Florida Department of Health

Bureau of Laboratories, Tampa

3602 Spectrum Boulevard
Tampa, FL 33612

Arbovirus Surveillance: Annual Summary Report 2005

Lillian Marcus Stark, Ph.D., M.P.H., M.S.
Deno Kazanis, Ph.D

This past arbovirus season demonstrated the effectiveness of our surveillance program. Because of the emergence of West Nile virus (WNV), an arbovirus new to the Americas, in the northeast in 1999 and its rapid migration, surveillance efforts had been intensified. Funding was through a supplemental ELC grant from the CDC. Our longstanding laboratory experience with arboviruses and multi-agency collaborative surveillance program placed Florida in a better position to face the onslaught of West Nile Virus then were many states. Surveillance included assay of dead bird and mammal tissue and mosquitoes (virus detection and isolation) as well as sentinel chicken and wild bird serology and clinical testing.

Diagnostic viral serology tests performed included IgM ELISA, IgG Elisa and serum neutralization (SN) for antibodies to the arthropod borne viruses. Because the IgG Elisa is allows for better turn-around-time and is slightly more sensitive than the HAI assay, HAI testing was only performed on one serum to confirm a secondary flavivirus infection. This year there was a decrease in the number of human cases of West Nile virus infection in Florida from 41 to 21. Most of the 2005 cases occurred locally, in east-central Florida.

During 2005, we detected/confirmed recent infections with West Nile in 17 clients, 9 with Dengue, and 2 with Eastern Equine Encephalitis (EEE) virus. Statewide, a total of 21 WN, 5 EEE and 18 Dengue cases were reported. All cases of Dengue infections were imported into Florida from other states or countries. Dengue 1 virus was detected by nested RT-PCR and isolated in VERO cell culture from sera of three travelers returning from Costa Rica. EEE virus was detected in the cerebrospinal fluid of one case.

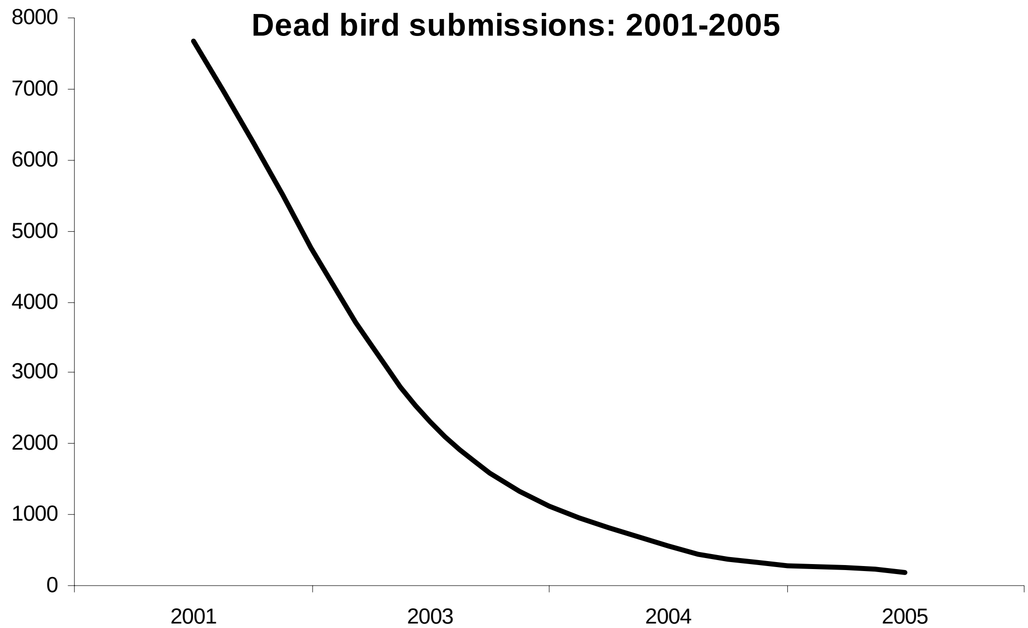
West Nile virus (WN) is a flavivirus, closely related to SLE but, unlike SLE, birds infected with WNV often die. Virus may be detected in the tissues of those birds. The first infected bird in Florida was detected on July 3, 2001, in a crow submitted from Jefferson County. At this time the virus is present throughout Florida, although level of activity varies throughout the state.

Effective arbovirus surveillance entails a concerted, coordinated effort over an extended time period. Sampling must be routinely and regularly performed in order for baseline activity to be recognized. Thus, increases above the historical levels of activity indicate increased risk of spread to the human population, risk that may be reduced by appropriate interventions.

This past season started in June in West Central Florida, with WN seroconversions in sentinels beginning in Hillsborough County and soon following in Pinellas County. A sharp increase in seroconversions were noted in Pinellas sentinels on July 11.This county has a long-standing sentinel program with extensive historical data. The county issued a medical advisory soon thereafter. Human cases began to be detected about two weeks later. An intensive mosquito surveillance and control effort was begun. Daily, pools of mosquitoes were trapped and brought to the TBL for assay for WN virus. Results were provided within 24 hours (often, same day) to the Pinellas County Mosquito Control. This, along with sentinel seroconversion data, enabled rapid targeting of control to affected areas. The outbreak was brought under control by the mid-September with only 18 human cases.

Numbers of dead bird submissions have fallen dramatically since 2001 (Figure 14). All of the submitted animals were screened for WNV by molecular assays (TaqMan RT-PCR), within 1 week of receipt. Samples negative by screening were inoculated onto VERO cell culture for detection of other arboviruses and to increase detection sensitivity for WNV. Molecular methods are highly sensitive, but only assay a very small amount of sample; cell culture is also a very sensitive technique and allows for the testing of a much larger sample volume.

Figure 1: Trend in submissions of dead birds for WNV detection.



A total of 259 specimens: 184 birds, 73 mammals, 2 reptiles, were received for virological assay during 2004. This is a decrease of 68% in dead animal submissions from 2004. Submissions were made from most counties (43) in Florida. Mammals included: 60 horses, 1 cow, 4 deer, 2 raccoons, 2 rhinoceroses, and 4 llamas. WNV was detected in 11 birds and 1 mammal (horse), EEE in 2 birds, and 19 mammals (all horses). WN virus was also cultured from two alligators (Lake County).

The highest number of West Nile positive birds, 9, was from Pinellas County, which was the epicenter of clinical cases this year. The greatest numbers of birds, 63, including 30 doves, were submitted by Dade County; none were positive. Although 42 species of birds were submitted, 91% of the positives were corvids (9 bluejays, 1 crow). WN virus was also detected in one duck (Pinellas County). The rate of WN positive birds was 6%, similar to the 2004 rate of 5.2%, but significantly lower than that for previous years (2003, 20.4%; 2002, 10.8%; 2001, 14.2%). EEE virus was detected in a crane and in a dove from Alachua County. Data on submissions and WN test results for 2004-2001 by county is presented in Table 1.

Table 1. Dead bird/mammal submissions for detection of arbovirus, by county, 2005

County	birds	WN+	mammals	WN+	EEE+
Alachua	9		8		2
Bradford			1		1
Brevard			3		2
Broward			1		
Charlotte	1		1		
Collier	1				
Columbia	4				
Dade	63		2		
Dixie	1	1			
Desoto			2		
Duval	3		1		
Escambia			1		
Gadsden	1				
Gilchrist	5				
Hendry			1		1
Hernando	17				
Hillsborough	15		6		
Indian River	2				
Jackson	2		1		1
Jefferson	2				
Lafayette			1		1
Lee			1		
Leon	5	1	1		1
Levy	4		3		1
Madison	2		1		
Manatee			1		
Marion			15		6
Monroe	2				
Orange	18		5		1
Osceola			1		
Palm Beach	2		1		
Pasco			3		
Pinellas	16	9			
Polk			2		
Putnam	1		2		1
Sarasota	2		1		1
Seminole			2		
St Johns	6				
Sumter			1		

County	birds	WN+	mammals	WN+	EEE+
Suwannee			1		
Union			1	1	
Walton			1		
Washington			1		
totals	184	11	73	1	19

During 2005, 1603 traditional pools of mosquitoes were submitted from 11 counties across the state. Molecular (TaqMan) assays for WNV were performed on all submitted pools. It is important to determine whether the virus detected in a mosquito is viable (i.e., multiplies in cell culture) as part of ascertaining vector potential of the various species. Additionally, extracts of some mosquitoes seem to contain inhibitors of RT-PCR, resulting in false negative molecular assays. Thus VERO cell cultures were also inoculated with homogenized pools.

Commercial assays for WNV antigen in mosquito pools (RAMP) were used by some mosquito control agencies. They sent residual samples from 73 RAMP tests to TBL for confirmation. Because these samples are inactivated, they can be tested only by RT-PCR; cell culture is not possible. One of these samples was confirmed positive for WN. Additionally, two specimens of *Oc. taeniorhynchus* from the Florida Keys that had been WN RAMP assay positive, reacted with the primer sets for EEE in the real-time RT-PCR assay. This was unexpected and is not confirmable, due to lack of sample for additional testing. Submissions and numbers of positive pools are presented in table 2. Table 3 lists positive results by species and collection dates.

Table 2. Mosquitoes submitted for arbovirus testing.

	# traditional				#RAMP	
County	submitted	# WN	# EEE	#CAL	submitted	WN+
Bay	0				2	
Duval	31				0	
Escambia	243		4	2	0	
Flagler	0				3	
Monroe	30				61	1
Palm Beach	78				0	
Pinellas	509	2			0	
Sarasota	351	2	3	4	3	
St Johns	239		1		3	
Volusia	72		2		0	
Walton	50				0	
totals	1603	4	10	6	72	1

Table 3. Arboviruses detected in mosquito pools by county and collection date..

agent	species	#/pool	county	collection date
CAL	*An. crucians*	50	Sarasota	04/06/05
CAL	*An. crucians*	50	Sarasota	11/30/05
CAL	*Cs. melanura*	15	Escambia	08/23/05
CAL	*Oc. atlanticus*	50	Sarasota	06/20/05
CAL	*Oc. atlanticus*	50	Sarasota	07/13/05
CAL	*Oc. atlanticus*	50	Escambia	08/10/05

agent	species	#/pool	county	collection date
EEE	*An. crucians*	50	Escambia	08/01/05
EEE	*Cq. peturbans*	16	Volusia	05/26/05
EEE	*Cs. melanura*	50	Escambia	06/28/05
EEE	*Cs. melanura*	50	Escambia	06/28/05
EEE	*Cs. melanura*	32	Escambia	07/18/05
EEE	*Cs. nigrapalpus*	50	Volusia	05/26/05
EEE	*Oc. atlanticus*	50	Sarasota	06/02/05
EEE	*Oc. atlanticus*	50	Sarasota	06/22/05
EEE	*Oc. atlanticus*	50	Sarasota	06/29/05
EEE	*Oc. infirmatus*	12	St Johns	06/23/05
WN	*Cx. nigripalpus*	50	Pinellas	08/08/05
WN	*Cx. nigripalpus*	2	Pinellas	08/12/05
WN	*Cx. nigripalpus*	50	Sarasota	08/31/05
WN	*Ma. titillans*	50	Sarasota	08/24/05
WN	*Oc. taeniorhyncus*	50	Monroe	09/09/05

The "Sentinel Chicken" surveillance program has long been a mainstay of arbovirus surveillance in Florida. Mosquito control agencies or County Health Departments within participating counties maintained small flocks of chickens at various sites in their area. The birds were bled at specified intervals, and the samples sent to our laboratory. All specimens received in the lab by 12 noon on Wednesday were processed and assayed in that week's test. The hemagglutination inhibition test (HAI) was used to ascertain the presence of antibody to Flavivirus (SLE/WNV) and to Alphavirus (EEE/HJ) viruses. Reports were expeditiously faxed to the submitters each Friday afternoon. Summary reports were also compiled and e-mailed to County Health Departments, Mosquito Control Agencies and other interested stakeholders. The Department of Health used this data in its determination of whether to issue/call off Medical Alerts.

The HAI test used in this laboratory is a broadly reactive screening test, and detects total antibodies developed to WN, SLE, EEE and HJ viruses. An additional advantage of the HAI assay, is that serum from any vertebrate species can be analyzed by this method. Thus, our surveillance program is capable of detecting the presence of all these arboviruses in sentinel chickens, wild birds, mammals and reptiles. Nevertheless, to ascertain which virus is present requires additional testing.

