

National West Nile Virus Conference: 2002

**Mosquito Species Associated
with West Nile Virus in the
United States, 1999-2001:
*Implications for Virus Transmission***

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Mosquito-Based Arbovirus Surveillance

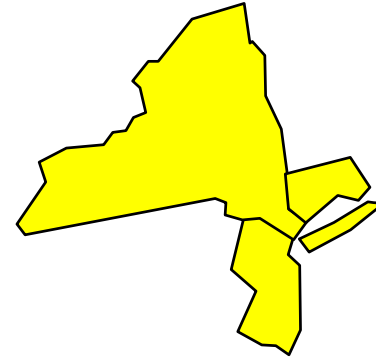
- **Value**
 - Monitor and quantify transmission activity.
 - Identify important vectors.
 - Monitor control efforts.
- **Limitations**
 - Costly.
 - Requires active effort.
 - Focal.

Mosquito-Based WN Surveillance

- **Effort**
- **Species associated with WN virus**
 - Identity
 - Frequency
- **Spatial and Temporal Distribution**
- **Patterns in Surveillance Programs**
- **Sources of information**
 - ArboNET

Mosquito-Based WN Surveillance: 1999

- **3 states**
 - NY, CT, NJ
- **17 WN virus isolates**
 - NY(14), CT(2), NJ(1)
- **24 species tested (n≈36,000)**
- **2 (4?) species positive**



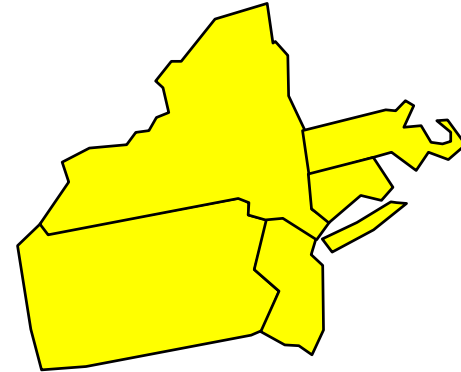
Mosquito-Based WN Surveillance: 1999

Species	WN-Positive pools
<i>Cx. pipiens</i>	8
<i>Cx. pipiens/restuans</i>	2
<i>Cx. restuans/salinarius</i>	4
<i>Cx. pipiens/restuans/salinarius</i>	2
<i>Ae. vexans</i>	1

Mosquito-Based WN Surveillance: 2000

- **5 states**

- CT, MA, NJ, NY, PA



- **515 WN-positive pools, 5 States**

- NY(393; 189 from NYC), NJ(58), PA(46), CT(14), MA(4)

- **35 species tested (n ≈ 560,000)**

- **14 species positive**

Mosquito-Based WN Surveillance: 2000

•515 Positive pools, 14 species^a

<i>Cx pipiens/restuans</i>	228
<i>Cx pipiens</i>	146
<i>Cx salinarius</i>	50
<i>Cx species</i>	26
<i>Ae vexans</i>	17
<i>Cx restuans</i>	12

<i>Oc japonicus</i>	9
<i>Oc triseriatus</i>	9
<i>Oc trivittatus</i>	8
<i>Cs melanura</i>	3

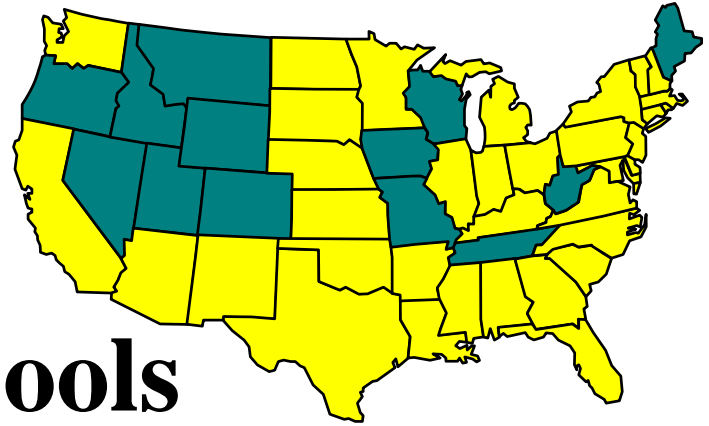
<i>Ae albopictus</i> ^b	1
<i>Oc atropalpus</i> ^b	1
<i>Oc canadensis</i>	1
<i>Oc cantator</i>	1
<i>Oc species</i>	1
<i>An punctipennis</i> ^b	1
<i>Ps ferox</i>	1

^a75% (386) *Culex pipiens, restuans*, or mixed pools.

^bRNA only, no live virus isolated

Mosquito-Based WN Surveillance: 2001*

- **34 states**
- **918 WN-positive pools**
 - 16 states, DC
- **91 species tested (n > 1,402,000)**
 - \approx 178 species in U.S.
- **27 species positive**



*reported by Mar. 12, 2002

Mosquito-Based WN Surveillance: 2001

State	Positive pools
NJ	357
NYC	193
NY	92
PA	51
GA	36
CT	31
OH	26
MA	25
IL	20

State	Positive pools
FL	39
MD	18
RI	14
KY	6
DC	3
NH	3
MI	2
DE	1
VA	1

Mosquito-Based WN Surveillance: 2001

Species	Positive pools
<i>Cx. pipiens</i>	349
<i>Cx. species</i>	184
<i>Cx. pipiens-restuans</i>	118
<i>Cx. restuans</i>	76
<i>Cx. salinarius</i>	70
<i>Cs. melanura</i>	26
<i>Oc. triseriatus</i>	13
<i>Cx. quinquefasciatus</i>	13
<i>Oc. japonicus</i>	8
<i>Oc. sollicitans</i>	6
<i>Cq. perturbans</i>	5
<i>An. quadrimaculatus</i>	5
<i>Ae. albopictus</i>	5
<i>Oc. canadensis</i>	5

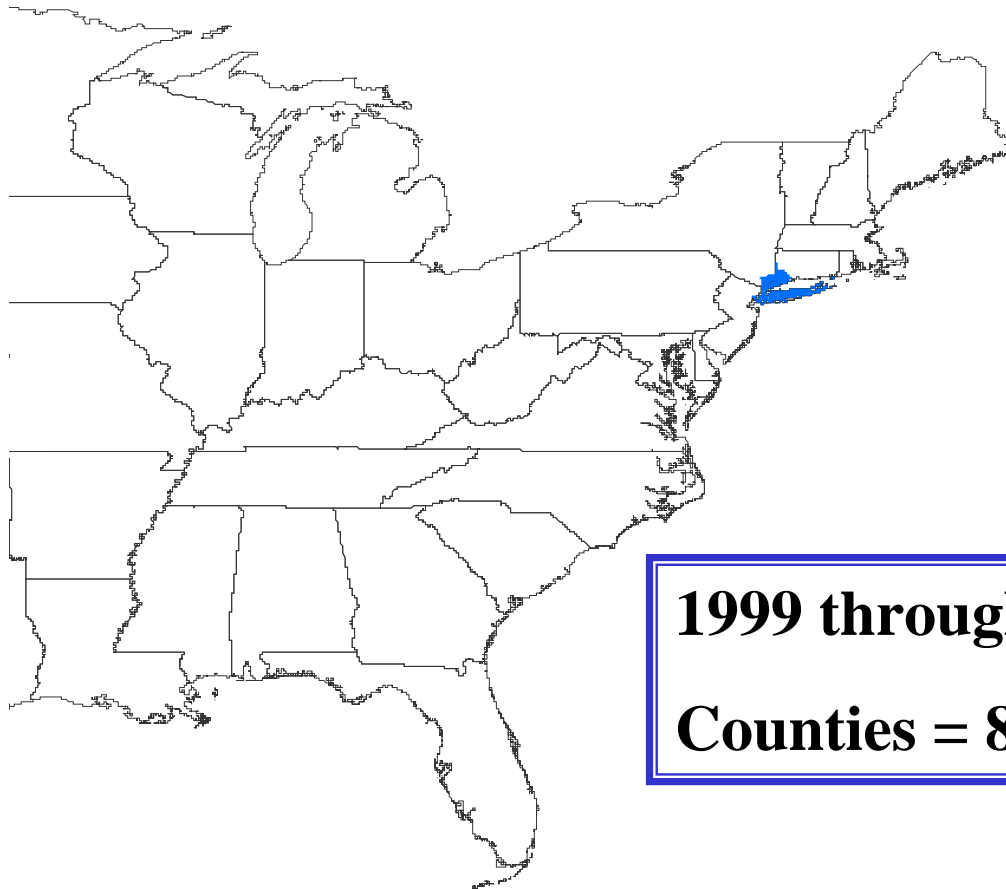
<i>Cx. nigripalpus</i>	5
<i>Ae. vexans</i>	4
<i>Oc. taeniorhynchus</i>	4
<i>Oc. trivittatus</i>	3
<i>An. punctipennis</i>	3
<i>Ae. species</i>	2
<i>Or. signifera</i>	2
<i>De. cancer</i>	2
<i>An. barberi</i>	1
<i>Cs. species</i>	1
<i>Oc. atlanticus/torm.</i>	1
<i>Oc. cantator</i>	1
<i>Ps. columbiae</i>	1
<i>Ur. sapphirina</i>	1
<i>Ae. cinereus</i>	1

