Hydrilla (*Hydrilla verticillata*) Monitoring in the Croton River/Bay and Nearby Waters of the Hudson River

By Chris Doyle, CLM

Senior Aquatic Biologist and Water Quality Supervisor

SOLITUDE LAKE MANAGEMENT

Restoring Balance. Enhancing Beauty.

Hydrilla (*Hydrilla verticillata*) Monitoring in the Croton River/Bay and Nearby Waters of the Hudson River

This Project was funded by and prepared for the Hudson River Estuary Program, New York State Department of Environmental Conservation, with support from the New England Interstate Water Pollution Control Commission

NEIWPCC
New England Interstate Water Pollution Control Commission

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Hudson River Estuary Program

A Program of the New York State Department of Environmental Conservation

The Viewpoints expressed here do not necessarily represent those of NEIWPCC or NYSDEC, nor does mention of trade names, commercial products, or causes constitute endorsement or recommendation for use

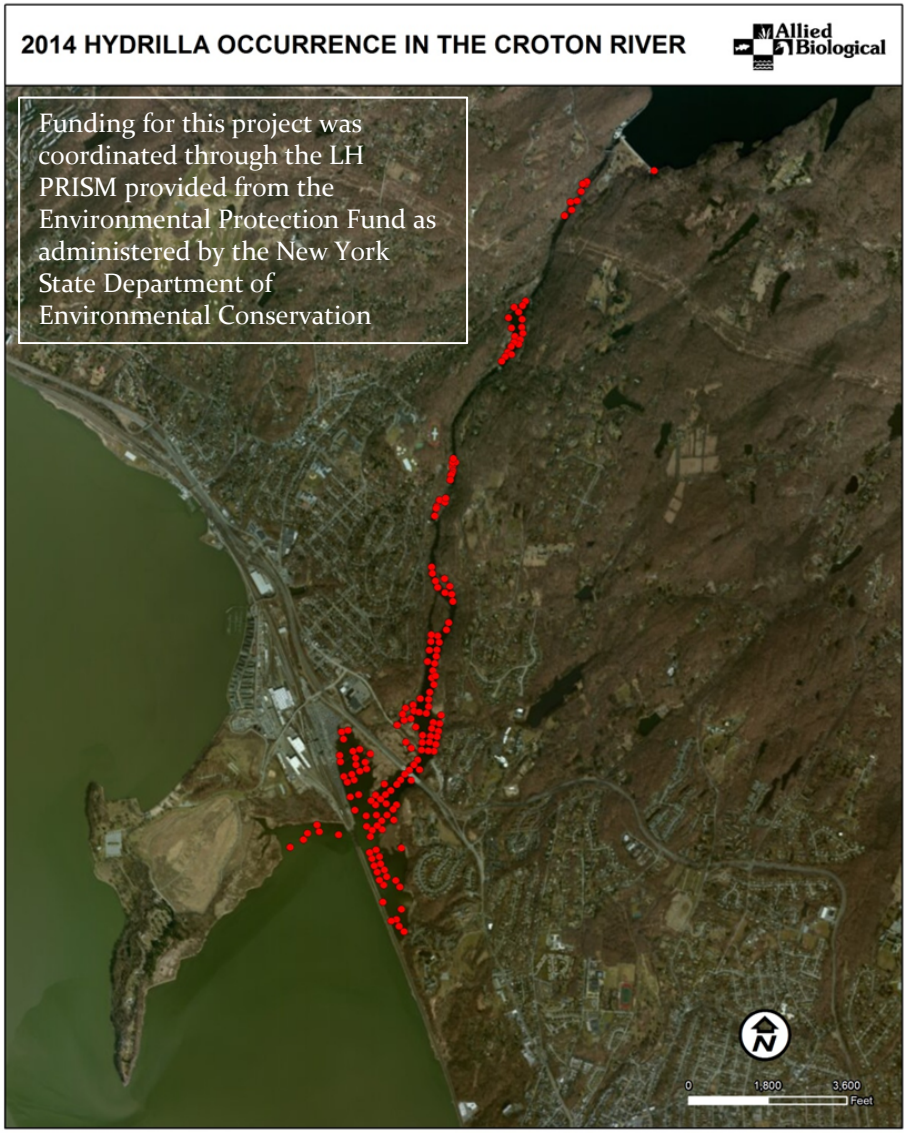
Initial Discovery

Croton River, NY

- October 19,2013
- NY Botanical Garden Survey of Rare Plants
- Confirmed by S. Kishbaugh
- Non-rooted fragments and rooted plants observed

2014 Results

- GPS-referenced Point Intercept (PIM)Survey:
  - Followed Methods Used at Cayuga Inlet
  - 50 meter grid
  - 2 weed rake tosses/site
- 354 Sites in Nine Locations
- **Hydrilla occurred at 42.3% of the sites surveyed**



Project Goals

- Conduct GPS-referenced PIM Aquatic Plant Surveys at Selected Sites Along the Hudson River
- Target Plants: Hydrilla and Wild Celery
  - But collect data on all SAV present
- Hydrilla Tuber Sampling
  - At the Croton River/Bay
  - Any additional sites where we find Hydrilla
- Additional Goals Added
  - Wild Celery Pilot Planting Sites
  - Future Hydrilla Monitoring Priority Ranking

Point Intercept Aquatic Plant Surveys

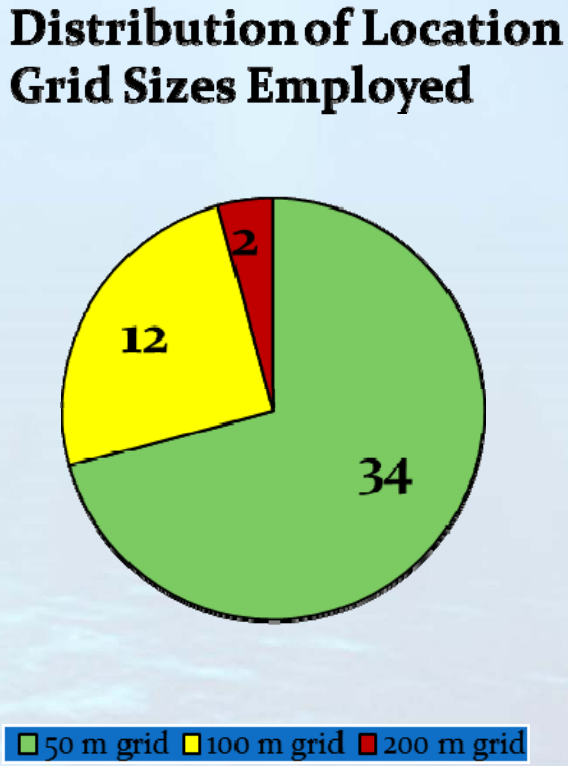
Abundance	Abundance #	Dry Weight (g/m^2)	Mean Weight (g/m^2)	Description
No Plants ("0")	0	0.0	0.0	Bare Rake
Trace ("T")	1	~0.0001-0.9999	0.5	Finger-full
Sparse ("S")	2	~1.0000-24.9999	13.0	Hand-full
Medium ("M")	3	~25.0000-99.9999	62.5	Covers Rake
Dense ("D")	4	~100.0000-400.0000+	250.0	Difficult to get plant mass into the boat

Original Project Specifications

- **25 Sampling Locations**
  - LH PRISM RFP
    - 24 Additional Sites
- 200 m x 200 m grid
- Min. 6 GPS-referenced sites/location
- Two weed rake tosses per site
- All Field Sampling August 15 (Saturday!) to October 15
  - 43 Field Days (excluding holiday and weekends)
- Tuber Monitoring at Croton River/Bay
  - Plus any sites where we find Hydrilla

What We Actually Did. . .