The IgM Elisa assay provides a means to distinguish between antibody to SLE or to WN with sera from humans or chickens, but not other animals; some cross-reactions may occur in this assay. Sentinel sera which reacted with SLE antigen in the HAI test were deemed "flavivirus positive" and if sufficient residual serum was available, were assayed by the Chicken IgM Elisa for antibody to SLE and to WN antigens, the week following the HAI test, with results reported on Tuesday. Additionally, sera that were reactive with EEE antigen were deemed "alphavirus positive" and were tested for antibody to EEE by the IgM Elisa. Since IgM in chickens appears to be of short duration (few weeks), ELISA negative or equivocal sera were then re-tested using a serum neutralization assay to confirm the presence of specific antibody.

The most specific test to distinguish between antibodies developed to these viruses is the serum neutralization assay. This quantitative assay uses infectious virus of each type to challenge the test serum. Cell cultures are then inoculated with the serum-virus mixture and the protective effect of the serum, that is, its ability to neutralize the lethality of the virus, is calculated. The serum neutralization assay is complex, hazardous and requires a significant amount of technologist time. Sera from animals other than chickens, e.g., from wild birds or mammals, are confirmed by the SN assay. Flavivirus positive sera are assayed against both WN and SLE viruses; alphavirus positive sera are assayed against both EEE and HJ viruses.

During 2004, Highlands J (HJ) virus was added to the SN protocol based on the MSPH thesis work of staff member Christy Ottendorfer. HJ virus cross-reacts to a limited extent with EEE in the HAI assay, however, it is not known to be a human pathogen. Thus, a positive test for HJ does not indicate the same risk of disease as does a positive EEE result and control measures would not be as critical. Both viruses frequently co-circulate.

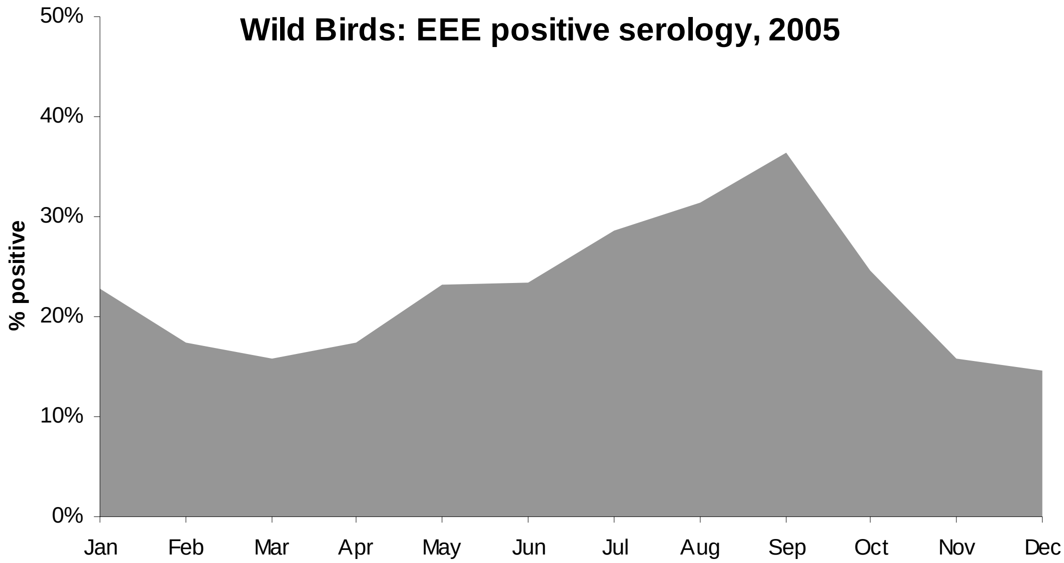
Of the 3,801 individual sentinel birds assayed this year (47,542 serum samples), 414 (10.9%) developed antibody to WN virus, 5 to SLE virus (0.13%), 414 (9.0%) to EEE virus and 108 (2.84%) to HJ virus. Sera from 2 horses were submitted for arbovirus antibody determination (HAI, SNPR assays); both were confirmed to have antibody to EEE virus.

Sera from 1127 non-sentinel avians (16 species) were also assayed in (HAI, SN) assays for the detection of antibody to WNV. Data are presented in table 4. It must be noted that this is prevalence data and not necessarily an indicator of incident (recent) infection. Of these birds, 24.2% had alphavirus antibody detected in the HAI test to and 2.1% had flaviviruses antibody (2004: 3.4% and 3.6% respectively). Seven birds had antibody to both WN and EEE. Seropositivity for alphavirus generally confirmed by the SN assay as due to EEE and ranged from 15 to 30% of submissions each month of the year, peaking in September and dropping off in October. Sentinel seroconversion rates in the panhandle peaked in August and again in October, indicating continued transmission (Figure 2).

Table 4. Non-sentinel avian serum assayed during 2005.

		alphavirus		flavivirus	
County	# submitted	# HAI +	% +	# HAI +	% +
Hillsborough	41	0	0.0%	4	9.8%
Okaloosa	340	100	29.4%	3	0.9%
Santa Rosa	227	48	21.1%	9	4.0%
St. Johns	2	1	50%	1	50%
Walton	244	60	24.6%	0	0.0%
Washington	273	64	23.4%	7	2.6%
Total	1127	273	24.2%	24	2.1%

Figure 2:



Figures 3a and 4a depict numbers of monthly positive sentinel seroconversions since 1988, for Alphavirus (EEE/HJ) and Flavivirus (SLE/WNV) respectively. Figures 3b and 4b depict rates of seroconversion. As the numbers of sentinels has changed significantly over the years, for a meaningful interpretation of the data, it is essential that rates of seroconversion rather than just numbers of positive birds be compared.

Of the 67 counties in Florida, 33 submitted sera for arbovirus surveillance last season. This is an increase from 27 counties participating in 2001. Degree of participation varied amongst the regions. Figure 5a depicts the # of sentinels exposed in each region of the state by month, 5b the number of sentinel sera submitted. Table 5 compares annual seroconversions by region with the regional historical means. Due to small numbers of historical data points, the North and Panhandle regions have been combined and the MASR computed for the combined regions. The MASR for WN virus was significantly greater than historical levels for flavivirus (SLE/WN combined) for the central, north and panhandle regions. EEE activity was significantly elevated above historical levels in the north and panhandle regions. EEE activity in the central region was also unusually high (near statistical significance).

Table 5. Mean annual seroconversions rates (MASR) by region, 2005.

	South	Central	*North*	*Panhandle*	North & Panhandle
EEE: 2005	0.2	2.7	*11.3*	*23.7*	14.5
HJ: 2005	0.2	0.7	*4.4*	*5.1*	4.6
Alphavirus: 2005	0.36	3.45	*15.74*	*28.8*	**19.05**
Alphavirus: MASR	0.4	2.0			10.0
Alphavirus:MASR 95% CI	0.03-0.43	0.46-3.48			7.92-12.16
SLE: 2005	0.0	0.5	*0.0*	*0.0*	0.0
WN: 2005	2.4	18.3	*8.7*	*11.0*	9.3
Flavivirus: 2005	2.37	**18.71**	*8.71*	*11.01*	**9.29**
Flavivirus: MASR	19.0	11.8			3.0
Flavivirus: MASR 95% CI	11.11-26.97	5.59-17.99			0.8-5.24

Figures 6, 7, 8, 9, 10, 11 and 12 show, respectively, for each county: the numbers of surveillance sites maintained, the total number of susceptible chickens exposed during 2005, the number of serum samples which were submitted from exposed birds, the number of sentinel birds which seroconverted to EEE, the number of birds which seroconverted to HJ, the number of birds which seroconverted to SLE and the number of birds which seroconverted to WNV during 2005.

There are still substantial areas of the state that are not monitored. Sampling is clustered, primarily in the "traditional SLE belt" across the central and northern regions of the state and hence, the distribution of virus activity appears clustered both in space and time. Counties initiate and terminate annual surveillance activity at various times during the year and thus there is a risk of missing detection of critical early season viral amplification. It would be of value for our understanding and future control of arbovirus outbreaks, if these currently underrepresented areas of the state could be encouraged to develop an appropriate surveillance program.

Table 6a provides a listing of the counties which participated during 2005, the numbers of sites and birds they maintained, the number of sera they submitted, the numbers of sentinels which seroconverted to EEE, HJ, SLE and WN viruses and the percent of exposed birds which seroconverted. Seroconversion dates are given in table 6b; confirmed seroconversions are indicated by "*"; presumptives are listed when a confirmation was not possible for that bird.

Figures 13, 14, 15 and 16 depict the rate of seroconversions to EEE, HJ, SLE and WNV, respectively, by month, for the four state regions. For comparative purposes, 2004 data is also show for EEE, SLE and WN. Assays for HJ were not routine until mid-season in 2004, and thus a comparison figure for HJ is not available. Seroconversions to alphavirus (EEE and HJ) occurred every month of year. Seroconversions in the panhandle exhibited a bimodal pattern with an early peak in March and an elevated rate from Jun through December, peaking in October. Seroconversion in the north region was unusually elevated from April through September, peaking in June. Activity in the central region was also elevated in June and July. Five human cases of EEE occurred in 2005, one in each of five different counties. Only two of those counties maintained sentinel flocks. In one, Leon county, sentinels seroconversions began to occur on 6/24/05, 24 days before onset of human infection.

The annual regional seroconversion rates for SLE were well below each regional historical mean. This is only the fifth year WNV has been detected in Florida, thus historical comparisons are not as effective as for agents with a long history in the state. Antibody response to WNV, peaked in September, a month later than last year, however, rather than a sharp peak, a plateau-like graph is seen. WNV activity was very low in the southern region, unlike 2004. Early season activity (July) was elevated in the central region of the state beginning in July and in the northern and panhandle region beginning in September. WN activity also occurred early in the year (January through February) in the panhandle, indicating virus transmission during the north Florida winter. Specific antibody to SLE was detected at a very low level. Historically, SLE has shown multiyear quiescent periods between widespread outbreaks.

The rate of WN positive sentinels was similar to last year (10.9 % vs. 10.8% statewide). However, human case numbers were lower than in 2004 (21 vs. 41). This may be related to the location of the epicenter of human activity. In 2005, it was in central Florida; 86% of the cases occurred in Pinellas county. This area has a long history of participation in sentinel surveillance and when early season data suggested that west-central Florida was going to be the epicenter for a significant outbreak of WNV, mosquito control acted appropriately on surveillance data, the Department of Health released appropriate prevention messages in a timely manner and the press, primarily in areas with surveillance activities, disseminated them. In 2004, 62% of the cases (24) occurred in areas new to or not participating in the sentinel surveillance program. The 2004 season was mercifully cut short, albeit by our extraordinary hurricane activity.

A total of 102,474 HAI, 1,864 ELISA and 2,171 SN tests were performed on field specimens for arbovirus studies. This includes both the sentinel flock incidence studies, and wild bird sera submitted for prevalence studies. An average of 986 sera were assayed each week (range 406 - 1,393).

It must be noted that this very effective Laboratory Arbovirus Sentinel Surveillance program is a success because of the efforts of its two full time technical staff, Maribel Casteneda and Rita Judge. They directed and trained OPS staff working on Arbovirus grants and student volunteers in the HAI protocol, while maintaining test quality control. Eddie Tensley, is responsible for the production of goose erythrocytes used each week as the indicator red blood cell in the HAI assay by both the Tampa and Jacksonville laboratories, and assists in specimen preparation. Dana Longo, Ann Mitulinsky, Christy Ottendorfer, Ana Quevedo and Logan Haller (OPS, ELC grant) performed HAI, Elisa, SN, dead bird and mosquito assays. Jazmine Mateus managed data. Drs. Kazanis and Stark supervised this effort. The Laboratory Arbovirus Surveillance Team by working together in such a productive manner has enhanced our ability to provide useful data in a timely manner to a variety of concerned agencies.

We also acknowledge the efforts of our partners in arbovirus control: the County Health Departments and Mosquito Control Agencies who are out in the field every week collecting specimens to send us, the DOH, especially the Bureau of Community Environmental Health who coordinate information sharing and response efforts, DACS, FWC, DEP and our university partners, FMEL and PHEREC. Protecting the State of Florida from Arbovirus epidemic is truly a group effort.

