A

APPENDIX A

Public Participation Materials

Presentation Outline

- Onterra, LLC
- Why Create a Management Plan?
- Elements of a Lake Management Planning Project
  - Data & Information
  - Planning Process

Onterra LLC
Lake Management Planning

Onterra, LLC

- Founded in 2005
- Staff
  - Four lead ecologists
  - Three field technicians
  - Five summer interns
- Services
  - Science and planning
- Philosophy
  - Promote realistic planning
  - Assist, not direct

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Why create a lake management plan?

- To create a better understanding of the lake's positive and negative attributes.
- To discover ways to minimize the negative attributes and maximize the positive attributes.
- To foster realistic expectations and dispel myths.
- To create a snapshot of the lake for future reference and planning.

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Past Planning Efforts

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Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together

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Data and information gathering

- Study Components
  - Water Quality Analysis
  - Watershed Assessment
  - Aquatic Plant Surveys
  - Fisheries Data Integration
  - Shoreline Assessment
  - Stakeholder Survey

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Water Quality Analysis

- General water chemistry (current & historic)
- Nutrient analysis
  - Lake trophic state (Eutrophication)
  - Limiting plant nutrient
- Supporting data for watershed modeling

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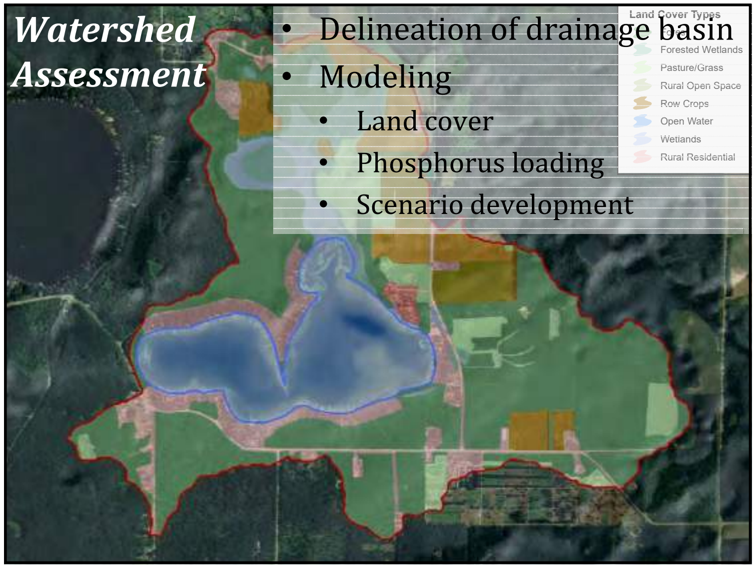

Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early Season AIS Survey → *Completed Last Week*
  - Point-intercept Survey
  - Late-Summer EWM Survey
  - Floating-leaf and Emergent Community Mapping Survey

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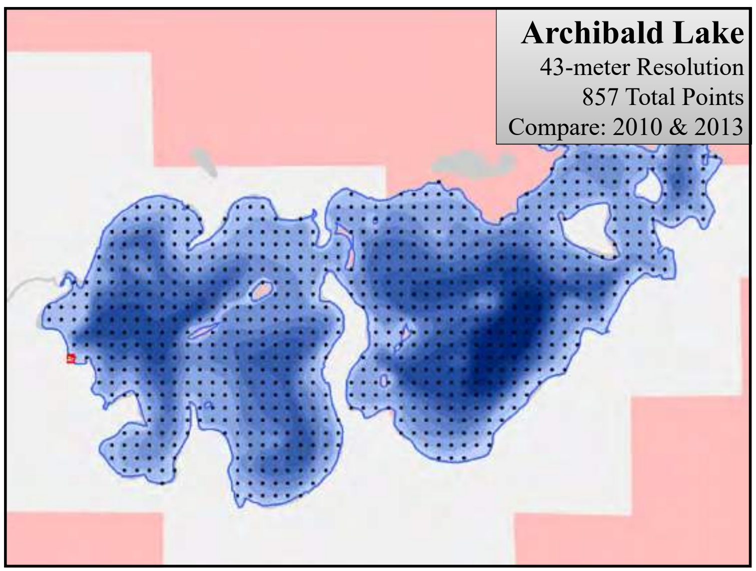
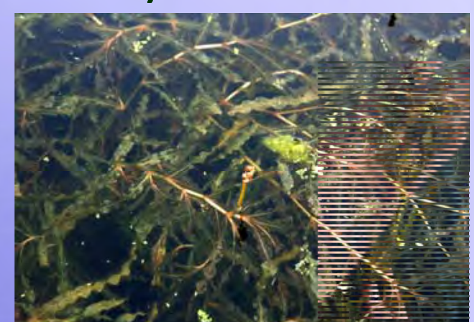


Non-native Aquatic Plants

Curly-leaf Pondweed



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Non-native Aquatic Plants

Pale Yellow Iris

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Non-native Aquatic Plants

Eurasian Water Milfoil

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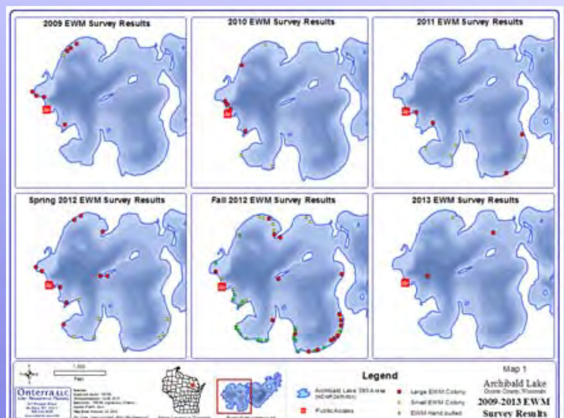
Historic EWM Population



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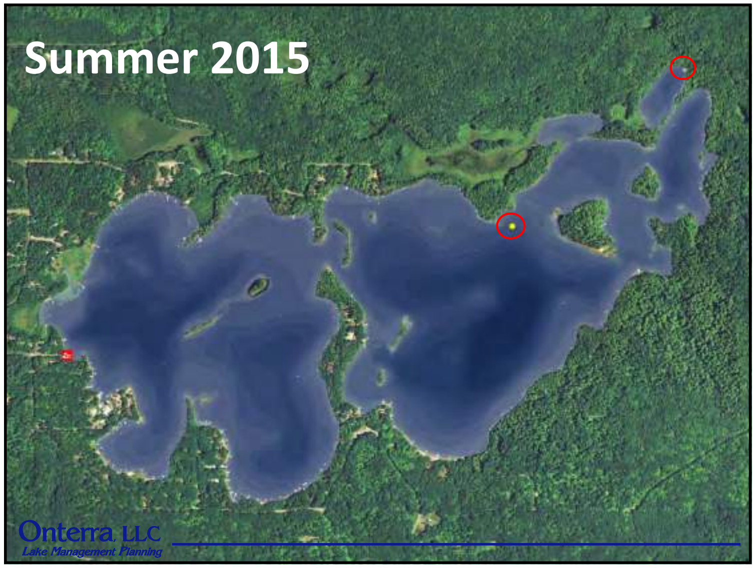

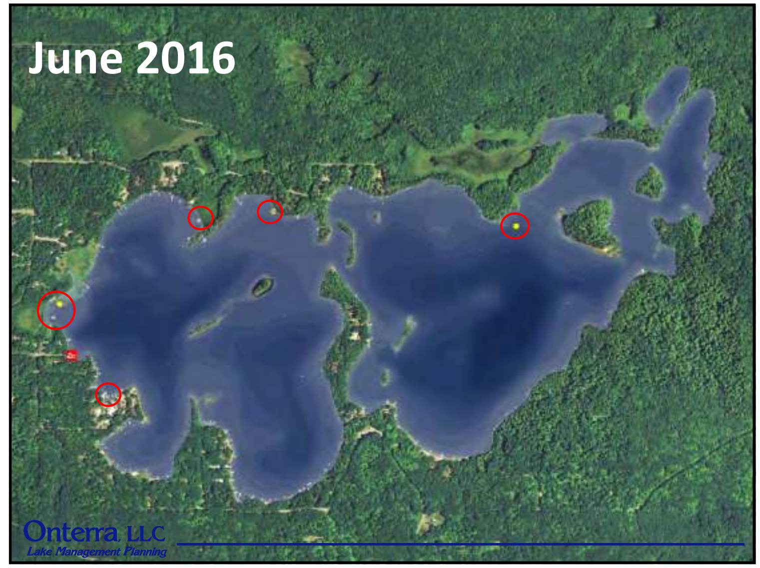

Non-native Aquatic Plants

Giant Reed (aka Phragmites)

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Non-native Aquatic Plants

Giant Reed (aka Phragmites)

Point	Latitude	Longitude	Field Notes
1	45.280711	-88.58877	10ft x 6 ft colony
2	45.280965	-88.588868	Small Plant colony, New shoots, young growth
3	45.281149	-88.588833	10ft x 6 ft colony

- 145 ft^2 treated with herbicide in September 2015

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Non-native Aquatic Plants

Flowering Rush

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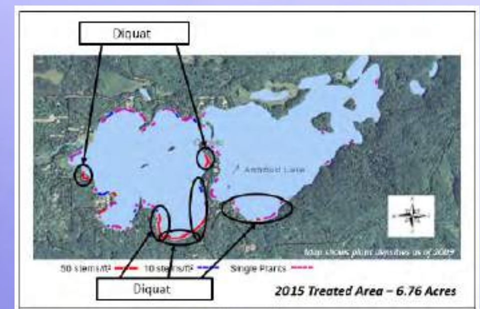
Non-native Aquatic Plants

Flowering Rush



- Efficacy herbicide treatment trials conduced in 2011-2015

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Fisheries Data Integration

- No fish sampling completed
- Assemble data from WDNR, USGS, USFWS, & GLIFWC
- Fish survey results summaries (if available)
- Use information in planning as applicable

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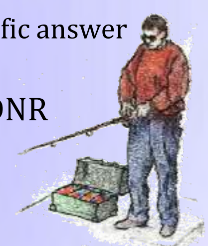
Stakeholder Survey

- Standard survey used as base
  - Planning committee potentially develops additional questions and options
  - Must not lead respondent to specific answer through a “loaded” question
- Survey must be approved by WDNR



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Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- Assessment ranks shoreland area from shoreline back 35 feet
- Assess shoreland development and habitat
  - Coarse woody habitat

Urbanized

Range

Natural

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Planning Process

Planning Committee Meetings

Study Results (including a stakeholder survey)
Conclusions & Initial Recommendations
Management Goals
Management Actions
  Timeframe
  Facilitator(s)

Implementation Plan

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Lake Management Planning

Project Costs

AIS - Education, Prevention, & Planning Grant

	Cash Cost	Donated Value	When
Onterra Fees			
Project Setup & Administration	$910.00		Split between 2 years
Stakeholder Participation - Onterra Facilitated	$2,775.00		Split between 2 years, more year 2
Watershed Assessment	$950.00		Split between 2 years, more year 2
Water Quality Assessment	$2,165.00		Split between 2 years
Fishery Data Compilation & Integration	$845.00		Split between 2 years, more year 2
Shoreline & Coarse Woody Habitat Assessments	$1,510.00		Fall Year 1
Early-Season AIS Survey	$1,390.00		Early Summer Year 1
Point-intercept Survey	$4,370.00		Summer Year 1
Aquatic Plant Community Mapping	$1,340.00		Summer Year 1
EWM Peak-Biomass Survey - 2016	$1,430.00		Summer Year 1
EWM Peak-Biomass Survey - 2017	$1,450.00		Summer Year 2
Data Analysis and Report/Plan Creation	$4,365.00		Split between 2 years, more year 2
Onterra Printing & Shipping	$300.00		Split between 2 years, more year 2
Travel (Lodging, Incidentals, & Mileage @ 0.58/mi)	$1,270.00		Split between 2 years, more year 1
Professional Dreissena Mussel Monitoring		$800.00	
Subtotal	$25,715.00	$800.00	
Other Fees			
State Laboratory of Hygiene Fees	$2,862.50		Year 1
Stakeholder Survey - Third Party Contractor	$1,200.00		Fall Year 1
ALA Project-Related Printing Costs	$300.00		Fall Year 1
Subtotal	$3,862.00		
Volunteer & In-kind Match Opportunities			
Planning Comm. - Stakeholder Survey		$288.00	
Planning Comm. - Plan Development		$576.00	
Kick-off Mtg Attendance		$1,080.00	
Wrap-up Mtg Attendance		$1,440.00	
Volunteer AIS Surveillance Monitoring - 2016		$480.00	
Volunteer AIS Surveillance Monitoring - 2017		$480.00	
CBCW Inspections - 2016 & 2017		$4,900.00	
ALA Grant Project Administration		$600.00	
Subtotal	$29,577.00	$10,544.00	
Project Total	**$40,121.00**		

AIS-Education, Prevention, and Planning Grant Specifics	
WDNR Portion (Cannot Exceed Cash Costs)	$29,577.00
Local Match	$10,544.00
Actual Cash Cost to ALA	***$0.00***
WDNR AIS-EPP Grant Prepayment to ALA	$5,032.25

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Lake Management Planning

Presentation Outline

- Lake Management Planning Project Overview
- Study Results
  - Water Quality
  - Watershed
  - Shoreland
  - Aquatic Plants
  - Fishery
  - Aquatic Plant Control Options
- "Big Picture"
- Next Steps

Stakeholder Survey

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Management Planning Project Overview

- Foster holistic understanding of Archibald Lake ecosystem
- Collect & analyze data
  - Technical & sociological
- Construct long-term & useable plan
  - Update management strategies for aquatic plants

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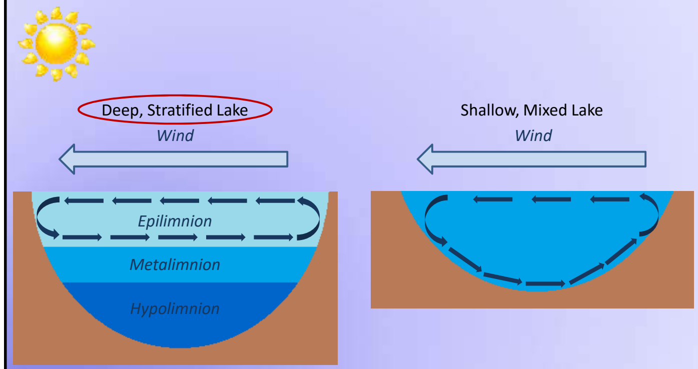
Wisconsin Lakes Classification



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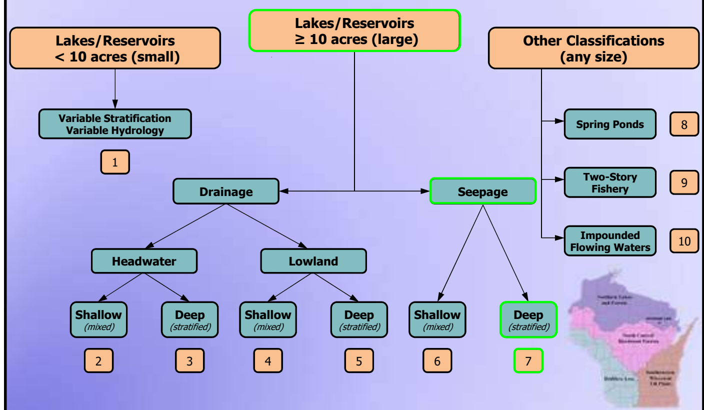
Wisconsin Lakes Natural Community Types



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Introduction to Lake Water Quality

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in **most** WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human activity often increases P delivery to lakes

Chlorophyll-*a*
Pigment used in photosynthesis
Used as surrogate for phytoplankton biomass

Secchi Disk Transparency
Measure of water clarity
Measured using a Secchi disk

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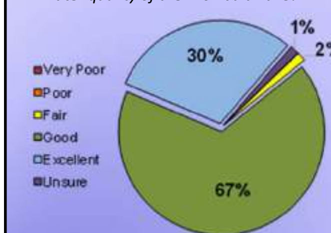
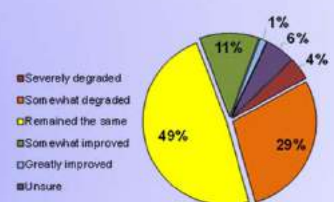
Archibald Lake Stakeholder Perceptions of Water Quality

How would you describe the current water quality of the Archibald Lake?



How has water quality changed in the Archibald Lake since you first visited the lake?



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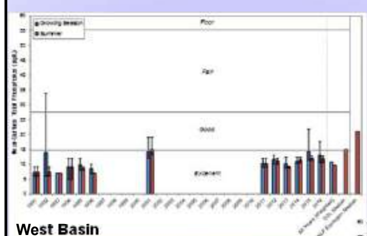
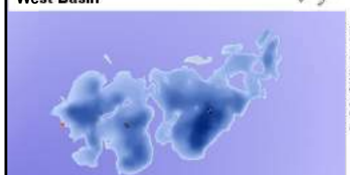
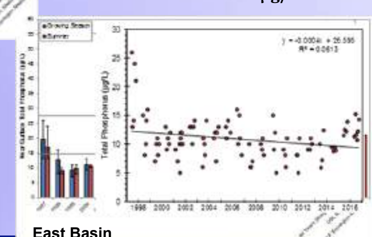
Long-Term Trends
Near-Surface Total Phosphorus

West Basin ave summer = 9.6 µg/L
East Basin ave summer = 10.3 µg/L
- Both *excellent* for DSL
- Both lower than ecoregion & DSL medians
- West Basin has higher TP, likely because less voluminous
- Weak but valid reduction in TP in Eastern Basin of ~2.0 µg/L







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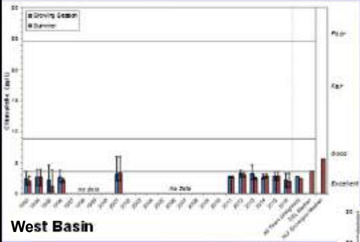
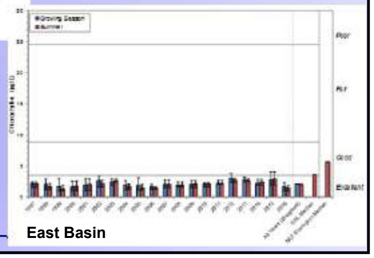
Long-Term Trends
Chlorophyll-*a*



West Basin ave summer = 2.4 µg/L
East Basin ave summer = 2.0 µg/L
- **Both *excellent* for DSL**
- **Both lower than ecoregion & DSL medians**
- **Not trends detected**



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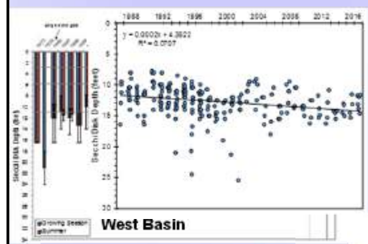
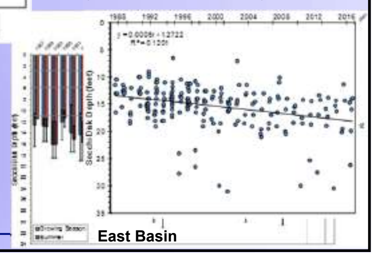
Long-Term Trends
Secchi Disk Transparency



West Basin ave summer = 12.8 µg/L
East Basin ave summer = 15.3 µg/L
- **Both *excellent* for DSL**
- **Both lower than ecoregion & DSL medians**
- **West Basin has greater SD cause less chl-a**
- **Valid increases in clarity observed (2.5 ft East, 2.0 ft West)**



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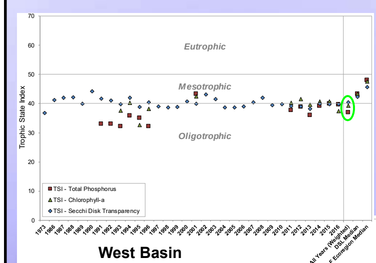
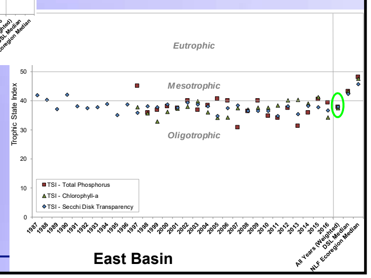
Trophic State Index



Both basins are oligotrophic
- **Productivity lower than ecoregion & DSL medians**



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Additional Water Quality Parameters

Alkalinity – capacity to resist fluctuations in pH
- E=97; W= 103 as mg/$CaCO_3$ in 2016
  - High values due to groundwater passing through calcium-rich bedrock, result in high pH (E=8.6, W=8.3),
  - Substantial ability to resist fluctuations in pH (ie acid rain)
  - High calcium and pH range makes "suitable" for ZM
    - ZM *veliger* samples were negative in 2016
    - No adult ZM observed
    - ZM confirmed in nearby Bass Lake (2014)

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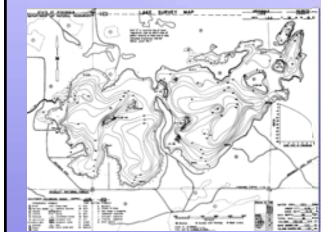
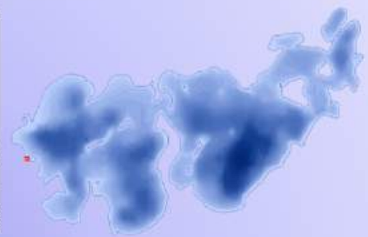
Watershed Assessment Procedure

Determine Lake and Watershed Characteristics

•Lake Bathymetry & Volume



WDNR Lake Survey Map
(June 1974)
393 acres
7,601 acre-feet



August 2016 Acoustic Survey Data
(bathymetry calculation by Onterra)
391.9 acres
6,589 acre-feet

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Watershed Assessment Procedure

Determine Lake and Watershed Characteristics
↓
Determine Land Cover Types and Acreages

Greater Phosphorus Export/Acre

- Urban - High Density
- Row Crops
- Urban - Med Density
- Pasture/Grass
- Open Water
- Rural Residential
- Wetlands
- Forest

Less Negative Impact on Lake

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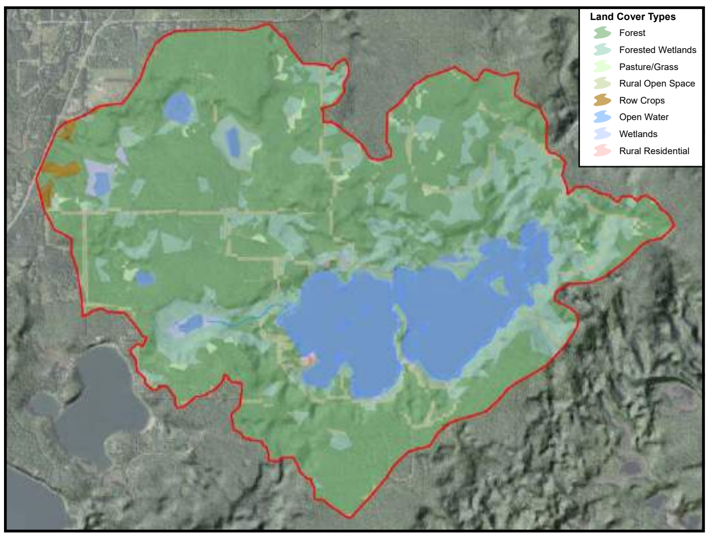

Watershed Assessment Procedure

Determine Lake and Watershed Characteristics
↓
Determine Land Cover Types and Acreages
↓
Wilms Modeling only applies to Tributary Systems, but the principals are prudent

- Use Growing Season Mean TP values to estimate phosphorus entering the lake from the watershed = 163 lbs
- Modeled phosphorus entering the lake from atmospheric deposition is valid = 106 lbs
- Use stakeholder survey to determine phosphorus entering from septic inputs = 10 lbs
- Use landcover export coefficients and landcover percentages to fill in remaining phosphorus budget = 47 lbs

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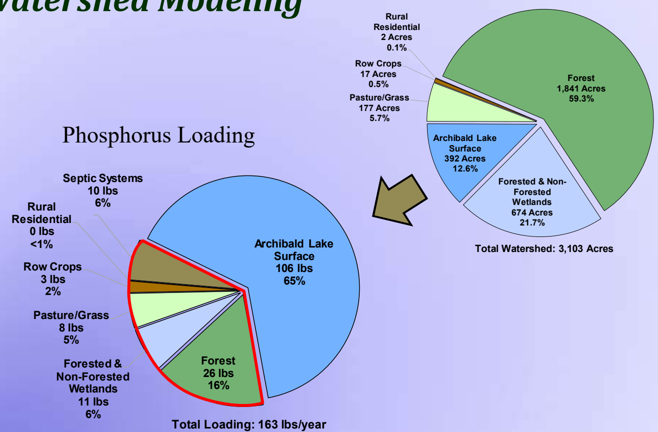
Watershed Modeling



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Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- EPA National Lakes Assessment results indicate shoreland development has greatest impact to health of our nation's lakes.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

Urbanized **Natural**

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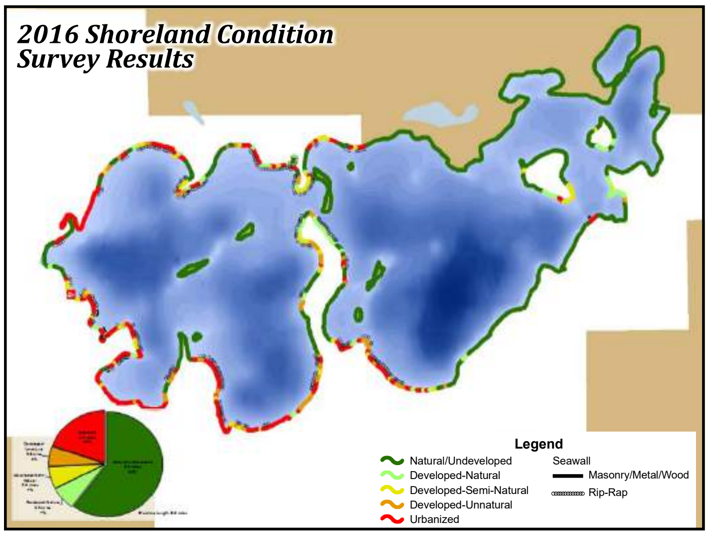
2016 Shoreland Condition Survey Results



Coarse Woody Habitat

- Provides shoreland erosion control and prevents suspension of sediments.
- Preferred habitat for a variety of aquatic life.
  - Periphyton growth fed upon by insects.
  - Refuge, foraging and spawning habitat for fish.
  - Complexity of CWH important.
- Changing of logging and shoreland development practices = reduced CWH in Wisconsin lakes.
- Survey aimed at quantifying CWH in Archibald Lake

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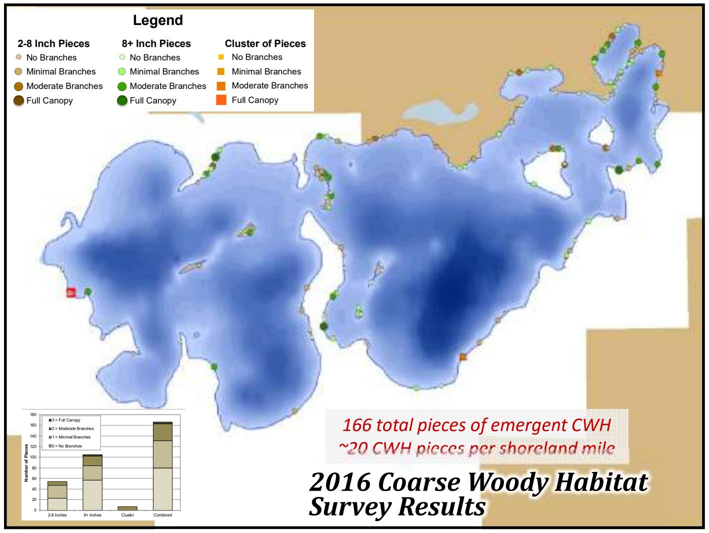

Aquatic Plant Surveys

- Determine changes in plant community from past surveys
- Assess both native and non-native populations
- Numerous surveys completed in 2016
  - Early-Season AIS Survey
  - Whole-Lake Point-Intercept Survey
  - Emergent/Floating-Leaf Community Mapping Survey
  - EWM Peak-Biomass Survey

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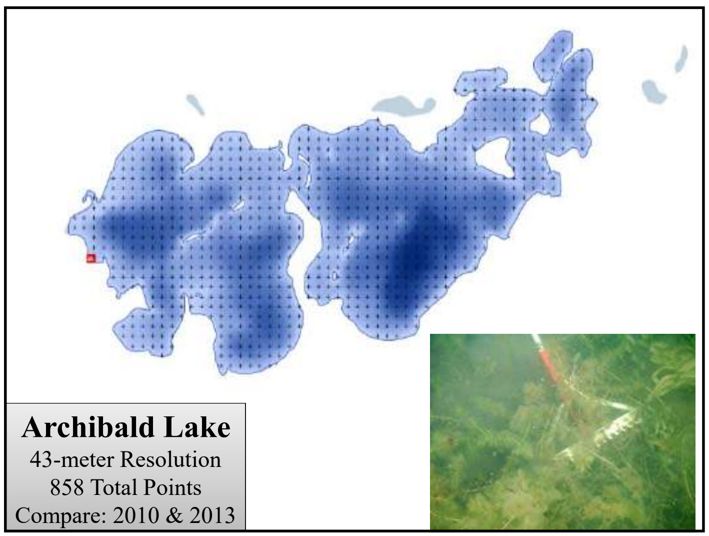
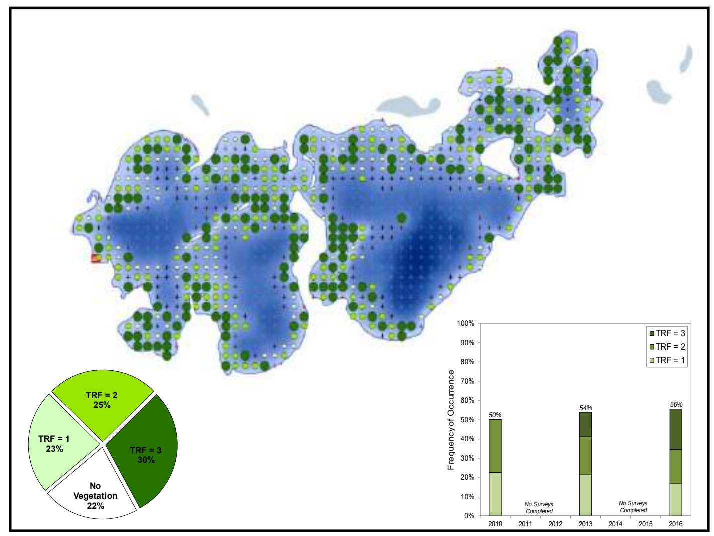
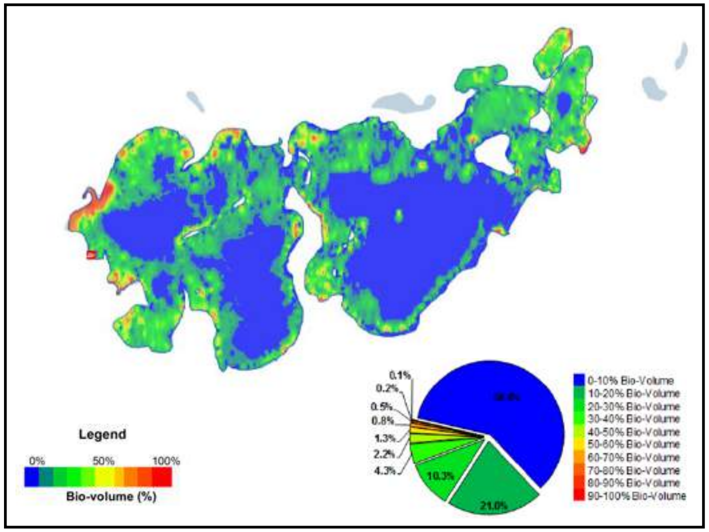
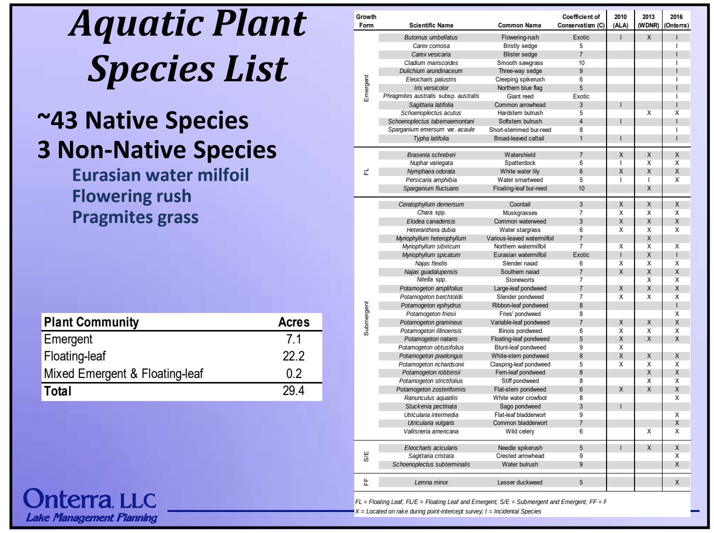




