

# **Mosquito Control Report 2014**

**On the Ni-les 'tun unit of the USFWS Bandon Marsh**

**Prepared Coos County Public Health**

**Narrative Rick Hallmark and Nikki Harris**

**December 2014**

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## **Appendices**

## **INTRODUCTION**

When the United States Fish and Wildlife Service (USFWS) created the Ni-les 'tun unit of the Bandon Marsh the goal was to re-establish marsh habitat by providing tidal influence to areas previously provided with tide gates and drained. This effort also caused a population explosion of the *Aedes dorsalis* mosquito. The *Aedes dorsalis* from the marsh negatively impacted the human population in the region. This report reviews work performed by Coos County Public Health as authorized by 2014 Special Use Permits (SUP) issued by USFWS to prevent large fly offs of *Aedes dorsalis* from the marsh and fills the SUP requirement to provide a report of activities under the permit.

Leading into spring 2014 and the mosquito treatment season USFWS and Coos County Public Health (CCPH) met several times to ensure coordination and a discussion on November 17, 2014 marked the conclusion of the year's effort and provided a focus for the 2015 season.

The narrative of this report covers the focus of the 2014 work on the Bandon Marsh including:

- Monitoring the *Aedes dorsalis* mosquito larvae;
- Larvicide Treatment;
- Post treatment monitoring and follow-up;
- Testing mosquitoes for pathogens; and
- Adult mosquito trapping.

The crux of the SUP centered on larvae monitoring and timely treatment. Coos County awarded Vector Disease Control International (VDCI) a contract to apply pesticide as necessary on the Bandon Marsh. USFWS, CCPH and VDCI each had positive motive to be involved in the monitoring effort. The dynamics of these motives helped lead to cooperation among the parties. Cooperation and communication could not have been expected to be better.

## **MONITORING**

The 300 acres of interest in the Ni-les 'tun unit was divided into 6 areas with transects for monitoring purposes (See Appendix 1, Map 2). This division was carried forward by USFWS from previous work. Ponds with capacity to produce *Aedes dorsalis* adults were identified, marked via GPS and flagged. Anticipating treatment field monitoring detailed larva count records for each flagged site as visited. A colored flagging system was used to provide a visual marker for each site with colors distinguishing a monitoring site, a site in need of treatment, a site treated, etc...

Initial monitoring was labor intensive and at times including one staff from CCPH, two staff from VDCI and three staff from USFWS. Coordinating with the refuge manager for approval to perform work on site, including larvicide application, became natural as refuge staff was integral to monitoring and sharing of data. When trenching and manipulation of drainage on the marsh commenced in July mosquito habitat was quickly reduced though some monitoring continued in drained areas. Treatments based on high tides were predictable. At times when USFWS performed limited monitoring it remained customary for an end of day briefing to take place between CCPH personnel and refuge leadership - particularly when a high tide made treatment imminent.

According to the Coos County Mosquito Management Plan treatment was based on a minimum threshold of 1 larva per 10 dips. The table in Appendix 2 was prepared by VDCI and summarizes their monitoring count of larvae in the areas to be treated showing consistency with the Coos County Mosquito Management Plan.

## **LARVICIDE APPLICATION**

There was on-going intent to provide transparency in all field work performed by CCPH or VDCI and USFWS maintained the role to observe field work performed. As contracted to do so by Coos County pesticide applications on the Bandon Marsh in 2014 were performed by VDCI.

On May 3, 2014 the first treatment for the calendar year 2014 was applied. To prevent a fly off the first treatment should have been applied at a time corresponding with the high tide near the last of April, but the federal regulatory process was not completed early enough to allow the late April treatment. This resulted in a mosquito fly off into May.

This document does not show the necessary work USFWS performed to make a partnership feasible with Coos County to provide mosquito treatment. As a precursor to treatment noteworthy points Coos County was responsible to address included:

- 5/2/14 the Oregon Health Authority approved the Coos County Pesticide Use Plan (PUP).
- 5/1/14 CCPH confirmed with the Oregon Department of Agriculture that VDCI was appropriately licensed and permitted to apply pesticide in the state of Oregon.
- 4/28/14 USFWS accepts the CCPH/VDCI joint Mosquito Management Plan.
- 4/24/14 the Oregon Department of Fish & Wildlife approved the Coos County Pesticide Use Plan (PUP).
- 3/26/14 the United States Fish and Wildlife Service issued a Special Use Permit (SUP) to Coos County for mosquito work on the Bandon Marsh (on May 1, 2014 this was superseded by another SUP).
- 3/25/14 Coos County awards a contract to Vector Disease Control International to apply pesticide and associated work on the Bandon Marsh for the 2014 mosquito season.
- 9/10/13 the Oregon Department of Environmental Quality issued a National Pollutant Discharge Elimination System (NPDES) permit to Coos County.