Figure 2a. Numbers of sentinel chicken seroconversions to Alphavirus (EEE/HJ) by month: 1988 to 2005

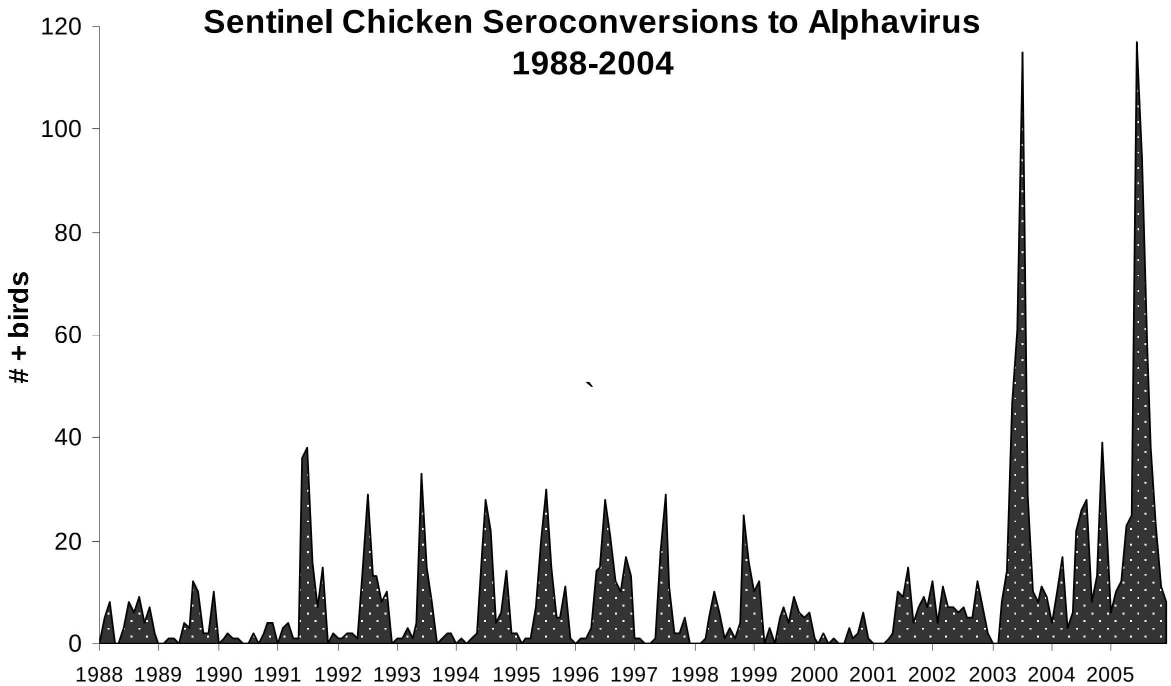


Figure 2b. Rate of sentinel Chicken seroconversion to Alphavirus (EEE/HJ) by month: 1988 to 2005

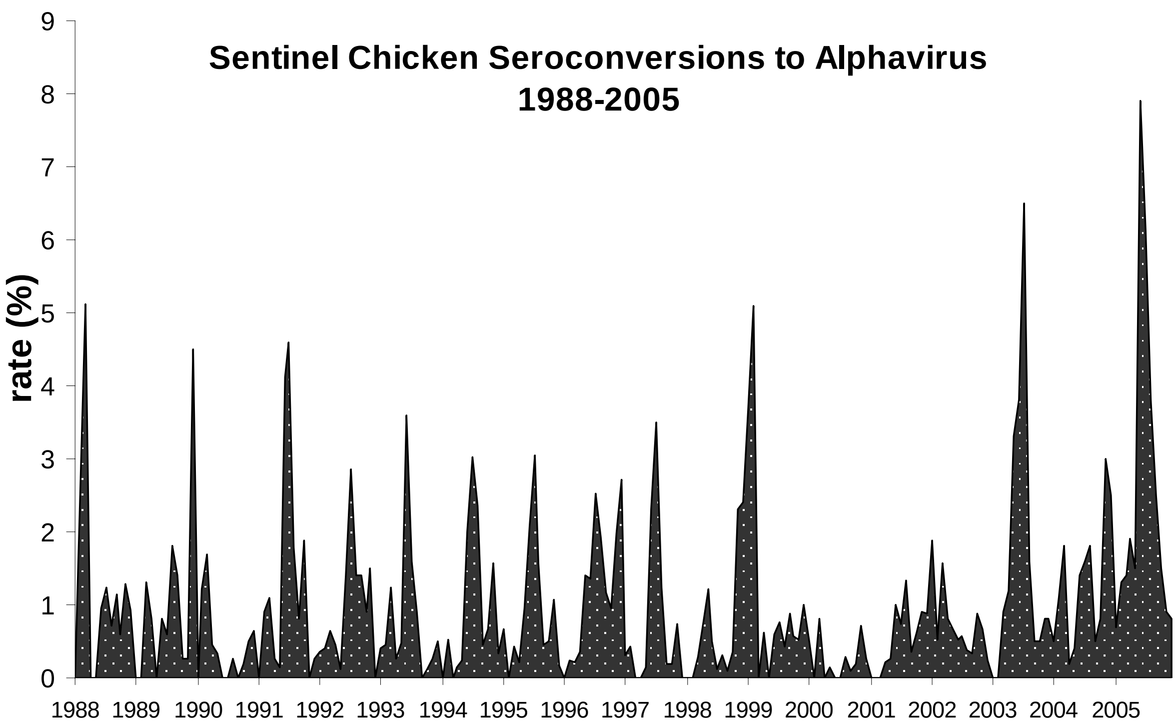


Figure 3a. Numbers of sentinel chicken seroconversions to Flavivirus (SLE/WN) by month: 1988 to 2005

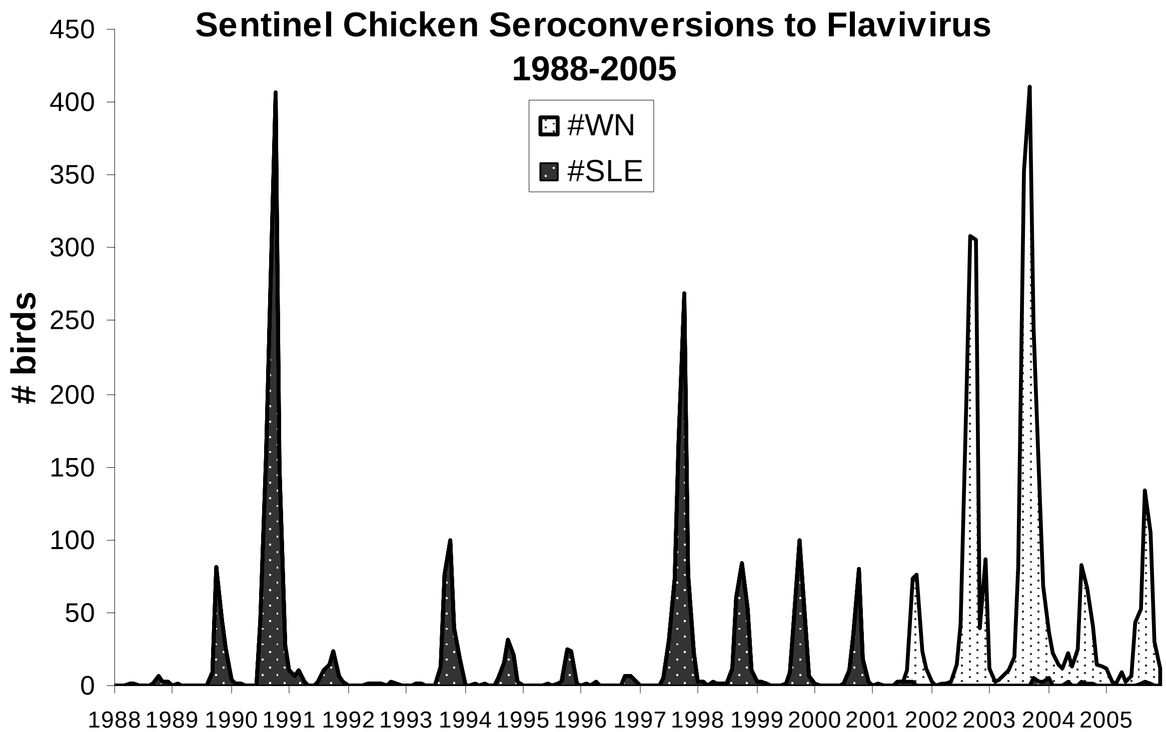


Figure 3b. Rate of sentinel Chicken seroconversion to Flavivirus (SLE/WN) by month: 1988 to 2005