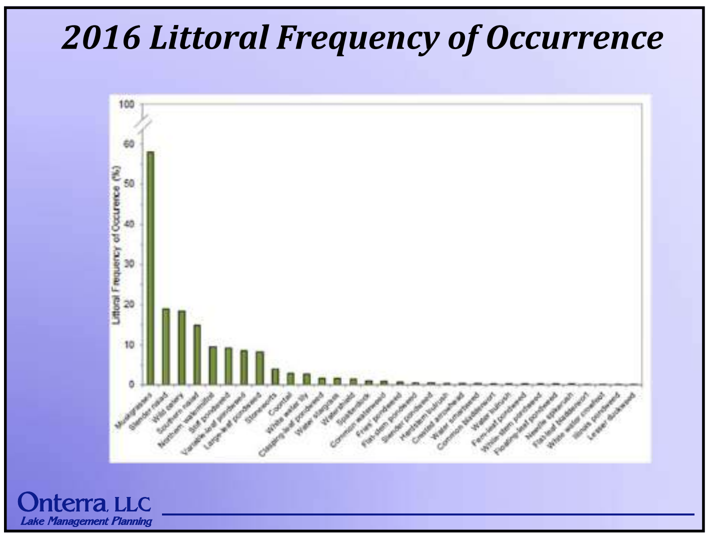


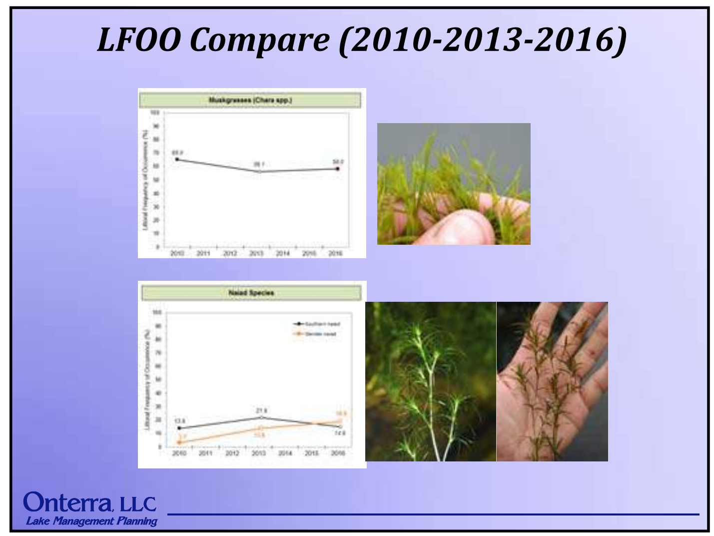


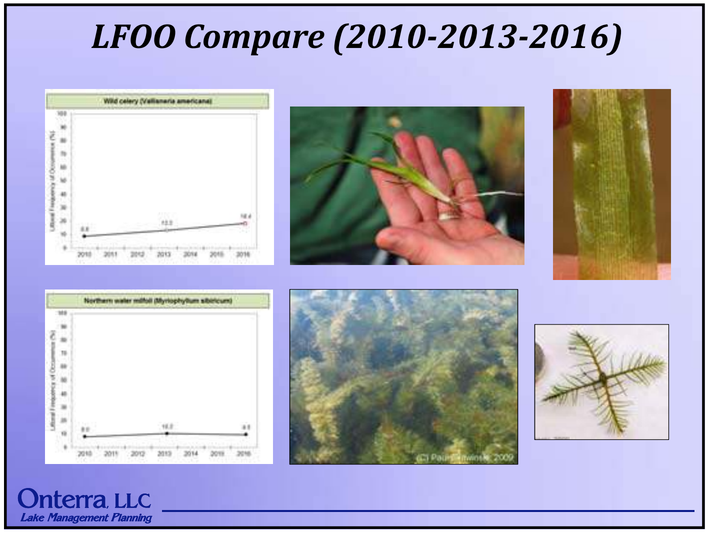
Plant Community	Acres
Emergent	7.1
Floating-leaf	22.2
Mixed Emergent & Floating-leaf	0.2
Total	29.4

Growth Form	Scientific Name	Common Name	Coefficient of Conservatism (C)	2010 (ALA)	2013 (WDNR)	2016 (Onterra)
Emergent	*Butomus umbellatus*	Flowering-rush	Exotic	I	X	I
	Carex comosa	Bristly sedge	5			I
	Carex vesicaria	Blister sedge	7			I
	Cladium mariscoides	Smooth sawgrass	10			I
	Dulichium arundinaceum	Three-way sedge	9			I
	Eleocharis palustris	Creeping spikerush	6			I
	Iris versicolor	Northern blue flag	5			I
	Phragmites australis subsp. *australis*	Giant reed	Exotic			I
	Sagittaria latifolia	Common arrowhead	3	I		I
	Schoenoplectus acutus	Hardstem bulrush	5		X	X
	Schoenoplectus tabernaemontani	Softstem bulrush	4	I		I
	Sparganium emersum var. *acaule*	Short-stemmed bur-reed	8			I
	Typha latifolia	Broad-leaved cattail	1	I		I
FL	*Brasenia schreberi*	Watershield	7	X	X	X
	Nuphar variegata	Spatterdock	6	I	X	X
	Nymphaea odorata	White water lily	6	X	X	X
	Persicaria amphibia	Water smartweed	5	I	I	X
	Sparganium fluctuans	Floating-leaf bur-reed	10		X	
Submergent	*Ceratophyllum demersum*	Coontail	3	X	X	X
	Chara spp.	Muskgrasses	7	X	X	X
	Elodea canadensis	Common waterweed	3	X	X	X
	Heteranthera dubia	Water stargrass	6	X	X	X
	Myriophyllum heterophyllum	Various-leaved watermilfoil	7		X	
	Myriophyllum sibiricum	Northern watermilfoil	7	X	X	X
	Myriophyllum spicatum	Eurasian watermilfoil	Exotic	I	X	I
	Najas flexilis	Slender naiad	6	X	X	X
	Najas guadalupensis	Southern naiad	7	X	X	X
	Nitella spp.	Stoneworts	7		X	X
	Potamogeton amplifolius	Large-leaf pondweed	7	X	X	X
	Potamogeton berchtoldii	Slender pondweed	7	X	X	X
	Potamogeton epihydrus	Ribbon-leaf pondweed	8			I
	Potamogeton friesii	Fries' pondweed	8			X
	Potamogeton gramineus	Variable-leaf pondweed	7	X	X	X
	Potamogeton illinoensis	Illinois pondweed	6	X	X	X
	Potamogeton natans	Floating-leaf pondweed	5	X	X	X
	Potamogeton obtusifolius	Blunt-leaf pondweed	9	X		
	Potamogeton praelongus	White-stem pondweed	8	X	X	X
	Potamogeton richardsonii	Clasping-leaf pondweed	5	X	X	X
	Potamogeton robbinsii	Fern-leaf pondweed	8		X	X
	Potamogeton strictifolius	Stiff pondweed	8		X	X
	Potamogeton zosteriformis	Flat-stem pondweed	6	X	X	X
	Ranunculus aquatilis	White water crowfoot	8			X
	Stuckenia pectinata	Sago pondweed	3	I		
	Utricularia intermedia	Flat-leaf bladderwort	9			X
	Utricularia vulgaris	Common bladderwort	7			X
	Vallisneria americana	Wild celery	6		X	X
S/E	*Eleocharis acicularis*	Needle spikerush	5	I	X	X
	Sagittaria cristata	Crested arrowhead	9			X
	Schoenoplectus subterminalis	Water bulrush	9			X
FF	*Lemna minor*	Lesser duckweed	5			X

FL = Floating Leaf; FL/E = Floating Leaf and Emergent; S/E = Submergent and Emergent; FF = F
X = Located on rake during point-intercept survey; I = Incidental Species






LFOO Compare (2010-2013-2016)
Wild celery (Vallisneria americana)
Northern water milfoil (Myriophyllum sibiricum)
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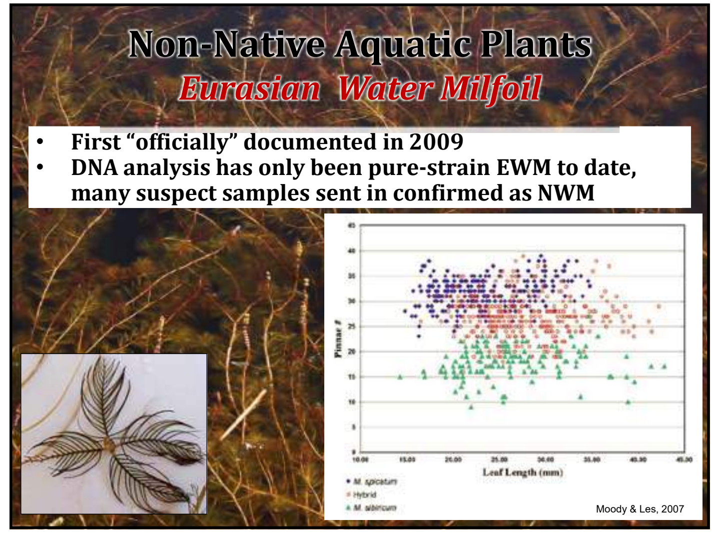
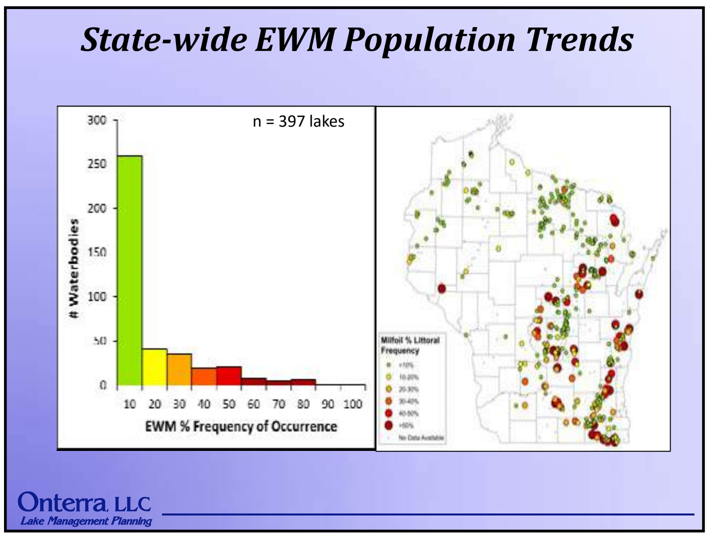

Non-Native Aquatic Plants
Eurasian Water Milfoil
First "officially" documented in 2009
DNA analysis has only been pure-strain EWM to date, many suspect samples sent in confirmed as NWM
Leaf Length (mm)
M. spicatum
Hybrid
M. sibiricum
Moody & Les, 2007


State-wide EWM Population Trends
n = 397 lakes
# Waterbodies
EWM % Frequency of Occurrence
Milfoil % Littoral Frequency
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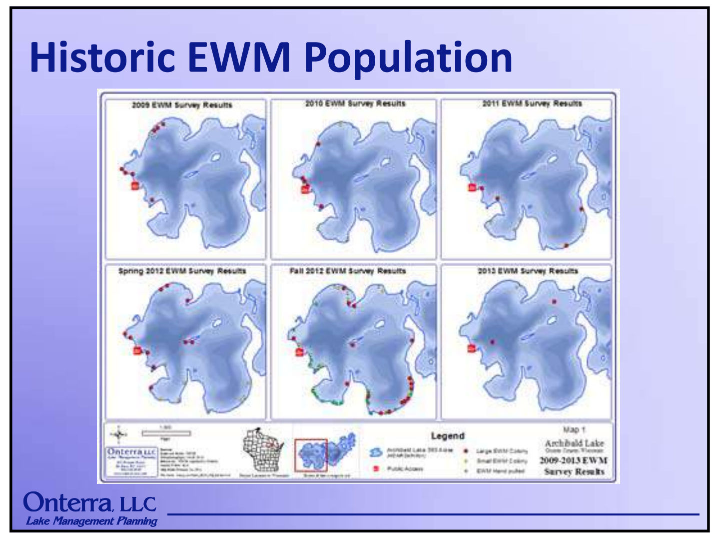
Historic EWM Population
2009 EWM Survey Results
2010 EWM Survey Results
2011 EWM Survey Results
Spring 2012 EWM Survey Results
Fall 2012 EWM Survey Results
2013 EWM Survey Results
Legend
Archibald Lake
2009-2013 EWM Survey Results
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AIS Control Strategies
• Do nothing (monitor)
• Management
• Biocontrol (weevils)
• Herbicide treatment
• Hand removal (includes DASH)
• Winter drawdown
• Mechanical harvesting
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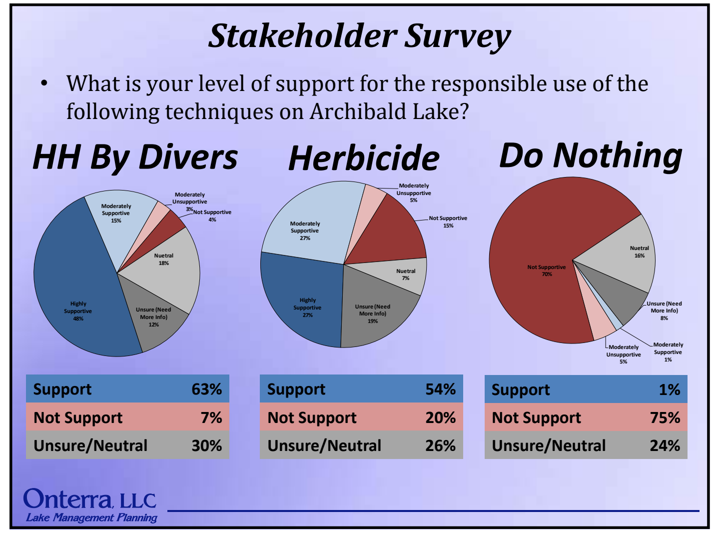
Lake Management Planning


Stakeholder Survey
• What is your level of support for the responsible use of the following techniques on Archibald Lake?
HH By Divers
Herbicide
Do Nothing
Support 63%
Not Support 7%
Unsure/Neutral 30%
Support 54%
Not Support 20%
Unsure/Neutral 26%
Support 1%
Not Support 75%
Unsure/Neutral 24%
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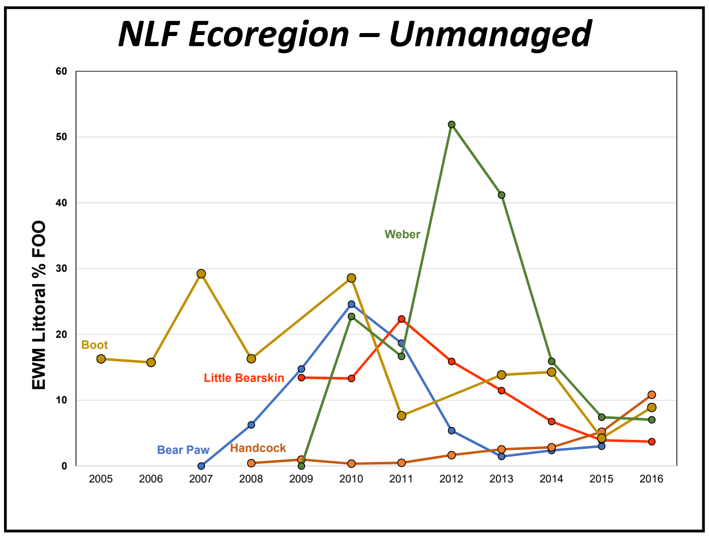
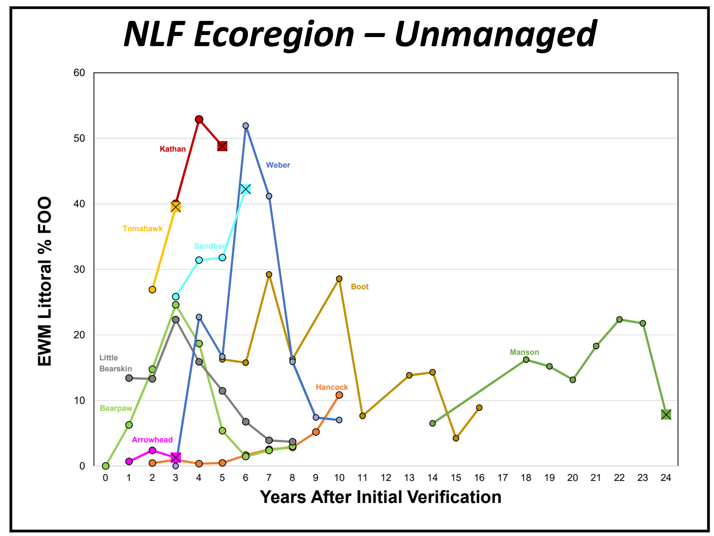
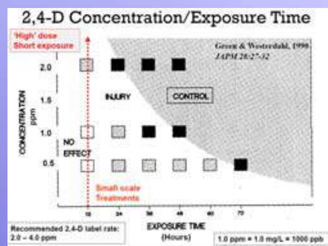

NLF Ecoregion – Unmanaged
EWM Littoral % FOO
Weber
Boot
Little Bearskin
Bear Paw
Handcock


NLF Ecoregion – Unmanaged
EWM Littoral % FOO
Kathan
Weber
Tomahawk
Boot
Little Bearskin
Manson
Hancock
Bearpaw
Arrowhead
Years After Initial Verification

Herbicide Spot Treatment

- **Ecological Definition:** Herbicide applied at a scale where dissipation will not result in significant lake wide concentrations; impacts are anticipated to be localized to in/around application area.



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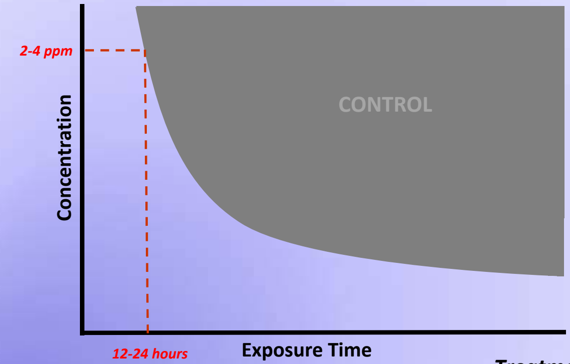
Herbicide Use Patterns



Treatment Type

High Concentration ▶ Short Exposure Time

Spot

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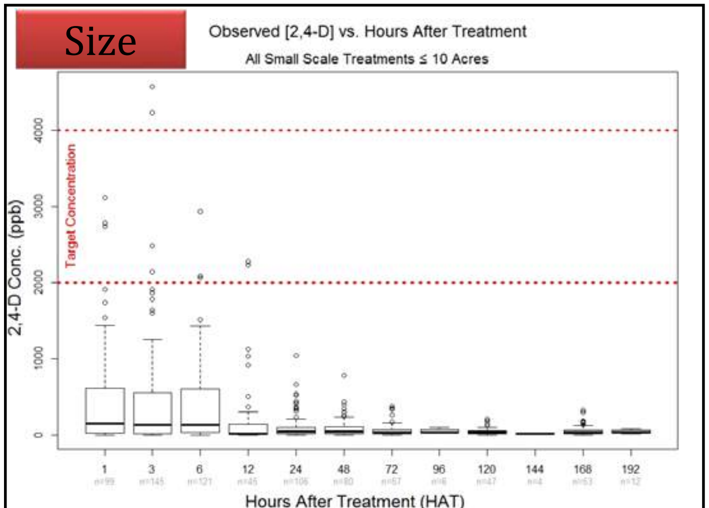
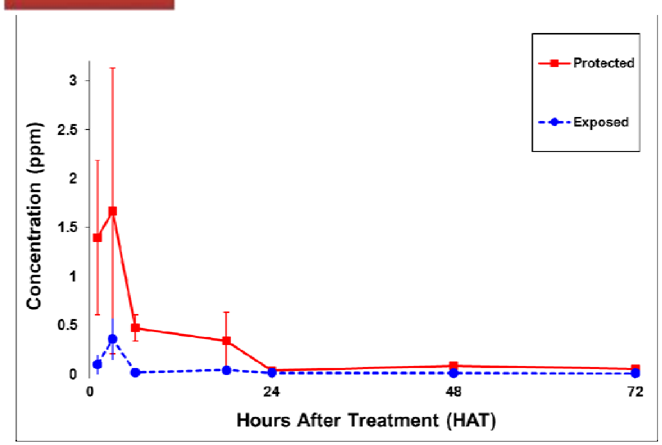
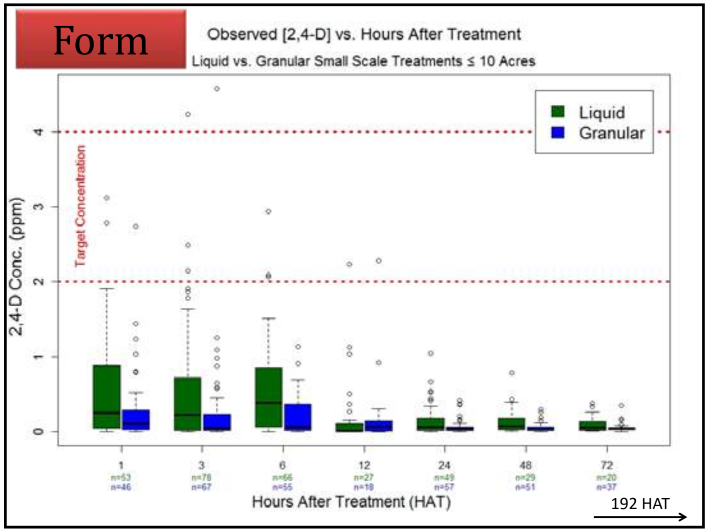
Size



Location





2015 Treatment on Loon Lake

- **Diquat (2 gallons per surface acre of application area)**
- ~24 acres of 305 acre lake (7.8%)
- Tracer Dye (Rhodamine WT) Survey
- Pre (spring) & post (late-summer) point-intercept sub-sampling

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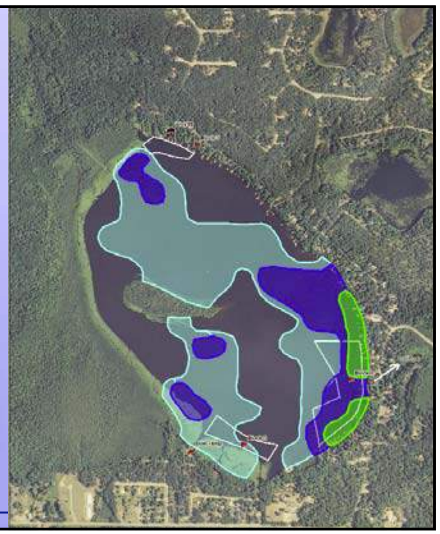
6 HAT

75-100%
50-75%
25-50%
10-25%
5-10%

If apply 2,4-D at 4.0 ppm, 5-10% would be 0.2 - 0.4 ppm



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AIS Active Management Discussion

Pros

- Keep AIS population low so native ecosystem can function as it did prior to AIS (***ecosystem restoration***)
- Keep AIS population low so it does not cause recreation, navigation, or aesthetic issues (***improve cultural ecosystem services***)
- Keep AIS population low so the lake is not a source population for other nearby lakes (***stewardship***)

Cons

- Management action itself may be damaging to the lake, so acknowledging potential known/unknown secondary impacts is important within the risk assessment.
- Management action may not be fully supported by public
- ***Unmanaged*** AIS population may be low enough to not cause measurable ecosystem impacts or reduce cultural ecosystem services

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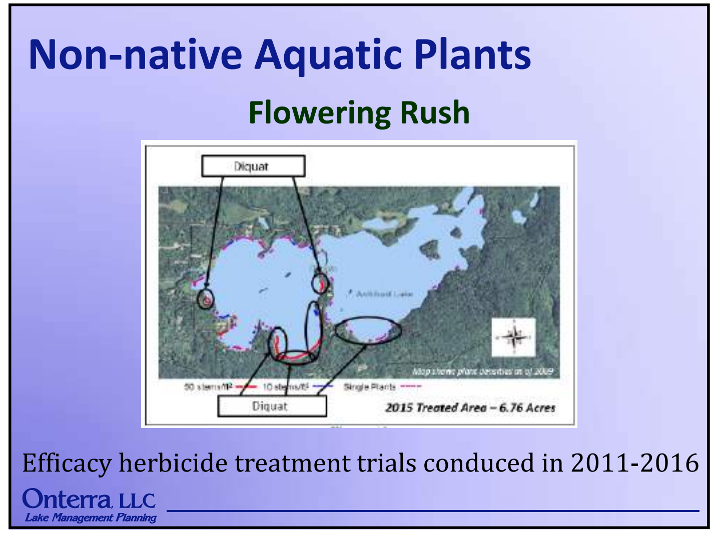
Non-Native Aquatic Plants
Flowering Rush
• First "officially" documented in 1989
• Likely fertile diploid morphotype, but not confirmed


Non-native Aquatic Plants
Flowering Rush
Diquat
Diquat
2015 Treated Area – 6.76 Acres
Efficacy herbicide treatment trials conduced in 2011-2016
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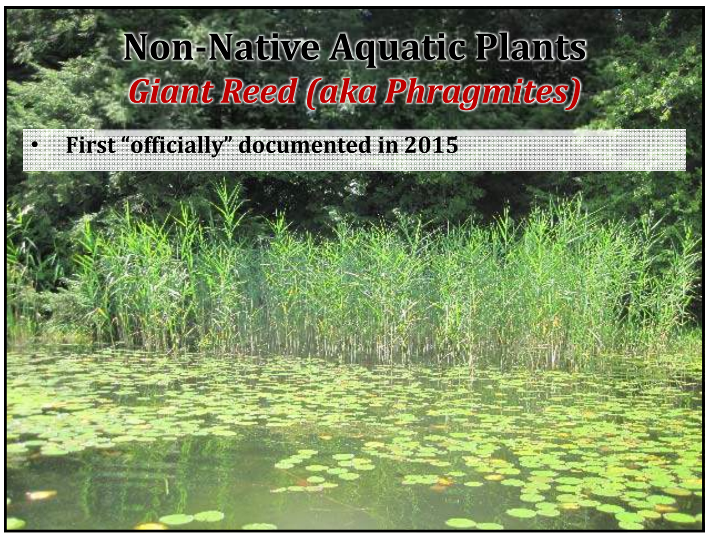
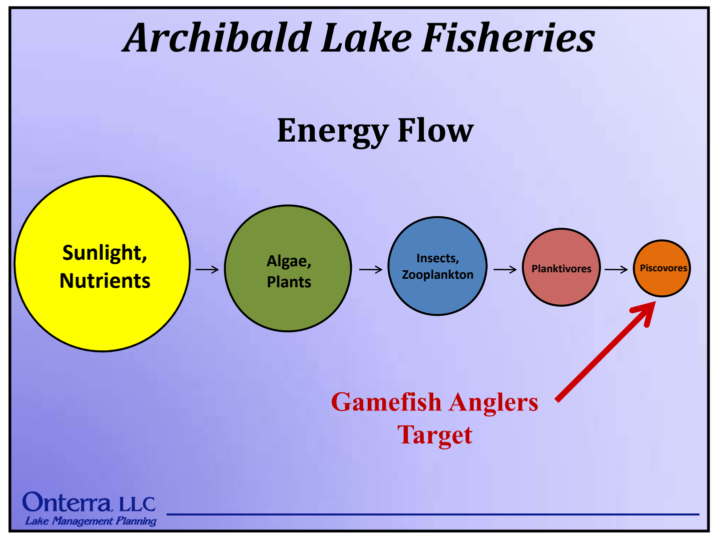

Non-Native Aquatic Plants
Giant Reed (aka Phragmites)
• First "officially" documented in 2015


Archibald Lake Fisheries
Energy Flow
Sunlight, Nutrients
Algae, Plants
Insects, Zooplankton
Planktivores
Piscovores
Gamefish Anglers Target
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Stakeholder Survey Responses

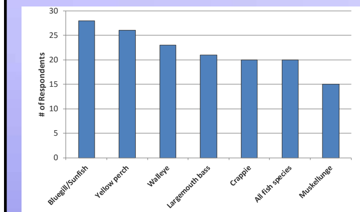

Figure 3.6-2. Stakeholder survey response Question #9. What species of fish do you like to catch on Archibald Lake?

Figure 3.6-4. Stakeholder survey response Question #10. How would you describe the current quality of fishing on Archibald Lake?

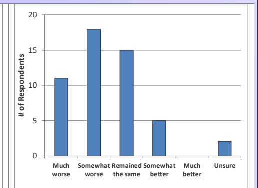

Figure 3.6-3. Stakeholder survey response Question #11. How has the quality of fishing changed on Archibald Lake since you started fishing the lake?

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Latest Fisheries Report

- Walleye
  - Heavy stocking since 2000, now on an even year stocking program
  - Spawning reef additions in 2008 (Ecology Improvement Committee)
  - Walleye population estimate increased from 1.5 fish/acre in 2007 to 1.9 fish/acre in 2011
- Muskellunge
  - Brood stock lake for GLSM, so stocking "fall yearlings" every year
  - Numbers decreased from 100 (2007) to 23 (2011)
- Large-mouth Bass
  - Most abundant predator (5.0/3.5 fish per acre)
  - 2007 was an excellent year class and they should be >14 inches at present
- Panfish
  - Primarily BG & YP
  - YP population increasing, perhaps due to 100 tree drops in 2009

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Open Water Tribal Spear Fishery

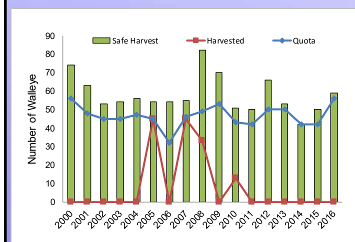

Figure 3.6-6. Archibald Lake walleye spear harvest data. (GLIFWC 1998-2016).

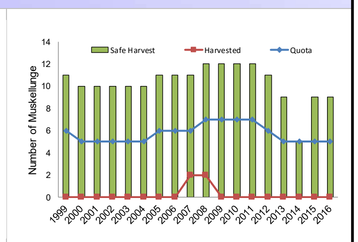

Figure 3.6-7. Archibald Lake muskellunge spear harvest data. (GLIFWC 1998-2016).

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4.0 Conclusions

Water Quality & Watershed

- Overall great for seepage lake
- Water quality appears to be improving over time
- Watershed is in great shape and supports the great water quality
- Attention should be paid to shoreland areas to increase habitat value, especially in western basin

Aquatic Plants

- AIS have been managed over time
- Changes in native plants likely from natural conditions
- Developing next phase of AIS management required

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5.0 Implementation Plan Example

- **Management Goal: Maintain Archibald Lake's Current Water Quality Conditions**
  - Management Action: Continue Citizens Lake Monitoring Network Program
  - Timeline: Immediately
  - Facilitator(s): Water Quality Committee

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2010 Plan Goal 1: Control EWM

Management Actions

1. Herbicide Treatment
2. Hand-harvesting
3. Monitoring

2010 Plan Goal 2: Reduce risk of future invasion

Management Actions

1. CBCW – 150 hr goal
2. Create CBCW Committee
3. Education

2010 Plan Goal 3: Monitor AIS

Management Actions

1. Develop Adopt A Shoreline by volunteers

2010 Plan Goal 4: Reduce flowering rush

Management Actions

1. Develop manual program for property owners
2. Conduct flowering rush herbicide treatment

2010 Plan Goal 5: Aquatic Plant Assessments

Management Actions

1. Point-intercept survey

2010 Plan Goal 6: Improve water quality monitoring

Management Actions

1. Conduct DO/Chla-a/TP in both lobes
2. Update figures with new data

2010 Plan Goal 7: Keep APM Plan alive

Management Actions

1. Hold APM team meetings

B

APPENDIX B

Stakeholder Survey Response Charts and Comments

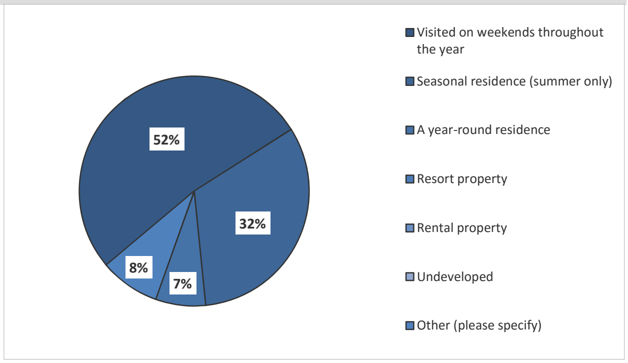
Archibald Lake - Anonymous Stakeholder Survey

Surveys Distributed: 183
Surveys Returned: 73
Response Rate: 40%

Archibald Lake Property

1. How is your property on or near Archibald Lake utilized?

Answer Options	Response Percent	Response Count
Visited on weekends throughout the year	52.1%	37
Seasonal residence (summer only)	32.4%	23
A year-round residence	7.0%	5
Resort property	0.0%	0
Rental property	0.0%	0
Undeveloped	0.0%	0
Other (please specify)	8.5%	6
	answered question	**71**
	skipped question	**2**



Number	Other (please specify)
1	spring,summer,fall
2	Seasonal residence (six months not summer only)
3	Also used spring and fall
4	used 9 months of the year
5	Weekends and some weekdays
6	Visited on weekends and weeks throughout the year.

