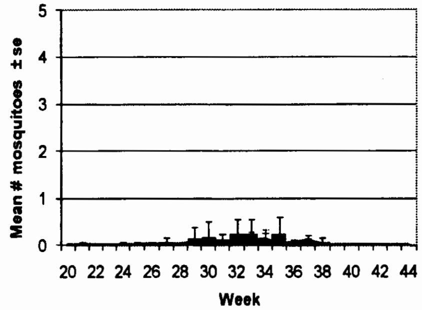
Delaware River Basin



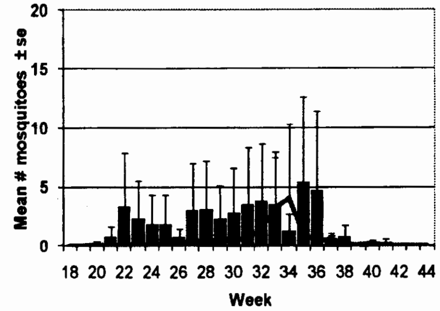
New York Metro



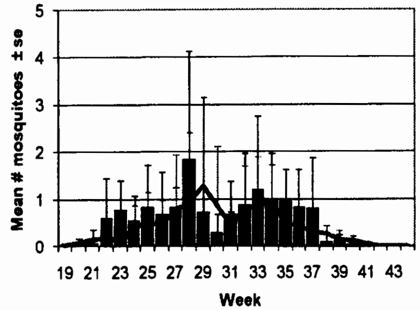
North Central Rural



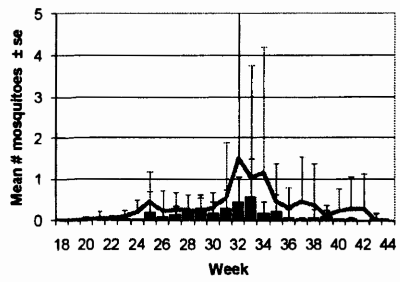
Northwestern Rural



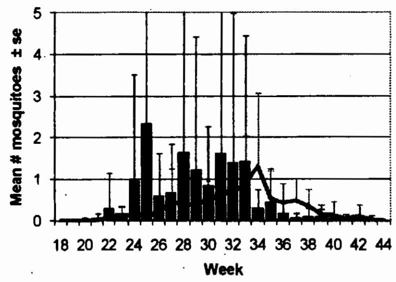
Philadelphia Metro



Pinelands



Suburban Corridor

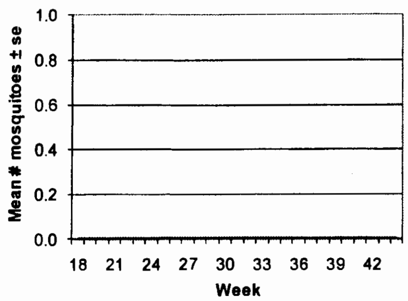


Comments

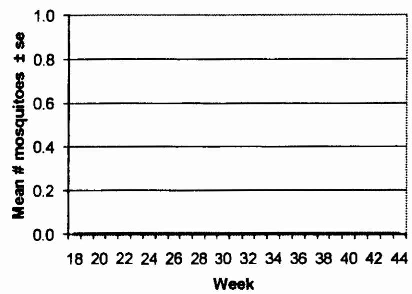
In the past, *An. quadrimaculatus* has been a significant vector of malaria in New Jersey. Their populations will grow over the season, and then decline in a pattern similar to *Culex* pipiens, except the habitat includes clean water with a tolerance to brackish water. In 2010, population reductions were only noted at the Coastal, Delaware Bayshore and Pinelands regions, while elevated populations were observed at the Agricultural, Delaware River Basin, Northwestern Rural, Philadelphia Metropolitan and the Suburban Corridor.

Anopheles walkeri – Monotypic (*An. walkeri* Type)

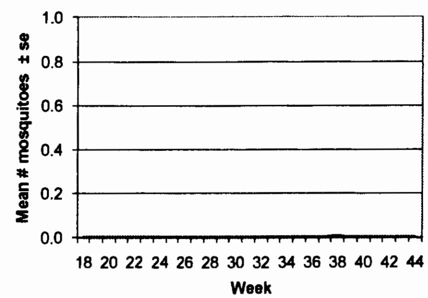
Agricultural



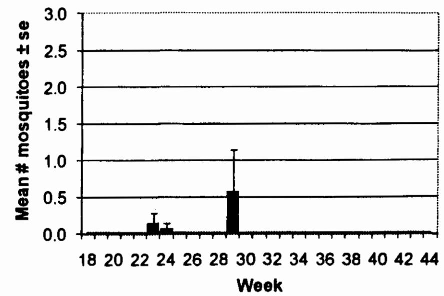
Coastal



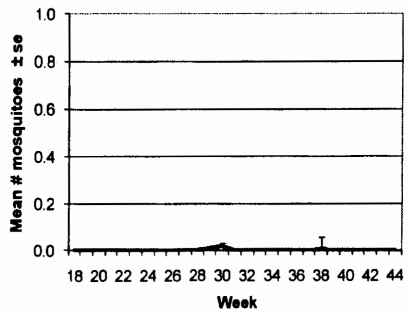
Delaware Bayshore



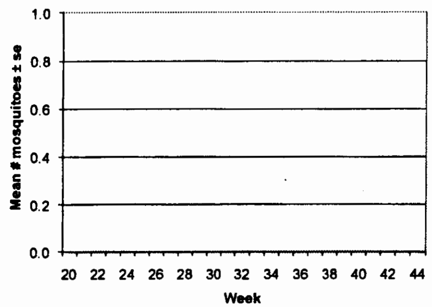
Delaware River Basin



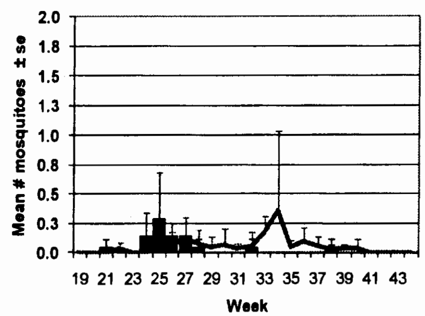
New York Metro



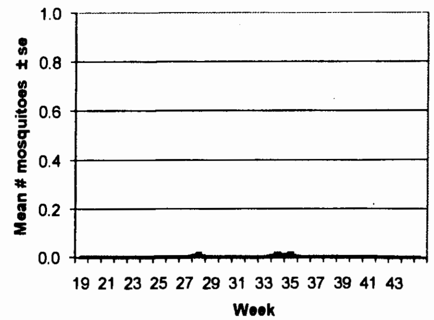
North Central Rural



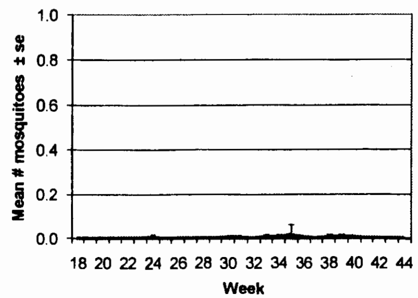
Northwestern Rural



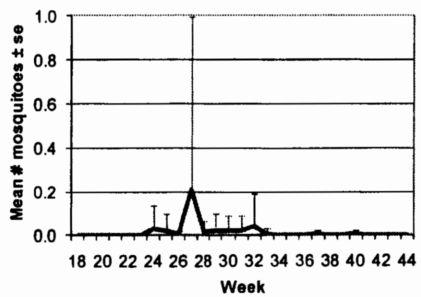
Philadelphia Metro



Pinelands



Suburban Corridor



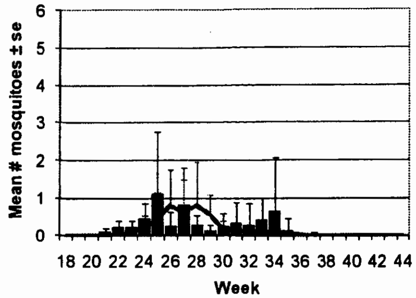
Comments

Anopheles walkeri is the only anopheline to overwinter as an egg and is thus given its own life cycle classification (Crans 2004). This species has been found in association with beaver dams in the Northwestern Rural region (Duckworth 2002). This species is not generally attracted to NJ light traps. Numbers in the Northwest Rural region were down this year, occurring primarily in the first half of the season. In past years, *An. walkeri* had been trapped in the Suburban Corridor. But this year no specimens were trapped there. The Delaware River Basin and the New York Metropolitan regions also trapped a few specimens.

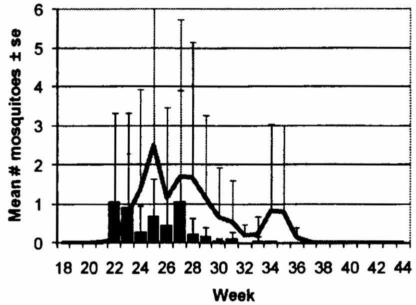
Crans, W. 2004 A classification system for mosquito life cycles: life cycle types for mosquitoes of the northeastern United States. Journal of Vector Ecology. 29: 1-10. Duckworth, T and C. Musa. 2002 Beaver activity – impacts on mosquito control. NJMCA Proceedings pp 29-36.

Coquillettidia perturbans – Miscellaneous Group

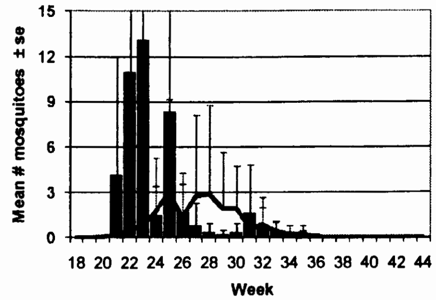
Agricultural



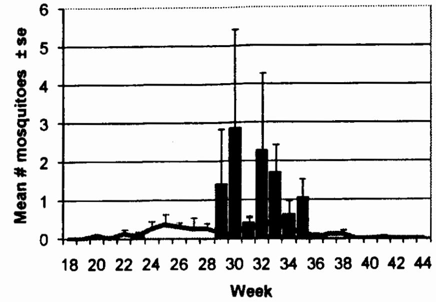
Coastal



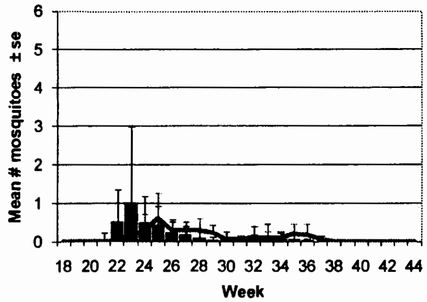
Delaware Bayshore



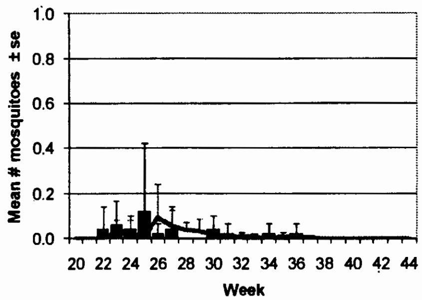
Delaware River Basin



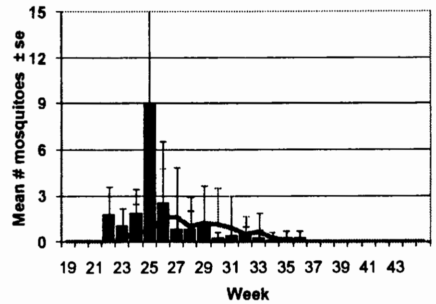
New York Metro



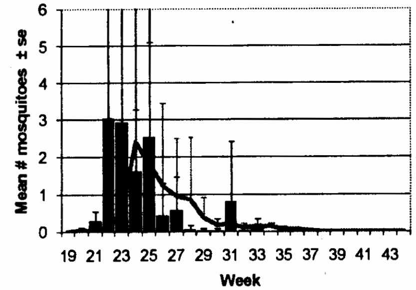
North Central Rural



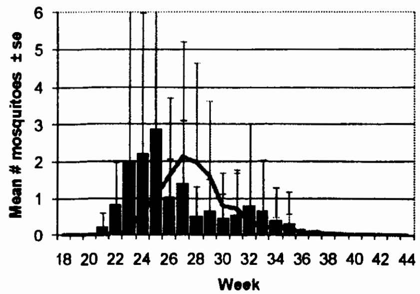
Northwestern Rural



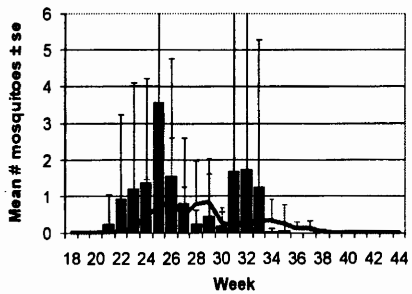
Philadelphia Metro



Pinelands



Suburban Corridor

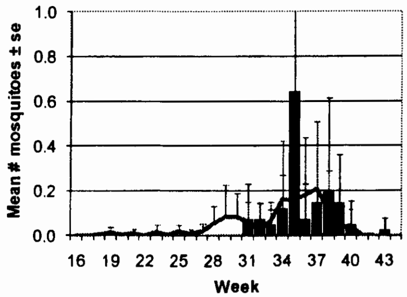


Comments

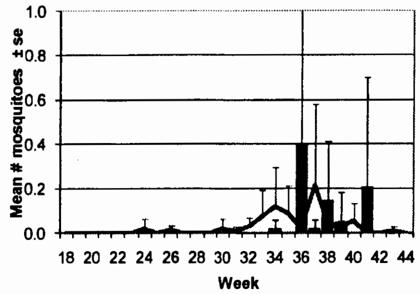
Coquillettidia perturbans, a suspected vector of inland EEE cases, spends its larval time attached to plants and gaining oxygen through the piercing of the plant phloem. This exploitation of plants makes this species more difficult to control. Last year, populations were suppressed in several regions. This year, the suppression continued in the Coastal region. This permanent water species rebounded, and made an early appearance in the Delaware Bayshore, New York Metropolitan, Northwestern Rural, Philadelphia Metropolitan, Pinelands and the Suburban Corridor. Later populations in the Delaware River Basin were also significant.

Culex erraticus – *Culex/Anopheles* (*An. quadrimaculatus* Type)

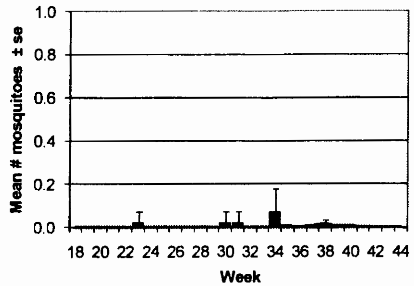
Agricultural



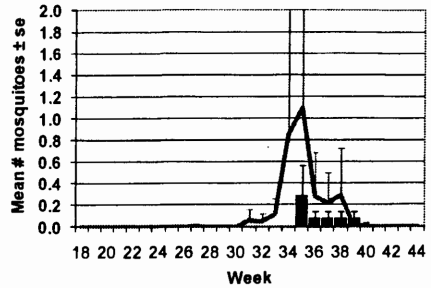
Coastal



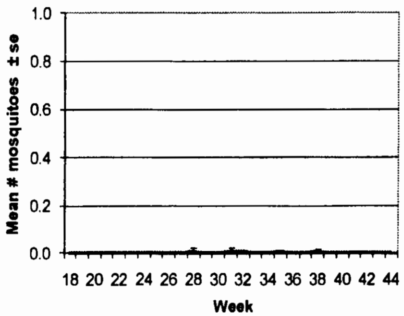
Delaware Bayshore



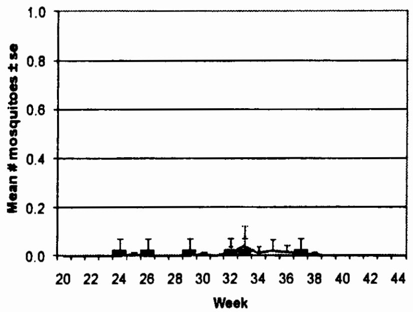
Delaware River Basin



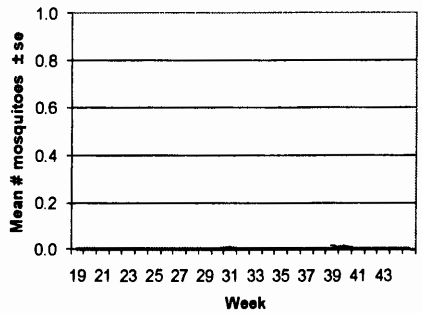
New York Metro



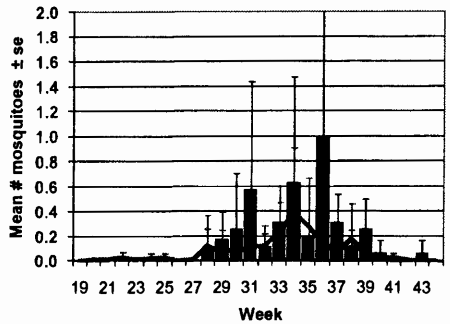
North Central Rural



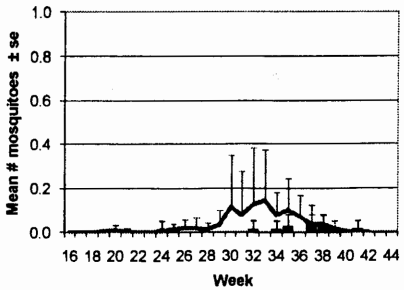
Northwestern Rural



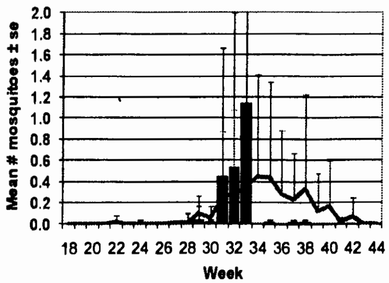
Philadelphia Metro



Pinelands



Suburban Corridor

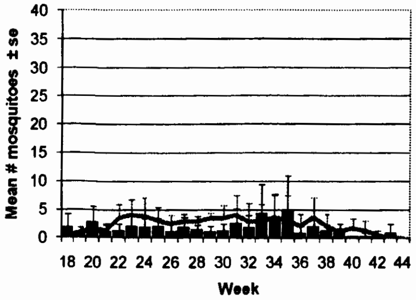


Comments

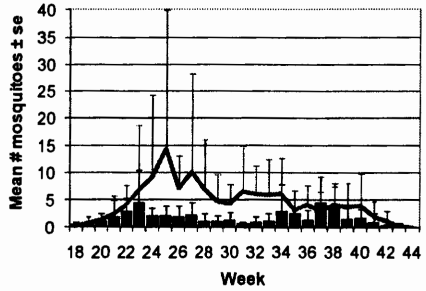
Culex erraticus was first detected in New Jersey in the late 1960's. For most of the years since then, this mosquito has been thought of as rare. Recently, populations have begun to show up more frequently in traps seen before as well as being seen for the first time in other areas. Catholic in its diet, *Cx. erraticus* has been implicated in the amplification and transmission cycle of eastern equine encephalitis. For the first time in New Jersey, this species has been found to be positive for EEE in 2009. Populations continued to be significantly high in the Philadelphia Metropolitan, and occasionally in the Agricultural, Coastal and the Suburban Corridor. An abrupt drop in the latter was likely due to control efforts directed toward the area with the traps contributing most toward the population.

