



Utilizing Hydroacoustic Technology for Aquatic Plant Management

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Purpose

- ▣ Submerged aquatic vegetation (SAV), such as non-native *Hydrilla verticillata*, can negatively affect North Carolina reservoirs through impeding:
 - Recreational activities
 - Power generation
 - Significantly disrupt native ecological function

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Relevance

- ❑ An excess of \$100 million dollars are spent annually in the US for aquatic weed management
- ❑ These costs are associated with scouting, eradicating and controlling the invasions.
 - Both chemical and biological control

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Importance

- ❑ **Early SAV detection maintains a viable option to reduce the total ecological and financial impact caused by invasive aquatic plant species.**
- ❑ **Assessing SAV inhabited areas and total biomass of target plants can help evaluate invasion levels, and provide sufficient information to delineate specific control actions.**

Remote Sensing Objectives

▣ Determine plant:

- Species
- Abundance
- Distribution
- Temporal canopy development and growth patterns

▣ Stakeholder Involvement

- Development of BMP action plan
- Mapping



Traditional Methods

▣ Visual Sighting, Random Block & Grid Sampling

- Limited informationally
- Tedious
- Requires precise GPS equipment
- Labor intensive
- Inefficient

▣ Point Intercept Sampling

- Specified location within the littoral zone



Current Technologies

- ▣ **Satellite Imagery: multispectral platforms**
 - ▣ **Commercial**
 - Ex. Worldview II
 - <1m-5m spatial and 24h temporal resolution
 - ▣ **Public Domain**
 - Ex. Landsat 8
 - 30m spatial resolution with ~15 day acquisition period

Hydroacoustics!!!

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Hydroacoustics

□ How does it work?

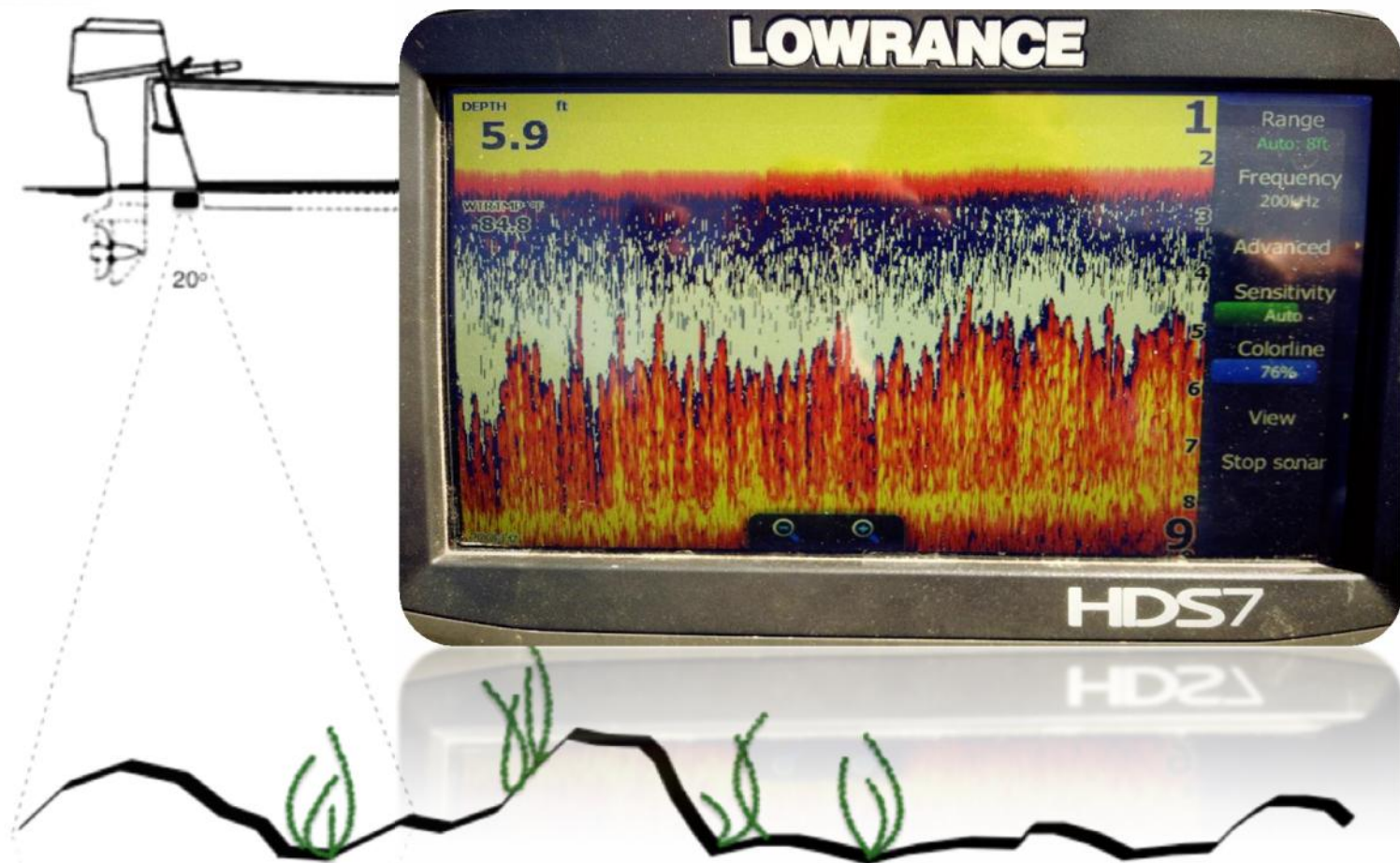
- Active acoustic technology
- High frequency, narrow-beamed SONAR transducers mounted to a watercraft
- Sound travels through water, encounters different media densities and returns back to the original source