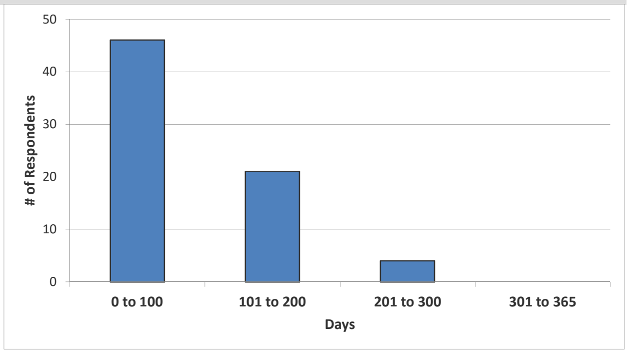
2. Is your property from Question 1 on the lake or off the lake?

Answer Options	Response Percent	Response Count
On the lake	87.5%	63
Off the lake	12.5%	9
	answered question	**72**
	skipped question	**1**

3. How many days each year is your property used by you or others?

Answer Options	Response Count
	71
answered question	**71**
skipped question	**2**

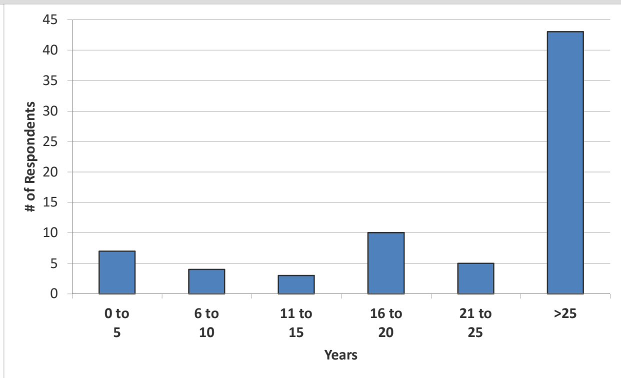
Category (# of days)	Responses	
0 to 100	**46**	**65%**
101 to 200	**21**	**30%**
201 to 300	**4**	**6%**
301 to 365	**0**	**0%**



4. How long have you owned or rented your property on or near Archibald Lake?

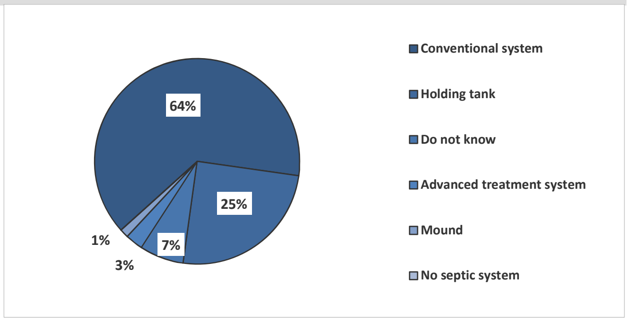
Answer Options	Response Count
	72
answered question	**72**
skipped question	**1**

Category (# of years)	Responses	% Response
0 to 5	**7**	**10%**
6 to 10	**4**	**6%**
11 to 15	**3**	**4%**
16 to 20	**10**	**14%**
21 to 25	**5**	**7%**
>25	**43**	**60%**



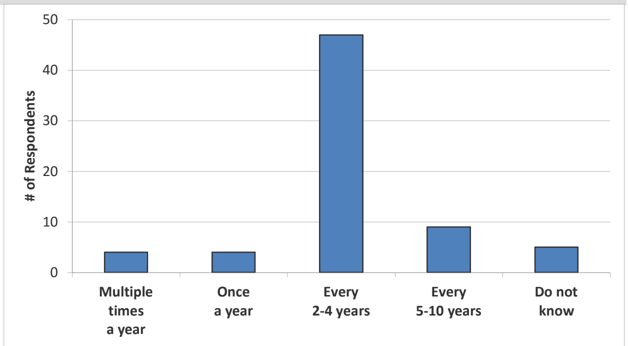
5. What type of septic system does your property utilize?

Answer Options	Response Percent	Response Count
Conventional system	63.9%	46
Holding tank	25.0%	18
Do not know	6.9%	5
Advanced treatment system	2.8%	2
Mound	1.4%	1
No septic system	0.0%	0
answered question		**72**
skipped question		**1**



6. How often is the septic system on your property pumped?

Answer Options	Response Percent	Response Count
Multiple times a year	5.8%	4
Once a year	5.8%	4
Every 2-4 years	68.1%	47
Every 5-10 years	13.0%	9
Do not know	7.2%	5
answered question		**69**
skipped question		**4**



Recreational Activity on Archibald Lake

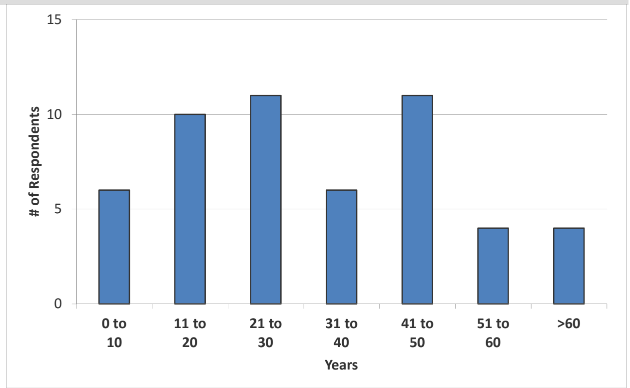
7. Have you personally fished on Archibald Lake in the past three years?

Answer Options	Response Percent	Response Count
Yes	72.9%	51
No	27.1%	19
answered question		**70**
skipped question		**3**

8. For how many years have you fished Archibald Lake?

Answer Options	Response Count
	52
answered question	52
skipped question	21

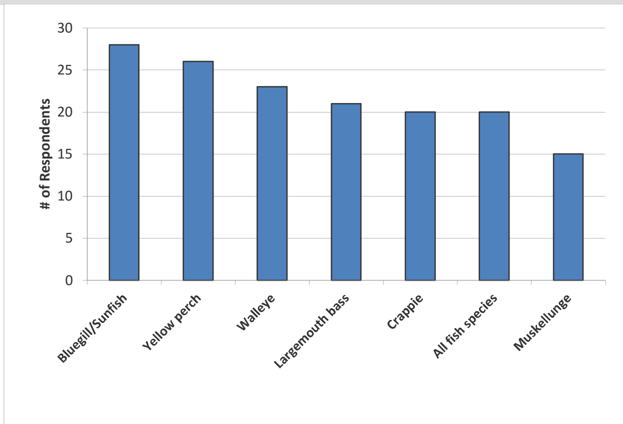
Category (# of years)	Responses	% Response
0 to 10	6	12%
11 to 20	10	19%
21 to 30	11	21%
31 to 40	6	12%
41 to 50	11	21%
51 to 60	4	8%
>60	4	8%



9. What species of fish do you like to catch on Archibald Lake?

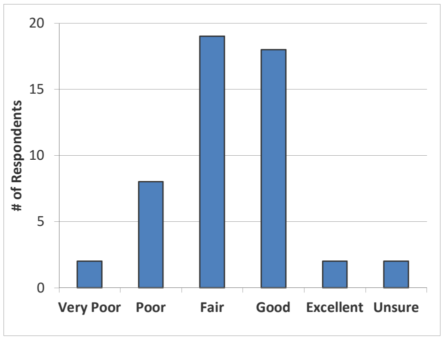
Answer Options	Response Percent	Response Count
Bluegill/Sunfish	54.9%	28
Yellow perch	51.0%	26
Walleye	45.1%	23
Largemouth bass	41.2%	21
Crappie	39.2%	20
All fish species	39.2%	20
Muskellunge	29.4%	15
Other (please specify)	3.9%	2
	answered question	**51**
	skipped question	**22**

Number	Other (please specify)
1	Rock bass northern pike
2	Rock Bass



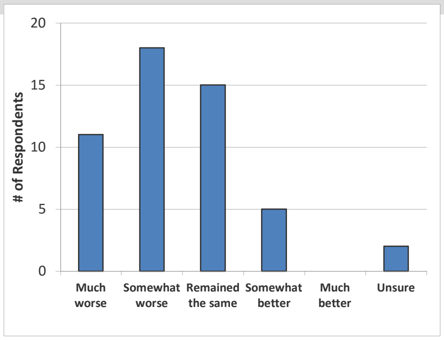
10. How would you describe the current quality of fishing on Archibald Lake?

Answer Options	Very Poor	Poor	Fair	Good	Excellent	Unsure	Response Count
	2	8	19	18	2	2	51
						answered question	**51**
						skipped question	**22**



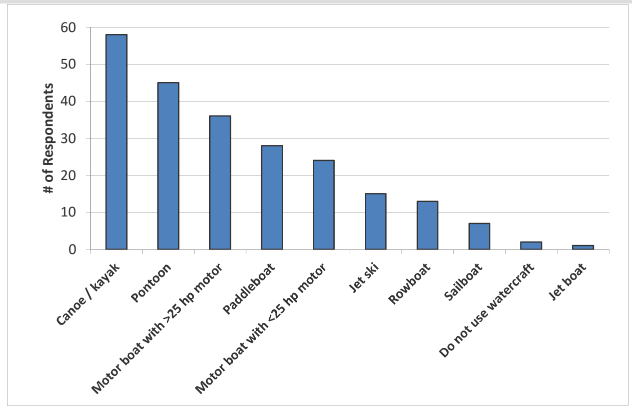
11. How has the quality of fishing changed on Archibald Lake since you have started fishing the lake?

Answer Options	Much worse	Somewhat worse	Remained the same	Somewhat better	Much better	Unsure	Response Count
	11	18	15	5	0	2	51
						answered question	**51**
						skipped question	**22**



12. What types of watercraft do you currently use on Archibald Lake?

Answer Options	Response Percent	Response Count
Canoe / kayak	82.9%	58
Pontoon	64.3%	45
Motor boat with greater than 25 hp motor	51.4%	36
Paddleboat	40.0%	28
Motor boat with 25 hp or less motor	34.3%	24
Jet ski	21.4%	15
Rowboat	18.6%	13
Sailboat	10.0%	7
Do not use watercraft	2.9%	2
Jet boat	1.4%	1
answered question		70
skipped question		3

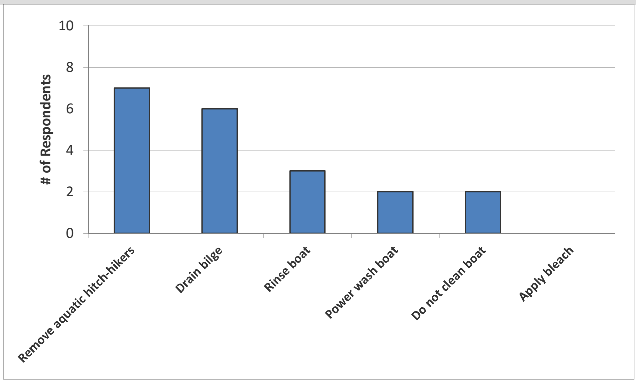


13. Do you use your watercraft on waters other than Archibald Lake?

Answer Options	Response Percent	Response Count
Yes	14.3%	10
No	85.7%	60
	answered question	**70**
	skipped question	**3**

14. What is your typical cleaning routine after using your watercraft on waters other than Archibald Lake?

Answer Options	Response Percent	Response Count
Remove aquatic hitch-hikers	70.0%	7
Drain bilge	60.0%	6
Rinse boat	30.0%	3
Power wash boat	20.0%	2
Do not clean boat	20.0%	2
Apply bleach	0.0%	0
Other (please specify)		1
	answered question	**10**
	skipped question	**63**

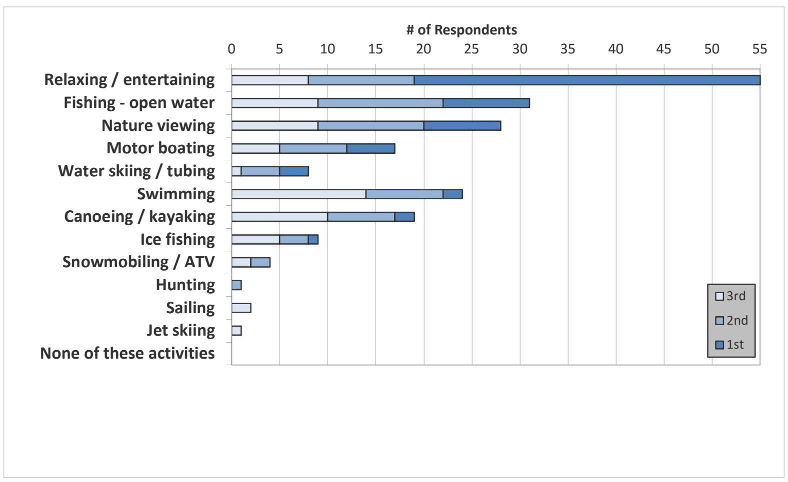


Number	Other (please specify)
1	Different boats, so don't transport back into Archibald Lake

15. For the list below, rank your top three activities that are important reasons for owning or renting your property on or near Archibald Lake, with 1 being the most important activity.

Answer Options	1st	2nd	3rd	Rating Average	Response Count
Relaxing / entertaining	36	11	8	1.49	55
Fishing - open water	9	13	9	2	31
Nature viewing	8	11	9	2.04	28
Motor boating	5	7	5	2	17
Water skiing / tubing	3	4	1	1.75	8
Swimming	2	8	14	2.5	24
Canoeing / kayaking	2	7	10	2.42	19
Ice fishing	1	3	5	2.44	9
Snowmobiling / ATV	0	2	2	2.5	4
Hunting	0	1	0	2	1
Sailing	0	0	2	3	2
Jet skiing	0	0	1	3	1
None of these activities are important to me	0	0	0	0	0
Other (please specify below)	3	1	2	1.83	6
Please specify "Other" response here					7
				answered question	**69**
				skipped question	**4**

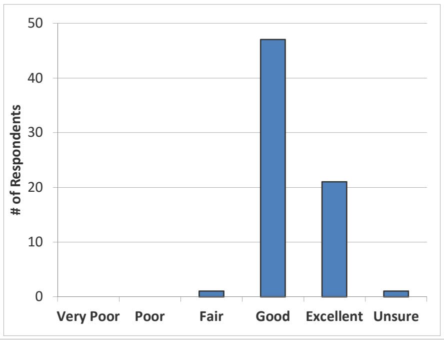
Number	"Other" responses
1	Family visits
2	Family members do all of above other than jet skiing and sailing
3	hiking
4	family cottage has been owned for 68 yrs. activities change with age
5	Investment
6	Poontoon rides
7	family gathering



Archibald Lake Current and Historic Condition, Health and Management

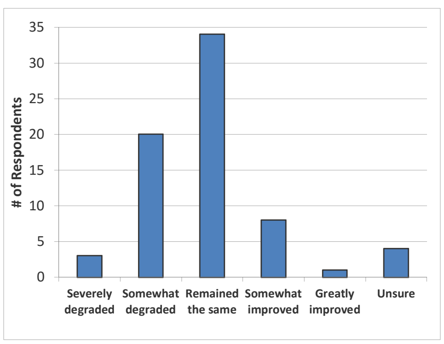
16. How would you describe the current water quality of Archibald Lake?

Answer Options	Very Poor	Poor	Fair	Good	Excellent	Unsure	Response Count
	0	0	1	47	21	1	70
						answered question	**70**
						skipped question	**3**



17. How has the current water quality changed in Archibald Lake since you first visited the lake?

Answer Options	Severely degraded	Somewhat degraded	Remained the same	Somewhat improved	Greatly improved	Unsure	Response Count
	3	20	34	8	1	4	70
						answered question	**70**
						skipped question	**3**



18. Before reading the statement above, had you ever heard of aquatic invasive species?

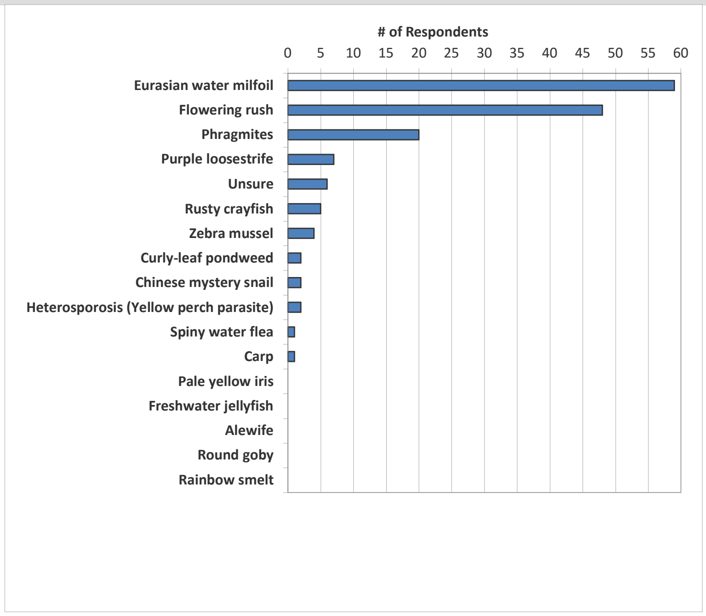
Answer Options	Response Percent	Response Count
Yes	100.0%	70
No	0.0%	0
	answered question	**70**
	skipped question	**3**

19. Do you believe aquatic invasive species are present within Archibald Lake?

Answer Options	Response Percent	Response Count
Yes	85.7%	60
I think so but am not certain	11.4%	8
No	2.9%	2
	answered question	**70**
	skipped question	**3**

20. Which aquatic invasive species do you believe are in Archibald Lake?

Answer Options	Response Percent	Response Count
Eurasian water milfoil	90.8%	59
Flowering rush	73.8%	48
Phragmites	30.8%	20
Purple loosestrife	10.8%	7
Unsure, but I believe AIS are present	9.2%	6
Rusty crayfish	7.7%	5
Zebra mussel	6.2%	4
Curly-leaf pondweed	3.1%	2
Chinese mystery snail	3.1%	2
Heterosporosis (Yellow perch parasite)	3.1%	2
Spiny water flea	1.5%	1
Carp	1.5%	1
Pale yellow iris	0.0%	0
Freshwater jellyfish	0.0%	0
Alewife	0.0%	0
Round goby	0.0%	0
Rainbow smelt	0.0%	0
Other (please specify)	1.5%	1
	answered question	**65**
	skipped question	**8**

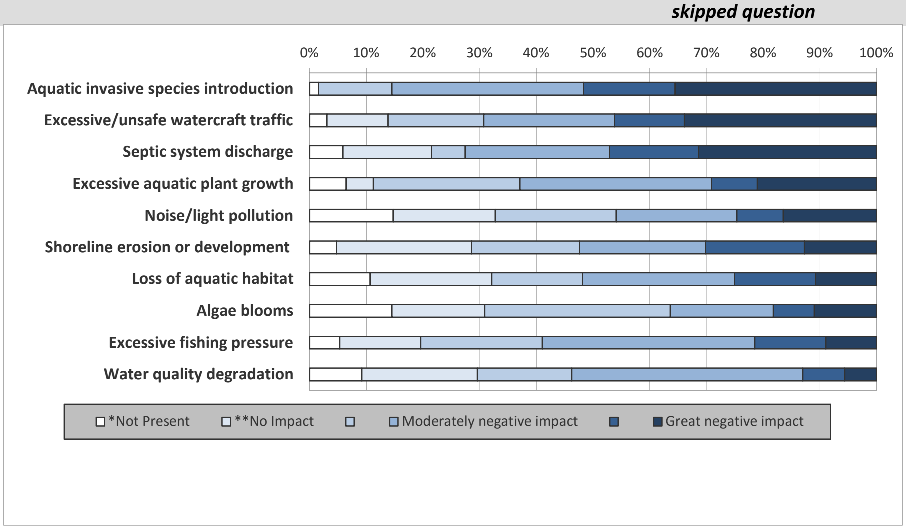


Number	"Other" responses
1	We have not personally identified any but I believe studies that indicate they are present.

21. To what level do you believe each of the following factors may currently be negatively impacting Archibald Lake?
*** Not Present means that you believe the issue does not exist on Archibald Lake.**
**** No Impact means that the issue may exist on Archibald Lake but it is not negatively impacting the lake.**

Answer Options	*Not Present	**No Impact		Moderately negative impact		Great negative impact	Unsure: Need more information	Rating Average	Response Count
Aquatic invasive species introduction	1	0	8	21	10	22	6	2.47	68
Excessive or unsafe watercraft traffic	2	7	11	15	8	22	3	2.25	68
Septic system discharge	3	8	3	13	8	16	17	1.72	68
Excessive aquatic plant growth (excluding algae)	4	3	16	21	5	13	6	1.84	68
Noise/light pollution	9	11	13	13	5	10	6	1.40	67
Shoreline erosion or development	3	15	12	14	11	8	4	1.57	67
Loss of aquatic habitat	6	12	9	15	8	6	11	1.30	67
Algae blooms	8	9	18	10	4	6	11	1.12	66
Excessive fishing pressure	3	8	12	21	7	5	12	1.40	68
Water quality degradation	5	11	9	22	4	3	11	1.18	65
Other (please specify)									5
								answered question	68
								skipped question	5

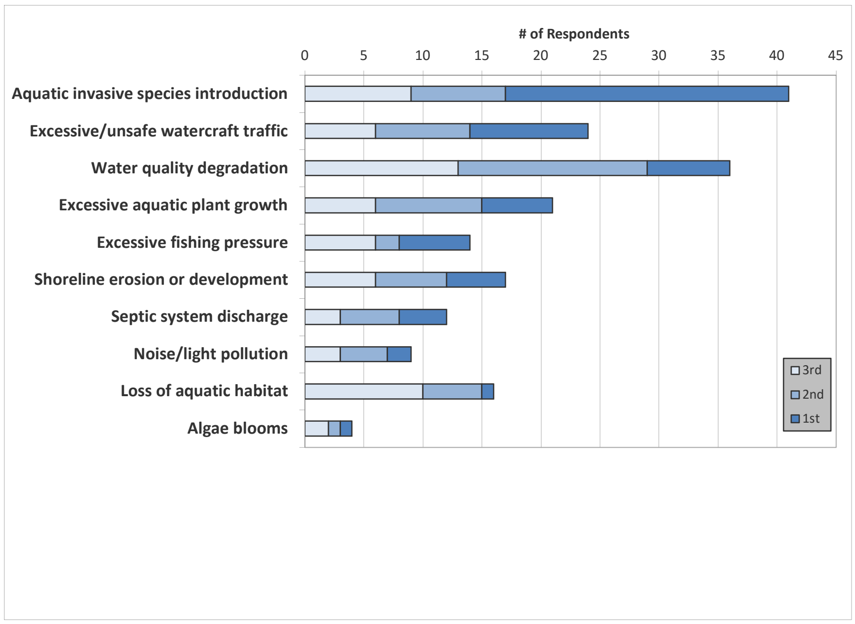
Number	Other (please specify)
1	Too many jet skis and hours are 1 hour too long - should stop at 4
2	jet skis undermine the lake bottom causing extreme uprooted floating vegitation
3	Noise is bad on weekends and holidays but okay during the week
4	I dont know of any light impact, only noise impact thal an aware of is excessie motor speeds and firecrackers which are supposed to be illegal.
5	Feel the no wake hours are useless, but there is too much jet ski/sport boating traffic for a lake this size.



22. From the list below, please rank your top three concerns regarding Archibald Lake, with 1 being your greatest concern.

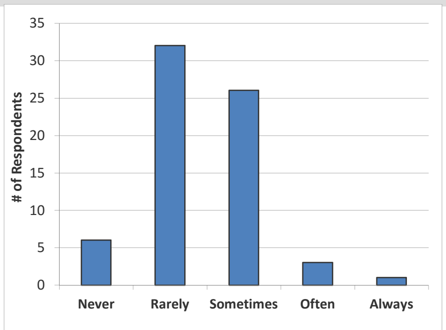
Answer Options	1st	2nd	3rd	Response Count
Aquatic invasive species introduction	24	8	9	41
Excessive or unsafe watercraft traffic	10	8	6	24
Water quality degradation	7	16	13	36
Excessive aquatic plant growth (excluding algae)	6	9	6	21
Excessive fishing pressure	6	2	6	14
Shoreline erosion or development	5	6	6	17
Septic system discharge	4	5	3	12
Noise/light pollution	2	4	3	9
Loss of aquatic habitat	1	5	10	16
Algae blooms	1	1	2	4
Other (please specify)	2	1	0	3
			answered question	7
			skipped question	68

Number	"Other" responses
1	There are large or "wave boats" that generate shoreline erosion.
2	ANYTHING thata interfers with the quality of the lake water is important
3	becoming prematurely eutrophic--allow some target dredging/plant removal
4	In 36 years, we have seen more weeds growing in our area but believe it is due to low water level the past several years.
5	We have way too much building of very large cottages/homes. We have too many boats on the lake that are too large in boat size and engine size, and whic h have a negative effect on shoreline erosion potential. Also too many jet skis driven by untrained drivers, often quite young.
6	no concerns
7	Feel the no wake hours are useless, but there is too much jet ski/sport boating traffic for a lake this size.



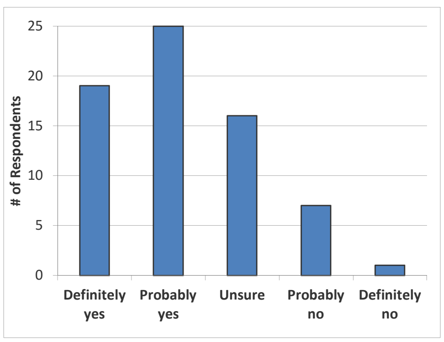
23. During open water season how often does aquatic plant growth, including algae, negatively impact your enjoyment of Archibald Lake?

Answer Options	Never	Rarely	Sometimes	Often	Always	Response Count
	6	32	26	3	1	68
					answered question	68
					skipped question	5



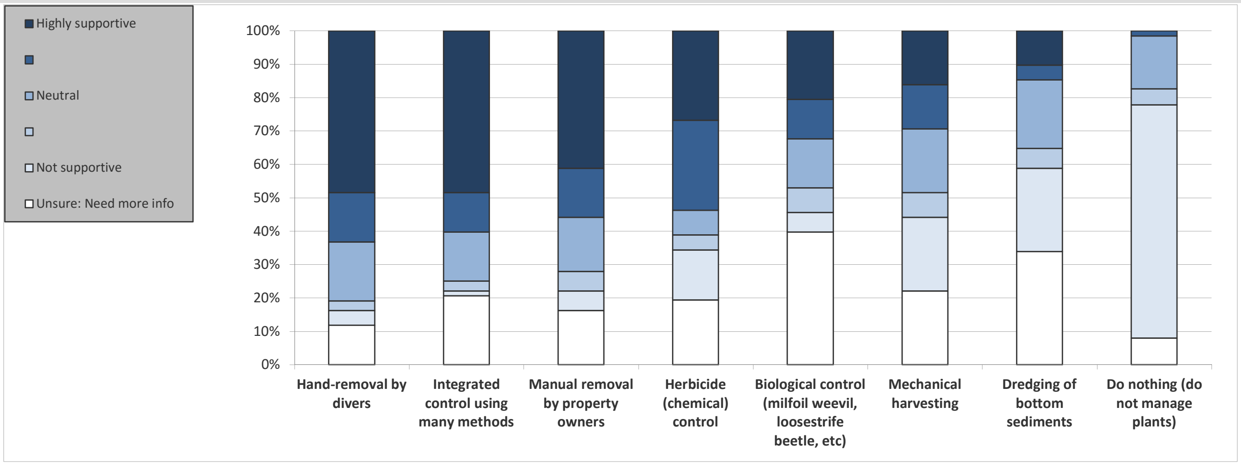
24. Considering your answer to the question above, do you believe aquatic plant control is needed on Archibald Lake?

Answer Options	Definitely yes	Probably yes	Unsure	Probably no	Definitely no	Response Count
	19	25	16	7	1	68
					answered question	68
					skipped question	5



25. Aquatic plants can be managed using many techniques. What is your level of support for the responsible use of the following techniques on Archibald Lake?

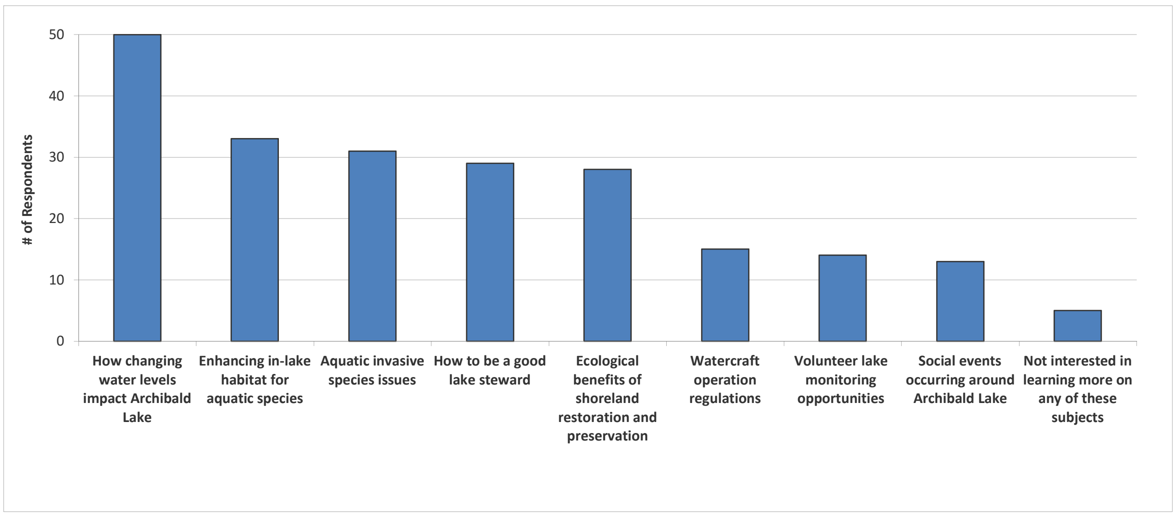
Answer Options	Not supportive		Neutral		Highly supportive	Unsure: Need more info	Rating Average	Response Count
Hand-removal by divers	3	2	12	10	33	8	2.49	68
Integrated control using many methods	1	2	10	8	33	14	2.37	68
Manual removal by property owners	4	4	11	10	28	11	2.26	68
Herbicide (chemical) control	10	3	5	18	18	13	2.12	67
Biological control (milfoil weevil, loosestrife beetle, etc)	4	5	10	8	14	27	1.38	68
Mechanical harvesting	15	5	13	9	11	15	1.41	68
Dredging of bottom sediments	17	4	14	3	7	23	0.91	68
Do nothing (do not manage plants)	44	3	10	1	0	5	0.84	63
							answered question	68
							skipped question	5



26. Stakeholder education is an important component of every lake management planning effort. Which of these subjects would you like to learn more about?

Answer Options	Response Percent	Response Count
How changing water levels impact Archibald Lake	76.9%	50
Enhancing in-lake habitat for aquatic species	50.8%	33
Aquatic invasive species issues	47.7%	31
How to be a good lake steward	44.6%	29
Ecological benefits of shoreland restoration and preservation	43.1%	28
Watercraft operation regulations	23.1%	15
Volunteer lake monitoring opportunities	21.5%	14
Social events occurring around Archibald Lake	20.0%	13
Not interested in learning more on any of these subjects	7.7%	5
Some other topic (please specify)	6.2%	4
	answered question	65
	skipped question	8

Number	Other (please specify)
1	fish stocking information
2	Discuss difference between shoreland restoration effectiveness in clay & rich organic soils vs sand lots. Planting conifer near shore, and cut back deciduous/leaves near shore.
3	better enforcement over watercraft rules offenders - ha!
4	I feel the Association does a fantastic job of addressing all of these issues in their newsletter.