<i>An. crucians/bradleyi</i>	1
<i>An. atropos</i>	1
<i>Unidentified</i>	1

Mosquito-Based WN Surveillance

- **Spatial and Temporal Distribution**
 - 1999 – 2001
 - By county/month

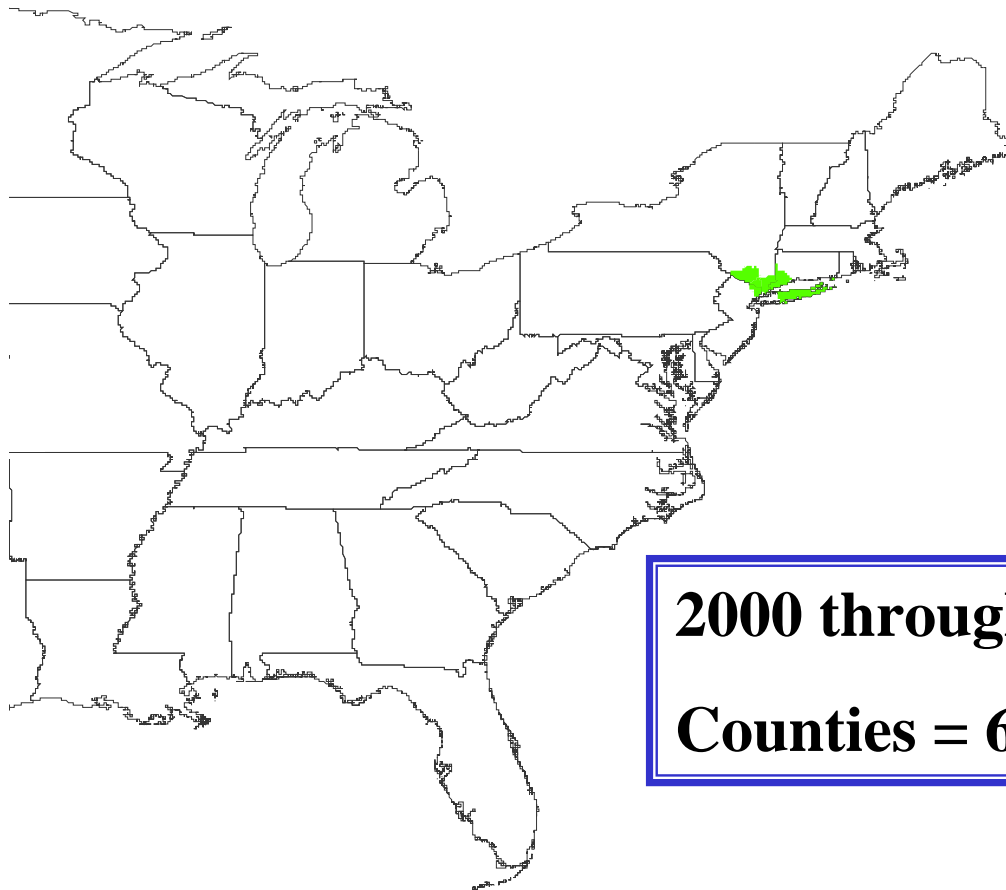
WN+ Mosquito Pools: County Reports



1999 through December

Counties = 8

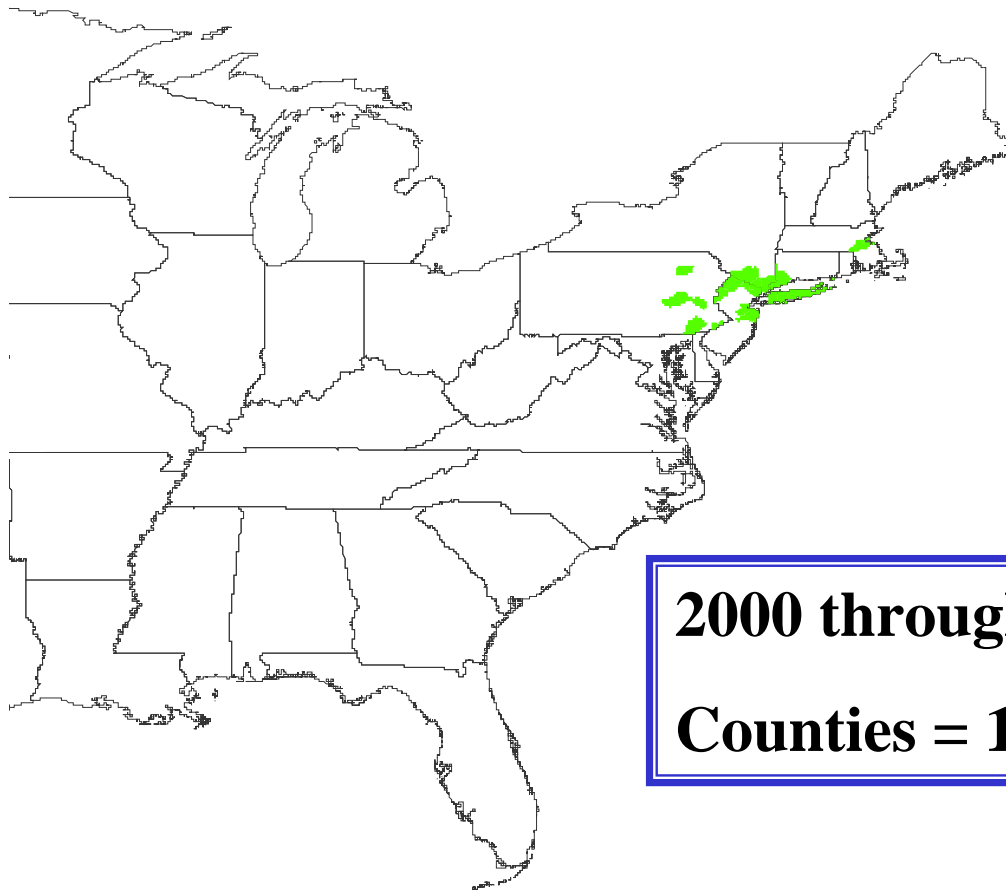
WN+ Mosquito Pools: County Reports



2000 through July

Counties = 6

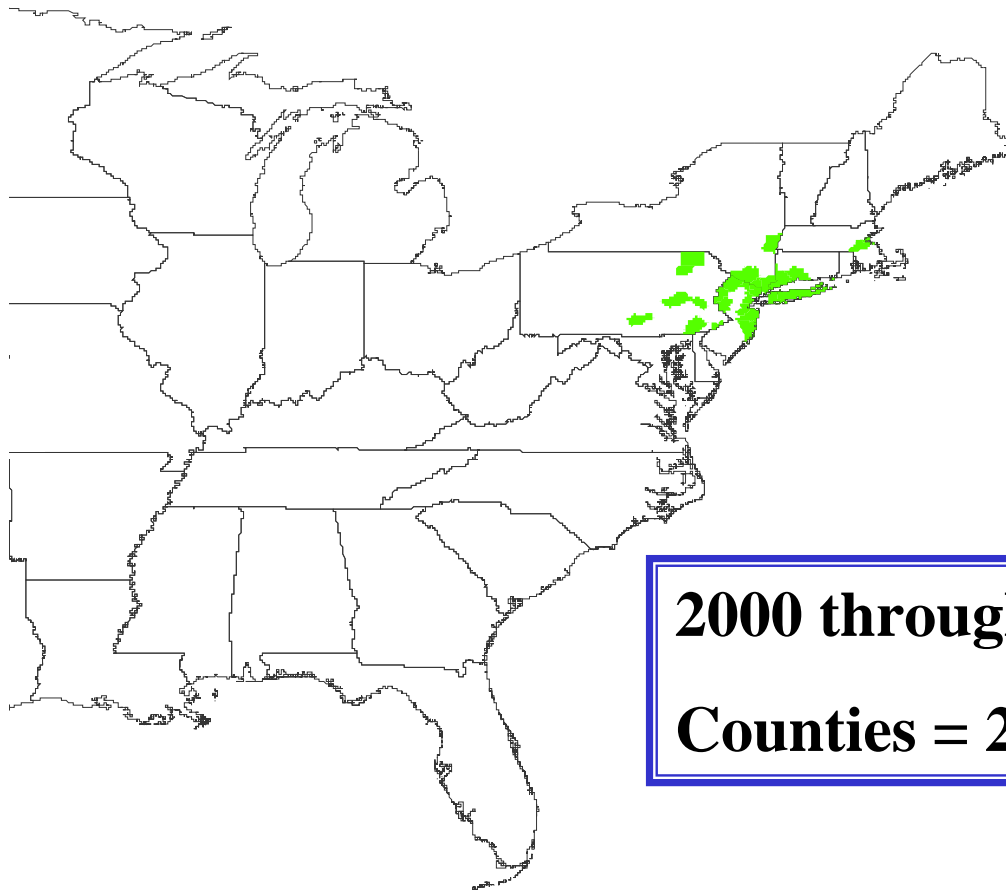