- **46 Sample Locations**
  - LH PRISM Sites Added to project
- 50 m by 50 m grid at most sites
- Min. 6 sites per location
- Field Sampling Initiated on August 17th concluded on October 15th
  - 33 days in the field sampling
- Additional Tuber Monitoring at Croton River/Bay only



Grid Size Comparison

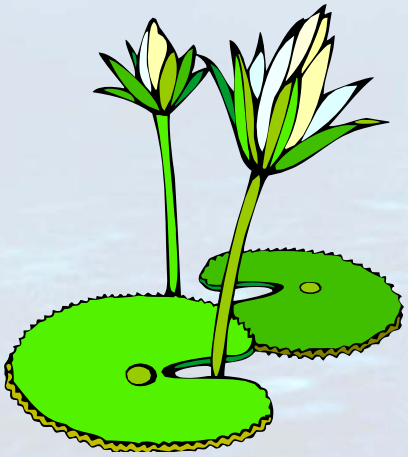
Fish Kill Creek Bay

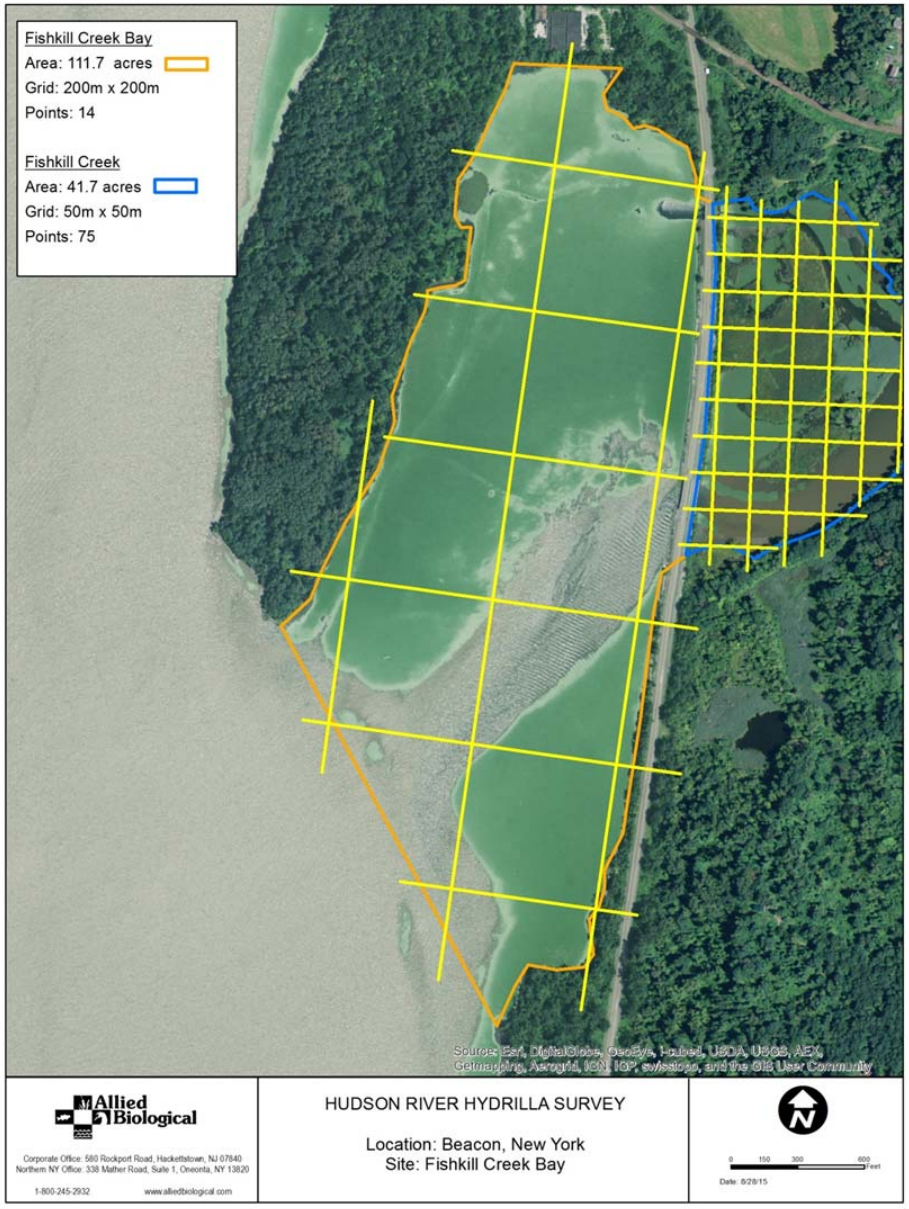
111.7 acres

- 200 m grid: 14 sites
- 100 m grid: 50 sites

Fishkill Creek

- Used 50 m grid





Sampling Locations

46 Locations

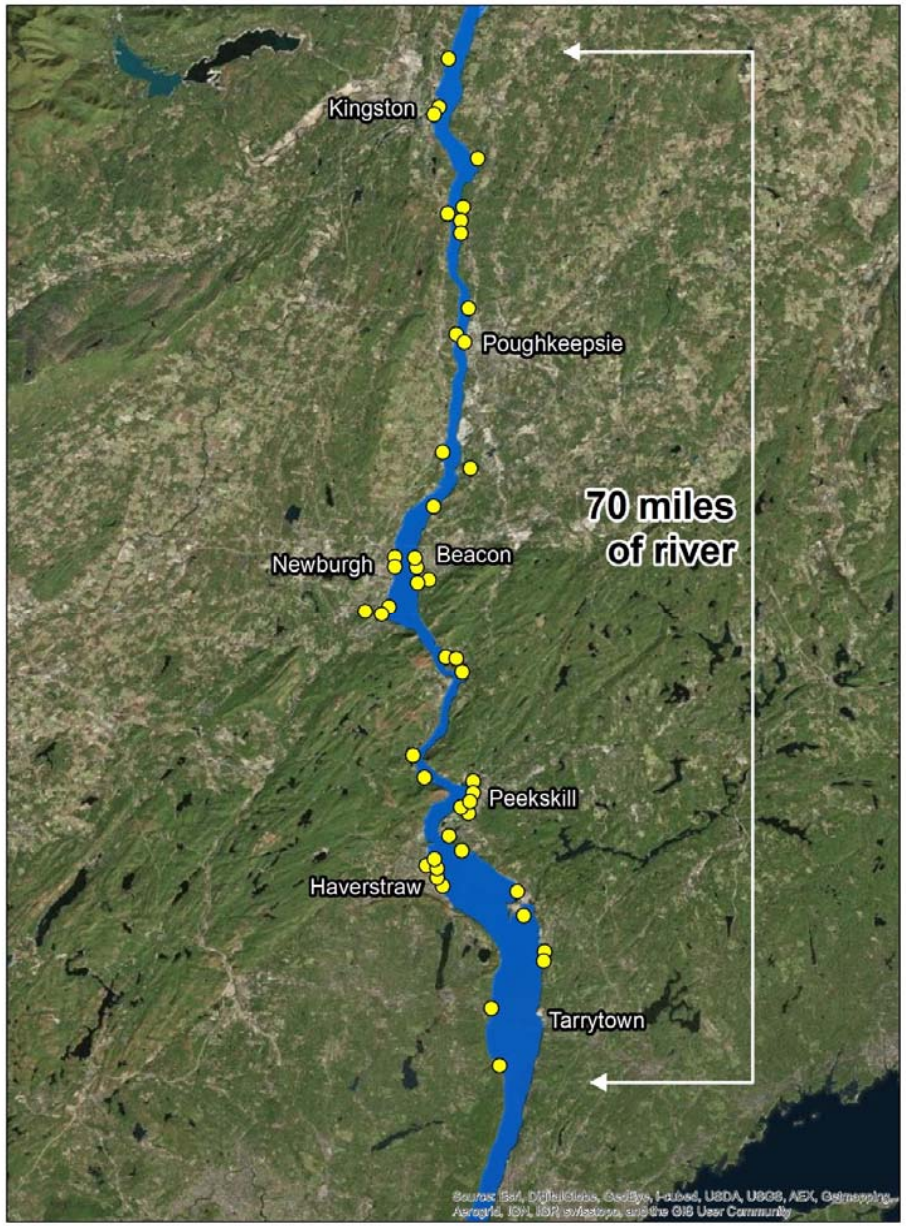
- 70 mile stretch of the Hudson River
- Six Counties
- Near Five Bridges