Archibald Lake Association (ALA)

27. Before receiving this mailing, have you ever heard of the ALA?

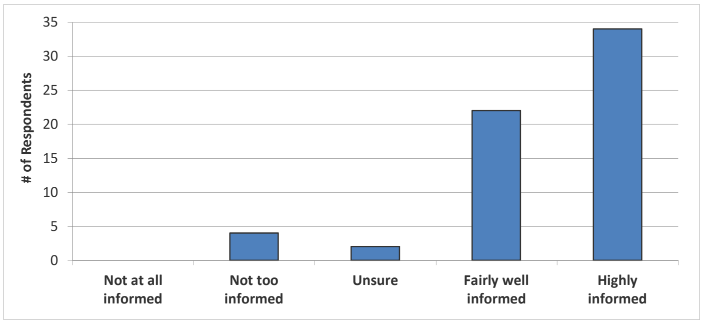
Answer Options	Response Percent	Response Count
Yes	97.1%	67
No	2.9%	2
	answered question	69
	skipped question	4

28. What is your membership status with the ALA?

Answer Options	Response Percent	Response Count
Current member	86.6%	58
Former member	6.0%	4
Never been a member	7.5%	5
	answered question	67
	skipped question	6

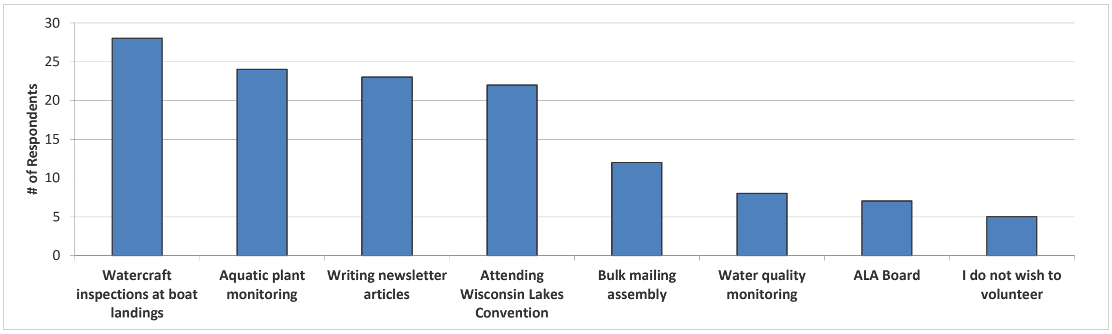
29. How informed has (or had) the ALA kept you regarding issues with your lake and its management?

Answer Options	Not at all informed	Not too informed	Unsure	Fairly well informed	Highly informed	Response Count
	0	4	2	22	34	62
					answered question	62
					skipped question	11



31. The effective management of your lake will require the cooperative efforts of numerous volunteers. Please circle the activities you would be willing to participate in if the ALA requires additional assistance.

Answer Options	Response Percent	Response Count
I do not wish to volunteer	41.8%	28
Aquatic plant monitoring	35.8%	24
Watercraft inspections at boat landings	34.3%	23
Water quality monitoring	32.8%	22
Bulk mailing assembly	17.9%	12
Attending Wisconsin Lakes Convention	11.9%	8
Writing newsletter articles	10.4%	7
ALA Board	7.5%	5
	answered question	**67**
	skipped question	**6**



31. Please feel free to provide written comments concerning the Archibald Lake, its current and/or historic condition and its management.

Answer Options	Answer Options	Response Count
		28
	answered question	**28**
	skipped question	**45**

Number	Response Text
1	Thanks to the ALA.
2	Thank you
3	The ski/tubing/wake hours should be returned to 10am - 4pm or further reduced hours is preferred.
4	Prefer no wake rule from 10-4
5	There has never been floating, uprooted vegetation as we've had in the last few years. I believe it's being caused by the water jet from jet skis when they are used too close to shore or in shallow water. The rules regarding the distance to shore for no wake are rarely followed and needs to be addressed. Any uprooted vegetation can replant itself causing the spread of weed beds including any invasive species.
6	We are only here for 2 weeks out of the summer. We find the the Board is highly active and keeps us well informed
7	Unfortunately, each of the family members spends one week a year (or not at all) at our cabin, nor do any of us live in Wisconsin. Until we retire (which is soon for some), we don't have the time to volunteer. But we so appreciate our neighbors around the lake who have dedicated so much time to maintaining and improving quality of the Lake Archibald experience.
8	The Board is doing a good job of keeping us informed about AIS and is "on top" of managing solutions
9	Good job of management by the ALA!
10	There are small islands where loons nest in spring. These islands are sanctuaries and humans should not be allowed to go ashore.
11	This survey was not intended for people who have given their time and talent to the lake for years. We have been around long enough to see fluxuations in lake quality and Association participation. Like lemming populations we have had times of high participation in the Association. Mainly because of the Board's handling of issues considered important to lake property owners. Then the Board over-extends its parameters and makes unilateral decisions that upset the property owners and there is a drop off of membership and participation. I foresee that drop coming again. I was not at the last Association meeting but talked to a lot of unhappy people. Some of the issues of contention are: 1) There is a ratified proposal to make a rock reef extend over a sand beach in the southern lobe of the east lake. I was at the meeting when that was "approved." Nothing prior to that meeting notified members of the reef vote. I voted to accept an invasive species proposal that was important and a benefit to the lake, not realizing that the rock reef was part of the proposal and did not fully grasping where it was. (I thought it ran in the other direction.) It is an ill-advised, excessively expensive project that covers a sand area that is in itself a spawning area. Rod Chaganos wrote a memo to the Board that detailed the negatives of the project but it was not seen by the membership as a whole. So, no changes are being discussed. Right now the beach is covered by water. A majority of ALA Members hopes the permits run out before the water recedes enough to implement the project. This is one example of member unrest. 2) There is an ongoing misunderstanding of who can vote at the Annual Meeting. This needs to be resolved in a timely and understandable manner. 3) A vast majority NO NOT want anything to do with our Association becoming a Lake District. Yet it keeps simmering in the background of all Association business. There is a fear that suddenly this will be on a front voting burner and that would be an Association back breaker. This needs to be put to rest irrevocably. 4) Email should be used more to apprise Members of things that are happening. It will be 2017. Twenty years ago people were reluctant to give the Association their email and worried about excessive correspondence, those days are over. We all know how to use a delete button. People want input. They want their questions answered more than once a year. Email them a one sentence “heads Up” and refer them to the Association Forum (suggested in #5). 5) The Archi Times is well done. It is now electronic. It would be nice if it became interactive. If we had a forum for people to ask questions and make comments, Rod's rock ledge information would not have died before being read by other members. 6) Kathy Wiggins has many talents, The Archi Times being one of them, but she is not a cohesive leader. She does not generate a positive, open atmosphere for Board Members and Membership alike. Nor does she project assurance and facilitate a meeting like Steve Fleming did. It’s not her fault she succeeded Steve, but following his example as a facilitator would be helpful. 7) We feel that a major factor of erosion on the lake is the increase of large boats and the use of "wake boats." Can this be addressed? 8) Last year trolling became legal. As we watch the number of dead fish generated by trolling increase, we question the soundness of this law change. There is a concern that species that are on the rise after being depleted, are being killed off by trolling. Can this be addressed? 9) The DNR seems to have a carte blanche to do what it wants with our lake with no regard what Association Members would like. It would be nice if Members could know what is being planted and why; when tests or nettings were taking place, etc. Again, it would be great if there was a forum on our website to keep Members appraised of the DNR’s intent and a place for Members to ask questions and make comments. 10) The Archibald Lake Association has done a spectacular job with many issues like invasive species on the lake. We have eradicated nearly all of the Eurasian Milfoil and Flowering Rush. Landowners are notified prior to herbicide treatments and people are appreciative. It all happened through the hard, cooperative work of very special people. Our Association is way ahead of most other Associations. Please take our comments as positive suggestions to keep the good work going.
12	Just a comment. My answers to Aquatic Plant Control questions are assuming that you are including Invasive plants in this as well and not just native

13	water level is almost as high as it was 25 years ago. It seems the water level corresponds to the overall quality of the lake in general. I feel it is imperative to keep invasive anything out of the lake and will help where and when I am able
14	Water quality is very important to us and I think steps need to be taken to make it better many of the places here 60 year old septic systems that have not been inspected in quite some time and are probably leaking sewage into the lake greatly affecting the water quality, the clean boats clean water program is a great tool to help against invasive species, the volunteers are doing a great job
15	One big concern is that when discussing management of runoff, and creating buffers and uncut areas around lake shorelines, there tends to be a one-size fits all approach to proposed solutions. More discussion needs to take place regarding some regulations that (while well intentioned) actually speed up the eutrophication of a lake. Open minded discussion needs to take place on this and other management issues, and the state regulations that sometimes work against their stated goals.
16	This is not in regards to the water itself, but more in regards to the history of the lake. The old Y-Camp that used to be on the lake I feel is a unique part of the history of the lake. I grew up walking down that gravel drive and looking at the old cabins and seeing how the new owners have maintained the cabins or refurbished them. Now that I bring my own children up there, I would love to be able to walk on that drive and explain the history of that camp. I understand the property lines of each property extend to the middle of the road making it a private drive, however walking in the road doesn't seem intrusive in any way. To be yelled at by current owners, seems very extreme and ruins that memory for me. No harm is being done walking on the gravel drive and it certainly would not hurt to be a bit more friendly around the lake. I go up there to enjoy a relaxing weekend with my family and not get yelled at for going on a walk. Maybe those owners should be proud of their properties, be proud of the history their property has, offer some facts or give a friendly wave.

17	Current Assoc seems hostile to any opposition. I believe his name is Rod-had fantastic facts to dispute rocks walls. He was shut down. Efforts to reduce # of needed votes is criminal. We need to modernize involvement to keep everyone informed as most do not live there.
18	I think it is great that light was added as a form of pollution seeing as how I have been battling with my neighbor about it since they have bought their place. I disagree with the planting of the Musky even though i like to catch all fish, I eat panfish.
19	Ala I think owes mr Matt Marty a debt of gratitude for alerting us to invasive species some years ago. I think that without his efforts in communicating potential problems the lake would be in much poorer condition now. As it stands i understand that Archibald lake is revered by recreational and fishing enthusiasts.
20	While the Board has done a number of good projects - they need to get members information, and get feedback as the plans are being developed and present both the direction they feel best and alternatives ahead of vote and the need to get more members involved in the votes
21	You are all doing an awesome job managing the lake and I am very appreciative and thankful for all you do.
22	Mother Nature has her ways of protecting herself. Yes, we humans do sometime abuse what she has given us. Unfortunately some associations (persons in charge) tend to make a mission of theirs to use an association for that purpose. Maybe if the DNR would do its job. Archibald lake could Survive with little help from an association!
23	We have owned this property for 36 years and we see very little change in the lake. Our particular area has more weeds than ever but probably because our children have grown and we no longer swim enough from the shore. The ALA does a remarkable job with activities, lake monitoring, and information sharing via a regular newsletter. We have always, and still, love Archibald Lake!!
24	I feel Archibald Lake has been very well managed over the years. There are and have been many dedicated leaders and lake association members supporting and working together to keep this a gem of a lake. I have a concern about the lake residents not having a say in what species of fish are planted in Archibald Lake. We need more communication and education related to these plantings and the effect on our fishery.
25	Over fishing has done in the crappie population and there are too many Largemouth bass.
26	We have always enjoyed our past use of Archibald Lake and still enjoy it for its beauty and clarity.
27	Although it's inevitable, I feel the charm of the Lake is ebbing with the construction of so many new year homes.
28	I strongly feel that the largemouth and rock bass population is out of control. This lake used to be a valuable walleye/crappie/perch/bluegill lake. The size limit either needs to be removed on largemouth bass or lessened. One a given weekend we've caught up to 50 largemouth and 50 rock bass. The largemouth are typically 10"-13". The walleye fishery needs to improve. I also feel that the no wake goes too late in the afternoon and begins too early in the evening. Along with that the jet skis and sport boats are a danger for lakes this small.

C

APPENDIX C

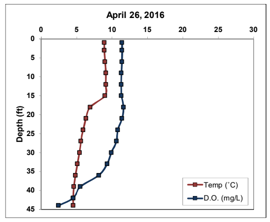
Water Quality Data

Archibald - East Lobe

Date: 4/26/2016
Time: 9:35
Weather: 35F, overcast, light breeze
Entry: EEH

Max Depth: 44.7
LS Depth (ft): 3.0
LB Depth (ft): 42.0
Secchi Depth (ft): 14.8

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	8.9	11.4		
3	8.9	11.4		
6	9.0	11.4		
9	9.1	11.3		
12	9.1	11.3		
15	9.0	11.3		
18	6.9	11.6		
21	6.3	11.4		
24	5.9	10.8		
27	5.6	10.6		
30	5.4	9.9		
33	5.1	9.3		
36	4.8	8.1		
39	4.6	5.5		
42	4.5	4.5		
44	4.5	2.4		



Parameter	LS	LB
Total P (µg/L)	11.30	17.20
Dissolved P (µg/L)	ND	ND
Chl-*a* (µg/L)	1.33	NA
TKN (µg/L)	446.00	539.00
NO_3 + NO_2-N (µg/L)	19.00	30.00
NH_3-N (µg/L)	17.20	190.00
Total N (µg/L)	465.00	569.00
Lab Cond. (µS/cm)	210.00	240.00
Lab pH	8.17	7.59
Alkalinity (mg/L $CaCO_3$)	98.10	113.00
Total Susp. Solids (mg/L)	ND	ND
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	ND	NA
Turbidity (NTU)	NA	NA

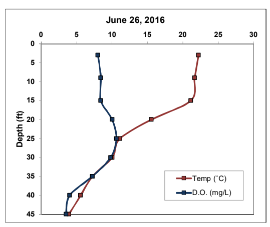
Data collecte by JLW and EEH (Onterra).

Archibald East Lobe

Date: 6/26/2016
Time: 10:00
Weather:
Entry: EEH

Max Depth:
LS Depth (ft):
LB Depth (ft):
Secchi Depth (ft): 19.9

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
3	22.2	8.0		
9	21.7	8.4		
15	21.1	8.4		
20	15.6	10.0		
25	11.1	10.6		
30	10.0	9.8		
35	7.2	7.2		
40	5.6	4.0		
45	3.9	3.5		

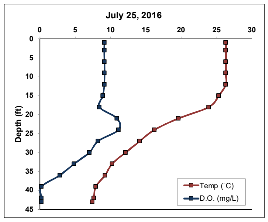


Parameter	LS	LB
Total P (µg/L)	11.60	NA
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	1.77	NA
TKN (µg/L)	NA	NA
NO_3 + NO_2-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	307.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

Archibald East Lake

Date: 7/25/2016	**Max Depth:** 44.0
Time: 11:20	**LS Depth (ft):** 3.0
Weather: Breezy, clear, 75F	**LB Depth (ft):** 42.0
Entry: JMB	**Secchi Depth (ft):** 14.1

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	26.3	9.1		
3	26.3	9.1		
6	26.3	9.1		
9	26.3	9.1		
12	26.3	9.1		
15	25.3	8.9		
18	23.9	8.4		
21	19.6	10.9		
24	16.2	11.1		
27	14.1	8.2		
30	12.1	7.0		
33	10.2	4.8		
36	9.2	2.8		
39	7.9	0.2		
42	7.6	0.2		
43	7.4	0.2		



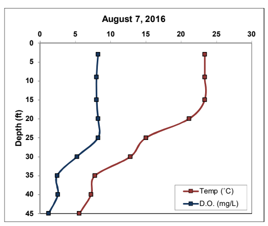
Parameter	LS	LB
Total P (µg/L)	10.70	25.10
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	1.65	NA
TKN (µg/L)	480.00	NA
NO_3 + NO_2-N (µg/L)	ND	NA
NH_3-N (µg/L)	ND	NA
Total N (µg/L)	480.00	NA
Lab Cond. (µS/cm)	197.00	236.00
Lab pH	8.59	7.42
Alkalinity (mg/L $CaCC_3$)	96.60	116.00
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	22.90	NA
Magnesium (mg/L)	12.10	NA
Hardness (mg/L)	107.00	NA
Color (SU)	5.00	NA
Turbidity (NTU)	NA	NA

Data collected by TAH (Onterra).

Lake Name

Date: 8/7/2016	**Max Depth:**
Time: 10:00	**LS Depth (ft):**
Weather:	**LB Depth (ft):**
Entry: EEH	**Secchi Depth (ft):** 16.0

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
3	23.3	8.2		
9	23.3	8.0		
15	23.3	8.0		
20	21.1	8.2		
25	15.0	8.2		
30	12.8	5.2		
35	7.8	2.4		
40	7.2	2.5		
45	5.6	1.2		



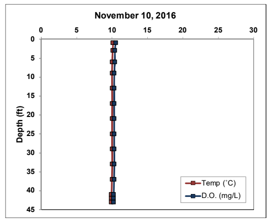
Parameter	LS	LB
Total P (µg/L)	12.20	NA
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	0.94	NA
TKN (µg/L)	NA	NA
NO_3 + NO_2-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	348.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCC_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

Archibald East Lake

Date: 11/10/2016
Time: 9:55
Weather: 0% clouds, 55F
Entry: JMB

Max Depth: 45.5
LS Depth (ft): 3.0
LB Depth (ft): 42.0
Secchi Depth (ft): 9.5

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	10.1	10.5		
3	10.1	10.4		
6	10.0	10.4		
9	10.0	10.3		
13	10.0	10.3		
17	10.0	10.3		
21	10.0	10.3		
25	10.0	10.3		
29	10.0	10.3		
33	10.0	10.3		
37	10.0	10.3		
41	9.9	10.2		
42	9.9	10.2		
43	9.9	10.2		



Parameter	LS	LB
Total P (µg/L)	19.00	21.00
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	5.63	NA
TKN (µg/L)	NA	NA
NO_3 + NO_2-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	ND	2.00
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

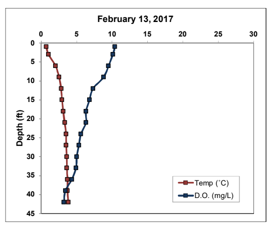
Data collected by JMB (Onterra).

Archibald East Lake

Date: 2/13/2017
Time: 10:30
Weather: 5% clouds, 5mph wind, 40F
Entry: JMB

Max Depth: 44.6
LS Depth (ft): 3.0
LB Depth (ft): 42.0
Secchi Depth (ft): 17.0

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	0.7	10.4		
3	1.0	10.1		
6	2.0	9.5		
9	2.5	8.8		
12	2.8	7.3		
15	2.9	6.8		
18	3.1	6.3		
21	3.3	6.3		
24	3.5	5.6		
27	3.5	5.3		
30	3.6	5.0		
33	3.6	4.9		
36	3.7	4.3		
39	3.7	3.4		
42	3.8	3.2		



Parameter	LS	LB
Total P (µg/L)	14.70	18.90
Dissolved P (µg/L)	5.70	7.30
Chl-*a* (µg/L)	NA	NA
TKN (µg/L)	461.00	715.00
NO_3 + NO_2-N (µg/L)	ND	ND
NH_3-N (µg/L)	127.00	360.00
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

Data collected by TWH & JMB (Onterra). Ice depth: 1.4.

Water Quality Data

2016-2017	Surface		Bottom	
Parameter	**Count**	**Mean**	**Count**	**Mean**
Secchi Depth (feet)	6	15.2	NA	NA
Total P (µg/L)	6	13.3	4	20.6
Dissolved P (µg/L)	2	5.7	2	7.3
Chl a (µg/L)	5	2.3	0	NA
TKN (µg/L	3	462.3	2	627.0
NO_3+NO_2-N (µg/L)	3	19.0	2	30.0
NH_3-N (µg/L)	3	72.1	2	275.0
Total N (µg/L)	4	400.0	1	569.0
Lab Cond. (µS/cm)	2	203.5	2	238.0
Alkal (mg/l $CaCO_3$)	2	97.4	2	114.5
Total Susp. Solids (mg/l)	2	ND	2	2.0
Calcium (mg/L)	1	22.9	0	NA
Magnesium (mg/L)	1	12.1	0	NA
Hardness (mg/L)	1	107.0	0	NA
Color (SU)	2	5.0	0	NA
Turbidity (NTU)	0	NA	0	NA

Trophic State Index (TSI)

Year	TP	Chl-a	Secchi
1987			41.9
1988			40.3
1989			37.1
1990			42.0
1991			38.0
1992			37.5
1993			37.7
1994			38.8
1995			35.1
1996			38.7
1997	45.0	37.8	35.8
1998	35.8	35.7	38.0
1999	36.9	32.8	37.8
2000	38.1	36.1	38.7
2001	37.4	37.2	37.6
2002	40.0	38.0	39.3
2003	36.9	39.9	38.7
2004	38.4	36.0	38.1
2005	40.6	34.2	34.8
2006	40.0	34.2	37.5
2007	30.8	37.4	38.4
2008	36.4	36.9	36.4
2009	40.0	37.6	36.5
2010	34.7	37.6	36.5
2011	34.1	38.4	34.8
2012	37.4	40.2	38.0
2013	31.2	40.2	35.4
2014	35.9	39.1	38.3
2015	40.4	41.2	37.7
2016	39.4	34.3	36.6
All Years (Weighted)	37.7	37.4	37.8
DSL Median	43.2	43.2	42.4
NLF Ecoregion Median	48.1	47.5	45.7

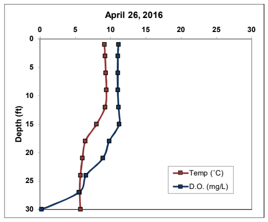
	Secchi (feet)				Chlorophyll-*a* (µg/L)				Total Phosphorus (µg/L)			
	Growing Season		Summer		Growing Season		Summer		Growing Season		Summer	
Year	**Count**	**Mean**	**Count**	**Mean**	**Count**	**Mean**	**Count**	**Mean**	**Count**	**Mean**	**Count**	**Mean**
1987	7	12.6	1	11.5								
1988	9	12.8	6	12.9								
1989	7	16.1	7	16.1								
1990	9	12.1	6	11.4								
1991	16	13.9	11	15.1								
1992	13	14.3	9	15.6								
1993	11	15.0	10	15.4								
1994	18	13.8	17	14.3								
1995	8	16.7	5	18.5								
1996	17	13.9	13	14.4								
1997	12	15.3	7	17.6	5.0	2.2	3.0	2.1	5.0	19.6	3.0	17.0
1998	9	15.3	6	15.1	4.0	2.0	2.0	1.7	5.0	12.6	2.0	9.0
1999	5	15.3	3	15.3	4.0	1.7	3.0	1.3	5.0	9.2	3.0	9.7
2000	8	16.7	5	14.4	4.0	1.6	2.0	1.8	5.0	11.0	2.0	10.5
2001	12	16.7	10	15.5	8.0	2.0	6.0	2.0	8.0	9.6	6.0	10.0
2002	7	14.1	5	13.8	3.0	2.6	2.0	2.1	5.0	12.6	3.0	12.0
2003	5	14.7	3	14.4	4.0	2.4	3.0	2.6	5.0	9.8	3.0	9.7
2004	5	15.7	3	15.0	5.0	1.9	4.0	1.7	6.0	11.2	4.0	10.8
2005	5	18.0	3	18.9	4.0	1.9	3.0	1.4	4.0	12.5	2.0	12.5
2006	5	16.7	3	15.7	4.0	1.6	3.0	1.5	5.0	12.0	3.0	12.0
2007	6	14.0	3	14.7	3.0	2.0	3.0	2.0	4.0	7.3	3.0	6.3
2008	4	17.6	3	16.8	3.0	1.9	3.0	1.9	4.0	9.5	3.0	9.3
2009	4	16.4	3	16.8	3.0	2.0	2.0	2.0	4.0	10.3	3.0	12.0
2010	4	20.1	3	16.8	3.0	2.0	3.0	2.0	4.0	8.5	3.0	8.3
2011	4	18.9	4	18.9	3.0	2.2	3.0	2.2	4.0	8.0	4.0	8.0
2012	4	18.0	2	15.1	3.0	3.0	2.0	2.7	4.0	9.8	2.0	10.0
2013	4	16.5	2	18.1	3.0	2.8	2.0	2.7	4.0	8.9	2.0	6.5
2014	4	19.1	2	14.8	3.0	2.2	2.0	2.4	4.0	9.1	2.0	9.0
2015	4	16.3	2	15.4	3.0	2.8	2.0	2.9	4.0	12.5	2.0	12.4
2016	6	17.5	3	16.7	5.0	1.6	3.0	1.5	6.0	12.5	3.0	11.5
All Years (Weighted)		15.2		15.3		2.1		2.0		10.9		10.3
DSL Median				11.2				3.6				15.0
NLF Ecoregion Median				8.9				5.6				21.0

Archibald Lake - West Lobe

Date: 4/26/2016
Time: 10:05
Weather: 35F, 100% clouds, breezy
Entry: EEH

Max Depth: 27.4
LS Depth (ft): 3.0
LB Depth (ft): 24.0
Secchi Depth (ft): 11.7

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	9.1	11.1		
3	9.2	11.0		
6	9.3	11.0		
9	9.4	11.0		
12	9.2	11.1		
15	8.0	11.2		
18	6.4	9.8		
21	6.0	8.9		
24	5.7	6.5		
27	5.6	5.5		
30	5.7	0.2		



Parameter	LS	LB
Total P (µg/L)	17.60	16.90
Dissolved P (µg/L)	ND	ND
Chl-*a* (µg/L)	1.97	NA
TKN (µg/L)	417.00	484.00
NO_3 + NO_2-N (µg/L)	ND	ND
NH_3-N (µg/L)	ND	45.60
Total N (µg/L)	417.00	484.00
Lab Cond. (µS/cm)	216.00	248.00
Lab pH	8.15	7.76
Alkalinity (mg/L $CaCO_3$)	102.00	117.00
Total Susp. Solids (mg/L)	ND	ND
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	5.00	NA
Turbidity (NTU)	NA	NA

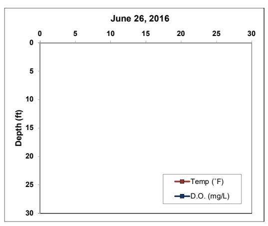
Data collected by JLW and EEH (Onterra).

Archibald Lake - West Lobe

Date: 6/26/2016
Time: 10:00
Weather:
Entry: EEH

Max Depth:
LS Depth (ft):
LB Depth (ft):
Secchi Depth (ft): 13.8

Depth (ft)	Temp (˚F)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
	72.0	8.0		
	72.0	8.0		
	69.0	7.8		
	59.0	8.8		
	54.0	3.4		
	50.0	3.0		



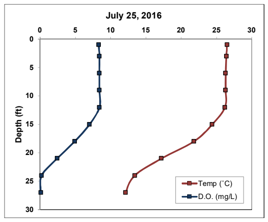
Parameter	LS	LB
Total P (µg/L)	11.80	NA
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	3.30	NA
TKN (µg/L)	NA	NA
NO_3 + NO_2-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	311.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

Archibald Lake - West Lobe

Date: 7/25/2016
Time: 10:45
Weather: Clear, breezy, 75F
Entry: JMB

Max Depth: 29.4
LS Depth (ft): 3.0
LB Depth (ft): 27.0
Secchi Depth (ft): 11.9

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	26.5	8.3		
3	26.4	8.4		
6	26.3	8.4		
9	26.3	8.4		
12	26.2	8.4		
15	24.4	7.0		
18	21.8	4.9		
21	17.2	2.4		
24	13.4	0.2		
27	12.1	0.1		



Parameter	LS	LB
Total P (µg/L)	12.70	24.20
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	1.02	NA
TKN (µg/L)	185.00	NA
NO_3 + NO_2-N (µg/L)	ND	NA
NH_3-N (µg/L)	ND	NA
Total N (µg/L)	185.00	NA
Lab Cond. (µS/cm)	211.00	243.00
Lab pH	8.30	7.37
Alkalinity (mg/L $CaCO_3$)	103.00	120.00
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	24.90	NA
Magnesium (mg/L)	12.40	NA
Hardness (mg/L)	113.00	NA
Color (SU)	5.00	NA
Turbidity (NTU)	NA	NA

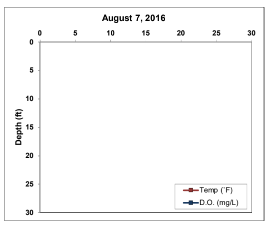
Data collected by TAH (Onterra).

Archibald Lake - West Lobe

Date: 8/7/2016
Time: 10:00
Weather:
Entry: EEH

Max Depth:
LS Depth (ft):
LB Depth (ft):
Secchi Depth (ft): 14.6

Depth (ft)	Temp (˚F)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
	74.0	7.4		
	74.0	7.4		
	74.0	7.2		
	68.0	4.4		
	52.0	1.7		
	50.0	3.8		



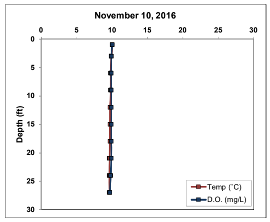
Parameter	LS	LB
Total P (µg/L)	10.50	NA
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	1.62	NA
TKN (µg/L)	NA	NA
NO_3 + NO_2-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	313.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

Archibald Lake - West Lobe

Date: 11/10/2016
Time: 10:35
Weather: 0% clouds, 55F
Entry: JMB

Max Depth: 29.4
LS Depth (ft): 3.0
LB Depth (ft): 27.0
Secchi Depth (ft): 9.6

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	10.0	10.0		
3	9.9	9.9		
6	9.8	9.9		
9	9.8	9.9		
12	9.7	9.9		
15	9.7	9.9		
18	9.7	9.9		
21	9.6	9.9		
24	9.6	9.8		
27	9.6	9.7		



Parameter	LS	LB
Total P (µg/L)	24.10	18.60
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	6.53	NA
TKN (µg/L)	NA	NA
NO_3 + NO_2-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	ND	ND
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

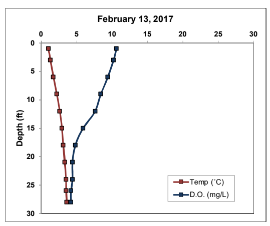
Data collected by JMB (Onterra).

Archibald Lake - West Lobe

Date: 2/13/2017
Time: 10:15
Weather: 5% clouds 5mph wind 40F
Entry: JMB

Max Depth: 29.2
LS Depth (ft): 3.0
LB Depth (ft): 26.0
Secchi Depth (ft): 9.0

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	1.0	10.6		
3	1.3	10.2		
6	1.7	9.4		
9	2.2	8.4		
12	2.6	7.6		
15	2.9	5.9		
18	3.1	4.8		
21	3.3	4.4		
24	3.5	4.4		
26	3.5	4.2		
28	3.6	4.2		



Parameter	LS	LB
Total P (µg/L)	16.30	13.90
Dissolved P (µg/L)	3.30	5.00
Chl-*a* (µg/L)	NA	NA
TKN (µg/L)	402.00	549.00
NO_3 + NO_2-N (µg/L)	ND	ND
NH_3-N (µg/L)	82.40	259.00
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA
Magnesium (mg/L)	NA	NA
Hardness (mg/L)	NA	NA
Color (SU)	NA	NA
Turbidity (NTU)	NA	NA

Data collected by TWH & JMB (Onterra). Ice depth: 1.4ft.