*Bacillus thuringiensis israelensis* (Bti) was the pesticide of choice on the Bandon Marsh. Vectobac G was the only trade name for Bti used for the season. The bulk of Bti treatment was labor intensive often requiring an applicator/technician to carry 40

pounds of product applied via gas powered back pack sprayer. On occasion five VDCI employees would be working to assure timely application of Bti in order to prevent a mosquito fly off.

Individual treatment dates of Bti are noted in Appendix 2. Treatment corresponded with high tides wetting depressions where *A. dorsalis* eggs waited for conditions and standing water to hatch.

The large coverage areas coming from anticipated high tides 6/15 and 7/11 plus weather likely conducive to larva maturation prompted requests of the refuge manager to allow aerial applications to assure effective and timely larvicide application. Aerial application of Bti was applied by fixed wing air craft on 6/15/2014 and again on 7/15/2014 (approved by the refuge manager on 6/10 and 7/1/2014 respectively).

Amphibious equipment was NOT used to apply Bti, but often through the season USFWS staff used an Argo to transport Bti. This increased efficiency of pesticide application (while also maintained the control of vehicular traffic on the marsh). This was particularly helpful for applicators working in the lower areas of the marsh or when there was need to apply Bti over larger tracts.

## **FOLLOW-UP MONITORING**

Within two hours after a Bti application there were signs whether treatment in a given pond was satisfactory. In general applications were effective, but follow up monitoring always occurred. As needed VDCI would immediately provide needed treatment or monitoring sites' flags were changed to indicate areas in need of treatment by an applicator.

The 7/15 aerial treatment of Bti was the exception to effective treatment. Results were sporadic across the subject area. It was requisite for each pond to be evaluated for need to treat and within a few hours of the aerial application point specific hand application had started, but in this case did not prevent a mosquito fly off. It appears that poor airplane flying conditions had delayed the aerial treatment long enough to allow instar to develop beyond the point where back pack application could be administered fast enough with the available staff to be effective.

## **ADULT MOSQUITO TRAPPING**

A new SUP was issued to CCPH on May 1, 2014 providing for the loan of sixteen Mosquito Magnets [traps] to private residents in the vicinity of the marsh through the season. These traps were used to eradicate adult mosquitoes. Mosquitoes caught in these traps were not analyzed in any fashion.

The City of Bandon partnered to effectively administer the loan of traps. Limited trap maintenance was provided by Coos County staff. Along with a trap USFWS provided a full propane tank and another propane tank refill.

Other mosquito trapping included the use of CDC light traps. Though the intensity of larva monitoring made it the best objective means to determine effectiveness of mosquito control on the marsh, the nearly weekly basis that CDC light traps were employed gave indication of adult *Aedes dorsalis* population and distribution (See Appendix 3). Under ideal trapping conditions trapping data might indicate the mosquito density that people in the same vicinity were dealing with. Adult *Aedes dorsalis* mobility did not allow pinpoint correlation between where a mosquito had matured from larva to where an adult mosquito was trapped.

Some generalizations of trapping data:

- Any storm with wind or precipitation reduced mosquito activity and lowered trapping counts.
- Considering the six adult trapping sites, the greater the distance from the east end of the marsh trap site the lower the count of *A. dorsalis* (See Appendix 1).
- The Prosper and East End of the Bandon Marsh Trap sites were nearest private properties subject to tidal influenced where Bti treatment was not provided and as such:
  - *A. dorsalis* were always found trapped and
  - Always had more *A. dorsalis* trapped than elsewhere

On rare occasion, a CDC light trap would be set elsewhere in or near residential areas when there seemed to be an unusual occurrence of mosquitoes. Such a trap set took place only as allowed by available resources in response to calls from community members. There was no intent or plan for follow up trapping for such sites.



## **PATHOGEN DIAGNOSTICS**

A single batch of *Aedes dorsalis* mosquitoes collected near the end of August was submitted to the Oregon State University Veterinary Diagnostic Laboratory to test for St Louis Encephalitis, Eastern Equine Encephalitis and West Nile Virus. No indication of the pathogens was found in the batch (See Appendix 4).

Although the SUP provided the option for testing mosquitoes for pathogens, funding for this work was not identified until a time when it was difficult to find enough subject mosquitoes at customary trapping sites to allow testing. Opportunities on the marsh were missed to test *A. dorsalis* when fly offs occurred early in May and again in mid-July. Counts of other species found in CDC light traps were also only high enough in the early season to allow testing.

Funding for diagnostic lab costs was provided by the Oregon Health Authority, Public Health Division, Acute and Communicable Disease Prevention Section as administered by Dr. Emilio DeBess.

