COUNTY OF ERIE
WEST NILE VIRUS & OTHER ARBOVIRUS
FIVE YEAR SURVEILLANCE REPORT
2000-2004

MAY 2005

DEPARTMENT OF HEALTH
DIVISION OF PUBLIC HEALTH LABORATORIES, EPIDEMIOLOGY AND ENVIRONMENTAL HEALTH
VECTOR CONTROL PROGRAM

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County of Erie
West Nile Virus & Other Arbovirus Five Year Surveillance Report
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Table of Contents

Introduction: History & Purpose pg. 3

Countywide Education and Information Campaign pg. 5

Surveillance
- Human Surveillance pg. 7
- Animal Surveillance (Birds & Mammals) pg. 9
- Larval Mosquito Surveillance pg. 12
- Adult Mosquito Surveillance pg. 14
  - CDC Light Trap Mosquito Species Composition pg. 20
  - CDC Gravid Trap Mosquito Species Composition pg. 25
- Positive Mosquito Pool Results
  - West Vile Virus Positive Mosquito Pools pg. 29
  - Other Arthropod-borne Viruses Detected pg. 31
  - Chronology of Other Arbovirus Events pg. 33
- Collaborative Effort with the Town of Amherst pg. 37
- WNV Positive Events, Human, Bird, Mammal and Mosquito pg. 40
- Weather Factors pg. 42
- Laboratory Services
  - Erie County Component pg. 45
  - Regional Component pg. 46

Mosquito Control
- Breeding Site Elimination pg. 49
- Larvicide Application pg. 50
- Project Swat pg. 53
- Adulticide Application pg. 54

Information Management
- Global Positioning System (GPS) pg. 55
- GEO Coding of Data pg. 55
- NYSDOH Health Information Network pg. 55

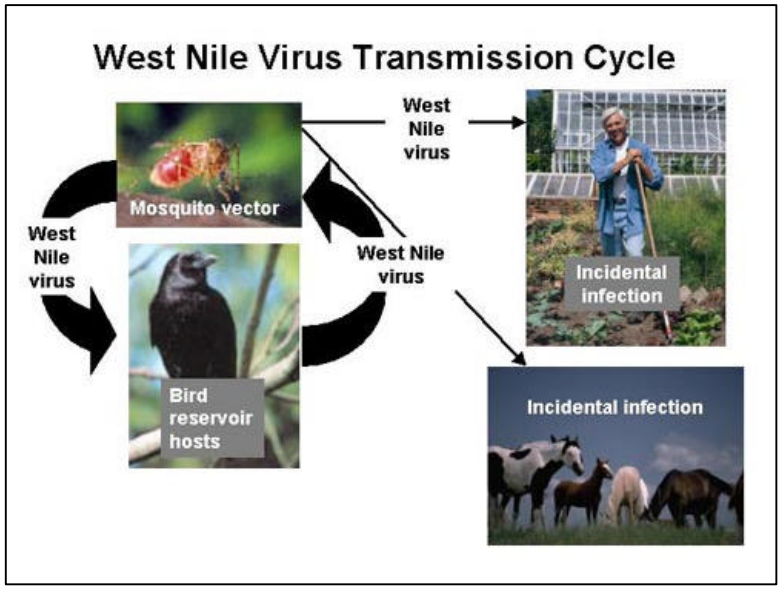
Conclusion and Lessons Learned pg. 56

Acknowledgements pg. 59

Appendix (Available upon request under separate cover)

INTRODUCTION: HISTORY & PURPOSE

West Nile Virus is a Flavivirus originally identified in 1937 from a febrile woman in the West Nile Region of Uganda. It entered the United States in 1999 in downstate New York, was detected in birds, mosquitoes, and was determined to be the cause of human illness and death. It is usually transmitted through the bite of an infected mosquito. The primary mosquito vectors in this region are *Culex pipiens* and *Culex restuans* but other secondary or bridge vectors may transmit the virus. Birds are the reservoir host for the virus. Corvids, including crows and bluejays, are considered indicator species in that they are especially susceptible to the virus where the infection is usually fatal. Humans, horses and other animals are incidental hosts. West Nile Virus causes human illness ranging from a sub-clinical infection, to flu-like symptoms and, in some cases, encephalitis and death.



In the past five years much has been learned about West Nile Virus in the United States. It has been detected in many species of birds, mammals, reptiles, mosquitoes, and other insects. As a human pathogen, West Nile Virus has manifested itself in different ways including flaccid paralysis. It has been found that it can be transmitted in the healthcare setting through organ transplant and blood transfusion. Testing of the blood supply and donor organs has been established. Transmission from mother to child has been documented as trans-placental transmission and through breast feeding. Vaccines are available for horses and birds with ongoing research for a human vaccine.

Target species – *Culex pipiens-restuans*

The virus has spread over much of North America in a relative short time span. By 2004, the United States has seen the virus detected in all of the 48 contiguous states and the District of Columbia. It has also been detected in Canada and Mexico. The following table (Table 1) summarizes the spread and magnitude of the virus.

Table 1. West Nile Virus Detection History							
		1999	2000	2001	2002	2003	2004
Erie County[1]	Birds	0	25	1	18	6	2
	Mosquito Pools	0	0	0	4	8	12
	Horses	0	0	0	1	0	0
	Human Cases	0	0	0	9	0	0
	Human Deaths	0	0	0	1	0	0
New York State[2]	Counties	9 of 62	61 of 62	22 of 62	59 of 62	59 of 62	42 of 62
	Birds	142	1263	731	1350	1366	191
	Mosquito Pools	15	400	316	445	471	238
	Horses	25	28	22	36	32	3
	Human Cases	62	14	15	80	70	8
	Human Deaths	7	1	2	5	9	0
United States[3]	States	4	12 & DC	27 & DC	44 & DC	46 & DC	47 & DC
	Birds	296	4305	6669	16115	11128	6107
	Mosquito Pools	17	522	863	5802	8230	7090
	Horses	25	70	752	3775	4636	977
	Human Cases	62	21	65	3775	9388	1951
	Human Deaths	7	2	9	216	246	62

1 Data from Erie County Surveillance Program
2 Data from NYSDOH HIN Website
3 Data from CDC Website and NYSDOH WNV Weekly Update

The Erie County Health Department conducted dead bird surveillance and limited mosquito surveillance in 2000. West Nile Virus was detected in 25 birds. Intermittent trapping at various locations yielded 17 mosquito pools all of which tested negative for West Nile Virus. It was determined by the Erie County Commissioner of Health that a need existed for a comprehensive surveillance program for this emerging infectious disease as well as other Arthropod-borne diseases.

In 2001, the Vector Control Program was established within the Erie County Health Department. The Vector Control Laboratory was built and staffed as part of this program enabling the Health Department to conduct larval and adult mosquito surveillance. A Vector Laboratory Intern Program for college students was established to assist the ECHD staff in conducting mosquito surveillance. In addition, the program staff continues to be responsible for coordinating dead bird surveillance and conducting environmental investigations following each positive Arbovirus report from a bird, mammal, mosquito pool or human case. The Vector Control Program staff coordinates all aspects of pesticide application within the Erie County Health Department including larval control measures.

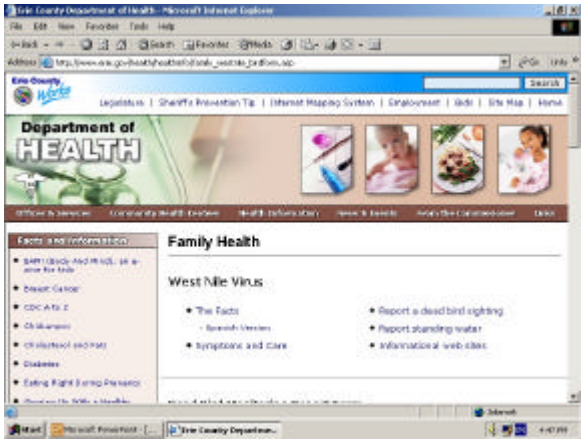
Through 2004, the West Nile Virus component of the Vector Control Program in Erie County has evolved through lessons learned each year. The program utilizes the following: educating the general public; human, bird, mammal and mosquito surveillance; elimination of larval habitat; targeted larvicide application; and regional cooperation. This report summarizes these efforts over the past five years.

COUNTYWIDE EDUCATION AND INFORMATION CAMPAIGN

Education is the greatest tool in preventing communicable diseases including West Nile Virus. Prevention includes public awareness of the steps to minimize the risk of infection. The Erie County Health Department has utilized the following tools to complete this task.

- An educational brochure titled "Mosquitoes and West Nile Virus – You Can Protect Yourself," developed in 2001, has been distributed at public events, rabies clinics, health fairs, county fair, etc. It is also distributed to residents where WNV investigations are conducted.

- Twenty billboard announcements were placed throughout Erie County addressing the threat of West Nile Virus. The messages ran from June through August of 2001. The remaining months were dedicated to rodent control issues. Billboards were discontinued in 2002.



- The Erie County web site provides West Nile Virus information and has the capability to take reports of standing water and dead bird sightings. This information is forwarded to Vector Control Staff for investigation. Link to West Nile Virus page of the Erie County Website: http://www.erie.gov/health/healthinfo/family_westnile_facts.asp

- Working with television and radio media to develop and air Public Service Announcements aimed at awareness and education. Articles in local newspapers have also been published thereby raising awareness.

- The Vector Control Lab participates in the West Nile Virus Education Day at the Environmental Health booth at the Erie County Fair. Static demonstrations of a CDC Light Trap, Gravid Trap as well as many maps and graphs depicting the West Nile Virus threat are displayed. Educational brochures, and promotional materials are distributed.

- Requests from community groups and organizations for educational presentations regarding West Nile Virus have been fulfilled by Vector Control Staff.

- In 2004, Health Alerts were added to the Health page of the Erie County Government web site. Four alerts regarding mosquito issues were posted. Two were issued for West Nile Virus including general mosquito safety. One was issued regarding the detection of Cache Valley Virus in mosquito pools collected in 2003 and one regarding the detection of LaCrosse Virus in a mosquito pool in 2004. These alerts were also sent by electronic mail to a network of physicians and veterinarians throughout Erie County.

Link to Health Alerts on Erie County Website http://www.erie.gov/health/services/health_pros_alerts.asp

West Nile Virus Update	08/04/04	Advisory	93
California serogroup LaCrosse Virus found in Mosquito Sample	07/28/04	Advisory	90
West Nile Virus Update	06/18/04	Advisory	87
Health Update #70 (Regarding Cache Valley Virus)	05/04/04	Update	70

SURVEILLANCE

Surveillance is the principal means to collect information regarding West Nile Virus. This includes the identification of larval habitat, determining the presence of vector mosquito species, detecting disease activity within bird and animal populations, and investigating human cases.

HUMAN SURVEILLANCE

Human surveillance for West Nile Virus was performed by the Erie County Health Department. The Bureau of Disease Control was responsible for the human component of West Nile Virus surveillance activity in Erie County and the Vector Control Program conducted environmental investigations in the event of a human case. In 2002, nine human cases of West Nile Virus, including one fatality, were detected and investigated. There were no human cases in Erie County in 2000, 2001, 2003 and 2004.

The procedure for human surveillance consisted of distributing information to hospitals, private physicians, and laboratories; conducting weekly human surveillance; and verifying reports for human specimens sent to the Wadsworth Laboratory for testing.

Information pertaining to West Nile Virus was sent to each hospital and laboratory in Erie County. The information included clinical presentation, diagnosis, specimen testing, reporting, and procedures for submitting specimens for testing. This information was faxed to private physicians and group practices upon request. Fax forms were provided for each facility and were used to report the number of suspect cases of encephalitis and meningitis. Weekly reports were collected from April thru November. Physicians submitting human blood or spinal fluid were required to fax the completed paperwork to the Bureau of Disease Control prior to submitting the specimens to the Wadsworth laboratory for testing. Disease Control staff checked laboratory results as they became available. The following table (Table 2) describes the human specimens that were sent to the Wadsworth laboratory for testing. Of the 156 specimens sent over the past four years, 9 were found to be positive for West Nile Virus.

Table 2. Specimens from Humans sent for West Nile Virus Testing

Year	Specimens Sent	Positive for WNV	Non-reactive for WNV	Not Tested	Unknown/ Pending
2001	14	0	12	0	2
2002	79	9 (11.4%)	44*	18**	8
2003	29	0	26 (5**)	0	3
2004	34	0	34	0	0
Total	156	9 (5.8%)	116 (5**)	18	13

*2 positive for Enterovirus, 4 positive for LaCrosse virus
** Did not meet case definition

In the event of a human case of West Nile Virus, the Vector Control Staff are notified. An environmental investigation is initiated at and around the victim's primary residence for risk factors. This investigation includes looking for standing water, containers holding water, broken screens, clogged gutters and mosquito resting sites. Larvicide may be applied when larvae are found.

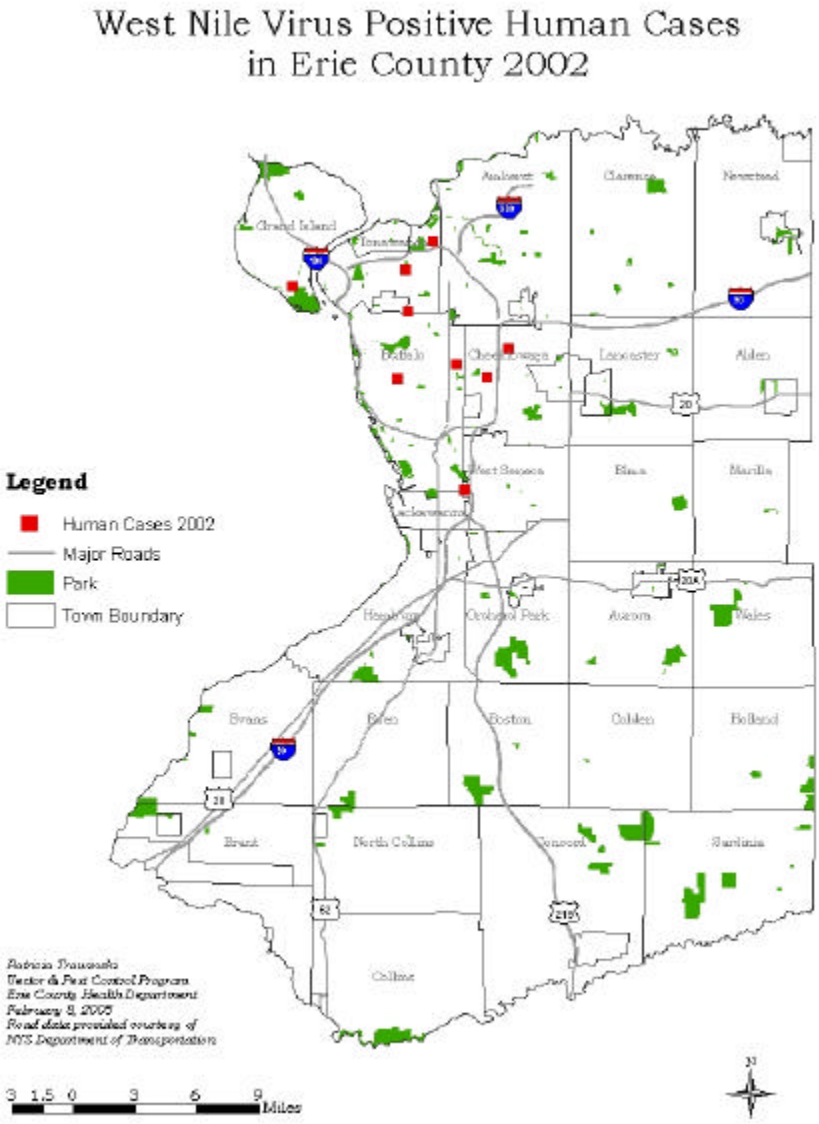
The following table (Table 3) shows the West Nile Virus human cases that occurred in 2002.

Table 3. West Nile Virus Human Case Data

Case #	Gender	Age	Township	Onset of Symptoms	Hospital	Status*	Outcome
1	Female	70	Cheektowaga	08/30/2002	St. Joseph's	Confirmed	Discharged
2	Male	45	Gr. Island	08/30/2002	NFMC	Confirmed	Discharged
3	Female	72	Tonawanda	09/02/2002	Maine	Probable	Discharged
4	Female	73	Tonawanda	09/13/2002	Kenmore Mercy	Probable	Discharged
5	Male	76	Buffalo	09/15/2002	ECMC	Probable	Expired 9/28
6	Female	82	Buffalo	09/17/2002	St. Joseph's	Probable	Discharged
7	Male	76	Cheektowaga	09/26/2002	VAMC	Confirmed	Discharged
8	Female	45	Kenmore	09/02/2002	None	Probable	Home
9	Male	50	West Seneca	09/20/2002	South Buffalo Mercy	Probable	Discharged

* Suspect: Submitted specimen meeting clinical case definition
Probable: Single serum IgM+ (Becomes Confirmed case when convalescent serum shows 4 fold rise in antibody level)
Confirmed: CSF IgM+ or CSF PCR+ or Acute and Convalescent serum show a 4 fold rise in antibody level

The following map indicates the primary residence for each of the nine human cases of West Nile Virus in 2002.



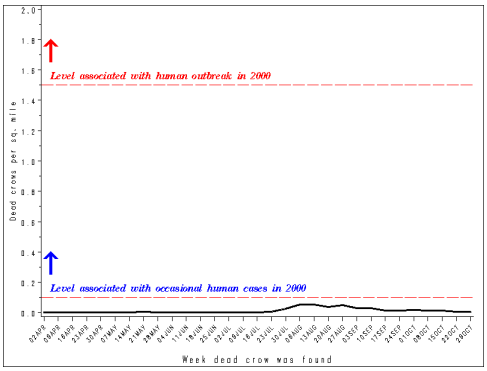
ANIMAL SURVEILLANCE (BIRDS & MAMMALS)

The Erie County Health Department begins accepting dead bird reports for further consideration from the public for West Nile Virus testing on April 1 of each year. The general public reports dead birds through the following means: phone call to any of the ECHD District Offices; data entry through the Erie County website at http://www.erie.gov/health/healthinfo/family_westnile_birdform.asp; or by calling the USDA Dead Bird Hotline at 1-866-537-2473. All ill or dead birds reported are entered in a database at the NYSDOH Health Information Network website. This information is used to calculate a weekly dead crow density. According to the NYSDOH, Dead crow density

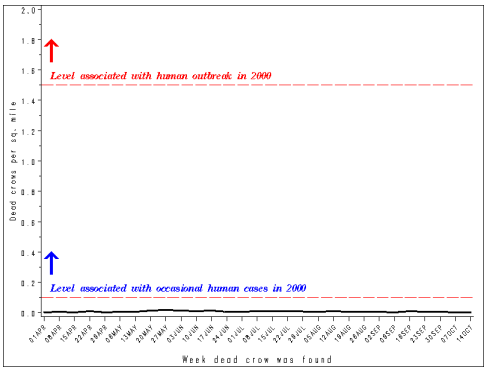
> "…does not provide a definitive prediction of human cases. Instead, it indicates when viral activity, as measured by the number of dead crows per square mile is at a level associated with the occurrence of human cases in 2000. It should be used with other surveillance data to assess the need for increased West Nile Virus control activities."

Weekly dead crow density (sightings per square mile) is tracked from the first week in April to the last week in October. The density remained low in 2000, 2001, 2003 and 2004. The value spiked into the moderate range in 2002. This was the only year that human cases of West Nile Virus were detected in Erie County. In 2002 there were 9 human cases with one fatality.

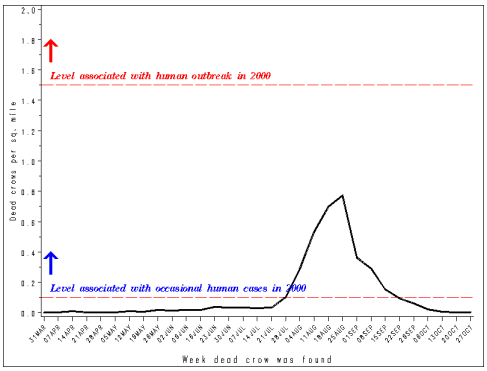
Graph 1. Weekly Dead Crow Sightings per Square Mile 2000-2004



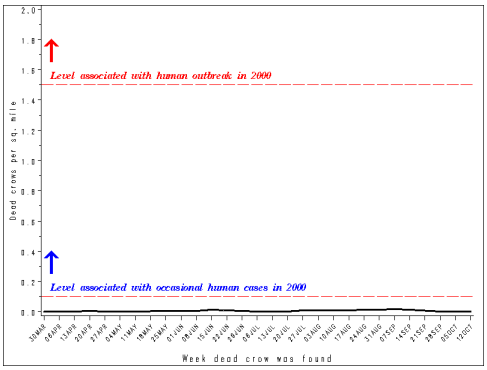
County: **ERIE** Year: **2000**



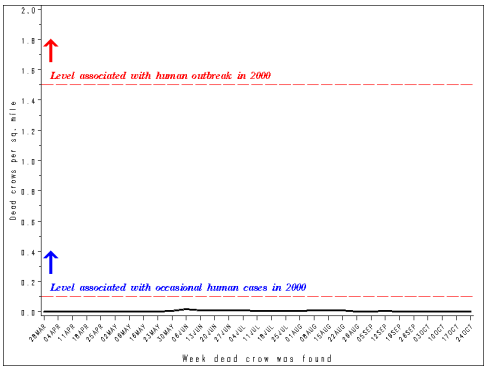
County: **ERIE** Year: **2001**



County: **ERIE** Year: **2002**



County: **ERIE** Year: **2003**



County: **ERIE** Year: **2004**

Note: These graphs do not provide a definitive prediction of human cases. Instead, it indicates when viral activity, as measured by the number of dead crows per square mile, is at a level associated with the occurrence of human cases in 2000. It should be used with other surveillance data to assess the need for increased WNV control activities.
(Data are shown for April through October, the months when mosquitoes are typically active in New York.)
Information derived from NYSDOH HIN Website Weekly Dead Crow Density by County

Surveillance for West Nile Virus among birds in Erie County consists of shipping ill or dead crows, blue jays and raptors that meet the criteria of no apparent trauma and fresh kill (little or no decomposition) to the NYS Department of Environmental Conservation's (NYSDEC) Wildlife Pathology Unit (WPU). Other bird species are approved for submission on a case-by-case basis. As of 2002, we stopped submitting birds following the first positive WNV result with the exception of raptors.

Over the past five years 7635 ill or dead birds have been reported. Of the 600 sent for testing, 51 (8.5%) have been found positive for West Nile Virus. The following table (Table 4) describes the workload associated with ill/dead bird surveillance for West Nile Virus. It lists the number of birds reported to the Erie County Health Department and subsequently the NYSDOH through the Health Information Network (HIN), the number of dead birds shipped to the Wildlife Pathology Unit (WPU) for necropsy, and the number of birds having tissue specimens forwarded by the WPU to NYSDOH's Wadsworth Lab for West Nile Virus testing.