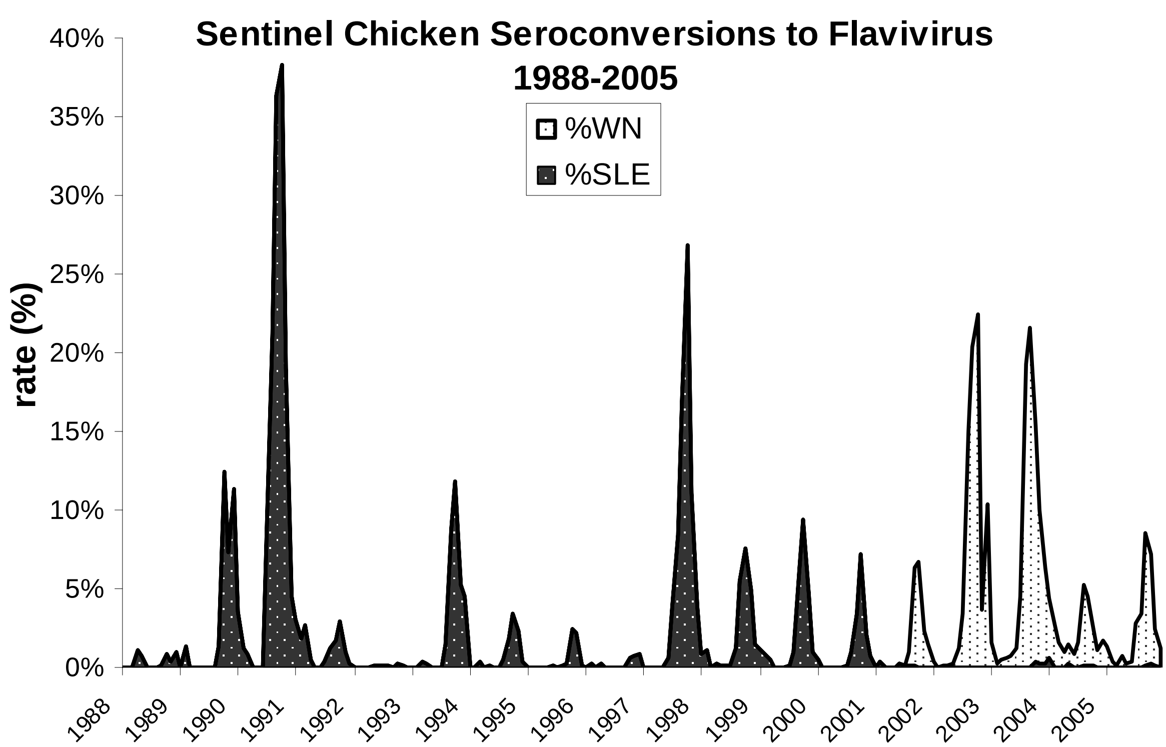


Figure 4a. Number of sentinels by region by month, 2005

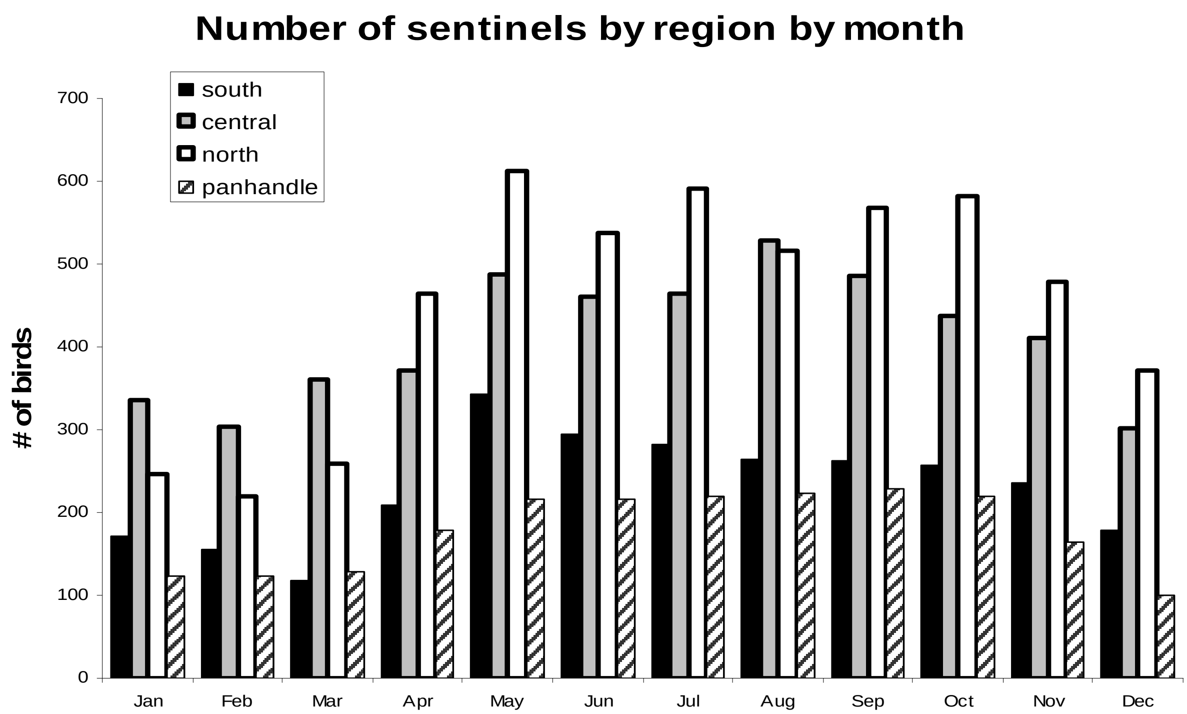


Figure 4b. Numbers of sentinel sera submitted by region by month, 2005

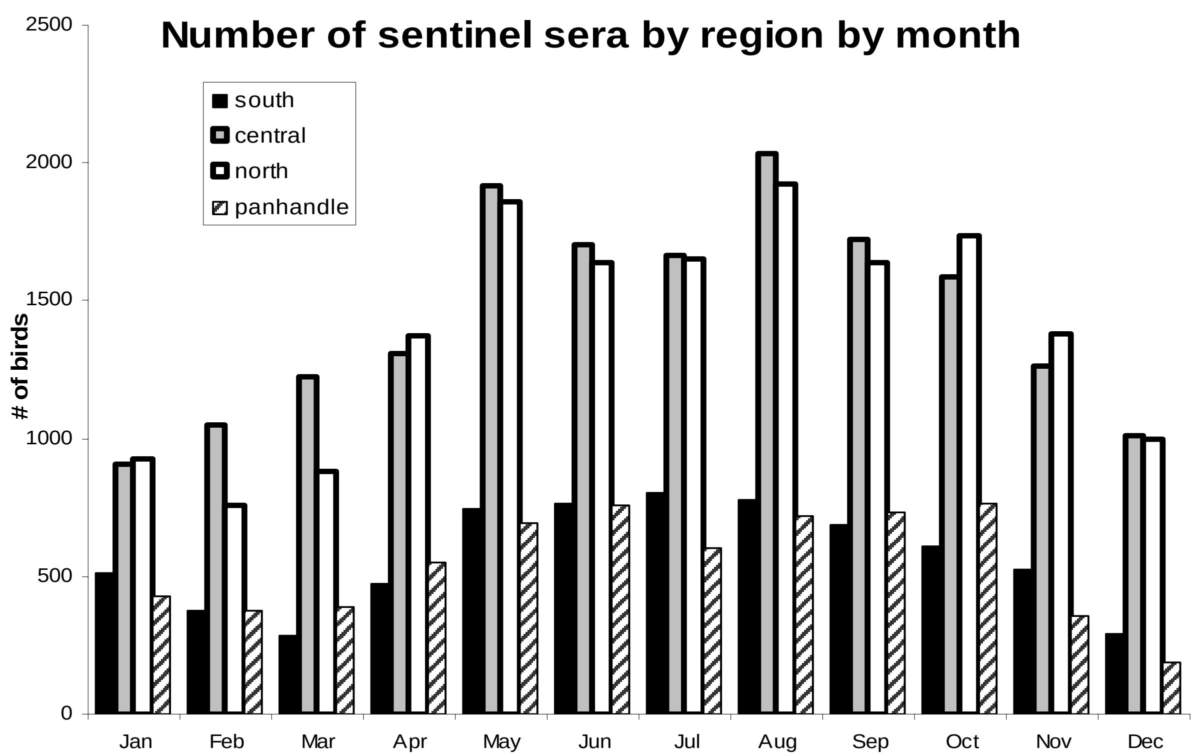


Figure 5. Number of sentinel sites by county, 2005.

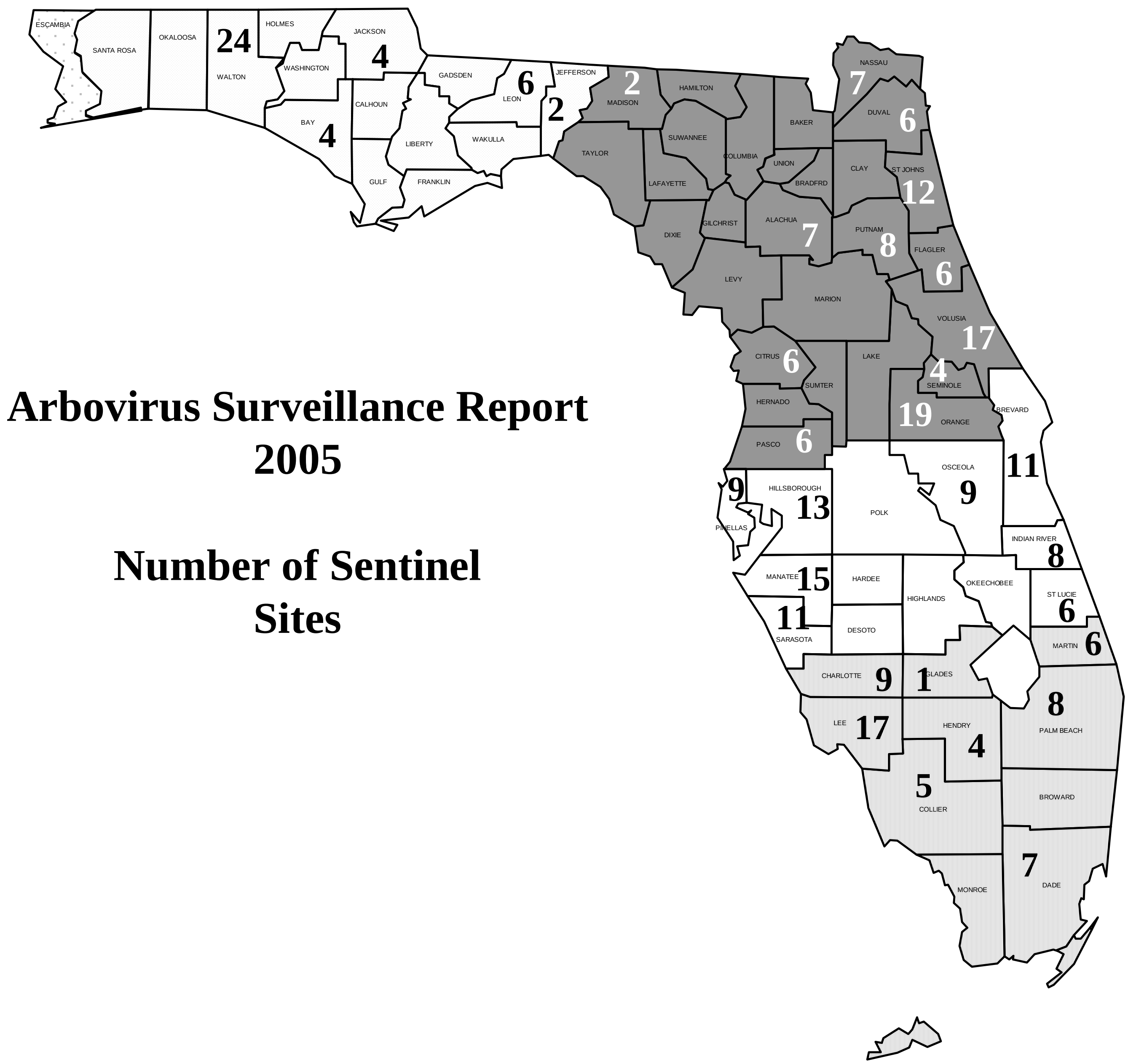


Figure 6. Number of sentinel birds by county, 2005.

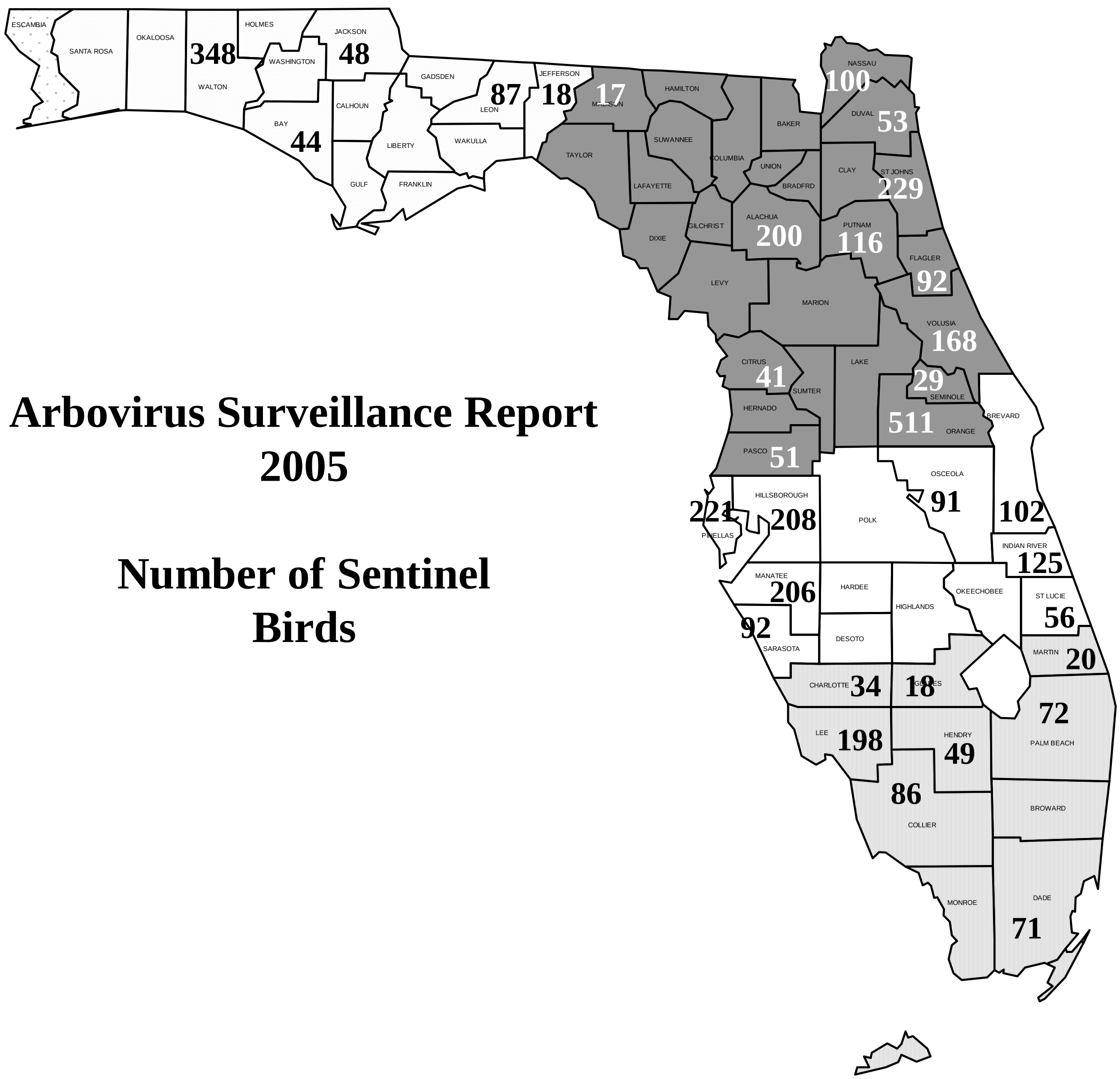


Figure 7.Number of sentinel sera by county, 2005.