Mixed *Culex* spp. – Culex/Anopheles (*Cx pipiens/salinarius* Type)

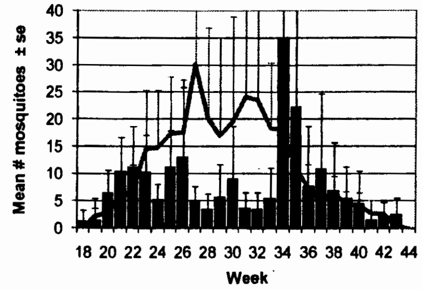
Agricultural



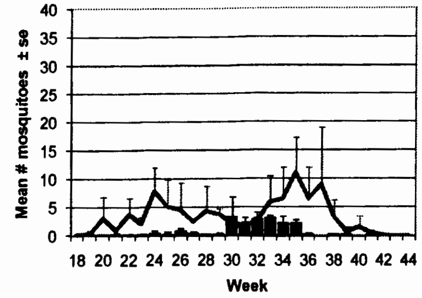
Coastal



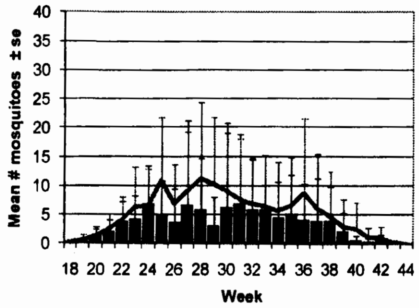
Delaware Bayshore



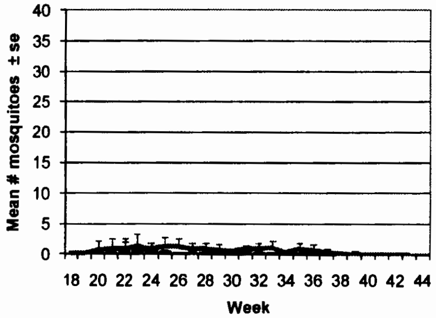
Delaware River Basin



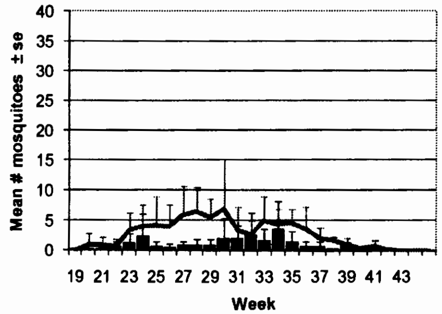
New York Metro



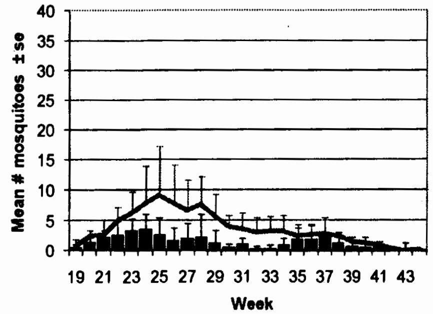
North Central Rural



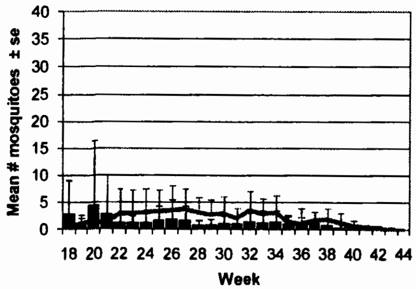
Northwestern Rural



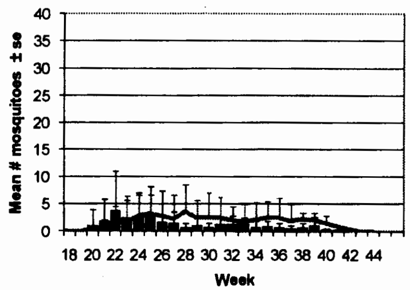
Philadelphia Metro



Pinelands



Suburban Corridor

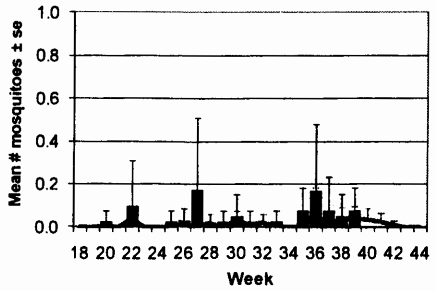


Comments

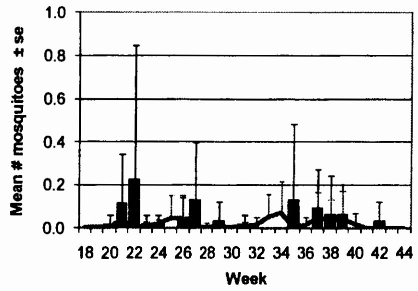
Mixed *Culex spp.* (including *Culex pipiens, Cx. restuans* and *Cx. salinarius*) are consolidated into one group as individuals from the three species can be difficult to distinguish after going through a light trap. Two of these (*Cx. pipiens* and *Cx. restuans*) are primarily bird feeders, although they may change their diet to include mammals as the summer ends. This is the primary enzootic vector for West Nile virus in the northeast US. Populations in 2010 were affected by drought with decreased abundances in all regions. Some decreases were small but consistent through the season while other regions should significant decreases from historical trends. Despite this apparent decrease in the population of the enzootic vectors for WNV, 2010 was the most active year to date for WNV activity on several levels. It is likely that the drought brought both vectors and hosts closer together, resulting in an increase in amplification.

Culex territans – Culex/Anopheles (An. quadrimaculatus Type)

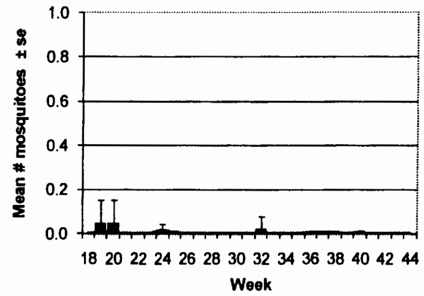
Agricultural



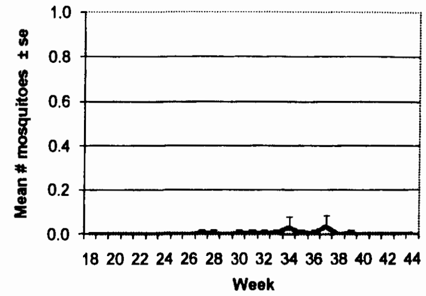
Coastal



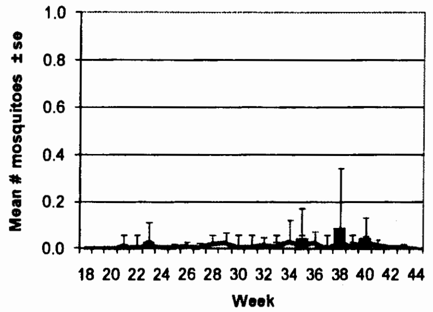
Delaware Bayshore



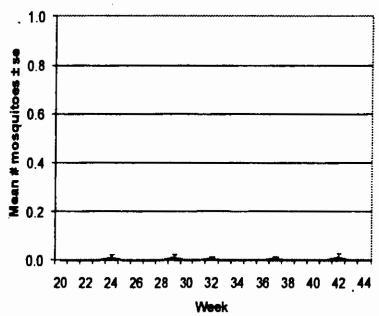
Delaware River Basin



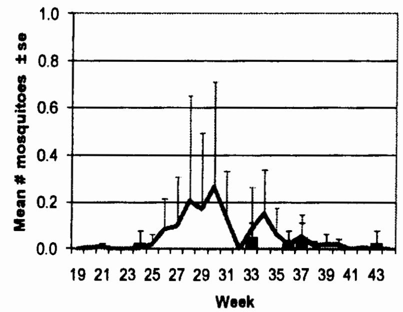
New York Metro



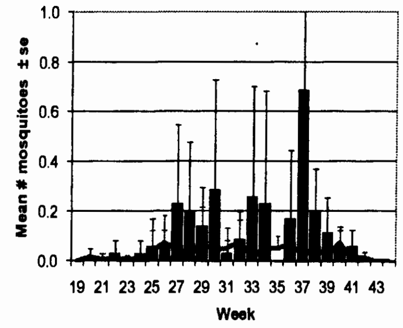
North Central Rural



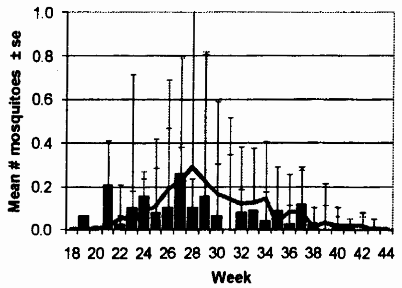
Northwestern Rural



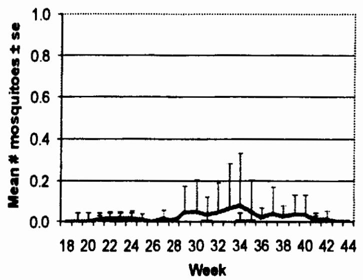
Philadelphia Metro



Pinelands



Suburban Corridor

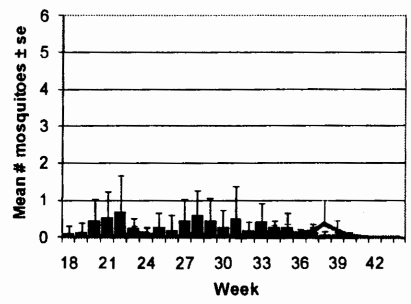


Comments

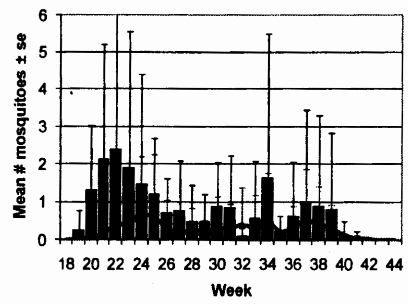
Culex territans is a specialized frog-feeder with cold tolerance that allows it to be present when early-season frogs appear. This means that a portion of the population is not likely recorded in the light traps as they have already appeared and disappeared before the traps were turned on. As with other *Culex*, females overwinter in protected hibernaculae. This species is found throughout most of New Jersey. Last years' patterns among the regions continued to 2010, with the exception of the Northwestern Rural region where populations decreased significantly. This may indicate that the previous year was the exceptional year and that patterns have returned to normal in that region.

Culiseta melanura – Unique (*Cs. melanura* Type)

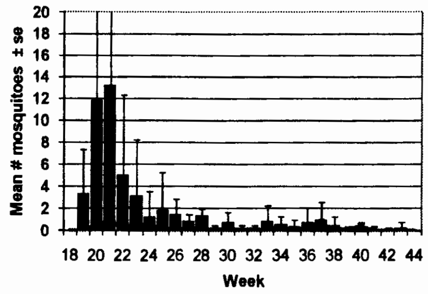
Agricultural



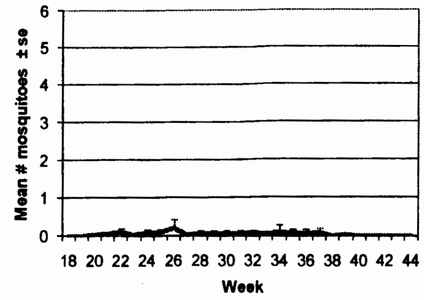
Coastal



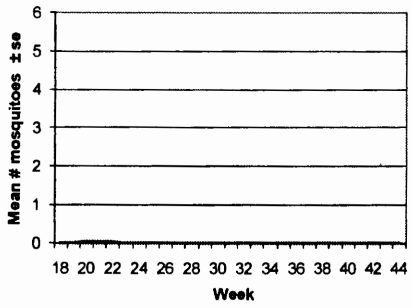
Delaware Bayshore



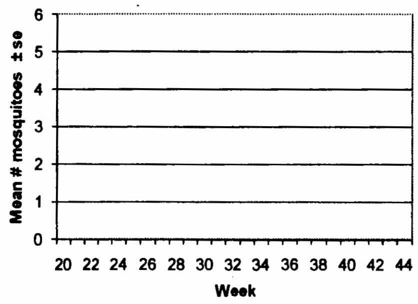
Delaware River Basin



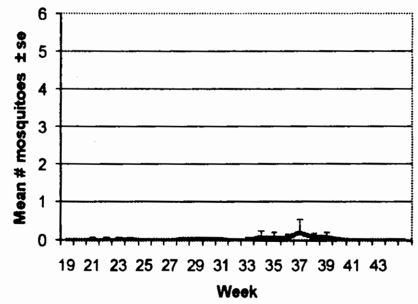
New York Metro



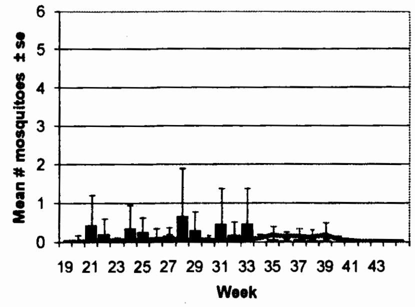
North Central Rural



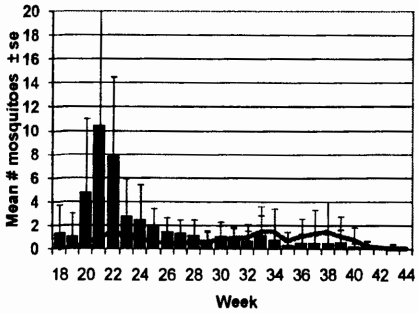
Northwestern Rural



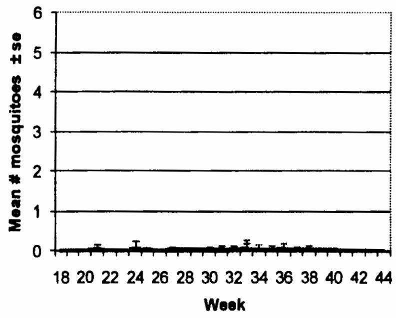
Philadelphia Metro



Pinelands



Suburban Corridor

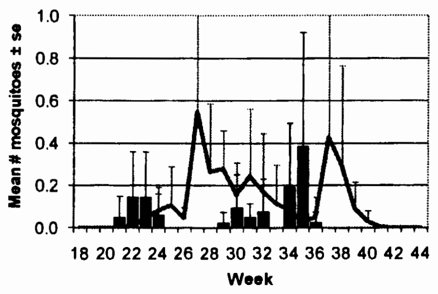


Comments

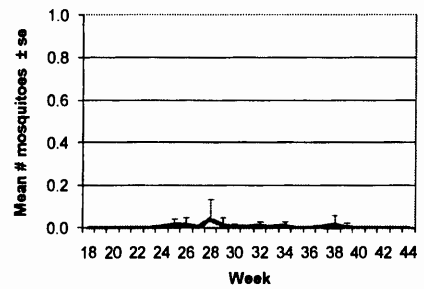
Culiseta melanura is the enzootic vector of eastern equine encephalitis virus. This species overwinters as larvae in the acidic waters of peat bogs, usually safely inside crypts formed at the base of trees. This makes larval control of them particularly difficult. Historical values of the Pinelands clearly show the second generation where most EEE amplification occurs that develops during the second half of the season. Last year, abundances in that region were high, contributing to the overwintering larvae that would emerge in 2010. Indeed, the high 2009 population led to a high first generation in the Pinelands (and Coastal and Delaware Bayshore regions as well). However, the drought that continued into the summer likely reduced the potentially abundant second generation, which appeared only at historical levels. EEE activity also was decreased from the previous year.

Psorophora ciliata – Multivoltine Aedine (Ae. vexans Type)

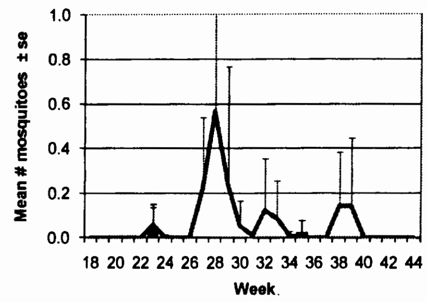
Agricultural



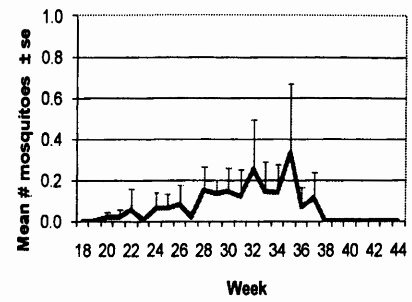
Coastal



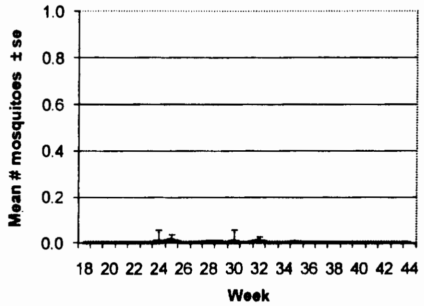
Delaware Bayshore



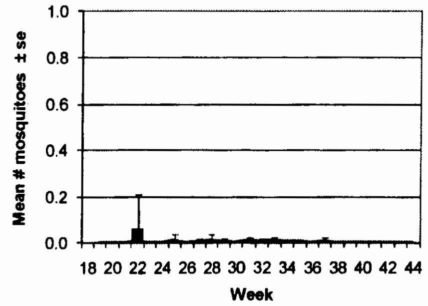
Delaware River Basin



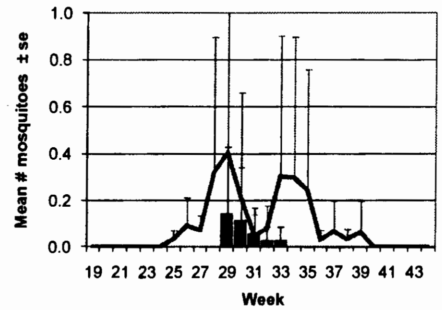
New York Metro



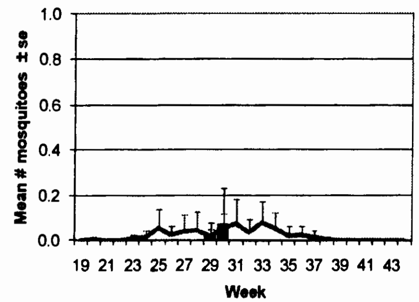
North Central Rural



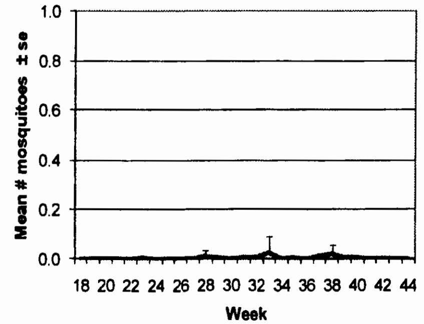
Northwestern Rural



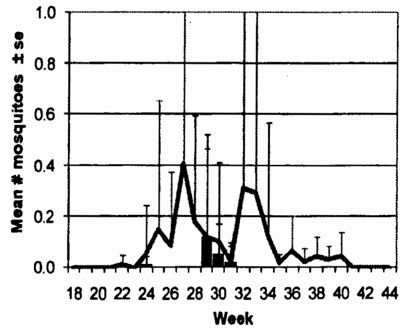
Philadelphia Metro



Pinelands



Suburban Corridor

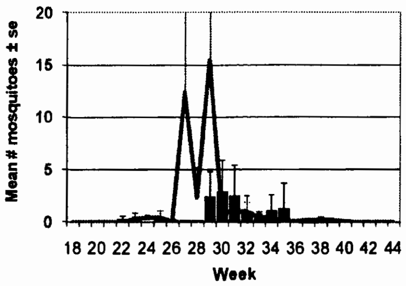


Comments

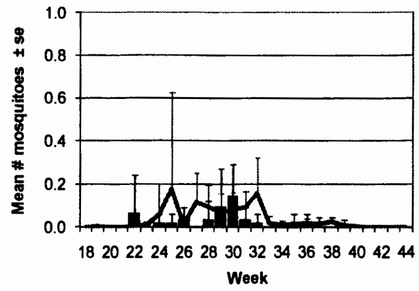
Psorophora ciliata is a large mosquito that preys upon smaller mosquitoes such as *Psorophora columbiae* and *Ae. vexans* as larvae. As a floodwater mosquito, both habitat and prey are important in the abundance of this species that could result. This year, population patterns were similar to the previous year, but at lower numbers, particularly in the Northwestern Rural and Suburban Corridor, likely reflective of the extended drought. Prey numbers for *Ps. columbiae* were also down (see next graph).