## **MOVING FORWARD**

1. Missed applications of Bti resulted in adult fly offs from the Bandon Marsh. The same mistakes can be prevented in 2015.
2. CCPH will goal to complete all necessary permitting by April 1, 2015 to allow pesticide treatment in the event of early warm weather
3. Applied correctly Bti is an effective larvicide as shown by larva monitoring and 2014 adult trapping data compared to limited adult trapping data from 2013. Bti will presumably continue as the larvicide of choice.
4. The choice of aerial application over manual spreading of Bti should consider the cost of procrastination in the event of delay of aerial application due to weather.
5. There is *Aedes dorsalis* habitat on private property very near to the Bandon Marsh producing adult mosquitoes. Without treatment the ongoing presence of *Aedes dorsalis* is expected.
6. *Aedes dorsalis* habitat was reduced on the Ni-les 'tun unit by improving drainage. Monitoring drained areas will be further considered to assure engineered drainage working against natural process does not cause unexpected *A. dorsalis* habitat.
7. The high tide cycles (wet-dry-wet) connected to all *A. dorsalis* hatches and Bti applications on the marsh, but there should be an expectation that a hatch cycle might be altered or quickened by unpredictable precipitation.
8. CCPH will seek to take advantage of opportunities to test mosquitoes for pathogens.
9. Apart from the mosquito fly offs in early May and late July the *Aedes dorsalis* problems appeared to stay localized, but CCPH will stay aware of comments of concern from the public and partnering agencies.
10. A competent consultant and contractor to apply pesticide like VDCI will continue to be paramount for CCPH in mosquito management on the marsh.
11. In general CCPH and the USFWS effectively pooled resources to prevent adult mosquito fly off from the marsh. Clear communication of needs and expectations served as the foundation of success and will be essential in the future.