□ Boat-based Platform

- Lowrance HDS-7 Gen2 Chartplotter
- 200 kHz transducer with 20° beam @ 15-20 pings s⁻¹ with StructureScan sonar



Hydroacoustics



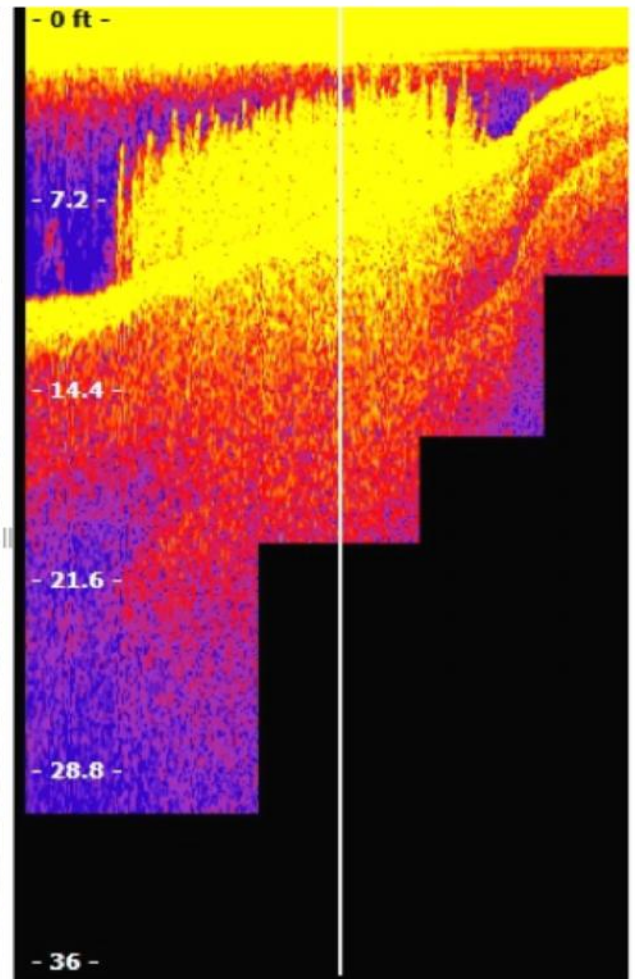
CiBiobase

- ❑ Structure scans recorded via Lowrance HDS depth finders are saved to a SD card then uploaded to a cloud-based algorithm
- ❑ Tools such as *kriging* are utilized to interpolate SAV inhabited areas to create interactive GIS maps and reports

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Results



Results

Lake Gaston, Halifax County North Carolina

Generated: 12/15/2014 4:34:58 PM (UTC)

Waterbody Size: 7,765.23 ha (19,188.30 acres)

[report link](#)



Data Collector

Justin Nawrocki

Data Collection Date

9/26/2014 1:31:21 PM (UTC)

Average Water Temperature

23.84° C (74.91° F)

Location

Start: 36.50239944, -77.81363678

End: 36.56268311, -77.86198425

Survey Size

Area: 298.18 ha
(736.82 acres)

Percent: 3.84% of waterbody

Volume: 8,332,042.70 cu. m
(6,754.90 acre ft)