Psorophora columbiae – Multivoltine Aedine (*Ae. vexans* Type)

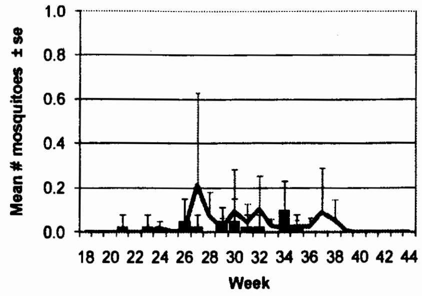
Agricultural



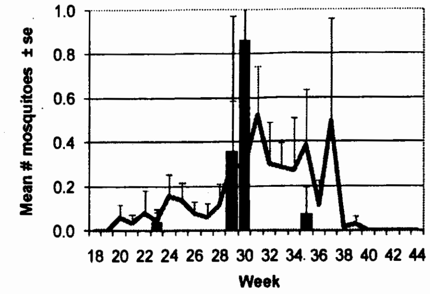
Coastal



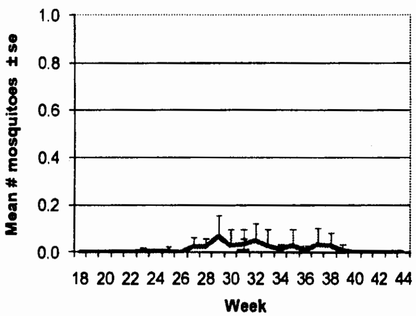
Delaware Bayshore



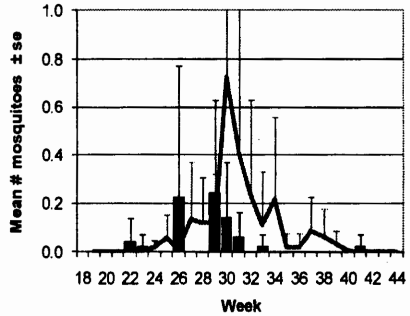
Delaware River Basin



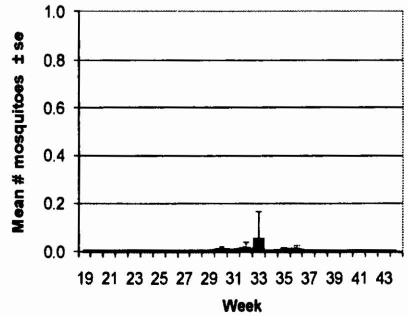
New York Metro



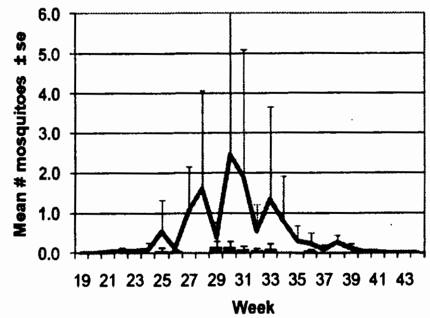
North Central Rural



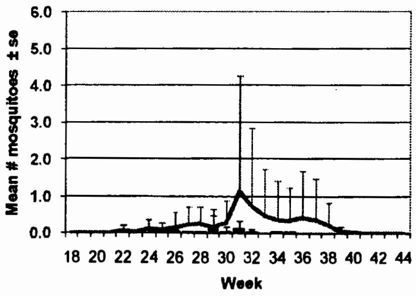
Northwestern Rural



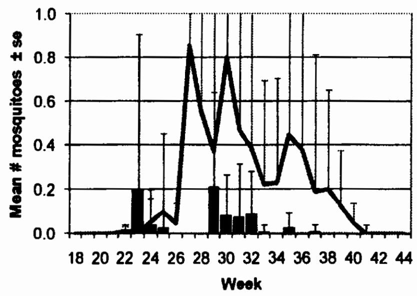
Philadelphia Metro



Pinelands



Suburban Corridor

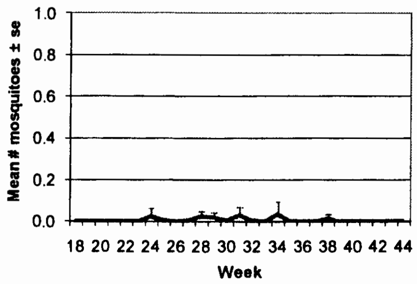


Comments

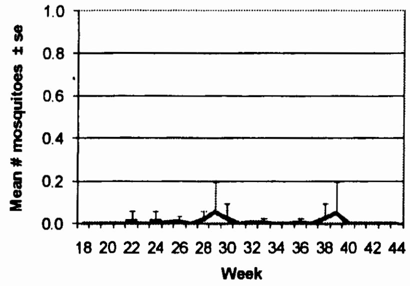
Psorophora columbiae is a smaller psorophoran that is preyed upon by its larger brethren. All the psorophorans are floodwater mosquitoes in New Jersey. As such, and as one of the food sources for the larger psorophorans, the population size of this mosquito as well as rain events can regulate the larger psorophorans. In 2010, the downward trend of this species continued under drought conditions. Patterns were similar to 2009, but population sizes were smaller, with the exception of the Agricultural region.

Psorophora ferox – Multivoltine Aedine (*Ae. vexans* Type)

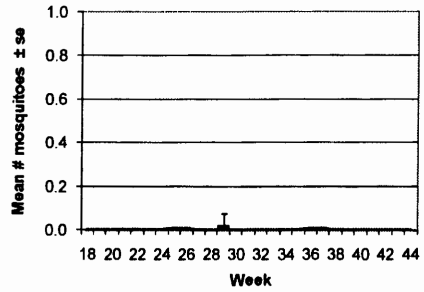
Agricultural



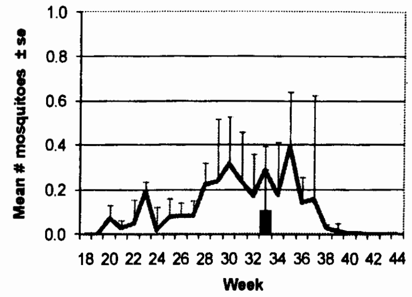
Coastal



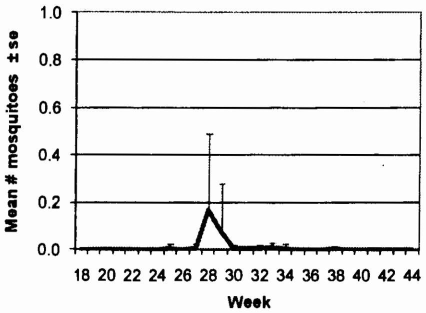
Delaware Bayshore



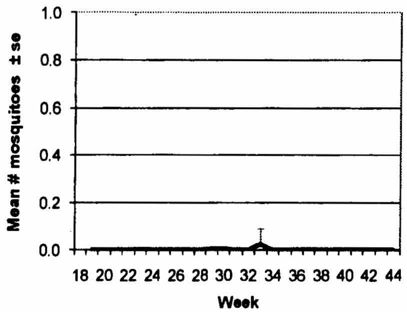
Delaware River Basin



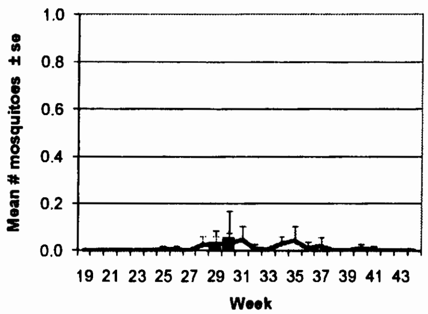
New York Metro



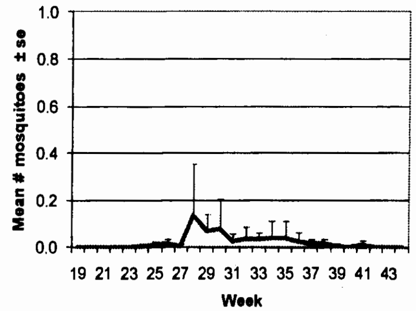
North Central Rural



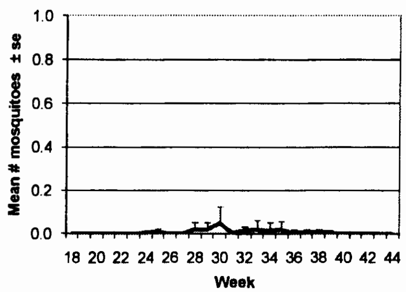
Northwestern Rural



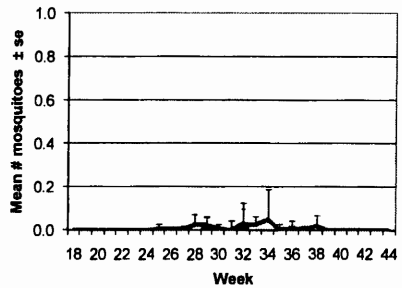
Philadelphia Metro



Pinelands



Suburban Corridor

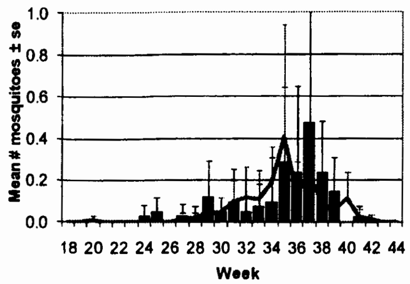


Comments

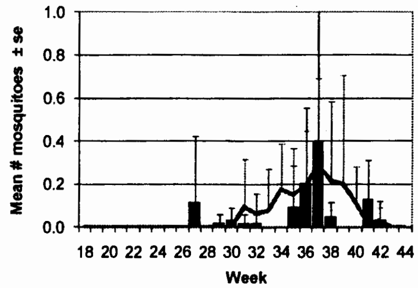
Psorophora ferox is a relatively large and aggressive mosquito that produces a fierce bite as an adult. They can attack when disturbed at their resting site. As like other multivoltine aedine-type life cycles, *Ps. ferox* can emerge after flooding events. As with *Psorophorans* and floodwater species, *Ps. ferox* abundances were reduced in 2010 from 2009 trends.

Uranotaenia sapphirina – Culex/Anopheles (An. quadrimaculatus Type)

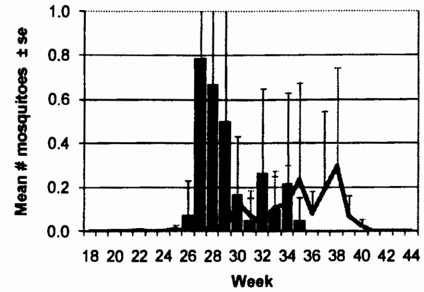
Agricultural



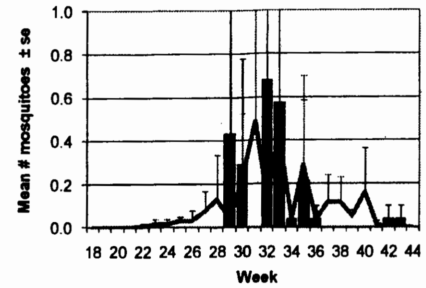
Coastal



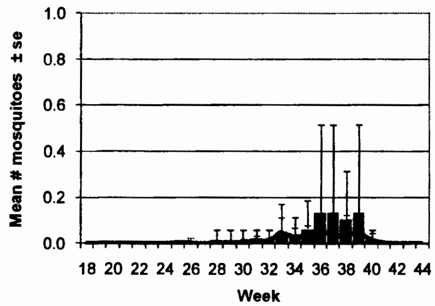
Delaware Bayshore



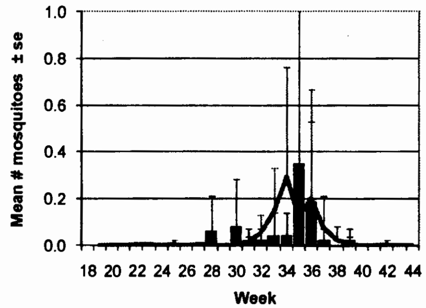
Delaware River Basin



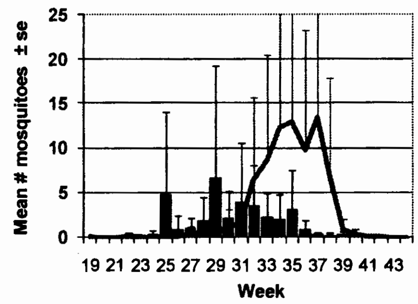
New York Metro



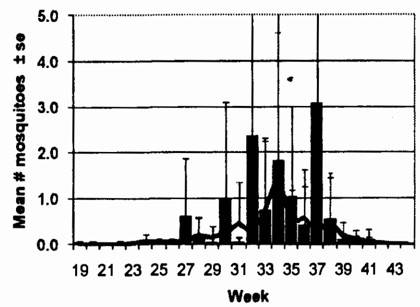
North Central Rural



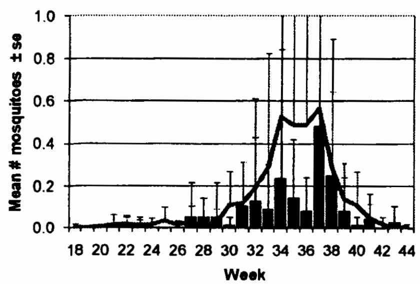
Northwestern Rural



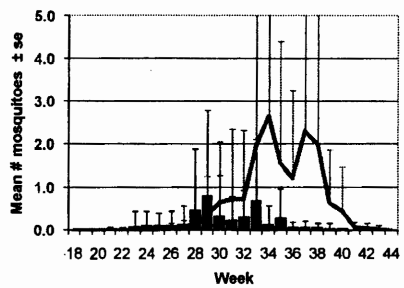
Philadelphia Metro



Pinelands



Suburban Corridor



Comments

This small mosquito is generally considered not to be a health threat, although eastern equine encephalitis and West Nile viruses have been detected in them in the US. Although it is found throughout New Jersey and is often recorded in the light traps of this program and can overwinter near anthropogenic sources, this mosquito apparently bites few humans. Largest populations occur in the Northwestern Rural region and the Suburban Corridor. Typically, populations will build up, then slowly decline. In 2010, areas such as the Coastal, Delaware Bayshore, River Basin, Northwestern Rural, Pinelands and the Suburban Corridor showed significant decreases in the second half of the season. However, the Agricultural and the two metropolitan regions did not show any decrease from historical trends.

NEW JERSEY ADULT MOSQUITO SURVEILLANCE

Report for 26 June to 2 July 2011, CDC Week 26

Prepared by Lisa M. Reed, Scott Crans and Mark Robson
Center for Vector Biology

RUTGERS
New Jersey Agricultural Experiment Station

USDA

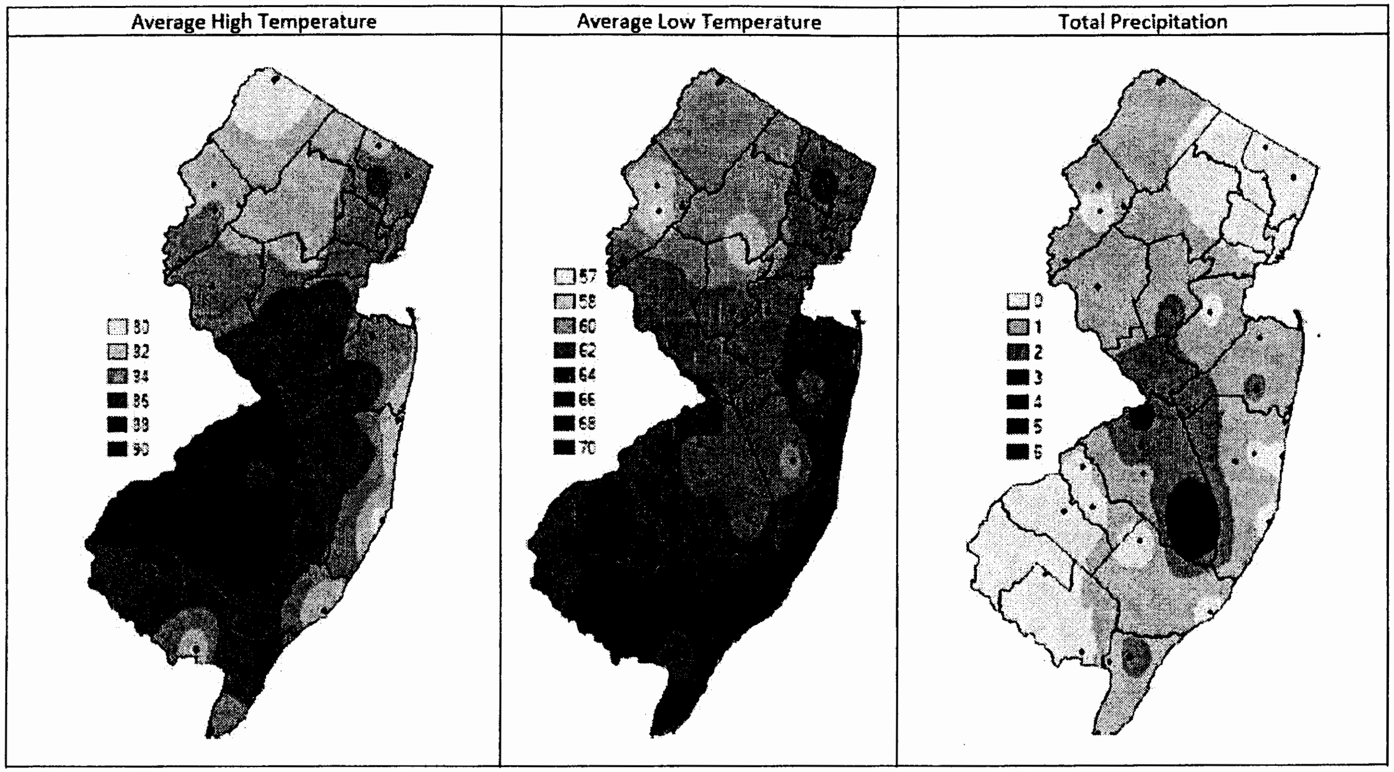
This New Jersey Agricultural Experiment Station report is supported by Rutgers University, Hatch funds, funding from the NJ State Mosquito Control Commission and with the participation of the 21 county mosquito control agencies of New Jersey.

Summary Table – Week 26

	Aedes vexans			*Culex* Mix			*Coquillettidia perturbans*			*Aedes sollicitans*		
Region	This Week	Average*	Increase	This Week	Average*	Increase	This Week	Average*	Increase	This Week	Average*	Increase
Agricultural	0.23	2.92	0	0.37	2.51	0	0.26	0.49	0	0.09	0.05	2
Coastal	1.03	6.43	0	5.27	6.97	0	0.21	0.63	0	29.89	4.62	4
Delaware Bayshore	6.43	2.67	3	28.80	15.63	2	6.23	1.42	4	6.49	6.86	0
Delaware River Basin	2.86	6.55	0	1.50	2.09	0	1.07	0.16	4	0.00	0.01	0
New York Metro	0.60	4.29	0	4.17	6.76	0	0.07	0.24	0	0.79	0.18	4
North Central Rural	0.12	0.23	0	0.29	1.25	0	0.00	0.04	0	0.00	0.00	0
Northwest Rural	1.20	7.94	0	4.63	3.50	1	0.50	3.36	0	0.00	0.00	0
Philadelphia Metro	0.64	9.74	0	1.00	7.60	0	0.04	0.96	0	0.00	0.00	0
Pinelands	0.79	2.66	0	1.81	3.37	0	0.29	1.05	0	0.25	0.06	4
Suburban Corridor	2.71	4.71	0	1.64	3.80	0	0.14	0.76	0	0.00	0.02	0

*Averages represent data from, at most, the previous 5 years. Increase is a scale of current values from historical values where no difference or a decrease is represented by 0 (blue), up to 50% greater difference by 1 (green), up to 100% greater difference by 2 (yellow), up to 150% greater difference by 3 (orange) and greater than 150% increase by 4 (red). White cells in the increase column denote increases from an historic zero and thus no value can be appropriately given.

State Summary: Significant increases in pestiferous populations continue. Higher than recent historical values for *Aedes* vexans was observed in the Delaware Bayshore. For *Culex* Mix, higher numbers continued in the Delaware Bayshore and the Northwest Rural. *Coquillettidia perturbans* numbers also continued with high abundance in the Delaware Bayshore and River Basin. *Aedes sollicitans* numbers were high in the two regions of traditionally significant values, the Coastal and Delaware Bayshore as well as in the New York Metro and Pinelands.