Selected by NYSDEC

- Added/Subst. Four

Size Range:

- .07 acres to 639 acres



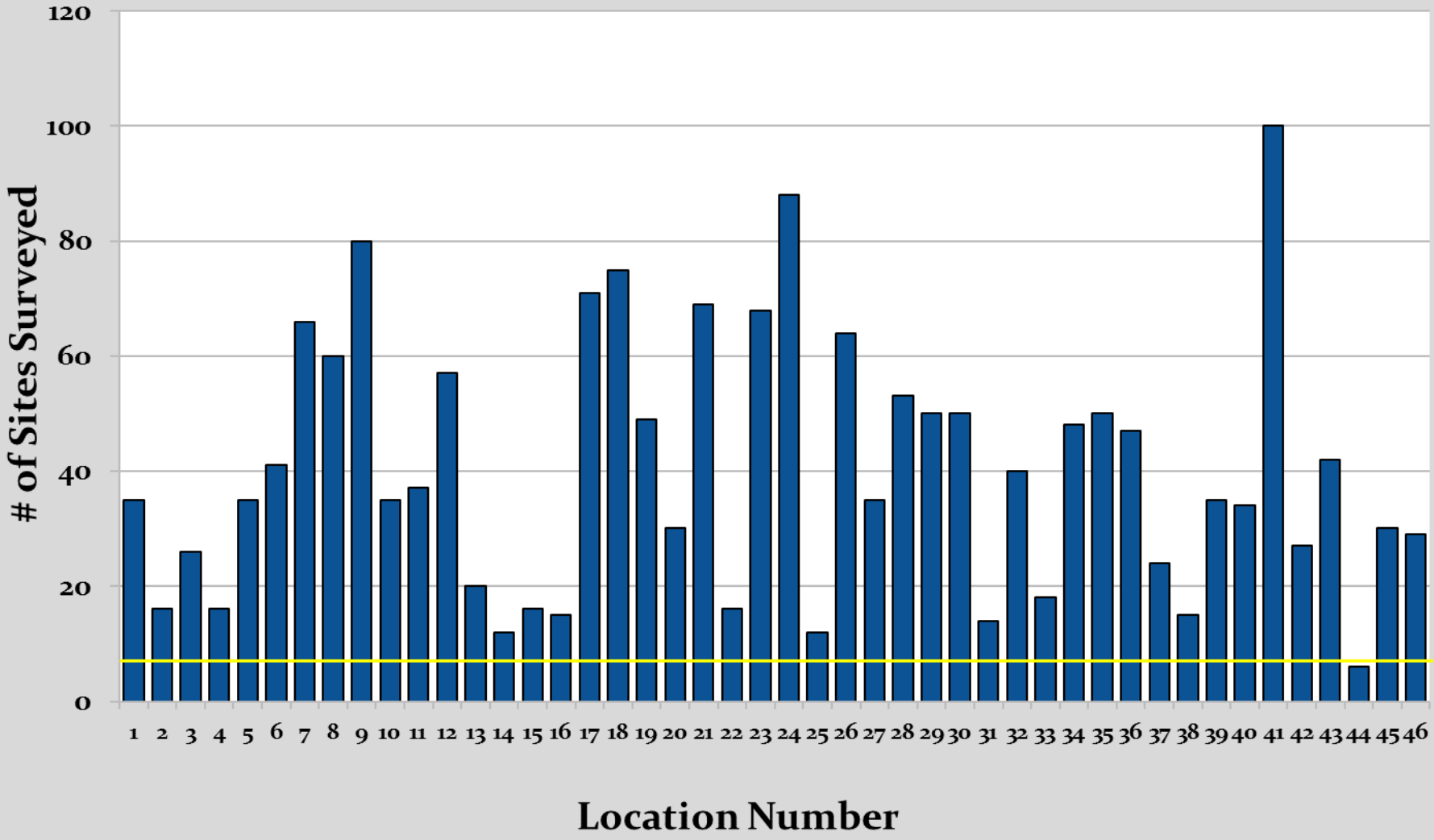
Sample Locations: Part 1

#	Date(s)	Location	Acreage	Grid Size (m)	# Sites
1	8/17/15	Bowline Point Park	72.9	100	35
2	8/18/15	Nyack Memorial Park BLS	5.0	50	16
3	8/18/15	Haverstraw Bay Park	13.7	50	26
4	8/18/15	Haverstraw Marina	58.0	100	16
5	8/19/15	Minisceongo Yacht Club	15.3	50	35
6	8/20/15	Cedar Brook Pond	82.0	100	41
7	8/24/15	Half-moon Bay	76.7	50/100	66
8	8/25/15	Georges Island Park	31.0	50	60
9	8/26/15	Piermont Marsh	330.0	50/100	80
10	8/27/15	Popolopen Creek	13.0	50	35
11	8/28/15	Viking Boat Yard	20.0	50	37
12	8/31/15	Lent's Cove	39.0	50	57
13	8/31/15	Dickie Brook	5.7	50	20
14	9/1/15	Newburgh Boat Launch Site	5.2	50	12
15	9/1/15	Front Street Marina	7.2	50	16
16	9/1/15	Sloop Hill Boat Launch Site	3.5	50	15
17	9/2/15	Croton Bay	639.0	200	71
18	9/3/15	Annsville Creek	144.5	100	75
19	9/8/15	Riverfront Green Park	43.8	50	49
20	9/8/15	Peekskill Land Park	19.0	50	30
21	9/9/15 & 9/23/15	Iona Marsh	152.0	100/200	69
22	9/14/15 & 9/23/15	Moodna Creek	13.0	50	16
23	9/14/15	Moodna Creek Bay	49.0	50	68