## APPENDICES

### Appendix 1

#### Maps

Map 1 Adult Trapping Sites

Map 2 *Aedes dorsalis* Larva Habitat

### Appendix 2

Table of Bti treatments

### Appendix 3

Adult Mosquito Trap Data and Comparison Charts

### Appendix 4

Mosquito Pathogen Lab Results

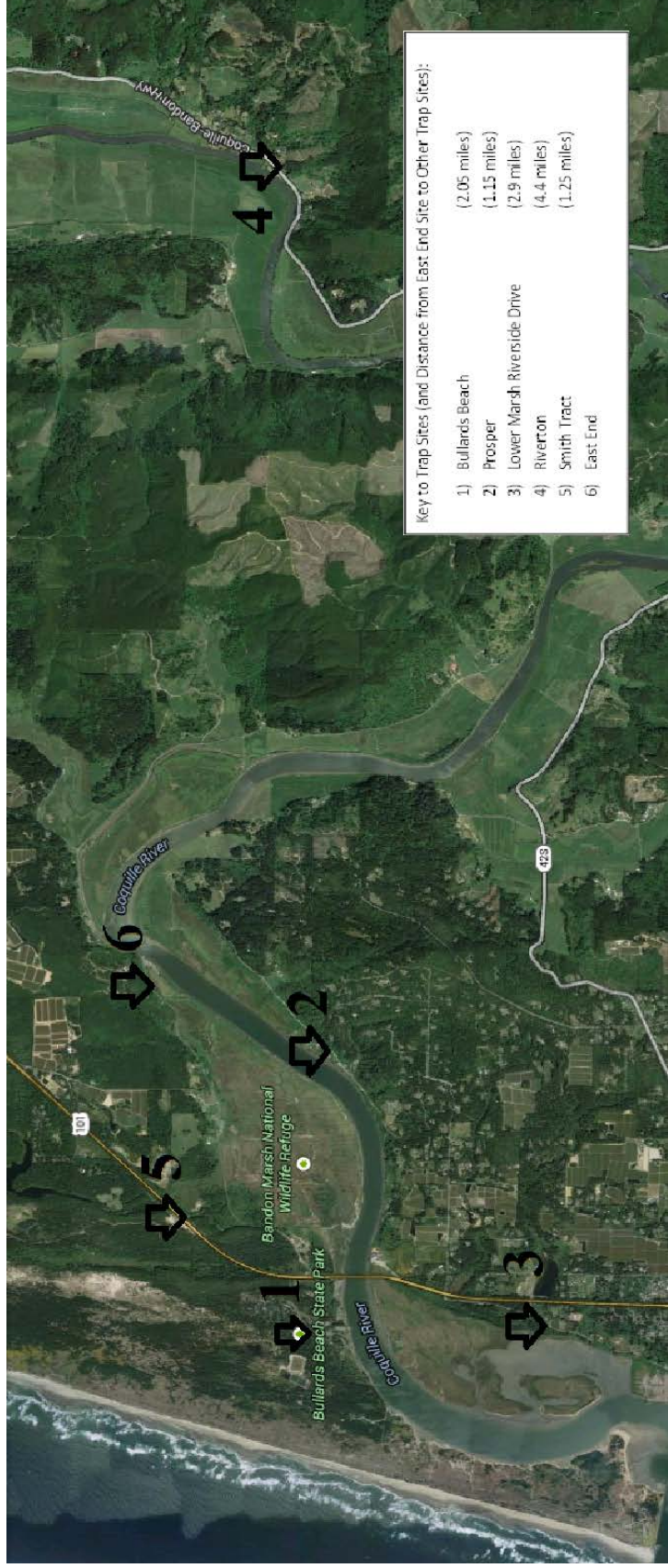
## **Appendix 1**

**Map 1 Adult Trapping Sites**

**Map 2 *Aedes dorsalis* Larva Habitat**

# Map 1

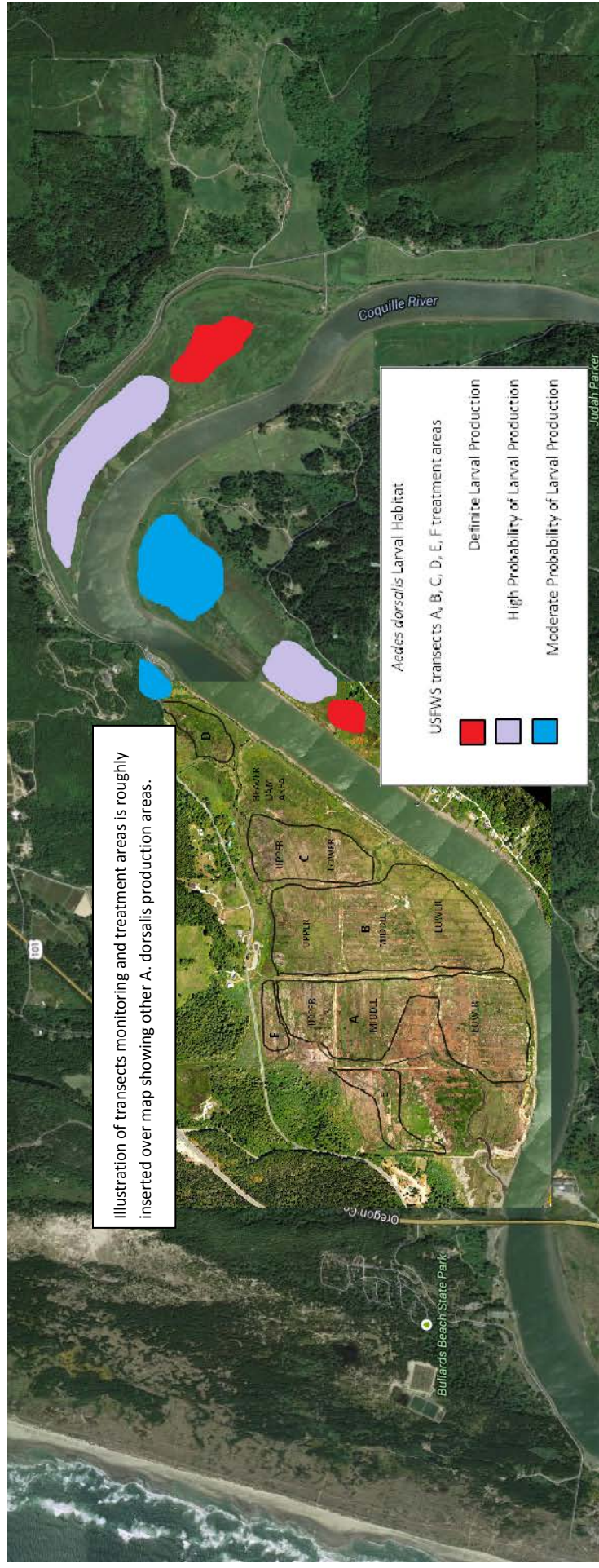
## Adult Trapping Sites in Proximity to the Bandon Marsh





## Map 2

# USFWS Transects Receiving Larvicide Treatment Other Vicinity Properties with Likelihood of Producing *A. dorsalis* Larva



## **Appendix 2**

### **Table of Bti Treatments**



High Tide Trigger Date	High Tide level	Treatment Event Count	Date of Treatment Event	Quantity (OZ) of Larvicide Used	Area Treated (sq ft)	Transect treated	Range of Larvae in each transect/dip count	Trade Name of Bti Used	EPA Reg. #
4/28/2014	7.7								
5/1/2014	7.4	1	5/3/2014	112	43,560	B	1-10	Vectobac G	73049-10
		2	5/3/2014	256	99,565.71	A and F	1-10	Vectobac G	73049-10
		3	5/3/2014	672	261,360	B	1-10	Vectobac G	73049-10
		4	5/4/2014	928	360,925.71	B	1-10	Vectobac G	73049-10
		5	5/4/2014	864	336,034.28	C	1-10	Vectobac G	73049-10
		6	5/5/2014	480	186,685.71	A	1-10	Vectobac G	73049-10
		7	5/5/2014	448	174,240	E	1-10	Vectobac G	73049-10
		8	5/5/2014	1,392	378,972	C	11-50	Vectobac G	73049-10
		9	5/5/2014	448	174,240	D	1-10	Vectobac G	73049-10
		10	5/6/2014	224	87,120	D	11-50	Vectobac G	73049-10