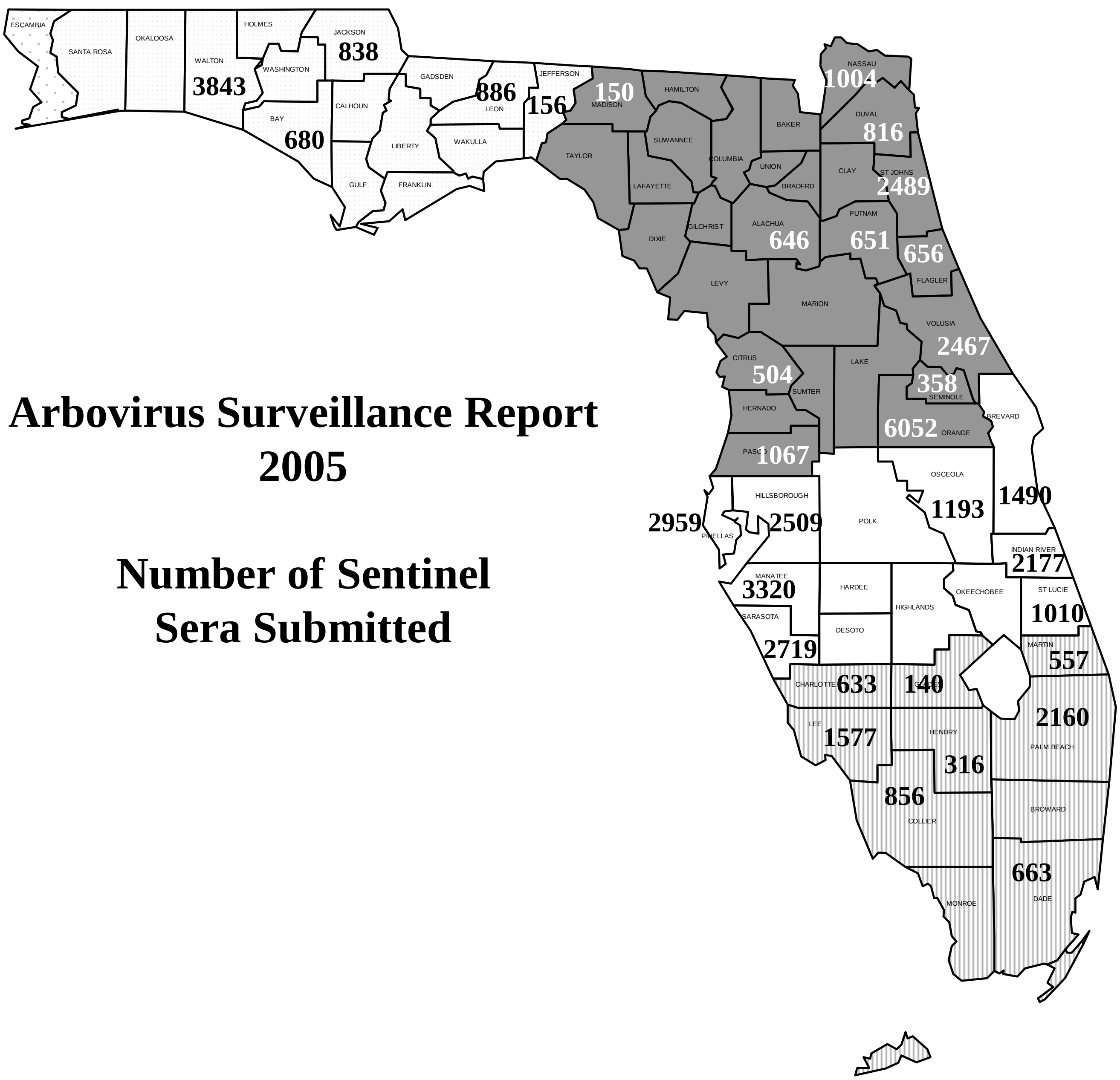


Figure 8. Number of sentinel seroconversions to EEE virus by county, 2005

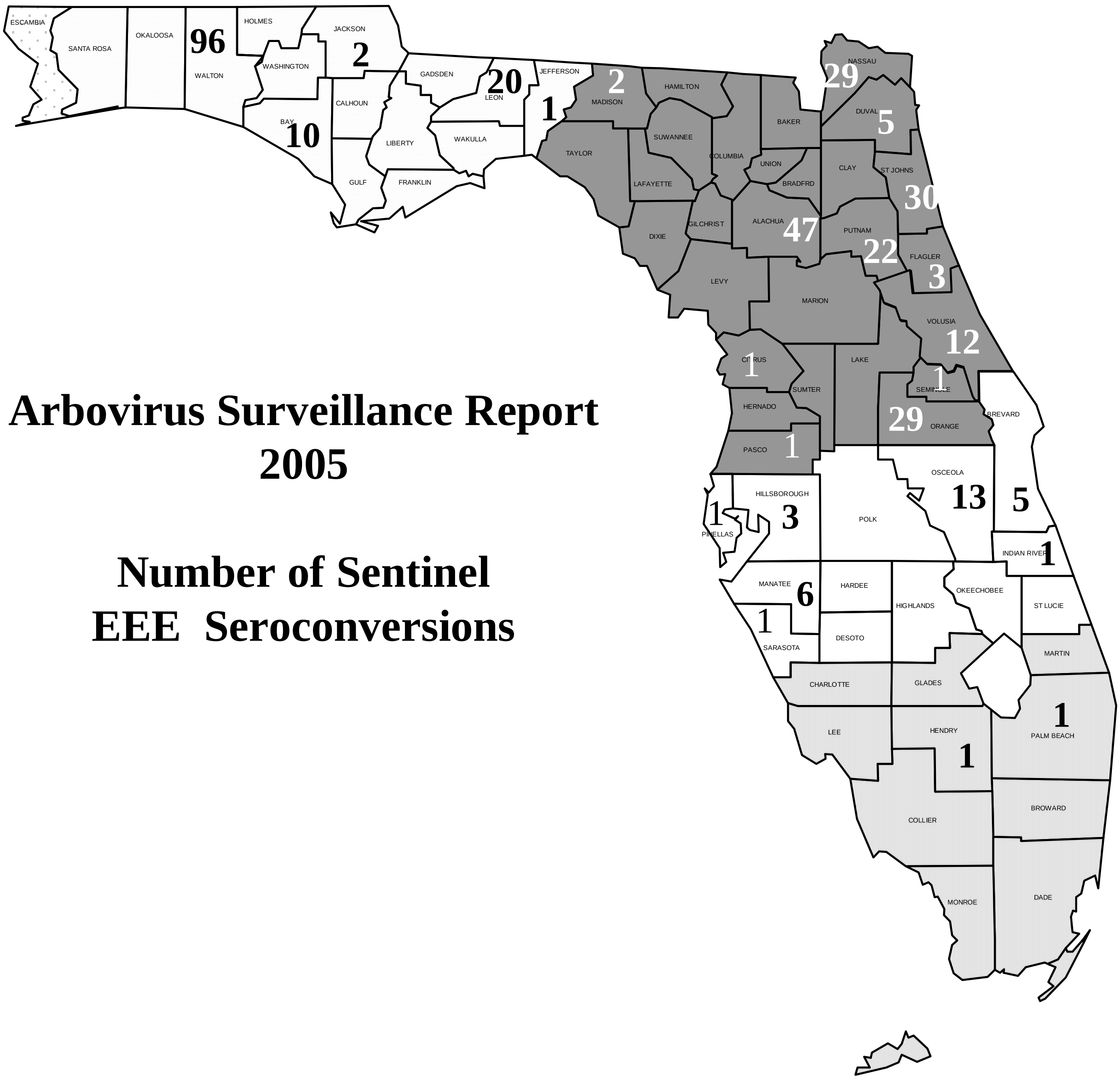


Figure 9. Number of sentinel seroconversions to HJ virus by county, 2005

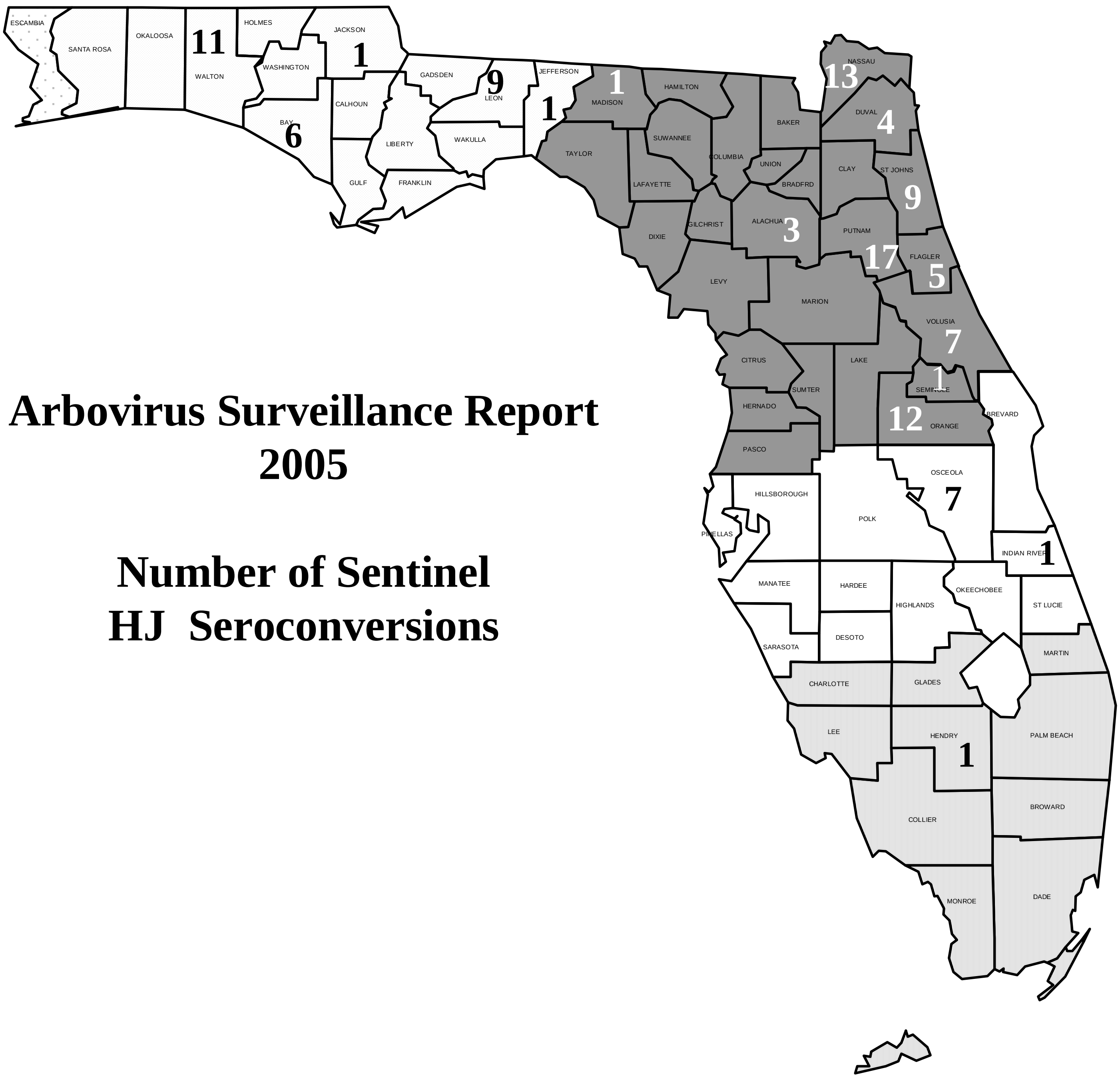


Figure 10. Number of sentinel seroconversions to SLE virus by county, 2005

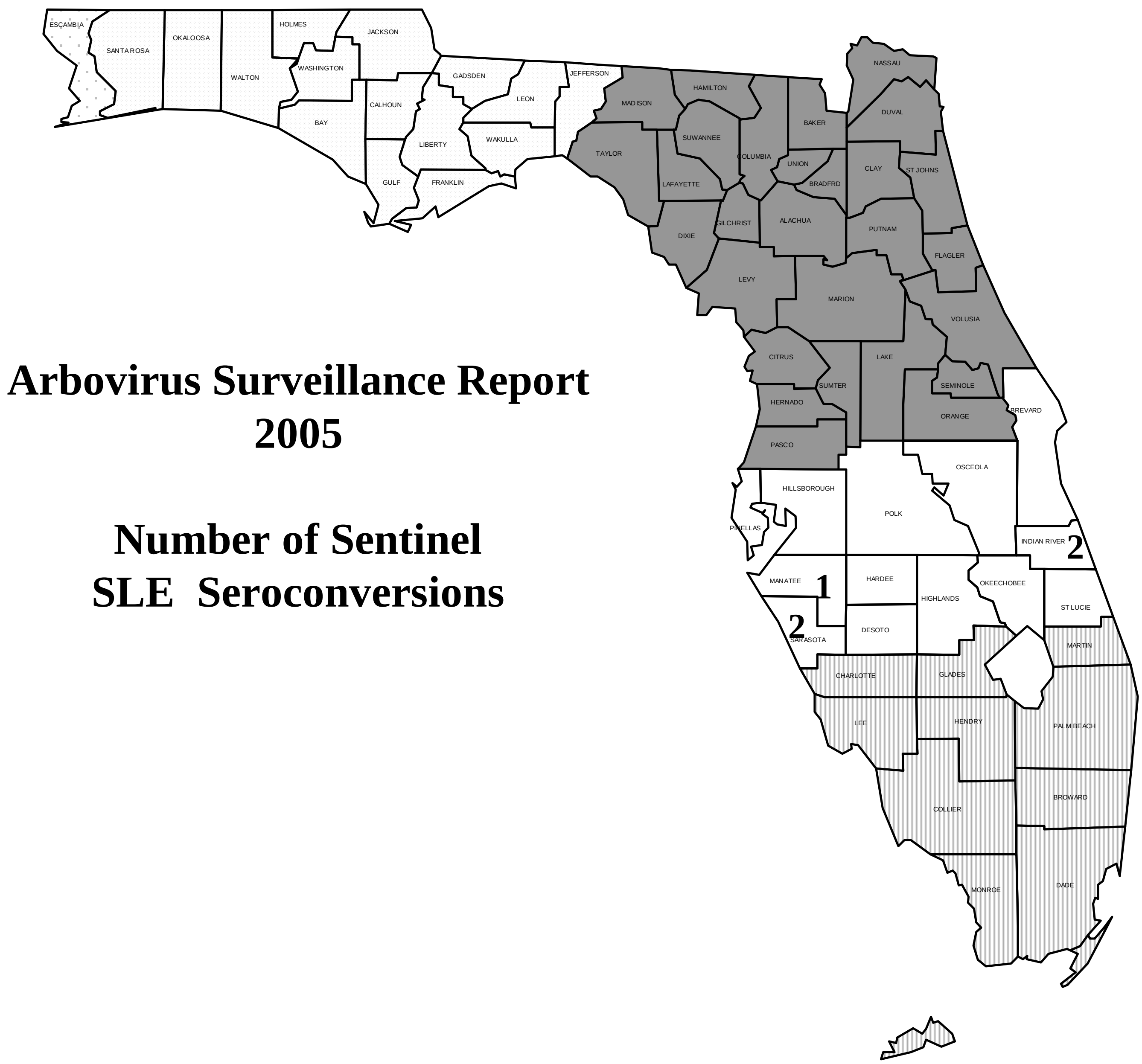


Figure 11. Number of sentinel seroconversions to WN virus by county, 2005

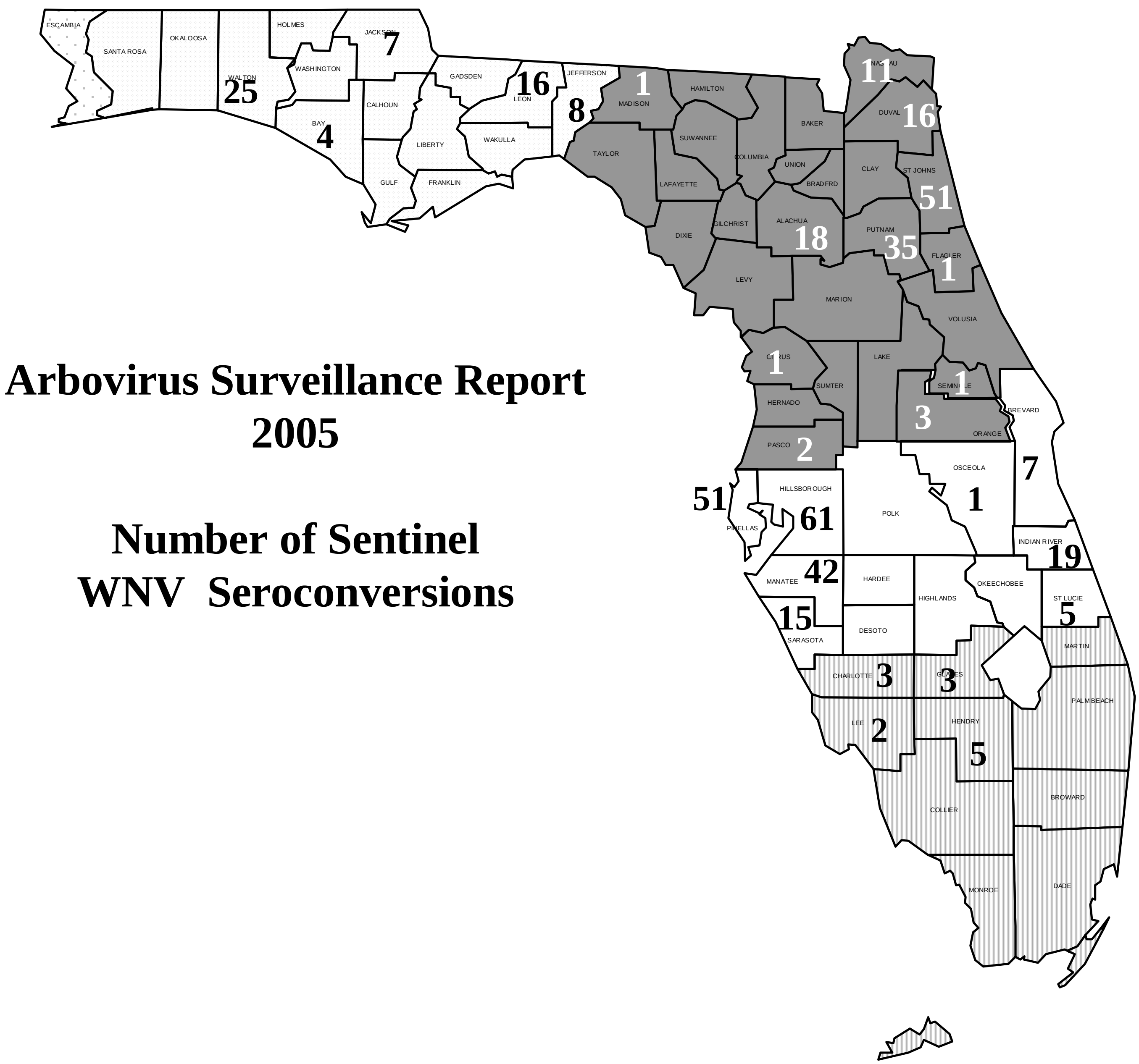


Table 6a. ARBOVIRUS SURVEILLANCE REPORT: Sentinel flock activity by county-

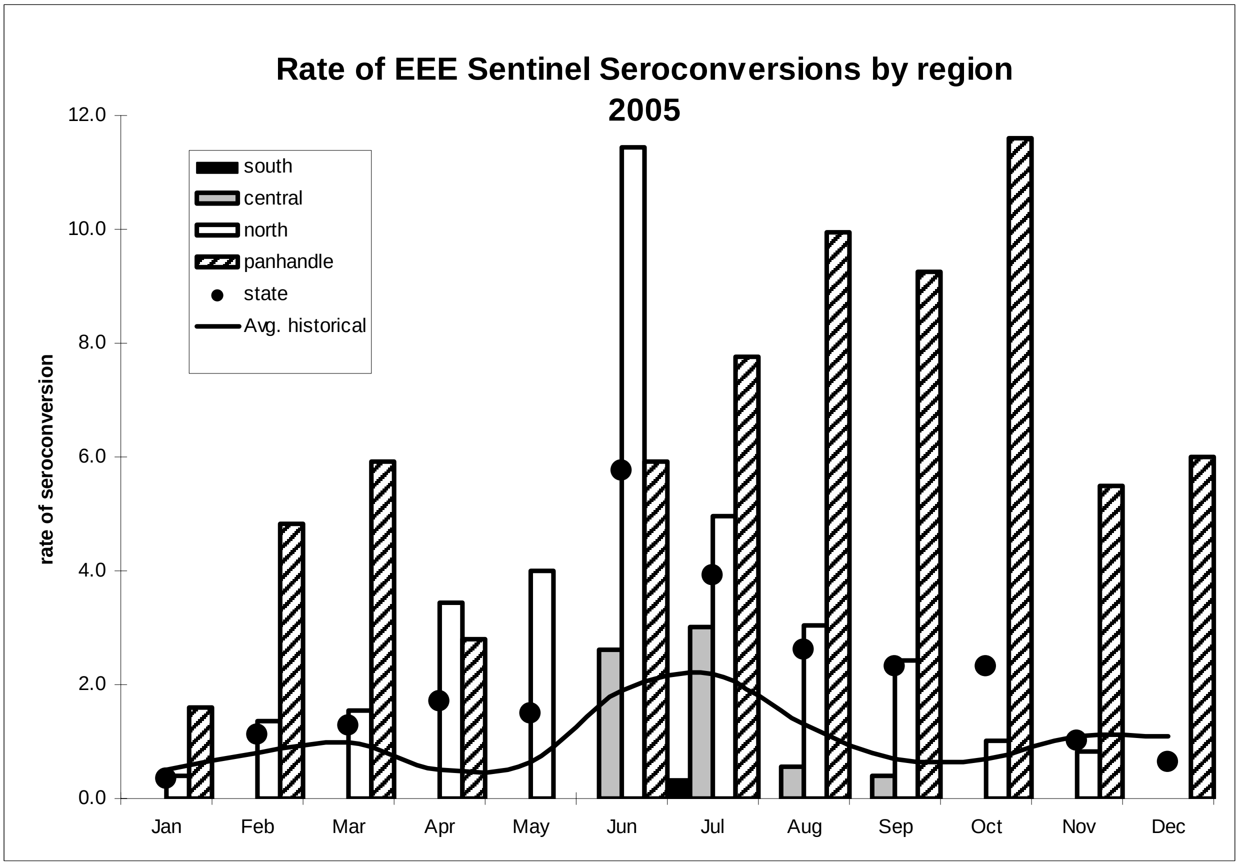
County	# of Sites Monitored	# of Susceptibles Examined	# of Sera from Susceptibles Examined	# of Sentinels Seroconverting				(%) Percent of Sentinels Seroconverting			
				EEE	HJ	SLE	WN	EEE	HJ	SLE	WN
Alachua	7	200	646	47	3	0	18	23.5	1.5	0.0	9.0
Bay	4	44	680	10	6	0	4	22.7	13.6	0.0	9.1
Brevard	11	102	1490	5	0	0	7	4.9	0.0	0.0	6.9
Charlotte	9	34	633	0	0	0	3	0.0	0.0	0.0	8.8
Citrus	6	41	504	1	0	0	1	2.4	0.0	0.0	2.4
Collier	5	86	856	0	0	0	0	0.0	0.0	0.0	0.0
Dade	7	71	663	0	0	0	0	0.0	0.0	0.0	0.0
Duval	6	53	816	5	4	0	16	9.4	7.5	0.0	30.2
