

Ten Years of Aquatic Vegetation Data Analyzed Through Floristic Quality Index at Lake Waccabuc, NY

By: Emily Mayer
Aquatic Biologist

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AGENDA

1. About Lake Waccabuc
2. Historical Management at Lake Waccabuc
3. Point Intercept Methodology
4. 2018 Results
5. FQI Method + Results
6. Summary of Findings
7. Future Management



About Lake Waccabuc

- Lake Waccabuc: 138 surface acres
- Connected Three Lake system
(Lake Waccabuc, Lake Oscaleta and Lake Rippowam)
- Uses: recreational activities
(swimming and fishing)
- Management History: hand pulling
- 3LC hired SLM (previously Allied Biological, Inc.)
in 2008
- Performed aquatic SAV surveys

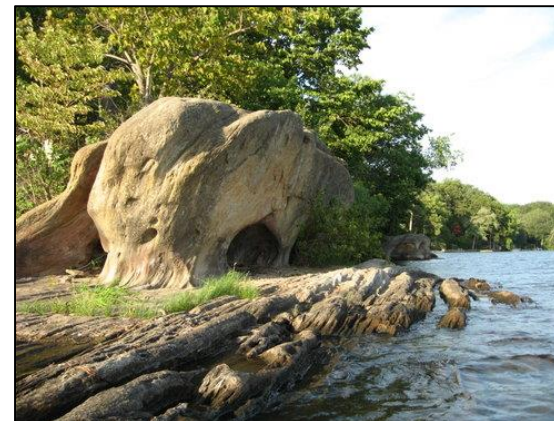


Photo Credit :Waccabuc Landowners Council. (2019). Historic Structures. Retrieved April 26, 2019, from Waccabuc Landowners Council website:
<https://www.waccabuc.org/lake-waccabuc>

Historical Management of Lake Waccabuc

- Brazilian Elodea discovered in 2008
 - Suction Harvesting conducted via DASH (2009)
 - Additional monitoring conducted by residents
- No Brazilian Elodea found since 2010
- Other Invasives found over the years:
Brittle Naiad, EWM, Water Chestnut, Curly-leaf Pondweed
- Aquatic Plant Surveys Performed Yearly (2008 - 2018)
 - 2008, 2016 and 2018 all three basins surveyed
- Zooplankton, phytoplankton collection since 2013
(once a year)
- CSLAP Program – D.O. profiles annually



Photo Credit: Google Earth
SLM, 2008

Point Intercept Methodology (PIM)

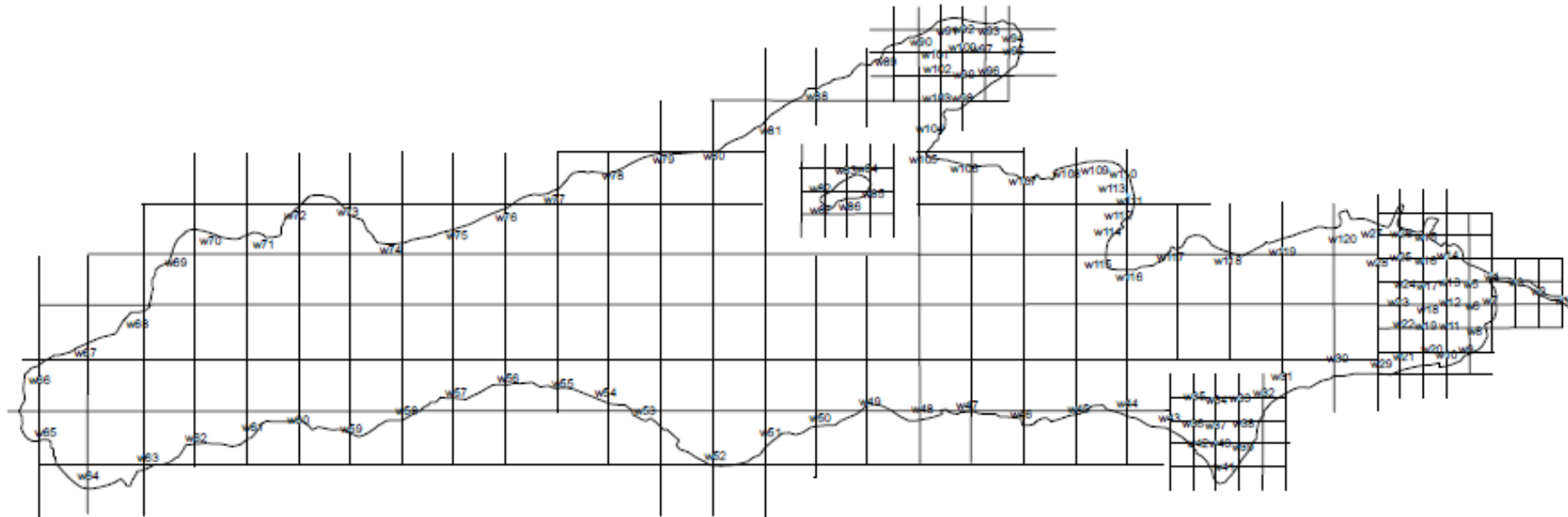
- Developed ACOE, and modified by Cornell University - accepted methodology by Regulators (NYSDEC) and Lake Scientists
- ArcGIS to overlay a grid to pre-determine # of GPS-referenced sampling stations
- Utilizing a Trimble GeoXH (sub-foot accuracy)
- **Why Conduct a PIM Aquatic Veg. Survey?**
 - Establish Baseline Plant Community
 - Repeatable over Time
 - Determine the Efficacy/Suitability of Control Programs
 - Determine the Timing and Type of Control
 - Identify Emerging Invasive Species (hydrilla, water chestnut)
 - Identify RTE Species