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High Tide Trigger Date	High Tide level	Treatment Event Count	Date of Treatment Event	Quantity (OZ) of Larvicide Used	Area Treated (sq ft)	Transect treated	Range of Larvae in each transect/dip count	Trade Name of Bti Used	EPA Reg. #
5/13/2014	7.4	11	5/13/2014	1,040	404,485.71	C	1-10	Vectobac G	73049-10
		12	5/17/2014	5,760	1,960,200	C and Low B	11-50	Vectobac G	73049-10
		13	5/18/2014	5,120	1,742,400	A and Low B	>50	Vectobac G	73049-10
		14	5/19/2014	5,120	1,742,400	B and F	1-10	Vectobac G	73049-10
		15	5/20/2014	960	326,700	D and E	11-50	Vectobac G	73049-10
5/27/2014	7.5	16	5/28/2014	5,920	2,302,457.14	B and C	1-10	Vectobac G	73049-10
		17	5/29/2014	1,920	746,742.85	A, D and E	1-10	Vectobac G	73049-10
6/15/2014	7.8	18	6/15/2014	3,200.00	1,244,571.42	B,D and E	>50	Vectobac G	73049-10
		19	6/15/2014	23,680.00	8,058,600.00	A, B and C	>50	Vectobac G	73049-10

		20	6/16/2014	3,200	871,200	A, C, D and F	>50	Vectobac G	73049-10
		21	6/17/2014	1,280	348,480	A and C	>50	Vectobac G	73049-10
		22	6/18/2014	1,280	348,480	A, B and C	11-50	Vectobac G	73049-10
High Tide Trigger Date	High Tide level	Treatment Event Count	Date of Treatment Event	Quantity (OZ) of Larvicide Used	Area Treated (sq ft)	Transect treated	Range of Larvae ea... transect/dip count	Trade Name	FPA #
6/25/2014	7.2	24	6/26/2014	2,560	696,960	A, F, and B	1-10	Vectobac G	73049-10
		25	6/27/2014	7,040	1,916,640	A and B	1-10	Vectobac G	73049-10
		26	6/28/2014	10,880	2,962,080	A, B, C, D and E	1-10	Vectobac G	73049-10
		27	6/29/2014	1,600	435,600	A, F and E	1-10	Vectobac G	73049-10
7/11/2014	7.9	29	7/12/2014	1,600	435,600	C	1-10	Vectobac G	73049-10
		30	7/13/2014	1,280	348,480	E	1-10	Vectobac G	73049-10
		31	7/13/2014	2,560	696,960	D	1-10	Vectobac G	73049-10
		32	7/14/2014	3,680	1,001,880	B	1-10	Vectobac G	73049-10
		33	7/14/2014	2,560	696,960	D and F	1-10	Vectobac G	73049-10
		34	7/15/2014	27,520	7,492,320	A, B and C	1-10	Vectobac G	73049-10
		35	7/16/2014	1,600	435,600	A, B, C, D and E	1-10	Vectobac G	73049-10

7/25/2014	6.9	36	7/26/2014	4,160	1,617,942.84	A, B, C, and E	1-10	Vectobac G	73049-10
		37	7/26/2014	480	186,985.71	D	1-10	Vectobac G	73049-10
		38	7/27/2014	320	124,457.14	A and B	1-10	Vectobac G	73049-10
High Tide Trigger Date	High Tide level	Treatment Event Count	Date of Treatment Event	Quantity (OZ) of Larvicide Used	Area Treated (sq ft)	Transect treated	Range of La Continued on next page each transect/dip count	Trade Name	#
8/10/2014	7.9	39	8/11/2014	2,560	995,657.14	D and E	1-10	Vectobac G	73049-10
		40	8/12/2014	6,400	2,489,142.85	A, B and C	1-10	Vectobac G	73049-10
		41	8/13/2014	2,880	784,080	A, B and F	1-10	Vectobac G	73049-10
		42	8/14/2014	2,080	377,520	A and C	1-10	Vectobac G	73049-10
8/24/2014	6.6	43	8/25/2014	400	155,571.42	D and E	1-10	Vectobac G	73049-10
		44	8/26/2014	160	43,560	C	1-10	Vectobac G	73049-10
		45	8/27/2014	112	43,560	B	1-10	Vectobac G	73049-10
9/10/2014  Final Tx	7.7	46	9/10/2014	512	199,131.42	E	1-10	Vectobac G	73049-10
		47	9/12/2014	2,896	1,126,337.14	A, B, C, D, E and F	1-10	Vectobac G	73049-10
		48	9/8/2014	112	43,260	C and D	1-10	Vectobac G	73049-10

## **Appendix 3**

### **Adult Mosquito Trap Data and Comparison Charts**

Number of adult female mosquitoes captured per trap site and the percent of *Aedes dorsalis* per event in 2014