Sample Locations: Part 2

#	Date(s)	Location	Acreage	Grid Size (m)	# Sites
24	9/16/15 & 9/17/15	Constitution Marsh	358.0	100	88
25	9/17/15	Foundry Cove Bay	6.75	50	12
26	9/17/15	Foundry Cove	41.5	50	64
27	9/18/15	Denning's Point Cove	91.7	100	35
28	9/18/15	Riverfront Park	31.0	50	53
29	9/21/15	Wappinger's Creek	94.3	100	50
30	9/22/15	Norrie State Park	28.0	50	50
31	9/24/15	Waryas Park	7.3	50	14
32	9/24/15	Poughkeepsie Yacht Club	39.0	50	40
33	9/24/15	Hyde Park Marina	4.2	50	18
34	9/25/15	Black Creek Preserve	36.0	50	48
35	9/28/15	Fishkill Creek Bay	111.7	100	50
36	9/28/15	Fishkill Creek	41.7	50	47
37	9/29/15	Chelsea Boat Launch Site	7.0	50	24
38	9/29/15	Shepherds Landing/Mariner's	8.0	50	15
39	10/5/15	Charles Rider Boat Launch Site	24.0	50	35
40	10/5/15	Marlboro Yacht Club	13.7	50	34
41	10/6/15	Sleightsburg Park	224.0	100	100
42	10/7/15	Vanderbilt Mansion Cove	10.0	50	27
43	10/7/15	Vanderburgh Cove	98.6	100	42
44	10/9/15	Scarborough Park	0.7	50	6
45	10/9/15	Kemey's Cove	12.0	50	30
46	10/15/15	Kingston Point Park Marsh	31.0	50	29

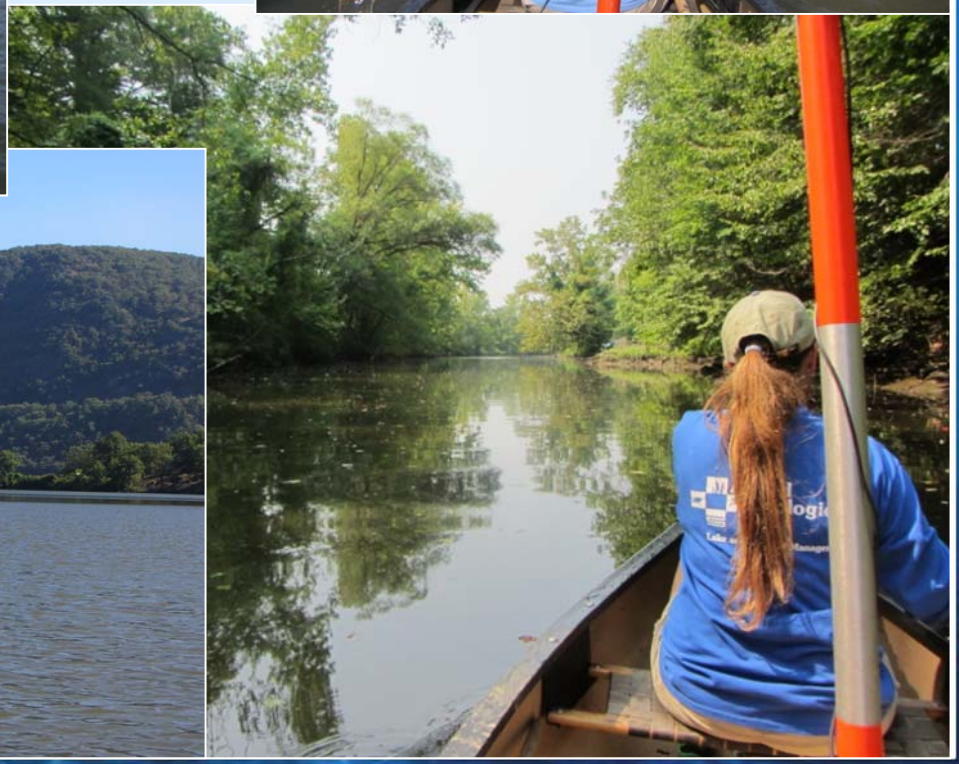
Sites Surveyed by Location

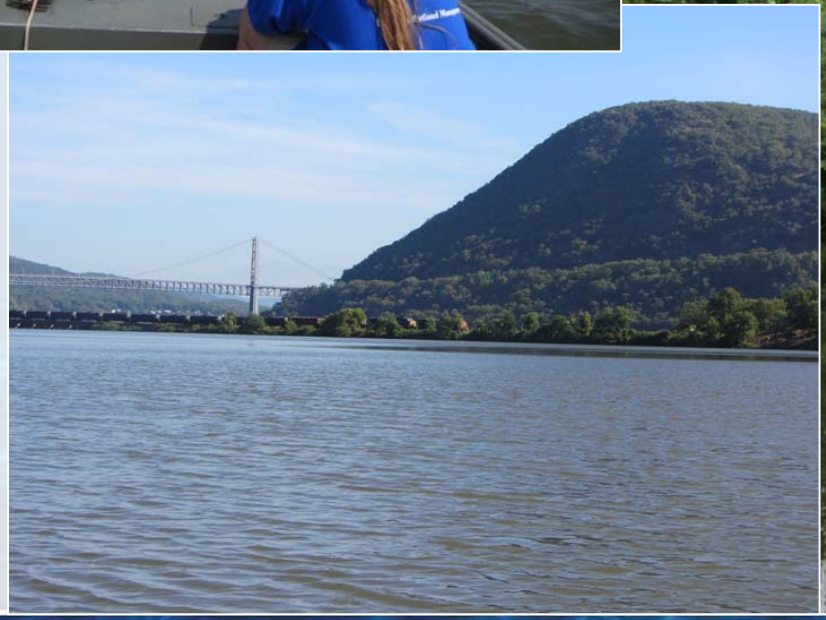


Project Challenges

- **Time**
  - ~ 6 weeks from RFP release to field sampling
  - 43 available field days
  - ~ 4 weeks draft report (11/20/15)
- **Tides**
- **Weather**
  - Wind at open water sites (canoe)
  - 11 of the first 16 sampling days were greater than 90°F
- **Location Variability**
- **Location Access**