Waccabuc Aquatic Veg Survey
August 2010

Shoreline Grid: 225 ft x 225 ft (approx 51 pts)
Cove Grid: 100 ft x100 ft (approx 56 pts)

0 280 560 1,120
Feet



Rake Densities

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



Eurasian Water Milfoil (*Myriophyllum spicatum*) Distribution



Lake Waccabuc
Aquatic Vegetation Survey
July 20 & 31, 2018

Total Sample Sites: 120

Plant Density
Legend

- = No Plants
- ⊙ = Trace Plants
- ⊙ = Sparse Plants
- ⊙ = Medium Plants
- = Dense Plants

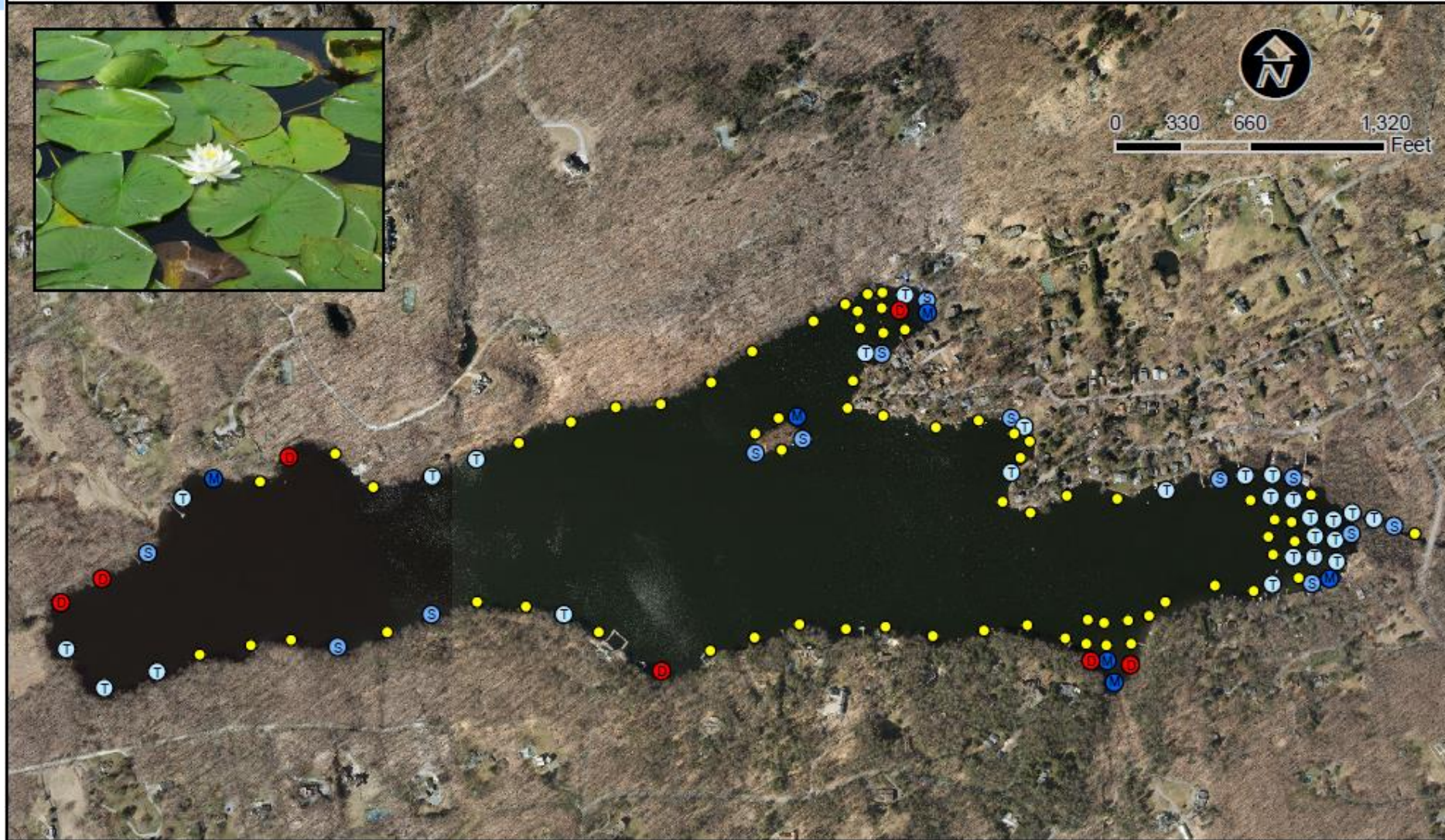
Percent
Distribution

Abundance	Sites	Percent
Total	75	63%
Trace	74	99%
Sparse	1	1%
Medium	0	0%
Dense	0	0%