Settings

Track Buffer: 50 m

Grid Cell Size: 10 m

Min. BV Detect: 1%

Min. Veg Depth Detect: 0.73152 m

Quality Control

Reviewer: Valley, Ray

Status: Pass

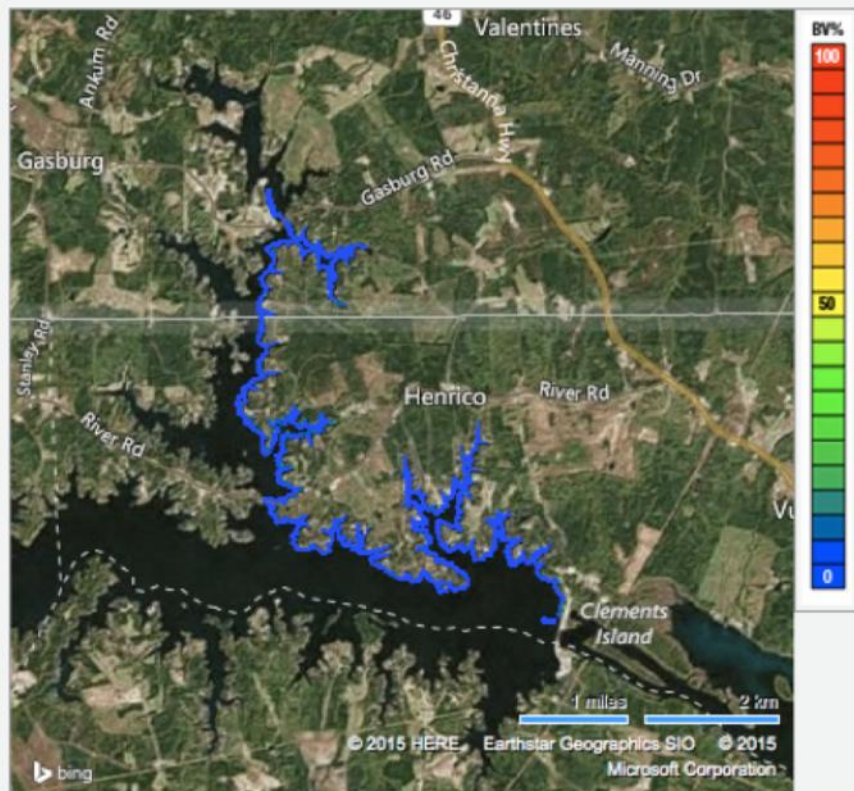
Most of the data looks good. Further algorithm adjustments cannot improve the overall accuracy of the vegetation. Review and edit as needed.

Area of Interest Summary

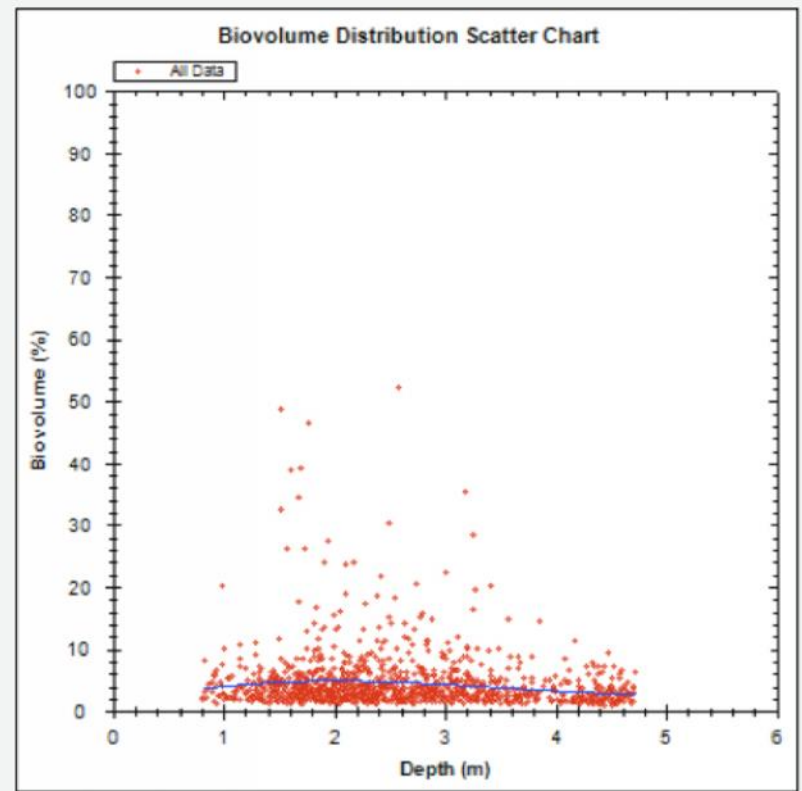
AOI ?	Type ?	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?	Depth Range	Avg Depth	Distance	No. Points
1	Point	7.4%	9.2%	±5.7%	0.7%	±2.9%	0.34-19.9 m	2.66 m	49.98 km	10,653
	Grid	5.9%	7.7%	±3.3%	0.5%	±2%	0-19.87 m	2.67 m	-	30,169