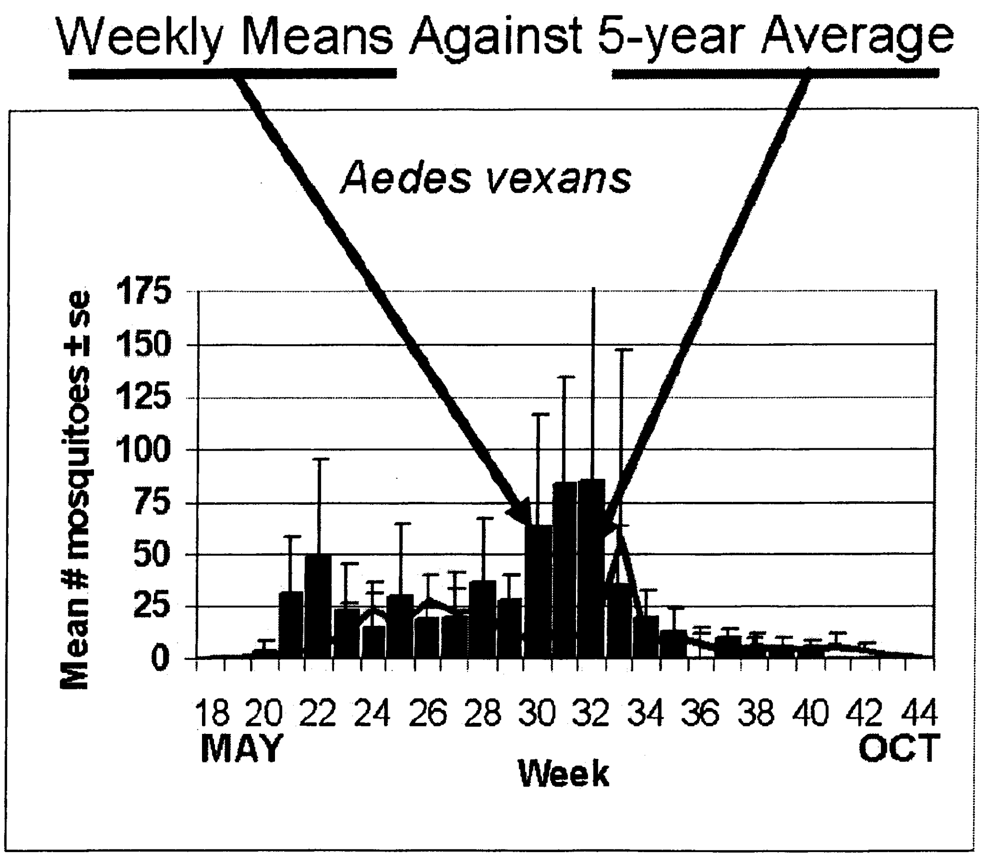


The three figures show the interpolation of average maximum and minimum temperature and total precipitation from 1 July to 8 July, 2011 in New Jersey. Data points are from about 37 weather stations maintained through the New Jersey Weather & Climate Network and the State Climatologist. Interpolation between points was performed using ArcMap 10.

Average high temperatures were seen in the interior southern half of New Jersey. Average low temperatures were slightly warmer than last week and were highest along the coastal region (moderating effects of large bodies of water – i.e., the Atlantic Ocean). Precipitation patterns changed as higher rainfall shifted southward.

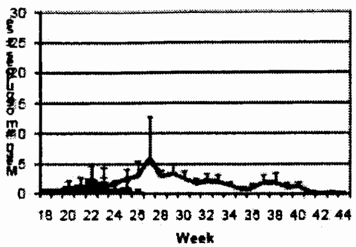
NJ Weather & Climate NETWORK & ONJSC at Rutgers University

The Species Graphs: The species graph pages include a graph with two plots for each of the ten regions defined on the first page (Agricultural, Coastal, Delaware Bayshore, Delaware River, New York Metro, North-Central, Northwestern, Philadelphia Metro, Pinelands, and Suburban Corridor). Below is an example of one graph from one species within one region. The bar plot show the average number of mosquitoes per trap within the region (weekly means) and line plots show the historical trend as the average number of mosquitoes from the previous 5 years (5-year average). In general, historical data are running means from the previous 5 years, but on occasion, will include data from fewer years. Adjustments are made to account for year discrepancies. Data for these weeks are from Atlantic, Bergen, Camden, Cape May, Hunterdon, Mercer, Monmouth, Morris, Ocean, Salem, Sussex, Union and Warren counties. Last week included Atlantic, Bergen, Burlington, Camden, Cape May, Essex, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Salem, Somerset, Sussex, Union and Warren counties. Note: County data is sent in at a variety of times during the week.

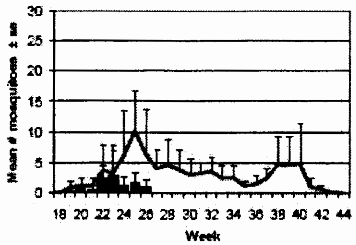


Aedes vexans - Fresh Floodwater Species
Multivoltine Aedine (*Ae. vexans* Type)

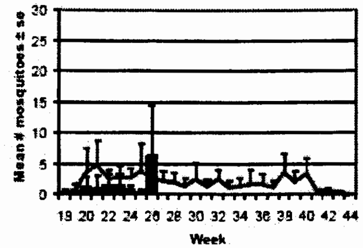
Agricultural



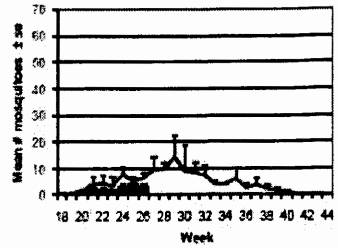
Coastal



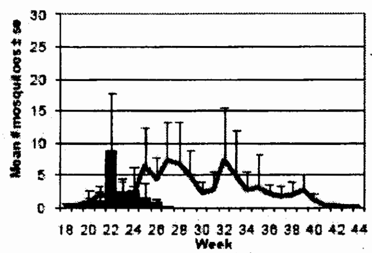
Delaware Bayshore



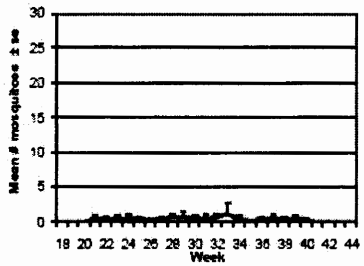
Delaware River Basin



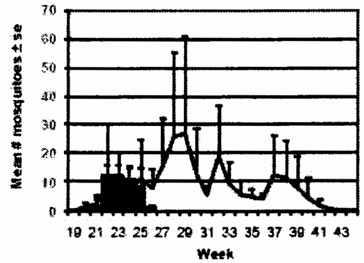
New York Metro



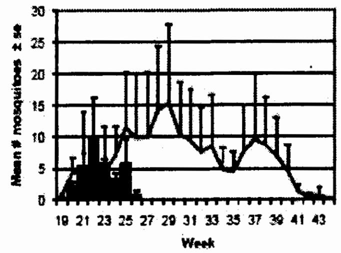
North Central Rural



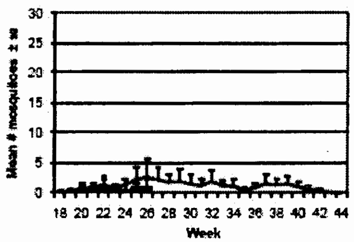
Northwestern Rural



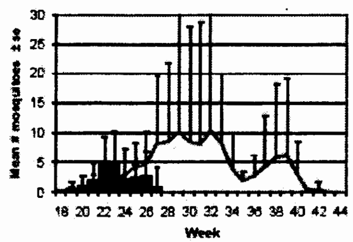
Philadelphia Metro



Pinelands



Suburban Corridor

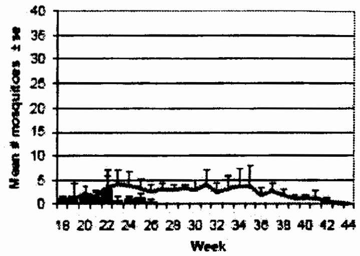


Comments

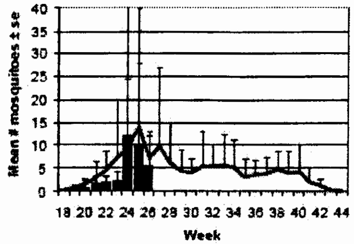
Aedes vexans populations remain at or lower than historical values in all but the Delaware Bayshore. While most of the activity from traps for that region showed a slight increase in numbers, one locale was particularly active. This was despite June's lower precipitation for southern NJ as compared to the northern half of the state. There was minor local rainfall event that occurred earlier, likely contributing to enough flooding conditions for emergence to occur.

Culex Mix – Permanent Water Species
Multivoltine *Culex/Anopheles* (*Cx. pipiens* Type)

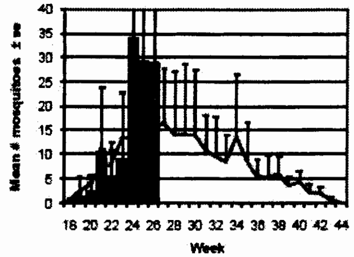
Agricultural



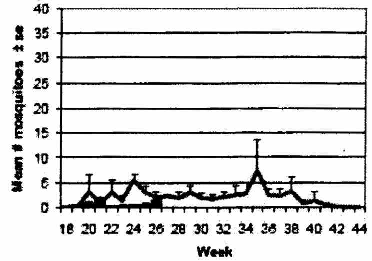
Coastal



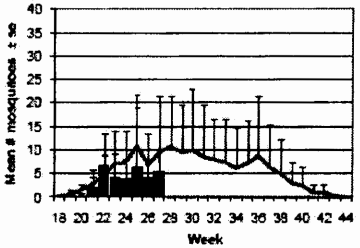
Delaware Bayshore



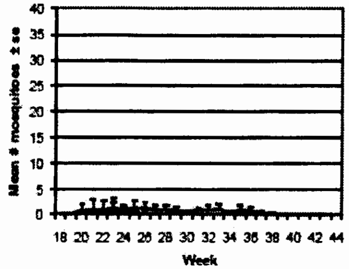
Delaware River Basin



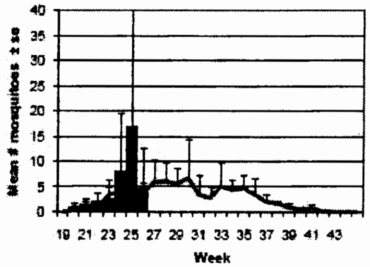
New York Metro



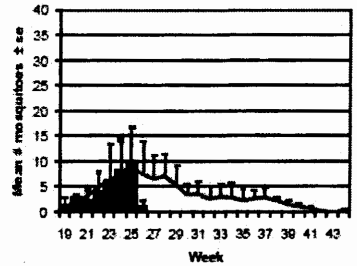
North Central Rural



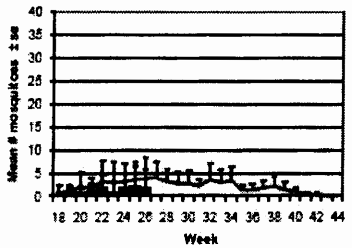
Northwestern Rural



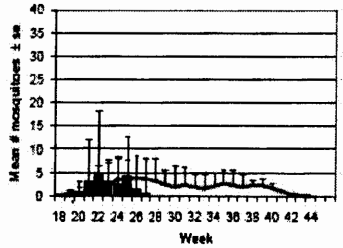
Philadelphia Metro



Pinelands



Suburban Corridor

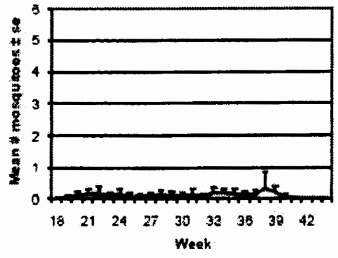


Comments

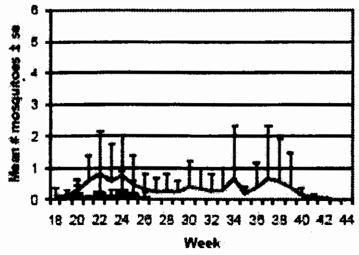
Culex Mix is composed of *Culex pipiens*, *Cx. restuans* and *Cx. salinarius*. These three species (especially *pipiens* and *restuans*) are often difficult to tell apart after encountering the damaging blades of the New Jersey light trap. Currently, local populations in the Delaware Bayshore continue to show significant increases, with most of the contribution from *Cx. salinarius*.

Culiseta melanura – Miscellaneous Group
Unique (*Cs. melanura* Type)

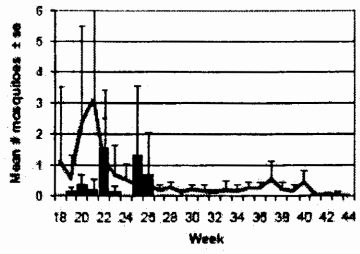
Agricultural



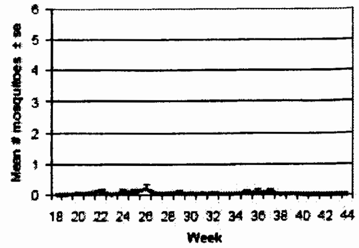
Coastal



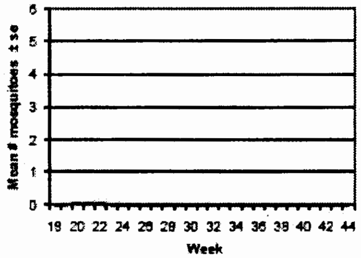
Delaware Bayshore



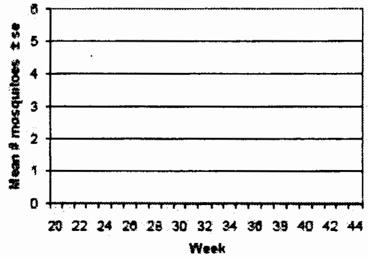
Delaware River Basin



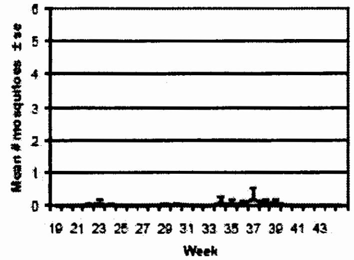
New York Metro



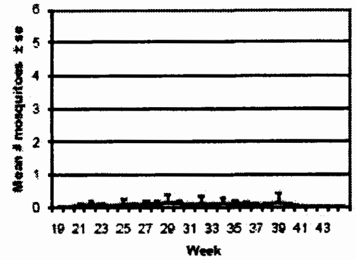
North Central Rural



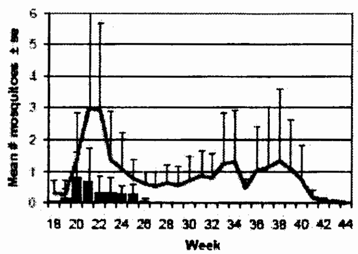
Northwestern Rural



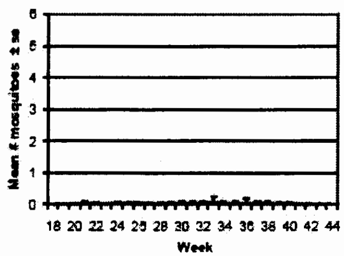
Philadelphia Metro



Pinelands



Suburban Corridor

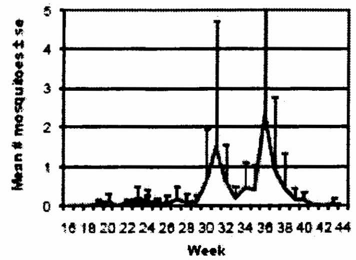


Comments

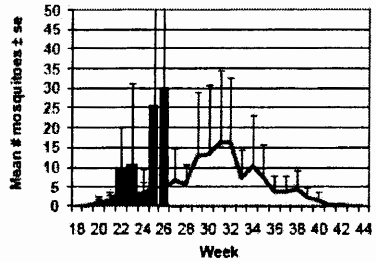
Culiseta melanura is the enzootic ornithophilic vector of eastern equine encephalitis. Some recent activity for this species has been observed in the Delaware Bayshore region. This is in contrast to the below historical trends observed in the resting boxes, a preferred trap. Numbers are expected to be low at this period between generations. Numbers should begin to rise as the offspring from the current generation, plus overwinter firsts and seconds finally develop, showing the typical rise in population numbers as displayed by the historical trends in the Pinelands.

Aedes sollicitans - Salt Floodwater Species
Multivoltine Aedine (*Ae. sollicitans* Type)

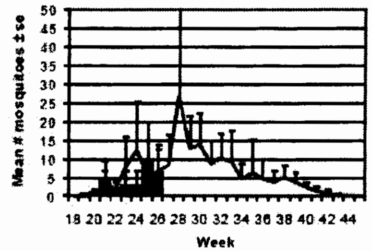
Agricultural



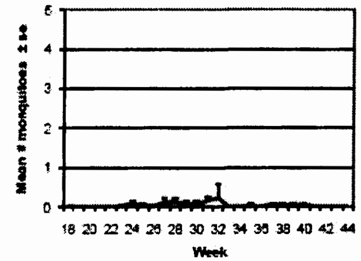
Coastal



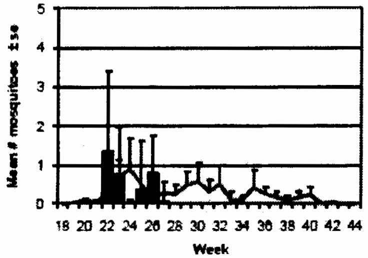
Delaware Bayshore



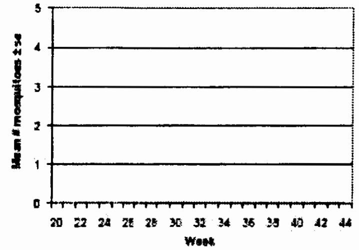
Delaware River Basin



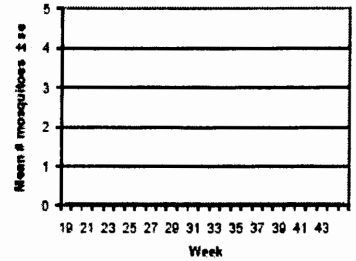
New York Metro



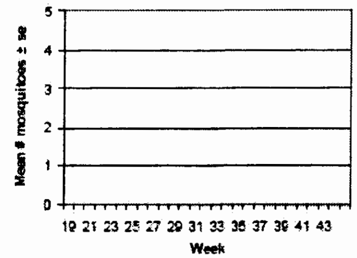
North Central Rural



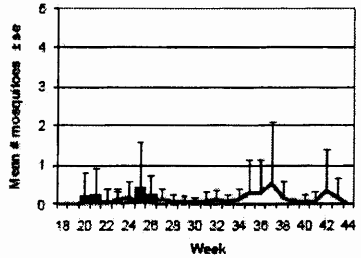
Northwestern Rural



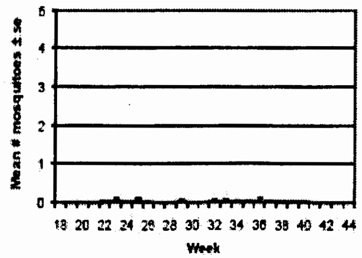
Philadelphia Metro



Pinelands



Suburban Corridor



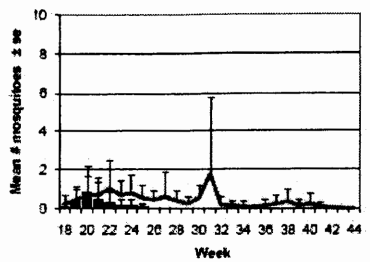
Comments

Aedes sollicitans population abundances remain significantly high in the Coastal and Delaware Bayshore regions as this second emergence continues. Numbers were also above historical trends in the New York Metro region. The migratory nature of this species is also reflected in the higher populations of the Pinelands.

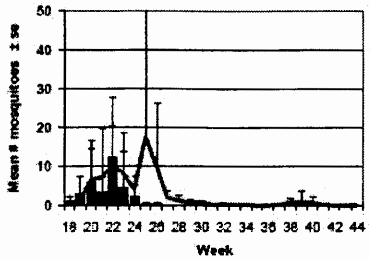
Next Full Moon: 15 July.