Table 4. Bird Surveillance Workload 2000 – 2004

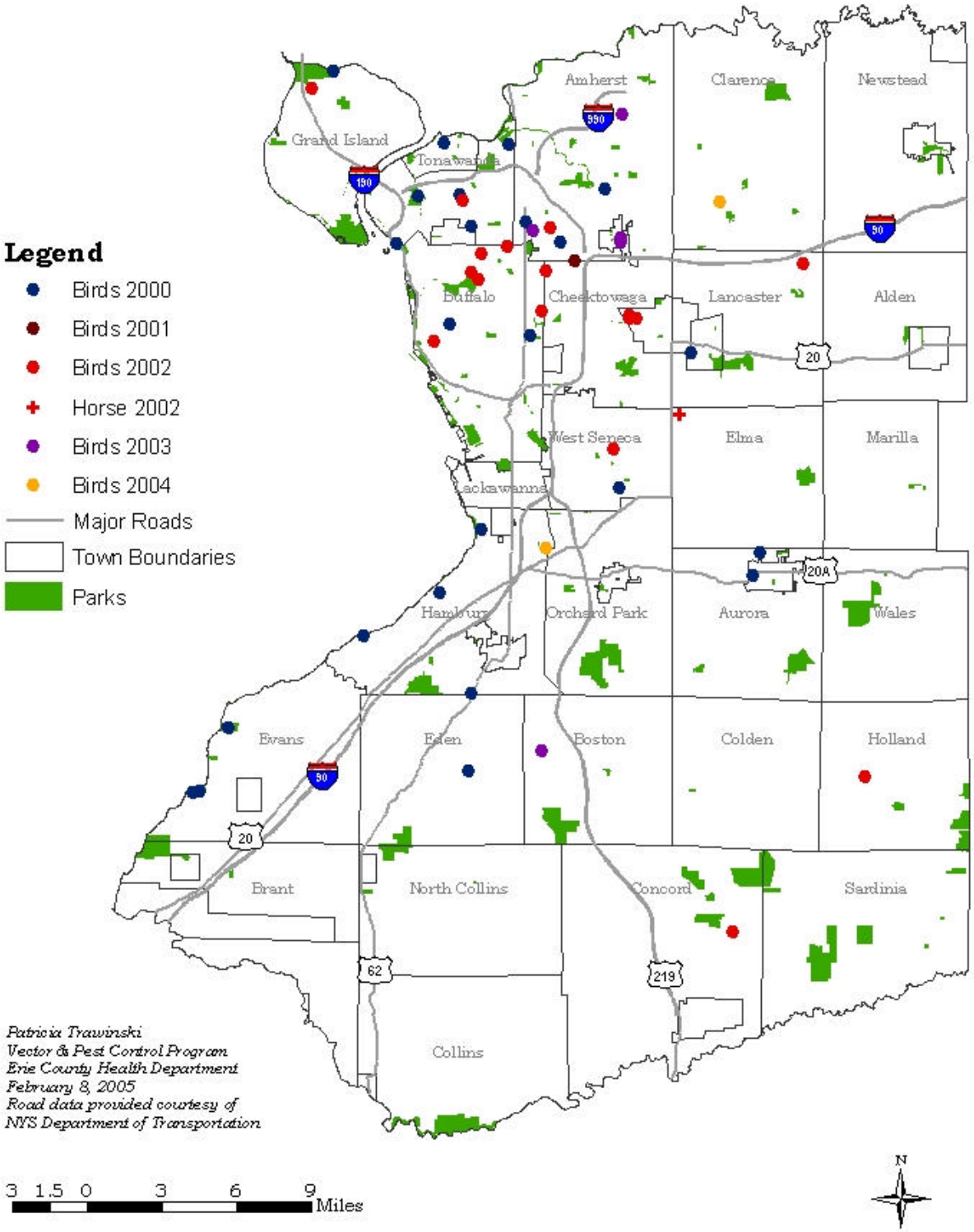
	Ill/Dead Birds Reported								
Year	Crow	Bluejay	Other	Total	Sent to WPU	Sent to Lab	Positive	Negative	Pending
2000	413	92	1128	1633	162	162	25	137	0
2001	219	21	80	320	275	274	1	272	1*
2002	3824	224	493	4541	64	64	17	47	0
2003	176	22	461	659	55	55	6	49	0
2004	141	9	332	482	44	44	2	42	0
Total	**4773**	**368**	**2494**	**7635**	**600**	**599**	**51**	**547**	**1**

*Sent to lab but test not done

No mammal surveillance was actively performed from 2000 to 2004 by the Erie County Health Department. Wadsworth Lab, at their discretion, could test rabies negative mammals for West Nile Virus but no tests have been performed through this mechanism. However, one positive mammal from Erie County was reported in 2002. This was an equine case in fall of 2002 with a blood specimen sent to Wadsworth Lab by the veterinarian caring for the animal. The horse survived the infection due to supportive veterinary care.

The following map shows the location of the West Nile Virus positive birds and mammals over the last five years. Note that although West Nile Virus positive birds were recorded in many parts of the county; the highest concentration of positive birds was in the following four municipalities: the towns of Tonawanda, Amherst, Cheektowaga, and the City of Buffalo.

West Nile Virus Positive Birds and Mammals in Erie County 2000 to 2004



LARVAL MOSQUITO SURVEILLANCE

Standing Water = Mosquito Breeding

The life stages of the mosquito are egg, larvae, pupae, and adult. Some species of mosquito over-winter as eggs. Others over-winter as adults and lay eggs in the spring. In either instance, the eggs hatch into larvae, which then grow through four steps or instars. Fourth instar larvae transform into pupae. Adult mosquitoes emerge from the pupae. Females require a blood meal in order to lay eggs.

Larvae are collected from open water using several dipping techniques as well as siphoning of water from storm receiver catch basins, tree holes, tires, etc. Mosquito species can be identified from fourth instar larvae. Pupae and earlier instar larvae cannot be identified. These are placed in hatch chambers, allowed to mature into adults, and identified.

Unmaintained pool breeding mosquitoes

Larval surveillance is performed to determine if a specific site is acting as a larval habitat. This larval habitat may be natural, such as swamps, ponds and tree holes or man-made such as tires, birdbaths, ditches, storm drains, and containers. Once a potential larval habitat is identified, it is sampled for larvae. If larvae are found, the sample is brought to the lab for identification and subsequently placed in a hatch chamber to mature to adult mosquitoes to verify the identification of the larvae. The species of larvae vary by type of habitat, condition of water and time as the mosquito season progresses. The Vector Control Lab staff conducts larval surveillance starting in April at various locations. The following table (Table 5) summarizes the locations sampled and the mosquito species identified over the past four years.

Tires are man's gift to Mosquitoes

Investigating Sanitarian Glenn Robert dipping larvae from a Storm Receiver

Table 5. Mosquito Larval Habitat Type and Species Found – 2000 through 2004					
Habitat type	Locations with larvae found (Locations with no larvae found)				Species found
	2001	2002	2003	2004	
Container (Children's pool, cup, plastic tarp, bird bath, swimming pool, etc)	5	12 (1)	18 (0)	34 (0)	*Aedes vexans, Anopheles punctipennis, Anopheles quadrimaculatus, Anopheles species, Culex restuans, Culex pipiens, Culex territans, Ochlerotatus atropalpus, Ochlerotatus communis, Ochlerotatus japonicus, Ochlerotatus triseriatus, Ochlerotatus trivitattus*
Ditch or Depression	11	28 (10)	17 (3)	11 (0)	*Aedes cinereus, Aedes vexans, Anopheles punctipennis, Anopheles quadrimaculatus, Anopheles species, Culex pipiens, Culex restuans, Culex territans, Ochlerotatus canadensis, Ochlerotatus stimulans*
Ornamental Pond	2	1 (0)	2(1)	3 (1)	*Anopheles punctipennis, Anopheles walkeri, Culex territans, Ochlerotatus japonicus*
Storm Receiver	24	26 (12)	24 (2)	11 (5)	*Culex pipiens, Culex restuans*
Tire	17	8 (2)	16 (1)	6 (0)	*Culex pipiens, Culex restuans, Ochlerotatus atropalpus, Ochlerotatus japonicus, Ochlerotatus triseriatus, Ochlerotatus stimulans*
Natural Setting (Tree moat, slow moving stream, woodland pool, woodland swamp, etc.)	13	28 (6)	36 (5)	20 (1)	*Aedes cinereus, Aedes vexans, Anopheles punctipennis, Anopheles quadrimaculatus, Anopheles species, Culex pipiens, Culex restuans, Culex territans, Ochlerotatus canadensis, Ochlerotatus dorsalis, Ochlerotatus japonicus, Ochlerotatus riparius, Ochlerotatus stimulans, Ochlerotatus trivitattus, Psorophora ferox*
Total	**72 (*)**	**103 (31)**	**113 (12)**	**85 (7)**	
Grand Total	**373 (50)**				
* not tracked in 2001					

ADULT MOSQUITO SURVEILLANCE

Trapping of adult mosquitoes is primarily performed using the Miniature CDC Light Trap baited with CO_2. The purpose of this type of trap is to attract and capture biting females. The female mosquito can detect concentrations of CO_2 in order to locate a victim for a blood meal. It is utilized to determine what mosquitoes are "on the wing" at a given time and place.

Miniature CDC Light Trap

Trapping is also performed using a Gravid Trap. This trap utilizes a container holding water with a high organic content as an attractant for gravid females (female mosquitoes ready to lay eggs). This trap is utilized to catch primarily *Culex* species of mosquitoes. These mosquitoes have taken a blood meal at some time in their life cycle because it is needed to develop eggs and become gravid. It is thought that there is a greater chance of trapping West Nile Virus positive mosquitoes using this type of trap.

Traps are set in the afternoon and retrieved the following morning. This is considered one trap night.

Traps are set on a weekly basis at nine fixed trap locations over an approximately 20-week season from May to October by the Erie County Health Department. Trapping begins when overnight temperatures stay above 50°F and continues until overnight lows drop below this level. Supplemental trapping is performed at various locations throughout the season.

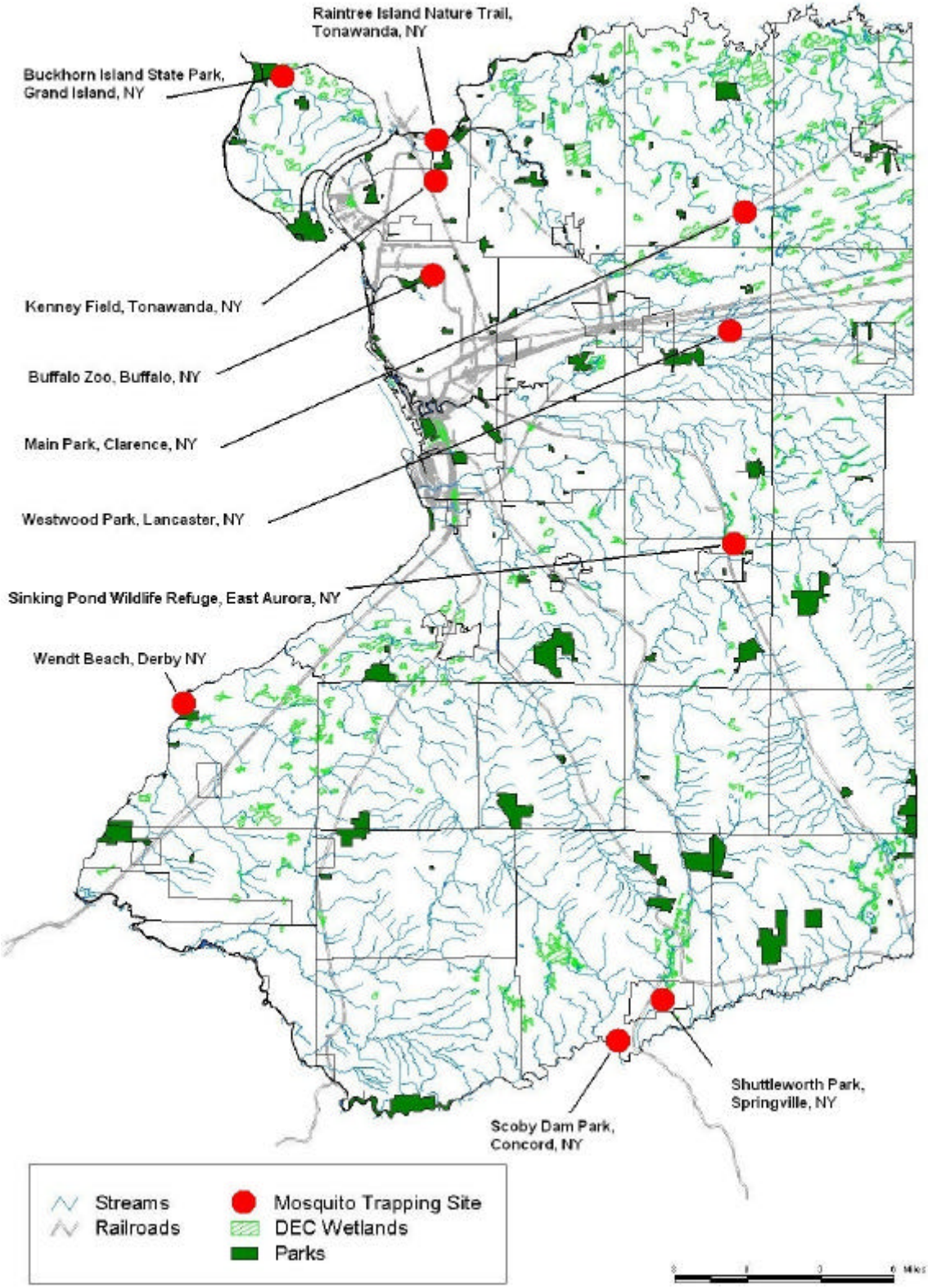
Supervising Sanitarian Peter Tripi setting a Gravid Trap to capture mosquitoes

In addition, the Town of Amherst, Mosquito Control Program traps using the same types of traps at various locations within the town limits. The town of Amherst Mosquito Program shares their mosquito trap data with the Erie County Health Department Vector Lab where it is entered on the NYSDOH HIN website. Appropriate mosquito pools are submitted by the Vector Control Lab for viral testing.

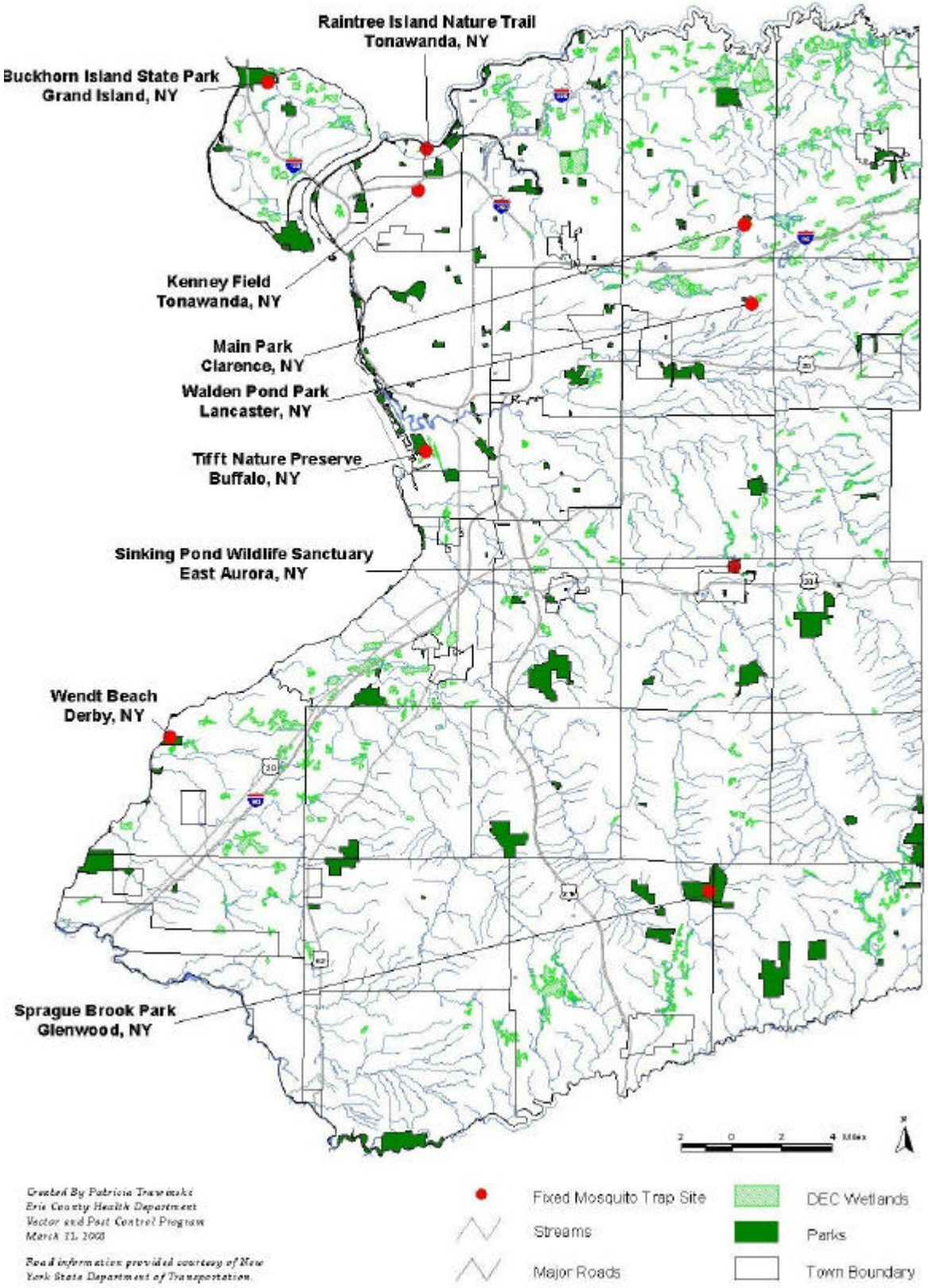
The following pages contain maps of the fixed locations for mosquito trapping. Note that Scoby Dam Park replaced Shuttleworth Park as a trapping location early in 2001. Following the 2001 mosquito season, surveillance data showed that three locations were less productive at capturing mosquitoes than anticipated. New locations were selected in 2002 as fixed mosquito trapping locations and were utilized to collect mosquitoes through 2004.

2001 Fixed Locations for Mosquito Trapping

Patricia Trawinski
Erie County Department of Health
December 18, 2001



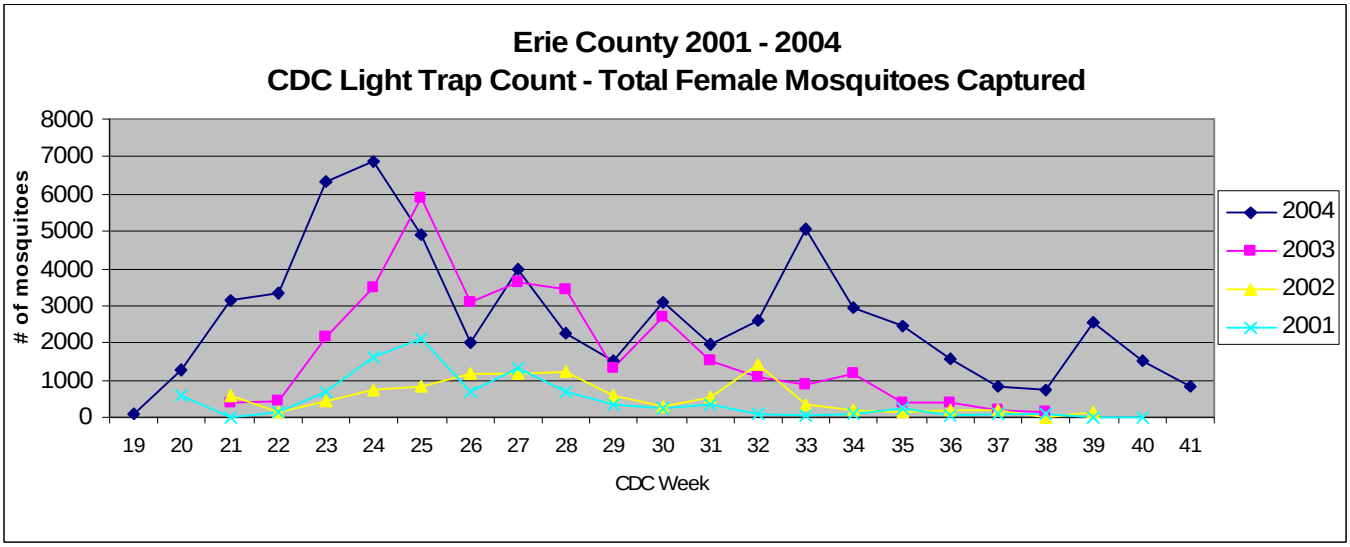
2002-2004 Fixed Locations for Mosquito Trapping



The following graphs depict the female mosquito counts for each of the last four years by CDC Week. Each year consisted of weekly trapping at nine fixed trap locations. Note that the same locations were utilized from 2002 through 2004 and that some locations were different in 2001. A chart of dates is included to define the CDC week for each given year.

The following graph (Graph 2) shows the total weekly mosquito counts in CDC Light Traps during the past four years by CDC Week. According to this graph, it appears that peak numbers of female mosquitoes are captured sometime in June, with lower magnitude peaks later in the season, and then gradually tapered off to the end of the season. Many factors effect mosquito activity including wind, precipitation and air temperature and may influence the number of mosquitoes trapped on any given trap night.