Results

Vegetation Biovolume Heat Map



Biovolume Distribution Scatter Chart



Volunteer Survey Results Lake Gaston 2014

Hydrilla Length (ft)

- >0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7



Benefits

- ❑ **Efficient- Passively recording while conducting other activities**
 - *In situ* survey, anglers and volunteer data
- ❑ **Reproducible**
 - GPS ability to record previous sites
- ❑ **Relatively inexpensive**
 - Consumer grade equipment
- ❑ **Mapping for application**
 - Bathymetry



Past & Current Surveys

▣ Lake Gaston – 2014

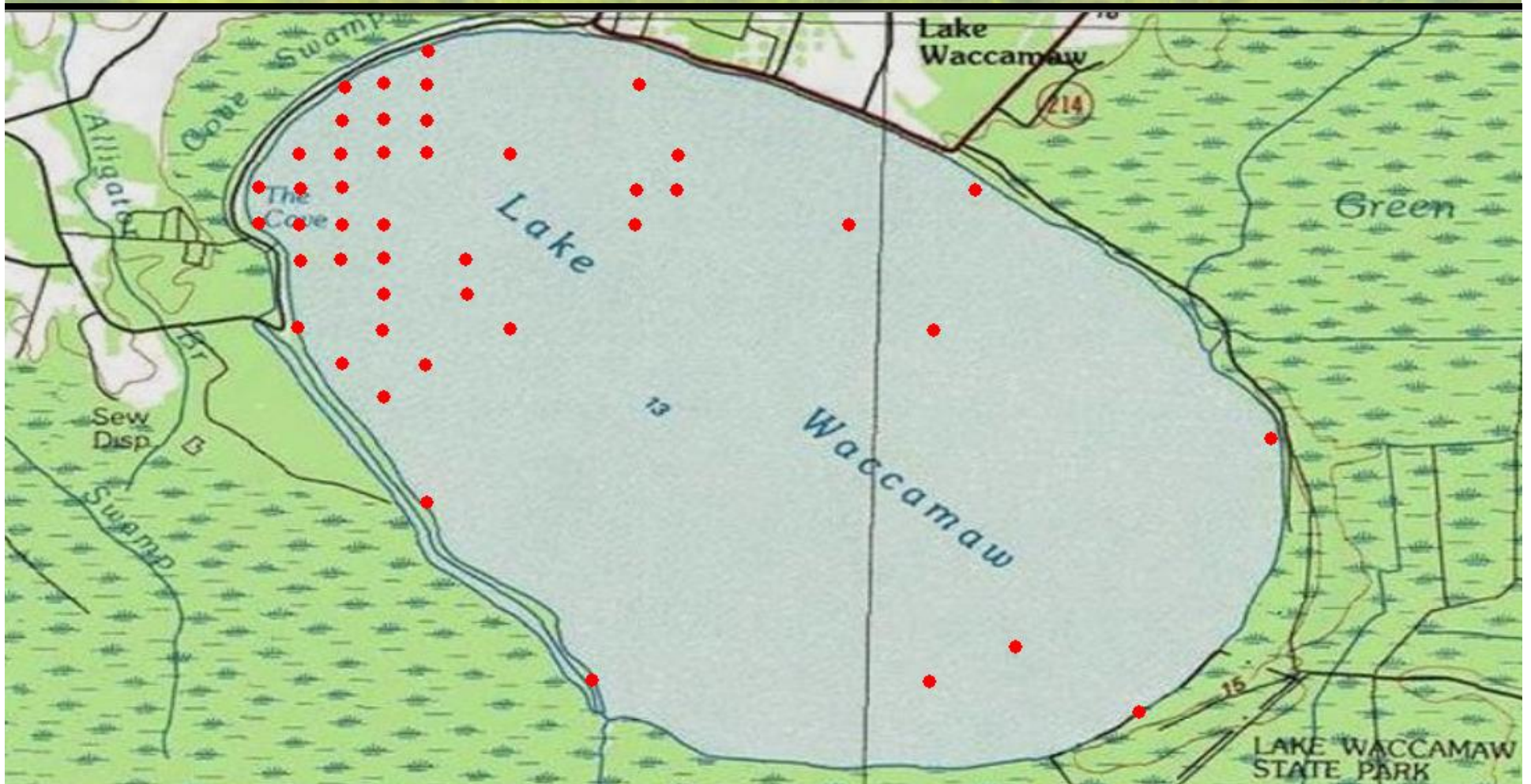
▣ Lake Waccamaw – 2012

- 9,000 acre bay lake with 14 miles of shoreline
- Average depth 7.5 ft
- High ecological diversity
 - Several rare and endemic terrestrial and aquatic species
- Native (pond weed and naiad sp.) vs. Non-native