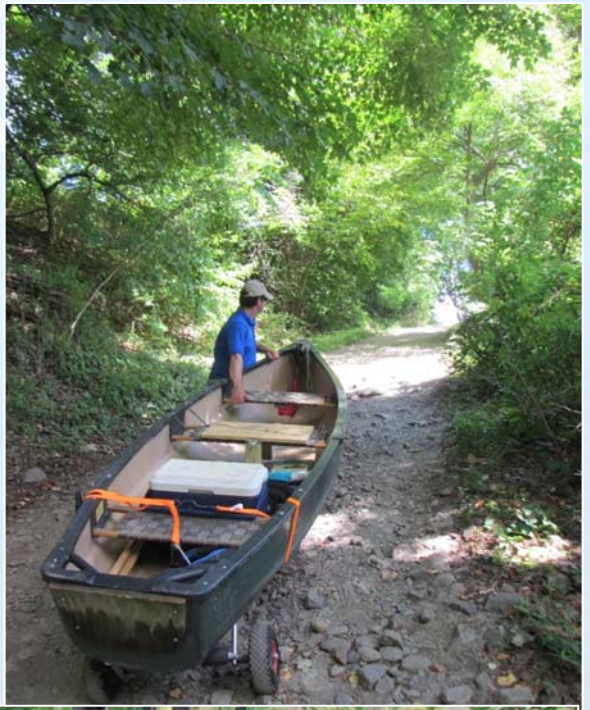
Location Variability





Location Variability

Location Access



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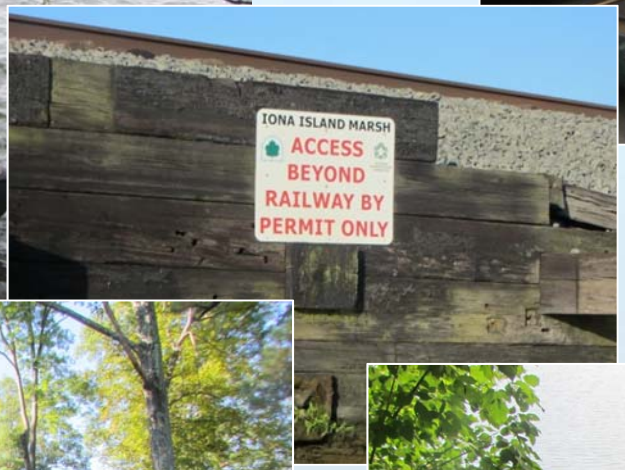
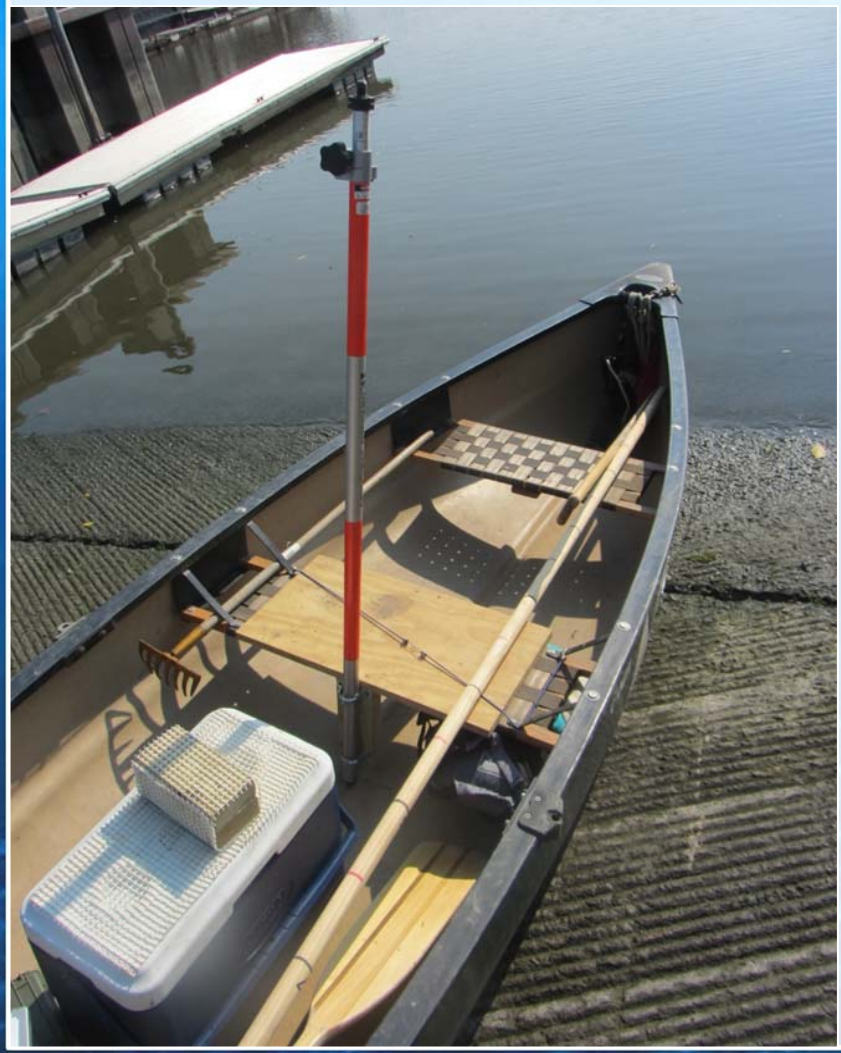
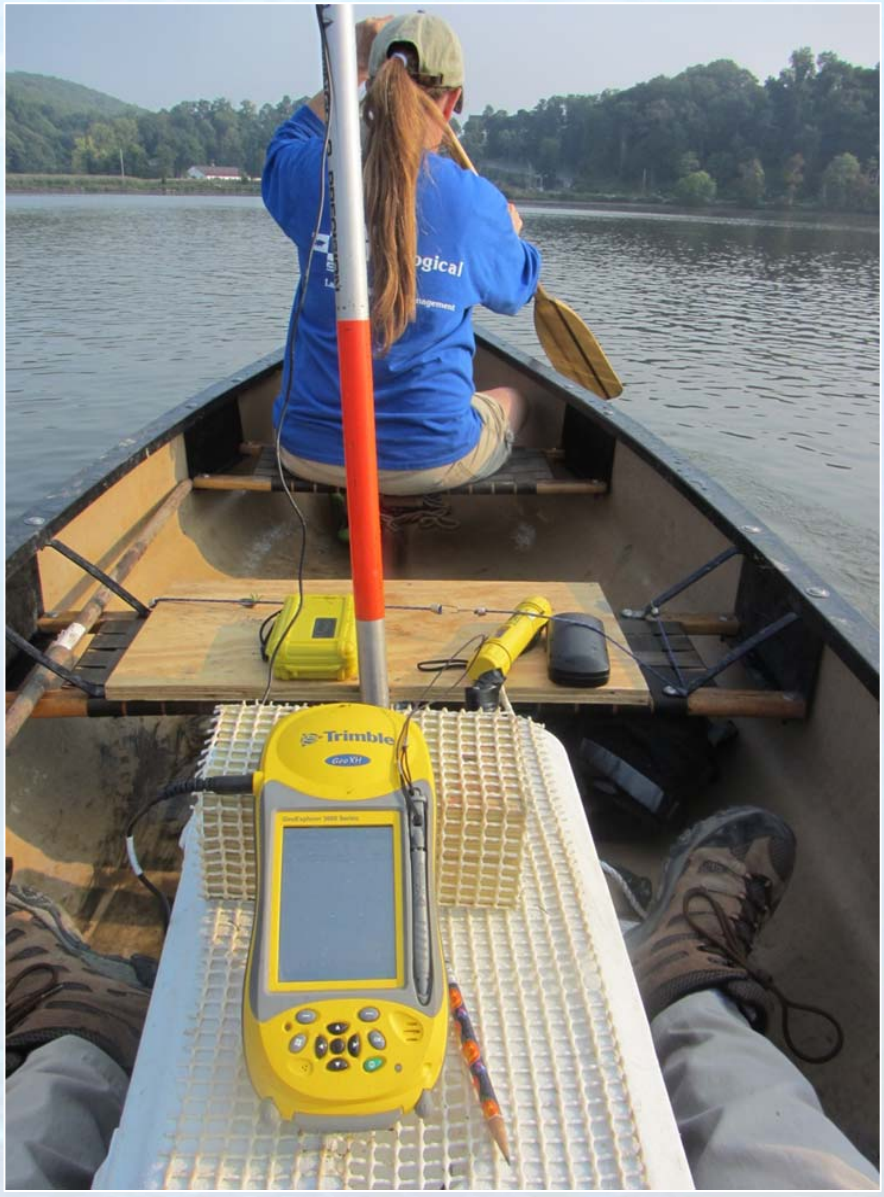