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White Water Lily (*Nymphaea odorata*) Distribution



**Lake Waccabuc
Aquatic Vegetation Survey
July 20 & 31, 2018**

Total Sample Sites: 120

Plant Density
Legend

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

Percent
Distribution

Abundance	Sites	Percent
Total	52	43%
Trace	26	50%
Sparse	13	25%
Medium	6	12%
Dense	7	13%

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2018 SAV Summary

- **Performed on July 20th and 31**
- Via Canoe/ prop boat
- ~ 12 hours on the water
- **120 GPS-referenced Stations**
- **Aquatic Plants at a Glance**
 - Submersed: 15 (including arrowhead rosette)
 - **Invasive Species: 2**
 - Pondweeds: 7
 - Native Milfoil: 1
 - Algae: 2
 - Bladderwort: 1
 - Floating-plants: 8



Photo Credits: SLM, 2008

2018 Results

Lake Waccabuc
Aquatic Macrophyte Abundance Distribution
July 20 & 31, 2018

	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
TOTAL SITES	120									
TOTAL SUBMERSED VEGETATION	95	79%	55	58%	23	24%	10	11%	7	7%
EURASIAN WATER MILFOIL	75	63%	74	99%	1	1%	0	0%	0	0%
COONTAIL	53	44%	41	77%	9	17%	1	2%	2	4%
BENTHIC FILAMENTOUS ALGAE	46	38%	27	59%	11	24%	6	13%	2	4%
BASSWEED	39	33%	30	77%	5	13%	1	3%	3	8%
WATER STARGRASS	30	25%	27	90%	3	10%	0	0%	0	0%
LEAFY PONDWEED	21	18%	21	100%	0	0%	0	0%	0	0%
ARROWHEAD (ROSETTE)	12	10%	11	92%	1	8%	0	0%	0	0%
RIBBON-LEAF PONDWEED	8	7%	4	50%	1	13%	3	38%	0	0%
PONDWEED SPECIES	6	5%	6	100%	0	0%	0	0%	0	0%
BRITTLE NAIAD	5	4%	5	100%	0	0%	0	0%	0	0%
COMMON WATERWEED	4	3%	4	100%	0	0%	0	0%	0	0%
CREEPING BLADDERWORT	4	3%	3	75%	1	25%	0	0%	0	0%
DWARF WATER MILFOIL	2	2%	2	100%	0	0%	0	0%	0	0%
TOTAL FLOATING VEGETATION	64	53%	13	20%	21	33%	14	22%	16	25%
WHITE WATER LILY	52	43%	26	50%	13	25%	6	12%	7	13%
WATERSHIELD	36	30%	12	33%	12	33%	9	25%	3	8%
SPATTERDOCK	21	18%	10	48%	7	33%	1	5%	3	14%
COMMON WATERMEAL	11	9%	9	82%	2	18%	0	0%	0	0%
SMALL DUCKWEED	11	9%	10	91%	1	9%	0	0%	0	0%
FLOATING FILAMENTOUS ALGAE	10	8%	8	80%	1	10%	0	0%	1	10%
GREAT DUCKWEED	6	5%	4	67%	2	33%	0	0%	0	0%
BUR-REED	2	2%	1	50%	1	50%	0	0%	0	0%

Floristic Quality Index

Typically used for wetland or terrestrial vegetation.

- Panel of botanists determine the values (Co-efficient of Conservatism)
- 0 = Means invasive
- The higher the number associated with the native plant species the better
- Keys have now been separated into Ecoregions (updated every 5+ years)
- Modified/ supplemented for aquatic use
- What can it tell us?