WN+ Mosquito Pools: County Reports



2000 through August

Counties = 19

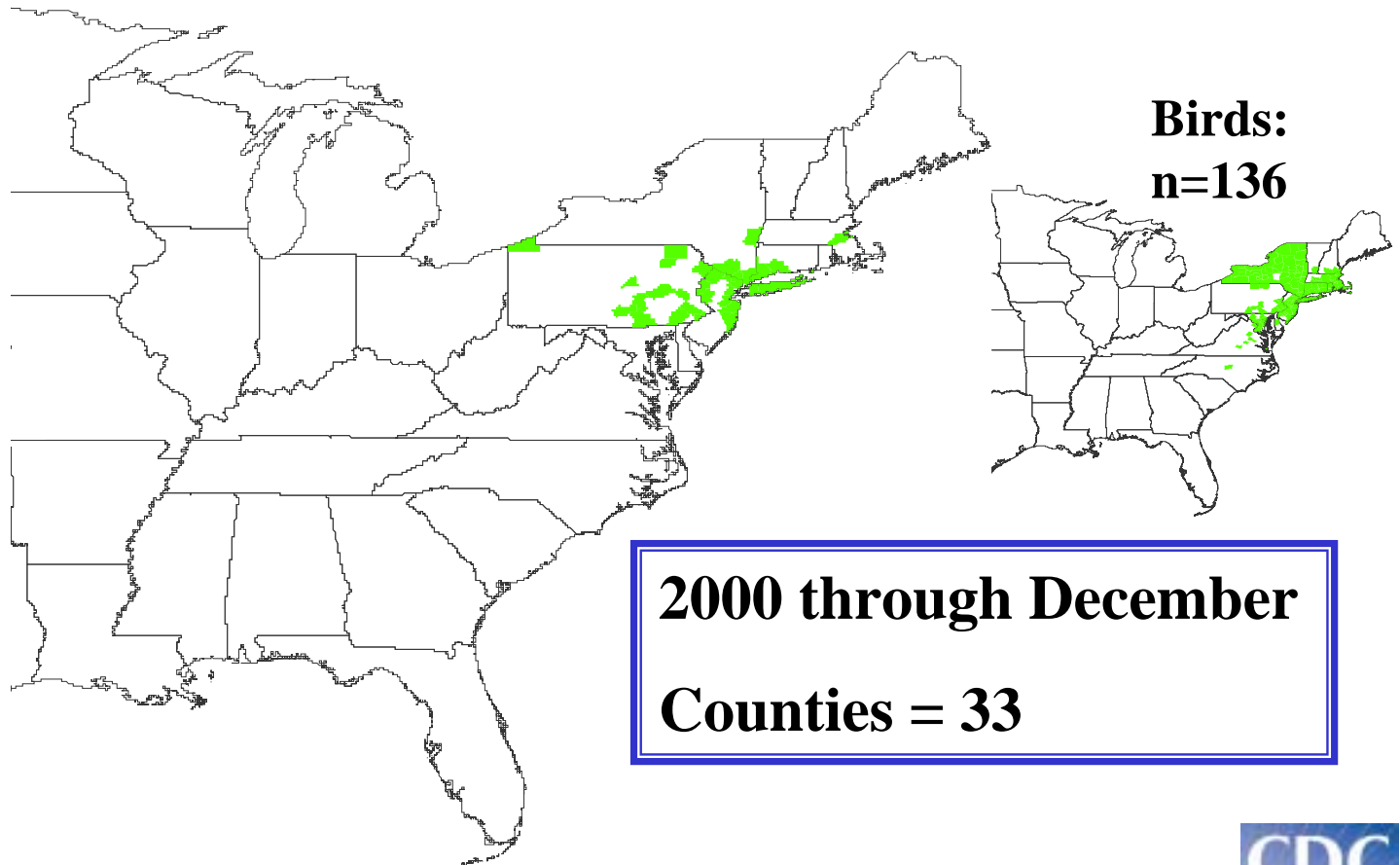
WN+ Mosquito Pools: County Reports



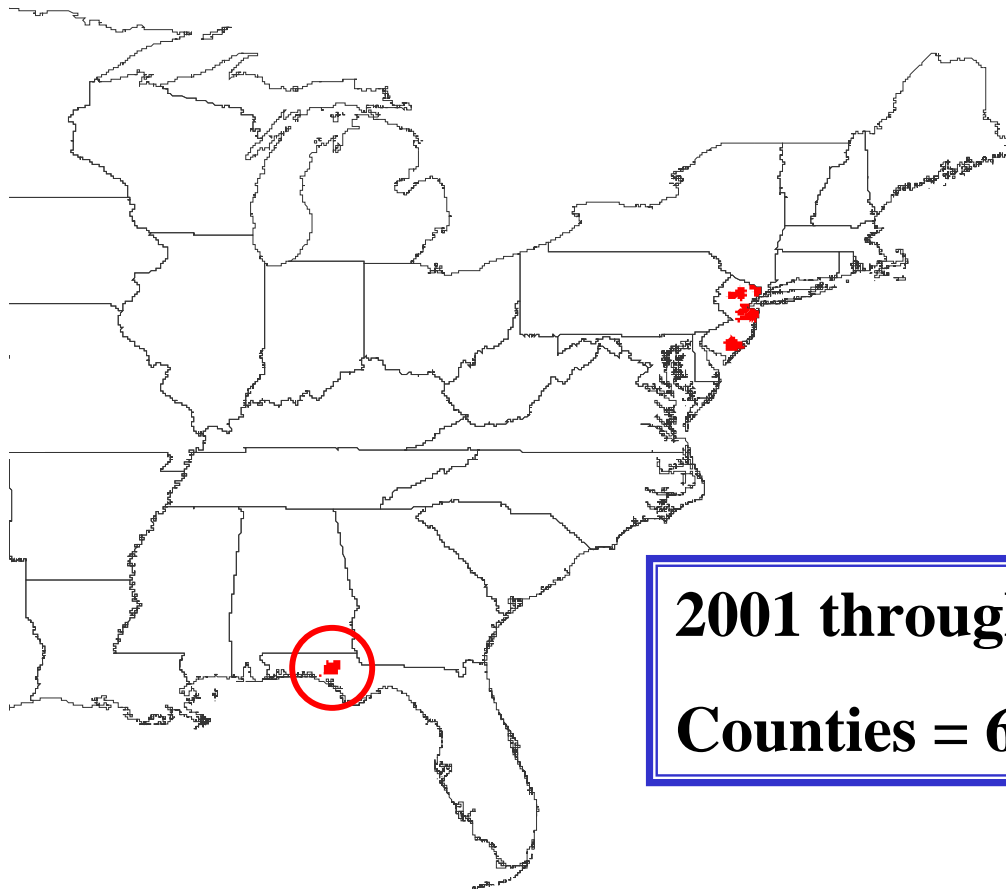
2000 through September

Counties = 27

WN+ Mosquito Pools: County Reports



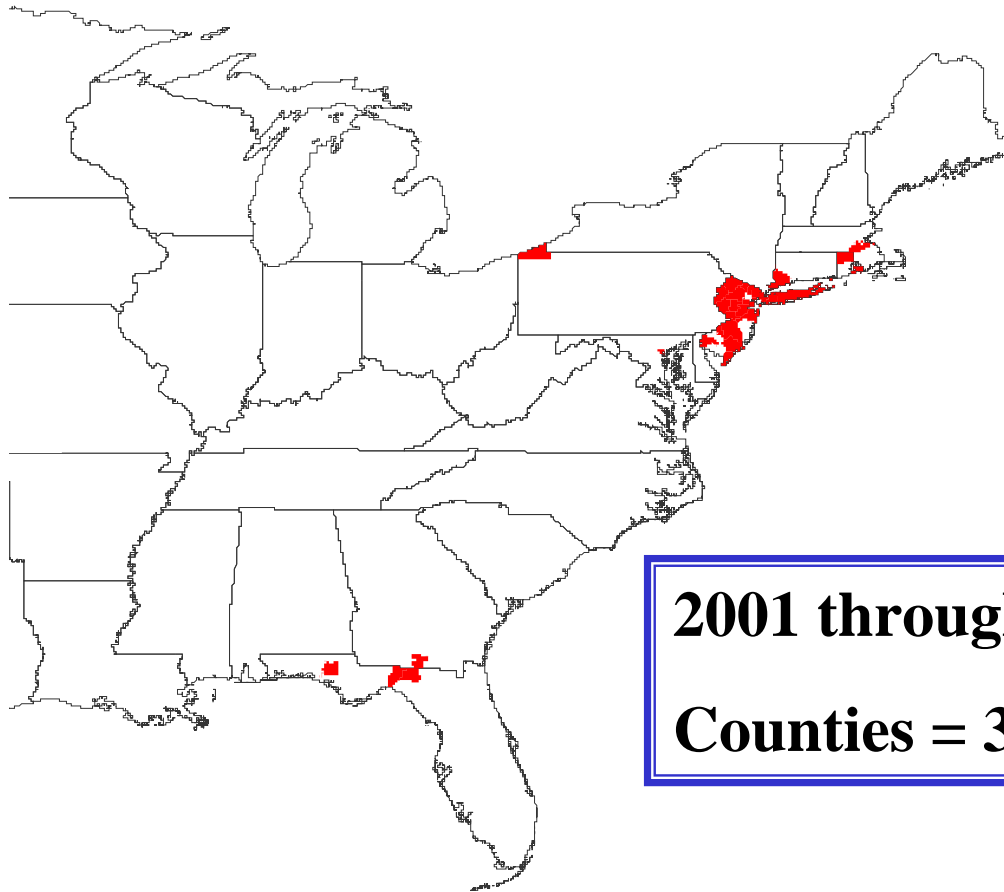
WN+ Mosquito Pools: County Reports



2001 through June

Counties = 6

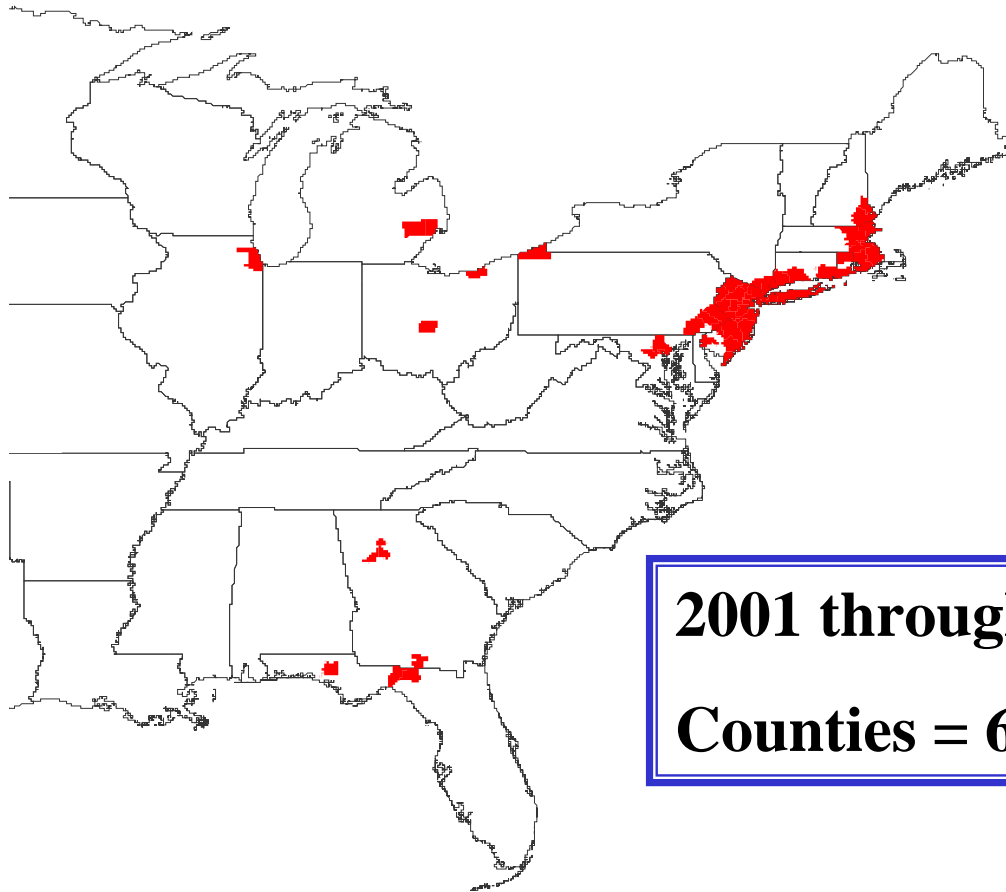
WN+ Mosquito Pools: County Reports



