Florida Department of Environmental Protection

2015 Statistical Surveys for Wastewater Tracers and Imidacloprid

Division of Environmental Assessment and Restoration
May 17, 2017





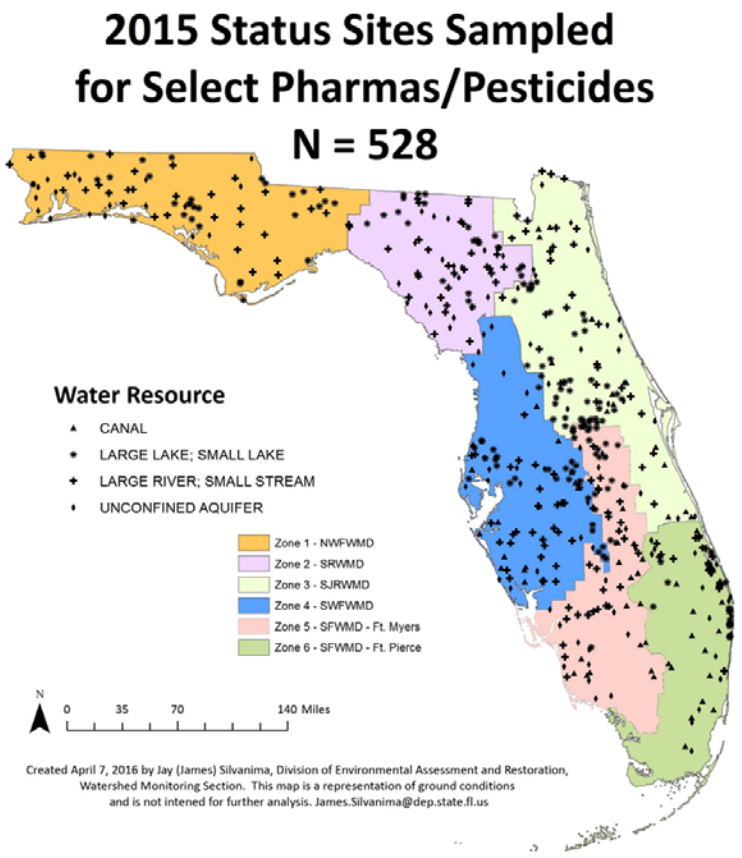
2015 Sample Surveys

Overview

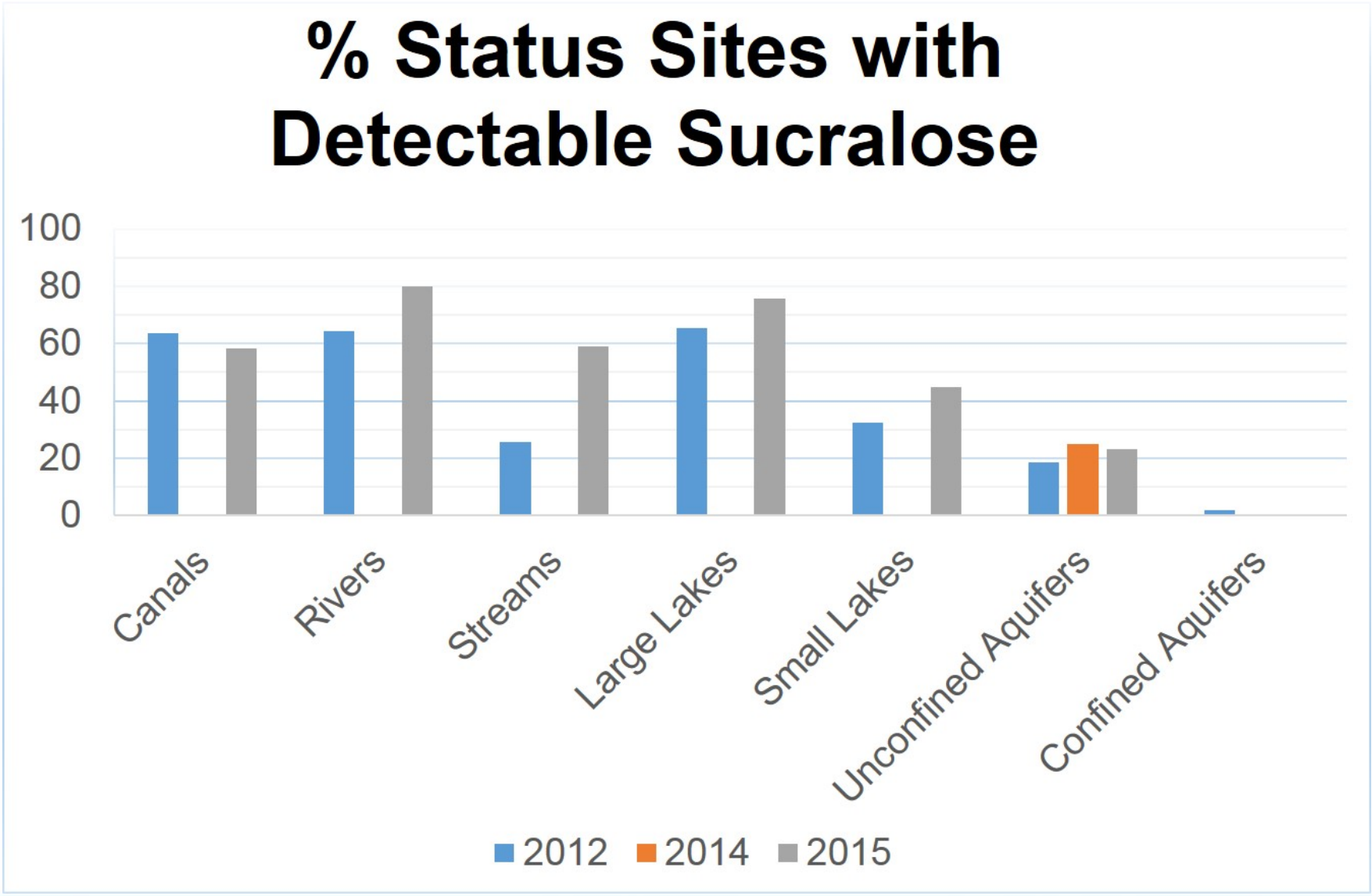
- ✓ Background Information
- ✓ % Sites with Detections
- ✓ Magnitude of Detections
- ✓ Estimate of Extent of Resource with Detections
- ✓ Correlations with Land Use
- ✓ Summary

2015 Sample Surveys

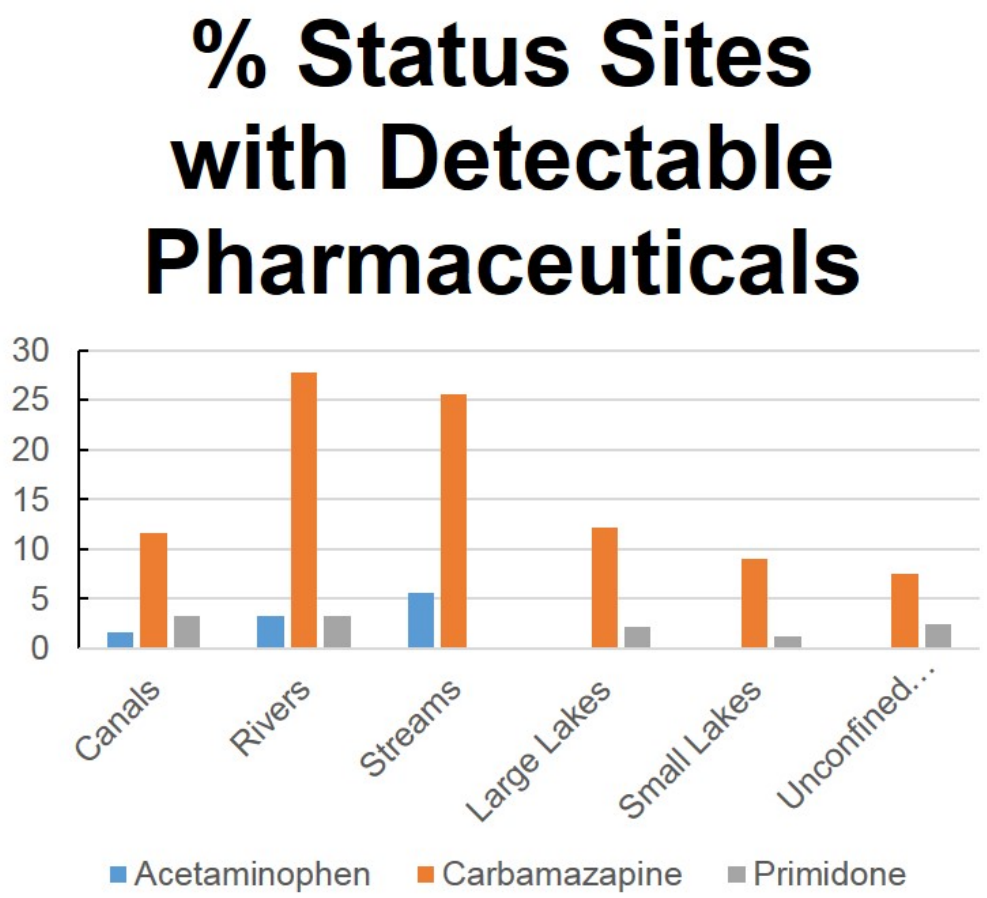
- Sucralose, pharmaceuticals and Imidacloprid collected at 528 sites
  - 60 canal sites
  - 90 river sites
  - 90 stream sites
  - 90 large lake sites
  - 78 small lake sites
  - 120 unconfined wells