Flagler	6	92	656	3	5	0	1	3.3	5.4	0.0	1.1
Glades	1	18	140	0	1	0	5	0.0	5.6	0.0	27.8
Hendry	4	49	316	1	0	0	3	2.0	0.0	0.0	6.1
Hillsborough	13	208	2509	3	0	0	61	1.4	0.0	0.0	29.3
Indian River	8	125	2177	1	1	2	19	0.8	0.8	1.6	15.2
Jackson	4	48	838	2	1	0	7	4.2	2.1	0.0	14.6
Jefferson	2	18	156	1	1	0	8	5.6	5.6	0.0	44.4
Lee	17	198	1577	0	0	0	2	0.0	0.0	0.0	1.0
Leon	6	87	886	20	9	0	16	23.0	10.3	0.0	18.4
Madison	2	17	150	2	1	0	1	11.8	5.9	0.0	5.9
Manatee	15	206	3320	6	0	1	42	2.9	0.0	0.5	20.4
Martin	6	20	557	0	0	0	0	0.0	0.0	0.0	0.0
Nassau	7	100	1004	29	13	0	11	29.0	13.0	0.0	11.0
Orange	19	511	6052	29	12	0	3	5.7	2.3	0.0	0.6
Osceola	9	91	1193	13	7	0	1	14.3	7.7	0.0	1.1
Palm Beach	8	72	2160	0	0	0	0	0.0	0.0	0.0	0.0
Pasco	6	51	1067	1	0	0	2	2.0	0.0	0.0	3.9
Pinellas	9	221	2959	1	0	0	51	0.5	0.0	0.0	23.1
Putnam	8	116	651	22	17	0	35	19.0	14.7	0.0	30.2
Sarasota	11	92	2719	1	0	2	15	1.1	0.0	2.2	16.3
Seminole	4	29	358	1	0	0	1	3.4	0.0	0.0	3.4
St. Johns	12	229	2489	30	9	0	51	13.1	3.9	0.0	22.3
St. Lucie	6	56	1010	0	0	0	5	0.0	0.0	0.0	8.9
Volusia	17	168	2467	12	7	0	0	7.1	4.2	0.0	0.0
Walton	24	348	3836	96	11	0	25	27.6	3.2	0.0	7.2
Totals	279	3801	47535	342	108	5	414				