2001 through July

Counties = 32

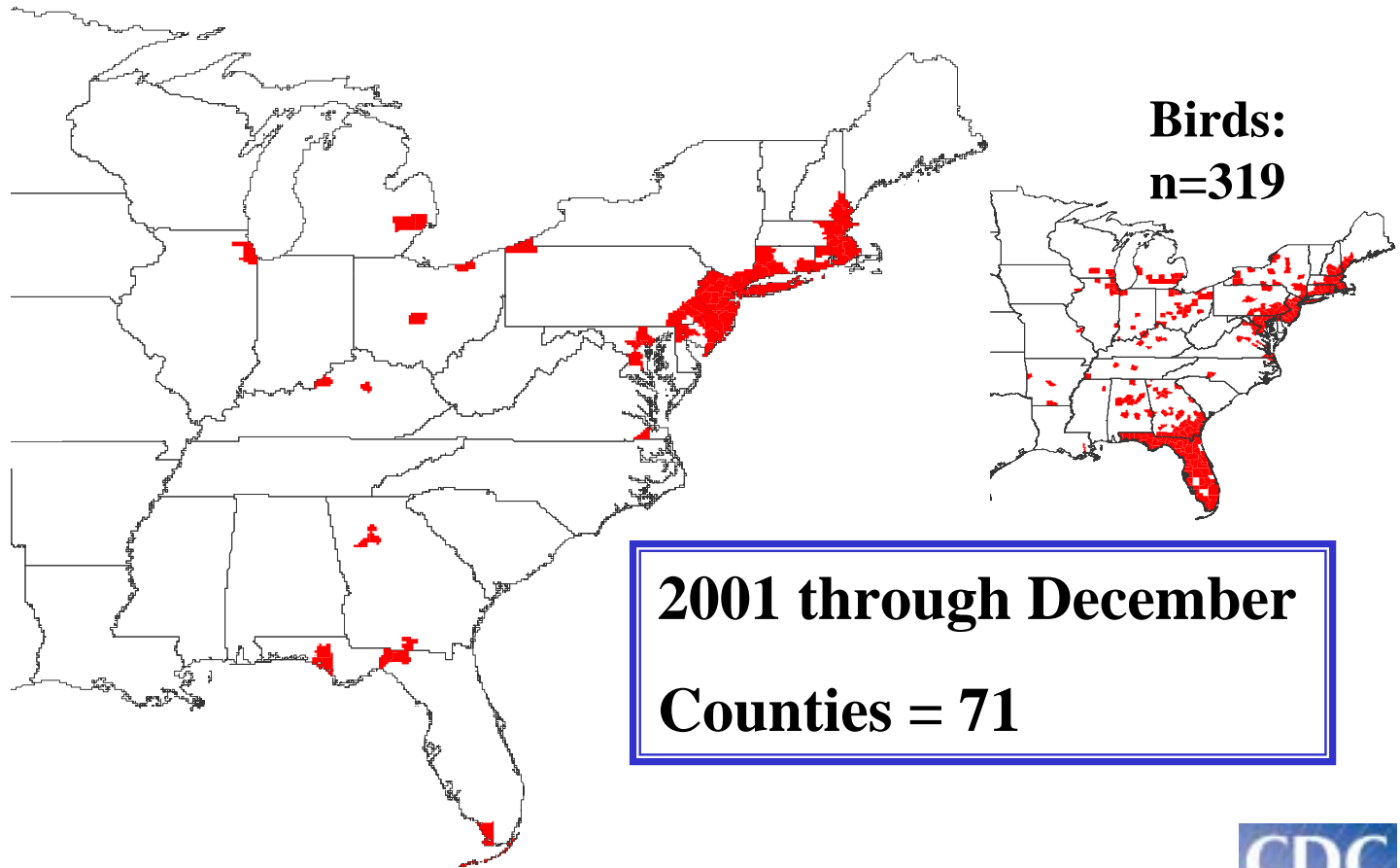
WN+ Mosquito Pools: County Reports



2001 through August

Counties = 61

WN+ Mosquito Pools: County Reports



Relative Vector Competence

Species	Vector Competence
<i>Ae. albopictus</i>	+++
<i>Cx. restuans</i>	+++
<i>Cx. salinarius</i>	+++
<i>Cx. tarsalis</i>	+++
<i>Oc. atropalpus</i>	+++
<i>Oc. japonicus</i>	+++
<i>Cx. nigripalpus</i>	++
<i>Cx. pipiens</i>	++