Photo credits: SLM

Definitions of CC Values

<u>Table 3: Definitions of Co-efficient of Conservatism (CC)</u>	
<u>Co-efficient of Conservatism</u>	<u>Definitions</u>
0	Invasive species; low tolerance
1 – 3	Native bordering invasive level or widespread native, not a typical part of plant community
4 – 6	Native with an intermediate or narrow range of tolerances; May persist under some anthropogenic disturbances.
7 - 10	Native community with a very narrow range of tolerances, sensitive to anthropogenic disturbances

Source: (New England Water Interstate Water Pollution Control Commission, 2013)

Example of CC Values

Table 5: Aquatic Macrophyte Co-efficient Conservatism Values			
<u>Aquatic Macrophyte</u>	<u>Scientific Name</u>	<u>Coefficient Conservatism (CC)</u>	<u>Type</u>
Arrowhead (rosette)	<i>Sagittaria graminea</i> *	7	S
Bassweed	<i>Potamogeton amplifolius</i>	7	S
Benthic Filamentous Algae	-	-	A
Brazilian Elodea	<i>Egeria densa</i>	0	S
Brittle Naiad	<i>Najas minor</i>	0	S
Common Waterweed	<i>Elodea canadensis</i>	4	S
Coontail	<i>Ceratophyllum demersum</i>	4	S
Creeping Bladderwort	<i>Utricularia gibba</i>	7	S
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	0	S
Dwarf Water Milfoil	<i>Myriophyllum tenellum</i>	8	S
Eurasian Water Milfoil	<i>Myriophyllum spicatum</i>	0	S
Flat-stem Pondweed	<i>Potamogeton zosteriformis</i>	6	S
Floating Filamentous Algae	-	-	A
Floating Bur-reed	<i>Sparganium fluctuans</i> *	8	S
Great Duckweed	<i>Spirodela polyrhiza</i>	3	F
Spiral fruited Pondweed	<i>Potamogeton spirillus</i>	6	S

FQI Formula Meanings

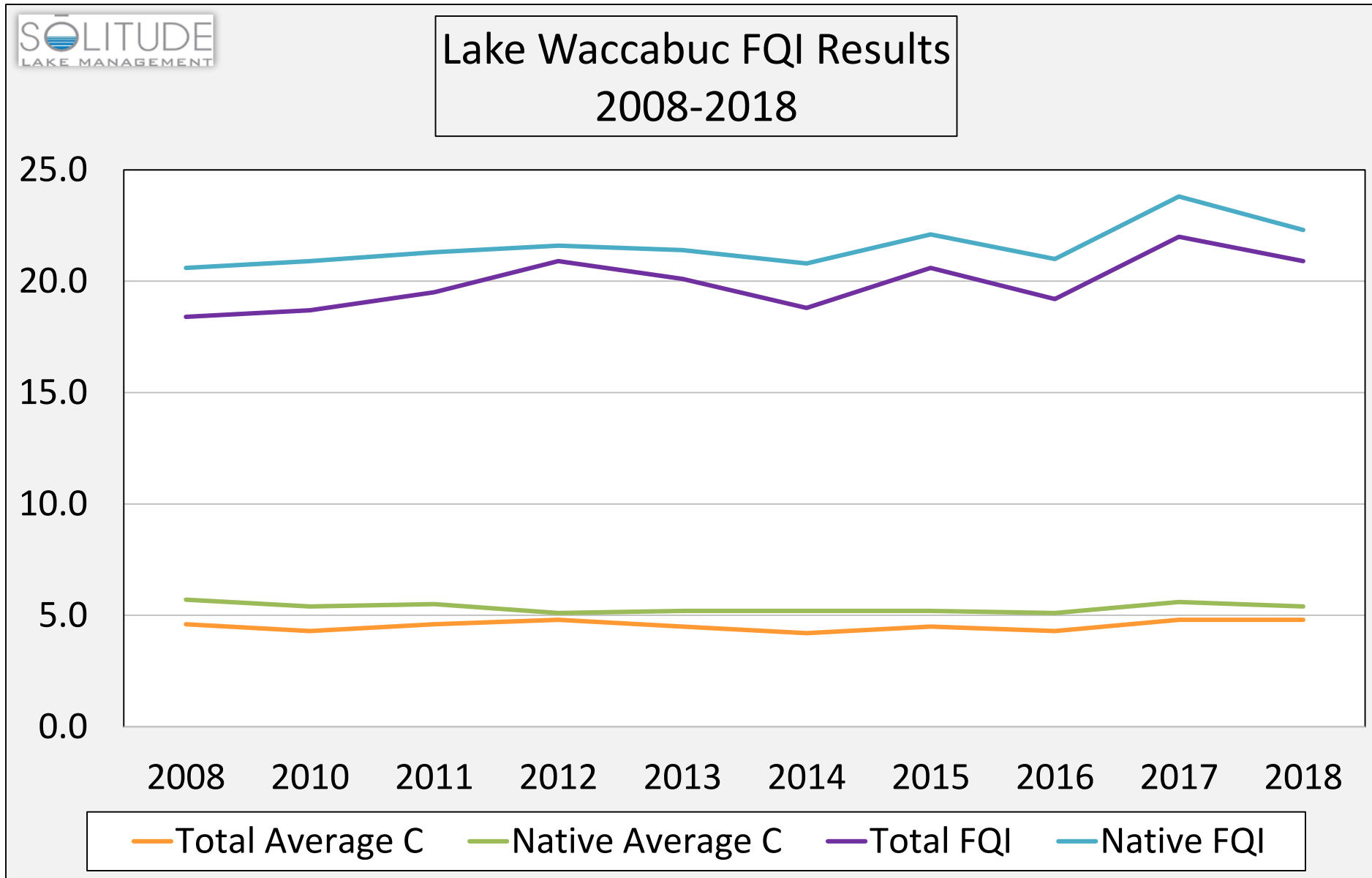
Table 4: FQI Metrics Definitions:		
<u>Metric</u>	<u>Description</u>	<u>Definition</u>
Total Mean C	$I = \bar{C}\sqrt{n}$	Mean C value for both native and non-native species
Native Mean C	Average (C_{Native})	Mean coefficient value of native species
Total FQI	Average (C_{Native} and $C_{\text{Non-Native}}$)	Only native species
Total N	Number of Native species + Number of Non-native specie	Total number of species