Water Quality Data

2016-2017	Surface		Bottom	
Parameter	Count	Mean	Count	Mean
Secchi Depth (feet)	6	11.8	NA	NA
Total P (µg/L)	6	15.5	4	18.4
Dissolved P (µg/L)	2	3.3	2	5.0
Chl a (µg/L)	5	2.9	0	NA
TKN (µg/L	3	334.7	2	516.5
NO_3+NO_2-N (µg/L)	3	ND	2	ND
NH_3-N (µg/L)	3	82.4	2	152.3
Total N (µg/L)	4	306.5	1	484.0
Lab Cond. (µS/cm)	2	213.5	2	245.5
Alkal (mg/l $CaCO_3$)	2	102.5	2	118.5
Total Susp. Solids (mg/l)	2	ND	2	ND
Calcium (mg/L)	1	24.9	0	NA
Magnesium (mg/L)	1	12.4	0	NA
Hardness (mg/L)	1	113.0	0	NA
Color (SU)	2	5.0	0	NA
Turbidity (NTU)	0	NA	0	NA

Trophic State Index (TSI)

Year	TP	Chl-a	Secchi
1973			36.7
1974			
1986			41.3
1987			41.9
1988			42.2
1989			39.8
1990			44.1
1991	32.9		41.7
1992	32.9		41.0
1993	32.2	37.6	39.8
1994	35.8	40.3	42.0
1995	35.0	32.6	38.7
1996	32.2	38.2	40.4
1997			38.9
1998			38.6
1999			38.8
2000			40.7
2001	43.2	42.5	39.9
2002			43.0
2003			41.5
2004			38.6
2005			38.6
2006			38.9
2007			40.3
2008			41.9
2009			39.5
2010			39.7
2011	37.7	40.2	39.2
2012	38.7	41.5	39.0
2013	36.0	39.5	38.1
2014	39.2	40.7	39.9
2015	39.9	40.8	39.7
2016	39.6	37.3	39.7
All Years (Weighted)	36.8	39.3	40.4
DSL Median	43.2	43.2	42.4
NLF Ecoregion Median	48.1	47.5	45.7

	Secchi (feet)				Chlorophyll-*a* (µg/L)				Total Phosphorus (µg/L)			
	Growing Season		Summer		Growing Season		Summer		Growing Season		Summer	
Year	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean
1973	1	16.5	1	16.5								
1974	2	21.0	0									
1986	5	12.1	5	12.1								
1987	11	10.9	5	11.5								
1988	9	12.0	6	11.3								
1989	7	13.3	7	13.3								
1990	9	9.9	6	9.9								
1991	14	11.0	10	11.7					4	7.3	3.0	7.3
1992	14	11.9	11	12.3					4	14.0	3.0	7.3
1993	13	13.0	12	13.4	4	2.4	3	2.0	1	7.0	1.0	7.0
1994	24	11.4	24	11.4	3	2.7	3	2.7	3	9.0	3.0	9.0
1995	13	14.3	13	14.3	6	2.2	4	1.2	4	9.8	2.0	8.5
1996	16	12.6	12	12.8	5	2.7	3	2.2	2	8.5	1.0	7.0
1997	11	13.3	6	14.2	0		0		0		0.0	
1998	9	14.3	6	14.5	0		0		0		0.0	
1999	5	14.9	3	14.3	0		0		0		0.0	
2000	8	13.8	5	12.6	0		0		0		0.0	
2001	12	14.1	10	13.3	4	3.2	3	3.4	4	14.3	3.0	15.0
2002	5	10.9	3	10.7	0		0		0		0.0	
2003	5	11.0	3	11.9	0		0		0		0.0	
2004	5	13.8	3	14.5	0		0		0		0.0	
2005	5	14.4	3	14.5	0		0		0		0.0	
2006	5	14.5	3	14.2	0		0		0		0.0	
2007	6	11.5	3	12.8	0		0		0		0.0	
2008	4	12.1	3	11.5	0		0		0		0.0	
2009	4	14.0	3	13.6	0		0		0		0.0	
2010	4	14.1	3	13.4	0		0		0		0.0	
2011	4	13.9	4	13.9	3	2.7	3	2.7	4	10.3	4.0	10.3
2012	4	13.8	2	14.1	3	3.3	2	3.1	4	11.5	2.0	11.0
2013	4	14.6	2	15.0	3	3.2	2	2.5	4	10.1	2.0	9.1
2014	4	14.0	2	13.2	3	2.7	2	2.8	4	10.9	2.0	11.4
2015	4	13.6	2	13.4	3	2.8	2	2.8	4	14.4	2.0	12.0
2016	6	12.8	3	13.4	5	2.2	3	2.0	6	13.0	3.0	11.7
All Years (Weighted)		12.8		12.8		2.7		2.4		10.6		9.6
DSL Median				11.2				3.6				15.0
NLF Ecoregion Median				8.9				5.6				21.0

D

APPENDIX D

Watershed Analysis WiLMS Results

Date: 1/11/2017   Scenario: Archibald Lake Current

Lake Id: Archibald Lake
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 2711.0 acre
Total Unit Runoff: 11.00 in.
Annual Runoff Volume: 2485.1 acre-ft
Lake Surface Area <As>: 392.0 acre
Lake Volume <V>: 6589.0 acre-ft
Lake Mean Depth <z>: 16.8 ft
Precipitation - Evaporation: 4.5 in.
Hydraulic Loading: 2632.1 acre-ft/year
Areal Water Load <qs>: 6.7 ft/year
Lake Flushing Rate <p>: 0.40 1/year
Water Residence Time: 2.50 year
Observed spring overturn total phosphorus (SPO): 16.6 mg/m^3
Observed growing season mean phosphorus (GSM): 12.4 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		|---- Loading (kg/ha-year) ----|				|----- Loading (kg/year) ----|		
Row Crop AG	17.0	0.50	1.00	3.00	3.9	3	7	21
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	177.0	0.10	0.30	0.50	12.3	7	21	36
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	2.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	674.0	0.10	0.10	0.10	15.6	27	27	27
Forest	1841.0	0.05	0.09	0.18	38.4	37	67	134
Lake Surface	392.0	0.10	0.30	1.00	27.2	16	48	159

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	87.0				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.52	4.35	13.92	2.5

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	201.9	385.2	861.1	100.0
Total Loading (kg)	91.6	174.7	390.6	100.0
Areal Loading (lb/ac-year)	0.51	0.98	2.20	
Areal Loading (mg/m^2-year)	57.72	110.14	246.23	
Total PS Loading (lb)	0.0	0.0	0.0	0.0
Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	165.7	270.7	480.7	97.5
Total NPS Loading (kg)	75.2	122.8	218.0	97.5

Phosphorus Prediction and Uncertainty Analysis Module

Date: 1/11/2017   Scenario: 45
Observed spring overturn total phosphorus (SPO): 16.6 mg/m^3
Observed growing season mean phosphorus (GSM): 12.4 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	12	23	52	11	89
Canfield-Bachmann, 1981 Natural Lake	13	20	35	8	65
Canfield-Bachmann, 1981 Artificial Lake	13	20	32	8	65
Rechow, 1979 General	4	8	18	-4	-32
Rechow, 1977 Anoxic	18	35	77	23	185
Rechow, 1977 water load<50m/year	7	13	30	1	8
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	13	24	53	7	42
Vollenweider, 1982 Combined OECD	11	19	36	4	28
Dillon-Rigler-Kirchner	7	14	30	-3	-18
Vollenweider, 1982 Shallow Lake/Res.	8	15	30	0	0
Larsen-Mercier, 1976	11	21	47	4	24
Nurnberg, 1984 Oxic	7	14	30	2	16

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	14	43	Tw	0	GSM
Canfield-Bachmann, 1981 Natural Lake	6	58	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	6	58	FIT	1	GSM
Rechow, 1979 General	5	15	FIT	0	GSM
Rechow, 1977 Anoxic	21	63	FIT	0	GSM
Rechow, 1977 water load<50m/year	8	25	FIT	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	12	47	FIT	0	SPO
Vollenweider, 1982 Combined OECD	9	36	FIT	0	ANN
Dillon-Rigler-Kirchner	8	25	FIT	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	7	28	FIT	0	ANN
Larsen-Mercier, 1976	13	38	P Pin	0	SPO
Nurnberg, 1984 Oxic	7	26	FIT	0	ANN

E

APPENDIX E

WDNR Aquatic Herbicide Regulations FAQ & WDNR Chemical Fact Sheets

Frequently Asked Questions about Aquatic Herbicide Use in Wisconsin

Prepared by Wisconsin Dept. of Natural Resources, Dept. of Health Services and Dept. of Agriculture, Trade, and Consumer Protection

June 23, 2011

Why are herbicides used in Wisconsin lakes and rivers?

Aquatic herbicides are used to reduce the abundance of invasive species to reduce spread to new water bodies, to help maintain a healthy native plant community that is beneficial for fish and other aquatic organisms, to improve navigational access to lakes and rivers and make boat navigation safer, and to control nuisance plant and algae growth that can pose a hazard to swimmers.

How is aquatic herbicide use regulated in Wisconsin?

In order to be used in Wisconsin, an aquatic herbicide must be all of the following:

1) Labeled and registered with U.S. EPA's office of Pesticide Programs;
2) Registered for sale and use by the Department of Agriculture, Trade, and Consumer Protection (DATCP);
3) Permitted by the Department of Natural Resources (DNR); and
4) Applied by a DATCP-certified and licensed applicator, with few exceptions.

Step 1) U.S. EPA's office of Pesticide Programs reviews the chemical and label.

Federal law requires herbicides to be registered with the Environmental Protection Agency (EPA) before they can be sold or used. The registration process determines potential risk to human health and the environment. The human health assessment includes sensitive groups such as infants, and risk is evaluated for both short-term and chronic effects. Ultimately, the EPA registers the herbicide if it determines that use of the pesticide will result in "no unreasonable adverse effects" as defined in federal law. This means that the benefits of using the pesticide according to the label outweigh the risks. Once an herbicide is registered, it is re-assessed by EPA every fifteen years.

Step 2) Herbicides must be registered by DATCP prior to sale or use in Wisconsin.

Most EPA-registered herbicide products are eligible to be registered for sale and use in Wisconsin by DATCP-licensed manufacturers and labelers. DATCP will not register an herbicide for use if it is prohibited for sale, use or distribution in Wisconsin, even if it is registered by EPA.

Step 3) DNR evaluates requests for use of chemicals in public waters when a permit application is submitted.

When making a decision whether or not to issue a permit, the Department considers the appropriateness of the herbicide selected at the site, the likely non-target organism effects, the potential for adverse effects on the water body, as well as the potential hazard to humans. DNR may then issue the permit, issue the permit with conditions, or deny the permit. Permit conditions are frequently used to make sure that the herbicide is used responsibly and in accordance with best management practices for the plant being managed.

Step 4) Applied by a certified applicator.

Most herbicide applications to water bodies in Wisconsin must be done by certified applicators. To become certified, an individual must complete a training course and pass a written exam. Businesses that provide herbicide application services must also be licensed by DATCP. A certified applicator is not needed only if the treatment area is less than ¼ acre in size and the product being applied is a granular herbicide.

Are herbicides safe?

The distinction between "EPA registered" and the terms "approved" or "safe" is important. Registration by the EPA does not mean that the use of the herbicide poses no risk to humans or the environment, only that for use in the U.S., the benefits have been determined to outweigh the risks. Because product use is not without risk, the EPA does not define any herbicide as "safe". It is prudent to minimize herbicide exposure whenever possible.

When an herbicide is registered, the EPA sets use requirements to minimize risk that are given on the herbicide label. When using herbicides it is important to follow the label instructions exactly, and never use an herbicide for a use not specified on the label.

What does the DNR do to minimize herbicide use and ensure that herbicides are used responsibly?

The Department of Natural Resources evaluates the benefits of using a particular chemical at a specific site vs. the risk to non-target organisms, including threatened or endangered species, and may stop or limit treatments to protect them. The Department frequently places conditions on a permit to require that a minimal amount of herbicide is needed and to reduce potential non-target effects, in accordance with best management practices for the species being controlled. For example, certain herbicide treatments are required by permit conditions to be in spring because they are more effective, require less herbicide and reduce harm to native plant species. Spring treatments also means that, in most cases, the herbicide will be degraded by the time peak recreation on the water starts.

The DNR encourages minimal herbicide use by requiring a strategic Aquatic Plant Management (APM) Plan for management projects over 10 acres or 10% of the water body or any projects receiving state grants. DNR also requires consideration of alternative management strategies and integrated management strategies on permit applications and in developing an APM plan, when funding invasive species prevention efforts, and by encouraging the use of best management practices when issuing a permit.

The Department also supervises treatments, requires that adjacent landowners are notified of a treatment and have an opportunity to request a public meeting, requires that the water body is posted to notify the public of treatment and usage restrictions, and requires reporting after treatment occurs.

How long do the chemicals stay in the water?

The amount of time an herbicide will stay in the water varies greatly based on a number of different factors, including the type of herbicide used. Residues may only be present in the water for a few hours, or for as long as a few months. Each herbicide has different characteristics that affect where the chemical moves (e.g. if it stays in the water column or settles into the sediment), how it is broken down, and how long it can be detected in water, sediments, and aquatic organisms. For more information on the environmental fate of a particular herbicide, please see the individual chemical fact sheets, available by request from your local lake coordinator (http://dnr.wi.gov/lakes/contacts/Contacts.aspx?role=LAKE_COORDINATOR). These are currently being updated and will be available online soon, as well.

Should I let my kids swim in the water?

None of the aquatic herbicides licensed for use in Wisconsin have swimming restrictions. Dilute amounts of herbicide may be present in the water, but EPA has determined that minimal exposure would result from adults or children swimming in treated waters.

Use restrictions for treated water vary by herbicide, but will always be listed on the herbicide label. To find out how to read an herbicide label, see http://www.epa.gov/pesticides/label/. Restrictions must be posted at public access points to the water body for at least one day near an herbicide treatment and sent to shoreline landowners in advance of the treatment. To minimize your risk of direct exposure, it is wise to stay a safe distance from the area being treated while herbicide applications are being made.

What if I accidently ingest some of the water while swimming or my pet drinks the water?

When assessing the risk posed by swimming in treated water, the EPA considers exposure from accidental swallowing of water, as well as from other routes such as through the skin. Any exposure to herbicide in the water while swimming or through accidental ingestion would be small and would not have toxic effects. Similarly, your pet should not have any side effects from swimming in or drinking treated water, so long as any applicable use restriction period is over.

Are there risks to drinking water?

In Wisconsin, most drinking water supplies come from groundwater, not surface water. For water bodies that are used for drinking water, treatments are required to be a minimum distance from any existing intakes (usually ¼ of a mile). Wells are not considered to be intakes, and therefore the setback distance does not apply. Some aquatic herbicides can move through the sediment into the groundwater, but even those that do move through soil have not been detected above drinking water thresholds in wells.

Campers that are treating surface water for drinking should obtain water from an alternate location until after any posted drinking water restrictions have passed.

Can I eat the fish?

There are no restrictions on eating fish for any currently registered aquatic herbicides following application to water. That does not mean you would not be exposed to the herbicide, just that the amount of herbicide that you might be exposed to is not toxic. A common concern with eating fish from treated water is that the herbicide concentration may be higher in fish tissues than in the water, and therefore exposure may be greater from fish than from exposure to lake water. The potential for bioaccumulation in fish varies by herbicide, and is evaluated by the EPA during the registration process.

Can I water my lawn/garden with lake water?

Many of the herbicides used in lakes and ponds are broadleaf herbicides which will damage garden plants including fruits and vegetables. Some aquatic herbicides will also affect grass. Whether you are watering your lawn or your garden, follow water usage restrictions to avoid any unintended damage. These restrictions on watering will be listed on the herbicide label and posted at boat landings and beaches. The limits vary widely, from no restriction to 120 days. If you are unsure about the herbicide used on the lake near your home, the safest option is to use water from your municipal supply or private well to water plants.

How can I find out if an aquatic herbicide treatment is scheduled for my lake, or has occurred recently?

Notices of herbicide applications and the use restrictions of the herbicides used are required to be posted along shore adjacent to a treatment area, as well as at public access points for the day of treatment through the end of the restricted use period. Additionally, landowners adjacent to a treatment area should be sent advance notification of the treatment by mail, email or newsletter. For a large-scale treatment (over 10 acres or over 10% of the area of the lake) all landowners around the lake would receive advance notification.

How can I be notified in advance of when and where an application will occur, even if I am not adjacent to the treatment area?

The DNR will notify any interested person of upcoming applications if they request to be notified in writing each year. To request notification, contact your local DNR aquatic plant management coordinator (http://dnr.wi.gov/lakes/contacts/Contacts.aspx?role=AP_MNGT).

Why can one person or group of people receive a permit to treat my lake if I don't want the treatment?

Any individual or group can request a permit from the DNR for a treatment since water bodies in the state are public property. The DNR is charged with evaluating any proposed treatments to consider the impact on the environment, and permits can be denied.

The permitting process requires that all landowners adjacent to the treated area be notified of the treatment. If you receive the notice and don't want the treatment to occur, you can send a written request to the applicant and the DNR requesting a public informational meeting on topics of concern to you regarding the treatment and alternatives. If 5 or more such requests are received within 5 days of the notice, the applicant is required to conduct such a meeting in a location near the water body.

What can I do to reduce the need for aquatic herbicide use?

Individuals can help reduce requests for herbicide use to control aquatic plants and algae by implementing best management practices on their property to prevent nutrients from running into the water and by preventing the spread of invasive species. To reduce runoff eliminate the use of fertilizers adjacent to a water body, rake leaves out of the street and off the lawn, plant a buffer strip of native vegetation on shore to reduce erosion and filter water coming off lawns, create a rain garden to filter and slow down water from driveways or rooftops, use a rain barrel to collect water from rooftops to use to water plants, or use a pervious option to pave driveways and sidewalks. To prevent the introduction of new invasive species and stop the spread of existing invasives, when boating remove plants, animals, and mud from your boat when leaving a boat launch, drain all water from your boat, and rinse your boat and equipment with hot or high pressure water or allow to dry for at least five days before moving to another water body.

Where can I find more information about a specific herbicide?

The DNR keeps a fact sheet on file for each herbicide used in aquatic systems. These fact sheets can be requested from your local DNR lake coordinator (http://dnr.wi.gov/lakes/contacts/Contacts.aspx?role=LAKE_COORDINATOR), and will be updated and available online soon, as well.

The EPA's risk assessments are available at http://www.epa.gov/pesticides/reregistration/status.htm.

Additional information can be found with these resources:

http://www.co.thurston.wa.us/health/ehipm/ehipm_aquaticreview.html
Health assessment of aquatic herbicides by Thurston County, Washington, Public Health and Social Services

http://extoxnet.orst.edu/pips/ghindex.html
Specific information on pesticides as well as toxicology

http://npic.orst.edu/
Information about pesticides, supported by EPA and Oregon State University

http://www.datcp.wi.gov/Plants/Pesticides/
WI Department of Agriculture, Trade, and Consumer Protection

January 2012

Diquat Chemical Fact Sheet

Formulations

Diquat, or diquat dibromide, is the common name of the chemical 6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide. Originally registered by the EPA in 1986, diquat was reregistered in 1995 and is currently being reviewed again. It is sold for agricultural and household uses as well as for use on certain floating-leaf and submersed aquatic plants and some algae. The aquatic formulations are liquids: two of the more commonly used in Wisconsin are Reward™ and Weedtrine-D™ (product names are provided solely for your reference and should not be considered endorsements).

Aquatic Use and Considerations

Diquat is a fast-acting herbicide that works by disrupting cell membranes and interfering with photosynthesis. It is a non-selective herbicide and will kill a wide variety of plants on contact. It does not move throughout the plants, so will only kill parts of the plants that it contacts. Following treatment, plants will die within a week.

Diquat will not be effective in lakes or ponds with muddy water or where plants are covered with silt because it is strongly attracted to silt and clay particles in the water. Therefore, bottom sediments must not be disturbed during treatment, such as may occur with an outboard motor. Only partial treatments of ponds or bays should be conducted (1/2 to 1/3 of the water body). If the entire pond were to be treated, the decomposing vegetation may result in very low oxygen levels in the water. This can be lethal to fish and other aquatic organisms. Untreated areas can be treated 10-14 days after the first treatment.

Diquat is used to treat duckweed (*Lemna* spp.), which are tiny native plants. They are a food source for waterfowl but can grow thickly and become a nuisance. Navigation lanes through cattails (*Typha* spp.) are also maintained with diquat. Diquat is labeled for use on the invasive Eurasian watermilfoil (*Myriophyllum spicatum*) but in practice is not frequently used to control it because other herbicide options are more selective.

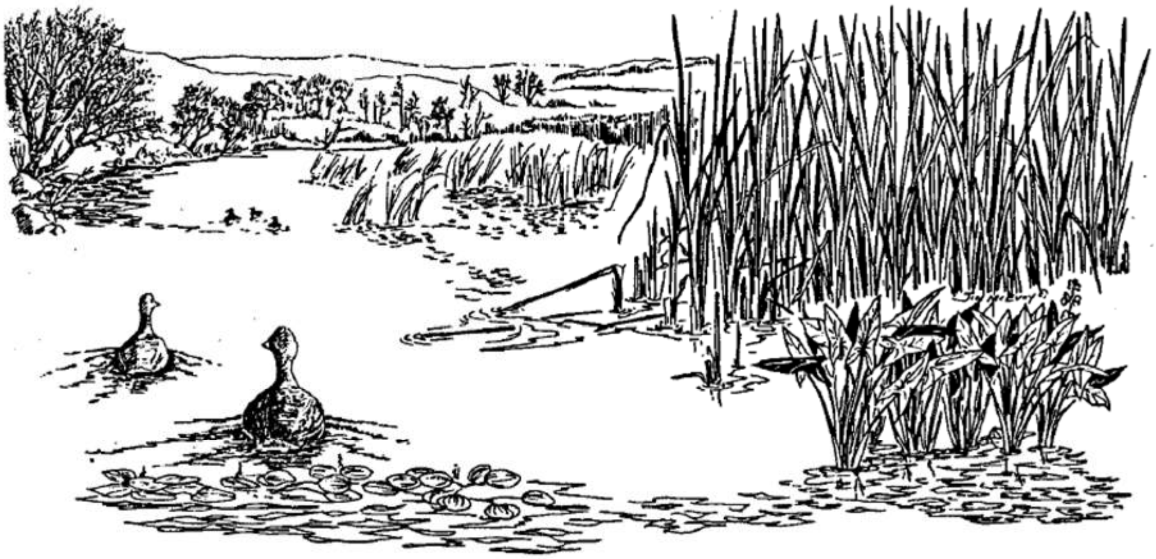
Post-Treatment Water Use Restrictions

There are no restrictions on swimming or eating fish from water bodies treated with diquat. Treated water should not be used for drinking water for one to three days, depending on the concentration used in the treatment. Do not use treated water for pet or livestock drinking water for one day following treatment. The irrigation restriction for food crops is five days, and for ornamental plants or lawn/turf, it varies from one to three days depending on the concentration used.

Herbicide Degradation, Persistence and Trace Contaminants

Diquat is not degraded by microbes. When applied to a waterbody, diquat binds with the organic matter in the sediment indefinitely. It does not degrade and will accumulate in the sediments. Diquat is usually detectable in the water column for less than a day to ~35 days after treatment. Diquat will remain in the water column longer when treating a waterbody with sandy soils due to the low organic matter and clay content. Because of its persistence and very high affinity for the soil, diquat does not leach into groundwater.

Ethylene dibromide (EDB) is a trace contaminant in diquat products. It originates from the manufacturing process. EDB is a carcinogen, and the EPA has evaluated the health risk of its presence in formulated diquat products. The maximum level of EDB in diquat dibromide is 10 ppb (parts per billion), it degrades over time, and it does not persist as an impurity.



Impacts on Fish and Other Aquatic Organisms

At application rates, diquat does not have any apparent short-term effects on most of the aquatic organisms that have been tested. However, certain species of important aquatic food chain organisms such as amphipods and Daphnia (water fleas) can be adversely affected at label application rates. Direct toxicity and loss of habitat are believed to be the causes. Tests on snails have shown that reproductive success may be affected, as well. These organisms only recolonize the treated area as vegetation becomes re-established.

Laboratory tests indicate walleye are the fish most sensitive to diquat, displaying toxic symptoms when confined in water treated with diquat at label application rates. Other game and panfish (e.g. northern pike, bass, and bluegills) are apparently not affected at these application rates. Limited field studies to date have not identified significant short or long-term impacts on fish and other aquatic organisms in lakes or ponds treated with diquat.

The bioconcentration factors measured for diquat in fish tissues is low. Therefore, bioconcentration is not expected to be a concern with diquat.

Human Health

The risk of acute exposure to diquat would be primarily to chemical applicators. Diquat causes severe skin and eye irritation and is toxic or fatal if absorbed through the skin, inhaled or swallowed. Wearing skin and eye protection (e.g. rubber gloves, apron, and goggles) to minimize eye and skin irritation is required when applying diquat.

The risk to water users of serious health impacts (e.g. birth defects and cancer) is not believed to be significant according to the EPA. Some risk of allergic reactions or skin irritation is present for sensitive individuals.

For Additional Information

Environmental Protection Agency
Office of Pesticide Programs
www.epa.gov/pesticides

Wisconsin Department of Agriculture, Trade, and Consumer Protection
http://datcp.wi.gov/Plants/Pesticides/

Wisconsin Department of Natural Resources
608-266-2621
http://dnr.wi.gov/lakes/plants/

Wisconsin Department of Health Services
http://www.dhs.wisconsin.gov/

National Pesticide Information Center
1-800-858-7378
http://npic.orst.edu/

January 2012

2,4-D Chemical Fact Sheet

Formulations

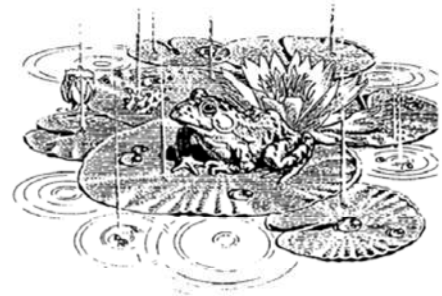
2,4-D is an herbicide that is widely used as a household weed-killer, agricultural herbicide, and aquatic herbicide. It has been in use since 1946, and was registered with the EPA in 1986 and re-reviewed in 2005. The active ingredient is 2,4-dichloro-phenoxyacetic acid. There are two types of 2,4-D used as aquatic herbicides: dimethyl amine salt and butoxyethyl ester. Both liquid and slow-release granular formulations are available. 2,4-D is sold under the trade names Aqua-Kleen, Weedar 64 and Navigate (product names are provided solely for your reference and should not be considered endorsements nor exhaustive).

Aquatic Use and Considerations

2,4-D is a widely-used herbicide that affects plant cell growth and division. It affects primarily broad-leaf plants. When the treatment occurs, the 2,4-D is absorbed into the plant and moved to the roots, stems, and leaves. Plants begin to die in a few days to a week following treatment, but can take several weeks to decompose. Treatments should be made when plants are growing.

For many years, 2,4-D has been used primarily in small-scale spot treatments. Recently, some studies have found that 2,4-D moves quickly through the water and mixes throughout the waterbody, regardless of where it is applied. Accordingly, 2,4-D has been used in Wisconsin experimentally for whole-lake treatments.

2,4-D is effective at treating the invasive Eurasian watermilfoil (*Myriophyllum spicatum*). Desirable native species that may be affected include native milfoils, coontail (*Ceratophyllum demersum*), naiads (*Najas* spp.), elodea (*Elodea canadensis*) and duckweeds (*Lemna* spp.). Lilies (*Nymphaea* spp. and *Nuphar* spp.) and bladderworts (Utricularia spp.) also can be affected.



Post-Treatment Water Use Restrictions

There are no restrictions on eating fish from treated water bodies, human drinking water or pet/livestock drinking water. Following the last registration review in 2005, the ester products require a 24-hour waiting period for swimming. Depending on the type of waterbody treated and the type of plant being watered, irrigation restrictions may apply for up to 30 days. Certain plants, such as tomatoes and peppers and newly seeded lawn, should not be watered with treated water until the concentration is less than 5 parts per billion (ppb).

Herbicide Degradation, Persistence and Trace Contaminants

The half-life of 2,4-D (the time it takes for half of the active ingredient to degrade) ranges from 12.9 to 40 days depending on water conditions. In anaerobic lab conditions, the half-life has been measured up to 333 days. After treatment, the 2,4-D concentration in the water is reduced primarily through microbial activity, off-site movement by water, or adsorption to small particles in silty water. It is slower to degrade in cold or acidic water, and appears to be slower to degrade in lakes that have not been treated with 2,4-D previously.

There are several degradation products from 2,4-D: 1,2,4-benzenetriol, 2,4-dichlorophenol, 2,4-dichloroanisole, chlorohydroquinone (CHQ), 4-chlorophenol and volatile organics.

Impacts on Fish and Other Aquatic Organisms

Toxicity of aquatic 2,4-D products vary depending on whether the formulation is an amine or an ester 2,4-D. The ester formulations are toxic to fish and some important invertebrates such as water fleas (*Daphnia*) and midges at application rates; the amine formulations are not toxic to fish or invertebrates at application rates. Loss of habitat following treatment may cause reductions in populations of invertebrates with either formulation, as with any herbicide treatment. These organisms only recolonize the treated areas as vegetation becomes re-established.

Available data indicate 2,4-D does not accumulate at significant levels in the bodies of fish that have been tested. Although fish that are exposed to 2,4-D will take up some of the chemical, the small amounts that accumulate are eliminated after exposure to 2,4-D ceases.

On an acute basis, 2,4-D is considered moderately to practically nontoxic to birds. 2,4-D is not toxic to amphibians at application rates; effects on reptiles are unknown. Studies have shown some endocrine disruption in amphibians at rates used in lake applications, and DNR is currently funding a study to investigate endocrine disruption in fish at application rates.

As with all chemical herbicide applications it is very important to read and follow all label instructions to prevent adverse environmental impacts.

Human Health

Adverse health effects can be produced by acute and chronic exposure to 2,4-D. Those who mix or apply 2,4-D need to protect their skin and eyes from contact with 2,4-D products to minimize irritation, and avoid inhaling the spray. In its consideration of exposure risks, the EPA believes no significant risks will occur to recreational users of water treated with 2,4-D.

Concerns have been raised about exposure to 2,4-D and elevated cancer risk. Some (but not all) epidemiological studies have found 2,4-D associated with a slight increase in risk of non-Hodgkin's lymphoma in high exposure populations (farmers and herbicide applicators). The studies show only a possible association that may be caused by other factors, and do not show that 2,4-D causes cancer. The EPA determined in 2005 that there is not sufficient evidence to classify 2,4-D as a human carcinogen.

The other chronic health concern with 2,4-D is the potential for endocrine disruption. There is some evidence that 2,4-D may have estrogenic activities, and that two of the breakdown products of 2,4-D (4-chlorophenol and 2,4-dichloroanisole) may affect male reproductive development. The extent and implications of this are not clear and it is an area of ongoing research.

For Additional Information

Environmental Protection Agency
Office of Pesticide Programs
www.epa.gov/pesticides

Wisconsin Department of Agriculture, Trade, and Consumer Protection
http://datcp.wi.gov/Plants/Pesticides/

Wisconsin Department of Natural Resources
608-266-2621
http://dnr.wi.gov/lakes/plants/

Wisconsin Department of Health Services
http://www.dhs.wisconsin.gov/

National Pesticide Information Center
1-800-858-7378
http://npic.orst.edu/

F

APPENDIX G

Archibald Lake 2011 Fisheries Report (WDNR)

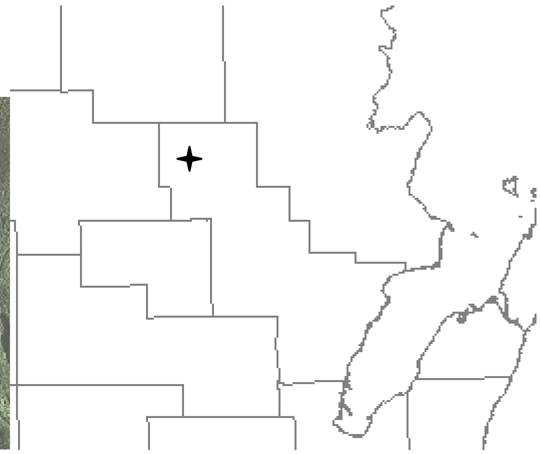
ARCHIBALD LAKE

Oconto County

2011 Fish Management Report

Christopher C. Long

Fisheries Biologist



Wisconsin Department of Natural Resources
101 N. Ogden Rd.
Suite A
Peshtigo, Wisconsin 54157

Your purchase of fishing equipment and motor boat fuel supports boating access and Sport Fish Restoration.

2012

Archibald Lake - Oconto County, Wisconsin
2011 Fish Management Report

12/11/12
Christopher C. Long, Fisheries Biologist, Date

12/11/12
Michael Donofrio, Fisheries Supervisor, Date

E. Randy Schumacher 12/21/12
Randy Schumacher, Eastern District Supervisor, Date

1/16/13
Steve Hewett, Bureau of Fisheries Management, Date

SUMMARY

<u>Lake and location:</u>
Archibald Lake, Oconto County, T32N R15E Sec 2

<u>Physical / chemical attributes (Carson et al. 1977):</u>
Surface acres: 392
Maximum depth (ft): 50
Average depth (ft): 19
Shoreline length (mi): 9.0
Lake type: Seepage Lake
Basic water chemistry: hard water, slightly alkaline, clear water of high transparency.
Littoral substrate: 50% sand, 34% muck, 10% gravel, and 6% rubble and boulders.
Aquatic vegetation: Moderate amount of submergent vegetation is found in many areas of the lake.
Aquatic invasive species: Eurasian water milfoil, a non-native invasive plant, is present.
Other features: A majority of the shoreline is upland hardwoods and conifers. Most of the shoreline is privately owned with significant ownership by the United States Forest Service.