Aedes cantator - Salt Floodwater Species
Multivoltine Aedine (*Ae. sollicitans* Type)

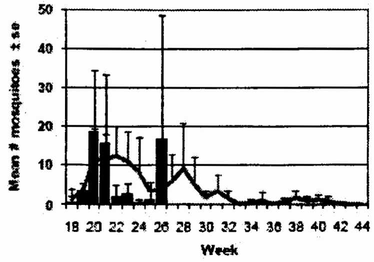
Agricultural



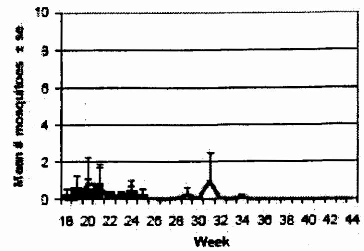
Coastal



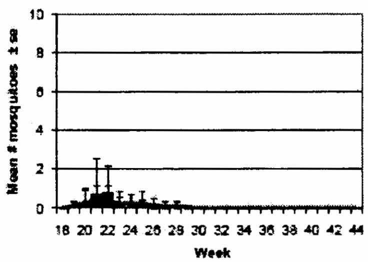
Delaware Bayshore



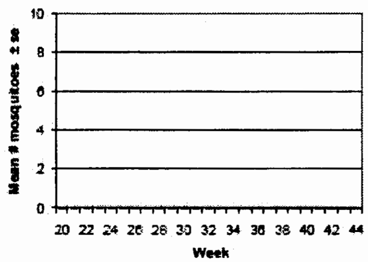
Delaware River Basin



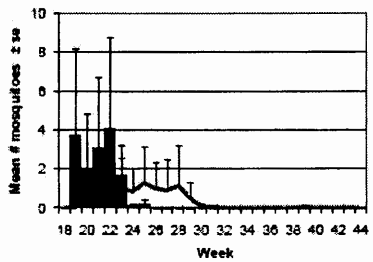
New York Metro



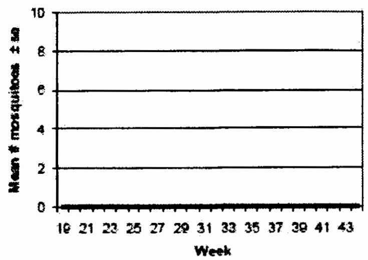
North Central Rural



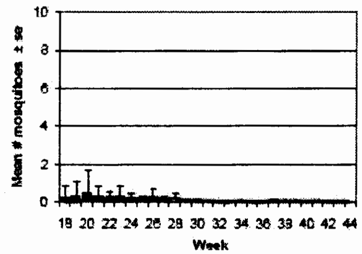
Northwestern Rural



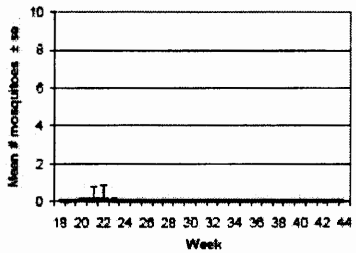
Philadelphia Metro



Pinelands



Suburban Corridor

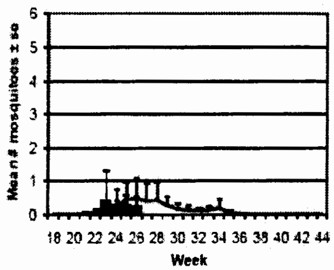


Comments

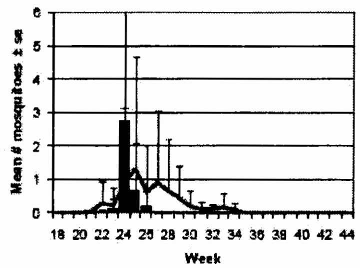
Last week, *Aedes cantator* populations appeared to be on the decline and this was to be the last set of graphs for this species unless unusual activity is observed. While most populations continued to decline, high activity was observed in the Delaware Bayshore. This was at the same site that *Aedes vexans* populations were also high. Both species being a floodwater species (one fresh, one salt) suggests that a significant (but local) rainfall event occurred, but likely not within the correct conditions required for exceptional *Ae. sollicitans* hatching.

Coquillettidia perturbans
Monotypic (*Coq. perturbans* Type)

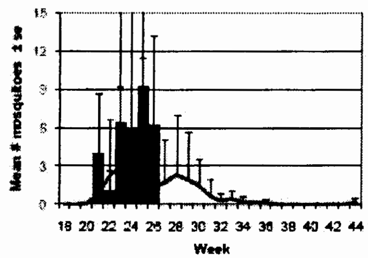
Agricultural



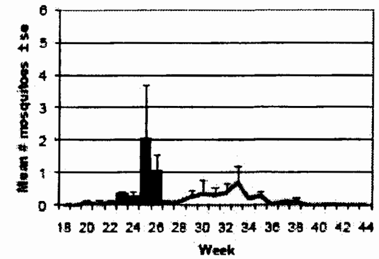
Coastal



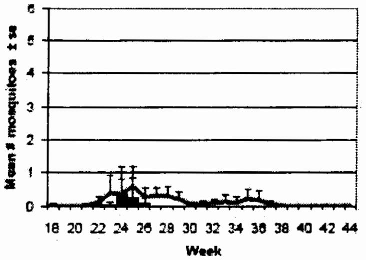
Delaware Bayshore



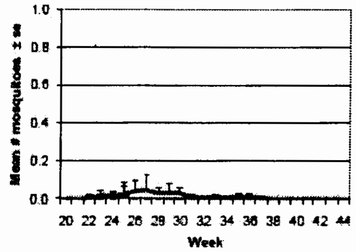
Delaware River Basin



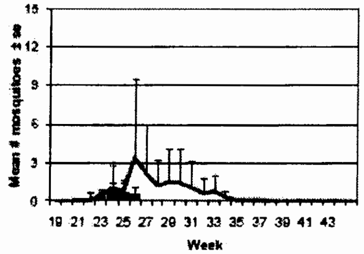
New York Metro



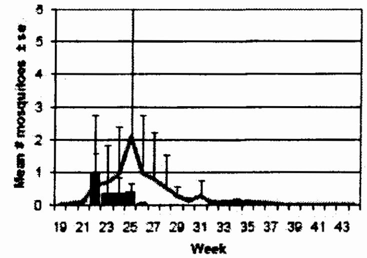
North Central Rural



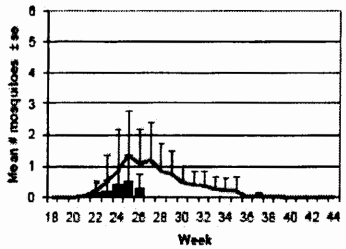
Northwestern Rural



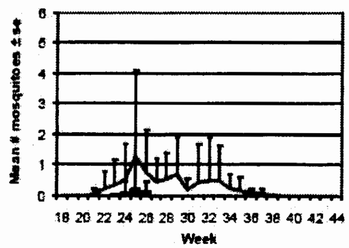
Philadelphia Metro



Pinelands



Suburban Corridor



Comments

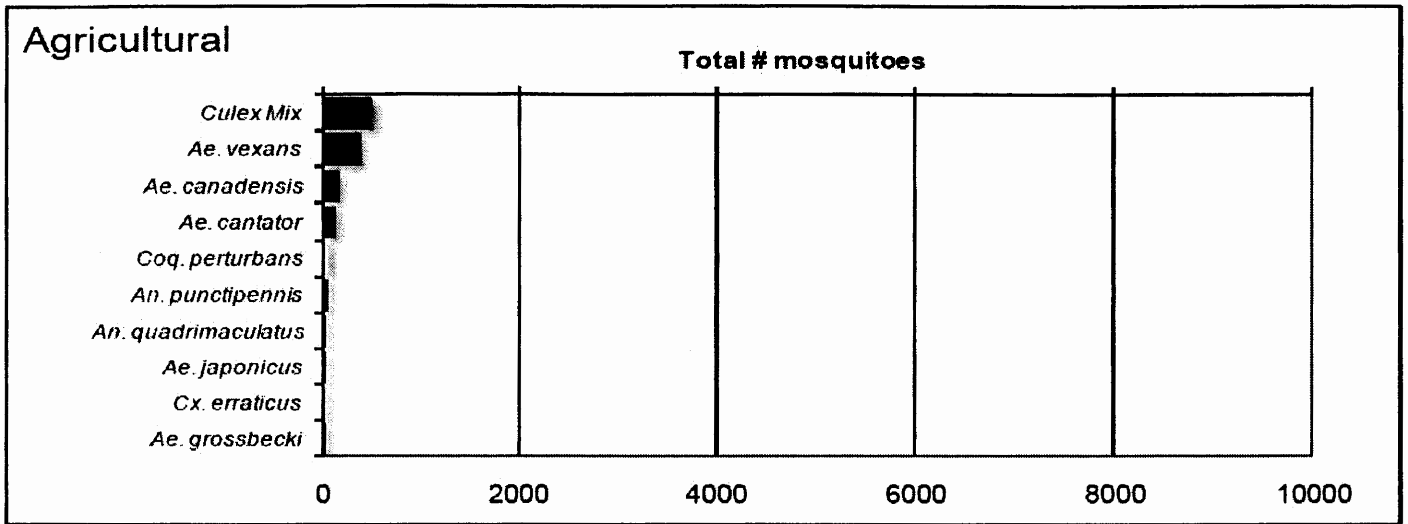
Coquillettidia perturbans populations have shown some significant activity in the Delaware Bayshore and Delaware River Basin regions, as well as earlier in the Coastal region. This species, a potential inland vector for Eastern Equine Encephalitis, can be a difficult species to control as the larvae are found attached to plant roots and stems to obtain oxygen (Romanowski and Candeletti). Drainage may be the most effective method for larval control.

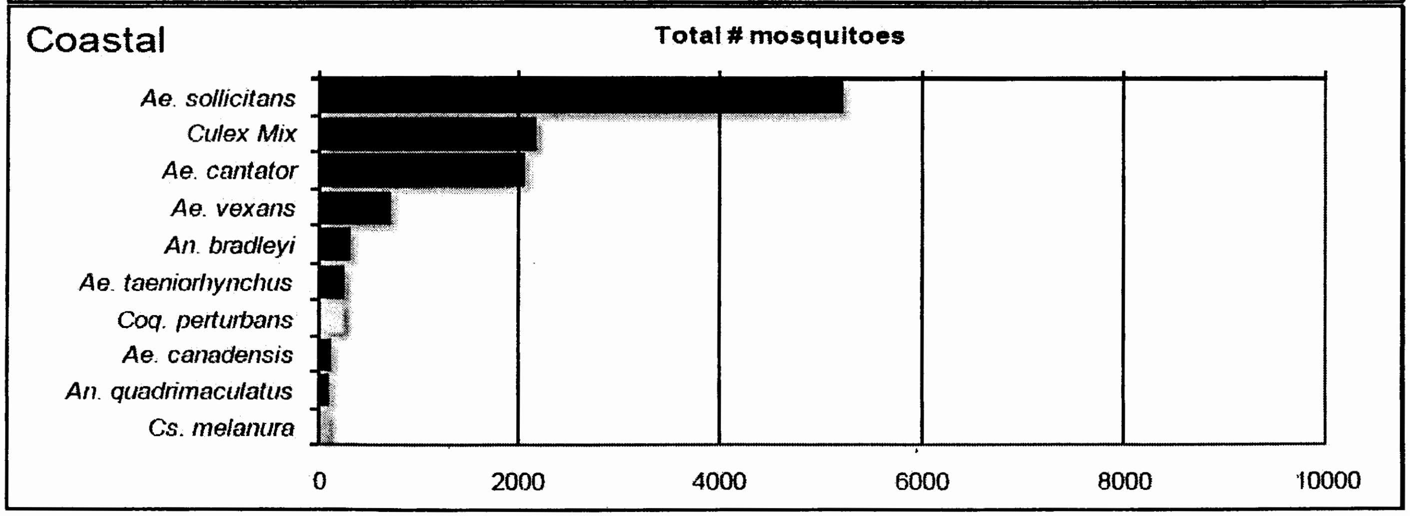
Romanowski, M and Candeletti T. 1984. Identification and surveillance of Coquillettidia perturbans breeding habitat, with observations on larviciding techniques, in Ocean County, N.J. Proc. N. J. Mosquito Control Assoc. pp. 54-58. http://www.rci.rutgers.edu/~insects/sp16.htm

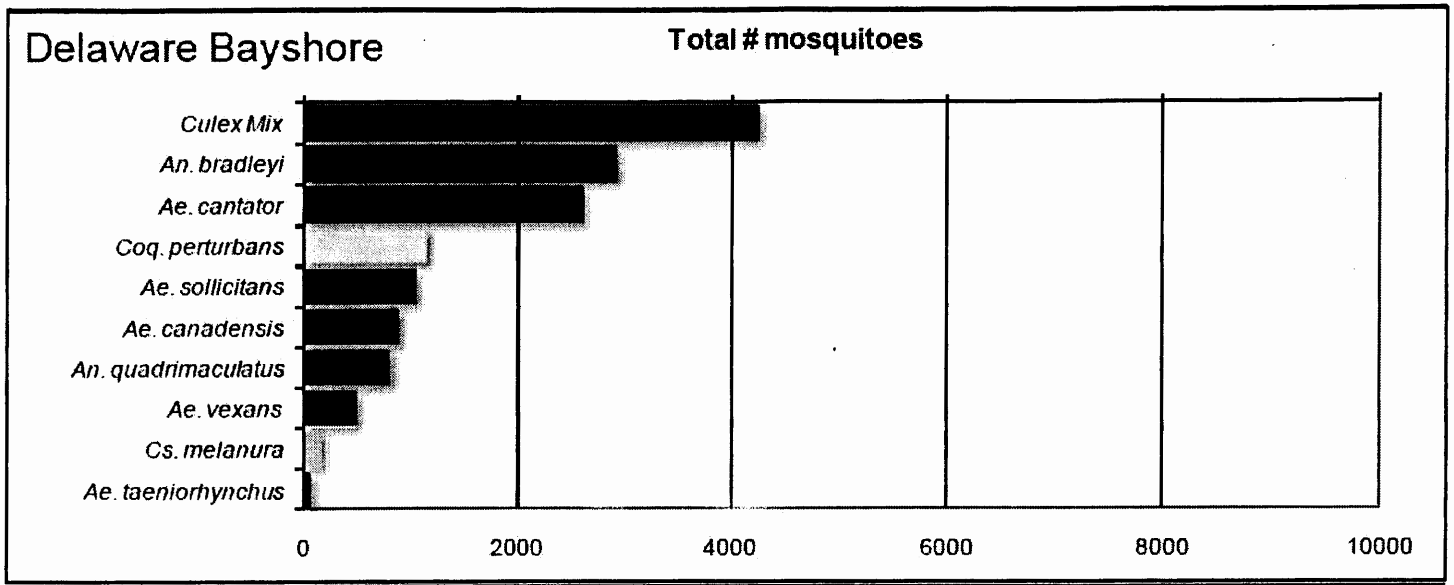
WNV EEE

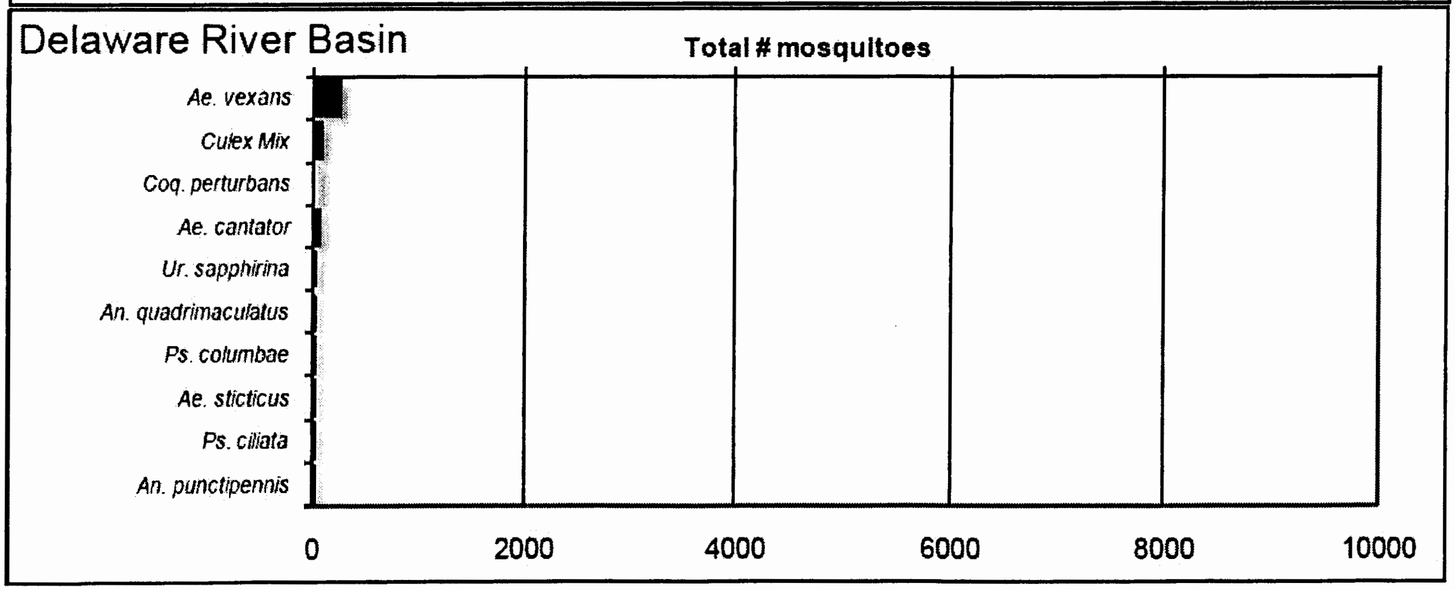
Top Ten Mosquito Species/Region - ■ *Ae. albopictus,* ■ *Ae. japonicus (invasives);* ▩ *Cs. melanura or Cx. erraticus* ☐ *Coq. perturbans*

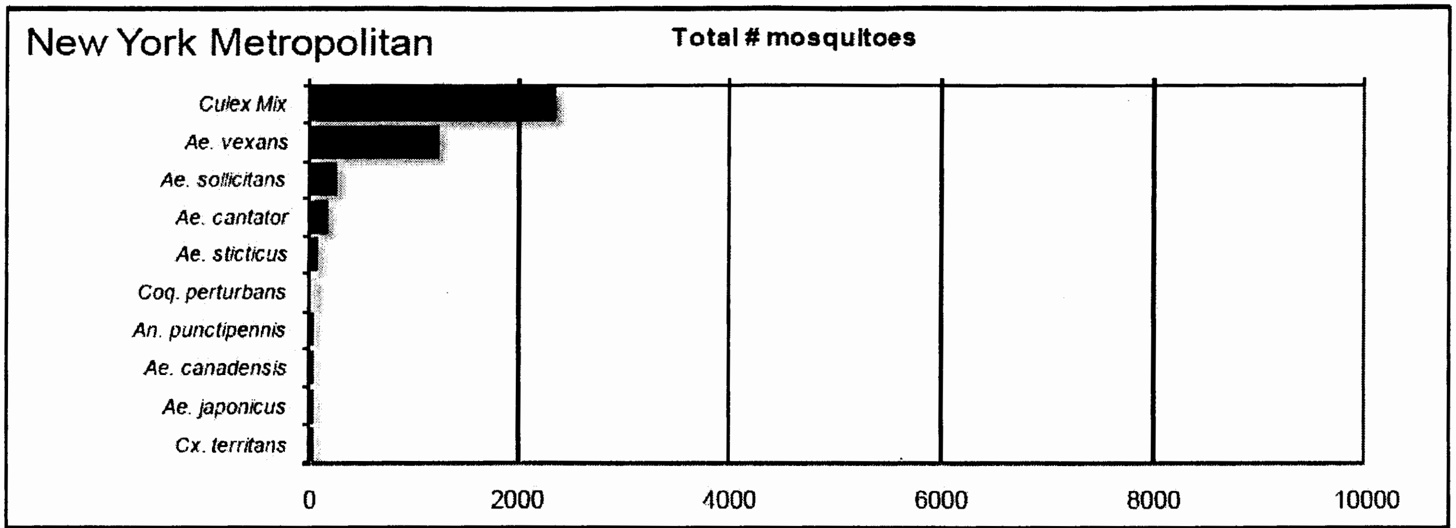
Note: In early season when fewer species are caught, graphs may show less than ten species listed.