Source: (Mid-Atlantic Wetland Working Group, 2019)

FQI Results

Table 6: 2008 – 2018 Lake Waccabuc FQI Results										
<u>FQI Results</u>	<u>2008</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>
Total Avg C:	4.6	4.3	4.6	4.8	4.5	4.2	4.5	4.3	4.8	4.8
Native Avg C:	5.7	5.4	5.5	5.1	5.2	5.2	5.2	5.1	5.6	5.4
Total FQI:	18.4	18.7	19.5	20.9	20.1	18.8	20.6	19.2	22.0	20.9
Native FQI:	20.6	20.9	21.3	21.6	21.4	20.8	22.1	21.0	23.8	22.3
% C value 0:	18.8	21.1	16.7	5.3	15.0	20.0	14.3	15.0	14.3	10.5
% C value 1-3:	0.0	5.3	0.0	15.8	10.0	10.0	14.3	15.0	4.8	15.8
% C value 4-6:	56.3	52.6	61.1	57.9	55.0	50.0	47.6	50.0	52.4	47.4
% C value 7-10:	25.0	21.1	22.2	21.1	20.0	20.0	23.8	20.0	28.6	26.3

FQI Results



FQI Results



FQI Results: % C values
Lake Waccabuc
2008 - 2018

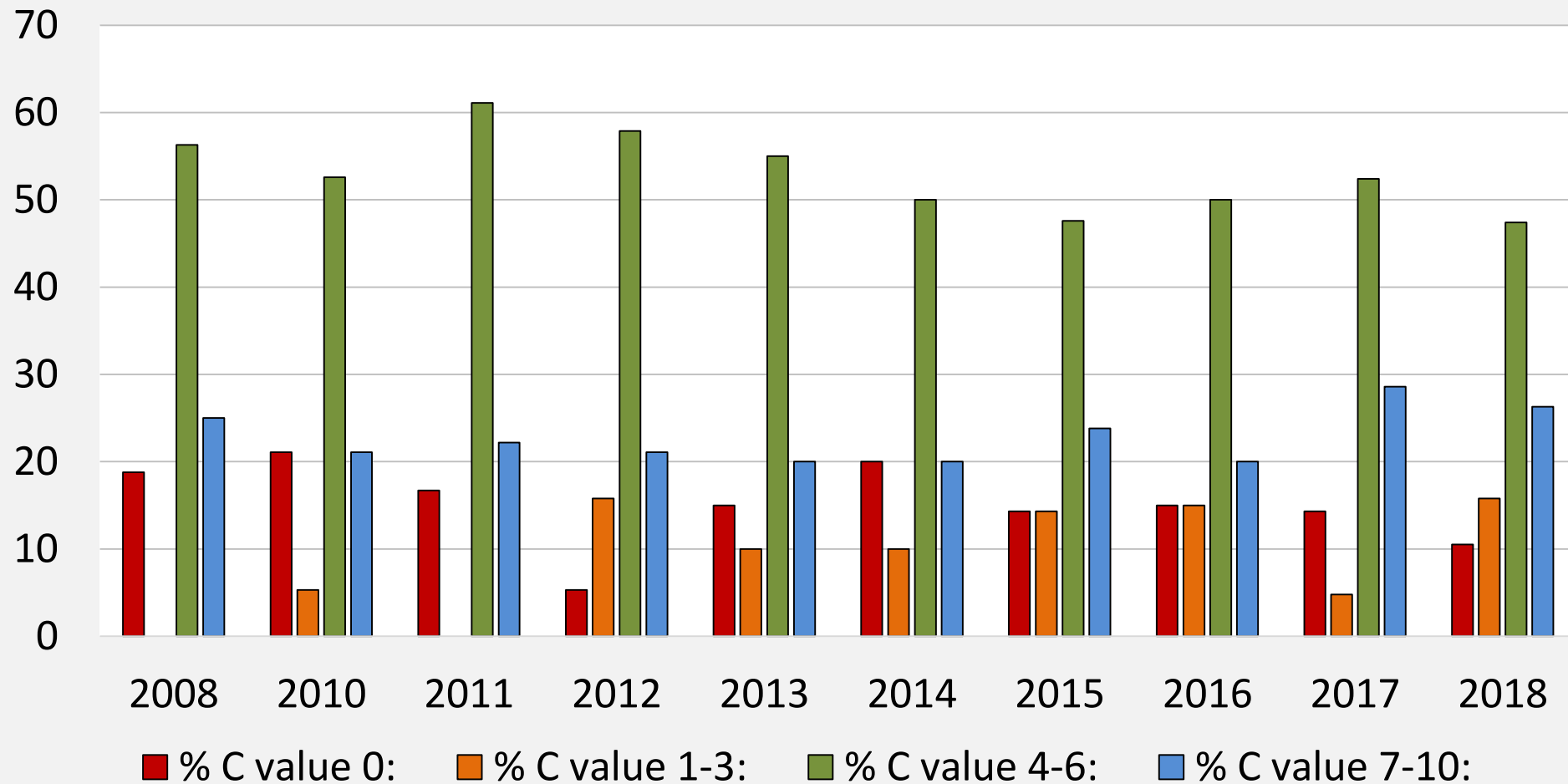
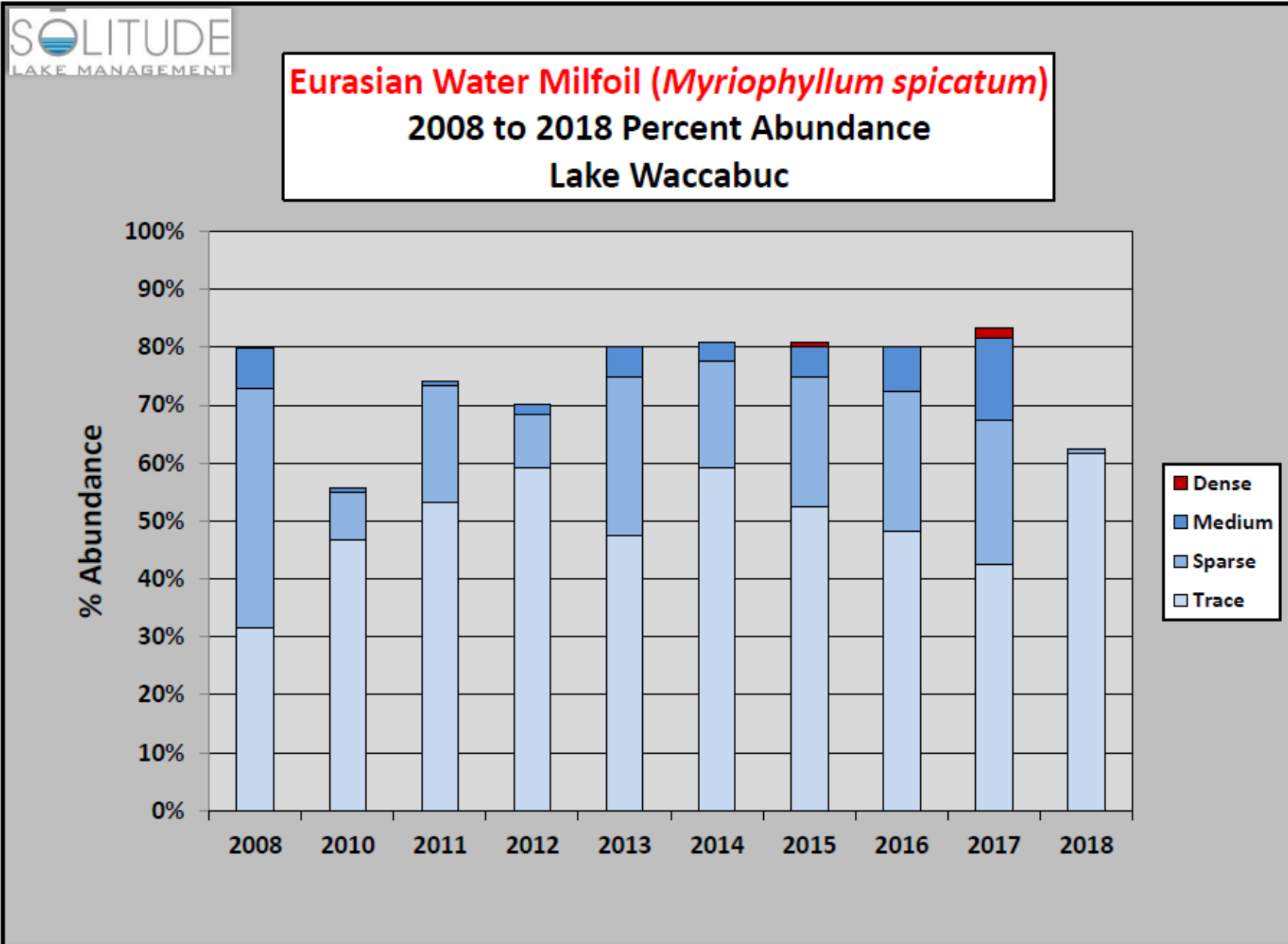