## 2014

	Bullards Beach	Prosper	Bandon Marsh Deck	Lower Marsh Riverside	Riverton	Bandon Marsh Smith Tract	Bandon Marsh East End
4/29	5	10	0				
	0%	0%	0%				
5/6	6	2	1				
	33%	50%	0%				
5/14	14	61	49	33	0	46	169
	50%	98%	100%	85%	56%	93%	95%
5/22	52	40	6	4	0	16	172
	15%	80%	33%	25%	33%	69%	94%
5/28	21	16	4	2	0	10	56
	19%	81%	25%	100%	26%	90%	89%
6/7	5	11	0	1	0	3	8
	0%	54%	0%	0%	0%	66%	62%
6/13	5	8	1	0	29	18	9
	20%	50%	0%	0%	0%	44%	44%
6/19	15	13	3	3	5	2	63
	0%	0%	100%	0%	0%	50%	97%
6/26	2	26	1	0	13	10	16
	100%	88%	100%	0%	0%	30%	31%
7/3	0	128	19	2	17	18	264
	0%	95%	84%	0%	0%	67%	94%
7/18	26	47	47	2	4	19	33
	58%	89%	94%	0%	50%	79%	88%
7/24	2	13	37	3	2	3	78
	50%	46%	97%	100%	0%	67%	90%

7/30	22	9	20	3	1	15	31
	86%	100%	100%	0%	0%	73%	98%
8/7	7	53	62	1	3	20	122
	86%	98%	98%	0%	0%	60%	95%
8/14	1	4	14	0	5	6	18
	0%	100%	93%	0%	0%	67%	94%
8/20	2	4	0	2	1	4	13
	50%	100%	0%	100%	0%	25%	100%
8/29	16	107	12	8	1	10	46
	100%	100%	100%	87%	0%	90%	96%
9/4	9	11	3	5	1	7	30
	100%	91%	100%	80%	0%	100%	100%

continued on next page

## 2014

	Bullards Beach	Prosper	Bandon Marsh Deck	Lower Marsh Riverside	Riverton	Bandon Marsh Smith Tract	Bandon Marsh East End
9/12	4	4	8	1	4	3	12
	100%	100%	100%	100%	0%	67%	100%
9/19	1	1	1	0	1	0	4
	0%	0%	100%	0%	0%	0%	75%
9/25	1	10	6	1	0	5	28
	100%	100%	100%	100%	0%	100%	100%
10/2	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%
10/9	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%
10/17	1	0	2	0	0	2	16
	0%	0%	100%	0%	0%	0%	69%
10/22	0	0	0	0	0	2	3
	0%	0%	0%	0%	0%	50%	100%

Number of adult female mosquitoes captured per trap site and the percent of *Aedes dorsalis* for some sites 2013