Location Access

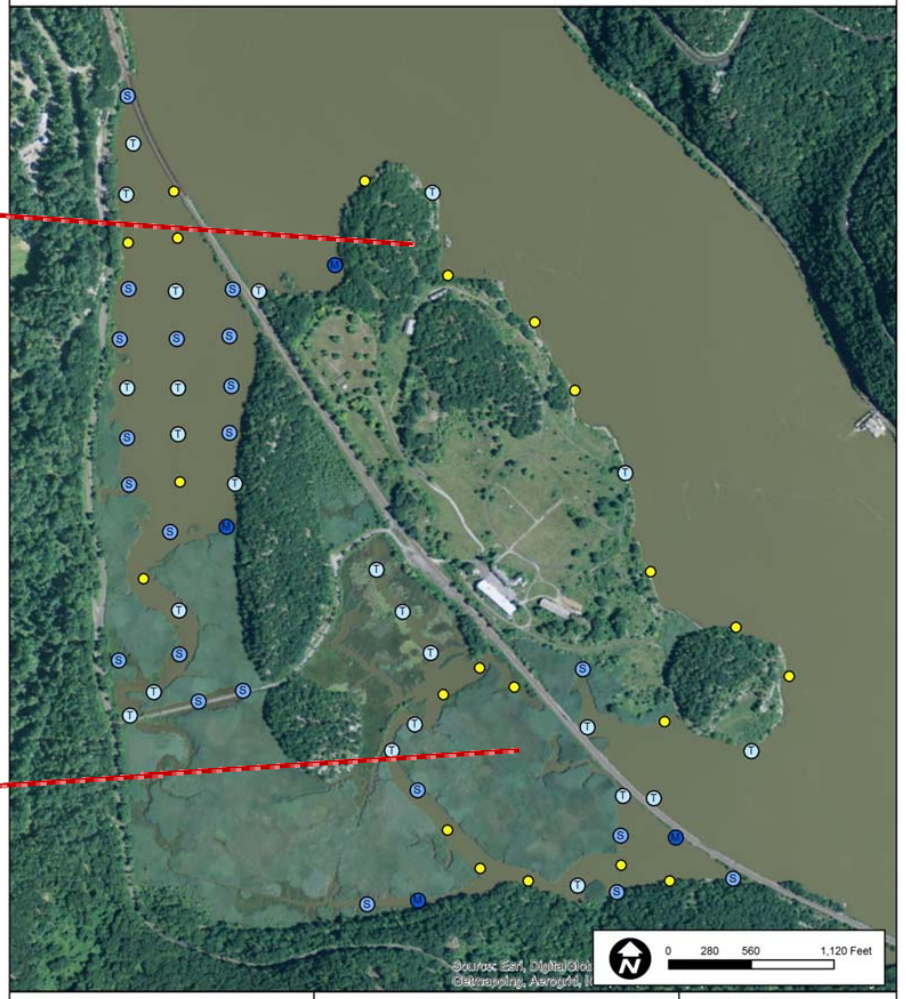
Our Office on Most Days





OVERALL AQUATIC PLANT ABUNDANCE

IONA MARSH
Hudson River Hydrilla Monitoring
September 9 and 23, 2015



Percent Distribution

Abundance	Sites	Percent
Total	**48**	**70%**
Trace	23	48%
Sparse	21	44%
Medium	4	8%
Dense	0	0%

Plant Density

- No Plants
- Trace Plants
- Sparse Plants
- Medium Plants
- Dense Plants

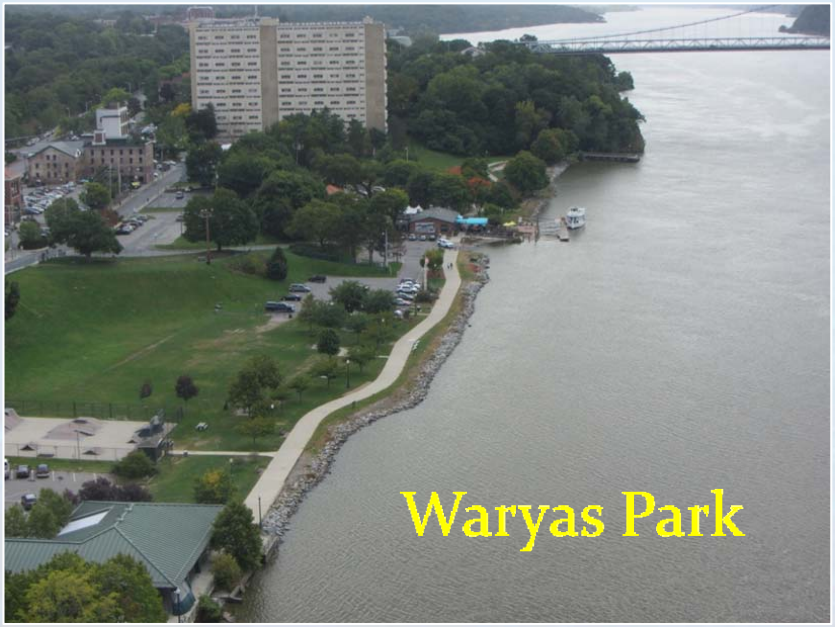
Project Code: 2015-020

Allied Biological

Date: 10/28/15
Prepared by: KM

Two More Locations

As seen from atop the Walkway over the Hudson



Visual Observations Supplemented GPS-Referenced Sites

Where Did We Find Hydrilla?