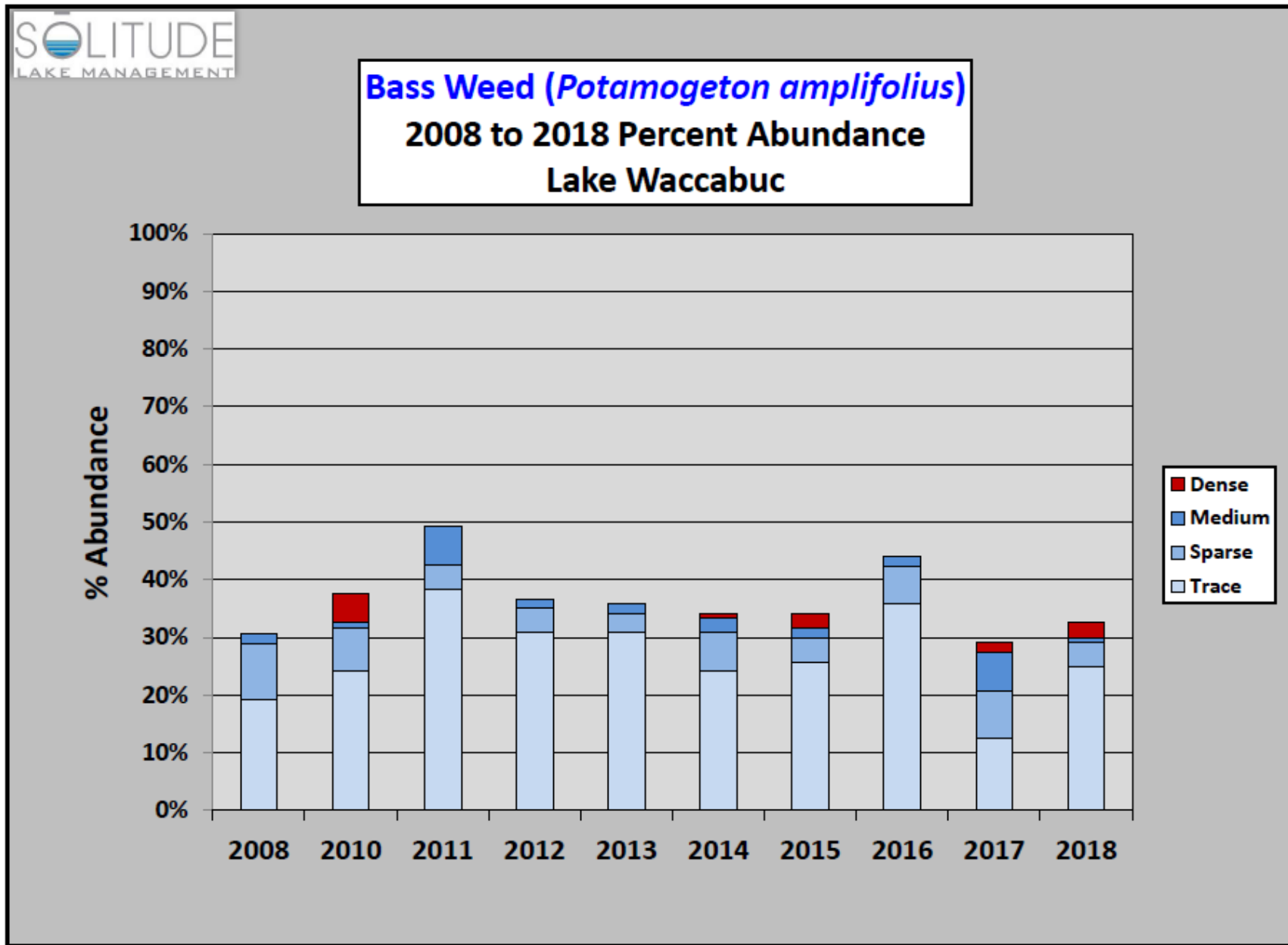
Table 7: 2008 – 2018 Lake Waccabuc Richness Results

<u>Richness</u>	<u>2008</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>
Total Richness:	16	19	18	19	20	20	21	20	21	19
Native Species:	13 (81.3%)	15 (78.9%)	15 (83.3%)	18 (94.7%)	17 (85%)	16 (80%)	18 (85.7%)	17 (85%)	18 (85.7%)	17 (89.5%)
Invasive Species:	3 (18.8%)	4 (21.1%)	3 (16.7%)	1 (5.3%)	3 (15%)	4 (20%)	3 (14.3%)	3 (15%)	3 (14.3%)	2 (10.5%)