## 2013

			Bandon Marsh Deck	Lower Marsh Riverside		Bandon Marsh Smith	
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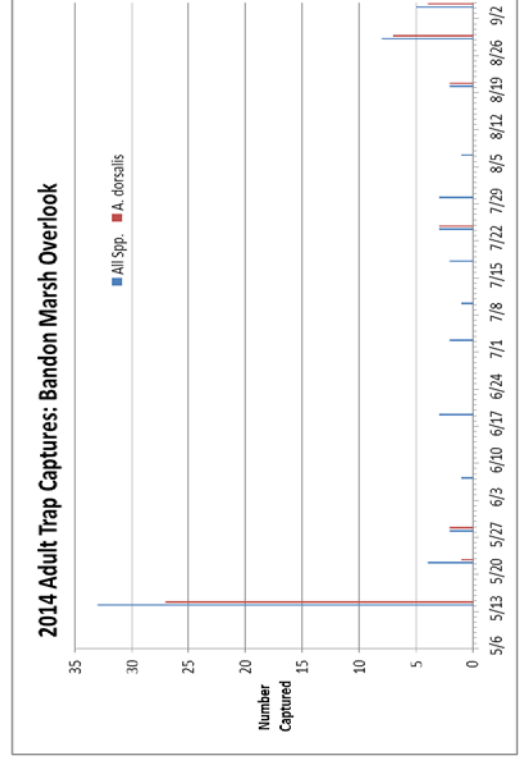
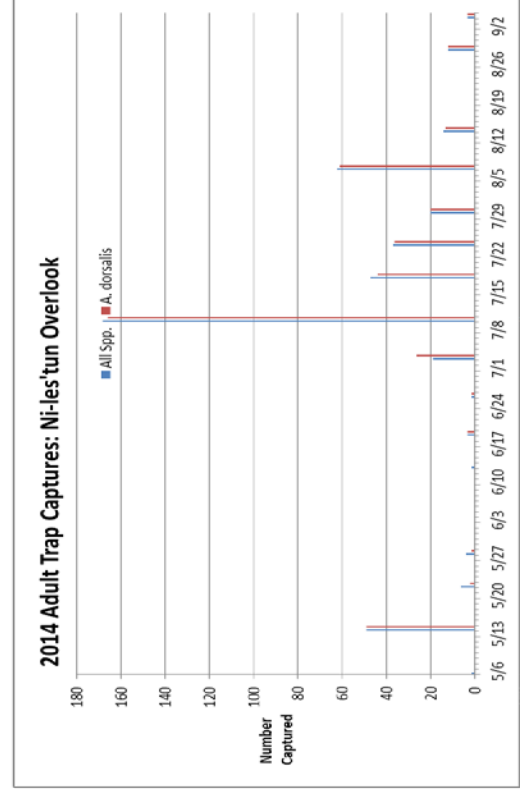
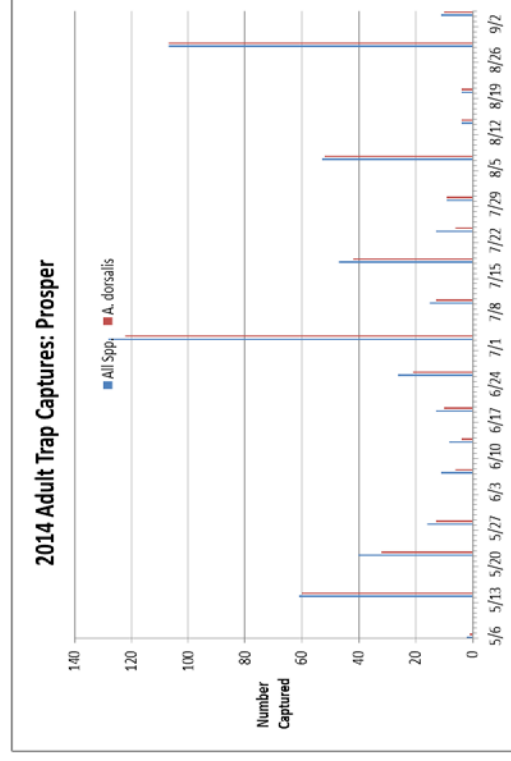
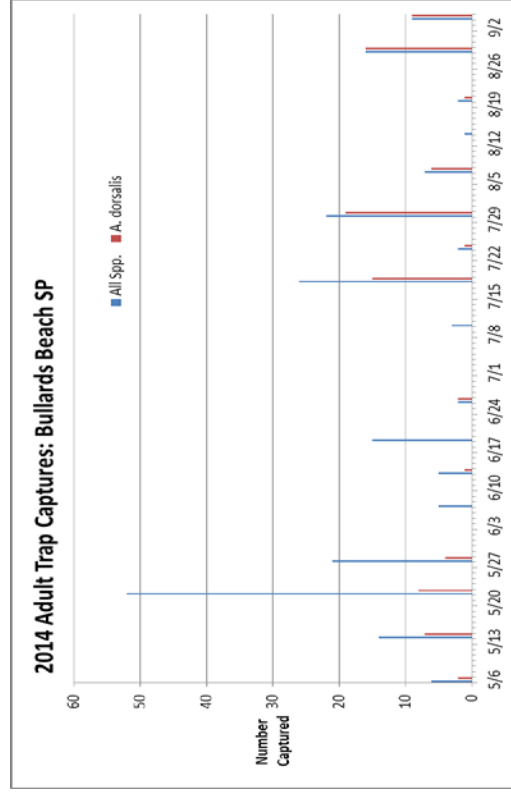
						Tract	
7/12			715	9		241	
			not known	not known		not known	
7/26			193	6		189	
			85%	50%		84%	
8/9			2300	216		4907	
			86%	not known		63%	
8/22			1600	11		227	
			59%	36%		66%	
9/6			339	69		800	
			89%	not known		86%	

Some *A. dorsalis* percentages in 2013 were extrapolated from a representative mosquito count.