Sample Surveys for Sucralose

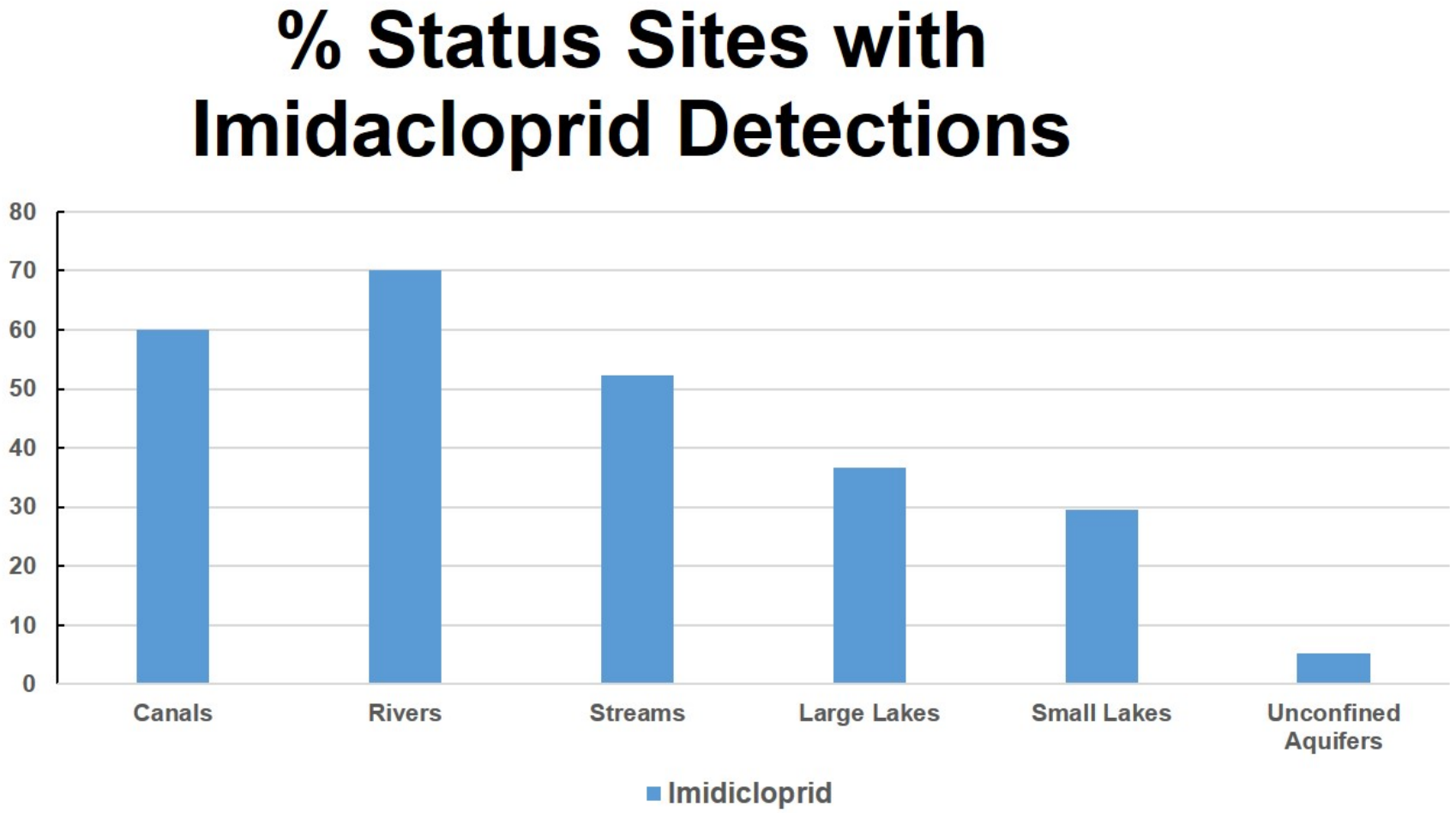


2015 Sample Surveys



- Acetaminophen
  - 9 detections (2 ng/L to 11 ng/L) only one quantified.
- Carbamazapine
  - 82 detections of carbamazepine (0.44 ng/L to 68 ng/L) 21 quantified. Notice the MDL is ~ an order of magnitude lower than Acetaminophen/Primidone
- Primidone
  - 11 detections (5.8 ng/L to 88 ng/L) two quantified.

2015 Sample Surveys



- 210 detections (2.1 ng/L to 520 ng/L), 103 quantified.

2015 Sample Surveys

Compound Half-lives and Aquatic Life Toxicology Values

Compound	Half-life Water	Predicted No Effect Concentrations (PNEC)	LC_{50} Insect	LC_{50} Crustacean	Reference
Sucralose	> year	930 µg/L	NA	NA	Tollefsen et al. 2012[1]
Acetaminophen	weeks	9.2 µg/L	NA	NA	Kim et al. 2007, Table 3[2]
Carbamazepine	weeks	31.6 µg/L	NA	NA	Kim et al. 2007, Table 3[2]
Primidone	weeks	NA	NA	NA	NA
Imidacloprid	weeks	$1/10^{th}$ LC_{50}	0.65 - 44 µg/L	7.1 - 361 µg/L	Goulson 2013, Table S1[3]

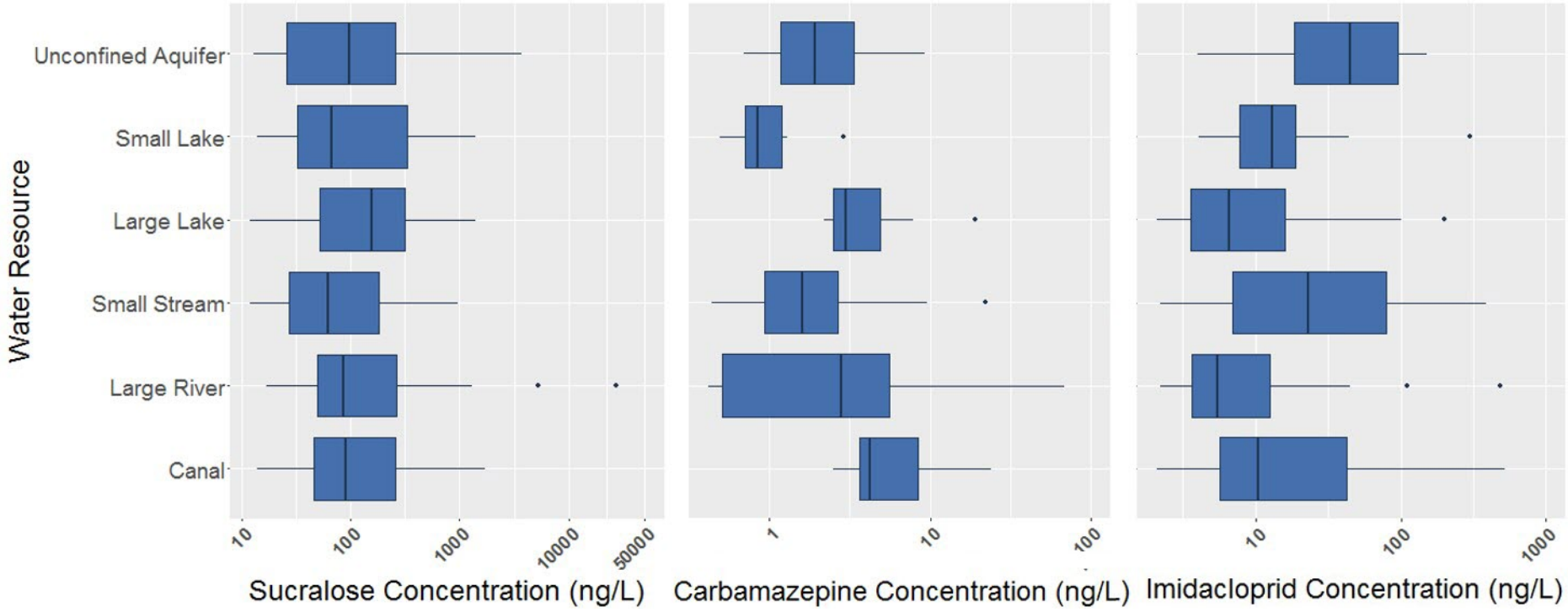
US EPA Pesticide Registration Program Benchmarks[4]

Compound	Half-life Water	Benchmark - Fish (Acute)	Benchmark - Fish (Chronic)	Benchmark - Invert (Acute)	Benchmark - Invert (Chronic)
Imidacloprid	weeks	>41,500 µg/L	1200 µg/L	35 µg/L	1.05 µg/L