2008 – 2018 Eurasian Water Milfoil



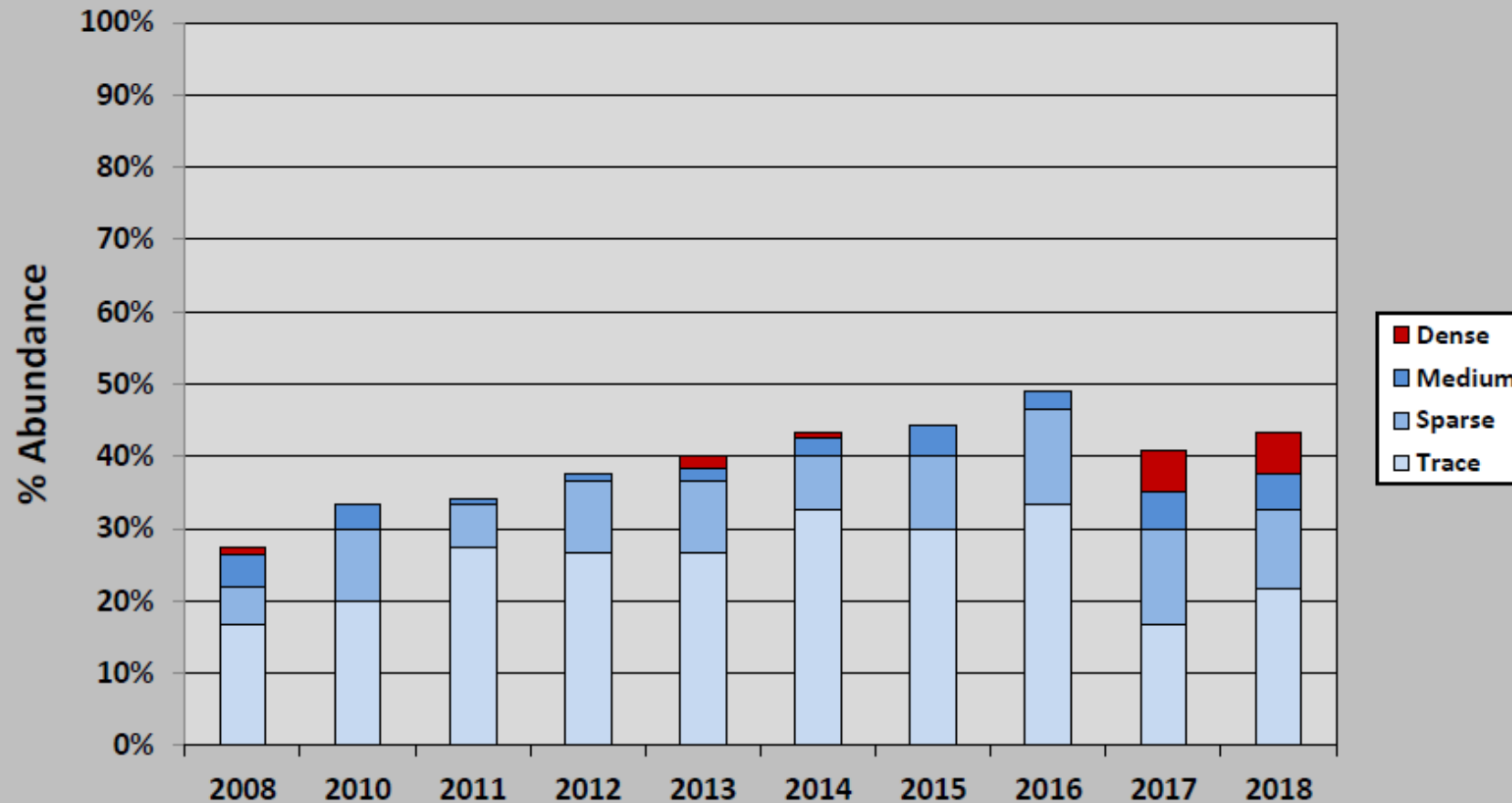
2008 – 2018 Bass Weed



2008 – 2018 White Water Lily



White Water Lily (*Nymphaea odorata*)
2008 to 2018 Percent Abundance
Lake Waccabuc



Summary of Findings

- EWM continues to be dominant SAV
- No Brazilian Elodea (8th yr) and water chestnut (4th yr)
- Two invasive species found in 2018 (EWM and brittle naiad)
- Diversity increased after 2008 – consistent (Least 2008 and most in 2017)
- FQI values favorable, natural variation pattern (Wagner, 2017).
- 2012, 2015, and 2017 years with the most native species
- **2012** – 1 invasive. **2010/2014** – 4 invasive species



Photo Credit: SLM, 2017

What Does This All Mean? (And For Future Management)

- Stability of the macrophyte community
- Potential problematic species
- **Future Management:**
- Continue monitoring to build up data
- Lookout for other invasive spp. (hydrilla)
- Monitor nearby lakes that are connected to Waccabuc
- Watershed monitoring / stewardship
- Emergency Rapid Response Plan (ERPP)



Photo credit: SLM, 2018

References

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Thank you! Questions?

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EMayer@solitudelake.com

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