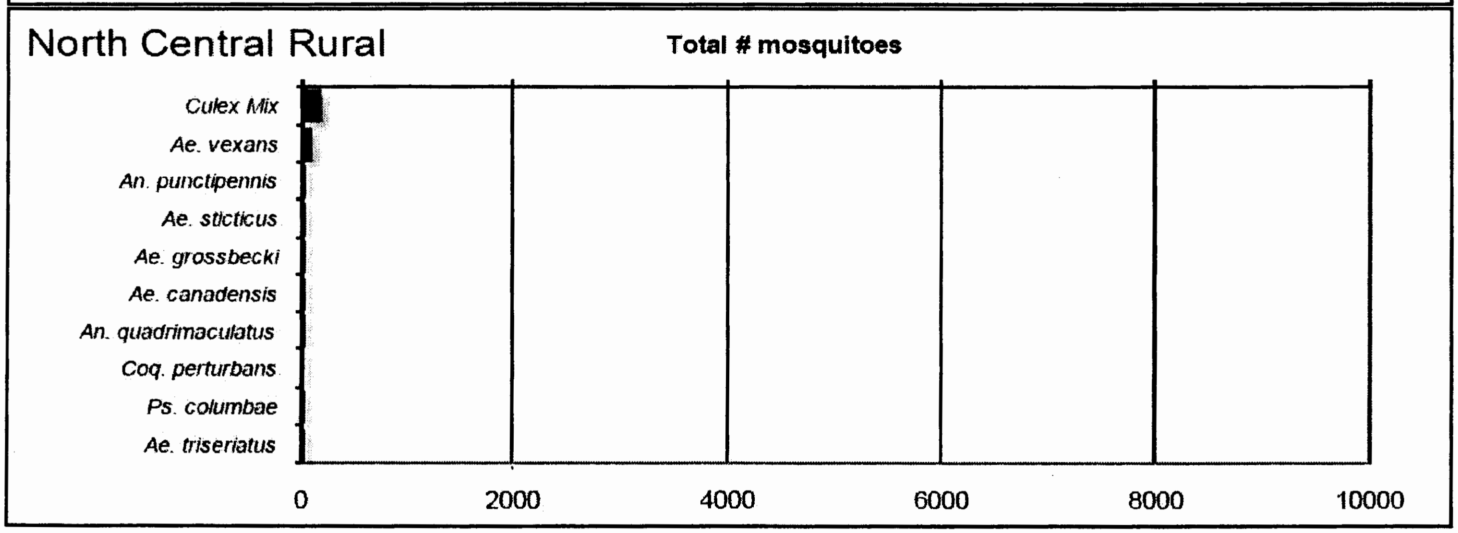


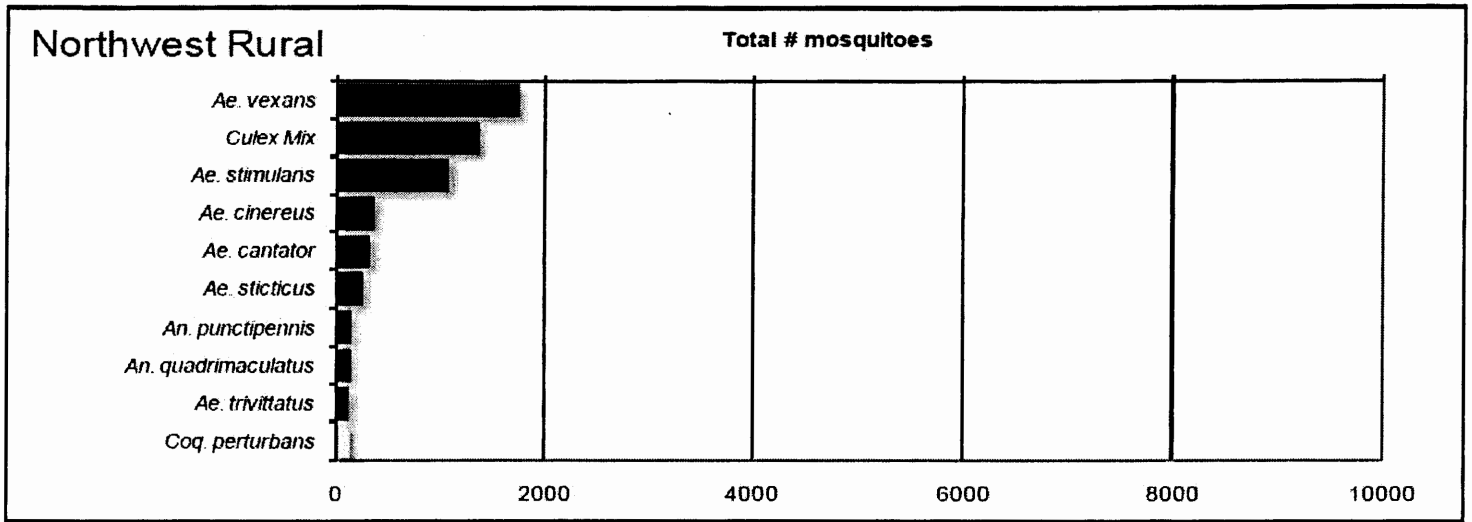


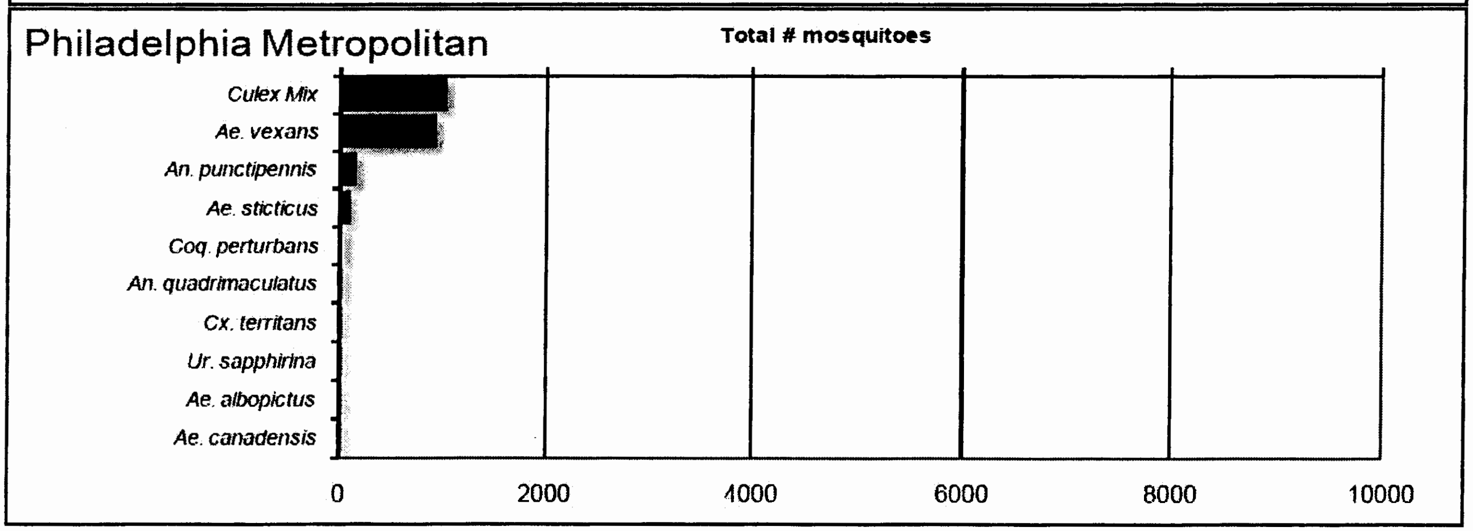

Delaware Bayshore
Total # mosquitoes
Culex Mix
An. bradleyi
Ae. cantator
Coq. perturbans
Ae. sollicitans
Ae. canadensis
An. quadrimaculatus
Ae. vexans
Cs. melanura
Ae. taeniorhynchus
0
2000
4000
6000
8000
10000

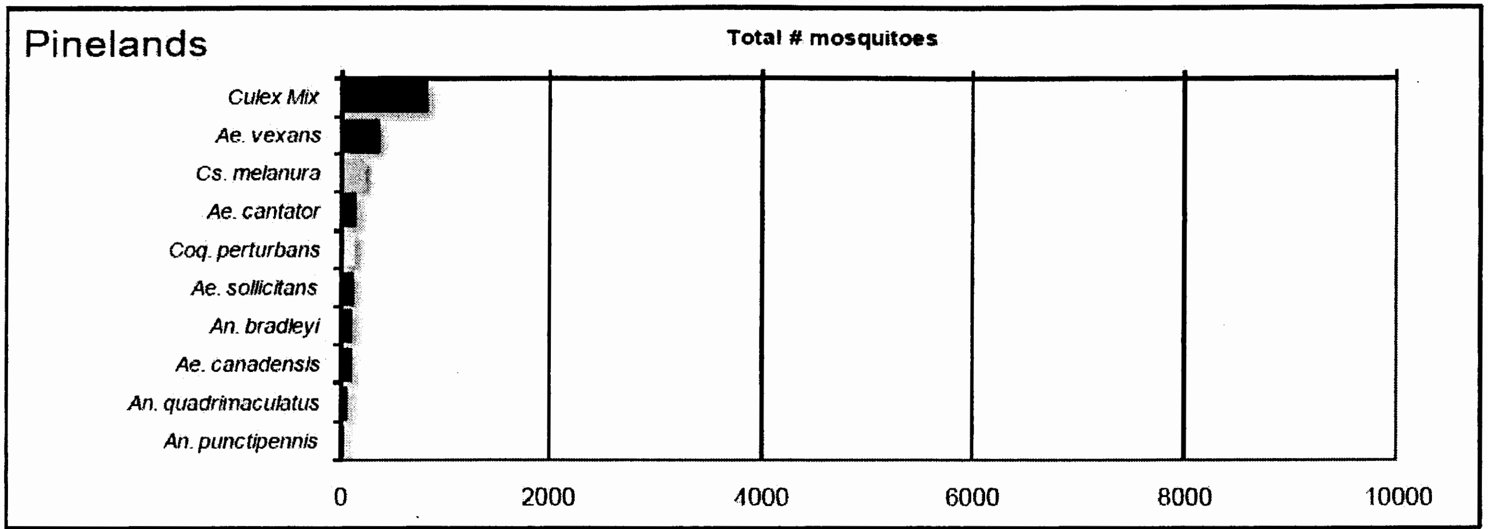

Delaware River Basin
Total # mosquitoes
Ae. vexans
Culex Mix
Coq. perturbans
Ae. cantator
Ur. sapphirina
An. quadrimaculatus
Ps. columbae
Ae. sticticus
Ps. ciliata
An. punctipennis
0
2000
4000
6000
8000
10000

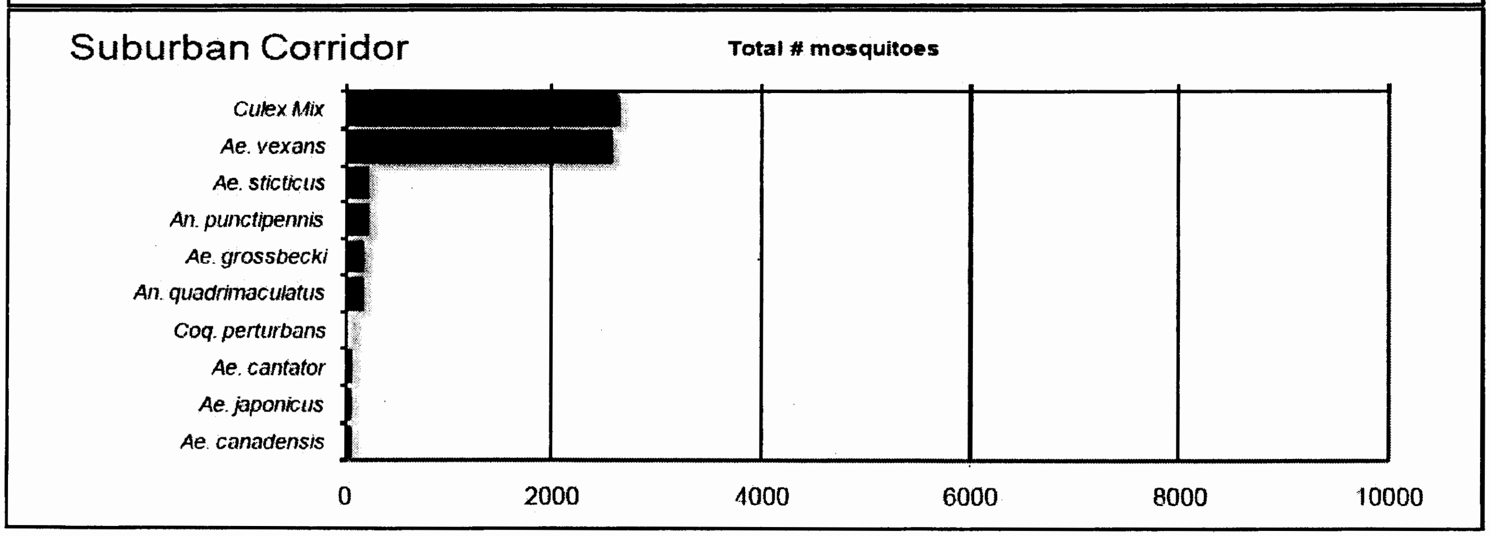

New York Metropolitan
Total # mosquitoes
Culex Mix
Ae. vexans
Ae. sollicitans
Ae. cantator
Ae. sticticus
Coq. perturbans
An. punctipennis
Ae. canadensis
Ae. japonicus
Cx. territans
0
2000
4000
6000
8000
10000

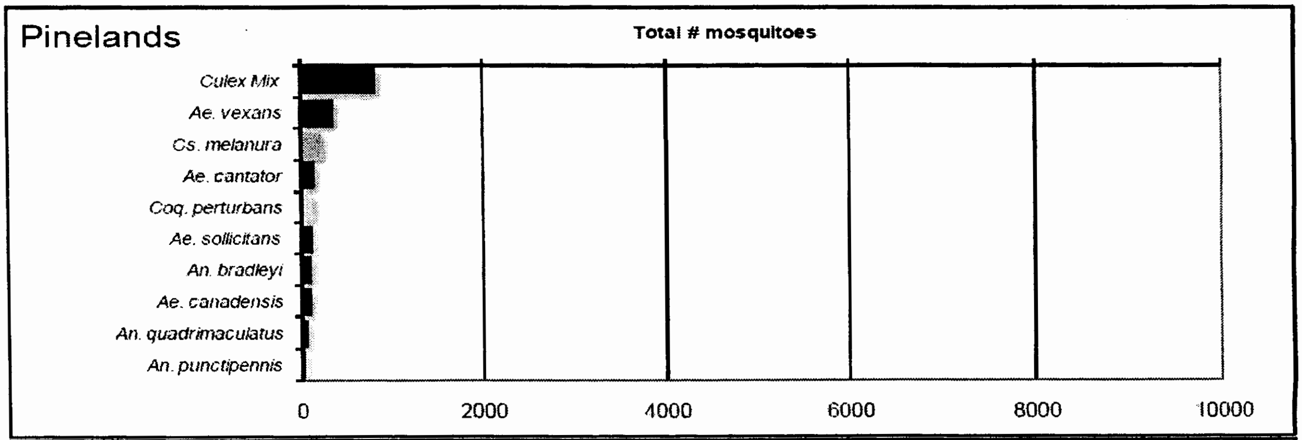

North Central Rural
Total # mosquitoes
Culex Mix
Ae. vexans
An. punctipennis
Ae. sticticus
Ae. grossbecki
Ae. canadensis
An. quadrimaculatus
Coq. perturbans
Ps. columbae
Ae. triseriatus
0
2000
4000
6000
8000
10000

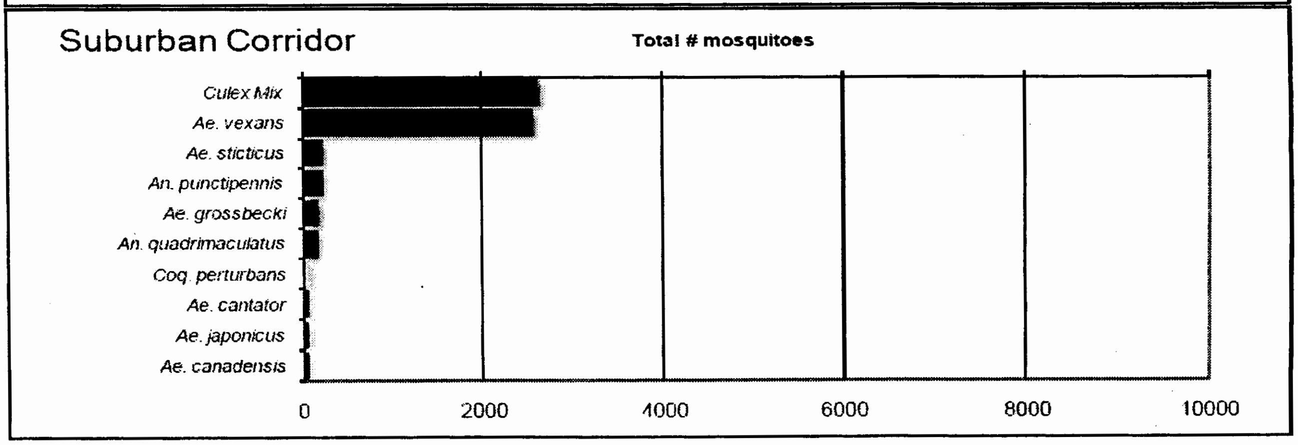

Northwest Rural
Total # mosquitoes
Ae. vexans
Culex Mix
Ae. stimulans
Ae. cinereus
Ae. cantator
Ae. sticticus
An. punctipennis
An. quadrimaculatus
Ae. trivittatus
Coq. perturbans
0
2000
4000
6000
8000
10000


Philadelphia Metropolitan
Total # mosquitoes
Culex Mix
Ae. vexans
An. punctipennis
Ae. sticticus
Coq. perturbans
An. quadrimaculatus
Cx. territans
Ur. sapphirina
Ae. albopictus
Ae. canadensis
0
2000
4000
6000
8000
10000


Pinelands
Total # mosquitoes
Culex Mix
Ae. vexans
Cs. melanura
Ae. cantator
Coq. perturbans
Ae. sollicitans
An. bradleyi
Ae. canadensis
An. quadrimaculatus
An. punctipennis
0
2000
4000
6000
8000
10000


Suburban Corridor
Total # mosquitoes
Culex Mix
Ae. vexans
Ae. sticticus
An. punctipennis
Ae. grossbecki
An. quadrimaculatus
Coq. perturbans
Ae. cantator
Ae. japonicus
Ae. canadensis
0
2000
4000
6000
8000
10000





Prepared by Lisa Reed, Ph.D., Department of Entomology, Rutgers University

THE SURVEILLANCE OF VECTOR-BORNE ARBOVIRUSES IN NEW JERSEY

Introduction

The NJ State Mosquito Control Commission (SMCC) has monitored potential vectors of mosquito-borne encephalitis in New Jersey since 1975 with a vector surveillance program designed to keep health related agencies aware of the potential for human involvement. Eastern equine encephalitis (EEE) was an original target for investigation because of its impact on coastal resorts in the southern portion of the state. West Nile virus (WNV) was added to the program in 2000 following an outbreak in New York City the previous year. In 2009, Saint Louis encephalitis and La Cross encephalitis surveillance were added. County mosquito control personnel were recruited and trained to collect and process specimens. This program functions as a cooperative effort that includes the NJ Department of Environmental Protection, the NJ Department of Health, the NJ Agricultural Experiment Station at Rutgers and the 21 county mosquito control agencies in the state. The goal is a disease surveillance effort that provides mosquito control with information to target vector populations for the prevention of human disease. This report documents the results of virus surveillance efforts during the 2010 encephalitis season.

Methodology of EEE Surveillance

The mosquito, *Culiseta melanura*, is monitored from late May to about mid-October as the primary indicator of EEE virus in southern New Jersey. This ornithophilic mosquito transmits virus to birds as part of the amplification and transmission cycle. *Cs. melanura* usually does not bite mammals but can be used to monitor virus levels as the season progresses. Weekly collections of *Cs. melanura* were made from resting boxes at permanent study sites by teams of field staff from four counties: Atlantic, Cape May, Monmouth and Ocean counties. The mosquitoes were frozen on dry ice at the collection site and transported to county labs for further processing. The frozen specimens were sorted on chill tables to maintain the cold chain and were identified to species, pooled and submitted weekly to the Public Health Epidemiological Labs (PHEL) facility of the Department of Health and Senior Services in Trenton or to the Cape May labs at the Cape May County Department of Mosquito Control for virus testing. Positive pools were detected by Taqman RT-PCR. Information from the investigation was summarized and distributed weekly to mosquito control and public health agencies in New Jersey and the Northeast through the website http://vectorbio.rutgers.edu/surveillance.php . The resting box collection sites for 2010 included:, Centerton in Salem County, Corbin City in Atlantic County, Dennisville in Cape May County, Glassboro in Gloucester County, Green Bank in Burlington County, Turkey Swamp in Monmouth County and Winslow in Camden County.

Results of EEE Surveillance in 2010

Culiseta melanura populations in the Pinelands began with low spring populations in 2009 but ended with high second generation populations. This set up for the potential of high spring populations in 2010 as the second generation of the previous year contribute to the overwintering larval population that emerges the following spring. Indeed, the 2010 spring populations were also high. This pattern of higher population number did not continue through the season and quickly fell to or below historical values. This may have been due to unusual climatic factors. The winter of 2010 saw considerable precipitation such that sheet water was commonly seen in southern New Jersey. This was followed by a warm spring. Beginning in April 2010, rainfall decreased significantly and New Jersey was under drought conditions through September. *Cs. melanura* is primarily found in acid water such as Atlantic white cedar swamps and generally in protected areas such as under roots of trees where water is likely controlled by ground water table levels. When ground water table levels decrease, the amount of suitable habitat is likely to decrease as well, reducing survivability of larvae. USGS groundwater surveys indicate that water levels decreased through the season.