1. Tollefsen KE, Nizzetto L, Huggett DB. 2012. Presence, fate and effects of the intense sweetener sucralose in the aquatic environment. Science of The Total Environment 438: 510–516.
2. Kim Y, Choi K, Jung J, Park S, Kim P-G, Park J. 2007. Aquatic toxicity of acetaminophen, carbamazepine, cimetidine, diltiazem and six major sulfonamides, and their potential ecological risks in Korea. Environment International 33: 370-375.
3. Goulson D. 2013. An overview of the environmental risks posed by neonicotinoid insecticides. Journal of Applied Ecology 50: 977-987.
4. U.S. EPA Office of Pesticide Program aquatic life benchmarks (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/aquatic-life-benchmarks-pesticide-registration)

2015 Sample Surveys

Range of Detected Values



2015 Sample Surveys

Range of Detected Values vs Available Aquatic Life Toxicology Guidance

1. **Sucralose, Acetaminophen, Carbamazepine – highest values are an order of magnitude lower than any known toxicology guidance**
2. **Imidacloprid – 47/210 sites' detections are higher than Goulson's suggested 1/10th of the LC_{50} lower range.**

Percentage of Water Resource Expected to Have Detectable Amounts of Wastewater Tracers

Water Resource	*Target Population Size**	*Number of Samples*	*% of Resource Expected to Have Sucralose Only with Upper/Lower 95% Confidence Bounds*	*% of Resource Expected to Have Sucralose and at least one Pharma with Upper/Lower 95% Confidence Bounds*	*% of Resource Expected to Have No Sucralose and at Least One Pharma Detection with Upper/Lower 95% Confidence Bounds*
Canals	4066	60	46.2 33.6 - 56.8	10.8 3.6-17.8	NA**
Streams	26175.1	89	35.2 23.3-47.1	23.5 13.9-33.1	3.4 1.2-27.9
Rivers	4308.3	90	43.2 33.0-53.5	30.9 21.5-40.2	NA
Large Lakes	408378.3	90	80.5 73.0-88.0	8.4 2.5-14.3	NA
Small Lakes	9521.5	78	30.8 17.0-44.5	11.6 2.0-21.1	NA
Unconfined Aquifers	15559	118	23.5 9.9-37.0	6.9 0-14.1	NA

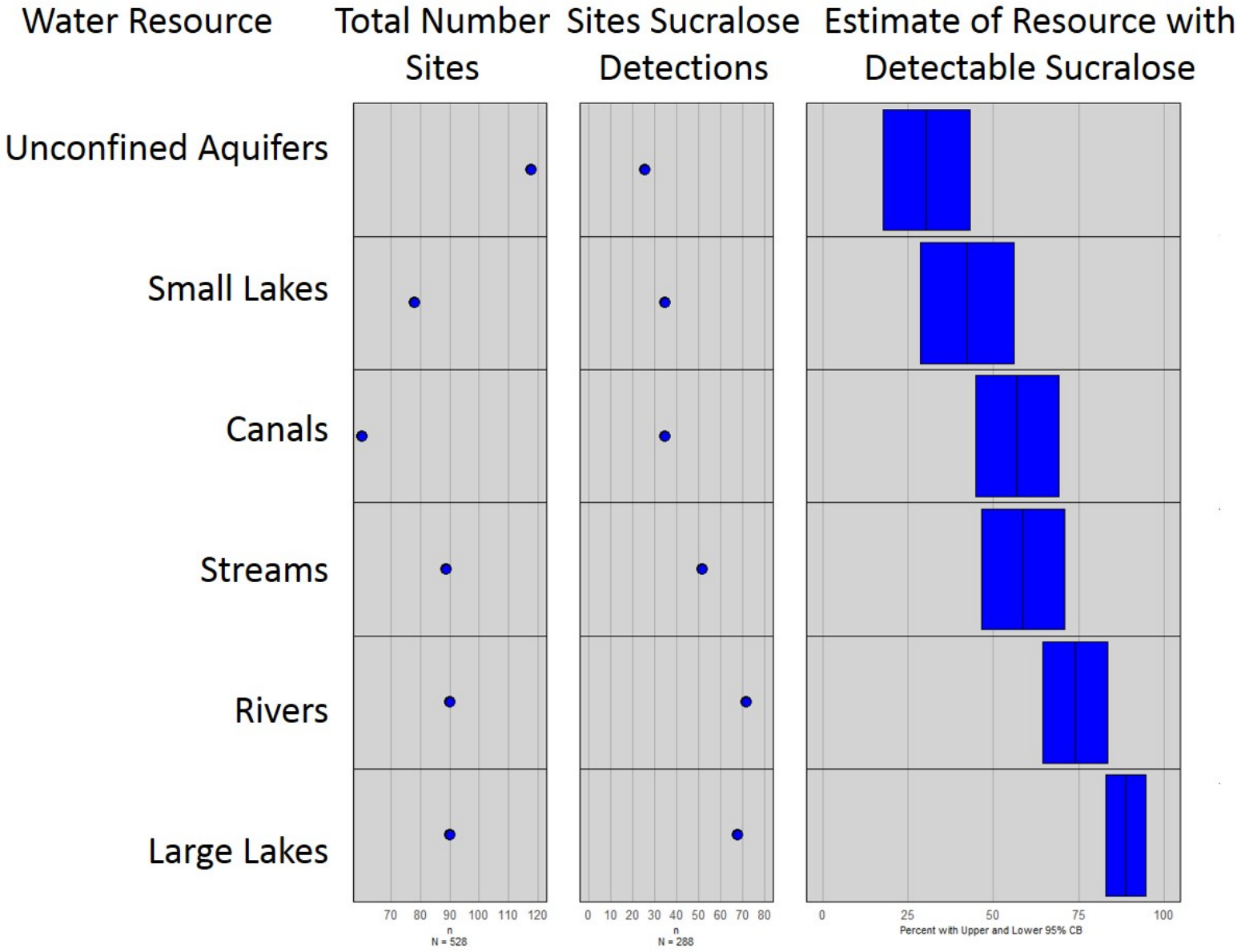
Units are as follows: canals, streams, and rivers = kilometers; lakes = hectares, unconfined aquifers = number of wells.

Percentage of Statewide Water Resource Having Detectable Amounts of Imidacloprid

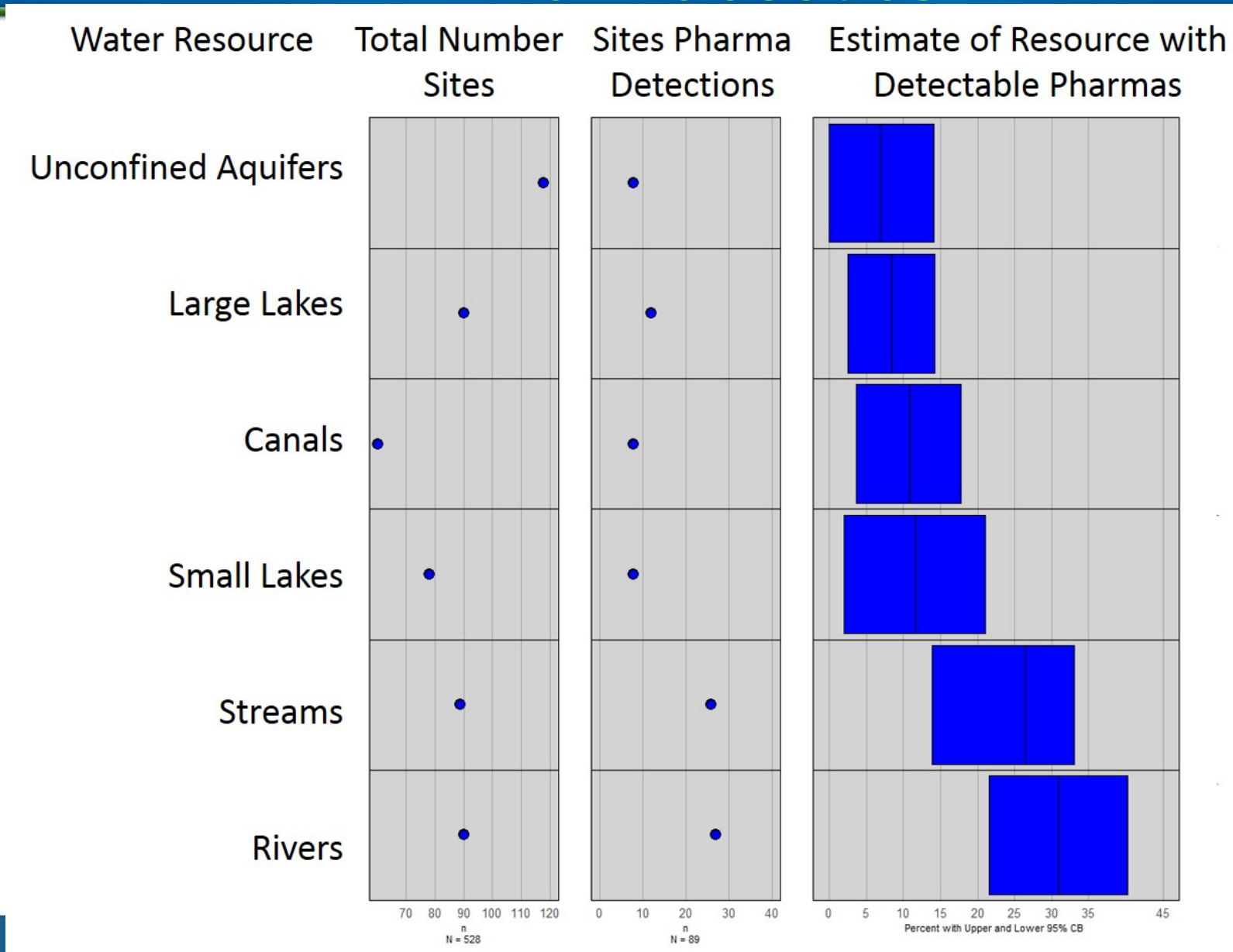
Water Resource	*Target Population**	*Number of Samples*	*% of Resource Expected to Have Imidacloprid*	*95% Confidence Bounds*	*Assessment Period*
Canals	4066	60	50.3	38.2-62.4	Jan.-Feb 2015
Streams	26175.1	89	36.9	27.9-45.9	July-Aug. 2015
Rivers	4308.3	90	64.8	54.7-74.8	May-June 2015
Large Lakes	408378.3	90	33.6	14.4-52.8	April-May 2015
Small Lakes	9521.5	78	50.0	37.5-62.4	Sept.-Oct. 2015
Unconfined Aquifers	15559	118	24.7	11.1-38.4	Nov.-Dec. 2015