Table 6b. ARBOVIRUS SURVEILLANCE REPORT: Sentinel flock activity by county

County	Week of Sero Conversion (* Indicates Confirmed)
Alachua	**EEE**: 4/18(2), 5/3(1), 5/24(3), 6/7(2), 6/14(2), 6/13(3), 6/20(3), 6/21(1), 6/27(2), 7/5(1), 7/11(3), 7/18(1), 8/15(3), 8/16(3), 8/29(3), 9/6(2), 9/12(3), 9/20(1), 9/27(1), 10/3(3), 10/18(2), 11/??(2); **HJ**: 6/7(1), 6/14(2); **ALPHA**: 10/10(1) **WN**: 8/22(2), 9/19(1), 9/13(1), 9/26(6,1n), 10/3(3), 10/17(3), 10/24(1);
Bay	**EEE**: 4/5(2), 6/14(1), 6/21(1), 7/5(1), 8/2(1), 8/23(1); 9/6(2), 9/27(1); **HJ**: 3/8(1^n), 6/7(2), 7/26(1), 8/9(1), 8/23(1); **WN**: 6/21(1), 9/13(1), 10/3(1), 10/11(1)
Brevard	**EEE**: 7/7(2), 7/14(3); **WN**: 7/15(1), 9/14(4), 9/22(1), 9/28(1)
Charlotte	**WN**: 10/7(1), 12/2(2)
Citrus	**EEE**: 8/15(1); **WN**: 11/28(1)
Collier	
Dade	
Duval	**EEE**: 5/16(1), 6/6(1), 7/1(1), 7/18(1), 8/29(1); **HJ**: 6/6(2), 7/24(1), 7/25(1); **WN**: 8/8(2), 9/2(1), 9/12(2), 9/15(1), 9/19(1), 9/22(1), 10/6(2), 10/10(3), 10/13(1), 10/25(1), 11/25(1)
Flagler	**EEE**: 5/2(2), 6/13(1); **HJ**: 6/6(2), 7/25(1), 8/1(1), 10/10(1); **WN**: 4/25(1)
Glades	**HJ**: 1/28(1); **WN**: 9/9(2), 11/11(2), 12/9(1)
Hendry	**EEE**: 7/18(1); **WN**: 11/7(2), 11/30(1)
Hillsborough	**EEE**: 7/5(1), 7/12(2); **WN**: 1/11(2), 1/18(1), 4/26(3), 5/31(1), 6/7(1), 7/19(4), 8/2(1), 8/23(6), 8/30(4), 9/6(2), 9/13(6,1^n), 9/20(10), 9/27(1,3^n), 10/4(1), 10/11(3), 10/18(2), 11/1(1), 11/28(2), 12/6(4), 12/13(1), 12/20(1)
Indian River	**EEE**: 6/30(1); **HJ**: 10/20(1); **SLE**: 9/29(1), 10/13(1);**WN**: 6/30(2), 7/6(1), 7/7(1), 7/20(4), 8/18(1), 9/9(1), 9/15(1), 10/6(3), 10/13(2), 10/20(3)
Jackson	**EEE**: 4/4(1^n), 10/18(1); **HJ**: 10/18(1); **WN**: 4/25(1), 9/12(1), 9/27(1), 10/10(1,1^n), 10/17(2)
Jefferson	**EEE**: 6/19(1); **HJ**: 10/30(1); **WN**: 7/24(1), 9/10(1), 10/2(1), 10/9(1), 10/16(1), 10/23(2), 10/30(1)
Lee	**WN**: 7/25(1), 9/27(1)
Leon	**EEE**: 6/24(2), 7/5(2), 7/22(2), 7/29(3), 8/5(4), 8/12(2), 8/19(1), 8/26(1), 9/2(1), 9/23(1), 10/20(1); **HJ**: 6/24(1), 7/5(1), 7/8(2), 7/15(1), 8/5(4); **ALPHA**: 7/8(2); **WN**: 7/29(2), 9/2(3), 9/8(3), 9/16(1), 10/7(1), 10/13(3), 10/20(1), 10/28(2);
Madison	**EEE**: 6/26(1), 7/2(1); **HJ**: 8/7(1); **WN**: 9/10(1)
Manatee	**EEE**: 6/27(2), 7/11(1), 7/18(1), 9/19(2); **SLE**: 8/15(1); **WN**: 8/1(2), 8/15(1), 8/22(1), 9/5(7), 9/12(1), 9/19(1), 9/25(3), 10/2(1), 10/3(2), 10/9(5), 10/10(3), 10/16(2), 10/22(2), 10/30(1), 11/6(5), 11/14(2), 11/18(1), 12/1(1), 12/20(1)
Martin	
Nassau	**EEE**: 5/2(1), 5/16(1), 5/27(1), 6/5(1), 6/13(1), 6/20(3), 6/25(1), 6/26(2), 7/2(1), 7/9(1), 7/10(2), 7/17(5), 7/31(1), 8/8(2), 8/15(1), 8/29(1), 9/12(1), 9/5(1), 9/26(2); **HJ**: 6/5(1), 6/12(1), 6/13(1), 6/20(1) 7/9(1), 7/17(4), 7/24(1), 7/31(1), 8/21(1),

County	Week of Sero Conversion (* Indicates Confirmed)
	8/22(1); WN: 8/22(1), 8/28(1), 9/4(4), 9/11(1), 9/18(4)
Orange	**EEE**: 4/11(1), 4/18(1), 4/28(2), 5/2(1), 5/26(1), 5/31(2), 6/3(1), 6/6(1), 6/13(3), 6/20(1), 6/23(4), 6/27(4), 7/1(1), 7/5(1), 7/6(1), 7/7(2), 7/25(1), 11/3(1); **HJ**: 6/9(3), 6/16(1), 7/8(1), 7/11(1), 7/14(2), 7/18(1), 8/15(1), 8/25(1), 10/17(1); **WN**: 1/21(1), 7/25(1), 10/17(1); **FLAVI**: 11/14(1)
Osceola	**EEE**: 6/14(3), 6/21(3), 6/28(1^{n}), 7/5(3), 8/23(1^{n}), 8/30(2); **HJ**: 6/14(2), 6/28(1), 7/19(1^{n}), 10/26(3); WN: 10/11(1); **ALPHA**: 6/14(1)
Palm Beach	
Pasco	**EEE**: 11/21(1); **WN**: 6/20(1), 8/2(1)
Pinellas	**EEE**: 6/27(1); **WN**: 1/10(1), 2/7(2), 2/15(1), 6/1(1), 6/27(1), 7/5(3), 7/11(7), 7/25(12), 8/1(8), 8/8(4), 8/15(4), 8/22(4), 8/29(1), 9/6(2)
Putnam	**EEE**: 4/15(1), 4/22(1), 4/28(1), 4/29(1), 5/19(1), 5/26(1), 6/2(2), 6/16(1,1^{n}), 6/20(1), 6/23(1), 6/30(1),7/8(3), 7/20(1), 8/5(1^{n}), 9/1(1), 9/29(2), 10/27(1); **HJ**: 4/28(1), 4/29(1), 6/2(2), 6/3(1), 6/20(1), 6/23(1), 6/24(1), 6/30(1), 7/1(2), 7/7(1), 7/14(2), 7/15(1), 7/20(1), 8/25(1); WN: 7/21(1), 8/26(1), 9/2(4), 9/7(1), 9/12(3), 9/15(1), 9/16(2), 9/23(3), 9/29(2), 10/8(2), 10/4(2), 10/14(2), 10/18(2), 10/27(1,2^{n}), 10/28(1), 10/31(2^{n}), 11/3(1,1^{n}), 11/4(1); **ALPHA**: 7/1(1)
Sarasota	**EEE**: 7/25(1); **SLE**: 9/19(2); **WN**: 4/25(2), 9/6(1), 9/12(1), 9/19(1), 10/10(1), 10/25(3), 11/7(5), 11/28(1)
Seminole	**EEE**: 6/17(1); **WN**: 9/23(1)
St. Johns	**EEE**: 1/10(1), 2/14(1), 2/21(2), 3/21(2), 4/4(2), 4/25(2), 5/9(1), 5/16(1), 5/23(2), 5/24(1), 5/31(1), 6/6(3), 6/13(3), 6/20(3), 6/27(3), 7/5(1), 7/11(1); **HJ**: 6/27(1), 2/7(1), 4/4(1), 5/2(1), 7/5(1), 7/18(1), 7/25(2), 8/8(1); **WN**: 8/15(2), 8/22(1), 8/29(1), 9/6(6), 9/12(5), 9/19(8), 9/26(2), 10/3(4), 10/10(4), 10/17(3), 10/24(1), 10/25(2), 10/28(4^{n}), 10/31(2), 11/7(3), 11/14(1), 11/21(2); **FLAVI**: 10/28(1); **ALPHA**: 6/27(1), 10/17(1)
St. Lucie	**WN**: 7/28(1), 8/4(1), 9/2(2), 10/14(1)
Volusia	**EEE**: 3/21(1), 3/28(1), 4/25(2), 5/9(1), 5/16(1), 5/23(1), 6/6(1), 6/13(2), 6/21(1), 6/27(1); **HJ**: 6/6(1), 6/13(2), 6/27(1), 7/18(1), 8/1(1), 12/5(1)
Walton	**EEE**: 1/10(1), 1/31(1), 2/7(1^{n}), 2/14(1^{n}), 2/16(4), 3/7(5), 3/8(1), 3/28(1), 4/21(2), 6/24(1), 6/25(2), 6/28(4), 7/6(3), 7/25(2), 7/29(1,2^{n}), 8/1(1), 8/3(2), 8/5(4), 8/22(2), 8/25(1,1^{n}), 9/6(3n), 9/7(2), 9/9(1), 9/22(1), 9/27(3), 9/29(3), 9/30(2), 10/3(1), 10/11(6), 10/13(2), 10/17(1), 10/18(2,1^{n}), 10/19(3), 10/20(1), 10/25(1^{n}), 10/28(3), 10/31(1), 11/3(3), 11/8(1), 11/10(3), 11/15(1), 11/29(1), 12/1(2^{n}), 12/2(3), 12/9(1), 12/14(1) ; **HJ**: 1/24(1), 4/4(1), 6/28(1), 7/2691), 8/2(1), 8/8(1), 8/15(1), 9/6(2), 10/18(1^{n}), 10/28(1); **WN**: 1/5(1), 1/6(2), 1/24(1^{n}), 1/31(2,1^{n}), 3/7(1), 4/15(1), 4/25(1), 5/16(1), 5/18(2), 5/20(1), 6/3(1^{n}), 7/6(1), 7/25(1), 7/29(1^{n}), 8/1(1), 8/17(1), 9/12(1), 9/25(2^{n}), 9/26(1^{n}), 12/13(1); **FLAVI**: 1/20(1), 5/20(1)

Figure 12. Rate of sentinel seroconversions to EEE virus by region by month, 2005 and 2004. "State" is the statewide rate for that month for 2005; "Avg. historical" is the average statewide rate from 1990 through 2005. Rate = number of seroconversions to EEE in a region divided by the number of susceptible birds exposed during the month in the region, expressed as %.