Species	Vector Competence
<i>Cx. quinquefasciatus</i>	++
<i>Oc. sollicitans</i>	++
<i>Oc. taeniorhynchus</i>	++
<i>Oc. triseriatus</i>	++
<i>Ae. vexans</i>	+
<i>Cq. perturbans</i>	+
<i>Oc. canadensis</i>	+
<i>Oc. cantator</i>	+

Species* role in WN transmission

Species	Enzootic	Epizootic/ Epidemic	Minor
<i>Cx. nigripalpus</i>	Yellow	Red	
<i>Cx. quinquefasciatus</i>	Yellow	Red	
<i>Cx. pipiens</i>	Yellow		
<i>Cx. restuans</i>	Yellow		
<i>Culiseta melanura</i>	Yellow		

*Speculated role of the 29 species associated with WNV in surveillance programs, 1999 - 2001

Species	Enzootic	Epizootic/ Epidemic	Minor
<i>Ae. albopictus</i>			
<i>Ae. vexans</i>			
<i>An. punctipennis</i>			
<i>An. quadrimaculatus</i>			
<i>Cq. perturbans</i>			
<i>Cx. salinarius</i>			
<i>Oc. canadensis</i>			
<i>Oc. sollicitans</i>			
<i>Oc. taeniorhynchus</i>			
<i>Oc. triseriatus</i>			
<i>Oc. trivittatus</i>			
<i>Ps. columbiae</i>			
<i>Ps. ferox</i>			

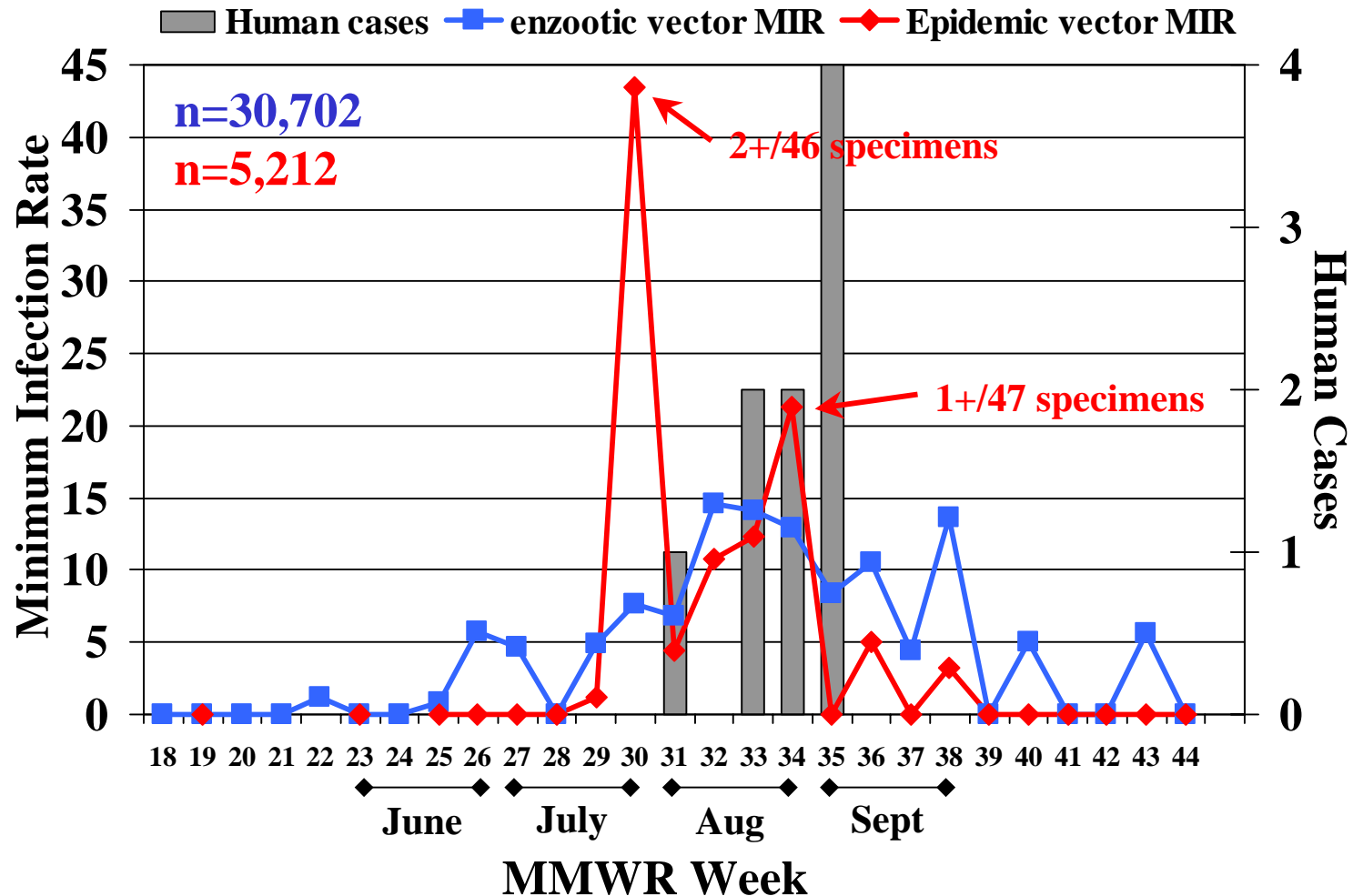
Species	Enzootic	Epizootic/ Epidemic	Minor
<i>Ae. cinereus</i>			
<i>An. atropos</i>			
<i>An. barberi</i>			
<i>An. crucians/bradleyi</i>			
<i>De. cancer</i>			
<i>Oc. atlanticus/tormentor</i>			
<i>Oc. atropalpus</i>			
<i>Oc. cantator</i>			
<i>Oc. japonicus</i>			
<i>Or. signifera</i>			
<i>Ur. sapphirina</i>			

Mosquito-Based WN Surveillance

- **Patterns in Surveillance Programs**
- **NJ Counties with human cases in 2001**
 - **Bergen, Camden, Essex, Hudson, Middlesex, Union**
- **NJ Counties without human cases in 2001**
- **MIR in enzootic vectors**
 - *Cx. pipiens*, *Cx. restuans*, *Cx. sp.*
- **MIR in suspect epidemic vectors**
 - *Ae. albopictus*, *vexans*, *An. punctipennis*, *quadrifasciatus*, *Cq. perturbans*, *Cx. salinarius*, *Oc. canadensis*, *japonicus*, *sollicitans*, *triseriatus*, *trivittatus*, *Ps. columbiae*, *ferox*