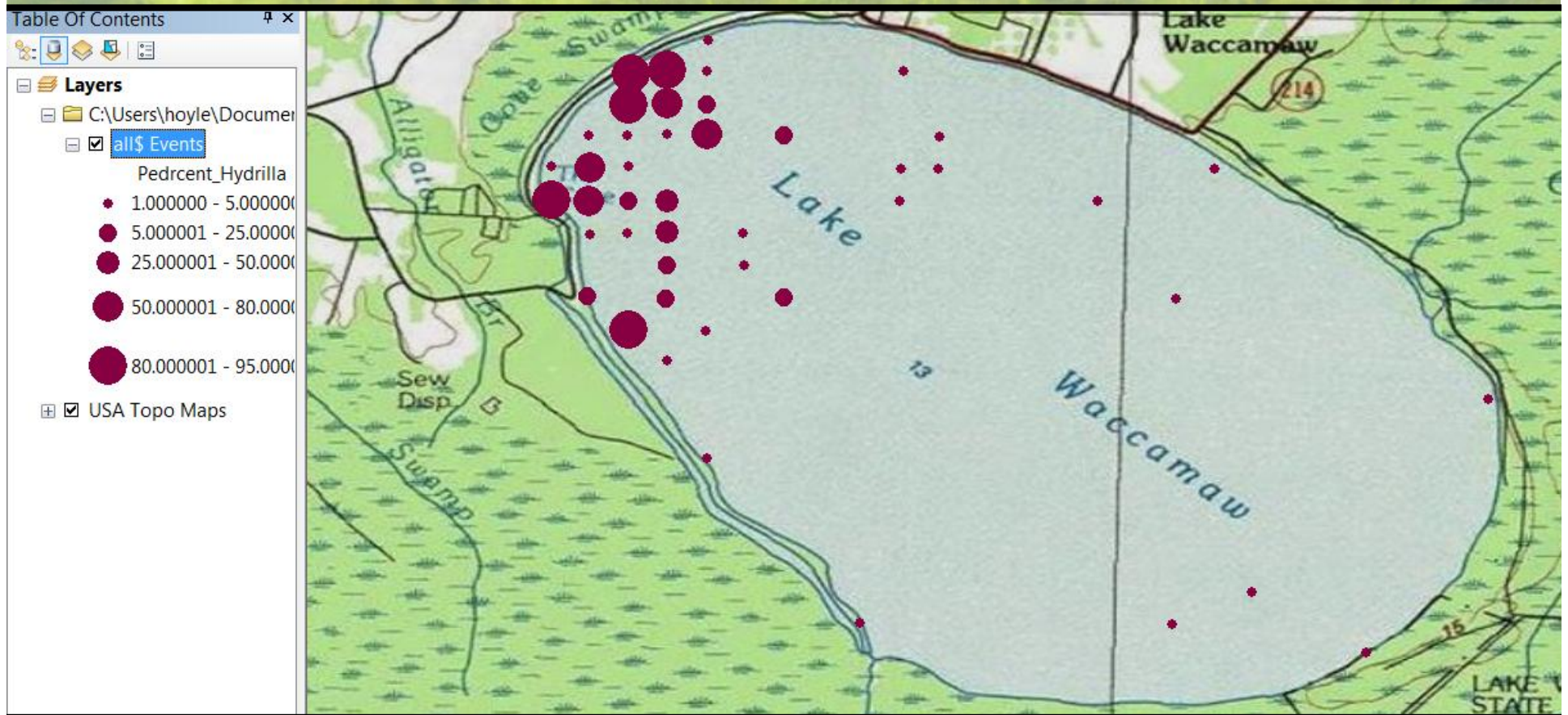
Native Species



Hydrilla



Hydrilla in Sample



Conclusion

- ▣ Hydroacoustic technology has the potential to provide NC aquatic plant managers vigorous quantitative tactics to gauge rank and trends in SAV abundance and composition. Combining cloud-based software with the described methodology will produce genuine maps identifying invasive conditions and provide foundation for decisive management interventions to reduce ecological and environmental impacts.

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Questions?

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