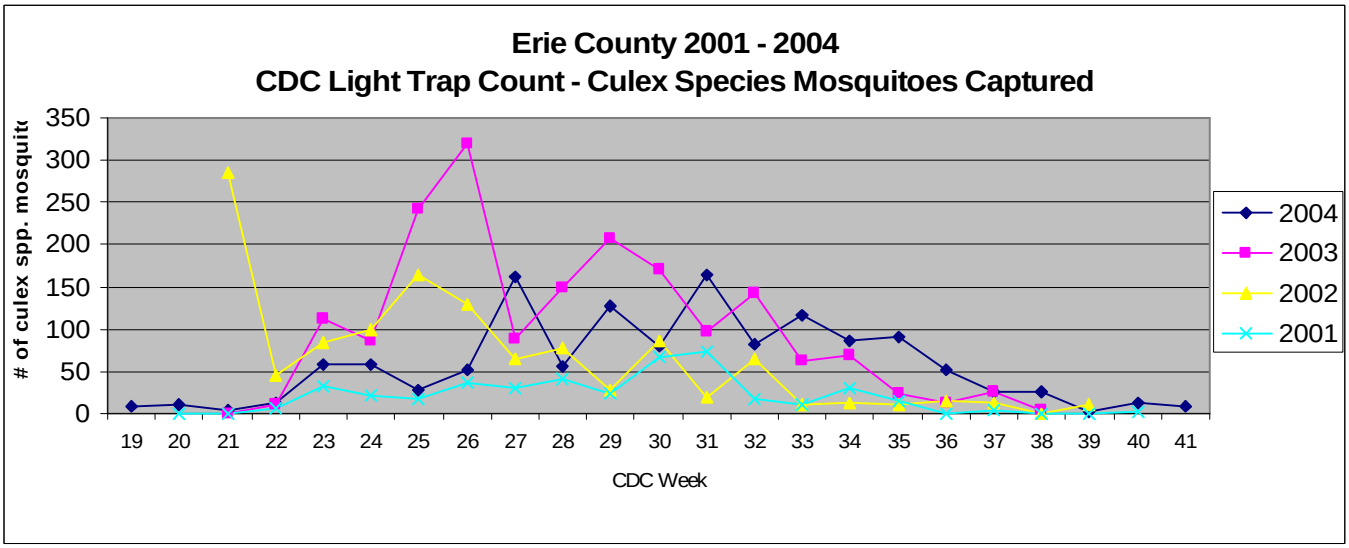
Graph 2



CDC Week	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
2004	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	8/15	8/22	8/29	9/5	9/12	9/19	9/26	10/3	10/10
2003	5/11	5/18	5/25	6/1	6/8	6/15	6/22	6/29	7/6	7/13	7/20	7/27	8/3	8/10	8/17	8/24	8/31	9/7	9/14	9/21	9/28	10/5	10/12
2002	5/12	5/19	5/26	6/2	6/9	6/16	6/23	6/30	7/7	7/14	7/21	7/28	8/4	8/11	8/18	8/25	9/1	9/8	9/15	9/22	9/29	10/6	10/13
2001	5/13	5/20	5/27	6/3	6/10	6/17	6/24	7/1	7/8	7/15	7/22	7/29	8/5	8/12	8/19	8/26	9/2	9/9	9/16	9/23	9/30	10/7	10/14

The next graph (Graph 3) depicts the total weekly *Culex* species mosquitoes captured in CDC Light traps over the past four years. *Culex pipiens-restuans* is the primary vector of West Nile Virus. The total weekly count of over 300 *Culex pipiens-restuans* that peaked the week of June 30, 2003 was the greatest number of mosquitoes of this species caught in any given week over four years. The only other time that the count approached this number was in the very beginning of mosquito season in 2002. This may have been due to a larger number of over-wintering *Culex* mosquitoes that survived to lay eggs in the spring. West Nile Virus is maintained over the winter in these mosquitoes. These factors may have contributed to in the increased West Nile Virus activity including human cases in 2002.

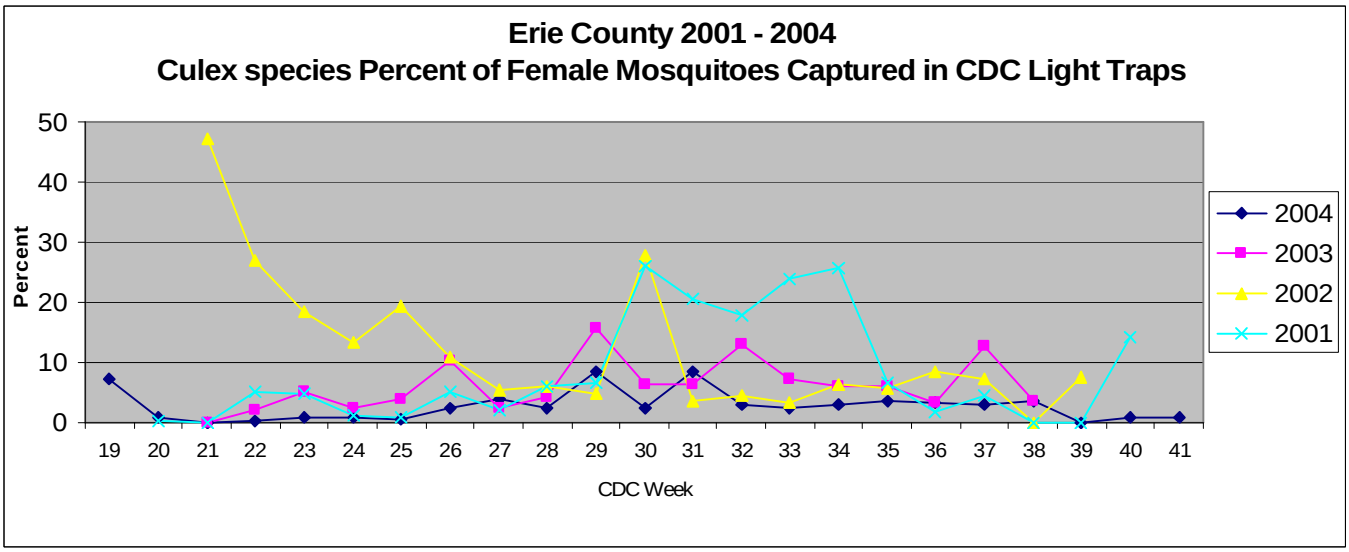
Graph 3



CDC Week	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
2004	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	8/15	8/22	8/29	9/5	9/12	9/19	9/26	10/3	10/10
2003	5/11	5/18	5/25	6/1	6/8	6/15	6/22	6/29	7/6	7/13	7/20	7/27	8/3	8/10	8/17	8/24	8/31	9/7	9/14	9/21	9/28	10/5	10/12
2002	5/12	5/19	5/26	6/2	6/9	6/16	6/23	6/30	7/7	7/14	7/21	7/28	8/4	8/11	8/18	8/25	9/1	9/8	9/15	9/22	9/29	10/6	10/13
2001	5/13	5/20	5/27	6/3	6/10	6/17	6/24	7/1	7/8	7/15	7/22	7/29	8/5	8/12	8/19	8/26	9/2	9/9	9/16	9/23	9/30	10/7	10/14

The next graph (Graph 4) shows the percent of the total female mosquito count that was made up of *Culex* species mosquitoes. The greatest *Culex* species percent of total mosquitoes caught was significantly greater over a large proportion of the season in 2002. This is especially evident near the beginning of the season again indicating that this may have been a contributing factor in the increased West Nile Virus activity in 2002.

Graph 4



Nine trapsites were utilized by the Erie County Health Department, Vector Control Program in order to obtain a clear representation of mosquito and West Nile Virus activity throughout the county. The following table (Table 6) describes what was caught under these conditions. Note that Gravid traps are designed to capture mainly *Culex* species of mosquitoes. The Tifft Nature Preserve trapsite had the

greatest total mosquito numbers but a low percentage of *Culex pipiens-restuans* in CDC Light Traps. The Kenney Field trapsite had the highest percentage of *Culex pipiens-restuans* in CDC Light Traps.

Table 6. Mosquitoes Captured in CDC Light Traps and Gravid Traps

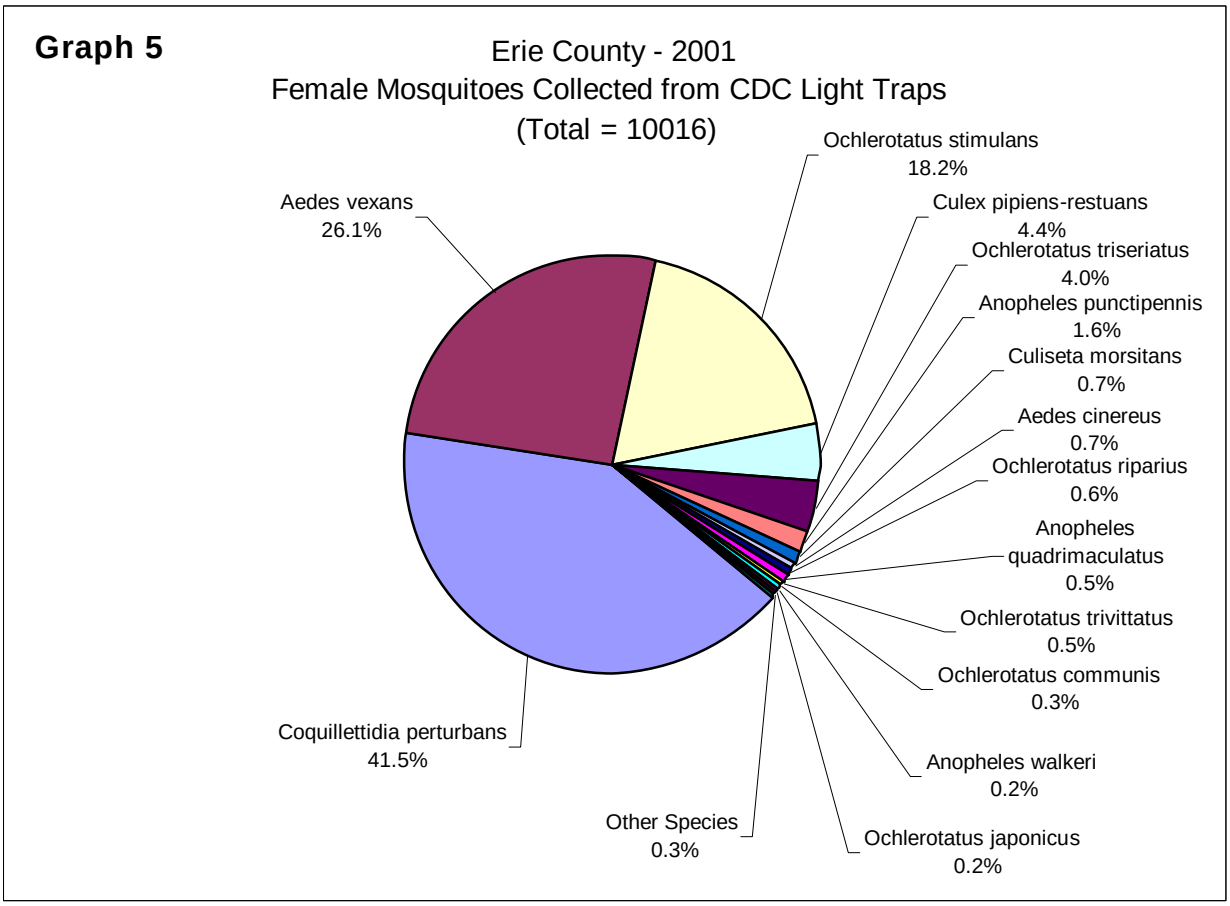
Trap Site	Year	Seasonal Total All Female Mosquitoes		Seasonal Total *Culex pipiens-restuans*		*Culex pipiens-restuans* Percent of Total	
		Light Trap	Gravid Trap	Light Trap	Gravid Trap	Light Trap	Gravid Trap
Buckhorn Island State Park 5808 East River Rd Grand Island, NY 14072	2001	3653	60	3	56	0.1	93.3
	2002	2659	143	9	37	0.3	25.9
	2003	6618	39	29	17	0.4	43.6
	2004	19565	28	30	12	0.2	42.9
Kenney Field 2000 Colvin Blvd Tonawanda, NY 14150	2001	1583	7	97	6	6.1	85.7
	2002	1675	129	911	124	54.4	96.1
	2003	3609	37	1060	28	29.4	75.7
	2004	5913	33	651	21	11.0	63.6
Main Park 10405 Main St Clarence, NY 14031	2001	445	112	5	100	1.1	89.3
	2002	220	178	8	144	6.4	80.9
	2003	1417	49	31	5	2.2	10.2
	2004	3163	189	14	78	0.4	41.3
Raintree Island Nature Trail 3000 Colvin Blvd Tonawanda NY 14150	2001	552	174	148	137	26.8	78.7
	2002	994	45	77	12	15.4	26.7
	2003	853	50	91	23	10.7	46.0
	2004	7420	75	153	5	2.1	6.7
Sinking Pond Wildlife Sanctuary 400 Pine Street East Aurora, NY 14052	2001	2380	70	125	69	5.3	98.6
	2002	1427	193	21	179	2.1	92.7
	2003	1640	83	48	28	2.9	21.7
	2004	3865	46	30	33	0.8	71.7
Sprague Brook Park* 9674 Foote Rd Glenwood, NY 14069	2001	70	8	29	0	41.4	0.0
	2002	557	23	17	0	1.4	0.0
	2003	4832	27	16	0	0.3	0.0
	2004	3368	58	8	0	0.2	0.0
Tifft Nature Preserve** 1200 Fuhrmann Blvd. Buffalo, NY	2001	71	6	0	6	0.0	100.0
	2002	2425	74	112	46	8.4	62.2
	2003	9515	117	163	21	1.7	17.9
	2004	14083	95	203	39	1.4	41.1
Walden Pond Park*** 4484 Walden Avenue Lancaster, NY 14086	2001	412	25	2	22	0.5	88.0
	2002	427	108	20	100	44.3	92.6
	2003	2289	43	151	15	6.6	34.9
	2004	3643	60	189	27	5.2	45.0
Wendt Beach 7676 Lakeshore Road Derby, NY 14047	2001	484	17	28	16	5.8	94.1
	2002	323	45	23	39	7.4	86.7
	2003	1596	10	194	0	12.2	0.0
	2004	981	37	24	2	2.5	5.4
Supplemental Trapping Various Locations	2001	336	0	8	0	2.2	0.0
	2002	102	12	1	9	1.0	75.0
	2003	53	1	1	1	1.9	100.0
	2004	1001	0	106	0	10.6	0.0
Total		**116219**	**2506**	**4836**	**1457**	**4.2**	**58.1**

Locations changed after 2001 Trapping Season
* Various Locations in Springville, Concord for 2001 (Shuttleworth Park then moved to Scoby Dam Park)
** Buffalo Zoo, Parkside Ave, Buffalo, NY for 2001
***Westwood Park, Pavement Rd, Lancaster, NY for 2001

CDC Light Trap Mosquito Species Composition

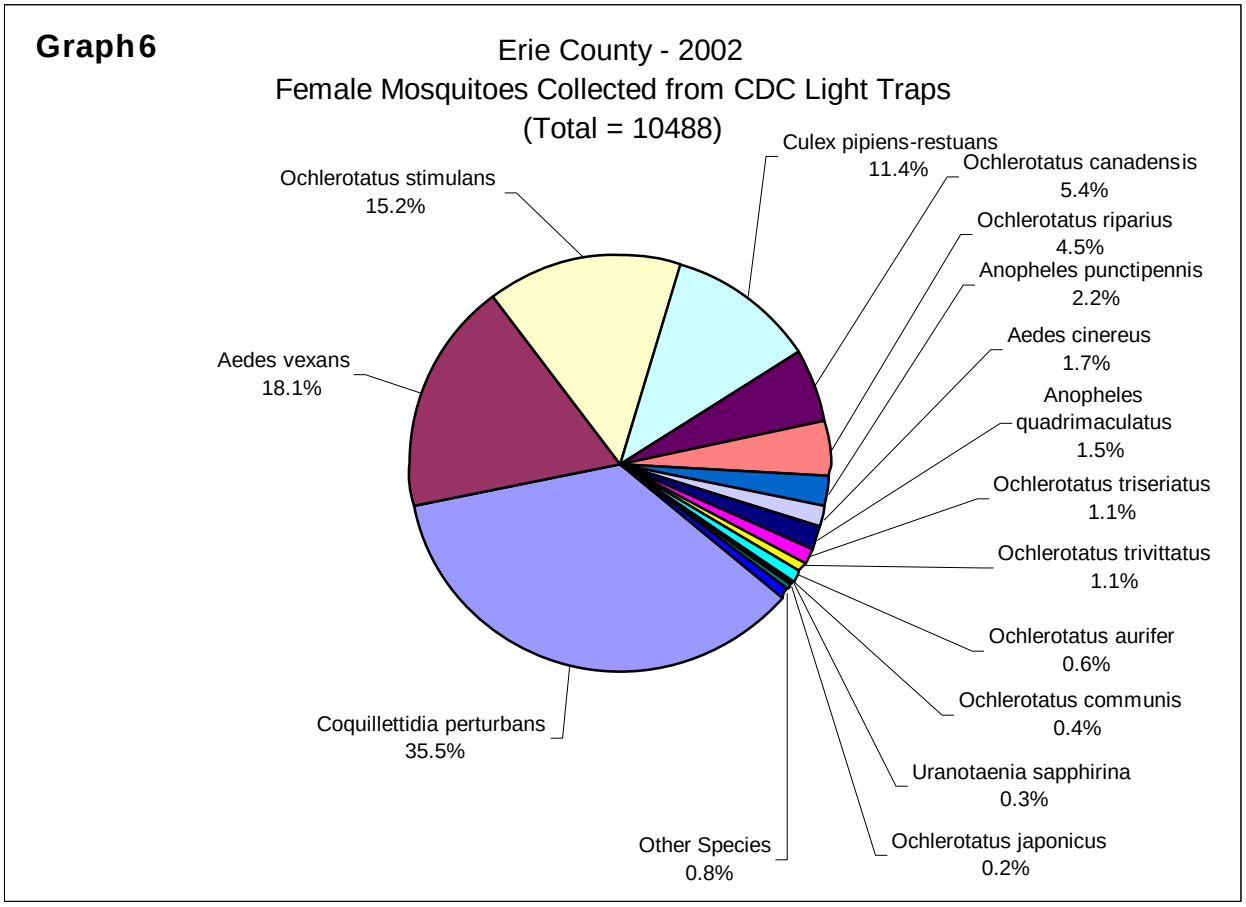
The following four graphs (Graph 5-7) depict the mosquito species mix captured in CDC Light Traps each year from 2001 to 2004 when trapping was performed at nine fixed locations on a weekly basis. This species composition has varied over the years and may be due to many environmental factors. One interesting point is that using similar trapping methods over a similar trapping season, three times as many mosquitoes (32369) were captured in 2003 and six times as many (62001) in 2004 than in 2001(10016) and 2002 (10488). Another notable difference is that the percentage of *Culex pipiens-restuans* as part of the total number of captured mosquitoes in 2002 (11.4%) was far greater than in 2001 (4.4%), 2003 (5.5%) and 2004 (2.1%). 2002 was the only year where Erie County experienced human cases of West Nile Virus.

The following graph (Graph 5) depicts the mosquito species mix captured for 2001. The three most abundant species trapped were as follows. *Coquillettidia perturbans* at 41.5% of all mosquitoes trapped is also known as the "Cat tail mosquito" and lives in cat tail marshes. In the larval stage, it has a modified siphon tube that attaches to the cat tail roots to breath. *Aedes vexans*, at 26.1% of mosquitoes caught, is a mid to late season floodwater mosquito. This small mosquito is a strong flyer and a voracious human biter. *Ochlerotatus stimulans*, making up 15.2% of the catch, is a larger spring floodwater mosquito and is known to bite humans. *Culex pipiens-restuans*, the primary vector of West Nile Virus, comprised only 4.4% of the mosquitoes caught in CDC Light Traps. *Ochlerotatus japonicus*, a species that is relatively new to Western New York, was caught in small numbers accounting for only 0.2% of the species mix. This species has been found to be a competent vector in the laboratory setting.



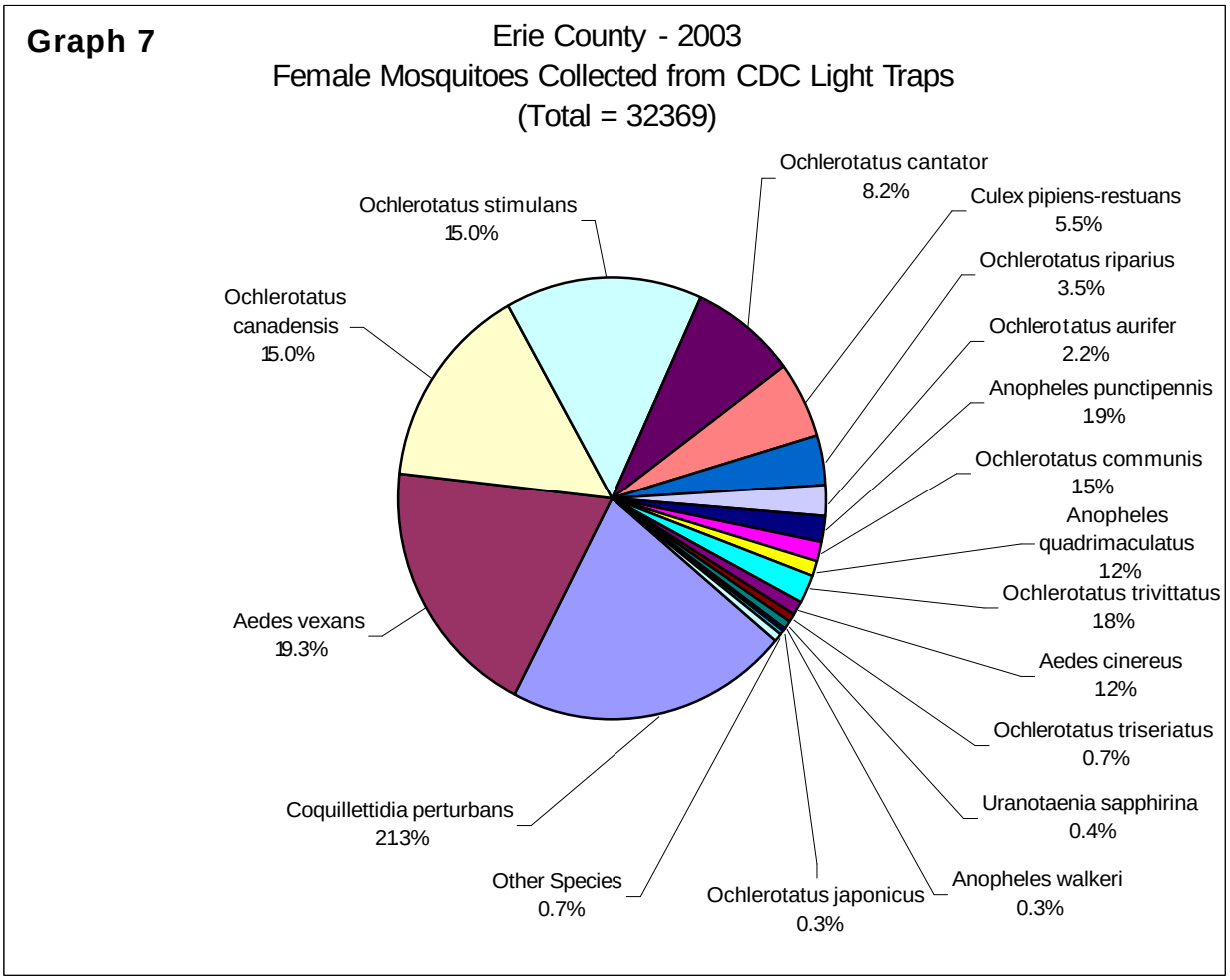
Other Species in 2001	
Culiseta melanura	0.1%
Uranotaenia sapphirina	0.1%
Ochlerotatus atropalpus	<0.1%
Ochlerotatus canadensis	<0.1%
Ochlerotatus dorsalis	<0.1%
Orthopodomyia signifera	<0.1%

The next graph (Graph 6) describes the 2002 data. The total number of mosquitoes caught at nine fixed trapsites was similar to 2001. The three most abundant species remained the same with slight differences in percentage of the total. The numbers of *Culex pipiens-restuans* increased from 4.4% to 11.4% of the total mosquitoes caught in CDC Light Traps. This was the first year that West Nile Virus was detected in mosquito pools of this species submitted by the Vector Lab. In addition, dead crow density spiked into the moderate range and nine human cases of West Nile Virus, including one fatality, were observed. *Ochlerotatus japonicus* remained at 0.2% of the species mix.