<u>Purpose of survey:</u>
Determine the current status of fishery.

<u>Surveys:</u>
WDNR Survey ID: 118915037 – Late spring bass and panfish (5/17/10 – 5/18/10)
WDNR Survey ID: 89769536 – Fall juvenile walleye (10/20/10)
WDNR Survey ID: 162050683 – Spring fyke netting (4/27/11 – 5/8/11)
WDNR Survey ID: 162360839 – Late spring bass and panfish (6/6/10 – 6/7/10)
WDNR Survey ID: 213340265 – Fall juvenile walleye (10/17/11 – 10/18/11)

<u>Fishery:</u>

The Archibald Lake fishery is comprised of panfish species (bluegill, yellow perch, black crappie, pumpkinseed, and rock bass) and gamefish species (walleye, largemouth bass, muskellunge and northern pike). Other species present include yellow bullhead and white sucker.

EXECUTIVE SUMMARY

- At 392 acres, Archibald Lake offers a variety of recreational opportunities in addition to fishing and has become a popular destination because of its natural, scenic beauty and relatively undeveloped shoreline.
- Archibald Lake was chosen as a brood stock lake for Great Lakes Spotted Muskellunge (GLSM) as part of the Green Bay Restoration Project. Spotted muskellunge were stocked in 2009 and 2010. GLSM stockings are scheduled to take place annually beginning in 2013.
- Small walleye fingerlings have been stocked by the Wisconsin Department of Natural Resources (WDNR) every other year (even numbered years) since 1998 at the rate of 35 fish/acre.
- An angler survey was conducted from May 7, 2011 to March 4, 2012. The creel or angler survey is an assessment tool used to examine the fishing activities of anglers and make projections of the species and number of fish caught and harvested (Table 9).
- Overall, 6,086 fish representing 11 species were collected during the 2011 sampling season (Table 4). The five most abundant species collected by number were yellow perch (59%), bluegill (11%), largemouth bass (10%), rock bass (7%) and walleye (7%).
- A total of 3,578 yellow perch was collected (Table 4). Perch ranged in length from 4.8 to 10.5 in and averaged 6.9 in (Figure 1). Thirty-seven percent of the perch were age 3 and averaged 6.2 in and 28% were age 4 and averaged 7.7 in.
- Five-hundred ninety-eight largemouth bass were collected during the 2011 survey. Bass ranged in length from 6.3 to 18.6 in and averaged 11.3 in (Figure 5). Five percent of largemouth bass collected were over the 14-in minimum length limit.
- Overall, 446 walleye were collected and ranged in length from 5.6 to 26.1 in and averaged 15.5 in (Figure 9). Walleye growth was about average at age 6 and younger but below average at age 7 and older (Figure 10). The Schumacher-Eschmeyer fyke net population estimate for walleye 12 inches and larger was 726 or approximately 1.9 walleye/acre.
- A total of 89 pike was collected and ranged in length from 9.5 to 31.8 in, while averaging 17.2 in (Figure 13). Age-3 pike averaged 17.6 in and represented 22% of the sample and age-4 pike averaged 19.4 in and represented 18% of the pike aged. The population estimate was 453 northern pike or approximately 1.1 pike/acre.
- Twenty-three muskellunge were collected in 2011. Muskellunge ranged in length from 32.8 to 43.5 in (Figure 15). Muskellunge were reaching the 40-inch minimum length limit by age 9. No GLSM were collected.
- Stocking small fingerling walleye has produced variable results. Increasing the stocking rate of small fingerling walleye would produce more consistent year class strength. Successful natural reproduction of walleye was observed in 2011. The low water level has somewhat impacted the utilization of the spawning reef. Extending the walleye spawning reef 200 to 300 feet to the east is strongly recommended.
- Changes to the fishing regulations for walleye should be drafted for further review and reflect the current management goals of the fishery.

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INTRODUCTION

Archibald Lake is located in northwestern Oconto County, west of Lakewood. At 392 acres, the lake offers a variety of recreational opportunities in addition to fishing and has become a popular destination because of its natural, scenic beauty and relatively undeveloped shoreline. The Town of Townsend owns and operates the public access site on the west end of the lake. Anglers can access the lake on the northeast side of the lake by walking through Nicolet National Forest.

Archibald Lake is in the Ceded Territory (22,400 square miles of northern Wisconsin that was ceded to the United States by the Lake Superior Chippewa Tribes in 1837 and 1842) and therefore eligible for tribal, off-reservation spearing harvest. Since 1985, a total of 243 walleye have been harvested during the spearing season. No fish were harvested during the 2011 season.

Except 2002, small walleye fingerlings have been stocked by the Wisconsin Department of Natural Resources (WDNR) every other year (even numbered years) since 1998 at the rate of 35 fish/acre (Table 1). The Archibald Lake Association also sponsored large fingerling walleye stockings in 1999 and 2008. A single, private muskellunge stocking occurred in 2005. Archibald Lake was chosen as a brood stock lake for Great Lakes Spotted Muskellunge (GLSM) as part of the Green Bay Restoration Project. Spotted muskellunge were stocked in 2009 and 2010. GLSM stockings are scheduled to take place annually beginning in 2013. Additionally, to ensure that the WDNR has adequate opportunity to harvest eggs from this population of GLSM, a 50-inch minimum size limit was proposed and approved (64% statewide) during the 2011 Annual Spring Fish and Wildlife Rule Hearings (Wisconsin Conservation Congress – question 14).

The last fisheries survey of Archibald Lake was conducted in 2006 and 2007 (Hasz 2008). Those surveys indicated healthy populations of panfish and gamefish. Compared to previous surveys (1992 and 1999), the 2007 survey reported a decline in the walleye and northern pike populations (Hasz 2008). Hasz (2008) also recommended adding an additional 300 feet of glacial stone to an existing walleye spawning area and increasing habitat complexity by introducing woody debris in the form of tree drops. In 2008, enhancement of the walleye reef was completed and in 2009, 100 large trees were placed at 46 locations around the lake to improve fish habitat.

The goal of the 2011 comprehensive fisheries survey was to assess the status of the fishery by characterizing gamefish populations based on relative abundance, proportional stock density (PSD), relative stock density (RSD), catch per unit effort (CPUE), mean length at capture (age), and comparisons (where applicable) to the 2006 / 2007 survey.

METHODS

Data collection:

Standard fyke nets (3-foot hoop, $^3/_4$-bar, 1.5-inch stretch), mini-fyke nets ($^1/_4$-inch stretch with turtle exclusion) and a standard Wisconsin Department of Natural Resources (WDNR) Direct Current electrofishing boat were used to collect fish on Archibald Lake. Sampling gear, effort, date, and target species for the survey are listed in Table 2. All fish collected were measured to the nearest 0.1 inch total length (TL) and separated into half-inch groups (X.0-X.4 for inch group and X.5-X.9 for half-inch group). A sub-sample of scales or dorsal spines was collected for age and growth analysis from all gamefish. Aging structures (scales or spines) were collected from 5 non young-of-the-year (YOY) per half inch group. If gender could be determined, structures from 5 fish per sex were collected per half inch group. Aging structures for panfish and nongame fish consisted of 10 samples per half inch group when gender could not be established. Ages were assigned to each fish using standard WDNR procedures. Passive integrated transponders (PIT tags) were implanted in all muskellunge collected.

Data analysis:

Relative abundance was calculated as the percentage each species represented from the total sample (i.e. 22 fish of a single species from a sample of 100 total fish = 22% relative abundance). Catch per unit effort (CPUE) was calculated as catch by gear divided by sampling effort for each species collected. Length frequency distributions were tabulated for dominant gamefish and consisted of combined April and May electrofishing samples as well as fyke net data. Proportional stock density (PSD) and relative stock density for **p**referred length fish ($RSD^{\mathbf{P}}$) were calculated for dominant gamefish (Anderson and Neumann 1996). Preferred lengths of various gamefish have a minimum length between 45 and 55% of the world record length for that species (Anderson and Neumann 1996). Stock, quality, and preferred lengths were used as proposed by Gabelhouse (1984). Age-length distributions were calculated for dominant gamefish. Mean length at capture data was calculated for dominant gamefish and compared to the average of mean length at age for northeast Wisconsin. Population estimates for walleye, northern pike, largemouth bass, and smallmouth bass were obtained during the spring fyke net survey by giving each captured fish a top caudal fin clip. Marks (fin clips) were noted is subsequent collections until the survey was complete. The Schumacher-Eschmeyer formulas for multiple census were used to generate population estimates (Schneider 1998).

Creel survey:

An angler survey was conducted from May 7, 2011 to March 4, 2012. The survey was divided into 2 survey periods; open water (May 7 to October 31, 2011) and ice fishing (December 1, 2011 to March 4, 2012). The creel or angler survey is an assessment tool used to examine the fishing activities of anglers and make projections of the species and number of fish caught and harvested. The creel clerk used a boat or snowmobile to count and interview anglers throughout the survey. The schedule consisted of randomly-selected days (weekday and weekend days) and shifts (AM or PM).

RESULTS

Overall, 6,094 fish representing 11 species and 1 hybrid were collected during the 2011 sampling season (Table 4). The five most abundant species collected by number were yellow perch (59%), bluegill (11%), largemouth bass (10%), rock bass (7%) and walleye (7%).

A total of 3,578 yellow perch was collected which accounted for 59% of the fish collected (Table 4). Perch ranged in length from 4.8 to 10.5 in and averaged 6.9 in (Figure 1). Electrofishing CPUE was 1.1/h and fyke net CPUE was 32.8/NN (Appendix III). A subsample of 90 yellow perch was aged from 3 to 9 years old. Thirty-seven percent of the perch were age 3 and averaged 6.2 in and 28% were age 4 and averaged 7.7 in. Growth was average compared to the mean length at age of yellow perch in northeast Wisconsin (Figure 2). Successful reproduction and recruitment of yellow perch was also evident.

During the survey, 658 bluegill was collected yielding an electrofishing CPUE of 91.3/h and a fyke net CPUE of 4.8/NN (Appendix III). Bluegill ranged in length from 3.2 to 8.3 in and averaged 5.9 in (Figure 3). Bluegill PSD was 30, and within the desirable range for a balanced population (Table 3), while RSD^P was 0. Fifty-six percent of the bluegill collected were 6 in (inches) or greater and considered harvestable. A subsample of 46 bluegill was aged from 3 to 11 years. Twenty-seven percent of bluegill were age 5 and averaged 5.2 in. Bluegill growth was average compared to the mean length at age for northeast Wisconsin (Figure 4).

Five-hundred ninety-eight largemouth bass were collected during the 2011 survey. Electrofishing yielded a CPUE of 138.8/h and fyke netting a CPUE of 1.5/NN. Bass ranged in length from 6.3 to 18.6 in and averaged 11.3 in (Figure 5). Largemouth bass PSD was 31 and RSD^P was 3. Bass PSD was below the desirable range for a balanced population (Table 3). Five percent of largemouth bass collected were over the 14-in minimum length limit. A subsample of 58 largemouth bass was aged from 2 to 13 years old (Appendix III). Largemouth bass growth was average between age 2 and age 4 but below average for bass age 5 and older compared to the average mean length at age for bass in northeast Wisconsin (Figure 6). Bass are reaching legal size (14 in) at age 7. Successful reproduction and recruitment of largemouth bass was evident. The Schumacher-Eschmeyer fyke net population estimate for largemouth bass 8 inches and larger was 1,385 or approximately 3.5 bass/acre.

A total of 447 rock bass was collected and ranged in length from 3.6 to 10.9 in and averaged 7.3 in (Figure 7). Electrofishing CPUE was 54.1/h and fyke net CPUE was 3.7/NN (Appendix III). Rock bass PSD was 73 and RSD^P was 13. A subsample of 71 rock bass was aged from 3 to 12 years old. Age-5 rock bass averaged 6.6 inches and accounted for 21% of the rock bass aged (Figure 8). Overall, rock bass growth improved since 2007. The length frequency suggests that the rock bass population is well balanced in terms of age and size structure (Appendix III).

Overall, 446 walleye were collected during both electrofishing and fyke netting (0.4/NN). This does not include recaptured fish. Electrofishing for walleye was conducted in May and October with CPUE's of 8.1/h and 8.7/h, respectively. Walleye ranged in length from 5.6 to 26.1 in and averaged 15.5 in across both samples (Figure 9). Walleye PSD and RSD^P from the spring fyke net sample was 58 and 14, respectively. Walleye PSD was within the desirable range of 30 to 60 (Table 1). A subsample of 179 walleye from fyke nets was aged from 1 to 17 years old. Walleye were reaching legal size (15 in) by age 4 (Figure 10). Young-of-the-year walleye collected in October (age 0) averaged 7.2 inches. Compared to the average length at age for northeast Wisconsin, walleye growth was about average at age 6 and younger but below average at age 7 and older (Figure 10). The Schumacher-Eschmeyer fyke net population estimate for walleye 12 inches and larger was 726 or approximately 1.9 walleye/acre.

A total of 111 black crappie was collected that ranged in length from 4.9 to 12.8 in and averaged 8.6 in (Figure 11). Black crappie were collected electrofishing at a rate of 1.2/h and fyke netting at a rate of 1.0/NN (Appendix III). Black crappie PSD 72 was and RSD^P was 27. A subsample of 52 crappie was aged from 2 to 10 years old. A majority of the black crappie were age 4 (33%) and averaged 8.9 in (Appendix III). Successful reproduction and recruitment of crappie was evident. The growth of black crappie was average compared to the mean length at age for crappie in northeast Wisconsin (Figure 12).

Northern pike accounted for 2% of the fish collected in 2011. A total of 89 pike was collected and ranged in length from 9.5 to 31.8 in, while averaging 17.2 in (Figure 13). Northern pike electrofishing CPUE in was 3.1/h. Fyke netting CPUE was 0.8/NN. Pike PSD was 20 and RSD^P was 7. A subsample of 79 northern pike was aged from 1 to 10 years old (Figure 14). Age-3 pike averaged 17.6 in and represented 22% of the sample and age-4 pike averaged 19.4 in and represented 18% of the pike aged. The growth of northern pike was average up to age 5 but below average at age 6 and older compared to the mean length at age for northeast Wisconsin (Figure 14). The Schumacher-Eschmeyer fyke net population estimate was 453 northern pike or approximately 1.1 pike/acre.

Twenty-three muskellunge were collected in 2011. Muskellunge ranged in length from 32.8 to 43.5 in (Figure 15). Eleven of the 23 muskellunge collected were aged. Ages ranged from 5 to 12 years old (Figure 16). Age-8 and age-9 muskie averaged 37.1 and 39.4 in, respectively. Muskellunge were reaching the 40-inch minimum length limit by age 9. Overall, muskellunge growth was average compared to other lakes in northeast Wisconsin (Figure 16).

Additionally, hybrid sunfish, pumpkinseed, yellow bullhead, and white sucker were also collected during the 2011 survey but only accounted for 2.4% of all fish collected (Table 4).

DISCUSSION

The fishery in Archibald Lake is healthy and diverse. Good populations of panfish (bluegill, yellow perch, black crappie and rock bass) and gamefish (northern pike, walleye, largemouth bass and muskellunge) are present.

Changes in sampling protocol between 2007 and 2011 have limited the amount of comparable data between surveys. The 2007 fisheries survey utilized fall electrofishing to collect the sample of gamefish and panfish whereas the 2011 gamefish/panfish sample was collected in June. As a result, limited comparisons will be made regarding PSD or RSD^P, size structure, growth, and fyke net catch rates for the dominant gamefish and panfish species.

Bluegill and yellow perch comprised the majority of fish collected in both 2007 and 2011 (Table 7). Between 2007 and 2011 the relative abundance of bluegill decreased from 37 to 11%, but PSD increased from 8 to 30 meaning the size structure of the bluegill population has improved.

According the creel survey results, anglers targeted and harvested bluegill more than any other species during the 2011-2012 fishing season (Table 9). The RSD^P (8 inches is the established length anglers prefer) for bluegill collected during the fisheries survey was 0 however, the average size of bluegill harvested during the creel survey was 7.2 inches. With bluegill being colony spawners, anglers can easily target and harvest bluegill likely explaining the discrepancy between the creel statistics (average size of harvested fish) and RSD^P. The decline in bluegill relative abundance was the result of the dramatic increase in the relative abundance of yellow perch which increased from 18% in 2007 to 59% in 2011. Yellow perch were the second most sought after and harvested species during the 2011-2012 fishing season (Table 9). Overall, the fyke net catch rate of perch increased by four fold between the 2007 and 2011 surveys (Table 5). It's probable that the expansion of the yellow perch population is a direct result of the addition of woody debris (tree drops) in 2009.

Blackspot was found in most panfish but was most prevalent in bluegill. Blackspot is a common fish disease/parasite in lakes is caused by a parasite (larval trematode) that burrows into the skin of a fish causing the formation of a cyst approximately one millimeter in diameter. This parasite has a complex life cycle that requires fish eating birds or mammals, snails, and fish at different stages in order to survive. While not aesthetically pleasing, this parasite is not harmful to humans and fish with blackspot can still be eaten. Skinning panfish fillets will remove most of the blackspot and proper preparation will kill any remaining parasites.

Black crappie increased in abundance between the 2007 and 2011 surveys (Figure 11). Crappie are cyclic spawners meaning that successful reproduction and recruitment can be highly variable or unpredictable from year to year. Surprisingly, crappie have produced several good year classes since the last survey which is evident from the number of smaller fish (< 6 inches) and the large number of fish collected that measured around 7 inches in length (Figure 11). Black crappie were the third most abundant fish harvested during the 2011-2012 fishing season with over 1,700 fish harvested which averaged 9.9 inches (Table 9). Good crappie fishing should continue for the next several years but due to their cyclic-spawning nature, continued successful spawning and recruitment will be necessary.

Walleye are a popular sportfish in northeast Wisconsin. Between 2000 and 2010, a total of 87,570 small fingerling and 800 large fingerling walleye have been stocked in Archibald Lake (Table 1). In 2010, fingerling walleye were chemically marked with oxytetracycline (OTC) before stocking. The 2010 fall YOY walleye assessment yielded the collection of 8 fish. Otoliths were removed from YOY walleye however, no OTC marks were detected and no determination could be made whether the fish collected were stocked or the result of natural reproduction. In 2011, no walleye were stocked however, 17 YOY walleye were collected. The addition of the walleye spawning reef in 2008 likely contributed to the successful natural reproduction of walleye observed in 2011. The combination of continued stocking and improved natural reproduction has increased the density (fish per acre) of walleye in Archibald Lake. In 2007, the walleye population estimate was 1.5 fish/acre but improved to 1.9 fish/acre in 2011. However, growth at larger sizes is below average compared to other lakes in northeast Wisconsin. For example, we collected a walleye that was tagged in 1999. In 1999, the walleye measured 16.8 inches long and was age 5. In 2011, at age 17, the same fish measured 21.0 inches indicating it grew only 4.2 inches in 12 years. Walleye harvest was negligible during the creel survey with only 60 being harvested during the fishing season (Table 9).

Only 23 muskellunge were collected during the 2011 survey which was down considerably since the 2007 survey whereby 100 fish were collected. There is no good explanation for the decreased collection of muskellunge. Archibald Lake was also selected as a brood lake for Great Lakes Spotted Muskellunge as part of the Green Bay Restoration Project. The first stocking of GLSM took place in 2009. During the fall juvenile assessment in 2010, a single, 14.8-inch GLSM was collected. No GLSM were collected during any portion of the 2011 survey.

Largemouth bass are the most dominant predator in Archibald Lake in terms of abundance. However, since the 2007 survey the relative abundance of bass decreased by 4% (Table 7) and density (fish/acre) decreased from 5.0 fish/acre in 2007 to 3.5 fish/acre in 2011. Good reproduction and recruitment of largemouth bass is sustaining the population. A large year class of bass between 6 and 7 inches was collected in 2007. This year class is now between 10 and 12 inches and contributed to the decline in PSD (45 to 31 between 2007 and 2011). Even though bass are abundant, there were few above the minimum length limit and growth was below average above age 5 (Figure 6). Better bass fishing opportunities should be available within the next few years as this year class reaches the 14-inch minimum length limit. Largemouth bass were the 3rd most commonly caught fish during the 2011-2012 fishing season but only 39 were harvested (Table 9).

The density of northern pike increased slightly from 0.8 to 1.1 fish per acre between 2007 and 2011, respectively. However the average size of pike collected decreased from 20.2 inches in 2007 to 17.2 inches in 2011. A total of 7,749 pike were caught and 1,338 were harvested during the fishing season (Table 9). The only species of fish targeted more than northern pike were bluegill and yellow perch (Table 9). Harvested fish averaged 19.3 inches which appears to be consistent with what was collected during the fisheries survey. The abundance of shallow, vegetated water will continue to allow pike to flourish in Archibald Lake.

According to the creel survey, fishing pressure on Archibald Lake was moderate and totaled 56.8 hours per acre which was lower than the Oconto County average (70.6 h/ac) but higher than the statewide average of 33.6 h/ac (Table 10). Total fishing effort for the 2011-2012 fishing season was 22,320 (Table 10), however directed effort (targeted fishing effort by fish species) totaled 52,873 hours (Table 9). In summary, it appears that panfish anglers often targeted more than one species which was evident from the comparison of total effort (Table 10) versus directed effort (Table 9).

CONCLUSIONS & RECOMMENDATIONS

The 2011 fisheries survey of Archibald Lake indicated good numbers of gamefish including panfish species such as bluegill, yellow perch, and black crappie and predator species such as largemouth bass and walleye. All species showed good size and age structure and good recruitment. Growth for most species was average at younger ages but below average at older ages.

Walleye have been stocked intermittently in Archibald Lake since the late 1990's (Table 1). Stocking small fingerling walleye has produced varied results during that time. Increasing the stocking rate of small fingerling walleye from 35/acre to between 50 and 100/acre, or stocking large fingerling walleye at the rate of 5/acre/year, would produce more consistent year class strength.

Low water levels have somewhat impacted the utilization of the spawning reef and other available spawning areas. Even though successful natural reproduction of walleye was observed in 2011, this was insufficient to create and sustain a desirable walleye density. Adding more glacial stone to the existing reef, and placing it below the ordinary high water mark, would provide more spawning habitat. Therefore, extending the existing walleye spawning reef 200 to 300 feet to the east is strongly recommended.

The density of walleye increased (1.5/ac to 1.9/ac between 2007 and 2011) as a result of both stocking and natural reproduction. However, added protection through a fishing regulation change is necessary. A proposal to increase the minimum length limit from 15 inches to 18 inches is necessary and will be drafted for consideration. In order to improve and enhance the walleye fishery, the proposed regulation change should increase the adult density of walleye thereby improving natural reproduction and density (fish/ac).

Stocking and evaluation of spotted muskellunge in Archibald Lake, as part of the Green Bay Restoration Project, will be ongoing. Future stockings of spotted muskellunge will utilize PIT (passive integrated transponder) tags. Tagging fish with PIT tags will provide data for known age fish in the population making it easier to assess age and growth in future surveys and allow for identification of fish suitable for gamete extraction for propagation. Future evaluations of spotted muskellunge will depend on the availability of funds and staff.

For the most part, the current fishing regulations (Table 8) are adequate to provide quality fishing opportunities for anglers. However, changing the minimum length limit of walleye should be considered to reflect the current management goals of the fishery. The next comprehensive fisheries survey (fyke netting, spring and fall electrofishing) of Archibald Lake is scheduled for 2023 and will focus on the age, growth, abundance, and recruitment of the dominant gamefish. Access is Archibald Lake is adequate. Control of Eurasian watermilfoil, a non-native species of aquatic vegetation is recommended. Boaters are reminded to remove all vegetation from their boat and trailer before leaving to limit the spread of this and other invasive species. A map of Archibald Lake can be found at the following internet address; (http://dnr.wi.gov/lakes/maps/DNR/0417400a.pdf).

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APPENDIX I – TABLES

Table 1. Stocking history of Archibald Lake from 1992 – present; Oconto County, WI.

Year	Species	Strain (Stock)	Source Type	Age Class	Number Stocked	Avg Length
1994	WALLEYE	UNSPECIFIED	DNR	FINGERLING	11267	3
1998	WALLEYE	UNSPECIFIED	DNR	SMALL FINGERLING	15000	2
1999	MUSKELLUNGE	UNSPECIFIED	PRIVATE	YEARLING	500	16
2000	WALLEYE	UNSPECIFIED	DNR	SMALL FINGERLING	15000	2
2003	WALLEYE	MISSISSIPPI HEADWATERS	DNR	SMALL FINGERLING	15000	2
2004	WALLEYE	LAKE MICHIGAN	DNR	SMALL FINGERLING	14988	1
2005	MUSKELLUNGE	UNSPECIFIED	PRIVATE	LARGE FINGERLING	100	13
2006	WALLEYE	LAKE MICHIGAN	DNR	SMALL FINGERLING	14983	1
2008	WALLEYE	MISSISSIPPI HEADWATERS	DNR	SMALL FINGERLING	13799	1
2008	WALLEYE	UNSPECIFIED	PRIVATE	LARGE FINGERLING	300	7
2009	MUSKELLUNGE	GREAT LAKES SPOTTED	OTHER STATE'S GVT. HATCHERY	YEARLING	566	9
2010	MUSKELLUNGE	GREAT LAKES SPOTTED	DNR	YEARLING	107	11
2010	WALLEYE	LAKE MICHIGAN	DNR	SMALL FINGERLING	13800	1
2012	WALLEYE	LAKE MICHIGAN	DNR	SMALL FINGERLING	14996	2

Table 2. Sampling gear, date, target species, sampling effort, and location (distance) for 2010 and 2011 fisheries survey on Archibald Lake in Oconto County, WI.

Sampling Gear	Date	Target Species	Sampling Effort hours (h) or net night (NN)	Shoreline Distance (mi)
Mini-fyke net	August (2010)	Juvenile gamefish and panfish	14 NN	*
Electrofishing	October (2010)	YOY walleye	3.4 h	6.3
Fyke net	April (2011)	All fish	109 NN	*
Electrofishing	May (2011)	Walleye	2	4.1
Electrofishing	June (2011)	Gamefish Panfish	3.2 0.9	6.0 1.5
Electrofishing	October (2011)	YOY walleye	3.7	7.1

GPS coordinates for sampling locations located in APPENDIX III.

Table 3. Proposed length categories for various fish species. Measurements are total lengths for each category in inches. Updated from Anderson and Neumann (1996), Bister et al. (2000), Hyatt and Hubert (2001).

Species	PSD	RSD-P	Stock	Quality	Preferred	Memorable	Trophy
Black crappie			5	8	10	12	15
Bluegill	20 - 40	5 - 20*	3	6	8	10	12
Brown bullhead			5	8	11	14	17
Largemouth bass	40 - 70	10 - 40*	8	12	15	20	25
Muskellunge	30 - 60		20	30	38	42	50
Northern pike	30 - 60		14	21	28	34	44
Pumpkinseed	20 - 40		3	6	8	10	12
Rock bass	20 - 60		4	7	9	11	13
Smallmouth bass	30 - 60		7	11	14	17	20
Walleye	30 - 60		10	15	20	25	30
Yellow perch	30 - 50		5	8	10	12	15
Yellow bullhead			4	7	9	11	14

*Range based on management strategy for balanced populations.

Table 4. Number, relative abundance (%), and length range (in) of fishes collected in Archibald Lake, Oconto County, WI 2011.

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT			
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)
Yellow perch	3578	58.7	4.8 - 10.5
Bluegill	658	10.8	3.2 - 8.3
Largemouth bass	598	9.8	6.3 - 18.6
Rock bass	447	7.3	3.6 - 10.9
Walleye	446	7.3	5.6 - 26.1
Black crappie	111	1.8	4.9 - 12.8
Northern pike	89	1.5	9.5 - 31.8
Hybrid sunfish	58	1.0	3.7 - 8.4
Pumpkinseed	49	0.8	3.5 - 7.5
Yellow bullhead	27	0.4	7.8 - 11.7
Muskellunge	23	0.4	32.8 - 43.5
White sucker	10	0.2	9.8 - 23.7
Total (11 Species)	6094		

*Common names of fishes recognized by the American Fisheries Society.

Table 5. Comparison of spring fyke netting data from Archibald Lake between 2007 and 2011 surveys; Oconto County, WI.

	2011 (109*)		2007 (122*)	
Species	**Total Catch**	**Mean Catch per net night**	Total Catch	Mean Catch per net night
Yellow perch	3577	32.8	898	7.4
Bluegill	528	0.8	683	5.6
Rock bass	401	3.7	234	1.9
Walleye	464	4.3	676	5.5
Largemouth bass	163	1.5	153	1.3
Black crappie	110	1.0	39	0.3
Northern pike	85	0.8	62	0.5
Hybrid sunfish	56	0.5	16	0.1
Pumpkinseed	33	0.3	62	0.5
Yellow bullhead	24	0.2	2	0.1
Muskellunge	19	0.2	124	1.0
White sucker	10	0.1	19	0.2

*Sampling effort in net nights for each corresponding year.

Table 6. Seasonal electrofishing summary between 2011 and 2007 surveys on Archibald Lake, Oconto County, WI.

	Gamefish / Panfish electrofishing						Spring walleye electrofishing						Fall electrofishing								
	2011			2007			2011			2007			2011			2010			2007		
Species	Total Catch**	CPUE / hour	CPUE / mile	Total Catch	CPUE / hour	CPUE / mile	Total Catch**	CPUE / hour	CPUE / mile	Total Catch	CPUE / hour	CPUE / mile	Total Catch**	CPUE / hour	CPUE / mile	Total Catch	CPUE / hour	CPUE / mile	Total Catch	CPUE / hour	CPUE / mile
Largemouth bass	444	138.8	74.0	168	62.6	42.0															
Bluegill	137	161.2	91.3	1203	448.3	300.8															
Rock bass	46	54.1	30.7	266	99.1	66.5															
Walleye	26	8.1	4.3	26	9.7	6.5	75	36.9	18.3	79	12.9	8.8	32	8.7	4.5	8	2.3	1.3	15	3.7	2.4
Pumpkinseed	16	18.8	10.7	42	15.7	10.5															
Hybrid sunfish	2	2.4	1.3	21	7.8	5.3															
Black crappie	1	1.2	0.7	13	4.9	3.3															
Muskellunge	1	0.3	0.2	3	1.1	0.8							4	1.1	0.6	3	0.9	0.5	6	1.5	1.0
Yellow perch	1	1.2	0.7	22	8.2	5.5															
Northern pike	10	3.1	1.7	13	4.9	3.3															
Green sunfish	0			9	3.4	2.3															

* See sampling effort table for date of sampling.

**Includes recaptured fish.

Table 7. Comparison of species relative abundance between 2011 and 2007 surveys on Archibald Lake, Oconto County, WI.

	2011		2007	
*COMMON NAME OF FISH	NUMBER	%	NUMBER	%
Yellow perch	3578	58.7	920	17.9
Bluegill	658	10.8	1886	36.7
Largemouth bass	598	9.8	708	13.8
Rock bass	447	7.3	500	9.7
Walleye	446	7.3	702	13.7
Black crappie	111	1.8	52	1.0
Northern pike	89	1.5	75	1.5
Hybrid sunfish	58	1.0	37	0.7
Pumpkinseed	49	0.8	104	2.0
Yellow bullhead	27	0.4	2	0.0
Muskellunge	23	0.4	127	2.5
White sucker	10	0.2	19	0.4
Green sunfish	0		9	0.2
Total	6094		5141	

*Common names of fishes recognized by the American Fisheries Society.

Table 8. Current fishing regulations for Archibald Lake, Oconto County, WI.

Species	Fishing Season	Daily Limit	Minimum Length
Largemouth bass	1st Saturday in May - June 18	0	Catch and release
Largemouth bass	June 19 - 1st Sunday in March	5 in total	14 inches
Northern pike	1st Saturday in May - 1st Sunday in March	5	None
Muskellunge	Last Saturday in May - November 30	1	50 inches
Walleye	1st Saturday in May - first Sunday in March	3	15 inches
Panfish (bluegill, pumpkinseed, crappie, and yellow perch	Open all year	25 in total	None
Yellow bullhead	Open all year	None	None
Rock bass	Open all year	None	None

Table 9. Archibald creel survey synopses for the 2011-2012 fishing season.