Units are as follows: canals, streams, and rivers = kilometers; lakes = hectares, unconfined aquifers = number of wells.

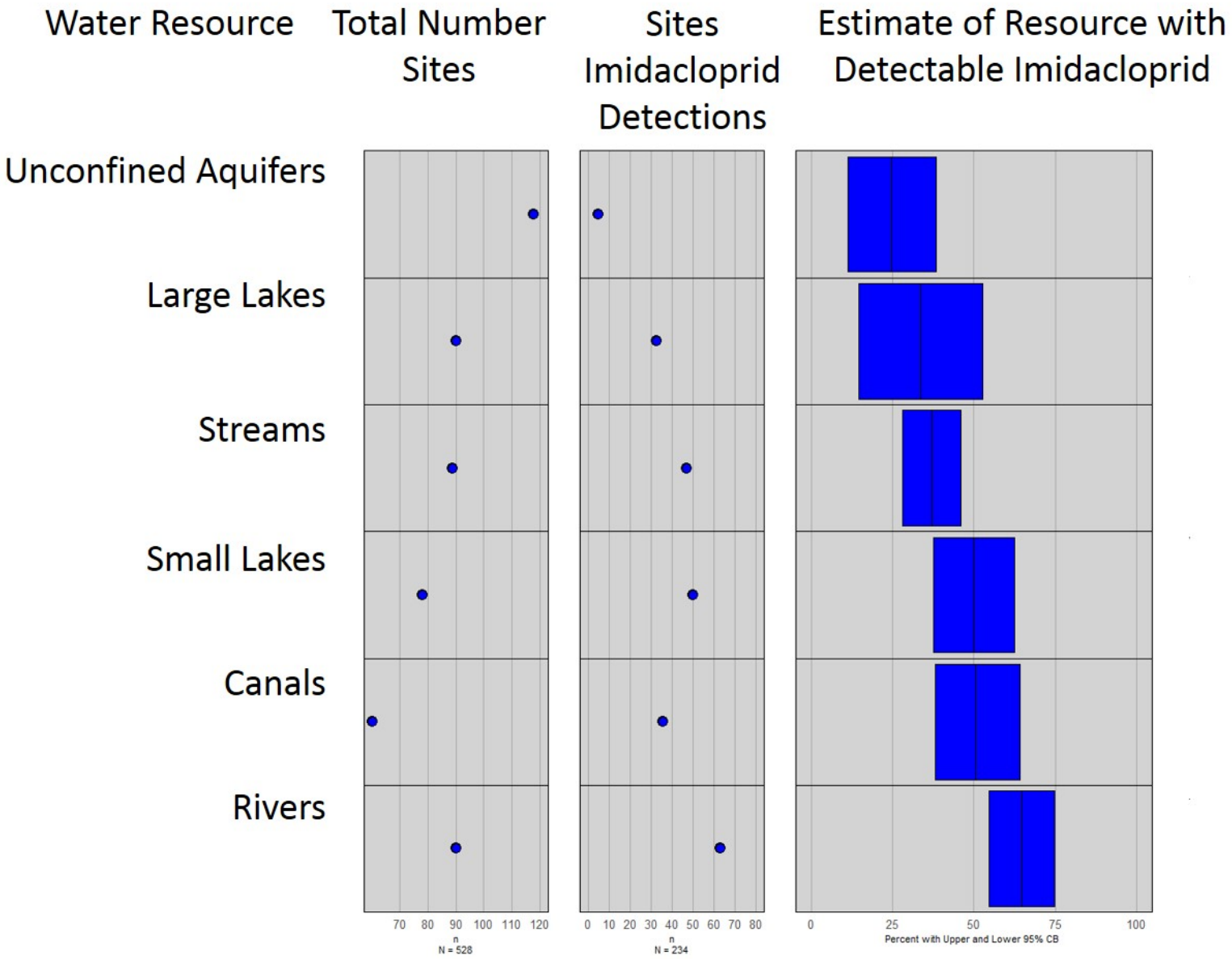
2015 Sample Surveys Sucralose



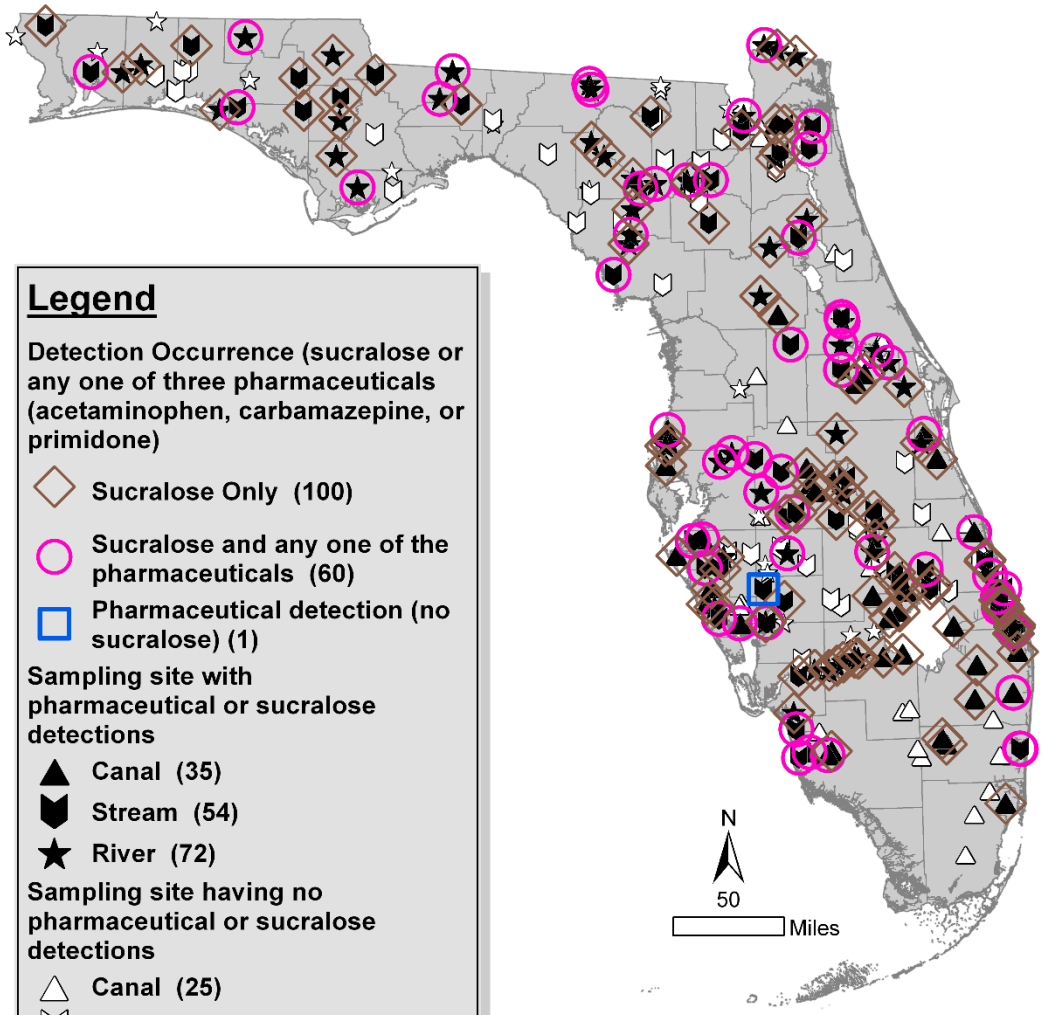
2015 Sample Surveys Pharmaceutics



2015 Sample Surveys Imidacloprid



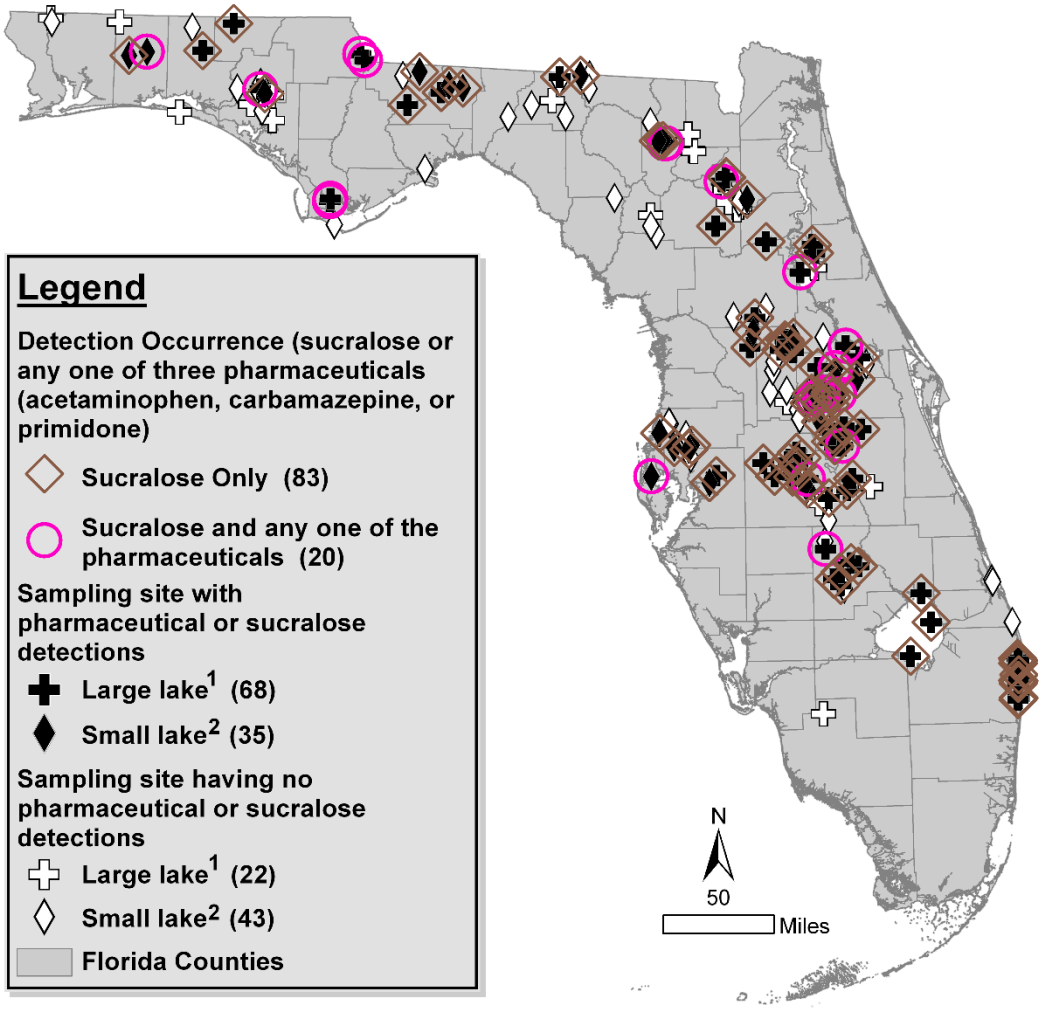
Detected Wastewater Tracers
Status Network Sampling for 2015
(Canals, Streams, and Rivers)



Created March 30, 2017 by Andy Woeber of the Watershed Monitoring Section, Division of Environmental Assessment and Restoration, DEP.

The map content is a cartographic representation and is not intended for further analysis.