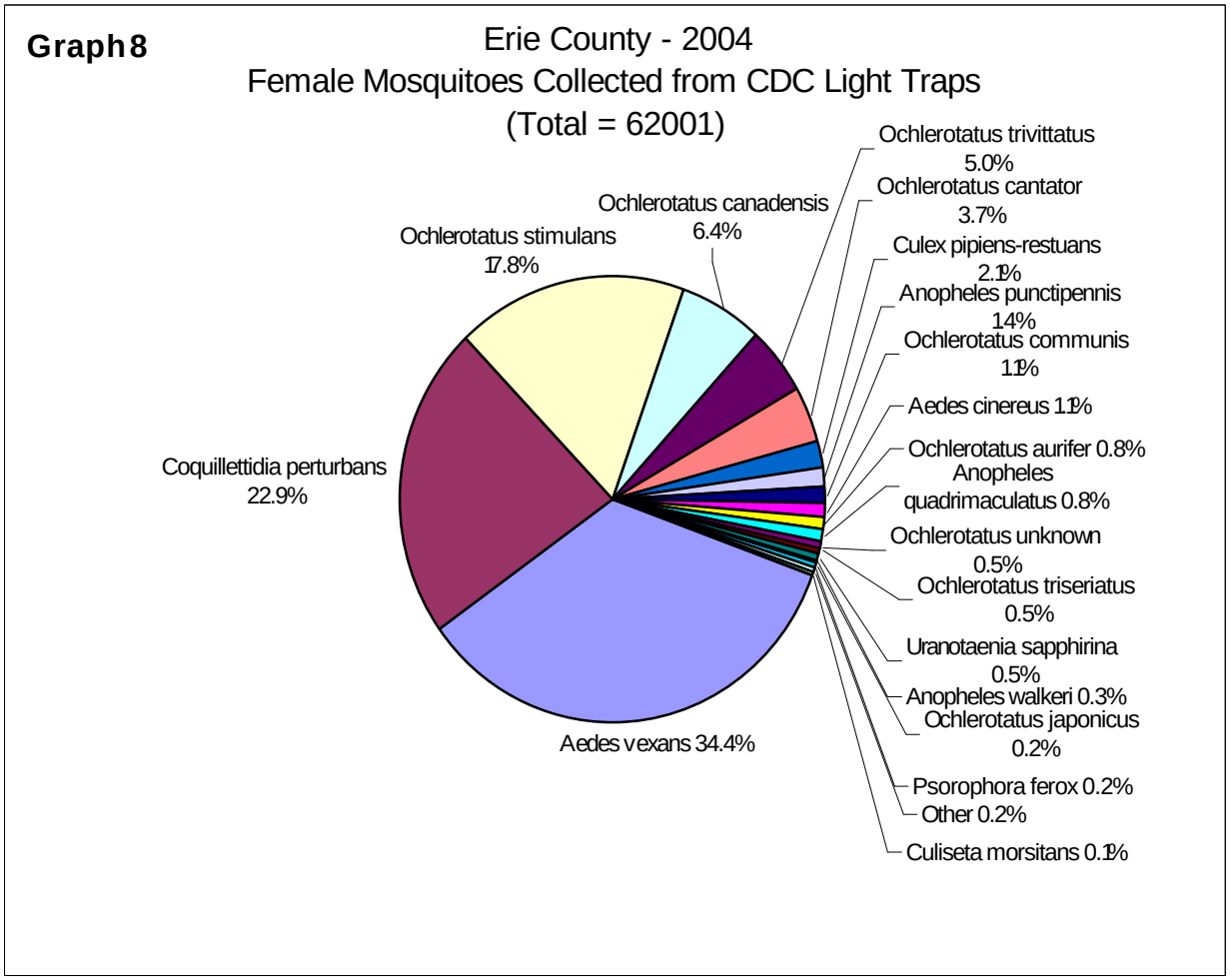
Other Species in 2002	
Anopheles earlei	0.2%
Anopheles walkeri	0.2%
Culex territans	0.2%
Culiseta inornata	0.1%
Ochlerotatus excrucians	0.1%
Culiseta melanura	<0.1%
Culiseta morsitans	<0.1%
Culex salinarius	<0.1%
Ochlerotatus cantator	<0.1%

The 2003 mosquito season, depicted in the next graph (Graph 7), achieved a three-fold increase in total mosquitoes caught in CDC Light Traps in comparison to 2001 and 2002. The three most abundant species remained the same as 2001 and 2002. In addition, an increased number of *Ochlerotatus canadensis* was observed. This species is a late spring and summer floodwater mosquito and is known to bite humans. The proportion of *Culex pipiens-restuans* decreased to 5.5% of the total mosquitoes caught in CDC Light Traps. West Nile Virus was again detected in eight mosquito pools of this species, dead crow density remained low and no human cases of West Nile Virus were observed. *Ochlerotatus japonicus* increased marginally to 0.3% of the species mix.



Other Species in 2003	
Culiseta minnesotae	0.2%
Anopheles earlei	0.1%
Culex salinarius	0.1%
Culex territans	0.1%
Culiseta morsitans	0.1%
Ochlerotatus excrucians	0.1%
Ochlerotatus intrudens	0.1%
Culiseta inornata	<0.1%
Ochlerotatus dorsalis	<0.1%
Psorophora ciliata	<0.1%
Psorophora ferox	<0.1%

The 2004 mosquito season achieved a two-fold increase in total mosquitoes caught in CDC Light Traps compared to 2003 and six-fold versus 2001 and 2002. The three most abundant species remained the same as previous years. A smaller proportion of *Ochlerotatus canadensis* was observed. The proportion of *Culex pipiens-restuans* decreased to 2.1% of the total mosquitoes caught in CDC Light Traps. West Nile Virus was again detected in 12 *Culex* species mosquito pools, dead crow density remained low and no human cases of West Nile Virus were observed. *Ochlerotatus japonicus* decreased again to 0.2% of the species mix.

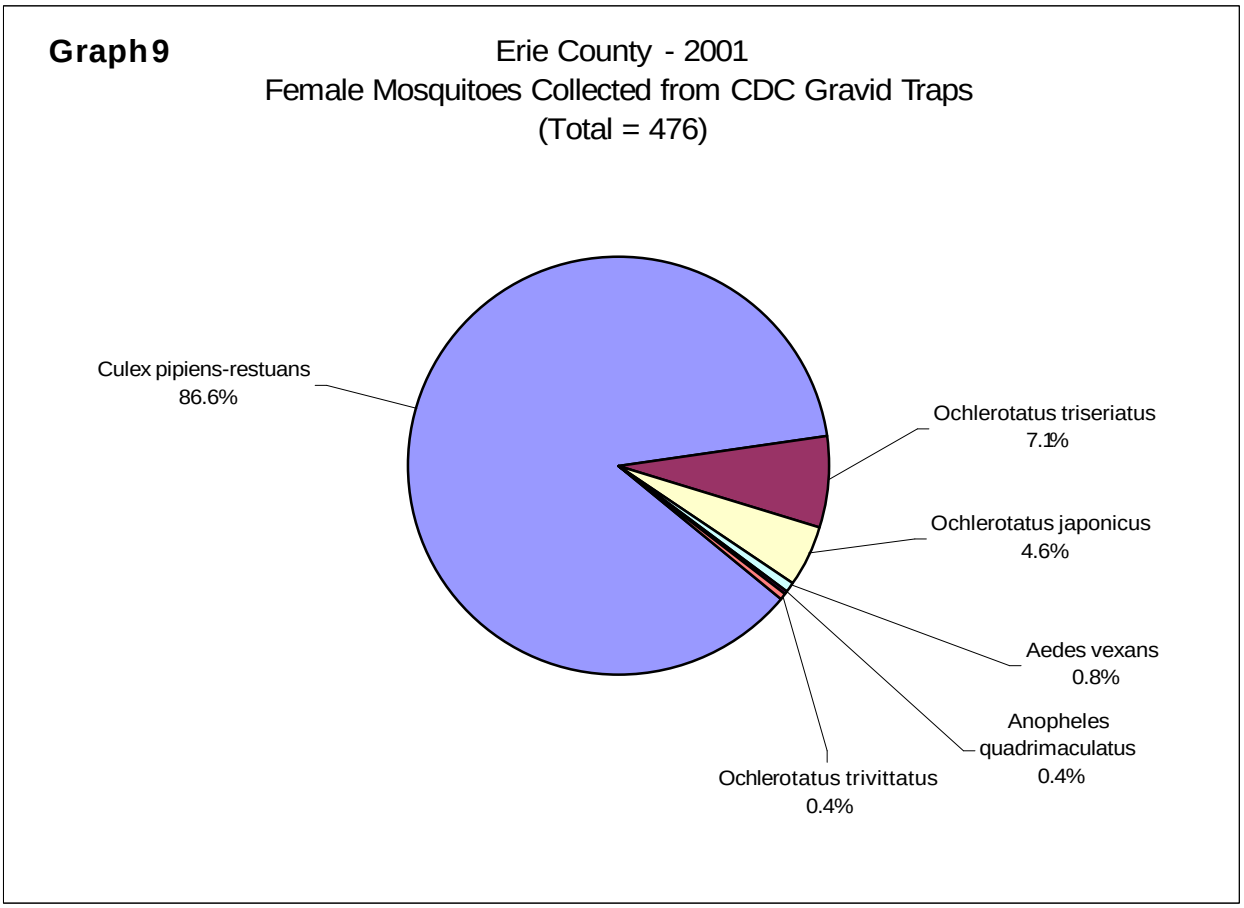


Other Species in 2004	
Anopheles earlei	0.084%
Culiseta minnesotae	0.026%
Culex territans	0.021%
Culiseta inornata	0.015%
Culex salinarius	0.015%
Ochlerotatus riparius	0.013%
Culiseta melanura	<0.01%
Ochlerotatus dorsalis	<0.01%
Ochlerotatus excrucians	<0.01%

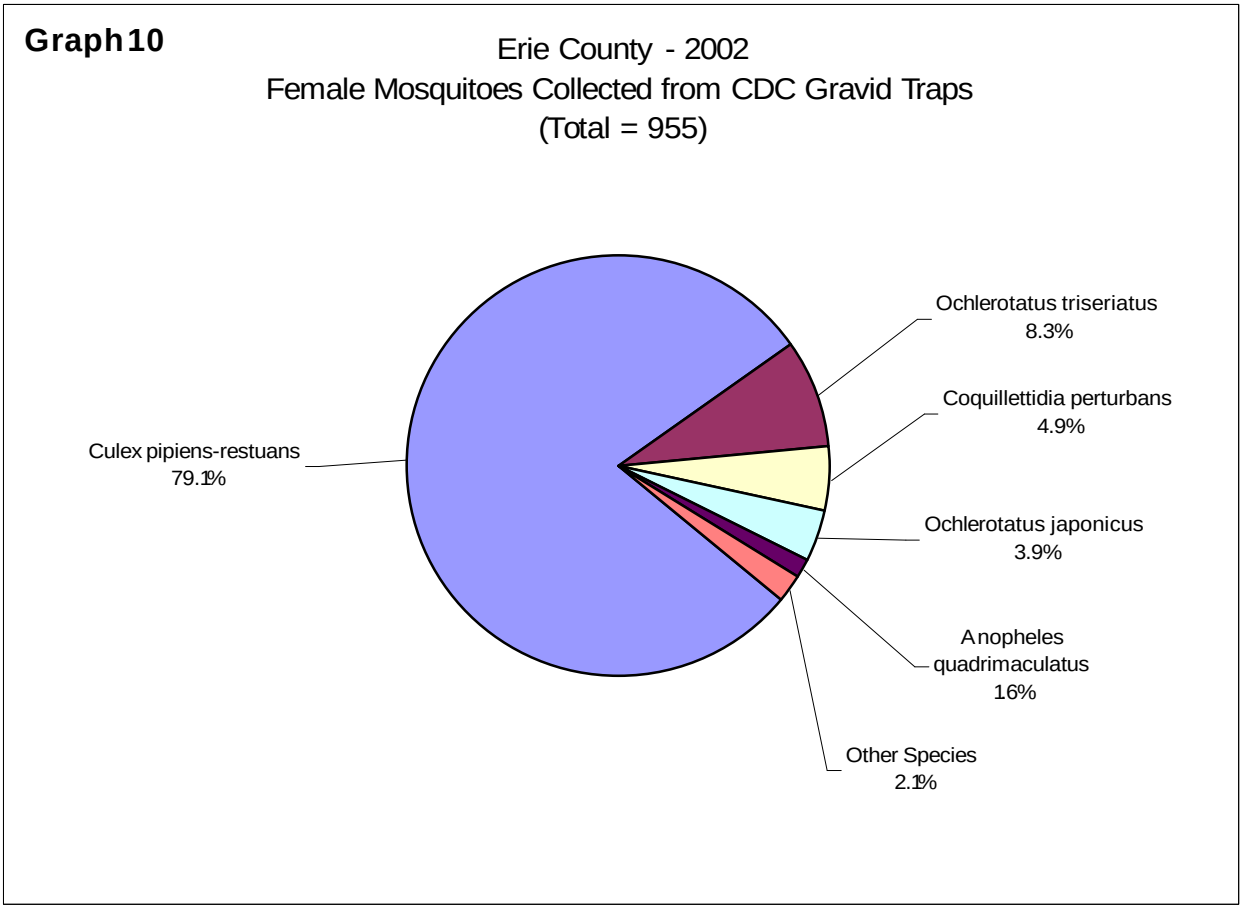
CDC GRAVID TRAP MOSQUITO SPECIES COMPOSITION

The next four graphs (Graphs 9-12) show the mix of mosquito species caught in each of the past four years in Gravid Traps. These traps are designed to capture mosquitoes that lay their eggs as egg rafts as in *Culex* species, those that lay their eggs on the waters surface singly as in *Anopheles* species and container breeders such as *Ochlerotatus japonicus*, *Ochlerotatus triseriatus* among others. It has been found that when other sources of stagnant water are available, gravid trap counts are negatively affected. It has also been determined that the more pungent the water, the better the catch of *Culex* species.

Gravid trapping was performed on a limited basis during the peak of mosquito season at all nine fixed trapping locations in 2001. The data is depicted in the following graph (Graph 9). This form of trapping predominantly captured *Culex pipiens-restuans* at 86.6% of the total catch. None of the mosquito pools were found to be positive for West Nile Virus from gravid trapping.

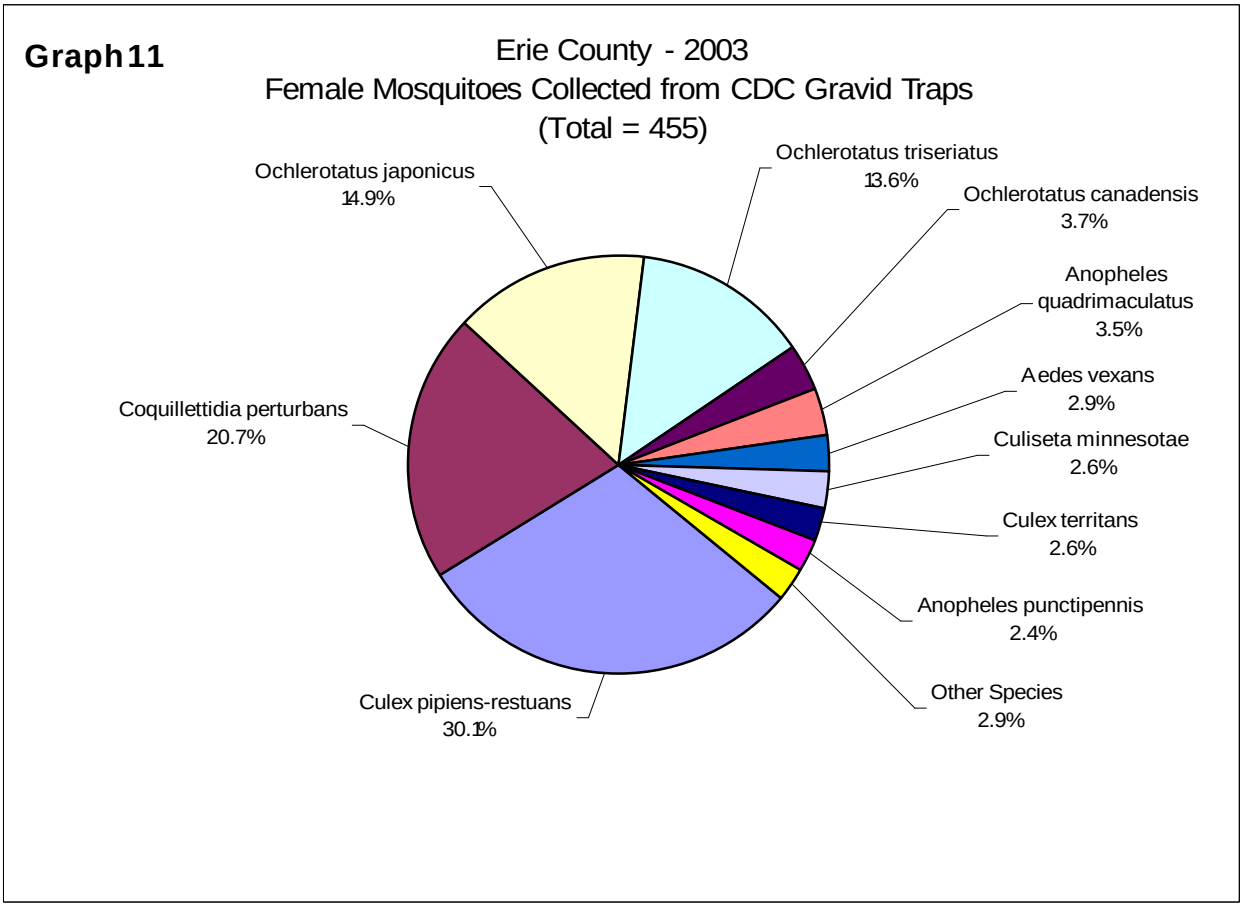


In 2002, Gravid trapping was expanded to a greater portion of the mosquito season at all nine fixed trapping locations. *Culex pipiens-restuans*, at 79.1% of the total catch, was the predominant species and three out of four of the West Nile Virus positive mosquito pools were caught in this type of trap.



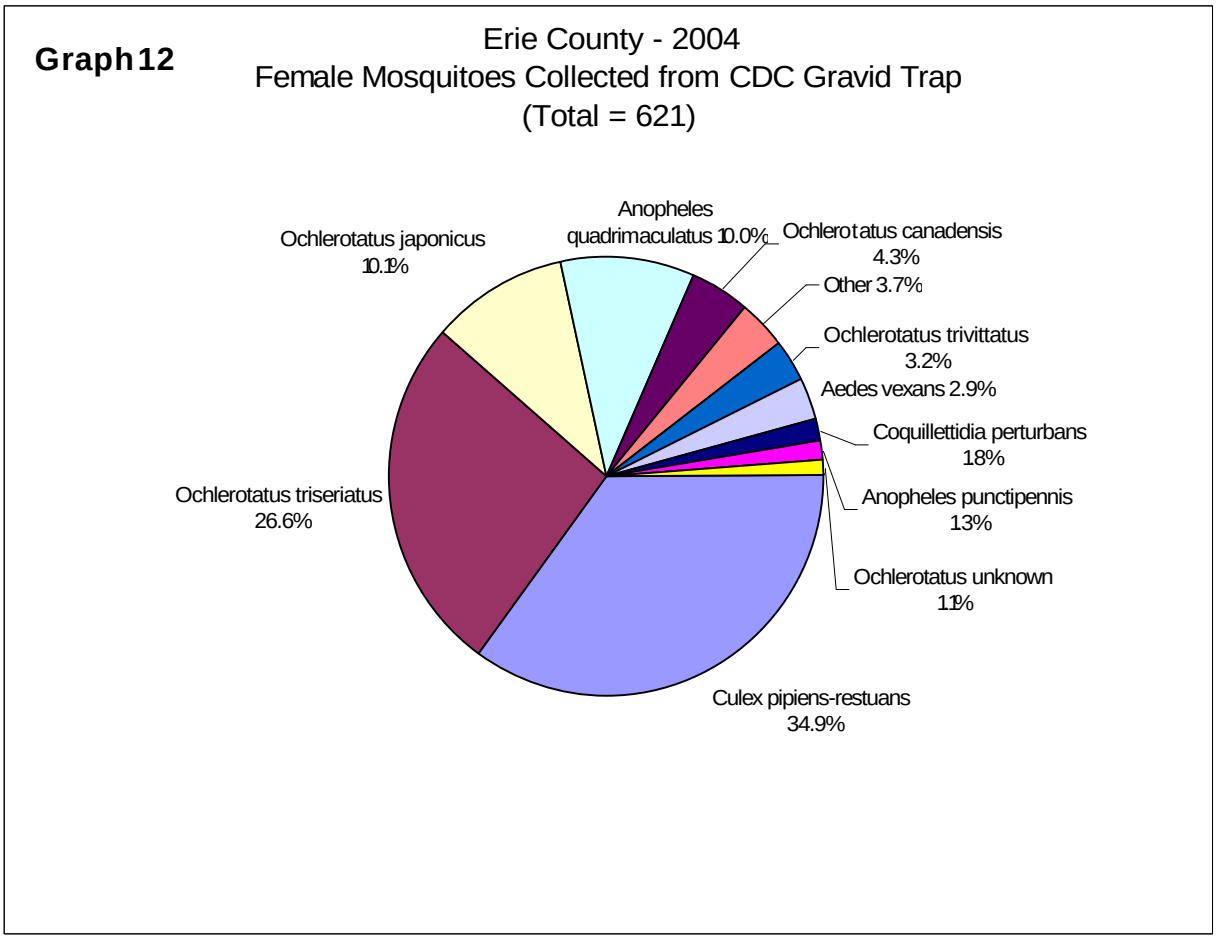
Other Species in 2002	
Aedes cinereus	0.4%
Aedes vexans	0.3%
Ochlerotatus cantator	0.3%
Culex territans	0.2%
Ochlerotatus trivittatus	0.2%
Anopheles earlei	0.1%
Anopheles punctipennis	0.1%
Culiseta inornata	0.1%
Ochlerotatus canadensis	0.1%
Ochlerotatus riparius	0.1%
Ochlerotatus stimulans	0.1%

In 2003, the expanded gravid trapping was continued but total count decreased by half. The proportion of *Culex pipiens-restuans* of the total mix also decreased as additional container breeders were caught. No mosquito pools were found positive for West Nile Virus from this trap method in 2003.



Other Species in 2003	
Ochlerotatus stimulans	0.7%
Anopheles walkeri	0.4%
Ochlerotatus aurifer	0.4%
Ochlerotatus trivittatus	0.4%
Uranotaenia sapphirina	0.4%
Culiseta inornata	0.2%
Ochlerotatus communis	0.2%

In 2004, gravid trapping was continued in the same manner and total counts increased marginally. The proportion of *Culex pipiens-restuans* of the total mix remained similar to the catch in 2003. An increase in *Ochlerotatus triseriatus*, a container breeder, was observed. As in 2003, no mosquito pools were found positive for West Nile Virus from this trap method in 2004.