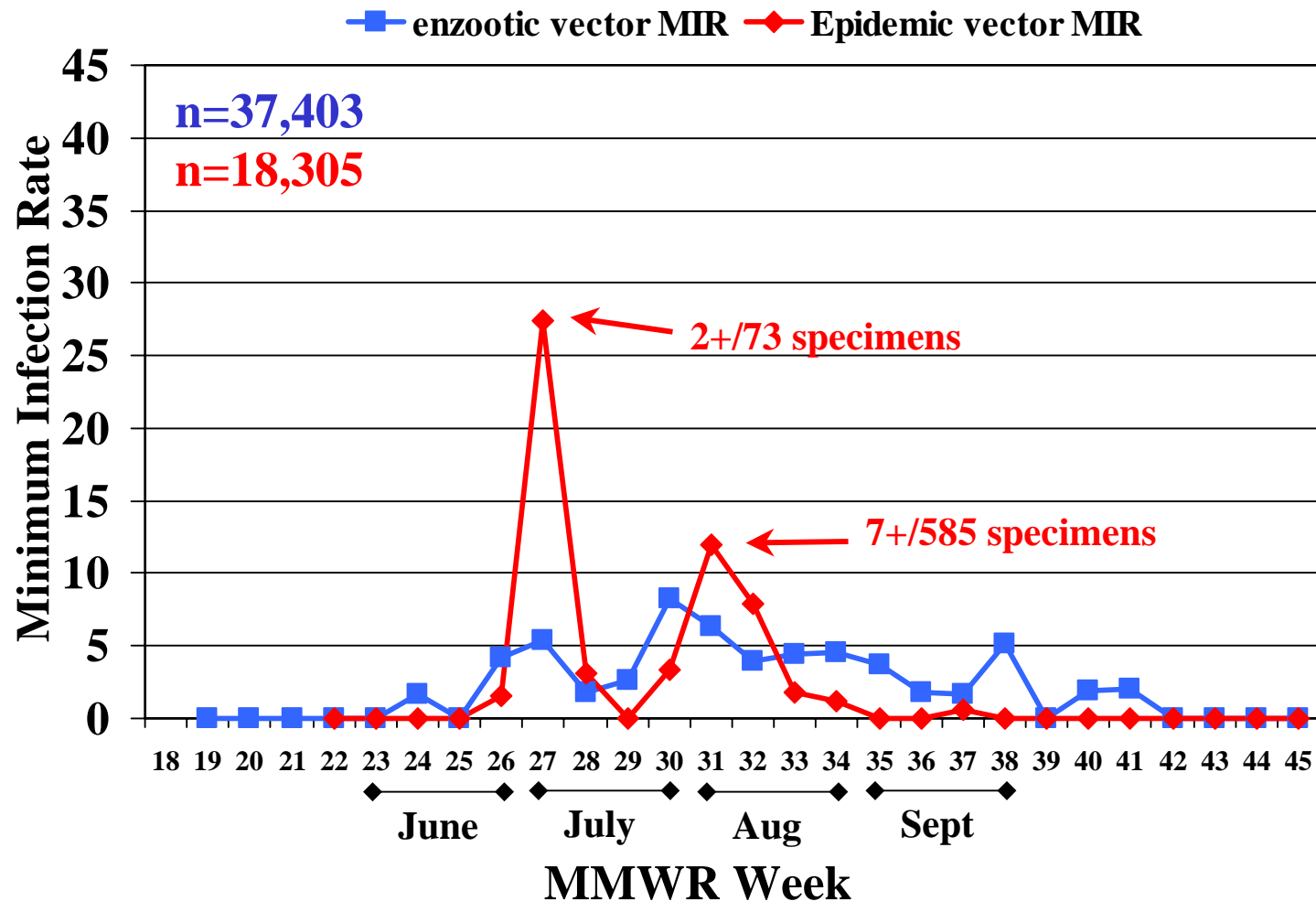
Mosquito-Based WN Surveillance

NJ counties with human cases: 2001



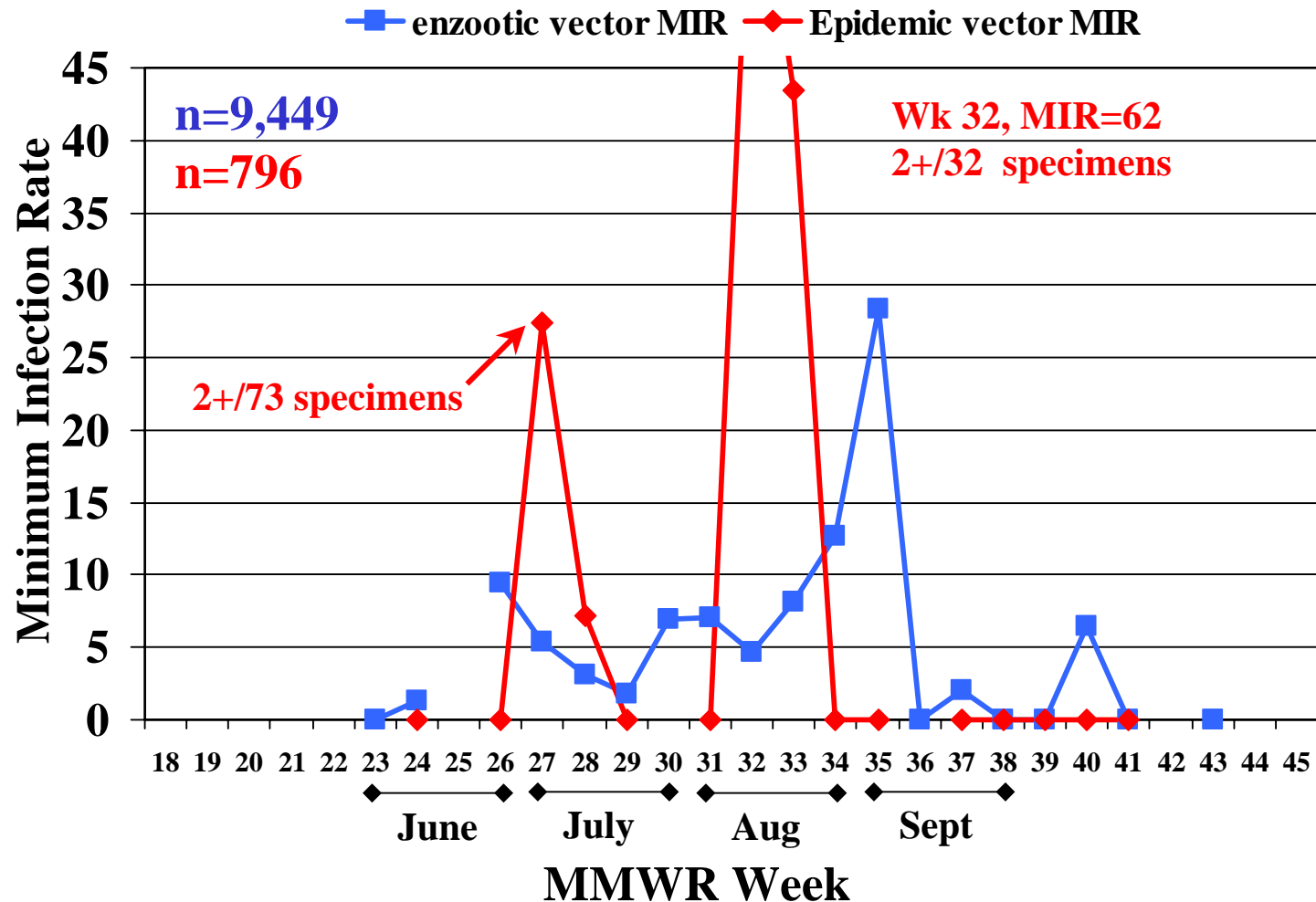
Mosquito-Based WN Surveillance

NJ counties without human cases: 2001



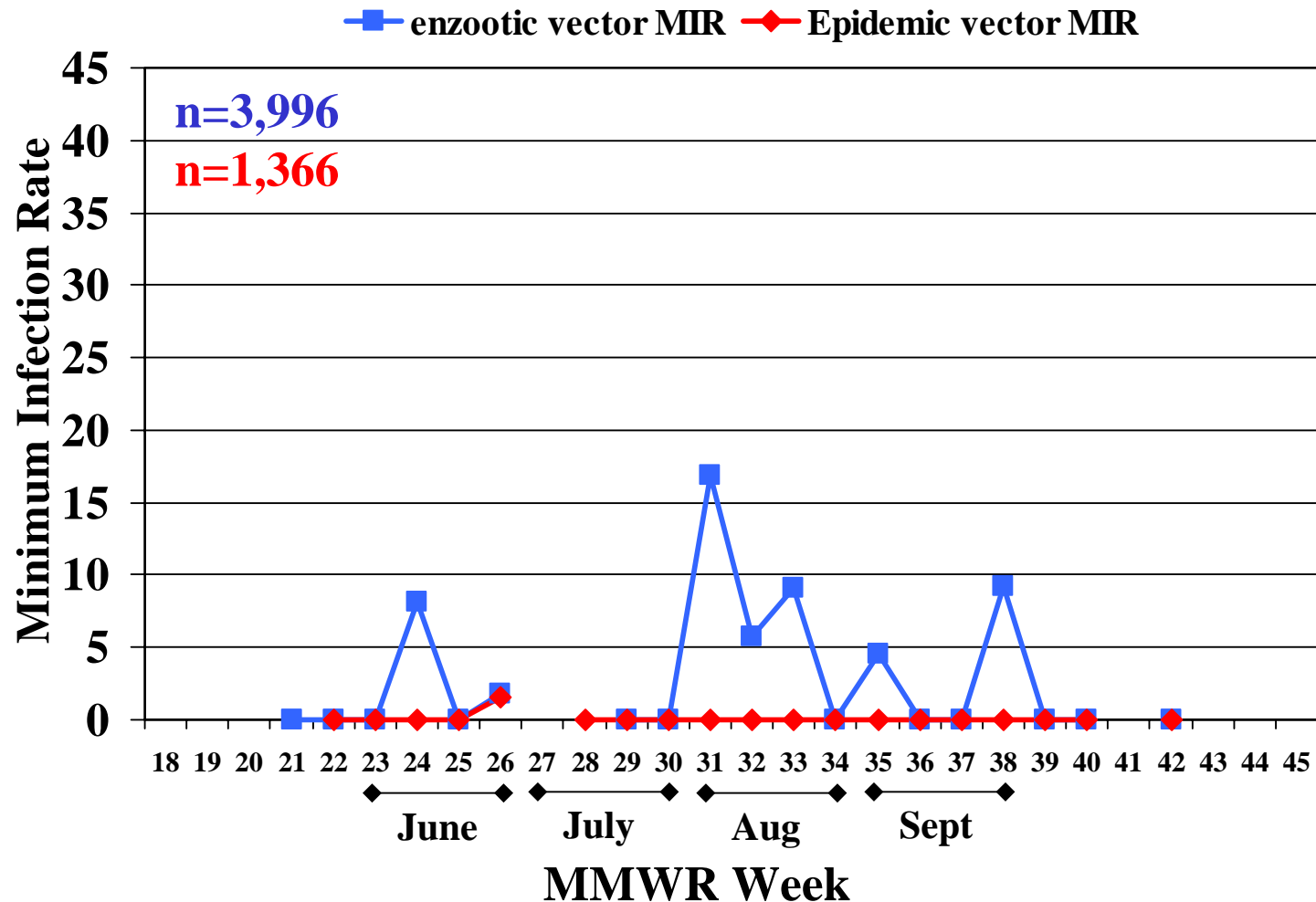
Mosquito-Based WN Surveillance

Monmouth County NJ, 2001 : No human cases



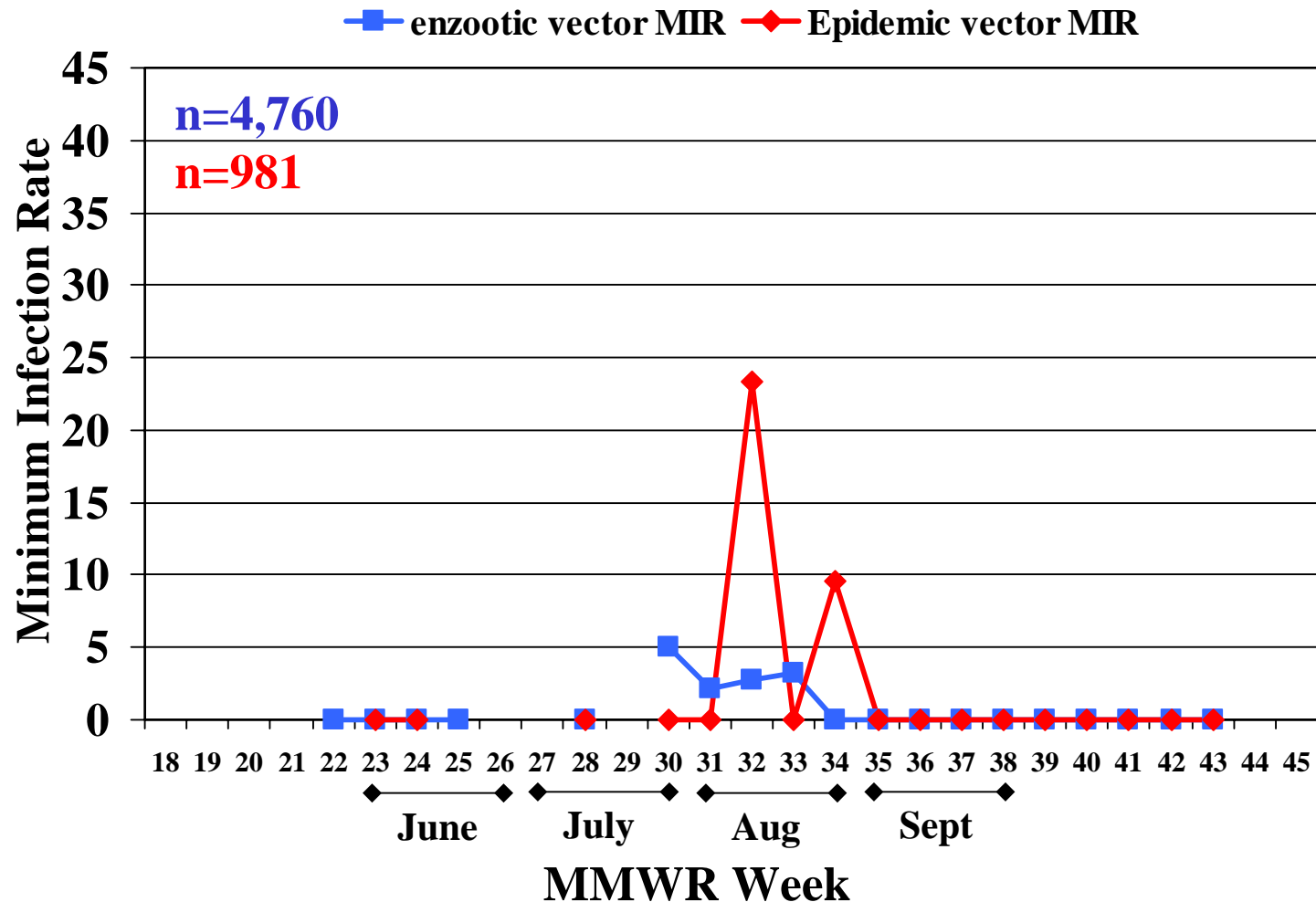
Mosquito-Based WN Surveillance