Detected Wastewater Tracers
Status Network Sampling for 2015
(Lakes)



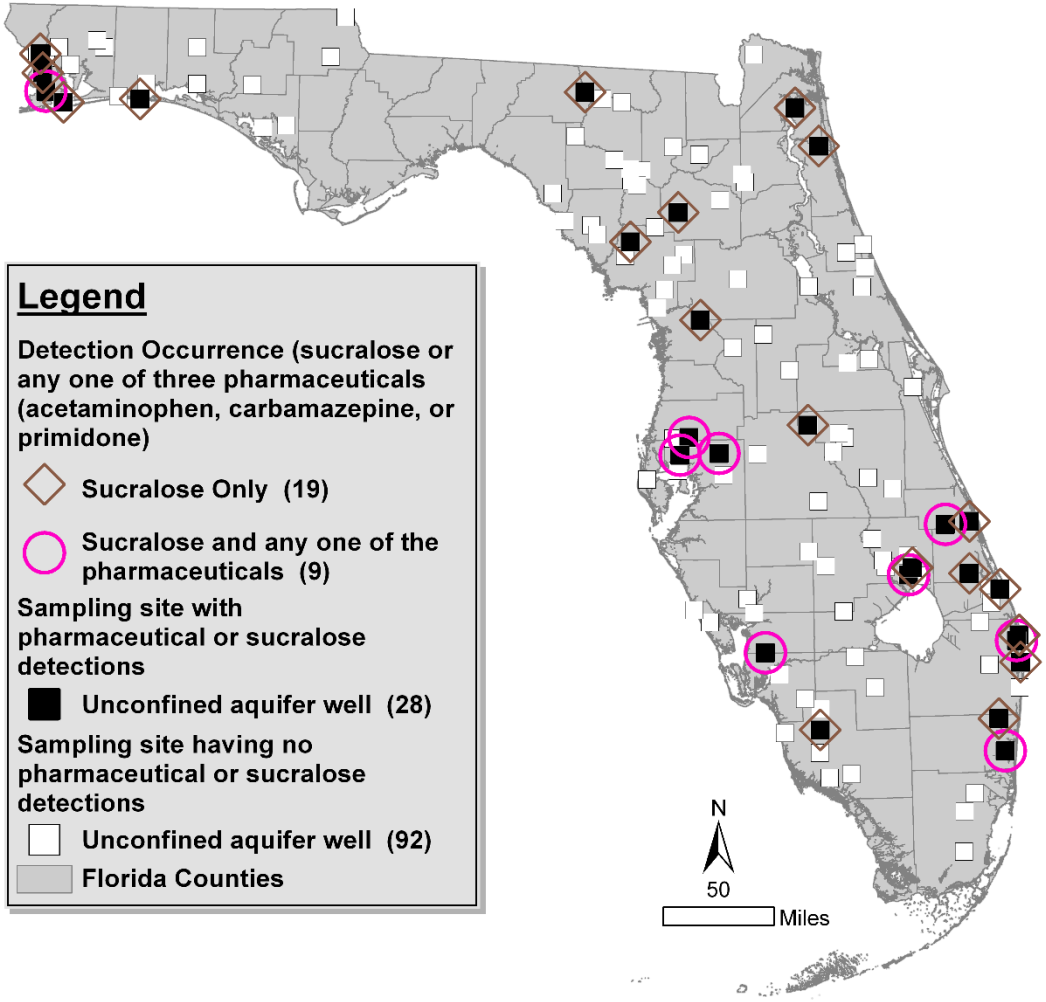
[1] Large lakes are equal to or greater than ten hectares in size.

[2] Small lakes are equal to or greater than four hectares and less than ten hectares in size.

Created March 30, 2017 by Andy Woeber of the Watershed Monitoring Section, Division of Environmental Assessment and Restoration, DEP.

The map content is a cartographic representation and is not intended for further analysis.

Detected Wastewater Tracers
Status Network Sampling for 2015
(Unconfined Aquifers)