Other Species in 2004	
Uranotaenia sapphirina	0.80%
Anopheles barberi	0.64%
Aedes cinereus	0.48%
Culex territans	0.32%
Ochlerotatus aurifer	0.32%
Ochlerotatus communis	0.32%
Anopheles earlei	0.16%
Anopheles walkeri	0.16%
Culiseta minnesotae	0.16%
Ochlerotatus cantator	0.16%
Ochlerotatus stimulans	0.16%

POSITIVE MOSQUITO POOL RESULTS

WEST NILE VIRUS POSITIVE MOSQUITOES

Female mosquitoes from each trap are brought to the ECHD Vector Control Lab, sorted, identified by species, counted, pooled, and submitted for West Nile Virus Testing at Griffin Lab. Males are sorted and discarded. Twenty-four positive pools detected since 2000 are described in the following table (Table 7).

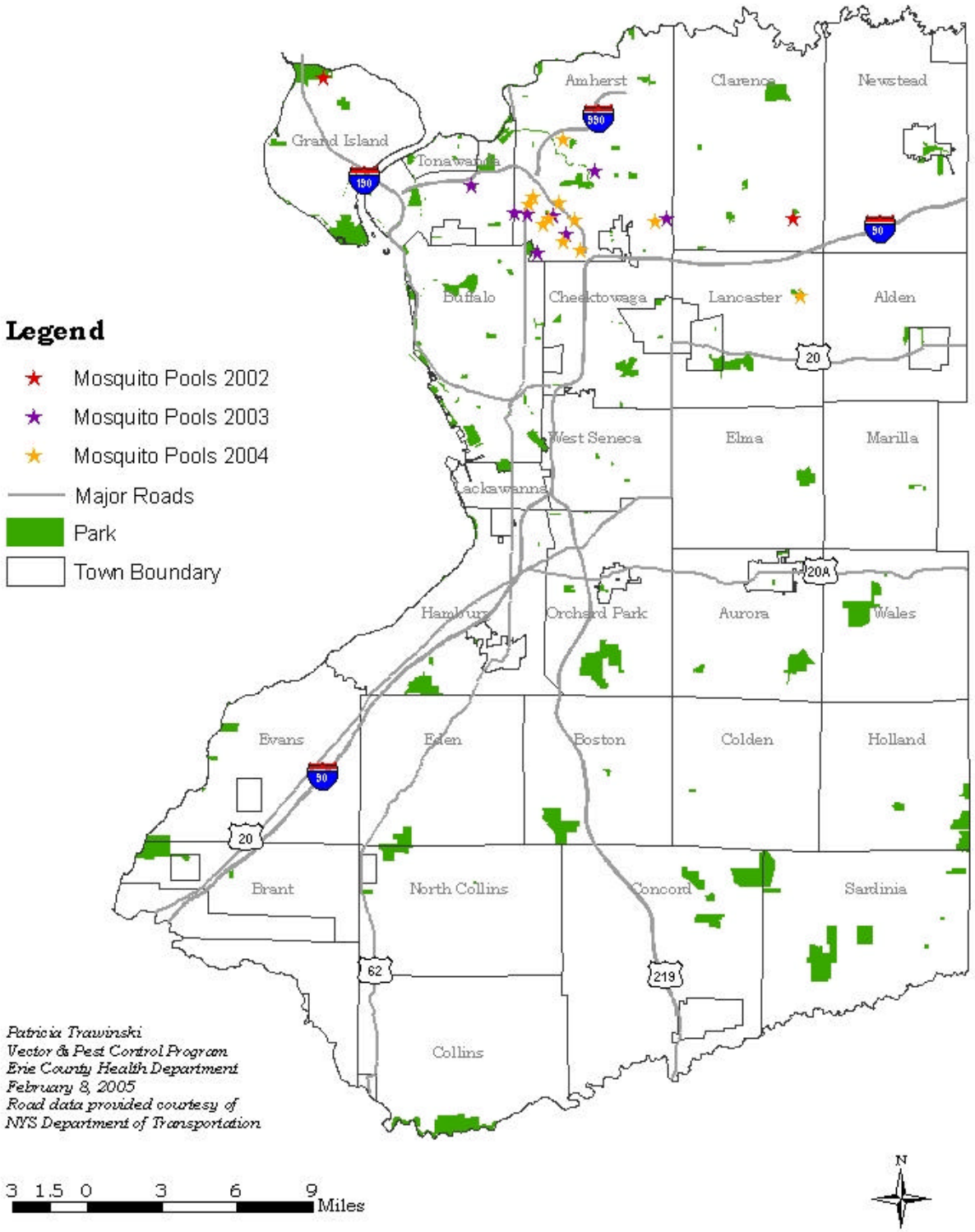
Table 7. West Nile Virus Positive Mosquito Pools 2000-2004

Trap Location	Address	Town	Trap Type	Date Collected	Species	Number of Mosquitoes	Date Reported
Buckhorn Island State Park	5808 East River Rd	Grand Island, 14072	GRA	07/31/02	*Culex pipiens-restuans*	50	08/09/02
Main Park	10405 Main St	Clarence, 14031	GRA	08/09/02	*Culex pipiens-restuans*	40	08/19/02
Kenney Field	2000 Colvin Blvd	Tonawanda, 14150	LGT	08/14/02	*Culex pipiens-restuans*	34	08/26/02
Kenney Field	2000 Colvin Blvd	Tonawanda, 14150	GRA	08/14/02	*Culex pipiens-restuans*	14	08/27/02
Kenney Field	2000 Colvin Blvd	Tonawanda 14150	LGT	08/13/03	*Culex pipiens-restuans*	33	08/25/03
03-459	960 Eggert Road	Amherst 14226	GRA	08/26/03	*Culex pipiens-restuans*	50	09/24/03
03-462	170 Marion Road	Amherst 14226	GRA	08/27/03	*Culex pipiens-restuans*	10	09/11/03
03-472	37 Campus Drive West	Amherst 14226	GRA	09/03/03	*Culex pipiens-restuans*	13	09/12/03
03-473	78 Chateau Terrace	Amherst 14226	GRA	09/03/03	*Culex pipiens-restuans*	50	09/12/03
03-476	Tennyson Terrace	Amherst 14221	GRA	09/03/03	*Culex pipiens-restuans*	32	09/12/03
03-491	41 West Klein Road	Amherst 14221	GRA	09/09/03	*Culex pipiens-restuans*	16	09/24/03
03-522	1847 Eggert Road	Amherst 14226	GRA	09/17/03	*Culex pipiens-restuans*	10	09/25/03
Walden Pond Park	4484 Walden Ave	Lancaster, 14086	LGT	07/22/04	*Culex pipiens-restuans*	27	08/02/04
04-115	15 Danebrock Dr	Amherst, 14226	GRA	08/03/04	*Culex pipiens-restuans*	40	08/18/04
04-125	57 Lincoln Rd	Amherst, 14221	GRA	08/10/04	*Culex pipiens-restuans*	50	08/20/04
04-135	256 Lorfield Dr	Amherst, 14226	GRA	08/11/04	*Culex pipiens-restuans*	50	08/20/04
04-049	Bryant Woods S	Amherst, 14228	GRA	08/12/04	*Culex pipiens-restuans*	34	08/23/04
04-180	90 Hardt Ln	Amherst, 14226	GRA	08/24/04	*Culex pipiens-restuans*	23	09/02/04
04-085	30 Manning Dr	Amherst, 14226	GRA	08/29/04	*Culex pipiens-restuans*	30	09/13/04
04-198	3286 Sheridan Dr	Amherst, 14226	LGT	08/31/04	*Culex pipiens-restuans*	46	09/13/04
04-202	52 Thistle Lea	Williamsville, 14221	GRA	09/07/04	*Culex pipiens-restuans*	14	09/17/04
04-141	7 Millbrook Ct	Williamsville, 14221	GRA	09/07/04	*Culex pipiens-restuans*	36	09/23/04
04-077	885 Sweethome Rd	Amherst, 14226	LGT	09/13/04	*Culex pipiens-restuans*	21	09/28/04
04-077	885 Sweethome Rd	Amherst, 14226	GRA	09/13/04	*Culex pipiens-restuans*	14	09/28/04

LGT=CDC Light Trap
GRA=CDC Gravid Trap

The Erie County Health Department response to each positive pool report from Griffin Lab is to perform larval surveillance in the immediate surrounding area where the positive mosquitoes were trapped. This includes inspecting for standing water/mosquito larval habitat, mosquito larval identification and subsequent remediation/control where needed. The West Nile Virus brochure was distributed in the local neighborhood and to the appropriate town office for local residents. The following page contains a map of the West Nile Virus positive mosquito pool trapping locations.

West Nile Virus Positive Mosquito Pools in Erie County 2002 to 2004



OTHER ARTHROPOD-BORNE VIRUSES DETECTED

Mosquitoes are the vector of many diseases other than West Nile Virus including malaria and other Arthropod-borne viruses (arbovirus). Malaria has not been prevalent in New York State due to numerous reasons including a lack of positive humans as a reservoir and lack of a large number of *Anopheles* species mosquitoes. There is a history of other Arthropod-borne viruses in both Western New York and New York State, in general.

Prior to 2004, a few select species known to carry certain viruses have been tested. A need existed for expanded testing for these viruses. A procedure for the testing of mosquito pools for Arthropod-borne viruses other than West Nile Virus has been developed by the NYSDOH. The following is an excerpt from 2004 revisions to the NYSDOH West Nile Virus Response Plan describing the changes.

> **"Mosquito Surveillance and Testing for Arboviruses other than WNV**. Eastern equine encephalitis (EEE) virus and St. Louis encephalitis (SLE) virus were both detected in New York State in 2003. This was the first finding of EEE in horses in NYS since 1991, and the first finding of SLE in NYS since 1975. In anticipation of finding these viruses concurrently in the future, the following procedures will take place with regard to mosquito surveillance, collection, and testing for arboviruses:
>
> • All mosquitoes submitted to Wadsworth for testing will be tested for WNV using PCR. Simultaneously, all non-*Culex* will be tested for other arboviruses using cell culture. Approximately one-third of *Culex* species will be tested for other arboviruses using cell culture.
>
> • PCR testing requires approximately 1-2 days to obtain results after receipt and data entry. Cell culture testing takes 2 to 4 days or longer, depending on which viruses may be present.
>
> • Should EEE or SLE be found using cell culture, subsequent mosquitoes from that particular county, and surrounding counties, will be tested for that virus using PCR."

Eastern equine encephalitis (EEE) virus and St. Louis encephalitis (SLE) have not been detected in Erie County despite human, animal or mosquito surveillance for these diseases. Through the efforts of the Erie County Health Department, Vector Control Program, Cache Valley Virus, Flanders-Like Virus, LaCrosse Virus and Trivittatus Virus have been detected in Erie County over the past two years.

Cache Valley Virus (CVV), discovered in Utah in 1956, is widely distributed in the United States and Canada. Cache Valley virus is in the family Bunyaviridae and has a wide vertebrate host range. Infections appear to occur most commonly in large vertebrates such as cattle, sheep, horses and white tail deer. CVV is known to cause abortions and birth defects such as malformed joints and excessive fluid accumulations in the cranium. It is currently not associated with human illness.

Flanders-Like Virus (FLV) is in the family Rhabdoviridae and has been isolated from *Culiseta melanura* and *Culex pipiens* mosquitoes. It has not been known to cause human disease. The only known host species is the Ovenbird, *Seiurus aurocapillus*. Other natural reservoirs of the virus have not been determined.

California serogroup is a set of Arthropod-borne viruses in the family Bunyaviridae. It consists of four complexes: California Encephalitis; Melao; Trivitattus; and Guaroa. LaCrosse Virus (LAX), in the

California Encephalitis complex, is the most important human pathogen in this group. It is distributed across the Eastern United States. The vector species is most commonly *Ochlerotatus triseriatus*, but in New York and Ohio it is also carried by *Ochlerotatus canadensis*. The host species includes small rodents such as chipmunks and squirrels. It can be transmitted transovarially from female mosquitoes to their eggs and from male to female mosquito during mating. This virus causes an acute febrile illness in children under 16 that in some cases can progress to encephalitis and rarely death.

Trivitattus Virus (TVT) is also in the California Serogroup in the Trivitattus Complex. The vector is *Ochlerotatus trivitattus*. The vertebrate host is the cottontail rabbit. Transovarial transmission in mosquitoes has also been documented. This virus is not considered a human pathogen.

The following table (Table 8) describes the surveillance data and viral results for the mosquito pools found positive for other Arthropod-borne viruses detected in Erie County.

Table 8. Mosquito Pools Positive for Arthropod-borne Viruses Other Than West Nile Virus 2000-2004

Trap Site	Address	Town	Trap Method	Date Collected	Species	Number of Mosquitoes	WNV_Final Result	WNV Results Completed	Other Results	Other Results Completed
Raintree Island Nature Trail	3000 Colvin Blvd	Tonawanda, 14150	LGT	07/29/03	*Aedes vexans*	11	NEG	08/07/03	CV	04/21/04
Buckhorn Island State Park	5808 East River Rd	Grand Island, 14072	LGT	08/06/03	*Aedes cinereus*	12	NEG	08/14/03	CV	04/21/04
Main Park	10405 Main St	Clarence, 14031	LGT	08/29/03	*Ochlerotatus trivittatus*	48	NEG	09/08/03	CV	04/21/04
Walden Pond Park	4484 Walden Ave	Lancaster, 14086	LGT	08/29/03	*Aedes vexans*	33	NEG	09/08/03	CV	04/21/04
Raintree Island Nature Trail	3000 Colvin Blvd	Tonawanda, 14150	LGT	09/09/03	*Aedes vexans*	31	NEG	09/22/03	CV	04/21/04
Main Park	10405 Main St	Clarence, 14031	LGT	09/12/03	*Ochlerotatus trivittatus*	24	NEG	09/22/03	CV	04/21/04
Main Park	10405 Main St	Clarence, 14031	LGT	09/18/03	*Ochlerotatus trivittatus*	18	NEG	09/25/03	CV	04/21/04
Kenney Field	2000 Colvin Blvd	Tonawanda, 14150	LGT	09/24/03	*Aedes vexans*	15	NEG	10/03/03	CV	04/21/04
Kenney Field	2000 Colvin Blvd	Tonawanda, 14150	LGT	09/17/03	*Ochlerotatus trivittatus*	10	NEG	09/25/03	I	04/21/04
Sprague Brook Park	9674 Foote Rd	Glenwood, 14069	LGT	06/15/04	*Aedes vexans*	15	NEG	06/25/04	LAX	07/22/04
04-104	879 Hopkins Rd	Williamsville, 14221	GRA	07/28/04	*Culex pipiens-restuans*	14	NEG	08/09/04	FLA	08/17/04
04-096	24 Augusta Ave	Amherst, 14226	GRA	08/02/04	*Culex pipiens-restuans*	50	NEG	08/13/04	FLA	08/26/04

Table 8. Mosquito Pools Positive for Arthropod-borne Viruses Other Than West Nile Virus 2000-2004										
Trap Site	Address	Town	Trap Method	Date Collected	Species	Number of Mosquitoes	WNV_Final Result	WNV Results Completed	Other Results	Other Results Completed
04-111	64 Leonore Rd	Amherst, 14226	GRA	08/02/04	*Culex pipiens-restuans*	28	NEG	08/13/04	FLA	08/26/04
04-017	Youngs/Stonewood	Williamsville, 14221	LGT	08/05/04	*Culex pipiens-restuans*	14	NEG	08/13/04	FLA	08/20/04
04-121	32 Northledge Dr	Amherst, 14226	GRA	08/09/04	*Culex pipiens-restuans*	28	NEG	08/20/04	FLA	09/30/04
04-125	57 Lincoln Rd	Amherst, 14221	GRA	08/10/04	*Culex pipiens-restuans*	50	NEG	08/20/04	FLA	09/13/04
04-127	229 Bentham Pkwy East	Amherst, 14226	GRA	08/10/04	*Culex pipiens-restuans*	50	NEG	08/20/04	FLA	09/13/04
04-132	59 Mona Dr	Amherst, 14226	GRA	08/11/04	*Culex pipiens-restuans*	24	NEG	08/20/04	FLA	09/13/04
04-135	256 Lorfield Dr	Amherst, 14226	GRA	08/11/04	*Culex pipiens-restuans*	49	NEG	08/20/04	FLA	09/13/04
Walden Pond Park	4484 Walden Ave	Lancaster, 14086	LGT	08/12/04	*Culex pipiens-restuans*	17	NEG	08/20/04	FLA	09/02/04
04-145	57 Thistle Lea	Williamsville, 14221	GRA	08/12/04	*Culex pipiens-restuans*	15	NEG	08/20/04	FLA	09/02/04
04-059	Burroughs Dr	Amherst, 14226	LGT	08/16/04	*Culex pipiens-restuans*	50	NEG	09/01/04	FLA	09/17/04
04-191	130 John Muir Dr	Amherst, 14228	GRA	08/30/04	*Culex pipiens-restuans*	14	NEG	09/13/04	FLA	10/05/04
04-194	745-756 Robin Rd	Amherst, 14228	GRA	08/30/04	*Culex pipiens-restuans*	16	NEG	09/13/04	FLA	10/05/04
Tifft Nature Preserve	1200 Fuhrmann Blvd	Buffalo, 14203	LGT	09/30/04	*Ochlerotatus trivittatus*	25	NEG	10/08/04	TVT	11/05/04

CVV=Cache Valley Virus
FLV=Flanders-Like Virus
LAX=LaCrosse Virus
TVT=Trivittatus Virus
I=Indeterminant

CHRONOLOGY OF OTHER ARBOVIRUS EVENTS

In April of 2004, Griffin Lab notified the Erie County Vector Control Lab through electronic mail that mosquito results have been updated on the NYSDOH Health Information Network (HIN). The results of subsequent testing showed that eight mosquito pools tested positive for Cache Valley Virus and one pool was listed as indeterminate. These mosquito pools had been tested through viral culture where Cytopathic Effect (CPE) was observed in cell culture. CPE indicated that a virus is present in cell culture. Assays

were then performed to identify the virus. Eight viruses were identified and one was indeterminate. After the Vector Control Staff analyzed the significance of Cache Valley Virus detection in Erie County, the Erie County Commissioner of Health was briefed and the following alert was posted for veterinarians by the commissioner.

County of Erie

JOEL A. GIAMBRA
COUNTY EXECUTIVE

DEPARTMENT OF HEALTH

ANTHONY J. BILLITTIER IV, M.D., FACEP
COMMISSIONER OF HEALTH

This message is a health notification from the Commissioner of Health.

The information enclosed should be utilized at your discretion.

Please distribute to Veterinarians, large animal farms, zoos, wildlife rehabilitation centers, and animal control offices.

HEALTH UPDATE #70 **MAY 4, 2004**

On April 21st of this year the NYS laboratory at Wadsworth posted Arthropod Borne virus results other than West Nile virus for Erie County in 2003. Eight of the mosquito pools (10 to 50 like mosquitoes) the Erie County Vector Control Program submitted tested positive for Cache Valley (CV) virus. The mosquitoes were trapped in Grand Island, Tonawanda, Clarence and Lancaster. Before 2003 the last mosquito pool tested positive for CV in Erie County was in Amherst in 1997.

"Cache Valley virus, discovered in Utah in 1956, is widely distributed in the United States and Canada. Cache Valley virus has a wide vertebrate host range, but infections appear to occur most commonly in large vertebrates such as cattle, sheep, horses and white tail deer. CV virus is known to cause abortions and birth defects such as malformed joints and excessive fluid accumulations in the cranium."

The NYS Department of Health does not consider CV virus a public health threat to humans.
The Erie County Health Department will continue to monitor CV virus in our area.

Additional information can be found at http://biology.nd.edu/grimstad.shtml

Please address any questions regarding CV or other Arthropod Borne diseases to:
John P. Eiss (716-898-5756) Erie County Department of Health Vector Control Program.

On July 22, 2004, it was reported to the ECHD Vector Control Lab by the NYSDOH via electronic mail that a pool of 15 *Aedes vexans* mosquitoes collected on June 15, 2004 at Sprague Brook Park in Glenwood, NY was found positive for LaCrosse Virus. All subsequent mosquito pools, were monitored throughout the remainder of mosquito season for any additional positive results for LaCrosse Virus and all were negative. After reviewing the significance to human health of LaCrosse Virus, the following health alert was issued by the Erie County Commissioner of Health.

County of Erie

JOEL A. GIAMBRA
COUNTY EXECUTIVE

DEPARTMENT OF HEALTH

ANTHONY J. BILLITTIER IV, M.D., FACEP
COMMISSIONER OF HEALTH

This message is a health notification from the Commissioner of Health.

The information enclosed should be utilized at your discretion.

HEALTH ADVISORY #90 **JULY 28, 2004**

California serogroup LaCrosse Virus found in Mosquito Sample in Erie County

Erie County has its first positive California serogroup LaCrosse Virus mosquito sample. On July 22nd, the Erie County Health Department was notified that a mosquito sample, collected on June 15, 2004 in Erie County, was found to be positive for the California serotype LaCrosse Virus. The mosquito sample was identified as Aedes vexans, a prolific human biter. Four other counties in New York State, including two in the Western Region, have found the California serogroup.

The LaCrosse Virus can infect humans. LaCrosse encephalitis is a rare disease that is spread by infected mosquitoes and occurs mostly in children under the age of 16 years. The incubation period is from 5 to 15 days after the bite of an infected mosquito. LaCrosse encephalitis is usually a mild illness, with fever, headache, nausea, vomiting and tiredness.

Persons who are at an increased risk are children, people who live in or visit woodland habitats and people who work outside or participate in outdoor recreational activities. Prevention is the control of mosquitoes and the prevention of bites.