CREEL YEAR: 2011-12

SPECIES	DIRECTED EFFORT (Hours)	PERCENT OF TOTAL	ESTIMATED TOTAL CATCH	SPECIFIC CATCH RATE (Hrs/Fish) *	ESTIMATED TOTAL HARVEST	SPECIFIC HARVEST RATE (Hrs/Fish) **	MEAN LENGTH OF HARVESTED FISH
Walleye	3981	7.53%	78	55.6	60	72.5	18.6
Northern Pike	7749	14.66%	1338	7.2	245	40.2	19.3
Muskellunge	3289	6.22%	65	67.6	0		
Largemouth Bass	7473	14.13%	6854	1.6	39	204.1	14.9
Yellow Perch	10938	20.69%	11212	1.0	4323	2.5	8.2
Bluegill	12013	22.72%	15217	0.8	4501	2.7	7.2
Pumpkinseed	495	0.94%	405	1.8	204	3.0	7.7
Rock Bass	1408	2.66%	3891	0.8	825	1.7	8.2
Black Crappie	5527	10.45%	3059	1.8	1723	3.2	9.9

* A blank cell in this column indicates that no fish of a given species were caught by anglers who specifically targeted that species.

** A blank cell in this column indicates that no fish of a given species were harvested by anglers who specifically targeted that species.

Table 10. Sportfishing effort summary for Archibald Lake (2011-2012), Oconto County and Statewide.

Month	Total Angler Hours	Total Angler Hours / Acre	Oconto County Average (Hours / Acre)	Statewide Average (Hours / Acre)
May	2840	7.2	6.7	5.8
June	2798	7.1	16.3	6.1
July	2800	7.1	14.6	6.4
August	2228	5.7	12.9	5.4
September	1516	4.0	4.2	3.8
October	1755	4.5	1.3	1.6
December	920	2.3	4.7	1.7
January	4080	10.4	5.3	1.5
February	3144	8.0	4.5	1.3
March	196	0.5	0.1	**
*Summer Total	13981	35.6	56.0	29.1
*Winter Total	8339	21.2	14.6	4.5
Grand Total	22320	56.8	70.6	33.6

*"Summer" is May - October; "Winter" is December - March

**Too few lakes have been surveyed in March to calculate a meaningful statewide average

APPENDIX II – FIGURES

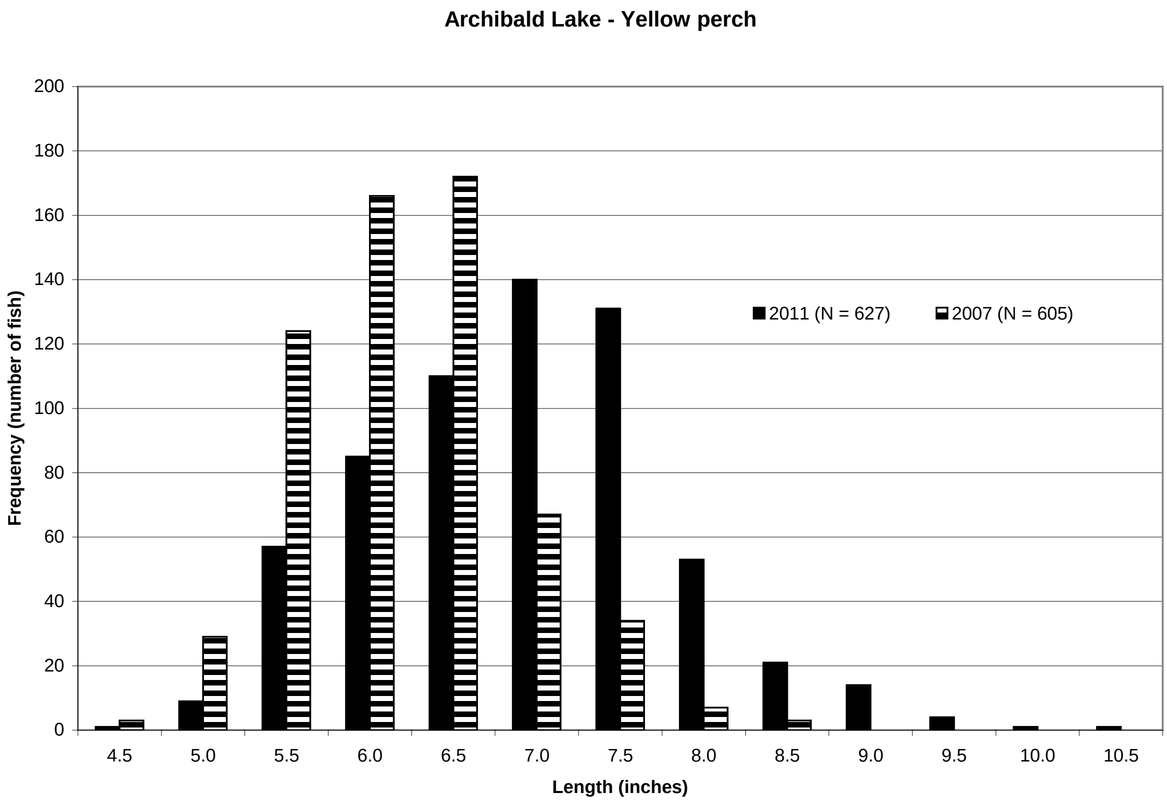


Figure 1. Yellow perch length frequency from 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

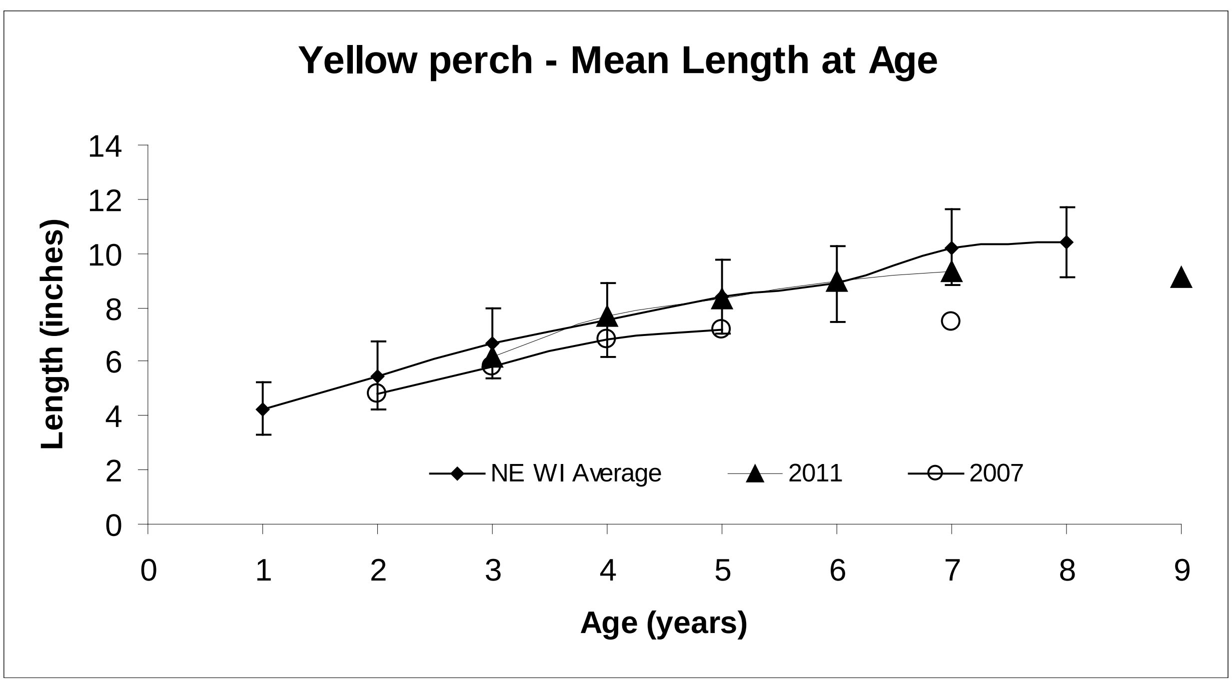


Figure 2. Yellow perch mean length at age comparison from Archibald Lake; Oconto County, WI.

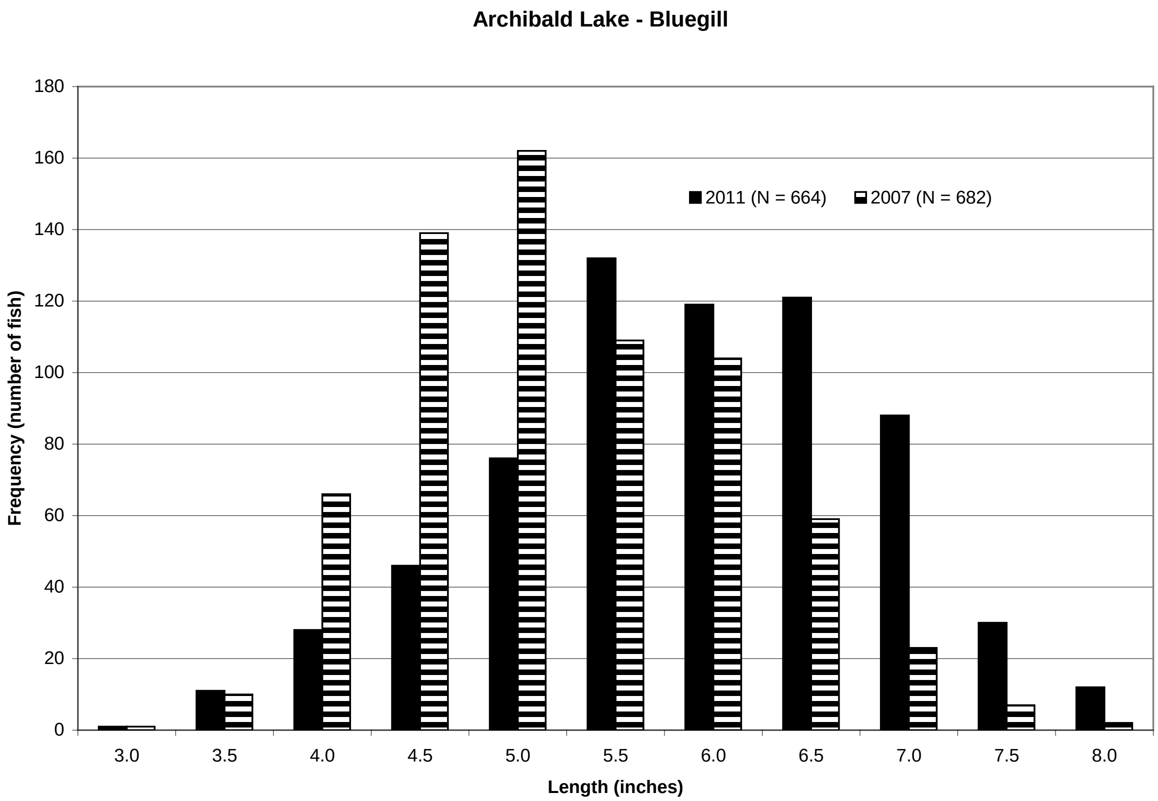


Figure 3. Bluegill length frequency from 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

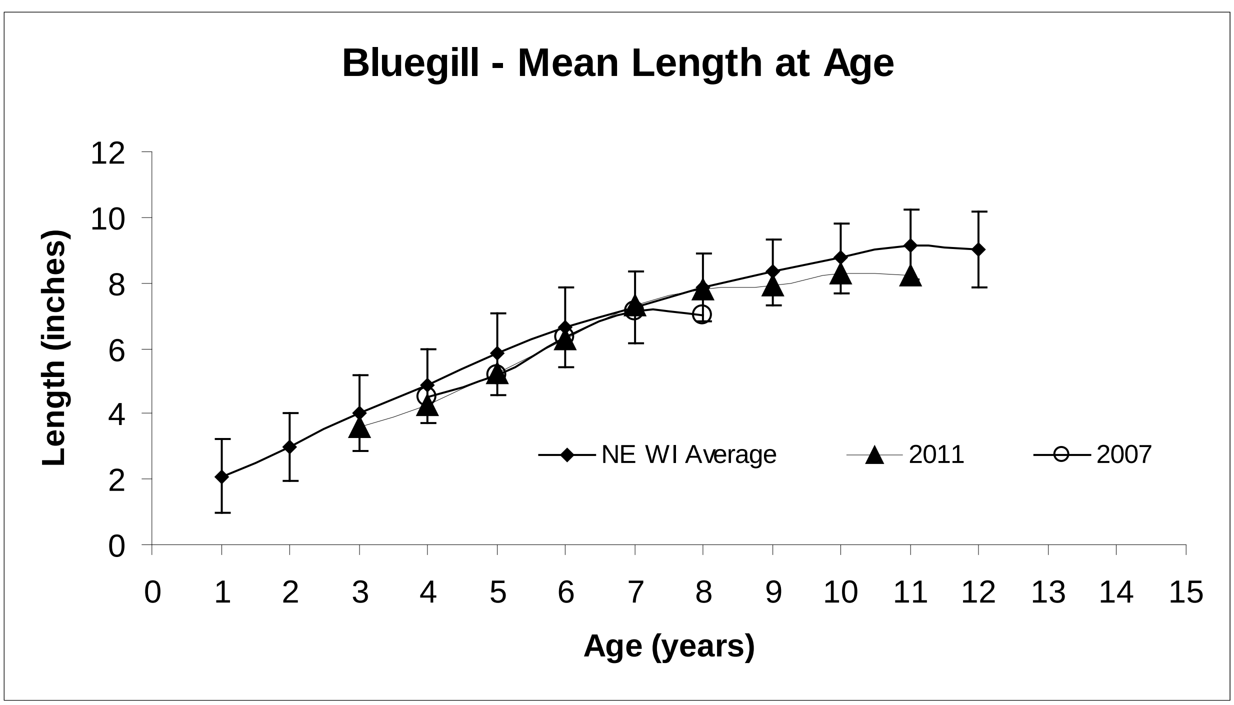


Figure 4. Bluegill mean length at age comparison from Archibald Lake; Oconto County, WI.

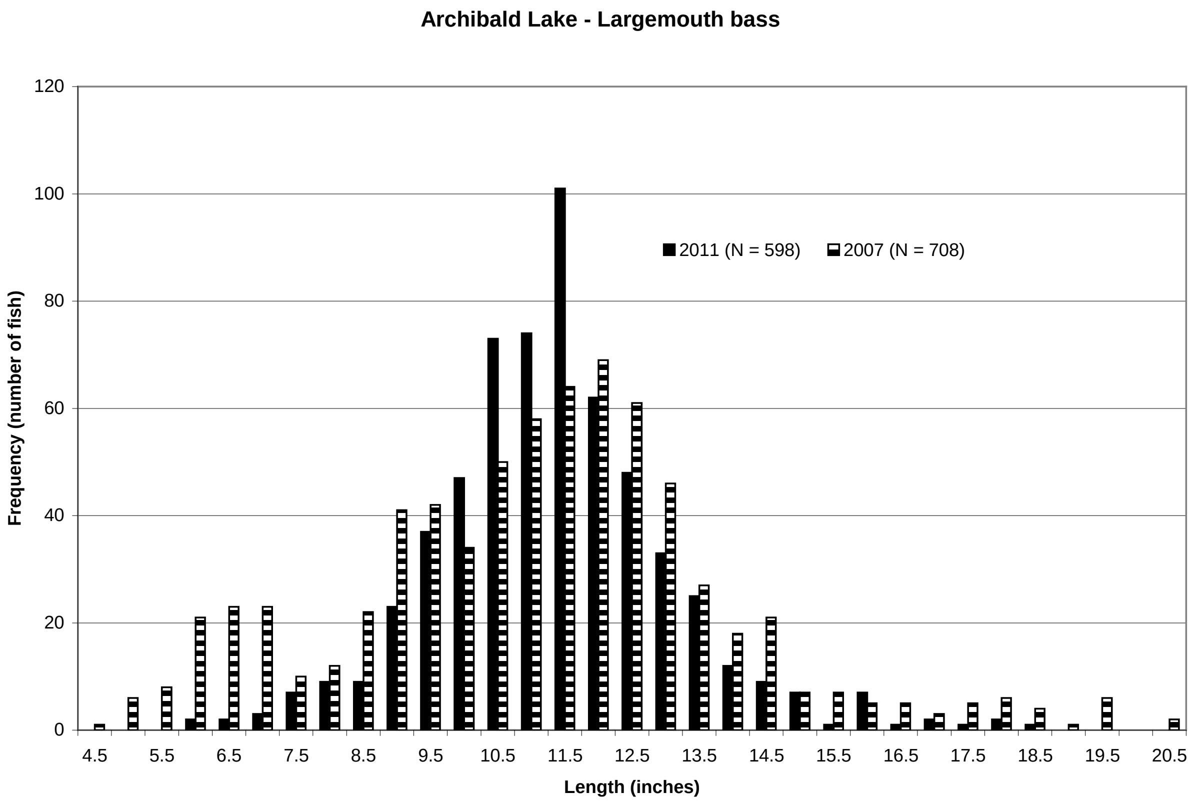


Figure 5. Largemouth bass length frequency from 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

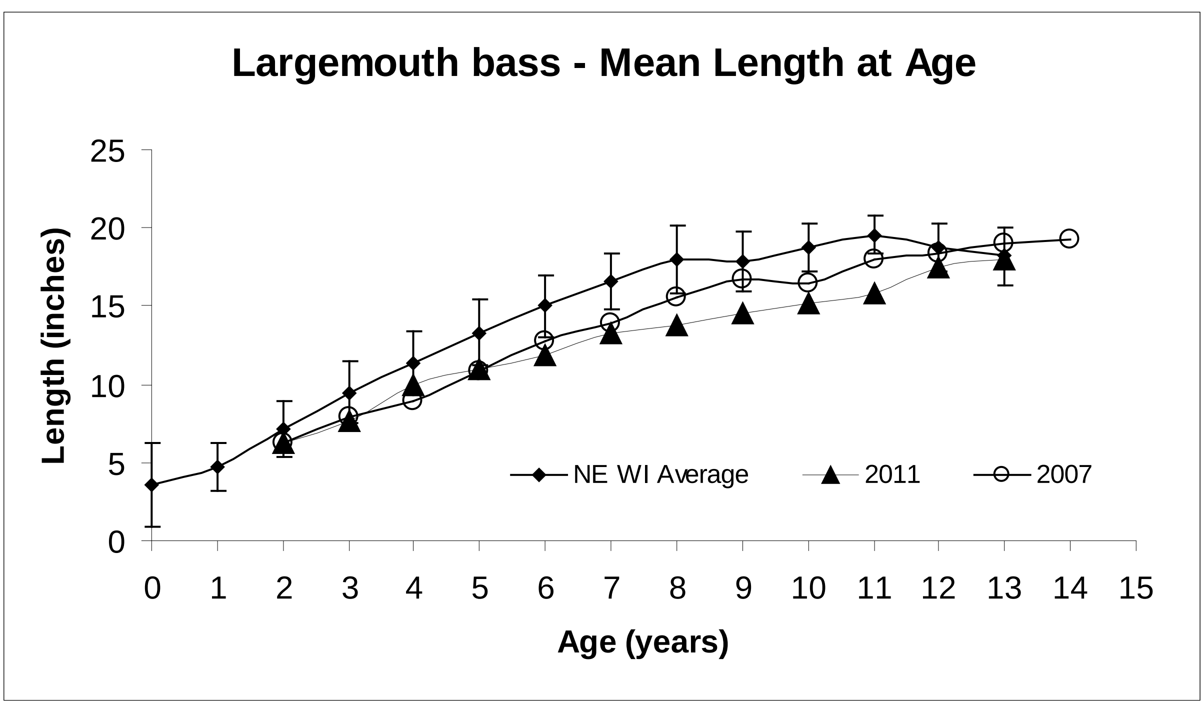


Figure 6. Largemouth bass mean length at age comparison from Archibald Lake; Oconto County, WI.

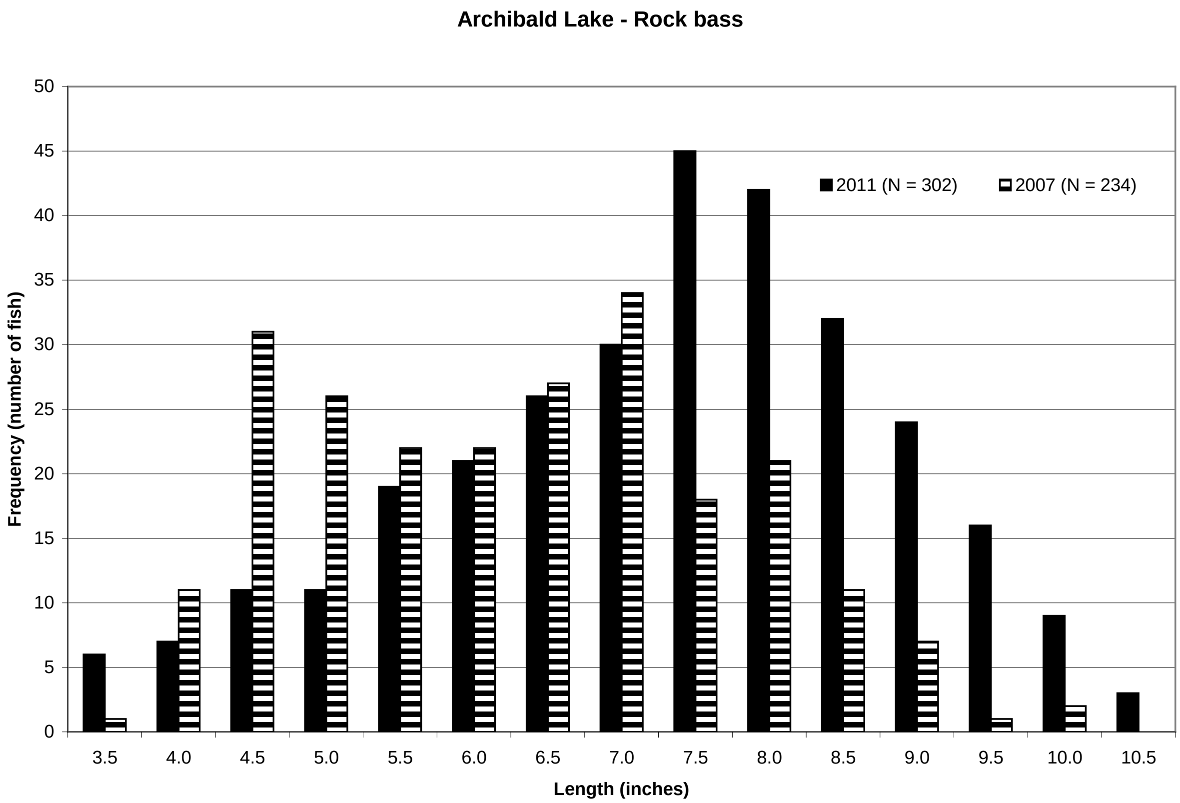


Figure 7. Rock bass length frequency from 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

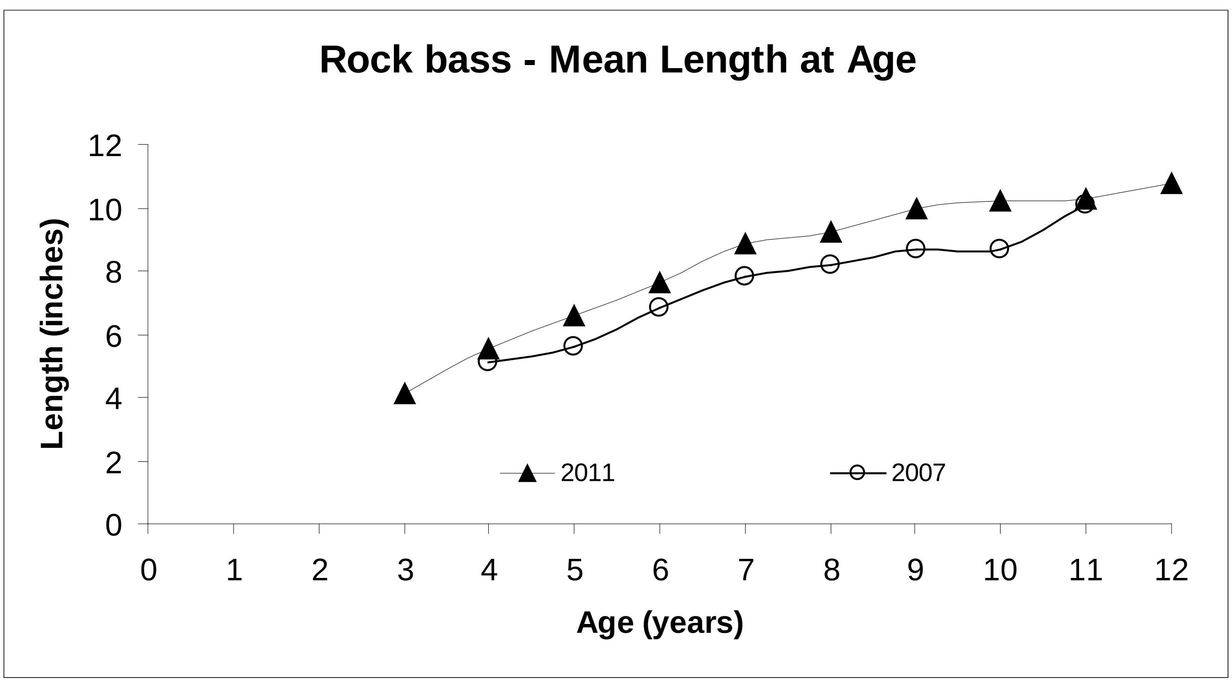


Figure 8. Rock bass mean length at age comparison from Archibald Lake; Oconto County, WI.

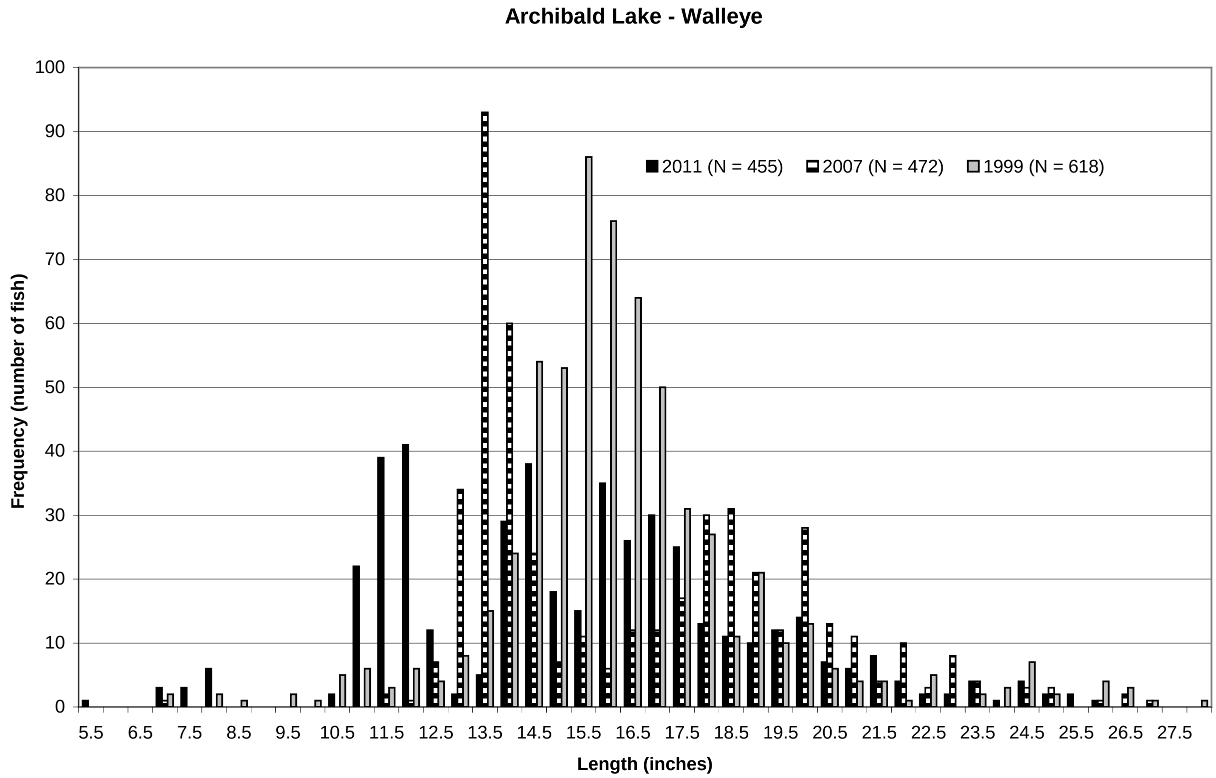


Figure 9. Walleye length frequency from, 1999, 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

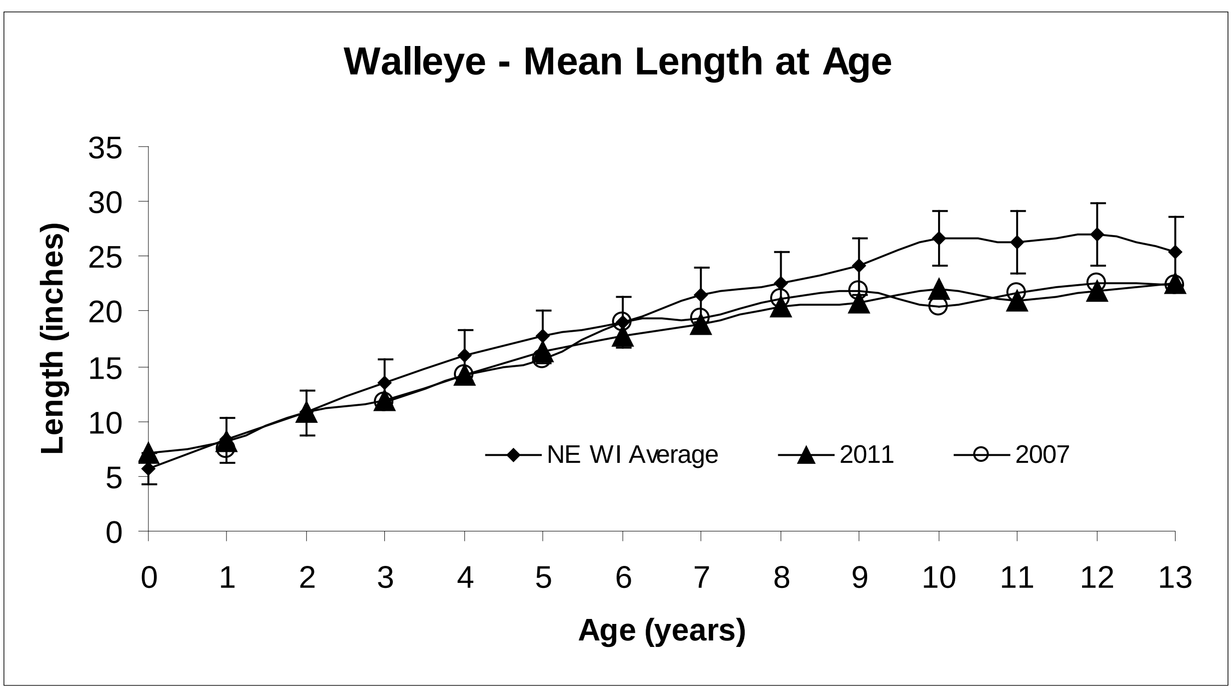


Figure 10. Walleye mean length at age comparison from Archibald Lake; Oconto County, WI.