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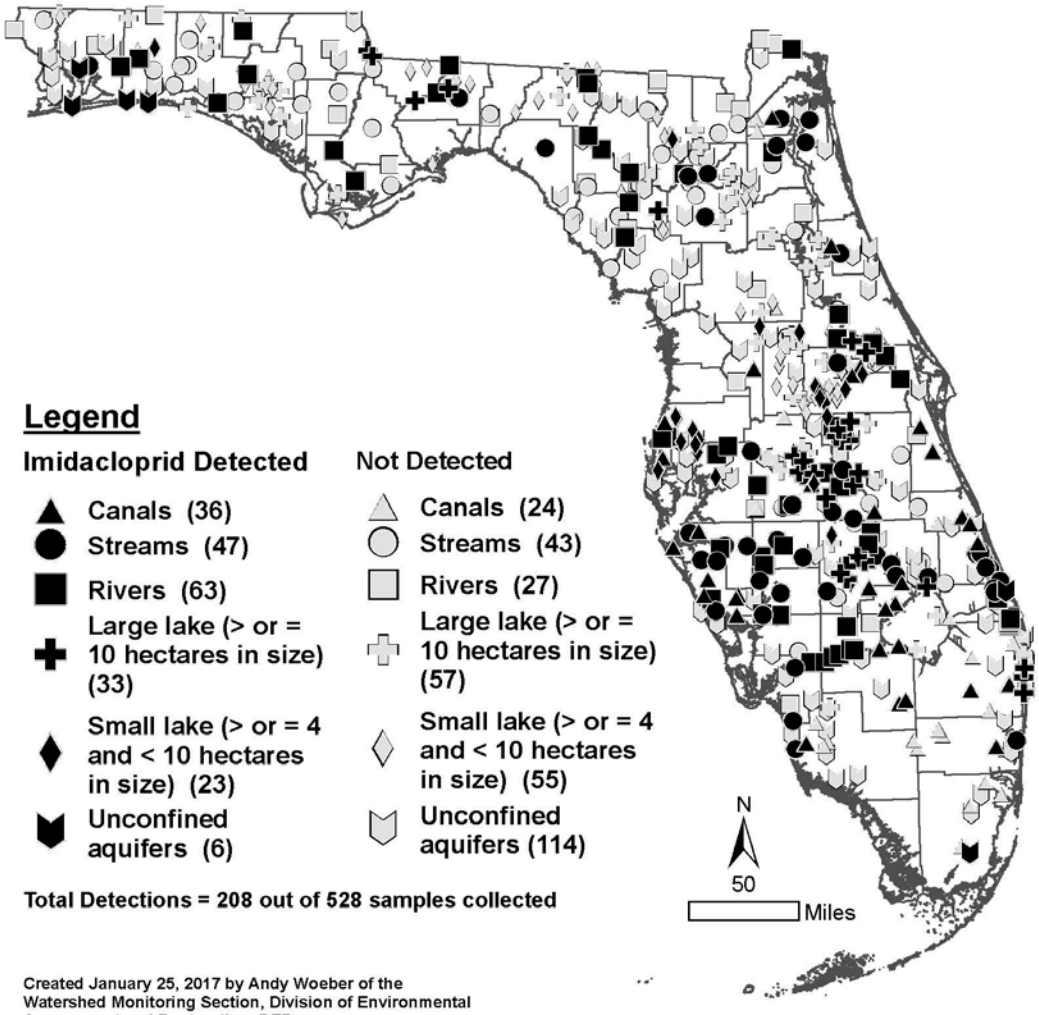
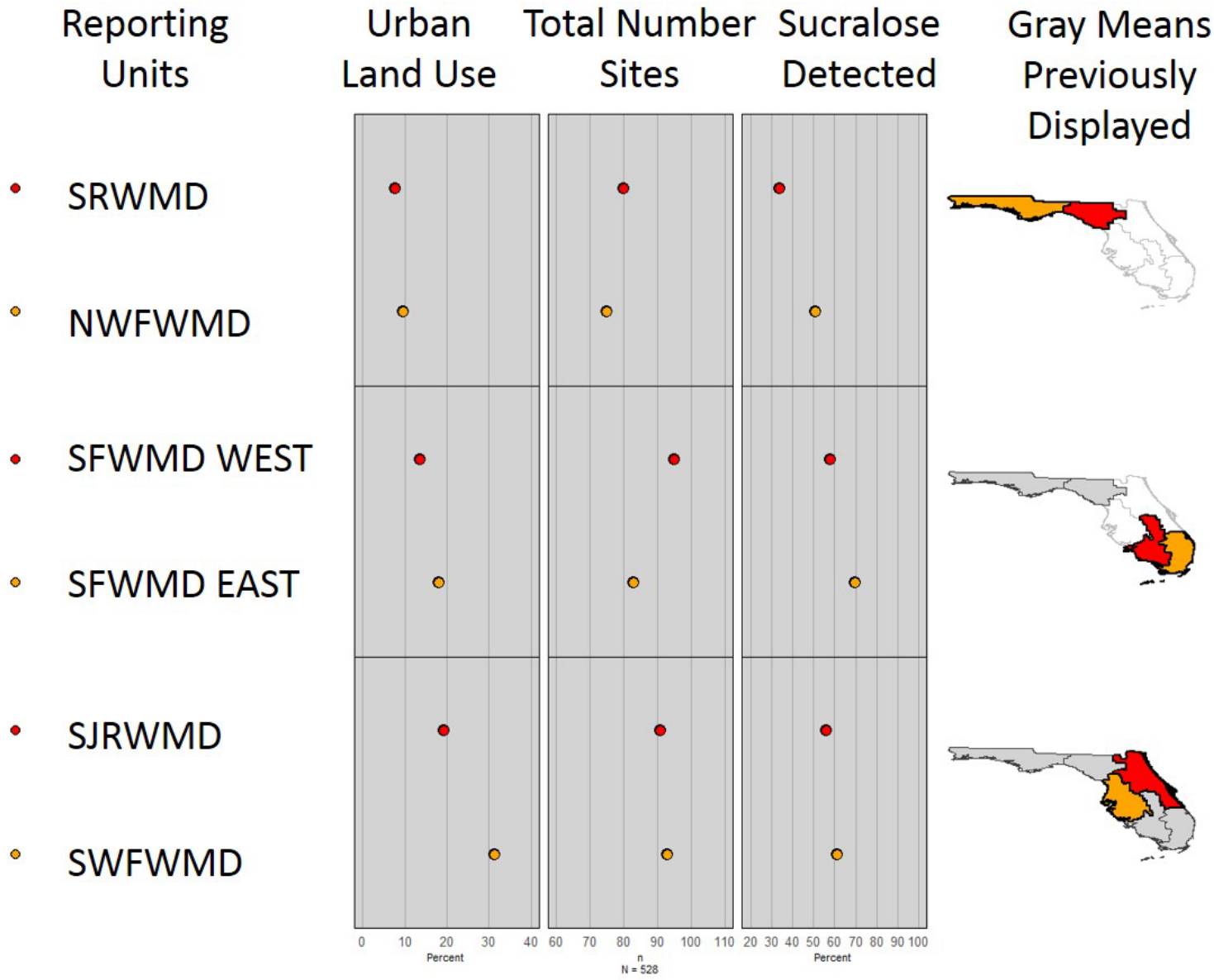
Imidacloprid Detections For The Status Network 2015 By Water Resource