Results: Aquatic Plants

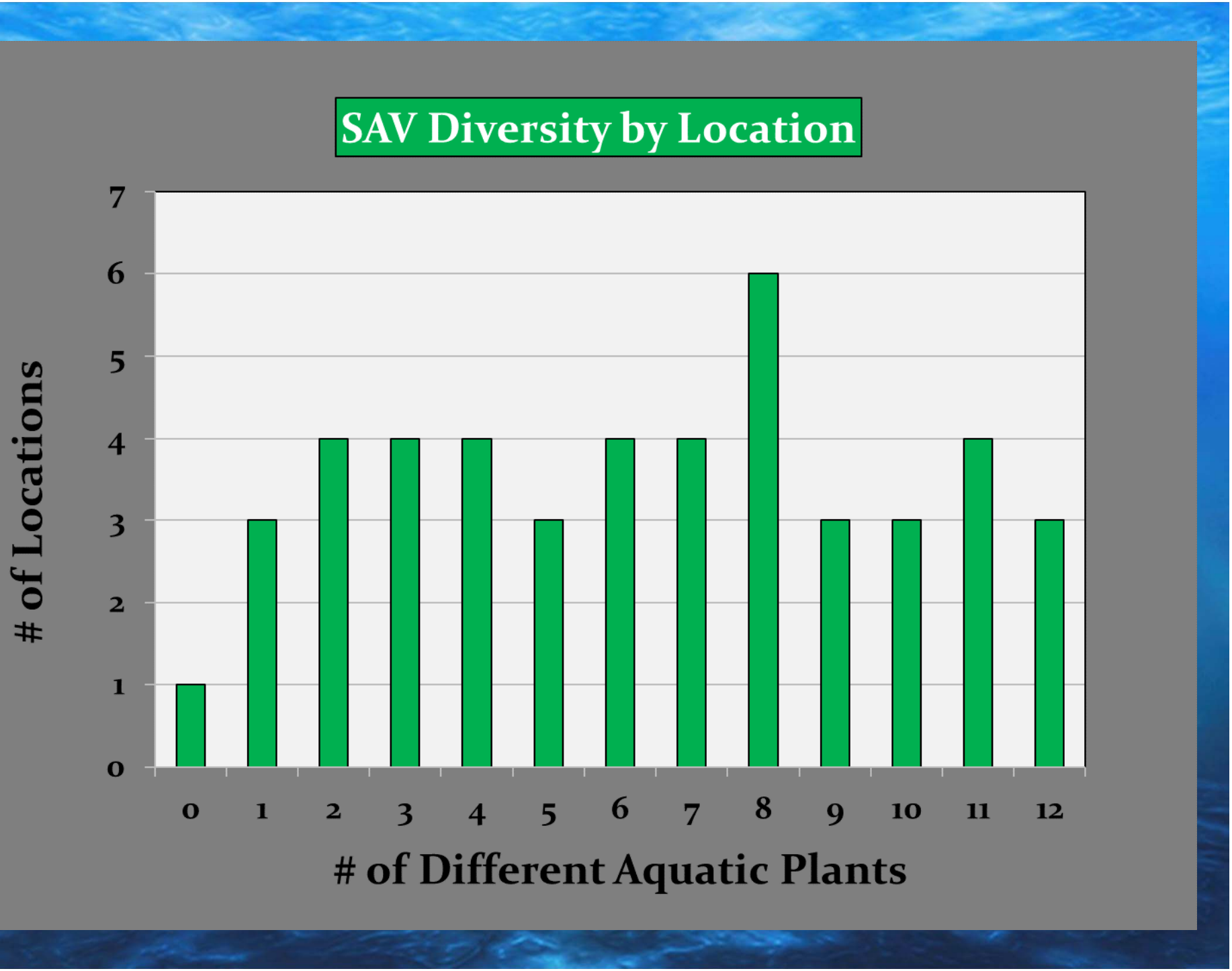
#	Aquatic Plant	Scientific Name	# of Occurrences	% Occurrence	# of Locations
1	Small Duckweed	*Lemna minor*	585	31.8%	35
2	Eurasian Water Milfoil	*Myriophyllum spicatum*	517	28.1%	35
3	Coontail	*Ceratophyllum demersum*	358	19.5%	33
4	Water Chestnut	*Trapa natans*	209	11.4%	18
5	Brittle Naiad	*Najas minor*	184	10.0%	19
6	Common Waterweed	*Elodea canadensis*	179	9.7%	17
7	Wild Celery	*Vallisneria americana*	169	9.2%	23
8	Great Duckweed	*Spirodela polyrhiza*	158	8.6%	16
9	Spatterdock	*Nuphar variegata*	110	5.9%	15
10	Common Watermeal	*Wolffia columbiana*	66	3.6%	4
11	Horned Pondweed	*Zannichellia palustris*	64	3.5%	7
12	Northern Naiad	*Najas gracillima*	61	3.3%	12
13	Benthic Filamentous Algae		59	3.2%	19
14	Water Fern	*Azolla caroliniana*	38	2.1%	2
15	Spikerush sp.	*Eleocharis* sp.	22	1.2%	3
16	Water Stargrass	*Zosterella dubia*	20	1.1%	6
17	Sago Pondweed	*Stuckenia pectinata*	18	0.9%	7
18	Arrowhead (rosette)	*Sagittaria sp.*	10	0.5%	3
19	Giant Arrowhead	*Sagittaria montevidensis* ssp *spongiosa*	9	0.5%	3
20	Heart Pondweed	*Potamogeton perfoliatus*	5	0.3%	1
21	Slender Naiad	*Najas flexilis*	3	0.2%	3
22	Curly-leaf Pondweed	*Potamogeton crispus*	2	0.1%	2
23	White Lily	*Nymphaea odorata*	2	0.1%	2
24	Ditch Grass	*Ruppia maritima*	2	0.1%	1
25	Small Bladderwort	*Utricularia minor*	2	0.1%	2
26	Stonewort	*Nitella* sp.	1	0.1%	1
27	Watermoss	*Fontinalis* sp.	1	0.1%	1
28	Bassweed	*Potamogeton amplifolius*	1	0.1%	1
29	Long-leaf pondweed	*Potamogeton nodosus*	0	0.0%	1

Notes

- 1,838 GPS-referenced Sites at 46 Different Locations
  - Two tosses per site = 3,676 total weed rake tosses
- 1,102 sites had aquatic plants
  - 59.95% of the sites
- Most Plants collected at >5% of the sites
- Four Invasive Species
- Two Macro-algae
- Six Pondweeds and Three Naiads

Factors that Limit SAV Growth in the Hudson River and Nearby Waters

- Turbidity
  - SAV limited to 3.0 ft.
- Tides
  - Salinity
  - Depth Fluctuation
    - ~ 2.5 to 4.0 ft.
- Wind
- Shoreline/Substrate
- Water Depth


SAV Diversity by Location
# of Locations
0
1
2
3
4
5
6
7
0
1
2
3
4
5
6
7
8
9
10
11
12
# of Different Aquatic Plants

Example Data Summary

Norrie State Park

Aquatic Macrophyte Abundance Distribution
September 22, 2015

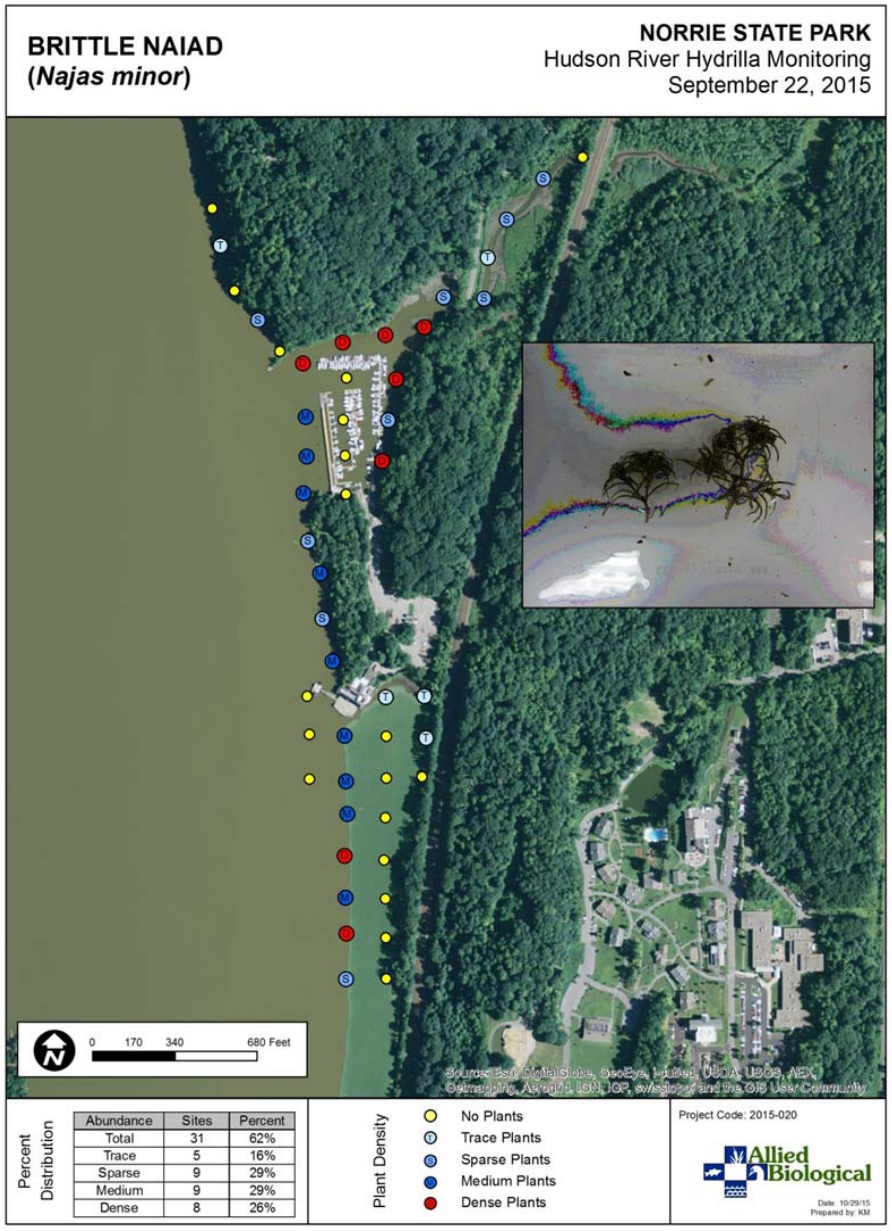
Aquatic Macrophytes	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	50	100%								
Overall Plant Abundance	40	80%	8	20%	5	13%	13	33%	14	35%
Small Duckweed	33	66%	19	58%	10	30%	2	6%	2	6%
Brittle Naiad	31	62%	5	16%	9	29%	9	29%	8	26%
Eurasian Water Milfoil	29	58%	13	45%	10	34%	5	17%	1	3%
Coontail	18	36%	16	89%	1	6%	1	6%	0	0%
Great Duckweed	16	32%	14	88%	2	13%	0	0%	0	0%
Northern Naiad	16	32%	8	50%	6	38%	2	13%	0	0%
Water Chestnut	15	30%	8	53%	5	33%	1	7%	1	7%
Spatterdock	6	12%	4	67%	2	33%	0	0%	0	0%
Wild Celery	4	8%	3	75%	1	25%	0	0%	0	0%
Water Stargrass	4	8%	4	100%	0	0%	0	0%	0	0%
Benthic Filamentous Algae	3	6%	2	67%	1	33%	0	0%	0	0%
Common Waterweed	2	4%	1	50%	0	0%	1	50%	0	0%