Figure 1. Populations of *Culiseta melanura* in two years of light trapping in southern New Jersey during 2009 (left) and 2010(right). This bivoltine species overwinters as larvae. The size of the overwintering population, partially determined by the fall population of the first year, can contribute to the size of the population that emerges the following spring.

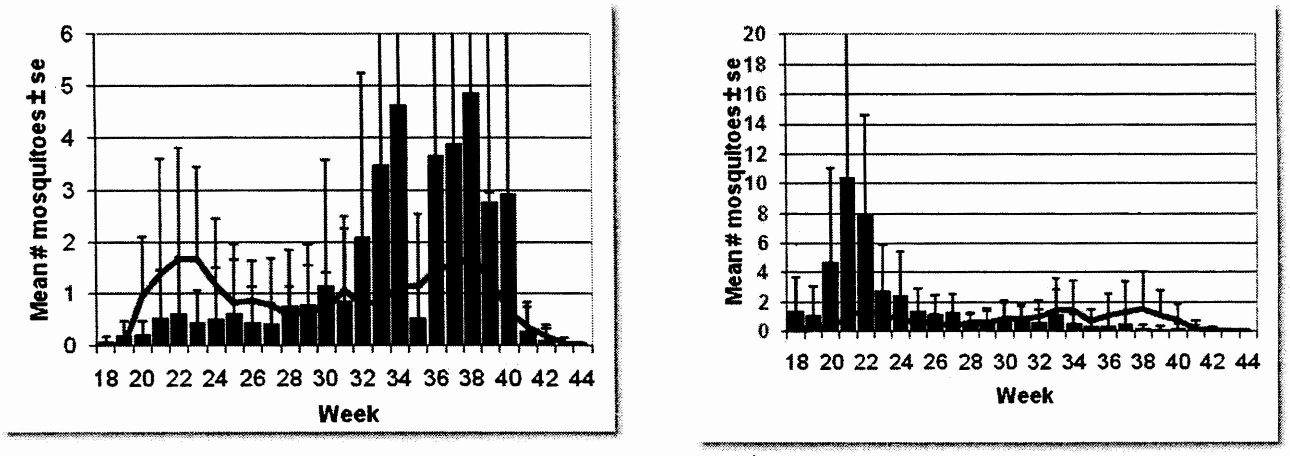
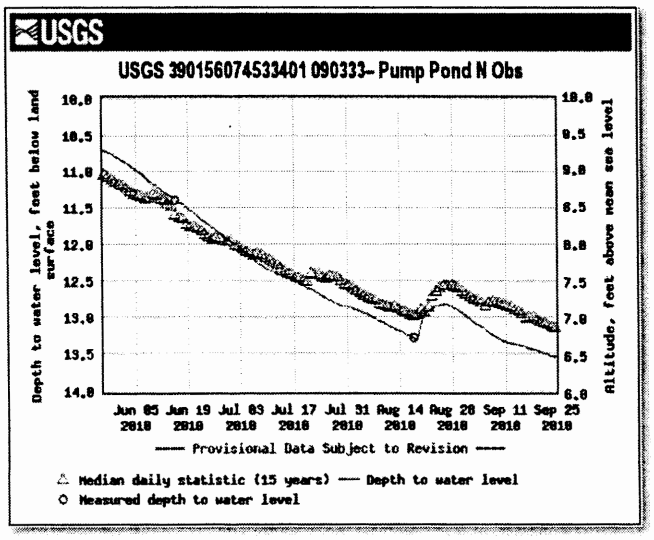


Figure 2. USGS data from a well source in northern Cape May County indicating ground water depth. As the season progressed, 2010 water levels (in blue) began higher than historical levels, but went below historical levels between 3 July and 17 July (CDC week 26 to 28). This corresponded to the time that population levels went at or below historical levels.



In the previous year, considerable EEE activity was detected with more than 100 mosquito pools found positive, including species other than the enzootic vector. In 2010, activity was significantly reduced, producing 21 positive pools, nineteen from *Cs. melanura*. *Culex erraticus* produced two positive pools. The decrease in EEE activity in New Jersey from 2009 to 2010 was also reflected in a decrease of EEE activity on the national scale. The number of positive mosquito pools nationally decreased from 580 to 177. Positive pools were first detected at a traditional resting box site (Dennisville) and from a county-run trap (Cape May) on 12 July. In the recent past, positive pools occurring before August tended to result in multiple horse cases, but this did not occur this year (see Horses, below). The traditional resting box sites produced 8 of the 19 positive *Cs. melanura* pools while the county-run sites produced 11 of the positive pools. The two positive *Cx. erraticus* pools were sampled from Cape May in county-run resting boxes. These two samples were collected on the 3rd and 17th of August. The last positive EEE pool was a *Cs. melanura* sample collected on 28 September from the Centerton resting box site.

Table 12. Total number of *Culiseta melanura* tested for EEE by site in 2010 with number positive pools and earliest isolation dates.

Site Name	Coastal or Inland	Total Pools	Total Mosquitoes	Positive pools	MFIR	Earliest Date
Corbin City	Coastal	20	369	0		
Dennisville	Coastal	26	725	2	2.76	12 Jul 2010
Green Bank	Coastal	22	251	0		
Centerton	Inland	40	1617	3	1.86	17 Aug 2010
Glassboro	Inland	19	513	0		
Turkey Swamp	Inland	66	763	0		
Winslow	Inland	51	2179	3	1.47	9 Aug 2010
Statewide		**252**	**6417**	**8**	**1.25**	12 Jul 2010

Counties often send out their own traps after the first positive EEE pool is detected, or as part of an ongoing surveillance. Counties caught *Cs. melanura* in a variety of traps, including CO2 traps, gravid and resting boxes.

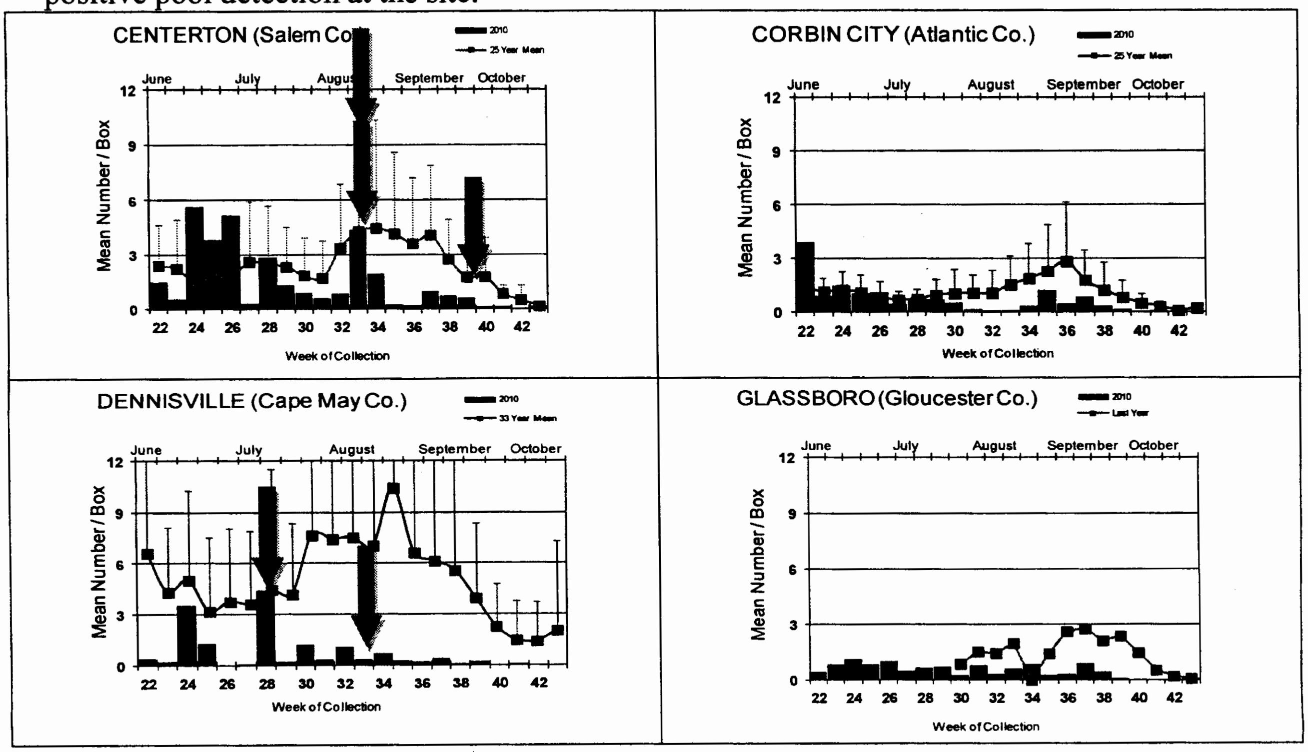
Table 13 Total number of *Cs. melanura* caught at non-traditional sites, by county and trap.

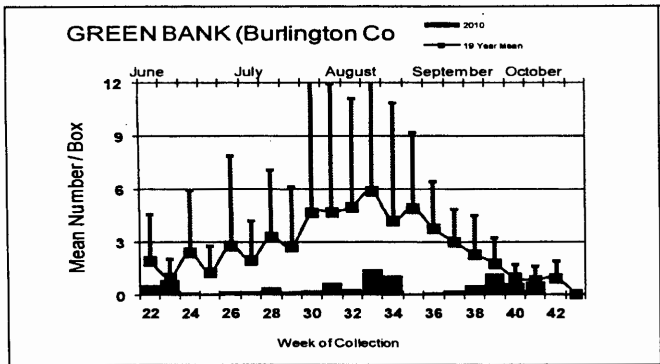
County/Trap Type	Total Pools	Total Mosquitoes	Positive Pools	MFIR
Atlantic	1	17		
CO2 Trap	1	17		
Burlington	70	2582	4	1.55
CO2 Trap	70	2582	4	1.55
Camden	2	3		
	2	3		
Cape May	171	2130	2	0.94
CO2 Trap	3	40		0
Gravid	84	197		0
Resting Box	84	1893	2	1.06

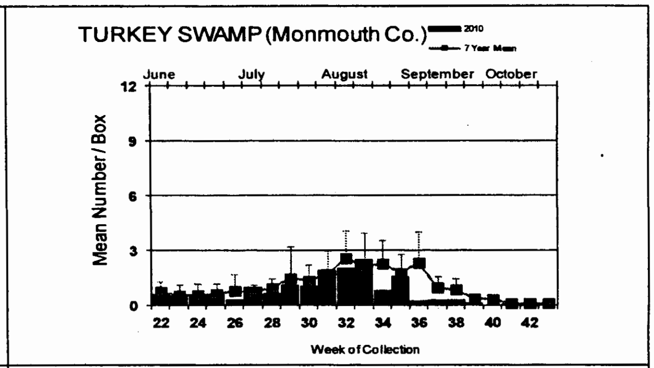
Cumberland	24	509	2	3.93
Gravid	2	2		0
Resting Box	22	507	2	3.94
Gloucester	95	1516	3	1.98
Resting Box	95	1516	3	1.98
Ocean	37	232		
CO2 Trap	18	147		
Gravid	7	9		
Resting Box	12	76		
Salem	1	1		
CO2 Trap	1	1		
Sussex	18	32		
CO2 Trap	6	12		
NJ Light Trap	12	20		
Grand Total	419	7022	11	1.57

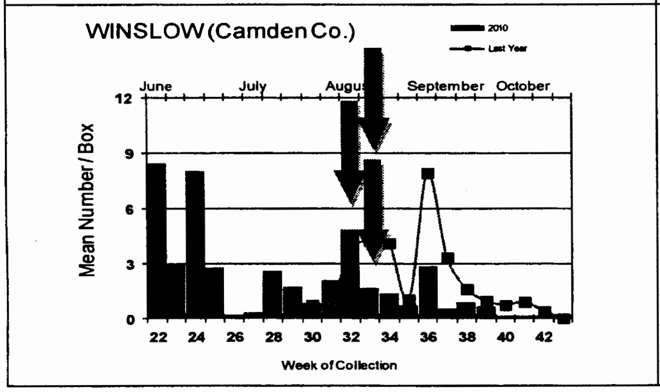
Figure 3 shows the population development over the season and the occurrence of positive *Cs. melanura* pools at the traditional resting box sites.

Figure 4. Population levels of *Cs. melanura* at the seven traditional monitoring sites. 2010 population levels are in black bars, historical trends (between 1 and 30 years) are in blue (coastal sites) or green lines (inland sites) with error bars, and red arrows indicate weeks of positive pool detection at the site.









In addition to *Cs. melanura* positive pools, EEE was detected in other species. Table x indicates that the only positive species other than *Cs. melanura* was *Culex erraticus*. *Cs. erraticus* was first detected in New Jersey in the 1960's and has been considered relatively rare until the past several years. A significant increase in both numbers and range in New Jersey, plus the involvement of *Cx. erraticus* in the EEE cycle in the southeastern US prompted its inclusion in the testing for EEE. In 2009 no positives were detected, but this year showed 13 positive pools from two distinct sites.

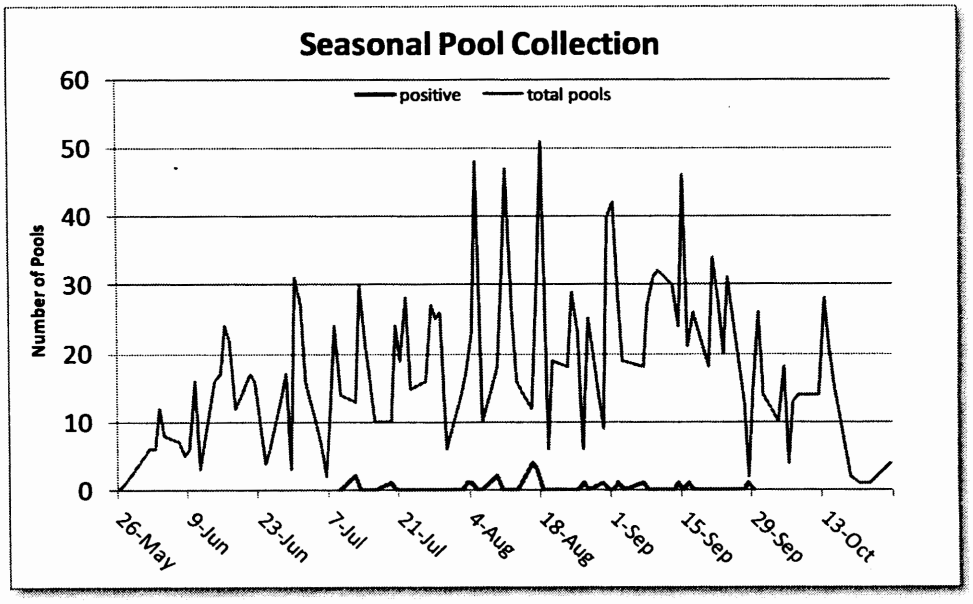
Table 14. Total non-*Cs. melanura* species tested for EEE. EEE was detected only in *Culex erraticus*. A total of 2 pools were detected in non-*Cs. melanura* species for 2010.

Species	Total Pools	Total Mosquitoes	Positive Pools	MFIR
Aedes albopictus	39	313		
Aedes canadensis canadensis	8	117		
Aedes cantator	3	3		
Aedes japonicus	6	23		
Aedes sollicitans	16	266		
Aedes taeniorhynchus	3	10		
Aedes triseriatus	18	57		
Aedes trivittatus	1	2		
Aedes vexans	28	374		
Anopheles bradleyi	47	487		
Anopheles crucians	2	122		
Anopheles punctipennis	14	87		

Anopheles quadrimaculatus	21	180		
Coquillettidia perturbans	54	897		
Culex erraticus	175	4479	2	0.45
Culex pipiens	429	3042		
Culex restuans	17	36		
Culex salinarius	60	699		
Culex spp.	253	5035		
Culex territans	2	2		
Culiseta minnesotae	2	2		
Psorophora columbiae	1	5		
Uranotaenia sapphirina	1	6		
Grand Total	1200	16244	2	0.12

Figure 5 indicates that all positive pool detections occurred well within the surveillance season.

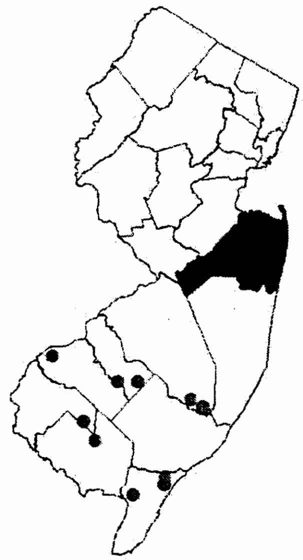
Figure 6. Timeline for positive pool detection of EEE in 2010.



Horse and Human Involvement with EEE:
Despite early detection in mosquitoes, there was only one horse that developed EEE. This horse from Monmouth County showed symptoms late in the season during epiweek 40 (October). Increased county surveillance to detect positive mosquitoes around this site did not result in any positives. This case was well north of any positive EEE mosquito pools.

There were no human cases.

Figure x. Location of county with the single horse case in Monmouth County (red fill) and location of positive EEE mosquito pools (green circles).



Methodology of WNV Surveillance

New Jersey's WNV surveillance program relies on county initiative to conduct meaningful surveillance within their county borders. Counties have various approaches to monitoring West Nile virus activity, ranging from focusing on the enzootic vector, *Culex pipiens* (primarily through the submission of Mixed *Culex* pools) to the submission of a wide range of potential bridge vectors. In 2010, mosquitoes were sampled through a variety of traps, chilled and transported to county labs for identification and pooling. Pools were submitted weekly to the PHEL facility in Trenton or to the Cape May labs at the Cape May County Department of Mosquito Control for WNV virus testing. Positive pools were detected by Taqman RT-PCR. Information from the investigation was summarized and distributed weekly to mosquito control and public health agencies in New Jersey and the Northeast through the website http://vectorbio.rutgers.edu/surveillance.php .

Results of WNV Surveillance in 2010

During the 2010 mosquito season, a total of 156,748 specimens were tested in 7,457 pools from 32 species. This is a decrease of about 50,000 mosquitoes and 3,000 pools, likely a result of the extended drought that impacted mosquito populations throughout the state. Results from the surveillance effort produced 846 WNV positive pools, an increase of 202 more positive pools than from the previous year when more overall submissions took place. All of New Jersey's 21 county mosquito control agencies participated in the state program during 2010. Table x indicates species results. The majority of positive pools came from *Culex* species, either mixed pools or species-identified, with *Culex pipiens*, the enzootic vector of WNV showing the highest degree of infection at 8.577 mosquitoes/1000 of the three mixed species. This was also an increase in MFIR value for this species from the previous year. *Culex restuans* was again the second most infected species, with an MFIR value of 2.993, also an increase from 2009. Last year *Culex salinarius* was the least of the infected mosquito species with an MFIR of 0.194. This year, the infection rate was higher (0.938). The mixed *Culex* pool had an MFIR value much closer to the value for *Culex pipiens* and it is likely that *Cx. pipiens* contributes proportionally to the overall Mixed *Culex* pools, continuing the pattern observed for several years. *Culiseta melanura*, another ornithophilic species, was also positive, with an MFIR value of 1.248.

Table 15. Mosquitoes tested for West Nile in New Jersey during 2010.

Species	Total pools	Total mosquitoes	Positive pools	MFIR
Aedes albopictus	704	3979	9	2.262
Aedes canadensis canadensis	29	485		
Aedes cantator	10	24		
Aedes japonicus	402	1807		
Aedes sollicitans	25	324		
Aedes sticticus	1	1		
Aedes stimulans	3	8		
Aedes taeniorhynchus	9	116		

Aedes triseriatus	179	388		
Aedes trivittatus	9	41		
Aedes vexans	151	1604		
Anopheles barberi	2	2		
Anopheles bradleyi	63	536		
Anopheles crucians	3	124		
Anopheles punctipennis	65	437		
Anopheles quadrimaculatus	128	1232		
Anopheles walkeri	5	29		
Coquillettidia perturbans	108	1655	1	0.604
Culex erraticus	190	4538		
Culex pipiens	1067	20170	173	8.577
Culex restuans	411	2005	6	2.993
Culex salinarius	85	1066	1	0.938
Culex spp.	3113	104116	641	6.157
Culex territans	3	4		
Culiseta inornata	1	1		
Culiseta melanura	670	12015	15	1.248
Culiseta minnesotae	2	2		
Orthopodomyia signifera	5	6		
Psorophora ciliata	1	1		
Psorophora columbiae	5	13		
Psorophora cyanescens	1	1		
Psorophora ferox	4	5		
Uranotaenia sapphirina	3	13		
Statewide	**7457**	**156748**	**846**	**5.397**

Table 16 also lists infection rates in potential bridge vectors. In prior years, WNV was detected in *Aedes albopictus, Coquillettidia perturbans* and *Culex salinarius*. The first and last species are highly competent vectors as well as aggressive mammalian biters. (*Coquillettidia perturbans* is a mosquito that is an inefficient vector for WNV) In 2010, *Aedes* japonicus was not found to be infected for the samples collected. But slightly more than 10 percent of the positive pools were in species other than bird biters, a tenfold increase over last year.