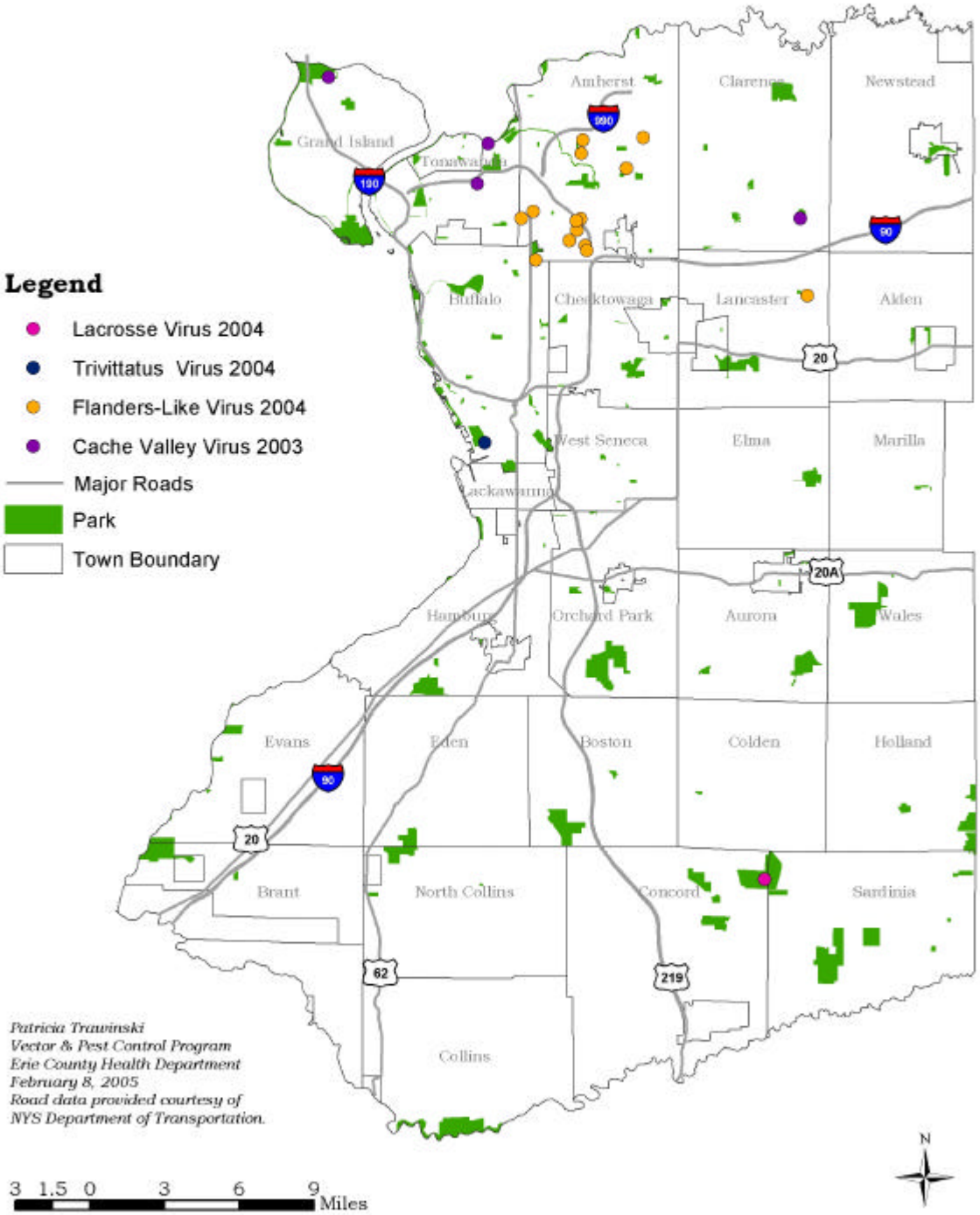
The Erie County Health Department is asking physicians and other healthcare providers to contact the Health Department if an encephalitis case is suspected at **716-858-7697** (Monday - Friday 8:30AM - 4:00PM) or **716-898-4225** (evenings, weekends, and holidays).

More information on LaCrosse Encephalitis and other forms of mosquito-borne viral encephalitis can be found at http://www.cdc.gov/ncidod/dvbid/arboinfo.htm and http://chppm-www.apgea.army.mil/ento

On August 17, 2004, the first of many Flanders-Like Virus (FLV) positive mosquito pools collected in Erie County was reported to the Vector Control Lab. No threat to human health was determined regarding this virus and no Health Alert was posted.

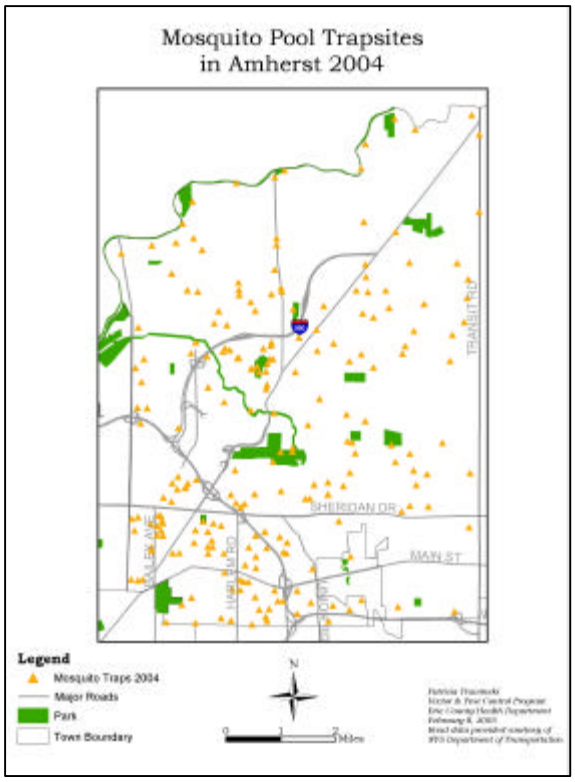
On November 5, 2004, a Trivittatus Virus (TVT) positive mosquito pool collected on October 8, 2004 at Tifft Nature Preserve was reported to the Vector Control Program. This result was reported after the end of the mosquito trapping season. The host species is the cottontail rabbit and no threat to human health is indicted for this virus. No Health Alert was issued but the staff at Tifft Nature Preserve was notified as a precaution. The following map shows the locations of Arbovirus detections other that West Nile Virus.

Other Arthropod Borne Viruses Detected from Mosquito Pools in Erie County 2003 to 2004



COLLABORATIVE EFFORT WITH THE TOWN OF AMHERST

The Erie County Health Department, Vector Control Laboratory has enjoyed a productive collaborative relationship with the Town of Amherst, Highway Department's Mosquito Control Program over the past five years. The Vector Control Lab has taken the lead role regarding mosquito surveillance by supplying the necessary means for viral testing of mosquito pools. All mosquito pools, defined as 10 to 50 mosquitoes of the same species caught the same trap-night, have the following requirements. The mosquitoes must be placed in Ependorf tubes with beads labeled with an appropriate specimen number. Both tubes and labels are supplied by Griffin Lab and distributed to the Town of Amherst by the ECHD Vector Control Program. These pool tubes must be shipped to Griffin Laboratory on dry ice on a weekly basis on the designated day. All mosquito shipping has been performed by the Vector Lab. All mosquito trap data must be entered on the NYSDOH Health Information Network (HIN) prior Griffin Lab receiving the samples. Viral testing for West Nile Virus and other arboviruses will not be performed without this information. All data entry for pools generated by the Town of Amherst was entered by the ECHD Vector Control Lab staff.



West Nile Virus and other viral results from Griffin Lab are reviewed on a weekly basis by the ECHD Vector Control Lab Staff. Results are also reviewed upon email notification stating that results have been posted. Any positive results from pools generated from Town of Amherst trapping are reported in a timely manner to them.

The Town of Amherst, Highway Department has had an active Mosquito Control Program since 1975. They have historically conducted mosquito surveillance and nuisance mosquito control, which includes both larvicide application and limited mosquito adulticide application.

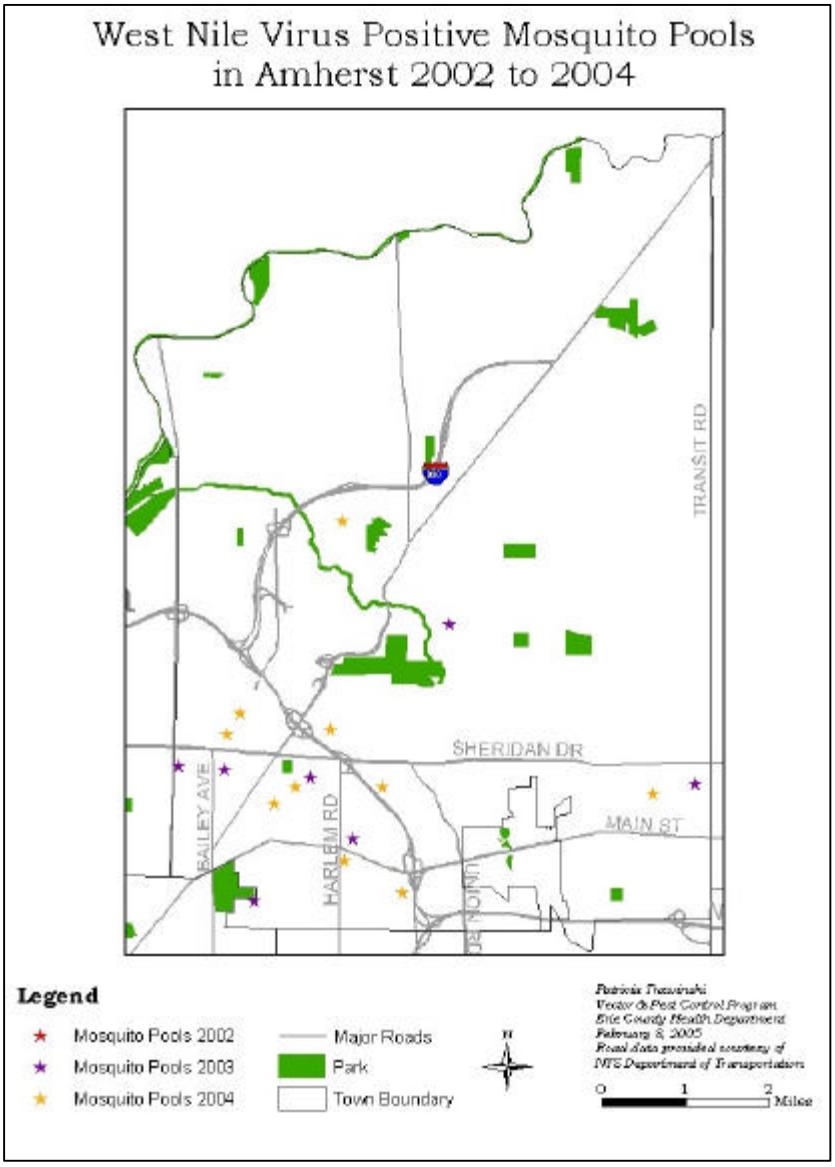
In 2004, the town of Amherst, Mosquito Control program conducted both CDC Light trapping and CDC Gravid trapping at 221 locations within the town limits capturing 63,677 mosquitoes. The trapping locations are indicated on the map above. Identification, counting and pooling was performed by the Town of Amherst staff. The following table (Table 9) shows the pools submitted by the Vector Control Lab on their behalf over the past four years.

Table 9. Mosquito Pools collected by the Town of Amherst, Mosquito Control Program

Year	Pools Submitted	West Nile Virus Detected	Other Arboviruses Detected
2001	118	0	0
2002	120	0	0
2003	181	7	0
2004	541	11	13*
Total	960	18	13

* Flanders-like Virus – from *Culex pipiens-restuans*- Not a human pathogen

The 17 locations where 18 West Nile Virus positive mosquito pools were found in the Town of Amherst are on the map to the right. This represents 75% of the 24 West Nile Positive Mosquito pools over the past three years since it was first detected in mosquitoes in Erie County. No positive pools or human cases occurred in the Town of Amherst in 2002, which was the only year that virus activity was observed in the human population of Erie County. In that year, dead crow density spiked into the moderate range and West Nile Virus Positive mosquito pools were detected in Tonawanda, Grand Island and Clarence. Note that a similar effort in trapping is conducted weekly in the town of Amherst as is performed in the remainder of Erie County by the Vector Control Program. In addition, extensive mosquito habitat exists within the town borders.



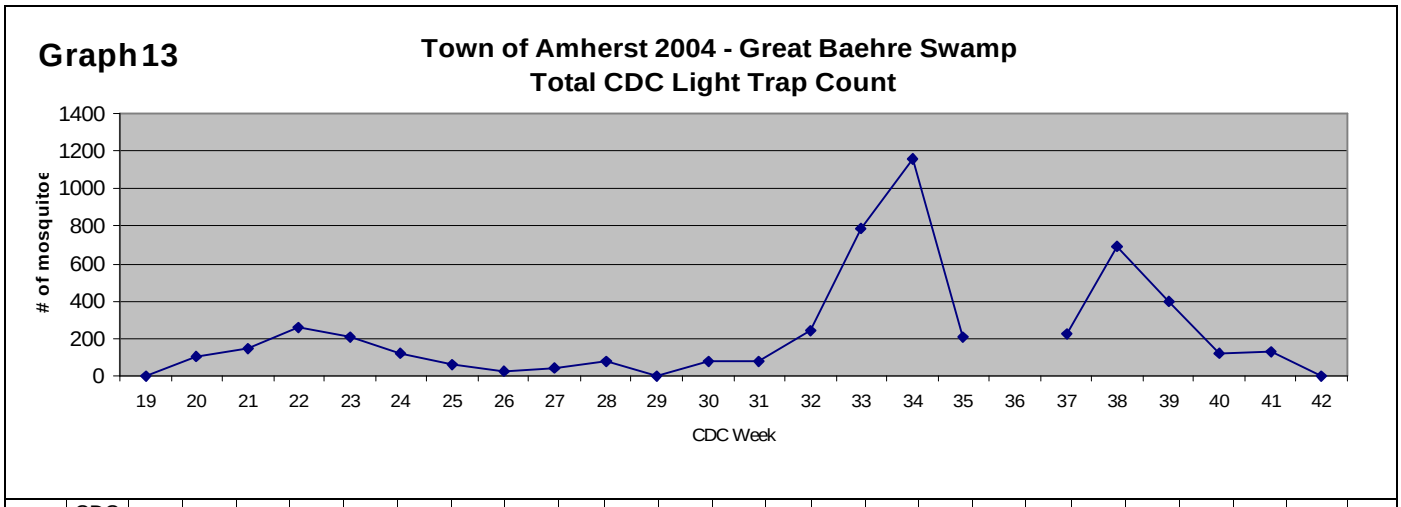
The following table (Table 10) shows the total mosquitoes trapped, *Culex* species trapped, and percentage of *Culex* species through CDC Light and Gravid trapping by the Town of Amherst, Mosquito Control Program. It was not required that data be entered through the NYSDOH HIN in 2001 and is not available.

Table 10. Mosquitoes Captured in CDC Light Traps and Gravid Traps

Trap Site	Year	Seasonal Total All Female Mosquitoes		Seasonal Total *Culex pipiens-restuans*		*Culex pipiens-restuans* Percent of Total	
		Light Trap	Gravid Trap	Light Trap	Gravid Trap	Light Trap	Gravid Trap
Town of Amherst Mosquito Control Program Various Locations	2002	10309	0	948	0	9.2	0.0
	2003	10411	2413	1387	2159	13.3	89.4
	2004	52223	11454	1484	6990	2.8	61.0

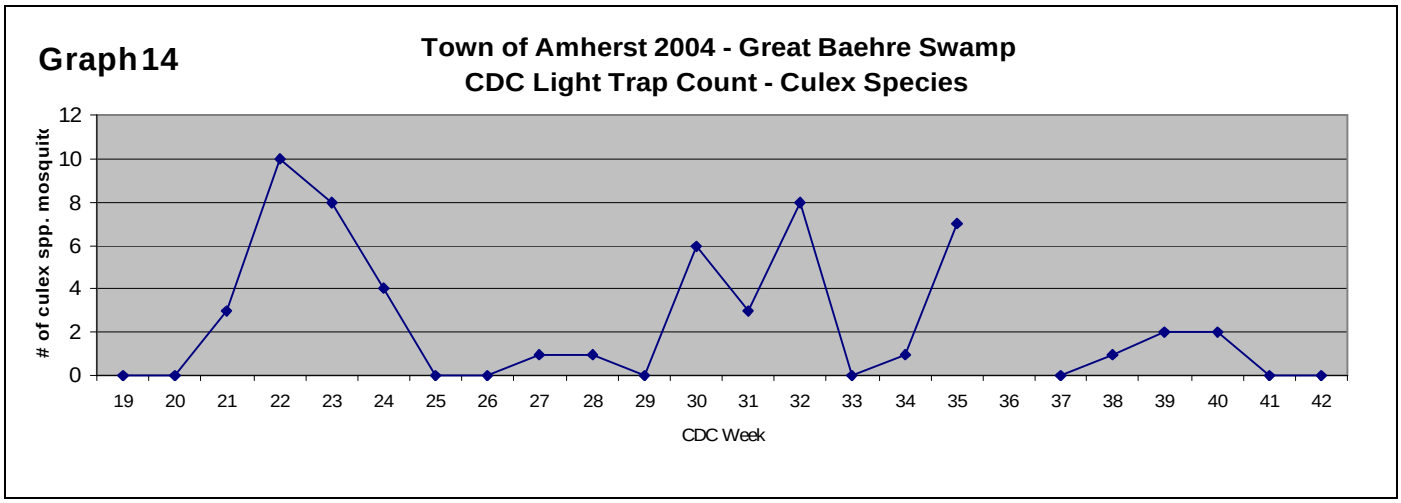
The Town of Amherst was asked by the Vector Control Program of the Erie County Health Department to conduct mosquito surveillance at one fixed trap location of their choosing in 2004 so that the population of mosquitoes could be consistently monitored throughout the season. An appropriate

location was selected for this purpose at the Great Baehre Swamp in the Town of Amherst. CDC Light and CDC Gravid traps were utilized at this location each week during the mosquito season. CDC light trapping captured relatively low numbers of mosquitoes until August when numbers increased rapidly. Mosquito counts the week of August 22 were just below 1,200 and many of the mosquitoes were listed as "unidentified" due to time constraints for laboratory processing as reported by the Town of Amherst Mosquito Control Program. Despite this large number of unidentified mosquitoes, an increase in the number of *Aedes vexans* was indicated in the data. Another peak was realized the week of September 19 most probably due to the rain event on September 8 from hurricane Frances. The gap in the graph (Graph 13) indicates that there is no data for CDC week 36.



CDC Week	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
2004	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	8/15	8/22	8/29	9/5	9/12	9/19	9/26	10/3	10/10

The numbers of *Culex* species at this trap location was generally low and at times absent completely. Other trap sites in the town of Amherst captured *Culex pipiens-restuans* mosquitoes in consistently good numbers.

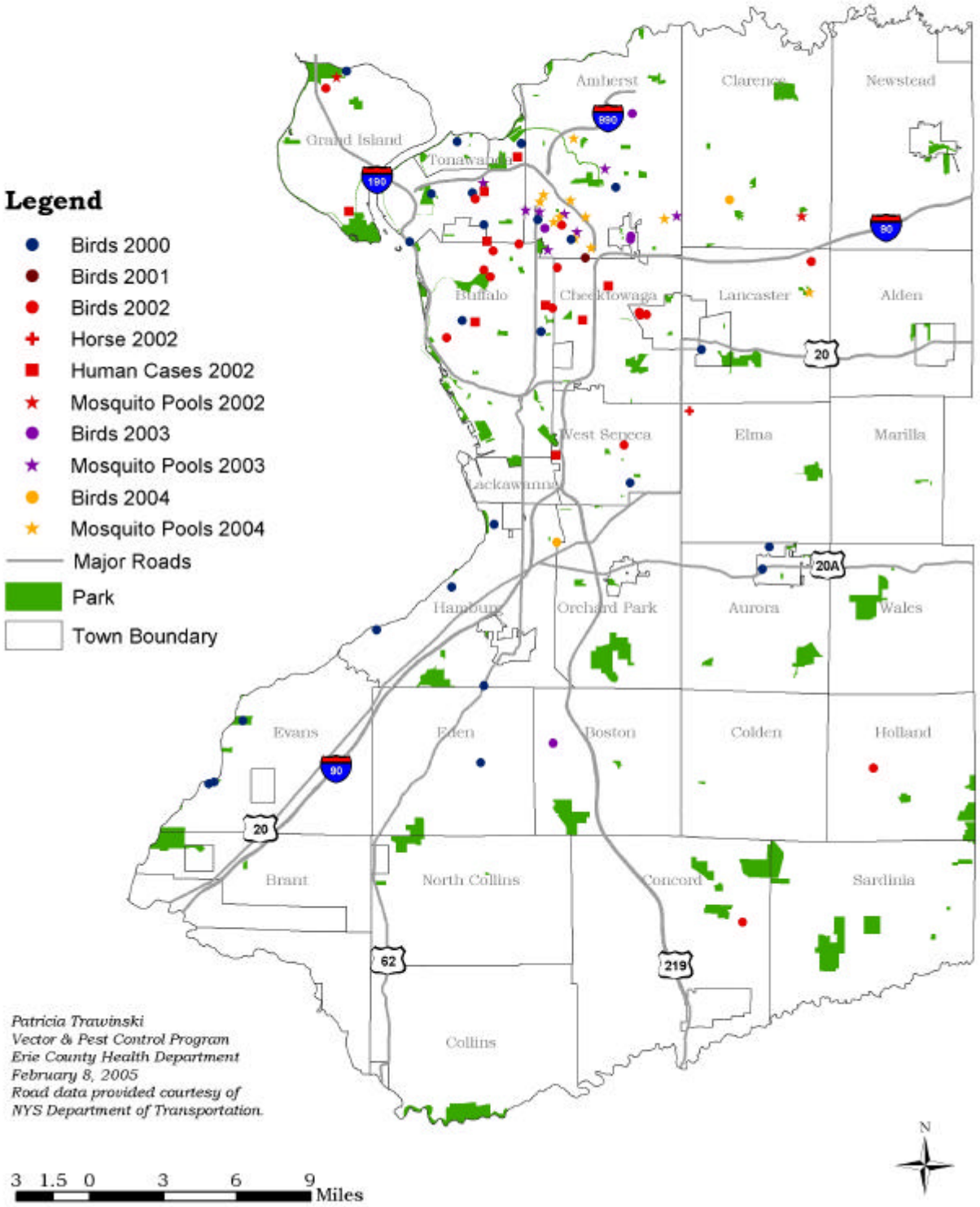


The Town of Amherst, Mosquito Control Program also partnered with the Vector Control Program regarding mosquito control and is covered in this report under the heading Project SWAT.

WNV Positive Events: Human, Bird, mammal and Mosquito

The Erie County Health Department has utilized the technology of Geo-Coding data in order to visually represent West Nile Virus events on a map of Erie County. This is performed to determine if there are trends in where these events have occurred and might be more likely to occur in the future. The map on the following page depicts the West Nile Virus positive events from 2000 to 2004. The Vector Control program is of the opinion that the severity of West Nile Virus events is greater in the northern towns of Erie County. This may be due to the higher human population density. Human activity creates unnatural larval habitat that lacks natural predators. These habitats include tires, house gutters, and other containers. There is also a higher occurrence of storm receiver catch basins in these areas which is proven to be an ideal habitat for the *Culex* species of mosquitoes. We have found through our investigations of positive events that usually when there is a positive mosquito pool, bird and human case, a suitable larval habitat with *Culex* species mosquitoes can be found nearby. It is important to note that in all educational materials and outreach, the point most stressed is to keep your backyard free of mosquito breeding sites. It is the single most effective means to prevent West Nile Virus and other mosquito borne diseases.