Sample Maps

384 Total Maps!

- Maps Per Location:
  - Site Location
  - Total Vegetation
  - Each Plant Species

- Example: If a Location had 10 different plants, we generated 12 maps for that Location.



Recommended Future Hydrilla Monitoring Priority

Factors to Consider

- SAV Habitat observed
- The Proximity to Croton River System
- Plant Diversity
- Elodea Present?

Volunteers?

Low Priority	Moderate Priority	High Priority
Nyack Memorial Park BLS	Bowline Point Park	Half-moon Bay
Haverstraw Bay Park	Cedar Brook Pond	Georges Island Park
Haverstraw Marina	Lent's Cove	Popolopen Creek
Minisceongo Yacht Club	Moodna Creek	Dickie Brook
Piermont Marsh	Hyde Park Marina	Croton Bay
Viking Boat Yard	Fishkill Creek Bay	Annsville Creek
Newburgh Boat Launch Site	Marlboro Yacht Club	Iona Marsh
Front Street Marina	Vanderbilt Mansion Cove	Moodna Creek Bay
Sloop Hill Boat Launch Site		Constitution Marsh
Riverfront Green Park		Foundry Cove Bay
Peekskill Land Park		Foundry Cove
Denning's Point Bay		Wappinger's Creek
Riverfront Park		Norrie State Park
Waryas Park		Black Creek Preserve
Poughkeepsie Yacht Club		Fishkill Creek
Chelsea Boat Launch Site		Sleightsburg Park
Shepherd's Landing/Mariners		Vanderburgh Cove
Charles Rider Boat Launch Site		Kemey's Cove
Scarborough Park		Kingston Point Park Marsh

Tuber Monitoring

- Conducted October 13, 2015 by North Carolina State University Staff

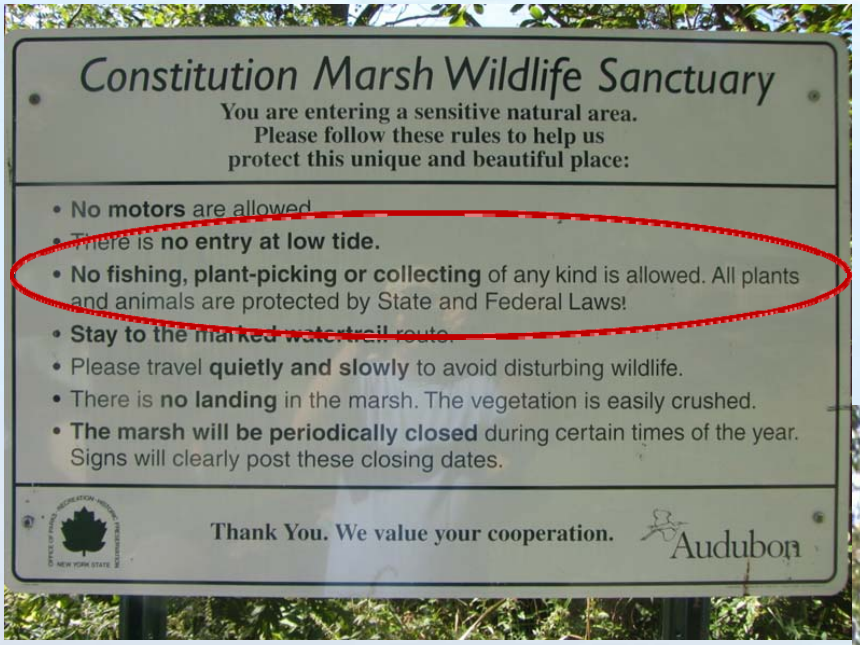
Site	Location	Cores	Tubers	Turions	T/M^2
1	Black Rock Park 1	10	13	1	161.499
2	Black Rock Park 2	28	64	0	283.9543
3	Lower Croton River 1	8	2	0	31.0575
4	Lower Croton River 2	10	24	0	298.152
5	Lower Croton River 3	10	7	0	86.961
6	Croton Bay 1	10	0	0	0
7	Croton Bay 2	10	0	0	0

The Worst Part of the Project

- We spent an estimated 115 hours driving to and from locations!

The Best Part of the Project

Signs


Constitution Marsh Wildlife Sanctuary
You are entering a sensitive natural area.
Please follow these rules to help us
protect this unique and beautiful place:
• No motors are allowed.
• There is no entry at low tide.
• No fishing, plant-picking or collecting of any kind is allowed. All plants and animals are protected by State and Federal Laws!
• Stay to the marked watertrail route.
• Please travel quietly and slowly to avoid disturbing wildlife.
• There is no landing in the marsh. The vegetation is easily crushed.
• The marsh will be periodically closed during certain times of the year. Signs will clearly post these closing dates.
Thank You. We value your cooperation.
Audubon


USE
BOAT RAMP
AT YOUR
OWN RISK


STOP
DANGER
ROAD ENDS
BOAT LAUNCHING
RAMP


Save our SAV!
Shallow waters around this boat launch are important habitat for submerged aquatic vegetation (SAV).
These underwater plants pump life-giving oxygen into the water and provide food and shelter for fish and waterfowl.
Please do not uproot the plants. Damage can last for years.

Acknowledgements

- Sandra LaVigne, ABI (Field)
- Krista Michniewicz, Solitude (maps)
- Cathy McGlynn, NYSDEC
- Dan Miller, NYSDEC
- Michael Jennings, NEIWPCC
- Barre Hellquist

Thank you!
Questions?

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