While counties (Table x) tended to maintain their collection patterns from one year to the next, counties varied on what they collected, likely based upon many factors. In the past several years, the number of pools submitted by counties for detecting WNV continued to play a significant role, with more pools likely to detect WNV activity. This year, the trend was not observed, (Spearman's r = -0.281, df=19, p>0.05). This pattern may have been affected by counties sampling in areas previously known to have virus activity which may be more likely to detect positive pools. Widespread WNV activity may have also contributed to this pattern.

Table 17. Cumulative infection rates in each county in the 2010 season.

County	Total pools	Total mosquitoes	Positive pools	MFIR
Atlantic	292	6726	60	8.921

Bergen	223	15612	140	8.967
Burlington	342	9495	46	4.845
Camden	262	5992	76	12.684
Cape May	1955	19393	11	0.567
Cumberland	81	720	1	1.389
Essex	337	3644	25	6.861
Gloucester	462	11421	117	10.244
Hudson	232	11403	94	8.243
Hunterdon	300	12270	11	0.896
Mercer	241	5302	59	11.128
Middlesex	266	10058	53	5.269
Monmouth	373	2668	9	3.373
Morris	251	7906	47	5.945
Ocean	331	4099	18	4.391
Passaic	146	1851	11	5.943
Salem	310	2708	1	0.369
Somerset	266	3060	10	3.268
Sussex	403	9671	6	0.620
Union	168	5932	44	7.417
Warren	216	6817	7	1.027
Grand Total	**7457**	**156748**	**846**	**5.397**

Out of the 241 avian species sent to PHEL, 129 tested positive for the presence of West Nile virus (Table x). Infection rates increased from the previous year for the three identified corvids (American and Fish Crow, Blue Jay). Submission of dead birds has varied considerably over the recent years as either the public does not report birds (surveillance fatigue, misinformation) or that the counties do not submit birds regardless of the requests of PHEL for continued participation. This year, submissions of dead birds were correlated with positive detection of WNV in birds ($r=0.982$, $df=12$, $p<0.05$). But, the number of positive dead birds in a county did not correlate with the MFIR value of positive mosquitoes ($r=-0.017$, $df=12$, $p>0.05$). Counties submitting dead birds were Atlantic, Bergen, Burlington, Camden, Cape May, Essex, Hunterdon, Mercer, Monmouth, Morris, Ocean, Sussex and Warren counties.

Table 18. Birds tested at PHEL for the presence of WNV and their corresponding infection rates.

Species	Negative	Positive	Tested	IR
American crow *Corvus brachyrhynchos*	7	25	32	0.781
Blue Jay *Cyanocitta cristata*	15	46	61	0.754
Fish crow *Corvus ossifragus*	13	33	46	0.717
Hawk	6	2	8	0.250
Other	61	12	73	0.164
Unidentified crow *Corvus*	10	11	21	0.524
All Birds	107	53	160	0.33

Horse and Human Involvement

There were two equine cases reported in 2010, a two year-old mare from Atlantic County (week 33, onset date of 17 August), and a second horse from Gloucester County (week 37, onset date 18 September). Both horses were unvaccinated.

Thirty human cases of WNV fever or neuroinvasive disease were detected in New Jersey. This was three times the number of cases that occurred in 2009. The first cases occurred during epiweek 31, the beginning of August. Last case was detected in the beginning of October. Figure x shows the distribution of human cases among counties over the distribution of positive mosquito pools. The distribution of cases follows the distribution of human population, along the urban –suburban corridor and down the coast and is typical for this urban disease. Figure x shows the epicurve for human cases under statewide weekly MFIR values (all mosquitoes). The cases appear well after the amplification of virus in mosquitoes, with first cases appearing when MFIR overall values were at 8.

Figure x. Cumulative WNV activity by the end of the mosquito season. Circles show when positive WNV pools were detected by week. Two horse cases are indicated by icon. The number of human cases per county are also shown.

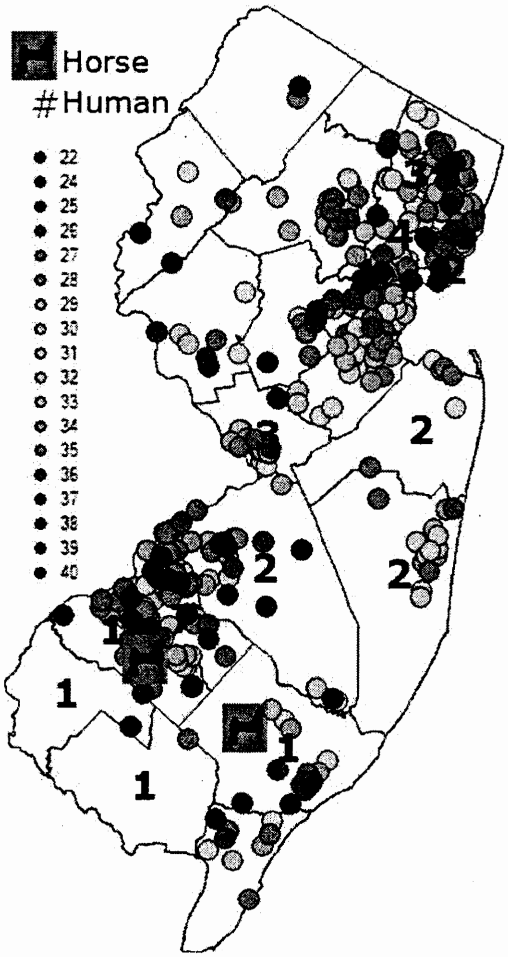
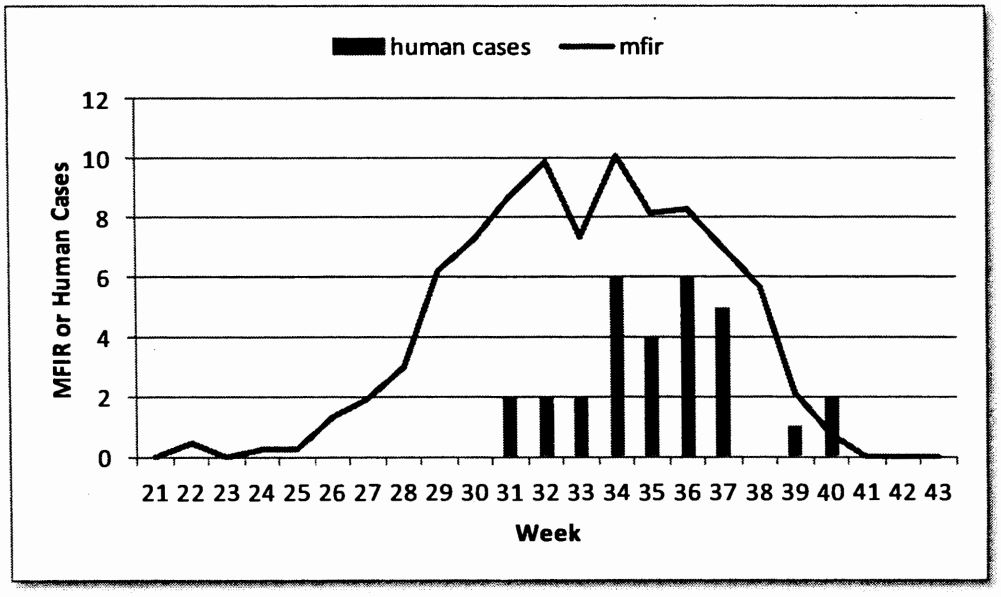
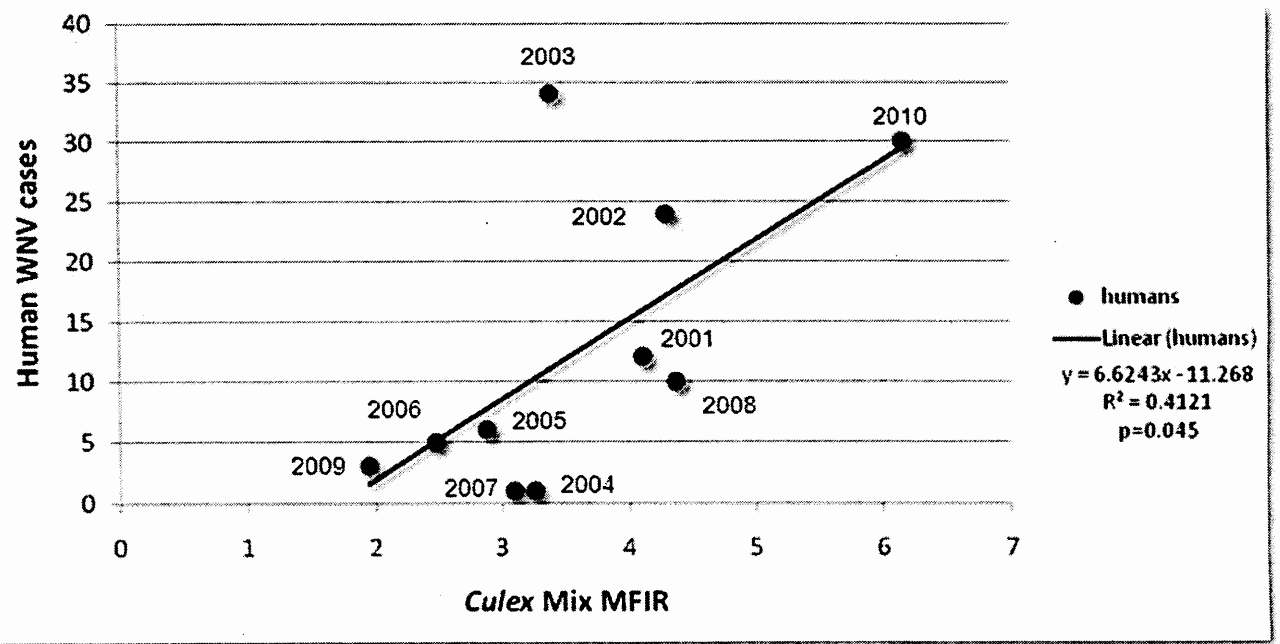


Figure 7. Human case distribution over week (blue bars) with weekly statewide MFIR values of all mosquitoes in 2010.



With the increased activity in *Culex* infections and the higher number of human cases observed in New Jersey, *Culex* MFIR rates were regressed onto human cases, ranging from 2001-2010 (Figure x). A significant positive linear relationship was found [human cases=6.623(*Culex* MFIR) – 11.268, R^2=0.41, p=0.045], suggesting that as MFIR values increase, human cases increase.

Figure 8. Correlation between *Culex* minimum field infection rates (MFIR) and human cases in New Jersey from 2001 through 2010.



Methodology and Results of St. Louis Encephalitis (SLE) Surveillance

New Jersey selectively tested for St. Louis encephalitis virus (SLE) in 2010. SLE has had previous activity in New Jersey, most notably in 1964 and 1975 (CDC's SLE **website**), the latter prompting the vector surveillance reporting by Rutgers. SLE is a flavivirus and has a similar transmission pattern to West Nile, with *Culex* species as the predominant vectors. Between 1964 and 2008, New Jersey has experienced 131 cases. Fatality rates are from 5-15% (CDC.gov website).

No pools tested positive for 2010 (Table 19).

Table 19. Mosquito species by county tested for SLE in 2010 through RT-PCR at NJDHHS PHEL.

	Pools	Mosquitoes
Burlington	316	9238
Aedes albopictus	30	289
Aedes canadensis canadensis	4	109
Aedes japonicus	4	17
Aedes sollicitans	6	185
Aedes taeniorhynchus	2	9
Aedes triseriatus	1	7
Aedes vexans	25	367
Anopheles bradleyi	8	190
Anopheles crucians	2	122
Anopheles punctipennis	1	13
Anopheles quadrimaculatus	3	10
Coquillettidia perturbans	9	352
Culex erraticus	17	635
Culex pipiens	8	107
Culex restuans	1	1
Culex salinarius	9	51
Culex spp.	113	4180
Culiseta melanura	70	2582
Culiseta minnesotae	1	1
Psorophora columbiae	1	5
Uranotaenia sapphirina	1	6
Camden	216	4771
Aedes albopictus	41	125
Aedes canadensis canadensis	1	1
Aedes japonicus	20	33
Aedes triseriatus	2	2

Aedes trivittatus	1	1
Aedes vexans	3	50
Anopheles punctipennis	5	7
Anopheles quadrimaculatus	1	1
Culex erraticus	2	8
Culex spp	133	4529
Culex territans	1	2
Culiseta melanura	1	1
Orthopodomyia signifera	2	3
Psorophora columbiae	1	1
Uranotaenia sapphirina	2	7
Cape May	974	17345
Aedes albopictus	18	88
Aedes cantator	1	2
Aedes japonicus	6	34
Aedes triseriatus	3	14
Anopheles quadrimaculatus	1	1
Coquillettidia perturbans	2	22
Culex erraticus	2	78
Culex pipiens	350	6575
Culex restuans	178	1775
Culex salinarius	21	182
Culex spp.	379	8423
Culiseta melanura	13	151
Essex	298	3557
Aedes albopictus	47	171
Aedes japonicus	37	291
Aedes sollicitans	1	18
Aedes triseriatus	6	13
Aedes vexans	18	134
Culex spp.	189	2930
Hudson	190	9703
Aedes albopictus	1	25
Culex spp.	189	9678
Salem	1	7
Culex spp.	1	7
Sussex	16	48
Aedes triseriatus	16	48
Grand Total	**1037**	**27324**

Methodology and Results of La Crosse Encephalitis (LAC) Surveillance

New Jersey selectively tested for La Crosse (LAC) virus this year. New Jersey has had 3 cases of this encephalitic disease since 1964 (see CDC's LAC website). The mortality is low but like other encephalitides, LAC can have both personal (lasting neurological sequelae) and economic impacts. LAC is a bunyavirus with a transmission cycle involving mosquitoes such as *Aedes triseriatus* and small mammals such as squirrels and chipmunks. LAC can infect *Aedes albopictus* with transovarial transmission also demonstrated (Tesh and Gubler 1975 Laboratory studies of transovarial transmission of La Crosse and other arboviruses by *Aedes albopictus* and *Culex fatigans*. American Journal of Tropical Medicine and Hygiene 24(5):876-880).

There were no positive pools detected in 2010 (Table x).

Table 20. Mosquito species by county tested for LAC in 2009 through RT-PCR at NJDHHS PHEL.

		Pools	Mosquitoes
Cape May		18	31
	Aedes triseriatus	18	31
Cumberland		7	10
	Aedes triseriatus	7	10.
Salem		5	5
	Aedes triseriatus	5	5
Warren		10	106
	Aedes canadensis canadensis	4	86
	Aedes triseriatus	6	20
Grand Total		40	152

Report submitted by: Lisa Reed, Ph.D., Department of Entomology, Rutgers University

FINANCIAL STATEMENT
STATE MOSQUITO CONTROL COMMISSION
End-of-Year
(FY'11)

FY'11 STATE MOSQUITO CONTROL, RESEARCH $1,346,000.00

ADMINISTRATION AND OPERATIONS APPROPRIATION

Office of Mosquito Control Coordination ($
300,000.00)

Carry Forward $
67,376.10

FY'11 STATE MOSQUITO CONTROL COMMISSION $1,113,376.10

PROGRAMS/SERVICES	ALLOCATED	EXPENDED	BALANCE
Administration	$ 2,770.10	$ 2,370.54	$ 399.56

Toll-Free Number (297.13)[1]
Coffee & Danish- July ($40.00)
Coffee & Danish- Aug. ($100.00)
AMCA Sustain Memb- ($500.00)
Coffee & Danish- Sept. ($40.00)
Coffee & Danish- Oct. ($40.00)
Legislative Index- ($325.00)
Coffee & Danish- Jan. ($40.00)
H. Emerson- Travel ($501.13)
Coffee & Danish – March ($40.00)
Digital recorder - ($99.99)
K. Bruder- Travel ($297.29)[2]
Coffee & Danish – June ($50.00)

State Airspray Program	$ 520,000.00	$ 519,444.96	$ 555.04

Insecticides ($60,128.64)
Insecticides ($1,599.60)
Insecticides ($40,040.00)
Insecticides ($30,064.32)
Downstown Aero- ($300,000.00)
Insecticides ($2,683.20)
Insecticides ($15,032.16)
Insecticides ($30,064.32)
Insecticides ($39,567.28)
Calibration Supplies ($265.44)

Equipment Repairs/Purchases	$ 65,000.00	$ 62,048.90	$ 2,951.10

Rot. Ex. Repair – Atlantic ($2,539.00)
Rot. Ex. Repair – Atlantic ($34,000.00)
Freezer Repair – Cumberland ($750.00)
Resting Boxes ($860.00)
Copepod Sprayers ($174.49)
Courier Vehicle Replacement ($15,175.00)
Dozer Repair – Warren ($4,903.98)
Freezer Repair – Warren ($1,113.00)
Marsh Master Repair – ($513.43)
Turbine Nozzle-Hudson ($2,020.00)

Education and Information	$ 2,000.00	$ 1,408.46	$ 591.54

Exhibit Supplies ($226.79)
NJMCA Exhibit Registration ($185.00)
Print annual reports ($996.67)

MOA

DH/SS WNV Testing	$ 180,000.00	$ 180,000.00	$ 0.00
CM Surveillance/Testing	$ 61,000.00	$ 61,000.00	$ 0.00
Biological Control- Mosquitofish	$ 25,000.00	$ 25,000.00	$ 0.00
Biological Control- Copepods	$ 35,000.00	$ 35,000.00	$ 0.00
Courier for Specimen Transport-North	$ 6,500.00	$ 6,500.00	$ 0.00
Courier for Specimen Transport-South	$ 9,500.00	$ 9,500.00	$ 0.00

Professional Services	$ 206,606.00	$ 206,606.00	$ 0.00
Vector Surveillance ($49,000.00) Monitor of Insecticides ($79,606.00) Statewide Surveillance ($37,000.00) Quality Control and Assurance ($41,000.00)			
TOTAL	**$1,113,376.10**	**$ 1,108,878.86**	**$ 4,497.24**

COMMISSION-SUPPORTED PUBLICATIONS AND PRESENTATIONS

JULY 1, 2010 – JUNE 30, 2011

Presentations

Reed, L. 2010. *Vector and Mosquito Population Surveillance in New Jersey, 2010.* Northeastern Mosquito Control Association, Sturbridge Massachusetts.

Reed, L. 2010. *Vector and Mosquito Population Surveillance in New Jersey, 2010.* New Jersey Mosquito Control Association, Atlantic City, New Jersey.

Kent, R. 2011. *The Annual Report on the N.J. State Mosquito Control Commission and the Office of Mosquito Control Coordination.* New Jersey Mosquito Control Association, Atlantic City, N.J.

O'Malley, C. 2011. *Experiences with the New Liquid Spinosad Formation, Natular.* New Jersey Mosquito Control Association, Atlantic City, NJ.

Publications

Brattsten, L., S Huaug, D. Sou and J.M Tomko. "Procuring Aedes sollicitans for Experiments: An Alternative to Forced Mating." Proc. *N.J. Mosquito Control Association 98: 17-28.*

Kent, R. 2011. "The NJ State Mosquito Control Commission and the Office of Mosquito Coordination." *Proc. NJ Mosquito Control Association 98: 3-9.*

Reed, L., S. Crans and M. Robson. "The New Jersey Vector Surveillance Program, 2010." *Proc. N.J. Mosquito Control Association 98: 30-41.*

Williams, G., A. Farajollahi, S. Healy and R. Gaugler. "Evaualtion of Truck – Mounted Equipment for the Area – wide Application of Vectobac®wdg. *Proc. N.J. Mosquito Control Association 98: 75-84.*