West Nile Virus Positive Events in Erie County 2000 to 2004

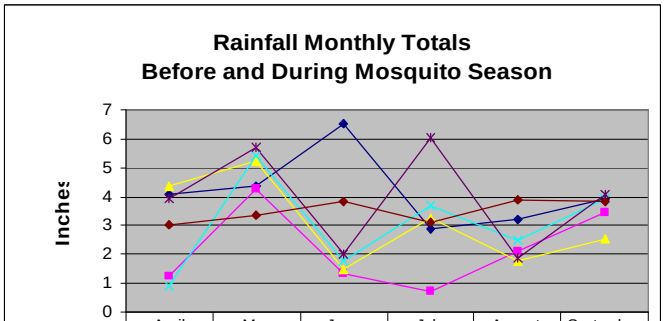


WEATHER FACTORS

Weather as a predictive tool for severity of the mosquito season is problematic. Even though, there are some indictors that can predict the severity of mosquito numbers. Mosquitoes need an aquatic habitat to breed. This water may come from rainfall and snow melt as in spring woodland pool species such as *Ochlerotatus stimulans* and *Ochlerotatus canadensis*. The water may be from lawn watering and car washing during hot dry summer months where runoff from these activities ends up in storm receiver catch basins. Mosquito habitat in the natural setting can essentially dry up, but conversely, the storm receiver catch basins hold water and organic material and can continue to breed mosquitoes. The species found in storm receivers, *Culex pipiens* and *Culex restuans*, are the primary vectors of West Nile Virus. The ECHD Vector Control Staff has observed that following a heavy rainfall, few mosquito larvae are found in the storm receivers due to being washed downstream through the storm sewer system. Drought years may prove to have more *Culex* activity than in wet years. Tires are also found to hold water when natural settings are dry. Tires are an excellent habitat for *Culex pipiens* and *Culex restuans*, the primary vector, as well as container breeders such as *Ochlerotatus triseriatus* and *Ochlerotatus japonicus* that have also been found to be competent vectors.

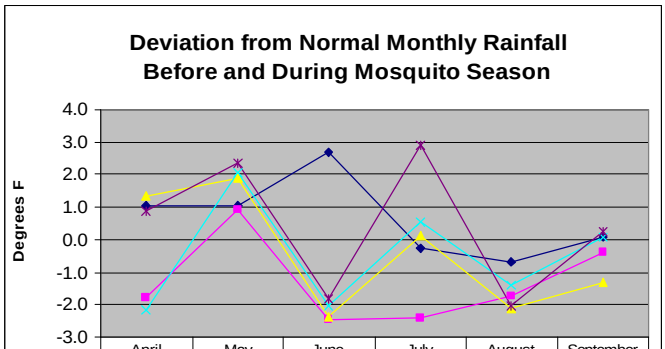
The graph (Graph 15) below on the left depicts the differences in monthly rain fall from April through September. The average rainfall for the five months is indicted for comparison. The graph (Graph 16) below on the right indicates the plus or minus deviation from normal indicated as 0.0.

Graph 15



	April	May	June	July	August	September
2000	4.07	4.38	6.51	2.9	3.21	3.92
2001	1.27	4.28	1.36	0.73	2.13	3.45
2002	4.38	5.23	1.47	3.24	1.77	2.54
2003	0.9	5.43	1.79	3.69	2.47	3.91
2004	3.94	5.72	2.02	6.04	1.86	4.07
Average	3.04	3.35	3.82	3.14	3.87	3.84

Graph 16



	April	May	June	July	August	September
2000	1.0	1.0	2.7	-0.2	-0.7	0.1
2001	-1.8	0.9	-2.5	-2.4	-1.7	-0.4
2002	1.3	1.9	-2.4	0.1	-2.1	-1.3
2003	-2.1	2.1	-2.0	0.6	-1.4	0.1
2004	0.9	2.4	-1.8	2.9	-2.0	0.2

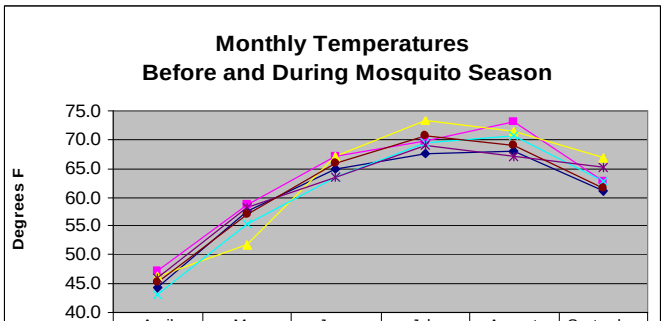
Info from National Weather Service, Buffalo, NY
http://www.erh.noaa.gov/buf/climate_information.htm

The year 2000 was the first year of West Nile Virus activity in Erie County. April, May and especially June were wetter that normal. Rainfall was normal to slightly below normal in July, August and September. In 2001, other than the month of May where rainfall was slightly above average, the remainder of the mosquito season was very dry. The only West Nile Virus activity observed in Erie County was a positive dead crow in late September. For the 2002 season, a wet April and May were followed by a dry summer where June, August and September rainfall was well below average and July

rainfall was average. Erie County experienced its greatest West Nile Virus activity with positive birds throughout the season, positive mosquito pools beginning in late July and human cases starting in early August. As for 2003, a very dry April was followed by a very wet May, leading to a large hatch of spring flood-water mosquitoes specifically *Ocherotatus canadensis*. The remainder of the summer was relatively dry where only July rainfall was slightly above average. Birds and mosquito pools positive for West Nile Virus were found but no human cases were observed. Mosquito counts in CDC Light Traps were three-fold higher than the two previous years. In 2004, April and May had above normal rainfall followed by below normal rainfall in June. July saw 2.9 inches above normal rainfall. This rainfall may have flushed *Culex* larvae out of the storm receiver catch basins thereby limiting their population. It also contributed to a larger than normal hatch of *Aedes vexans* in late July. August had below normal rainfall followed by a relatively dry September with one exception; a single 24 hour period September 8 through 9 where 3.93 inches of rain fell. The monthly total was 4.07 inches. This rain was from the remnants of hurricane Frances. This contributed to a spike in mosquito numbers, mostly floodwater mosquitoes, in CDC Light traps the week of September 26 and lingering into October.

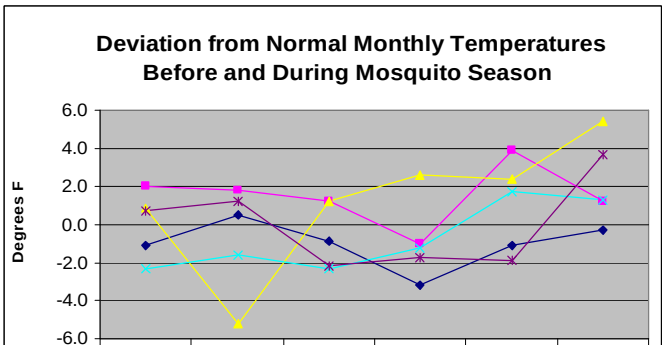
Temperature also has an effect on the time it takes for mosquito larva to mature, pupate and emerge as adults. Warmer water leads to a shorter duration from larvae to adult which generally ranges from seven to ten days. Monthly temperatures over the last four years have generally followed a similar pattern but it should be noted that in 2002, the year of greatest West Nile Virus activity in Erie County, monthly temperatures were above normal from June through September. Higher water temperatures allow mosquito larvae to pupate and mature to adult mosquitoes at a more rapid rate.

Graph 17



	April	May	June	July	August	September
2000	44.2	57.5	64.9	67.6	68.0	61.2
2001	47.3	58.8	67.0	69.8	73.0	62.7
2002	46.2	51.8	67.0	73.4	71.5	66.9
2003	43.0	55.4	63.5	69.6	70.8	62.8
2004	46	58.2	63.6	69.1	67.2	65.2
Normal	45.3	57.0	65.8	70.8	69.1	61.5

Graph 18



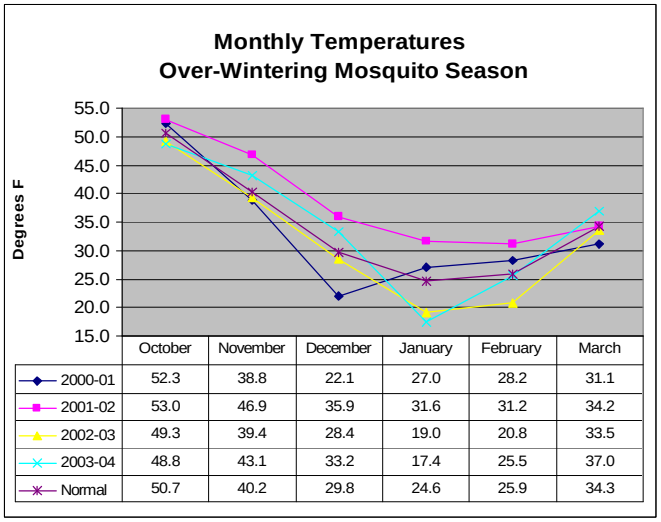
	April	May	June	July	August	September
2000	-1.1	0.5	-0.9	-3.2	-1.1	-0.3
2001	2.0	1.8	1.2	-1.0	3.9	1.2
2002	0.9	-5.2	1.2	2.6	2.4	5.4
2003	-2.3	-1.6	-2.3	-1.2	1.7	1.3
2004	0.7	1.2	-2.2	-1.7	-1.9	3.7

Info from National Weather Service, Buffalo, NY
http://www.erh.noaa.gov/buf/climate_information.htm

Previously stated in this report is the fact that *Culex* species mosquito counts were near 300 then declined during the beginning of the 2002 mosquito season. This comprised nearly 50 percent of the mosquitoes caught in CDC Light traps the first week of trapping and then declined in subsequent weeks. It is speculated that these were over-wintering *Culex* species mosquitoes that survived the winter to take one more blood-meal and lay their last raft of eggs. West Nile Virus is stored in these over-wintering

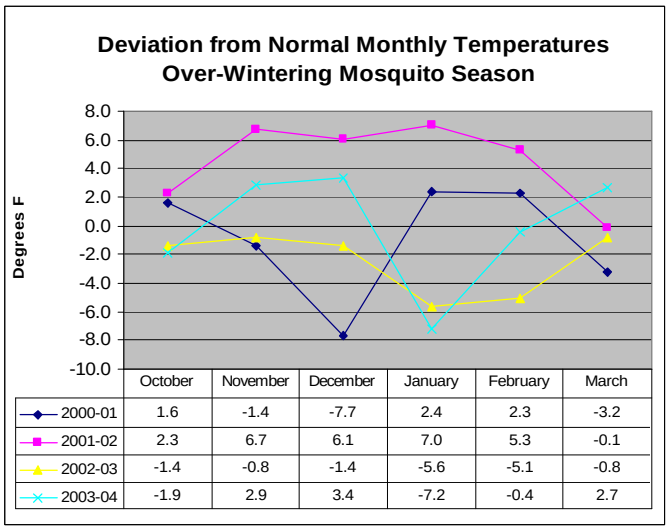
Culex species mosquitoes and transmitted to the bird population to continue the transmission cycle each spring. The following graphs (Graphs 19 & 20) indicate that the average monthly temperatures during the over-wintering season for mosquitoes. Prior to the 2002 mosquito season, winter temperatures were generally milder than other recent years and the 30 year monthly average temperature. From December of 2001 to March of 2002, monthly average temperatures were at least 5°F and as many as 7°F warmer than average. Monthly averages in January and February of 2002 were barely below freezing. These conditions might have lead to a greater number of *Culex* species adult mosquitoes surviving the over-wintering cycle.

Graph 19



	October	November	December	January	February	March
2000-01	52.3	38.8	22.1	27.0	28.2	31.1
2001-02	53.0	46.9	35.9	31.6	31.2	34.2
2002-03	49.3	39.4	28.4	19.0	20.8	33.5
2003-04	48.8	43.1	33.2	17.4	25.5	37.0
Normal	50.7	40.2	29.8	24.6	25.9	34.3

Graph 20



	October	November	December	January	February	March
2000-01	1.6	-1.4	-7.7	2.4	2.3	-3.2
2001-02	2.3	6.7	6.1	7.0	5.3	-0.1
2002-03	-1.4	-0.8	-1.4	-5.6	-5.1	-0.8
2003-04	-1.9	2.9	3.4	-7.2	-0.4	2.7

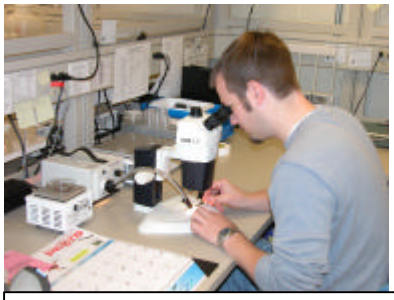
Info from National Weather Service, Buffalo, NY
http://www.erh.noaa.gov/buf/climate_information.htm

In summation, a warmer than usual winter of 2001 to 2002 potentially caused a greater proportion of the over-wintering *Culex* species mosquitoes, the primary vector of West Nile Virus, to survive the winter. In the spring, these mosquitoes take a blood meal potentially transmitting the virus to the bird population. These mosquitoes then lay their last raft of eggs and perpetuate their species. A wet April and May of 2002, followed by a dry summer where June, August and September were well below average and July was average coupled with monthly temperatures that were above normal from June through September may have been the causative weather factors in the greater severity of West Nile Virus activity in Erie County in 2002.

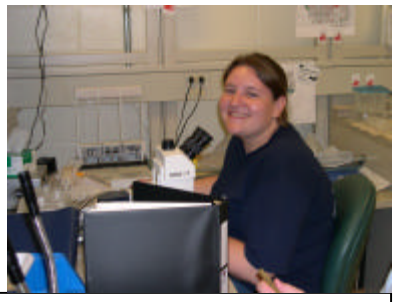
LABORATORY SERVICES

ERIE COUNTY COMPONENT

The Erie County Health Department, Vector Control Lab located at 462 Grider, Clinical Center Building, Room BB122 was established in April of 2001. The lab is currently staffed by a Supervising Public Health Sanitarian, an Investigating Public Health Sanitarian and a part-time Associate Public Health Sanitarian. Three summer interns were hired and trained in 2003 and two in 2004 to perform various mosquito surveillance duties. Responsibilities of this lab include among other things the collection of mosquito surveillance data.



Interns Identifying Mosquitoes Left to Right: Adam Kinney 2004, Jason Jay 2004, Elizabeth Steele-Zaepfel 2002



Interns Identifying Mosquitoes Left to Right: Jason Kirk 2001-03, Nick Risch 2001&03, Hillary Jobson 2003

Mosquitoes collected are brought to the lab on a daily basis as part of the Vector Control Program surveillance efforts. The trap nets are placed in an ultra-low freezer at –70°C for 15 minutes to immobilize the mosquitoes. The mosquitoes are sorted so that insects that are not mosquitoes are removed and discarded. The remaining mosquitoes are placed in a petri dish on a chill table to prevent degradation of any virus that might be present. The mosquitoes are then identified using the following publications.

Illustrated Key to Common Mosquitoes of Northeastern North America. C. J. Stojanovich. 1961

Mosquitoes of North America (North of Mexico). Carpenter, Stanley J., Walter J. LaCasse. University of California Press. 1955

Mosquitoes of New York Part I. The Genus *Aedes* Meigen with Identification Keys to Genera of Culicidae. Means, Robert G. The University of the State of New York. Albany, 1979

Mosquitoes of New York Part II. Genera of Culicidae other than *Aedes*. Means, Robert G. The University of the State of New York. Albany, 1987

The identified mosquitoes are placed in petri dishes by species on a second chill table. After all mosquitoes are identified, they are counted. Appropriate species are pooled and placed in epindorf tubes with beads. Each pool is comprised of 10 to 50 mosquitoes of a single species collected on a given trap night from a specific trap method and location. An exception is made in that as few as five *Ochlerotatus japonicus* make up a pool due to the fact that it is a recently observed species and difficult to trap in large numbers. These are placed in the ultra-low freezer for storage awaiting shipment the following Monday. All mosquito trap data is then entered in a spreadsheet and on the HIN.

The Vector Control Lab submitted 2,377 mosquito pools to the Highly Infectious Unit of the Griffin Lab for West Nile Virus testing over the past five years, 24 of which were found to be positive. This includes 960 pools submitted on behalf of the Town of Amherst, Mosquito Control Program.

Table 11. Mosquito Pools and West Nile Virus Positive Results

Year	Mosquito Pools	Number of Mosquitoes in pools	WNV Positive Pools	Positivity Rate
2000	17 (*)	512	0	0%
2001	249 (118)	8456	0	0%
2002	340 (120)	10137	4(0)	1.6% (0%)
2003	623 (181)	18988	8 (7)	1.3% (3.9%)
2004	1148 (541)	34562	12 (11)	1.1% (2.0%)
Total	2377 (960)	72655	24 (18)	1.2% (1.9%)

*Not Available
( ) Number of pools associated with Town of Amherst Trapping

REGIONAL COMPONENT

The Vector Control Lab was envisioned and established having regional capabilities. The service of processing mosquitoes was offered to the counties of Western New York outside Erie County. The process is comprised of identifying, counting, pooling and shipping of mosquitoes to Griffin Laboratory for West Nile Virus testing. The process is labor intensive and requires the proper equipment and skills. Nine counties from the western region have entered into a Fee-For-Service Contract with the County of Erie to perform this service at some time over the past four years. Seven counties contracted in 2004. The mosquitoes arrive as planned, are processed and information is shared with the respective county Health Department of origin. The information includes the numbers of each species for each trap. The Vector Control Lab processed 478 mosquito traps, identified 53857 mosquitoes, and submitted 617 mosquito pools to Griffin Lab on their behalf. All were found to be negative for West Nile Virus. The following tables (Tables 12-15) describe the workload associated with mosquitoes received from each Health Department outside of Erie County over the past four years.

Table 12. Mosquitoes Processed from Health Departments outside Erie County 2001				
County	Trapping Date Range	Number of Traps Processed	Number of Mosquitoes Processed	Mosquito Pools Submitted for WNV Testing
Genesee	8/8-9/26/2001	8	113	4
Orleans	7/25-10/3/2001	20	312	7
Seneca	8/15-9/5/2001	5	70	1
Wyoming	8/8-8/29/2001	3	28	1
Total		**36**	**523**	**13**

Table 13. Mosquitoes Processed from Health Departments outside Erie County 2002				
County Health Unit	Trapping Date Range	Number of Traps Processed	Number of Mosquitoes Identified	Mosquito Pools Submitted for WNV Testing
Genesee	7/14 to 9/29	12	750	23
Orleans	6/9 to 9/1	43	6248	82
Seneca	7/7 to 9/15	43	1399	34
Steuben	7/28 to 9/15	12	144	4
Wyoming	7/28 to 9/8	12	195	4
Yates	7/28 to 9/15	16	71	1
Total		**139**	**8807**	**148**

Table 14. Mosquitoes Processed from Health Departments outside Erie County 2003				
County Health Unit	Trapping Date Range	Number of Traps Processed	Number of Mosquitoes Identified	Mosquito Pools Submitted for WNV Testing
Orleans	6/18 - 8/27	19	3789	45
Seneca	6/17 - 9/03	48	6224	66
Steuben	7/3 – 8/26	26	1526	32
Yates	7/1 – 8/26	34	1260	32
Total		**127**	**12799**	**175**

Table 15. Mosquitoes Processed from Health Departments outside Erie County 2004				
County Health Unit	Trapping Date Range	Number of Traps Processed	Number of Mosquitoes Identified	Mosquito Pools Submitted for WNV Testing
Orleans	6/09-9/01/2004	10	642	17
Ontario	6/15-8/24/2004	23	1974	23
Schuyler	6/15-8/24/2004	26	5633	34
Seneca	6/23-9/28/2004	56	22230	173
Steuben	6/10-8/26/2004	25	327	10
Wayne	6/22-8/24/2004	13	377	10
Yates	6/10-8/26/2004	23	545	14
Total		**176**	**31728**	**281**

The Erie County Health Department Vector Control Program voluntarily participated in a study and submitted 1,645 blood-fed mosquitoes to Dr. Laura Kramer, NYSDOH over the past four years to determine the vertebrate host and to test for West Nile Virus infectivity. In 2003, Kiet A. Ngo and Laura

D. Kramer published an article in the Journal of American Entomology titled "Identification of Mosquito Bloodmeals Using Polymerase Chain Reaction (PCR) With Order-Specific Primers" from data collected through this study. The publication is available on the NYSDOH HIN website. The following table (Table 16) describes the numbers of blood-fed mosquitoes submitted.

Table 16. Blood-Fed Mosquitoes Submitted for Testing				
Collected by	Number of Blooded Mosquitoes each Year			
	2001	2002	2003	2004
Erie County Health Department	55	197	435	219
Town of Amherst – Mosquito Control Program	7	68	92	95
Genesee County Health Department	2	5	0	---
Ontario County Health Department	---	---	---	2
Orleans County Health Department	1	78	12	3
Schyuler County Health Department	---	---	---	1
Seneca County Health Department	0	3	19	2
Steuben County Health Department	---	0	12	2
Wayne County Health Department	---	---	---	1
Wyoming County Health Department	0	1	0	---
Yates County Health Department	---	1	7	0
Total	**65**	**353**	**577**	**325**
Grand Total	**1645**			
--- Did not trap for mosquitoes in that year				

MOSQUITO CONTROL

BREEDING SITE ELIMINATION

The most effective means to control mosquitoes is to identify and eliminate mosquito-breeding sites on residential, commercial and municipal property. The elimination of mosquito breeding sites does not require the use of pesticides and, if maintained, can permanently control larval habitat in a given area.

Tires are an excellent habitat for mosquito larvae. Water collects in tires and is not readily drained. Wind dispersed organic material is deposited in tires supplying the larvae with nutrition. Tires absorb heat from sunlight thereby increasing larval activity and decreasing the time of maturation to adult mosquitoes.

A Regional Intergovernmental Tire Removal Initiative has been developed by the Erie County Health Department, Vector Control Program and executed utilizing the City of Buffalo, Division of Citizen Services and Mayor's Taskforce/Urban Renewal Agency. County inspectors identify locations throughout the city especially in targeted rodent blitz areas where scrap tires have been discarded onto vacant land and vacant housing near populated areas. Locations were provided through the following means:

Tires are considered man's gift to mosquitoes.

- All Rat Blitz Targeted Areas - Tire locations are identified by Vector Control staff during the rodent survey and rodent baiting in these areas
- ECHD Sanitarians identified locations during routine housing inspections of city properties
- ECHD Pest Control Workers identified locations during routine baiting and inspections of city properties
- Mayors Task Force/Division of Citizen Services identified tire dumping locations at vacant lots and houses. In addition, they removed tires found curbside during routine travels.
- Mayors Impact Team participated in "The Great American Cleanup" in the city and around the County and removed tires from the area highways and city vacant lots.
- Fruit Belt Block Club requested tire cleanup in their area. Members dropped off tires collected from neighborhood vacant lots at a specified location for pick up by the Mayors Task Force.
- City of Buffalo Councilman request for tire removal in a targeted area of the West Side.

The Urban Renewal Agency sent out a crew to remove and transport the tires to a disposal site. The City of Buffalo provides the manpower, equipment and trucking costs and, in turn, the Erie County Health Department provides the monies for tire disposal utilizing funds appropriated by the Erie County Legislature specifically for tire removal to combat West Nile Virus. The Vector Control Program

monitored removal and submitted the invoices for disposal to the Erie County Department of Environment and Planning who administered the funds.

From 2001 to 2003, this cooperative effort resulted in the removal of 203.18 ton (406,360 pounds) of tires from the city of Buffalo. This eliminated the tires as mosquito breeding sites and contributed to improving the quality of life in these neighborhoods. This program did not continue in 2004 due to a lack of funding. The remaining balance of what was originally appropriated by the Erie County Legislature in 2001 was returned to the Erie County General Fund by the Erie County Department of Environment and Planning in 2004 without ECHD knowledge or approval.