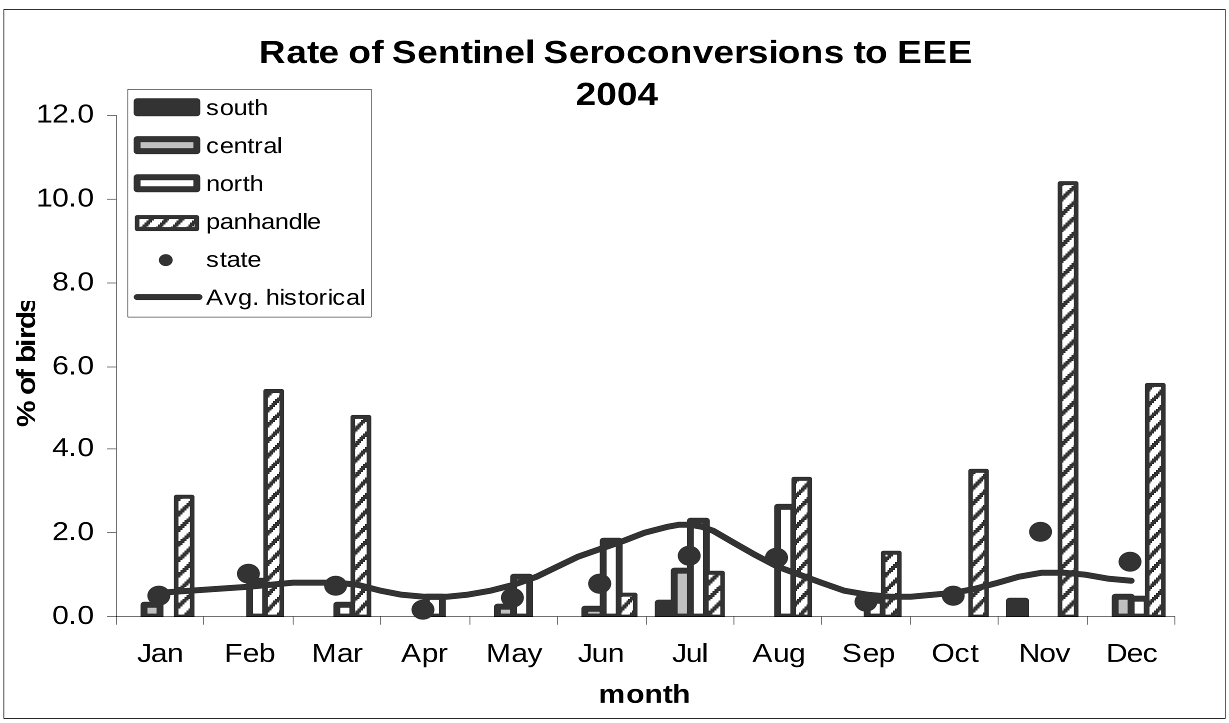


Figure 13. Rate of sentinel seroconversions to HJ virus by region by month, 2005. (2004 data not available)
”State” is the statewide rate for that month for 2005; “Avg. historical” is the average statewide rate from 1990 through 2005. Rate = number of seroconversions to EEE in a region divided by the number of susceptible birds exposed during the month in the region, expressed as %.

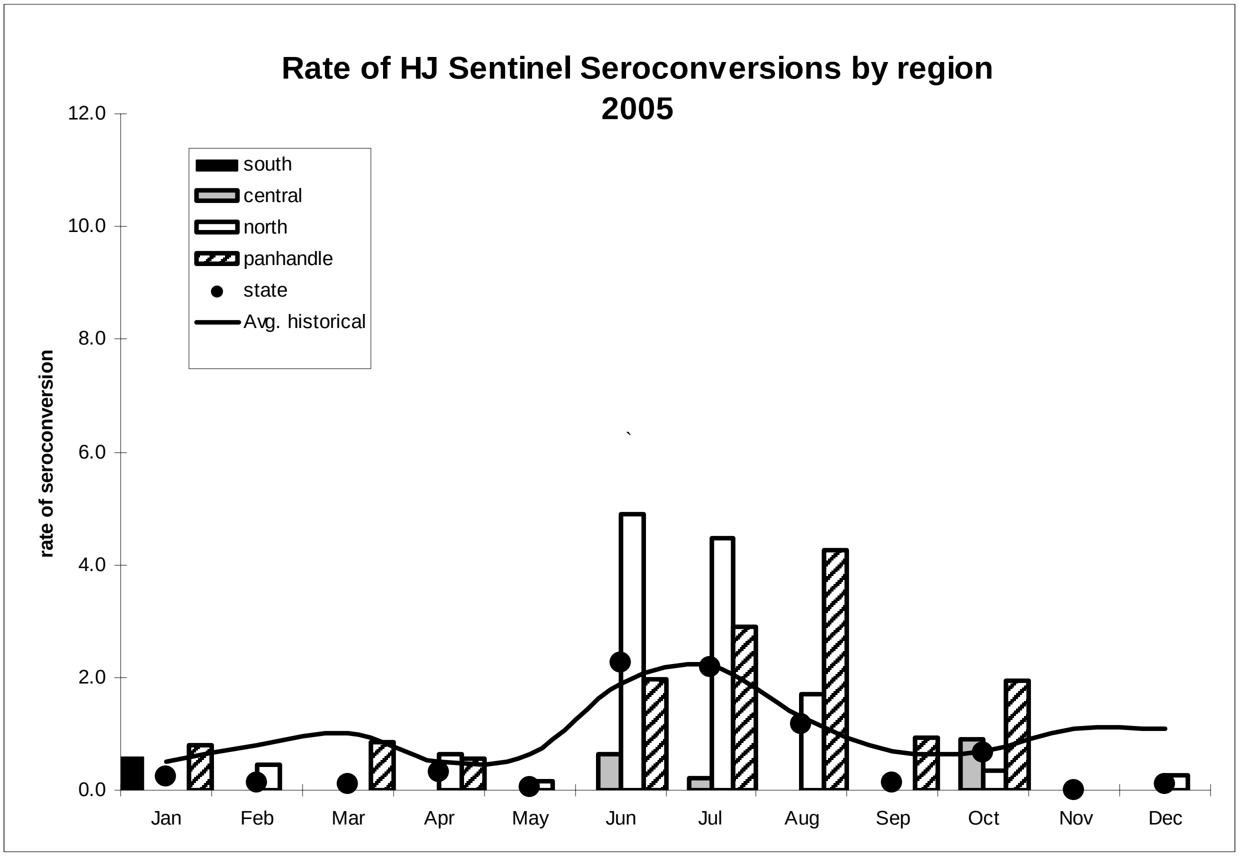
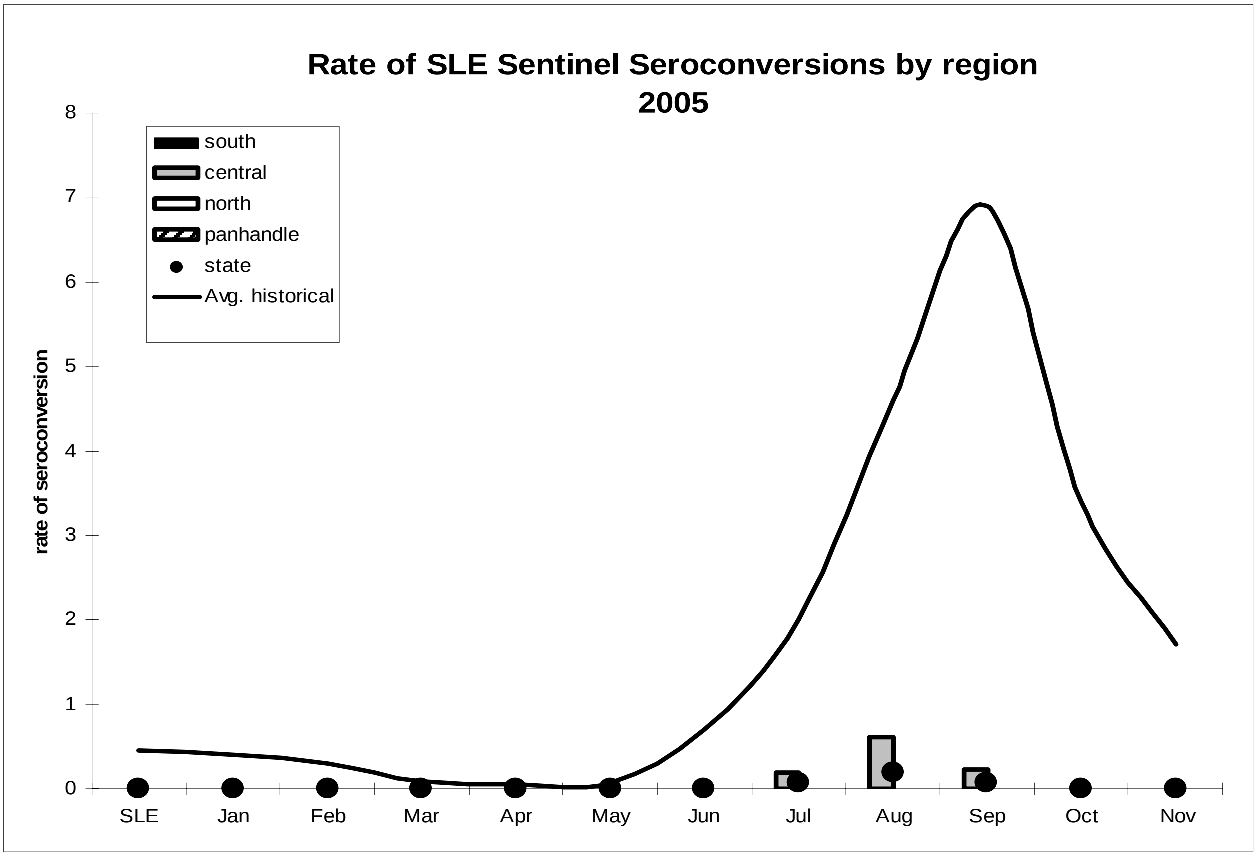


Figure 14. Rate of sentinel seroconversions to SLE virus by region by month, 2005 and 2004. ”State” is the statewide rate for that month for 2004; “Avg. historical” is the average statewide rate from 1990 through 2005. Rate = number of seroconversions to SLEE in a region divided by the number of susceptible birds exposed during the month in the region, expressed as %.



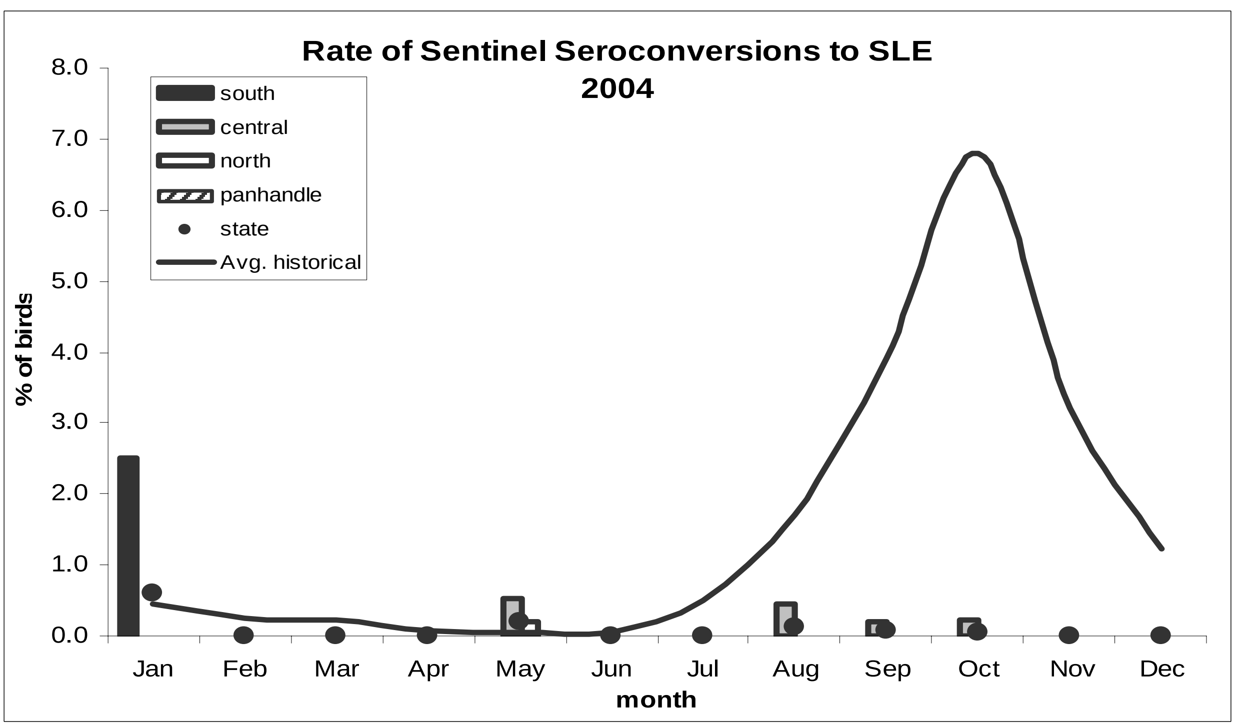


Figure 15. Rate of sentinel seroconversions to WN virus by region by month, 2005 and 2004. ”State” is the statewide rate for that month for 2005; “Avg. historical” is the average statewide rate from 1990 through 2005. Rate = number of seroconversions to WN in a region divided by the number of susceptible birds exposed during the month in the region, expressed as %.