Morris County NJ, 2001 : No human cases



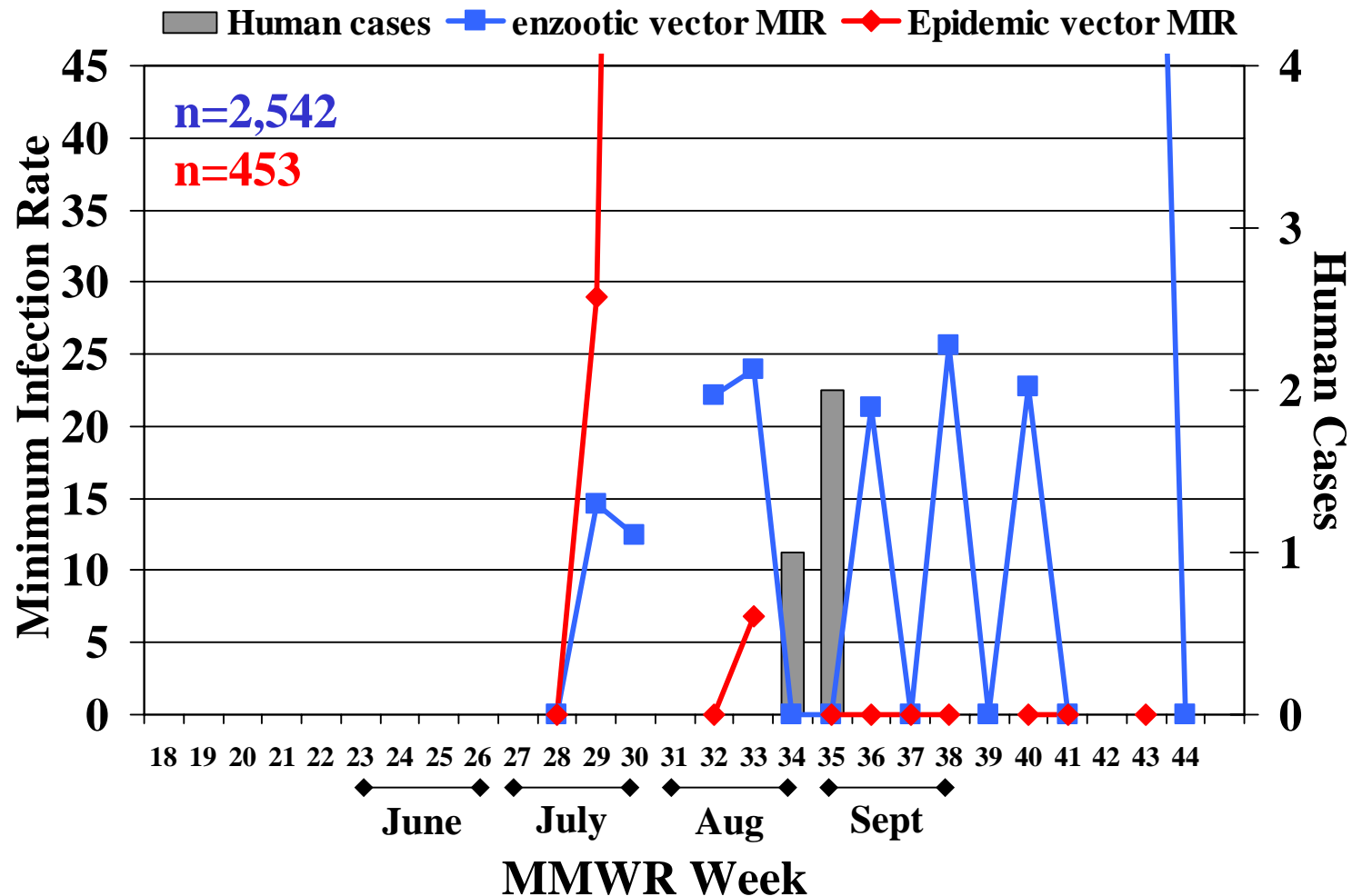
Mosquito-Based WN Surveillance

Warren County NJ, 2001 : No human cases



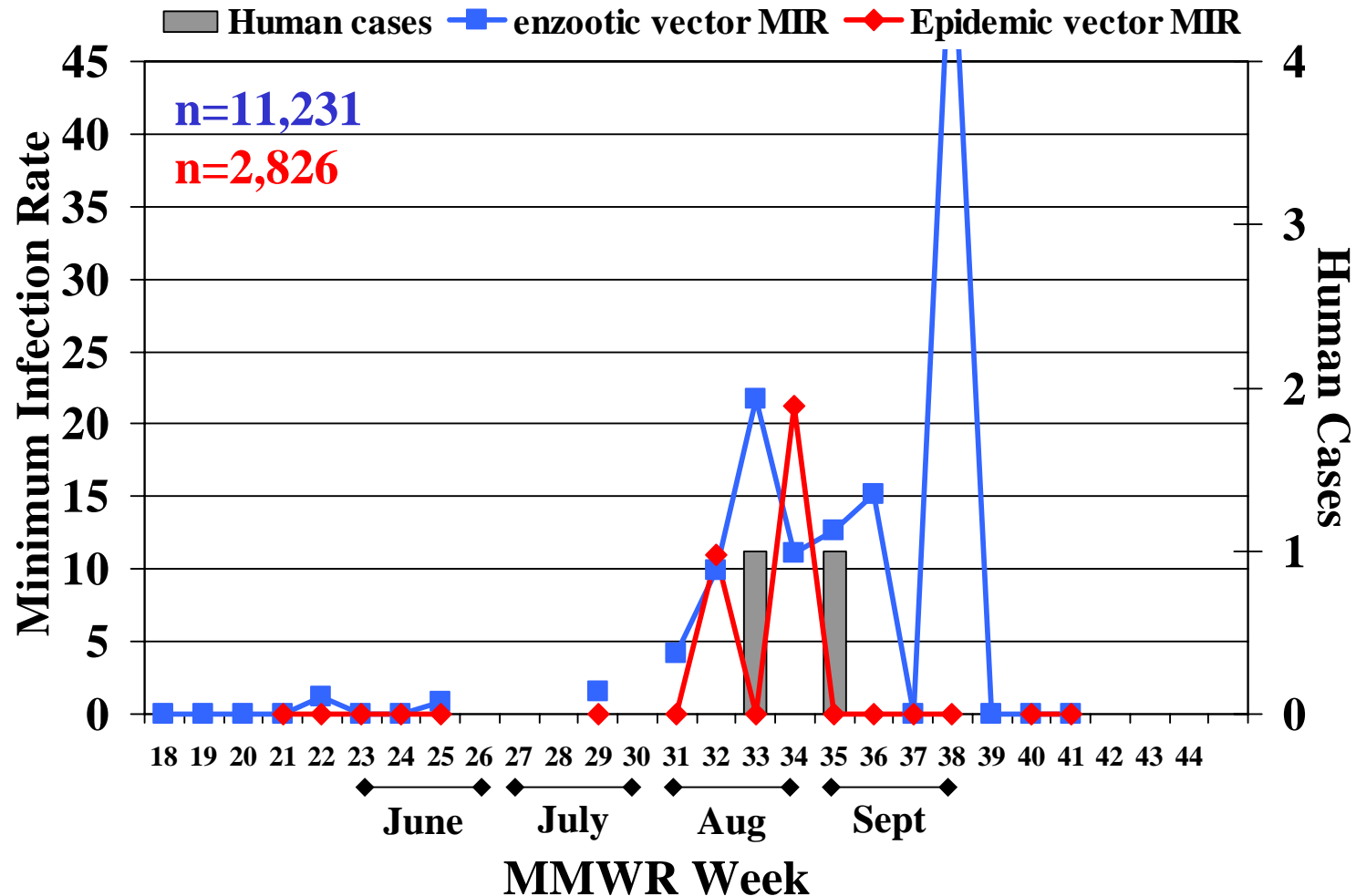
Mosquito-Based WN Surveillance

Camden County NJ, 2001 : 3 human cases



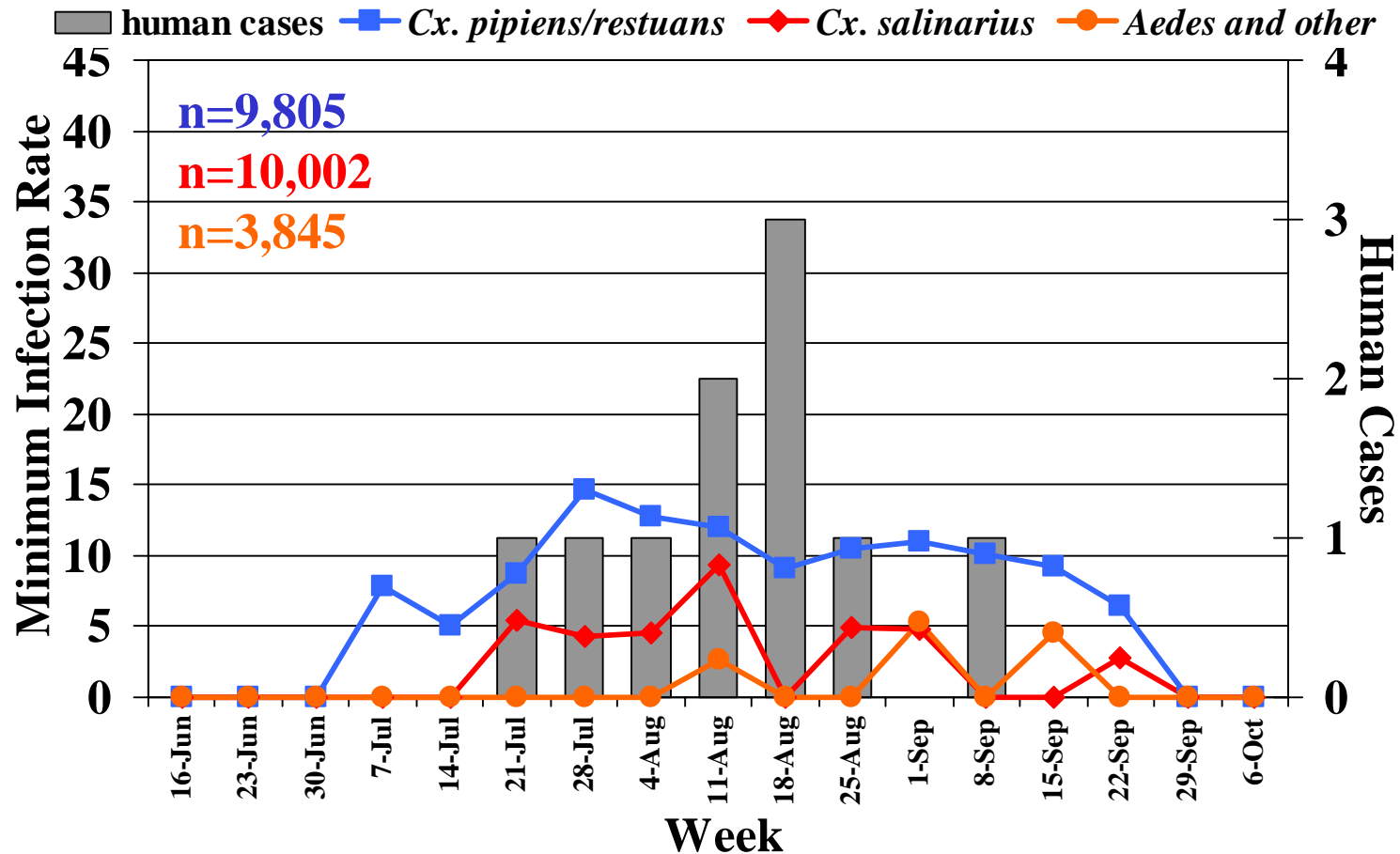
Mosquito-Based WN Surveillance

Middlesex County NJ, 2001 : 2 human cases:



Mosquito-Based WN Surveillance

Staten Island, NY 2000 : 10 human cases



Mosquito-Based WN Surveillance

- **Predictive for human risk?**
 - **Consistent effort.**
 - **Adequate sample size.**
 - **Combine enzootic vectors.**
 - **Combine suspected mammalian epizootic and epidemic vectors.**
 - **Use in association with vector density data.**
 - **Accumulate historical basis for data evaluation.**
 - **Regional and Local.**

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