Table 17. Tires Removed from the City of Buffalo

	Loads	Tons	Pounds
2001	N/A	50	100,000
2002	80	111.2	222,400
2003	31	41.98	83,960
Total	--	203.18	406,360

LARVICIDE APPLICATION

The Erie County Health Department recognizes that larvicide application is the primary means of controlling mosquitoes when the breeding site cannot be eliminated. It is reasonably specific to mosquito larvae and prevents biting adults from emerging thereby preventing the spread of the West Nile Virus.

Storm receivers are an ideal mosquito-breeding habitat. This is especially true for *Culex* species, which are known to be the primary vector of the West Nile Virus. *Culex* species prefer water with a high organic content, which is usually associated with storm water runoff. Storm receivers are also found in more populous areas thereby supplying the adult mosquito with a potential human blood meal. Due to these facts, the Erie County Health Department has proposed and executed a strategy to apply methoprene (Altosid 150 day briquets) to storm receivers. This concept is the focus of Project SWAT and larvicide application by Vector Control Program staff.

Senior Vector Control Investigator Guy Thomas applying Altosid XR ingot to Storm Receiver Catch Basin

Areas prone to temporary flooding are prime larval habitats for *Aedes vexans*. This mosquito species is a prolific human biter, historically found in large numbers and can transmit West Nile Virus. These types of areas require appropriate larval control. Larvicide was also applied to roadside ditches and other standing water determined to be larval habitats that could not be eliminated.

Methoprene (Altosid) has been the product of choice in Erie County. The toxicity to humans is extremely low. Methoprene is an insect growth regulator in that it prevents the emergence of adult

mosquitoes from the pupal stage. Three formulations have been used for differing purposes. Altosid XR 150-Day Briquets are used in areas that need long-term protection. Altosid Briquets, a 30-day formulation of the same product, are used for areas requiring a shorter duration of protection. Altosid XRG, a granular formulation, is used in smaller habitat areas and in areas of thick vegetation using a Maruyama Mist/Duster to apply the product. These products have not been used in fish habitat in compliance with the product label. The following table (Table 18) shows the total amounts of methoprene used from 2000 to 2004.

Table 18. Larvicide Applied Containing Methoprene as the Active Ingredient

Chemical Product or Trade Name EPA Product Registration Number		Amount Applied in Ounces and Briquets					
		2000	2001	2002	2003	2004	Total
Altosid Briquets 2724-375	Ounces	1277.1	163.59	108.3	168.72	293.36	2011.07
	Briquets	990	861	570	888	1544	4853
Altosid XR Briquets 2724-421	Ounces	760	14620.86	25561.35	4040.28	3842.91	48825.4
	Briquets	4000	11334	19815	3132	2979	41260
Altosid XR-G 2724-451	Ounces (Pounds)	320 (20)	339 (21.2)	1641.52 (102.6)	105 (6.6)	1129.50 (70.6)	3535.02 (221.0)

The Erie County Health Department has also made treatment using AQUABAC 200G. The active ingredient is *Bacillus thuringiensis* var. *israelensis* (BTI) and is considered a microbial larvicide. It is a type of bacteria that is normally found in soil. The mode of action is to bind with receptors found in the larval gut of aquatic dipterans affecting its ability to absorb nutrition. When used according to the product label, this product is effective at controlling mosquito larva. Duration is dependant on environmental factors such as rainfall, wind, etc. The product floats on the surface of the water and is not recommended for storm receivers due to potentially being flushed out with the flow of water through the storm sewer system during rain events. It was utilized on a limited basis in 2003 and 2004.

Table 19. Larvicide Applied Containing *Bacillus thuringiensis* var. *israelensis* as the Active Ingredient

Chemical Product or Trade Name EPA Product Registration Number	Amount Applied in Ounces (Pounds)			
	2001	2002	2003	2004
Aquabac (200G) 62637-3	0	0	240 (15)	144 (9)

The Erie County Health Department also made treatment using AGNIQUE MMF. The active ingredient is Isostrearyl Alcohol [Poly (oxy-l, 2-ethanediyl), ? - isooctadecyl - ? -hydroxyl] to control larval and pupal stages of mosquitoes within Erie County. The product is a mono-molecular film that lies on the surface of a body of water. It acts as a barrier for the larvae and pupae to breathe at the surface. It also reduces the surface tension of the water so that when a female adult mosquito lands on the surface to lay eggs, it submerges and dies. The following table shows the amount used from 2002 - 2004.

Table 20. Larvicide Applied Containing Isostearyl Alcohol as the Active Ingredient

Chemical Product or Trade Name EPA Product Registration Number	Amount Applied in Fluid Ounces			
	2001	2002	2003	2004
Agnique MMF Mosquito Larvicide & Pupicide 53263-28	0	22.0	24.8	5.6

Each year starting in 2001, an aggressive larvicide application program began in early May in Erie County. A larvicide application blitz was performed by the ECHD, Vector Control Program Staff throughout the county prioritizing locations frequented by high-risk populations such as senior citizens and young children. These target locations included Adult Homes, Children's Camps, Daycare Centers, Hospitals/Healthcare Facilities, Nursing Homes, Parks/Water Parks and Schools.

The Department applied larvicide on these properties and surrounding areas in storm receiver catch basins and standing water. Regarding parks/water parks, larvicide was only applied in areas of standing water near playgrounds and recreation areas. There were 896 locations targeted countywide paying particular attention to the northern and lakeshore townships where the greatest number of mosquito larval habitats are located.

Table 21. Larvicide Application in Erie County

Targeted Locations with High-Risk Populations for West Nile Virus	Number of Locations			
	2001	2002	2003	2004
Adult Homes	39	37 (9)	38 (9)	38 (9)
Children's Camps	75	63 (9)	69 (12)	69 (12)
Daycare Centers	208	208 (21)	210 (29)	210 (29)
Hospitals/Healthcare Facilities	66	54 (8)	81 (10)	81 (10)
Nursing Homes	47	46 (9)	47 (10)	47 (10)
Parks/Water Parks	83	106 (21)	150 (21)	150 (21)
Schools	99	58 (18)	248 (25)	248 (25)
Senior Citizen Feeding Sites (SOFA)	54	52 (2)	53 (3)	53 (3)
Total	**681**	**624 (97)**	**896 (119)**	**896 (119)**
( )=part performed by Town of Amherst				

The Vector Control Program has worked closely with the Town of Amherst Mosquito Control Program who have agreed to larvicide the target locations identified by our program within their town borders. Erie County provides the larvicide for both these target locations and all of the storm receivers in the town of Amherst. The amounts are as follows.

Table 22. Larvicide Distributed to the Town of Amherst Mosquito Control Program

Chemical Product or Trade Name EPA Product Registration Number	Number of Briquets Distributed			
	2001	2002	2003	2004
Altosid Briquets 2724-375	800	0	2800	0
Altosid XR Briquets 2724-421	4400	6600	5060	5500

These amounts are not included in the Erie County Health Department larvicide usage and are reported by the Town of Amherst Mosquito Control Program.

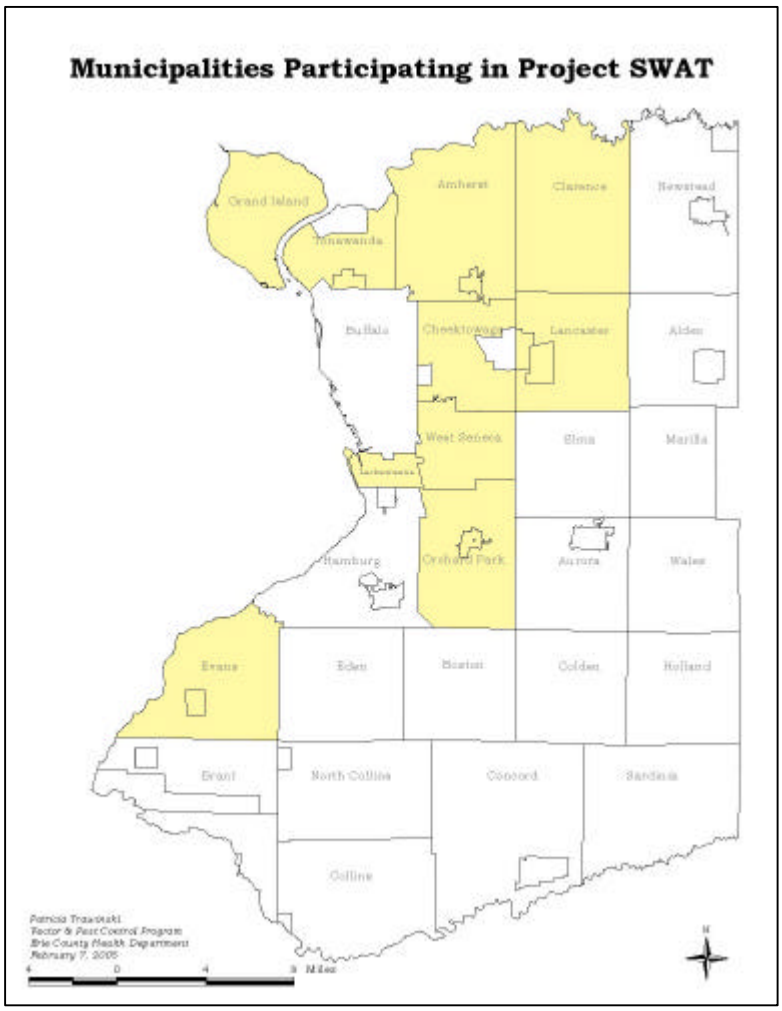
In addition, Service Requests/Complaints were received by the ECHD from the public regarding unmaintained swimming pools, standing water and mosquito nuisance complaints. The Department

responded by investigating each complaint and applying larvicide where necessary. When appropriate, a warning notice was issued to the owner of the property to eliminate the conditions causing mosquito breeding and subsequently remediation was verified.

Table 23. Standing Water Service Requests in Erie County					
	2001	2002	2003	2004	**Total**
Number of Service Requests	238	373	444	317	**1372**

PROJECT SWAT (SHARE THE WORK TO ALLEVIATE THE THREAT)

Project S.W.A.T. is a regional initiative, proposed by County Executive Joel Giambra and Commissioner of Health, Dr Anthony Billittier IV in late 2000 following the detection of West Nile Virus in 25 birds in 2000. The Erie County Health Department was assigned the lead role in a program to train county municipalities participating on a voluntary basis in larvicide application procedures and recognition of larval habitat. The Erie County Health Department supplies the training, the NYSDEC Permit to Apply Chemicals to Control Aquatic Insects, and the larvicide product. Each municipality supplies the manpower to apply the larvicide and perform record keeping. In May of 2005, the National Association of County and City Health Officials (NACCHO) informed the Erie County Health Department that Project SWAT was selected as a "NACCHO Model Practice."



The 30 Hour Pesticide Applicator Training Course, hosted by the Erie County Health Department and Univar USA, was first held in 2001 and again in 2003. It was attended by municipalities from Erie County as well as other counties in Western New York, the Seneca Nation of Indians and employees of private pesticide businesses that have worked under contract for the County of Erie in the past. An opportunity was given to all attendees to take the Core and Category 8 Exams to become a Certified Pesticide Technician. The Vector Control Program plans to offer this course again in 2005.

In 2002 and 2004, a 12-hour recertification course was conducted as prescribed by the NYSDEC. This allowed Certified Pesticide Technicians with one application season of experience to upgrade to a

Certified Pesticide Applicator. This is required to apply products containing methoprene without on-site supervision.

An intergovernmental contract was developed and executed between each municipality and the County of Erie. We were able to complete the training for eleven municipalities who submitted signed contracts. Each municipality indicated has at least one Certified Pesticide Applicator in Category 8 to apply methoprene in storm receiver catch basins. The Town of Amherst also participated in project SWAT as a separately permitted agency bringing the total number of participating municipalities to twelve. A total of 131763.18 ounces of Altosid XR (active ingredient methoprene), and 42.37 ounces of Altosid Briquets (active ingredient methoprene), were applied to 102365 storm receiver catch basins by these municipalities in the past four mosquito season. The larvicide product was provided by the Erie County Health Department at no cost to the participating municipality. These twelve municipalities represent the area of the county with the greatest risk for West Nile Virus based on amount of mosquito habitat in the natural setting and number of storm receiver catch basins present.

Table 24. Number of Storm Receiver Catch Basins treated with Altosid by Municipalities

Municipality	2001	2002	2003	2004	Total
Amherst, Town of	6500*	6573	6500*	6500*	26073
Cheektowaga, Town of	626	0**	4177	4368	9171
Clarence, Town of	2331	2684	3683	3918	12616
Evans, Town of	60***	273	305	273	911
Grand Island, Town of	63***	1661	1277	1291	4292
Kenmore, Village of	0	0	695	886	1581
Lackawanna, City of	30***	1479	1575	1526	4610
Lancaster, Town of	50***	1989	1710	2144	5893
Orchard Park, Town of	871	2164	2907	3240	9182
Tonawanda, Town of	2015	3261	4365	4339	13980
West Seneca, Town of	1680	4162	3334	3820	12996
Williamsville, Village of	65***	339	331	325	1060
Total	**14291**	**24585**	**30859**	**32630**	**102365**

*Amherst reported that larvicide was applied to all 6500 storm receivers within the town limits.
**Product returned to Erie County Health Department – 6160 Altosid XR – None Applied
***Altosid Briquets applied later in mosquito season for larval control and training purposes

ADULTICIDE APPLICATION

No mosquito adulticides were applied under the direction of the Erie County Health Department in 2003. Adulticide as a tool for mosquito control would have been utilized only to prevent West Nile Virus infection in human populations. The decision criteria to spray adulticides based on risk assessment would have been made by the Erie County Commissioner of Health, Dr. Anthony Billittier IV, after achieving consensus among the Western New York Public Health Alliance, Inc. (WNYPHA). If adulticide application were deemed necessary, it would have been performed by a NYSDEC Certified Applicator as a private contactor.

INFORMATION MANAGEMENT

GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System is employed extensively in the Erie County Health Department, Vector Control Program. Hand-held GPS units provide local address information as well as latitude and longitude coordinates. The GPS allows for accurate locating, mapping, and relocating of larval surveillance sites, storm receivers surveyed, and adult mosquito trap sites. One GPS unit is provided to the Town of Amherst, Mosquito Control Program at the beginning of mosquito trapping season for the purpose of obtaining and recording the location of each trap site.

GEO CODING OF DATA

GEO Coding of information is a high tech approach to effectively combat the West Nile Virus with limited resources. The technology and expertise was used to input geographical data and obtain output in the form of specialized maps. Maps created using GEO Coding were used to report larvicide application to the NYSDEC as required by permits and to create maps for this report. The technology was also used for the following:

- Location of daycare centers, schools, senior citizen centers, nursing homes, parks, and other areas where at risk populations live, work and recreate.
- State and Federal wetlands, flood plains, drainage basins and other potential mosquito breeding sites can be overlaid to prioritize our response in the form of surveillance and control.
- Reported location of dead birds in order to analyze trends.
- Mosquito trap site locations.
- Control activities such as breeding site elimination and larvicide application.
- Positive West Nile Virus Events.

NYSDOH HEALTH INFORMATION NETWORK

The Health Information Network (HIN) administered by the New York State Department of Health was an invaluable tool in several areas. All Erie County mosquito surveillance data was entered on the HIN. This was required in order to have testing performed by Griffin Lab. The HIN was used to download mosquito pool lab results from the Griffin Lab. Vector Control Staff assisted in entering dead bird data on the HIN. It was also used for downloading the Weekly West Nile Virus Update, locating lab results for birds submitted, checking the weekly dead bird density for the county, and viewing and printing the current WNV Positive Test Results Map for New York State.

CONCLUSION AND LESSONS LEARNED

West Nile Virus as an Arthropod-borne disease has expanded its range across the state and nation. In 2000 and 2001, West Nile Virus was only detected in the bird population in Erie County. The first human, mosquito and horse cases were recorded in 2002. Since 2002, there have been no human cases of West Nile Virus in Erie County but it has continued to be detected in mosquitoes and birds. The assumption is that West Nile Virus will remain a viable public health threat in Erie County, New York State and the United States for the foreseeable future. West Nile Virus persists in birds as a reservoir of the virus and transmission to the mosquito vectors is likely to continue.

The most prudent course of action is to continue to educate the public, perform surveillance, eliminate mosquito habitat, larvicide where needed, and only apply adulticide in the event of a public health threat on a regional basis. The comprehensive regional approach to the threat of West Nile Virus has enabled us to better respond to the disease. It has also provided a mechanism to offer both efficient and proficient services. This is evident in both mosquito surveillance and control. The lessons learned over the past five years are listed as follows by category.

Education

- Educational efforts must be sustained and expanded. Each year the public needs to be made aware of mosquito related issues and reminded of recommended precautions.
- The use of several media sources for education including radio, television, billboards, the internet, newspapers and educational brochures is essential to reach as many individuals as possible.

Surveillance

- Surveillance is the cornerstone of an effective West Nile Virus Response Program.
- Human surveillance must be closely coupled with environmental surveillance.
- A correlation exists between the occurrence of positive mosquito pools, increased dead crow density, and the risk of transmission of West Nile Virus to humans.
- Fixed trapping locations provide consistent mosquito surveillance data from year to year.
- CDC Light Traps are an effective means to collect surveillance data regarding the number and species of mosquito that are actively seeking a blood meal.
- Gravid traps are an effective means of trapping mosquitoes that are potentially positive for West Nile Virus especially during dry mosquito seasons.
- 34 species of mosquitoes have been identified by the Erie County Vector Control Lab through the surveillance efforts of 10 Western New York Counties.
- *Ochlerotatus japonicus* is more widespread than originally believed.
- Increased range of *Ochlerotatus japonicus* in Erie County and the detection of *Aedes albopictus* in Seneca County, both being daytime biters, have suggested the need for mosquito collection using Fay-Prince traps.
- Mosquito surveillance in Western New York is needed not only for West Nile Virus, but also for other Arthropod-borne viruses and mosquito population data.

- Geo-coding is a valuable tool in documenting the occurrence and distribution of West Nile Virus.

Control

- A well-planned, comprehensive mosquito larval habitat reduction and larvicide application program can reduce the need for adulticide application.
- Regional cooperation through Project SWAT is an efficient and effective means to apply larvicide to a large portion of the storm receiver catch basins in Erie County municipalities in a relatively short time frame.
- The Vector Control approach to mosquito control is quite different than the Nuisance Control approach. Vector control is focused on the species that can transmit a disease and their habitat. Nuisance control is focused on decreasing the numbers of mosquitoes at any stage to alleviate the nuisance of mosquitoes biting regardless of species.

Weather Factors

- Dry years require a different approach to surveillance and larvicide application than wet years.
- Weather is a contributing factor in the severity of the mosquito season including the numbers and species of mosquitoes at a given time.
- Milder winters could allow a greater number of *Culex* species mosquitoes to survive to bite and lay eggs in spring.
- *Culex* species thrive in tires, clogged rain gutters and storm receiver catch basins. Frequent summer rain events tend to flush mosquito larvae out of rain gutters and storm receiver catch basins. During drought conditions, water is usually present in storm receivers due to human activities such as lawn watering and car washing. Nutrition for larvae is plentiful in the form of grass clipping and fallen leaves in this habitat.
- Individual storm events can contribute to increased numbers of floodwater species of mosquitoes. This has been seen in the Vector Control Programs surveillance data as increased numbers of *Ochlerotatus canadensis* and *Ochlerotatus stimulans* during the spring and *Aedes vexans* in the late summer and fall.

In a recent article in the journal Emerging Infectious Diseases titled "West Nile Virus Risk Assessment and the Bridge Vector Paradigm," Kilpatrick et al. state that as many as 80% of all West Nile Virus human infections may have been transmitted by *Culex pipiens-restuans.* According to the trap data in Erie County, counts of *Culex pipiens-restuans* trapped in Erie County have dropped as a percent of total mosquitoes captured over the last few years. Acknowledging that weather conditions are the major factor influencing total mosquito populations, *Culex pipiens-restuans populations* may have been negatively affected by targeted larvicide application and larval habitat mitigation conducted over the last five years. In the following table (Table 25) it is indicated that since 2002 *Culex pipiens-restuans* per Trap Night and *Culex pipiens-restuans* as a Percent of Total mosquitoes captured has steadily decreased.

Table 25. Total Mosquito Counts compared to *Culex pipiens-restuans* counts over 4 years							
Year	Light Trap Nights	Gravid Trap Nights	Total Trap Nights	Total Mosquitoes Captured	*Culex pipiens-restuans* Captured	*Culex pipiens-restuans* per Trap Night	*Culex pipiens-restuans* as Percent of Total
2001	151	23	174	10492	857	4.9	8.2%
2002	161	50	211	11426	1934	9.2	16.9%
2003	156	108	264	32824	1920	7.3	5.9%
2004	201	134	335	62622	1519	4.5	2.4%
Total	669	315	984	117364	6230	6.3	5.3%
Average	167.25	78.75	246	29341	1557.5	6.5	8.4%

Available information indicates West Nile Virus will remain in Erie County for the foreseeable future. Mosquito surveillance activity has also detected the presence of several other arboviruses, many of which are human pathogens. Four human cases of LaCrosse virus as well as nine cases of West Nile Virus occurred in the county in 2002. This makes it critical that our comprehensive regional mosquito education, surveillance, and control program continue as the first line of defense to protect Erie County residents against the threat of West Nile Virus and other Arthropod-borne Viruses.

Note: The Vector Control Program is also responsible for the Rodent Control Program, Rabies Prevention Program, Lyme Disease Tick Identification Program and Environmental Air Monitoring and other related specific projects.

ACKNOWLEDGEMENTS

Anthony Billittier M.D., F.A.C.E.P. – Erie County Commissioner of Health

For enthusiastically supporting education, surveillance and control activities regarding West Nile Virus, other Arthropod-borne viruses and mosquitoes.

Erie County Health Department - Public Health Lab, Epidemiology and Environmental Health

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Special thanks to:

Dr Wayne K. Gall, Regional Entomologist, NYSDOH Western Region
Dr Jacque Berlin, Regional Entomologist, NYSDOH Western Region (Retired 2001)

Dennis White PhD, Director of the NYSDOH Arthropod-borne Disease Program
Bryon Backenson, Assistant Director of the NYSDOH Arthropod-borne Disease Program

The Town of Amherst, Mosquito Control Program for collaboration in mosquito surveillance

The following municipalities for their participation in Project SWAT

Town of Amherst
Town of Cheektowaga
Town of Clarence
Town of Evans
Town of Grand Island
Village of Kenmore
City of Lackawanna
Town of Lancaster
Town of Orchard Park
Town of Tonawanda
Town of West Seneca
Village of Williamsville

The following Local Health Departments for contracting for mosquito identification, their dedication to West Nile Virus surveillance and their efforts to protect the public health:

Genesee County Health Department
Ontario County Health Department
Orleans County Health Department
Schyuler County Health Department
Seneca County Health Department
Steuben County Health Department
Wayne County Health Department
Wyoming County Health Department
Yates County Health Department

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For Additional Information

Erie County Health Department

http://www.erie.gov/health/healthinfo/family_westnile_facts.asp

New York State Department of Health

http://www.health.state.ny.us/

Centers for Disease Control

http://www.cdc.gov/ncidod/dvbid/westnile/index.htm