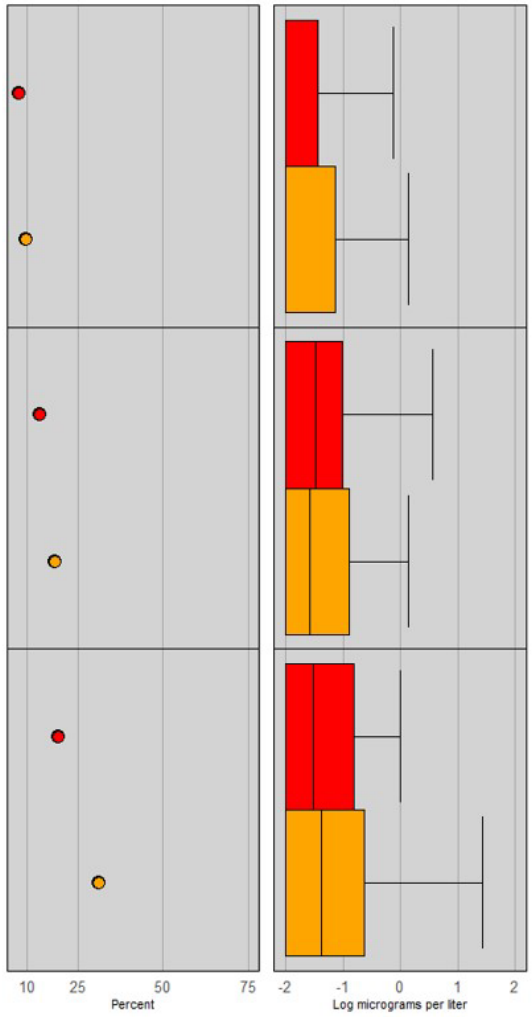


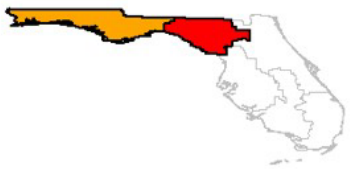
2015 Sample Surveys Sucralose

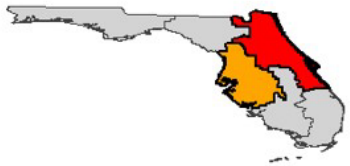


2015 Sample Surveys Sucralose

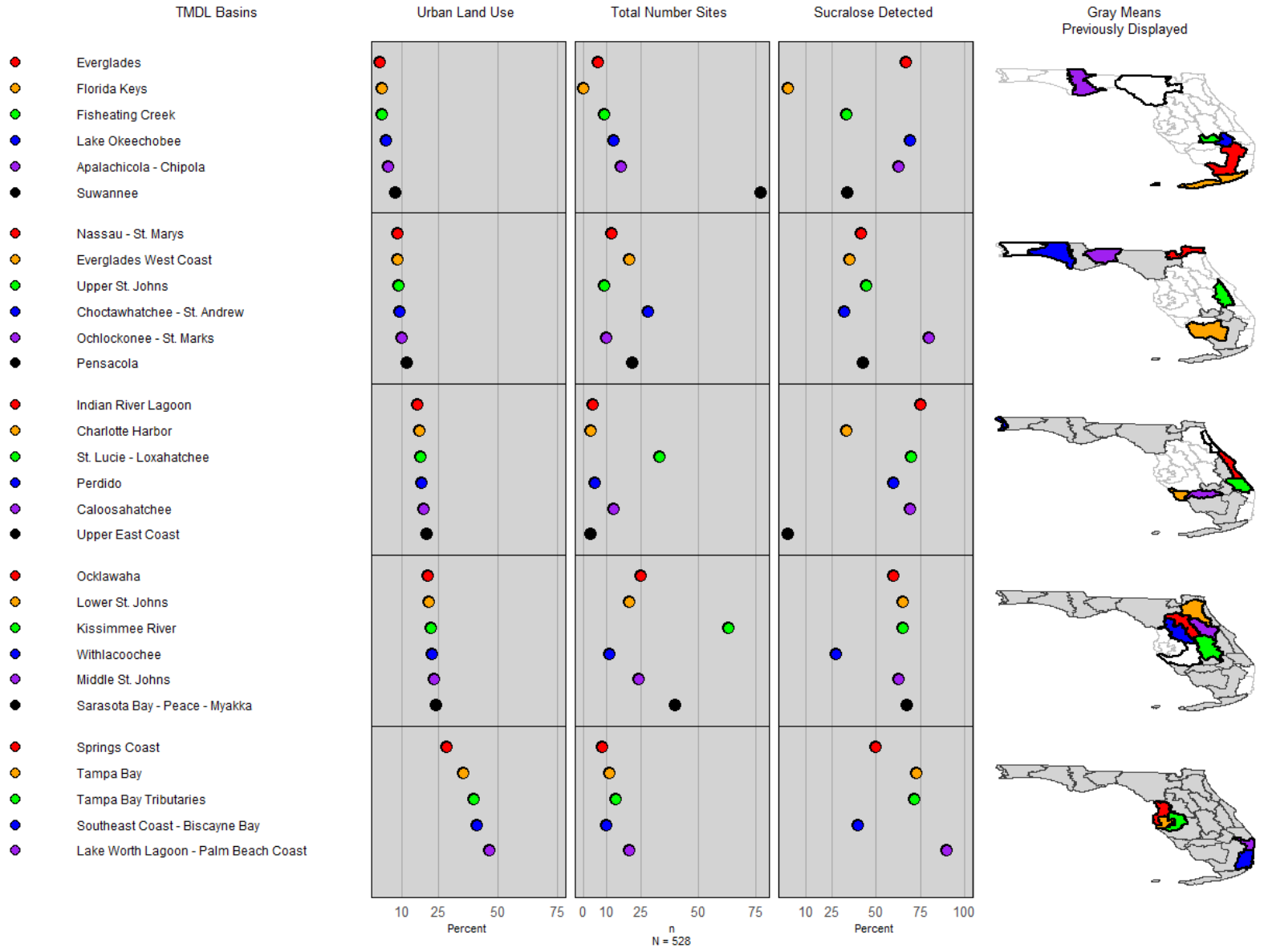
Reporting Units	Urban Land Use	Sucralose Median with min, 25th, 75th, & max	Gray Means Previously Displayed
SRWMD			
NWFWMD			
SFWMD WEST			
SFWMD EAST			
SJRWMD			
SWFWMD			





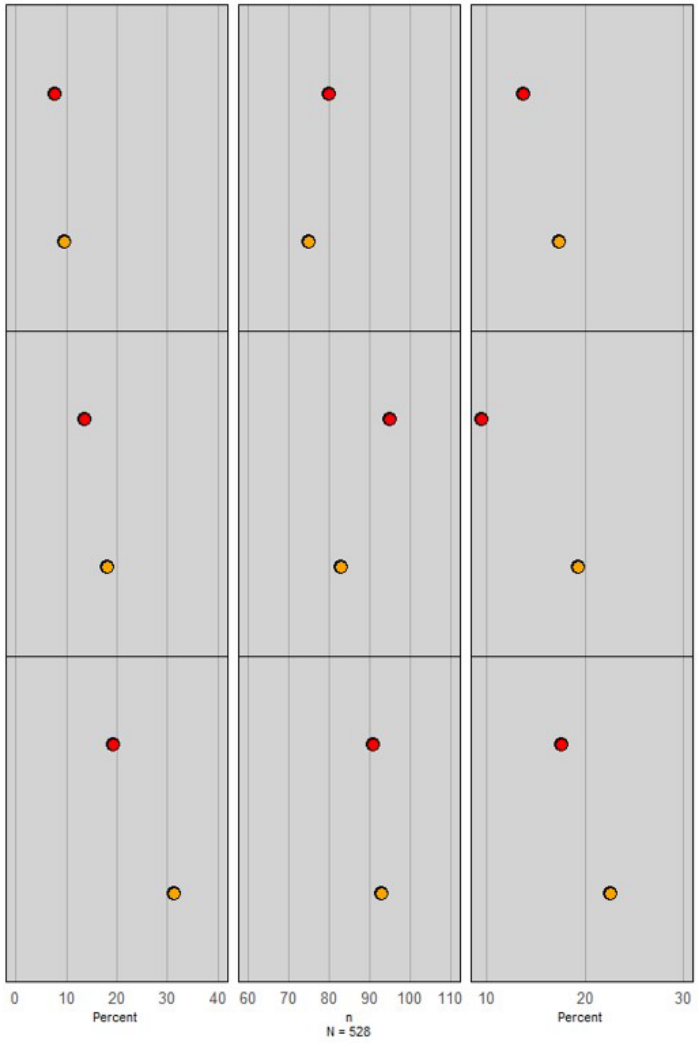


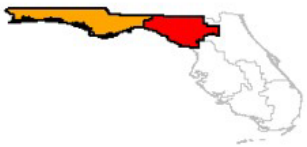
2015 Sample Surveys
Sucralose

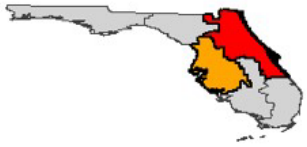


2015 Sample Surveys Pharmaceuticals

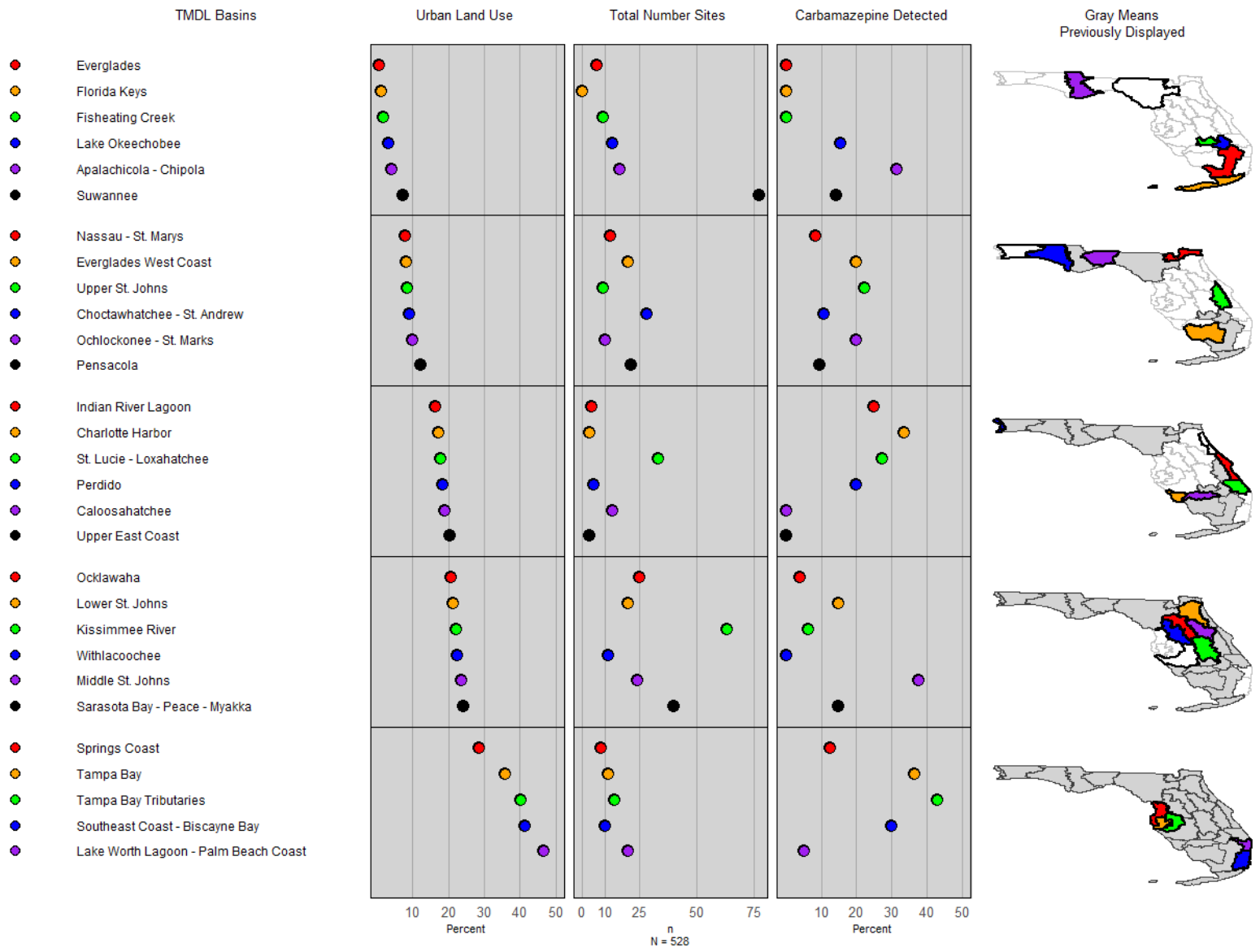
Reporting Units	Urban Land Use	Total Number Sites	Pharma Detected	Gray Means Previously Displayed
SRWMD				
NWFWMD				
SFWMD WEST				
SFWMD EAST				
SJRWMD				
SWFWMD				