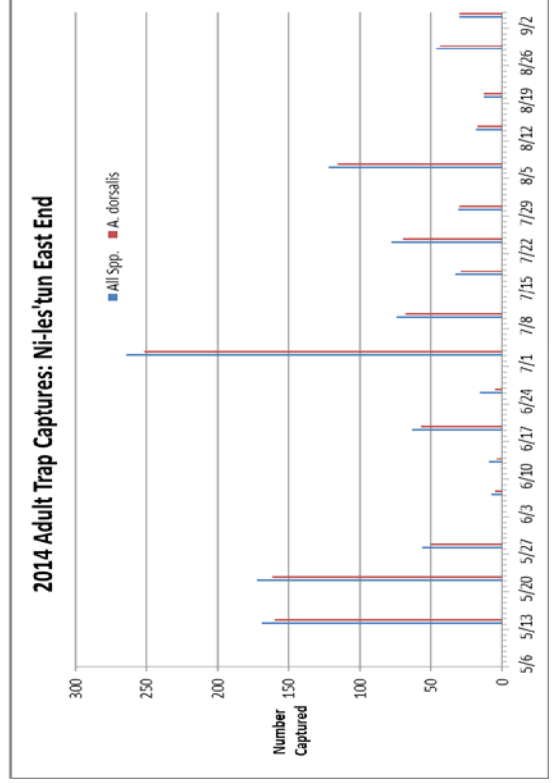
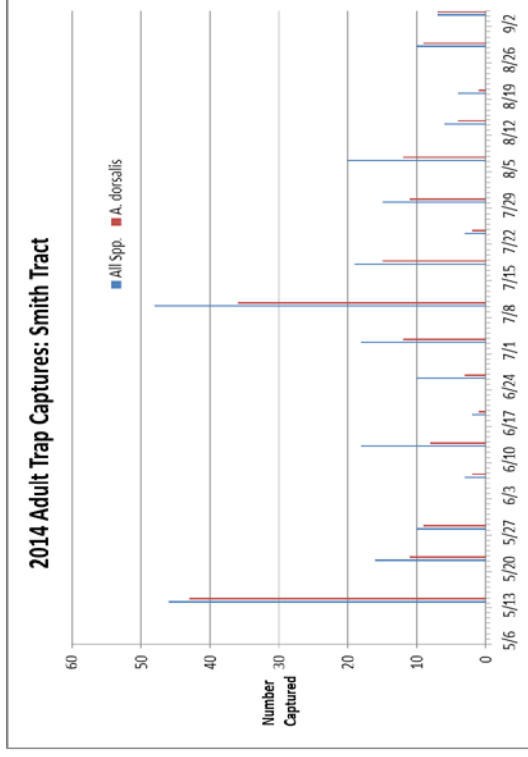
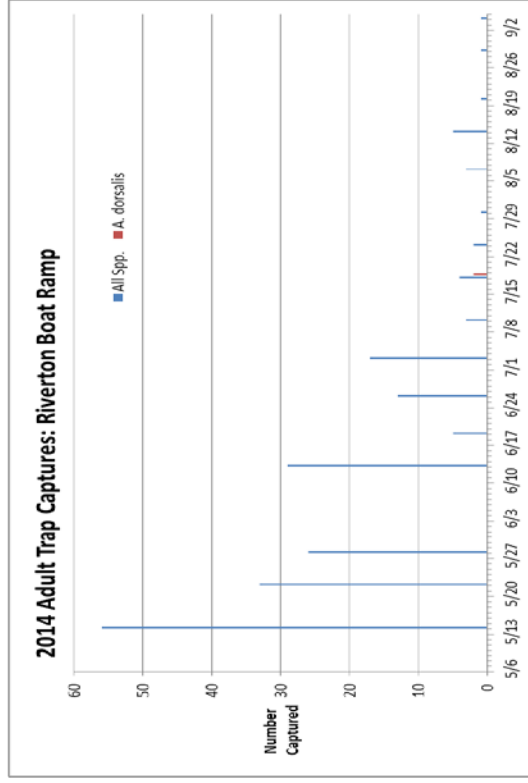


Charts comparing all mosquitoes captured to Aedes dorsalis captured 2014 provided by Dr. Bill Bridgeland, USFWS

Note: Y-axis vary.



Note: Y-axis vary.



## **Appendix 4**

### **Mosquito Pathogen Lab Results**



**Oregon State University Veterinary Diagnostic Laboratory**

PO Box 429  
Corvallis, OR 97339-0429  
Phone(541) 737-3261  
FAX (541) 737-6817

**VDL Accession #:** 15V02906

**Final  
Version 1**

**Referral #:**  
**VTHCase #:**  
**Date Collected:** 09/09/2014

*This report supersedes all*

*previous reports for this case*

**Date Received:** 09/10/2014

**Case Coordinator:** Donna Mulrooney,  
Molec Diagnostics Supervisor  
**Electronically Signed and Authorized  
By:** Andree Hunkapiller, Microbiologist on  
behalf of Donna Mulrooney, Molec  
Diagnostics Supervisor on 9/10/2014  
4:46:38PM

**Email To:**

0014745

Coos County Health Department  
[rhallmark@co.coos.or.us](mailto:rhallmark@co.coos.or.us)

**Collection Site:**

Coos County Health Department  
North Bend, OR 97459-3411  
Phone: 5417562020

**Comments to Client:** Attn: Nikki Harris

**Specimens Received:** 3 Mosquito Pool;

**C a s e C o n t a c t s**

Bill To	Oregon State Health Division - Surveillance Program	9716731111	800 NE Oregon Street, Ste 772, Portland, OR 97232-2109
Submitter	Coos County Health Department	5417512400	1975 McPherson St, North Bend, OR 97459-3411

**S p e c i m e n D e t a i l s**

ID	ID Type	Other IDs	Taxonomy	Gender	Age/DOB
15V02906-01	OSU Internal ID		Family culicidae	Not Reported	Not Reported

**M o l e c u l a r D i a g n o s t i c s**

**WNV, SLE, WEE rRT-PCR MOSQUITO PANEL**

<b>Animal/Source</b>	<b>Specimen Type</b>	<b>Date Resulted</b>
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	Mosquito Pool	10-Sep-2014
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<b>GroupID</b>	<b>Specimen ID</b>	<b>SLE qRT-PCR</b>	<b>WEE qRT-PCR</b>	<b>WNV qRT-PCR</b>
15V02906-01	1	Negative	Negative	Negative
	2	Negative	Negative	Negative
	3	Negative	Negative	Negative

**Administration****UPS CHARGES**

<b>Animal/Source</b>	<b>Specimen</b>	<b>Specimen Type</b>	<b>Date Resulted</b>	<b>Results</b>
15V02906-01	1	Mosquito Pool	10-Sep-2014	See invoice for UPS charges