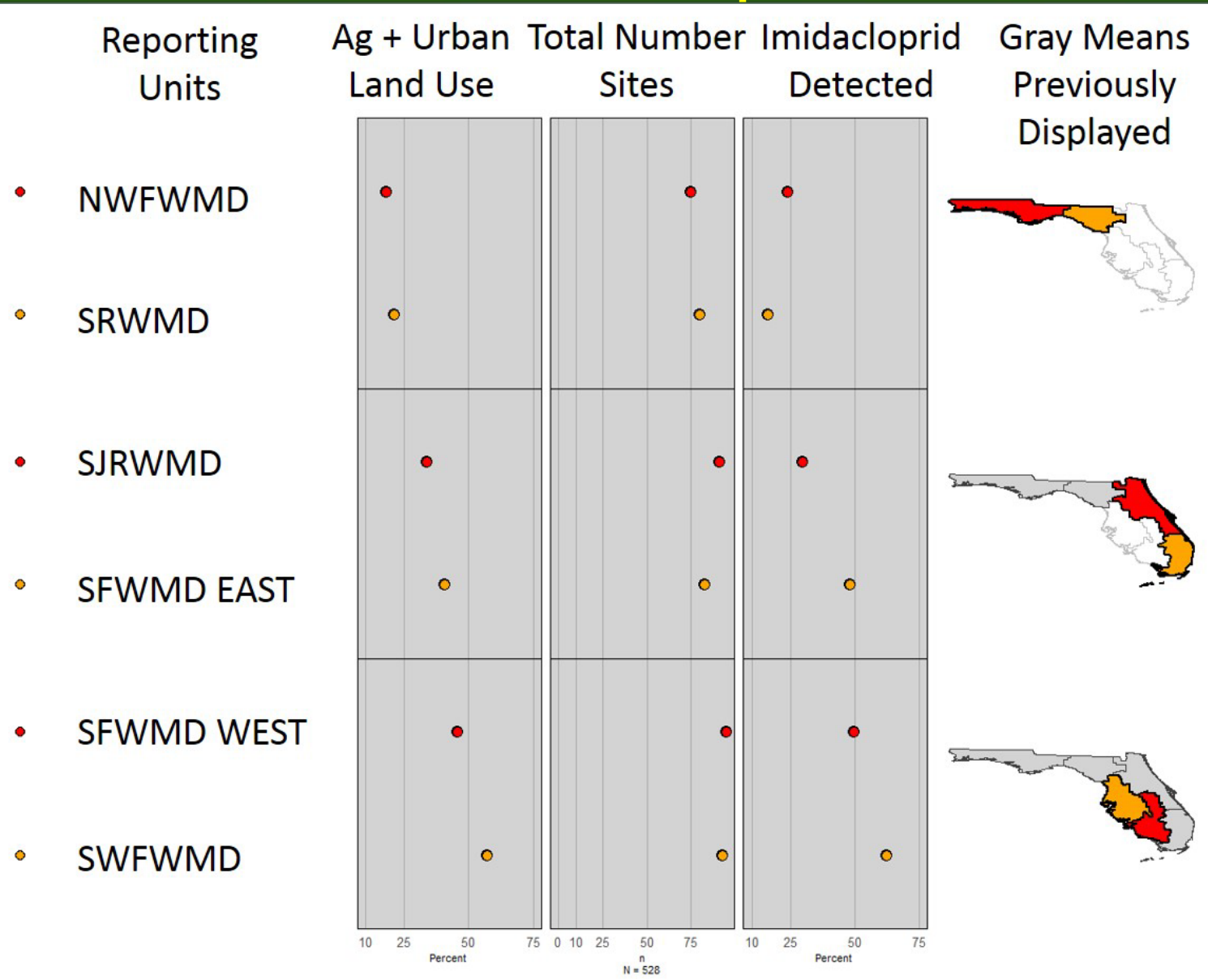




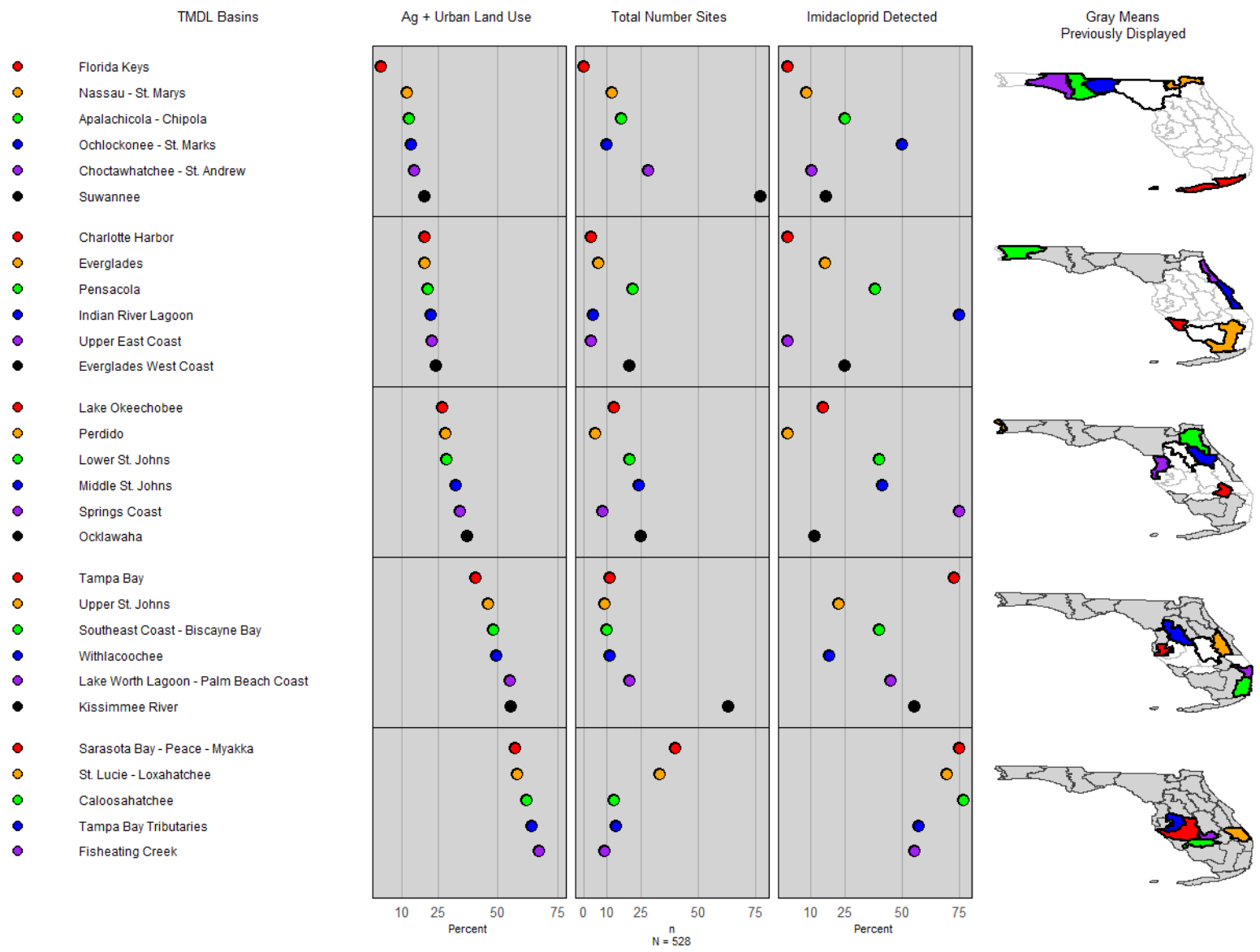
2015 Sample Surveys Carbamazepine



2015 Sample Surveys Imidacloprid



2015 Sample Surveys Imidacloprid



Summary

1. A large percentage of Florida's freshwater resources were found to be affected by very low concentrations of wastewater compounds and neonicotinoid pesticides.

2. Of the four compounds examined, only imidacloprid was found to exceed any recommended toxicology guidance. 47/528 sites (~9 percent) were found to exceed the lower threshold of the PNEC for insects and crustaceans.

3. Numbers and magnitude of sucralose and pharmaceutical detections are directly correlated with Urban land use within reporting units.

4. Numbers and magnitude of imidacloprid detections are directly correlated with agricultural and urban land use within reporting units.

5. Of the 29 TMDL basins those having estuaries produced the highest percentage of detections for all four compounds

Next Steps

- We are pursuing means to integrate these indicators into some of our monitoring plans (strategic and basin management action plan monitoring).
- Investigating additional sampling means (passive sampling devices) to collect a more extensive list of contaminants, including hormones.

Acknowledgements

- FDEP, Northwest Florida WMD, & St. Johns River WMD
  - Sampling staff
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  - Monitoring Design and Data Analysis
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  - Geographic Information Systems and Quality Assurance