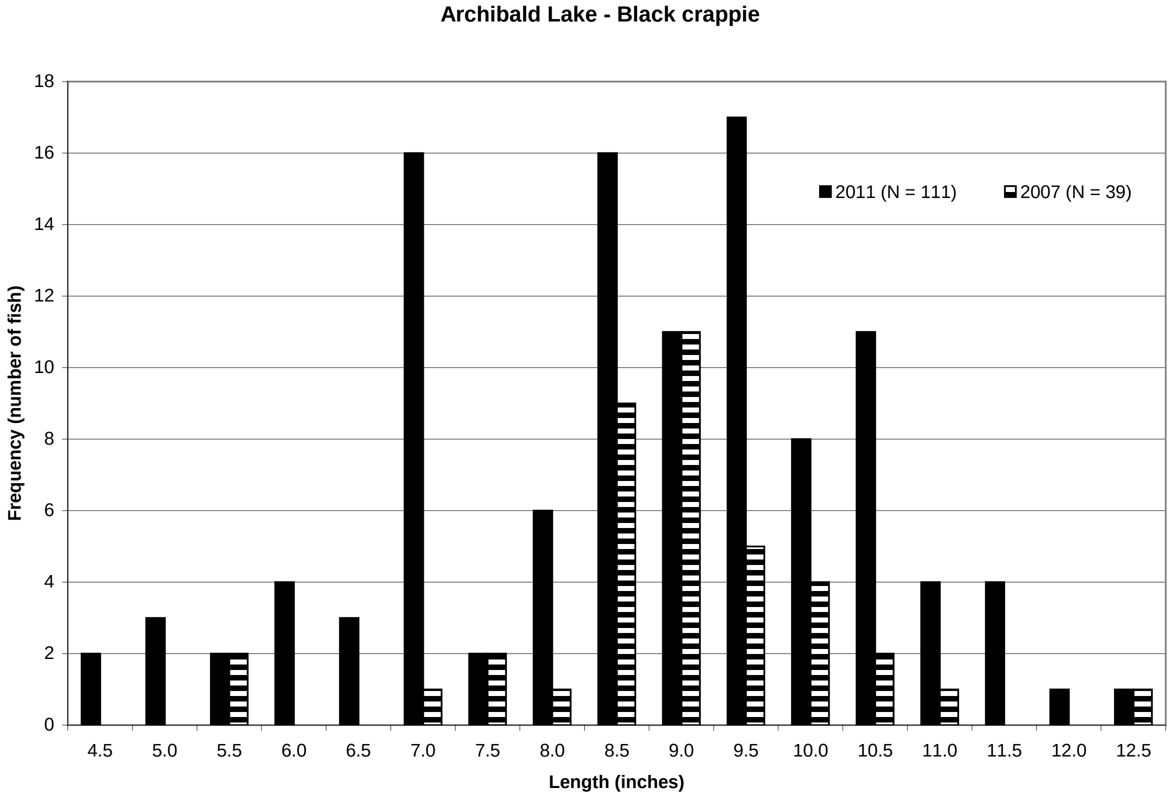


Figure 11. Black crappie length frequency from 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

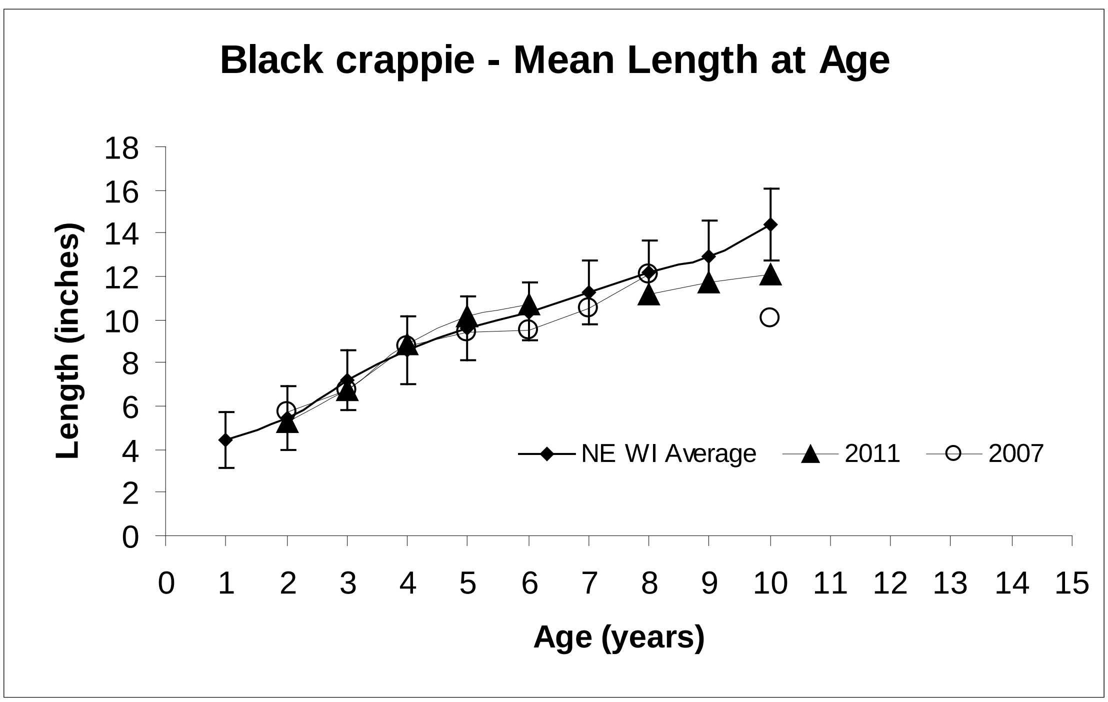


Figure 12. Black crappie mean length at age comparison from Archibald Lake; Oconto County, WI.

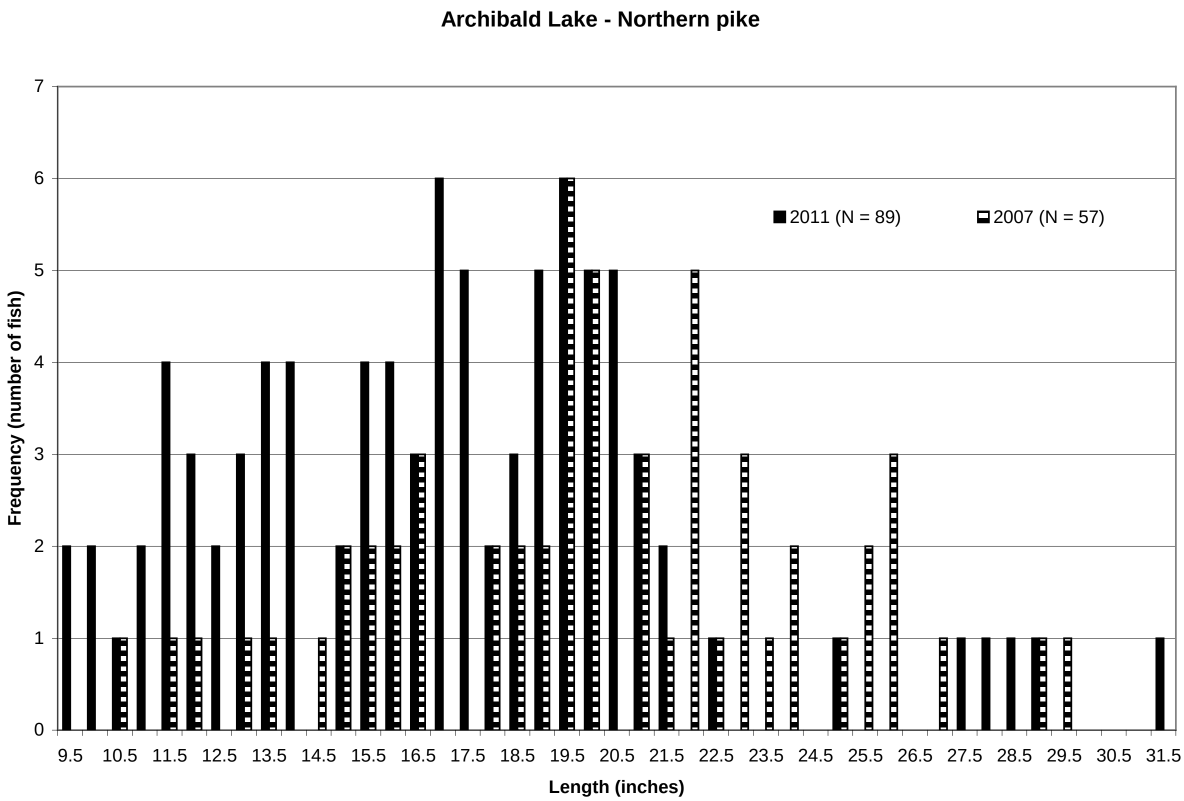


Figure 13. Northern pike length frequency from 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

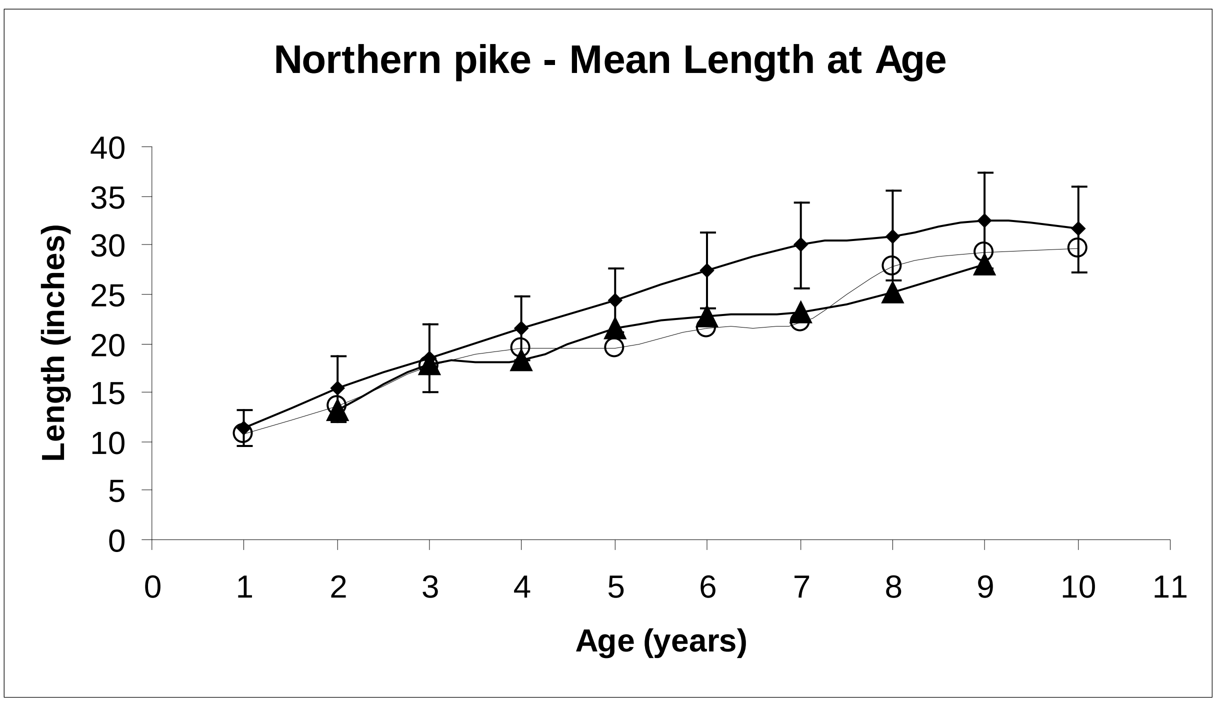


Figure 14. Northern pike mean length at age comparison from Archibald Lake; Oconto County, WI.

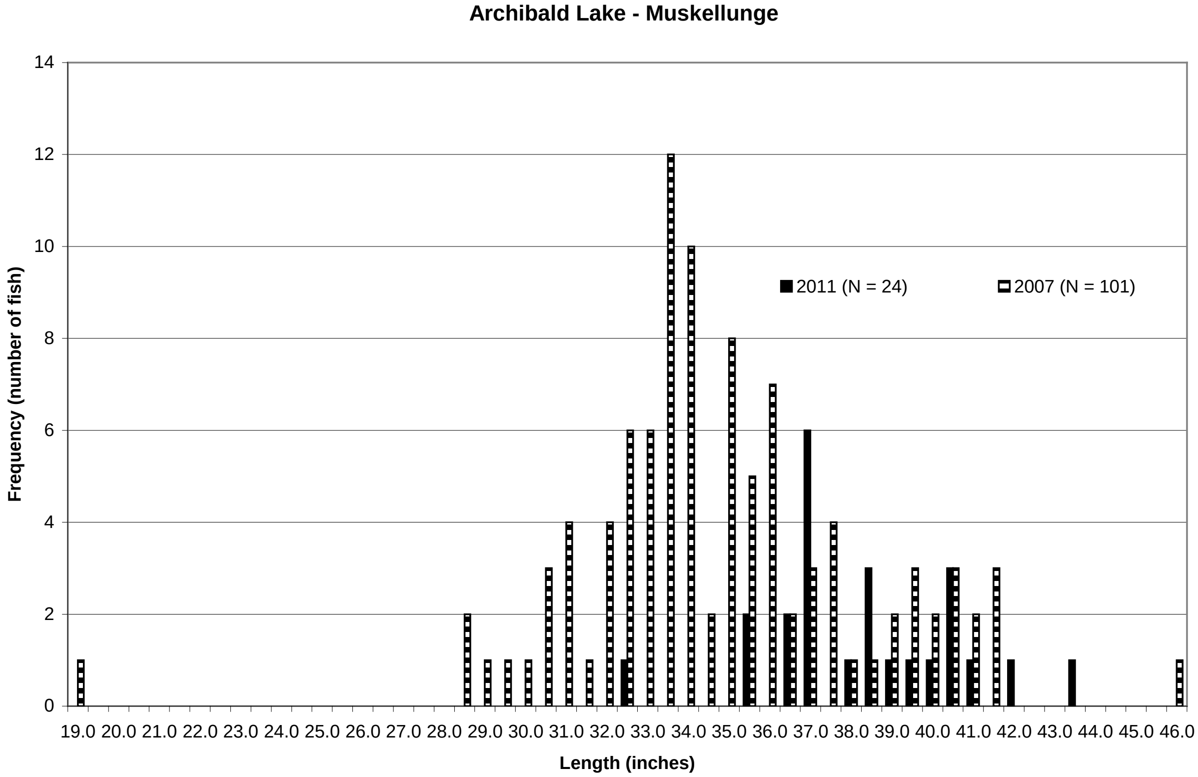


Figure 15. Muskellunge length frequency from 2007 and 2011 fisheries surveys at Archibald Lake; Oconto County, WI.

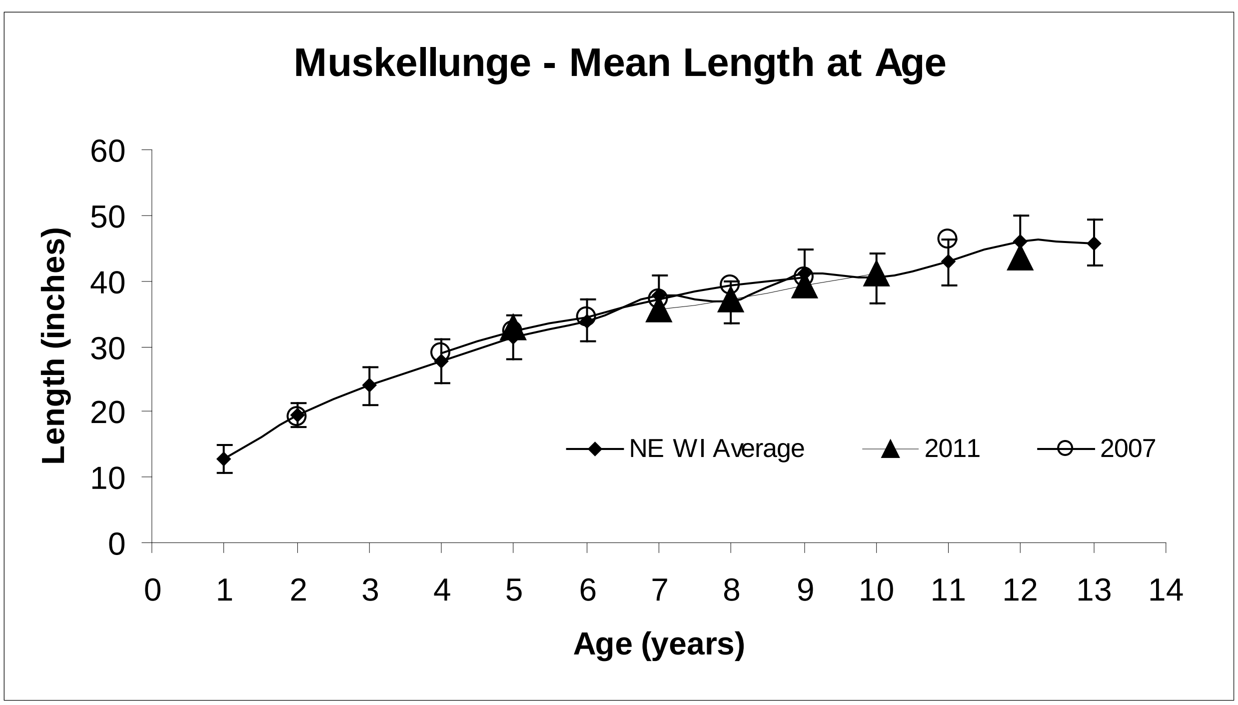


Figure 16. Muskellunge mean length at age comparison from Archibald Lake; Oconto County, WI.

APPENDIX III – LENGTH FREQUENCIES AND SAMPLING LOCATION DATA

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Yellow perch							
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH
1.0				19.0			
1.5				19.5			
2.0				20.0			
2.5				20.5			
3.0				21.0			
3.5				21.5			
4.0				22.0			
4.5	1	0.2	not aged	22.5			
5.0	9	1.4	3	23.0			
5.5	57	9.1	3	23.5			
6.0	85	13.6	3, 4	24.0			
6.5	110	17.5	3, 4, 5	24.5			
7.0	140	22.3	3, 4	25.0			
7.5	131	20.9	3, 4, 5	25.5			
8.0	53	8.5	4, 5, 6	26.0			
8.5	21	3.3	4, 5, 6	TOTAL	627		
9.0	14	2.2	4, 5, 6, 7, 9				
9.5	4	0.6	6				
10.0	1	0.2	6				
10.5	1	0.2	5				
11.0							
11.5							
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							
16.5							
17.0							
17.5							
18.0							
18.5							

ELECTROFISHING CPUE	1.2/hr	FYKE NET CPUE	32.0/lift

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Bluegill							
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH
1.0				19.0			
1.5				19.5			
2.0				20.0			
2.5				20.5			
3.0	1	0.2	not aged	21.0			
3.5	11	1.7	3, 4, 5	21.5			
4.0	28	4.2	4, 5	22.0			
4.5	46	6.9	4, 5, 6	22.5			
5.0	76	11.4	4, 5	23.0			
5.5	132	19.9	5, 6	23.5			
6.0	119	17.9	5, 6	24.0			
6.5	121	18.2	5, 6	24.5			
7.0	88	13.3	6, 7	25.0			
7.5	30	4.5	8, 9	25.5			
8.0	12	1.8	9, 10, 11	26.0			
8.5				TOTAL	664		
9.0							
9.5							
10.0							
10.5							
11.0							
11.5							
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							
16.5							
17.0							
17.5							
18.0							
18.5							

ELECTROFISHING CPUE	161.2/hr	FYKE NET CPUE	4.8/lift

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Largemouth bass							
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH
1.0				19.0			
1.5				19.5			
2.0				20.0			
2.5				20.5			
3.0				21.0			
3.5				21.5			
4.0				22.0			
4.5				22.5			
5.0				23.0			
5.5				23.5			
6.0	2	0.3	2	24.0			
6.5	2	0.3	2, 3	24.5			
7.0	3	0.5	3	25.0			
7.5	7	1.2	3	25.5			
8.0	9	1.5	3, 4	26.0			
8.5	9	1.5	3, 4	TOTAL	598		
9.0	23	3.8	4				
9.5	37	6.2	4, 5				
10.0	47	7.9	4, 5, 6				
10.5	73	12.2	4, 5, 6				
11.0	74	12.4	4, 5, 6				
11.5	101	16.9	5, 6				
12.0	62	10.4	5, 6				
12.5	48	8.0	7, 8				
13.0	33	5.5	6, 7, 8				
13.5	25	4.2	7, 8, 10				
14.0	12	2.0	8, 9				
14.5	9	1.5	7, 8, 9				
15.0	7	1.2	9, 10, 11				
15.5	1	0.2	11				
16.0	7	1.2	8, 9, 10, 11, 12				
16.5	1	0.2	10				
17.0	2	0.3	11, 12				
17.5	1	0.2	12				
18.0	2	0.3	13				
18.5	1	0.2	14				

ELECTROFISHING CPUE	138.8/hr	FYKE NET CPUE	1.5/lift

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Walleye							
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH
1.0				19.0	10	2.2	6, 7, 8, 9, 10
1.5				19.5	12	2.6	6, 8, 10, 11, 12, 13
2.0				20.0	14	3.1	7, 8, 10, 11
2.5				20.5	7	1.5	8, 11
3.0				21.0	6	1.3	6, 8, 12
3.5				21.5	8	1.8	7, 8, 17
4.0				22.0	4	0.9	7, 8
4.5				22.5	2	0.4	8, 10
5.0				23.0	2	0.4	8
5.5	1	0.2	0	23.5	4	0.9	8, 10
6.0				24.0	1	0.2	9
6.5				24.5	4	0.9	8, 9, 10, 11
7.0	3	0.7	0, 1	25.0	2	0.4	12, 13
7.5	3	0.7	0, 1	25.5	2	0.4	8, 10
8.0	6	1.3	1	26.0	1	0.2	16
8.5				TOTAL	455		
9.0							
9.5							
10.0							
10.5	2	0.4	2				
11.0	22	4.8	2, 3				
11.5	39	8.6	1, 2, 3				
12.0	41	9.0	2, 3, 4				
12.5	12	2.6	3, 4				
13.0	2	0.4	3, 4				
13.5	5	1.1	4				
14.0	29	6.4	4				
14.5	38	8.4	4, 5				
15.0	18	4.0	4, 5, 7				
15.5	15	3.3	4, 5, 7, 8				
16.0	35	7.7	5, 6, 8				
16.5	26	5.7	5, 6, 7				
17.0	30	6.6	6				
17.5	25	5.5	5, 7, 8				
18.0	13	2.9	5, 6, 7, 8, 9				
18.5	11	2.4	7, 8, 9				

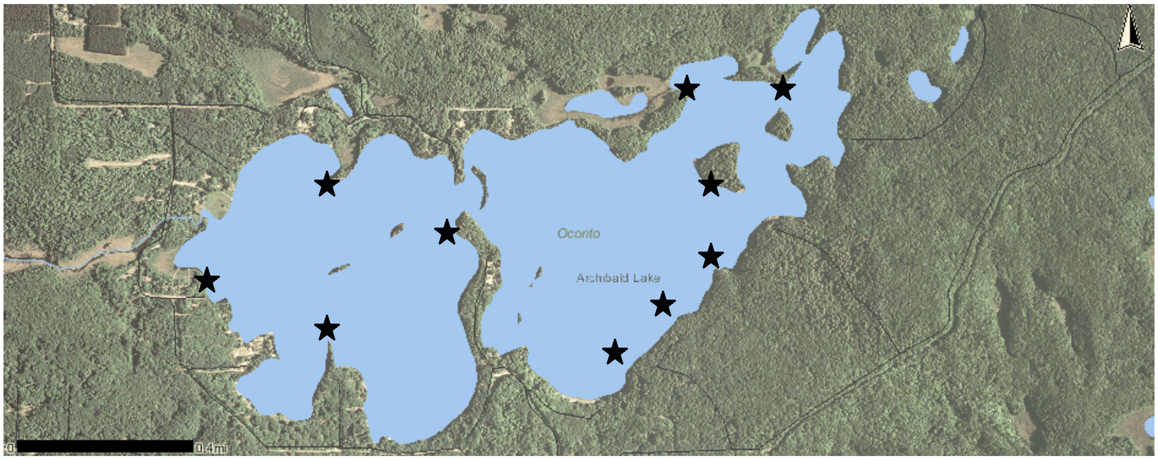
APRIL ELECTROFISHING CPUE	36.9/hr	FYKE NET CPUE	4.3/lift
JUNE ELECTROFISHING CPUE	8.1/hr		
OCTOBER ELECTROFISHING CPUE	8.7/hr		

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Rock bass							
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH
1.0				19.0			
1.5				19.5			
2.0				20.0			
2.5				20.5			
3.0				21.0			
3.5	6	2.0	3	21.5			
4.0	7	2.3	3	22.0			
4.5	11	3.6	3, 4	22.5			
5.0	11	3.6	4, 5	23.0			
5.5	19	6.3	4, 5	23.5			
6.0	21	7.0	4, 5	24.0			
6.5	26	8.6	5, 6	24.5			
7.0	30	9.9	5, 6	25.0			
7.5	45	14.9	5, 6, 7	25.5			
8.0	42	13.9	4, 6, 7	26.0			
8.5	32	10.6	5, 6, 7, 8	TOTAL	302		
9.0	24	7.9	7, 8, 9				
9.5	16	5.3	8, 9, 10				
10.0	9	3.0	7, 9, 10, 11				
10.5	3	1.0	9, 10, 12				
11.0							
11.5							
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							
16.5							
17.0							
17.5							
18.0							
18.5							

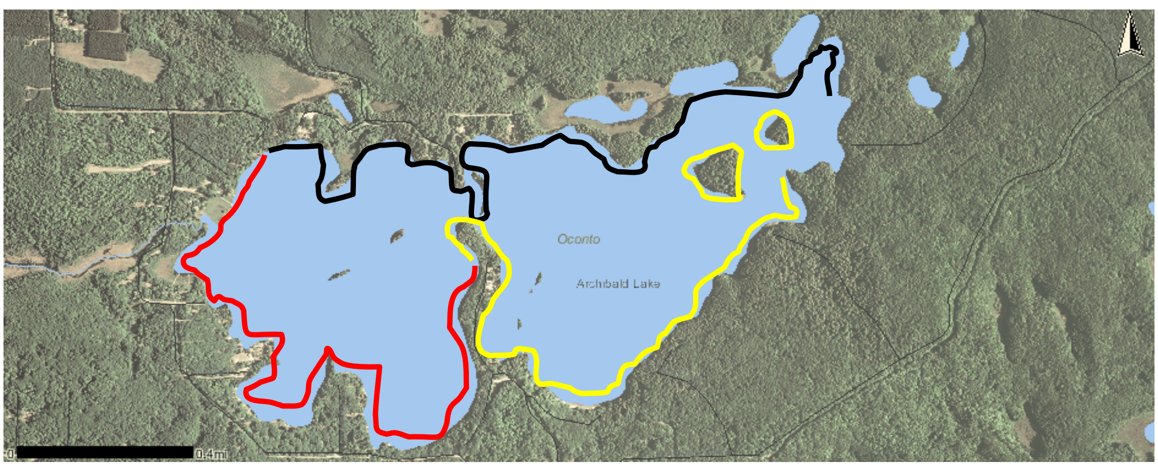
ELECTROFISHING CPUE	54.1/hr	FYKE NET CPUE	3.7/lift

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Black crappie							
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH
1.0				19.0			
1.5				19.5			
2.0				20.0			
2.5				20.5			
3.0				21.0			
3.5				21.5			
4.0				22.0			
4.5	2	1.8	2	22.5			
5.0	3	2.7	2	23.0			
5.5	2	1.8	2, 3	23.5			
6.0	4	3.6	3	24.0			
6.5	3	2.7	3	24.5			
7.0	16	14.4	3	25.0			
7.5	2	1.8	3, 4	25.5			
8.0	6	5.4	4	26.0			
8.5	16	14.4	4	TOTAL	111		
9.0	11	9.9	4				
9.5	17	15.3	4, 5				
10.0	8	7.2	5, 6, 8				
10.5	11	9.9	5, 6				
11.0	4	3.6	6, 8, 9, 10				
11.5	4	3.6	6, 8, 9				
12.0	1	0.9	9				
12.5	1	0.9	10				
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							
16.5							
17.0							
17.5							
18.0							
18.5							

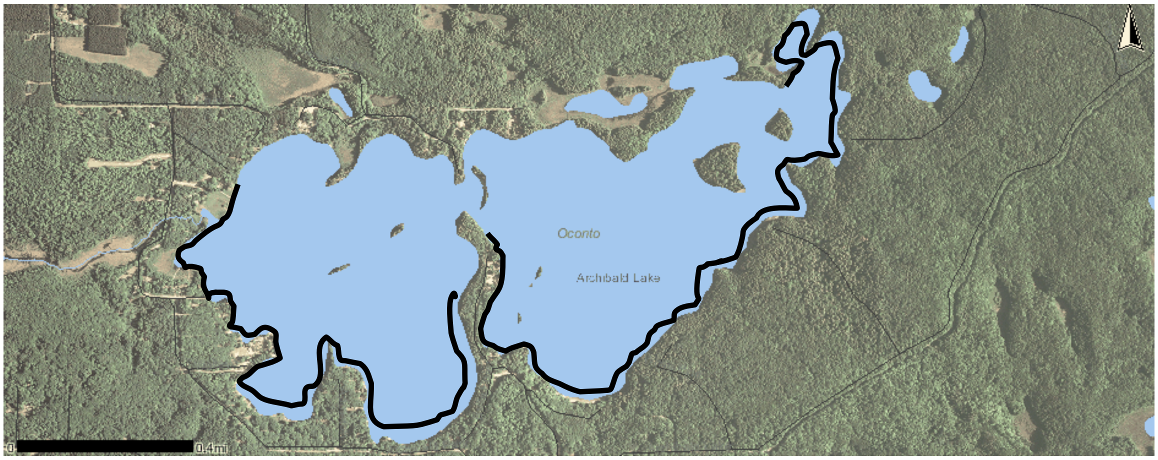
ELECTROFISHING CPUE	1.2/hr	FYKE NET CPUE	1.0/lift



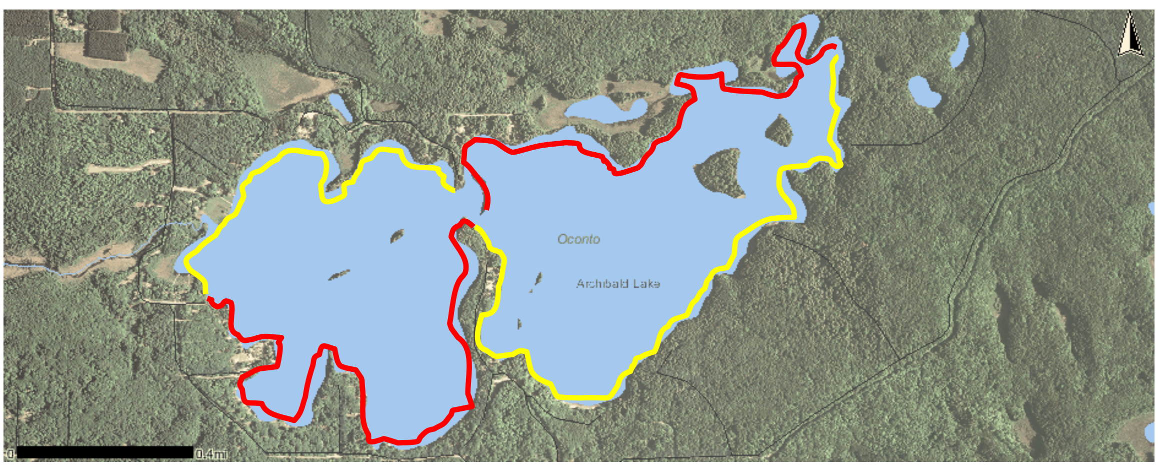
Fyke net locations during 2011 comprehensive survey of Archibald Lake, Oconto County, Wisconsin.



Gamefish and panfish electrofishing (June) during 2011 comprehensive survey of Archibald Lake, Oconto County, Wisconsin (Red & Yellow lines = June 6; Black line = June 7).



Walleye recapture electrofishing (May) during 2011 comprehensive survey of Archibald Lake, Oconto County, Wisconsin.



Walleye recruitment assessment (October) during 2011 comprehensive survey of Archibald Lake, Oconto County, Wisconsin (Yellow line = October 17; Red line = October 18).

Date and GPS location for all sampling locations (fyke nets and electrofishing) during 2011 on Archibald Lake; Oconto County, WI.

FYKE NETS

1	N	45.28759	W	-88.57425
2	N	45.28774	W	-88.57780
3	N	45.28485	W	-88.57770
4	N	45.28233	W	-88.57737
5	N	45.28070	W	-88.57890
6	N	45.28323	W	-88.58890
7	N	45.28025	W	-88.59459
8	N	45.28485	W	-88.59461
9	N	45.28231	W	-88.59975
10	N	45.28020	W	-88.57989

ELECTROFISHING

03-May-2011		Begin	N	45.28730	W	-88.57399
		End	N	45.28300	W	-88.58680
		Begin	N	45.28108	W	-88.58898
		End	N	45.24650	W	-88.59810
06-Jun-2011	0.5 mile (all fish)	Begin	N	45.28766	W	-88.57223
		End	N	45.28758	W	-88.57773
	1.5 mile (gamefish only)	Begin	N	45.28758	W	-88.57773
		End	N	45.28543	W	-88.59314
	0.5 mile (all fish)	Begin	N	45.28543	W	-88.59314
		End	N	45.28337	W	-88.58926
	1.5 mile (gamefish only)	Begin	N	45.28337	W	-88.58926
		End	N	45.27802	W	-88.58882
07-Jun-2011	0.5 mile (all fish)	Begin	N	45.28425	W	-88.58817
		End	N	45.27990	W	-88.58577
	1.5 mile (gamefish only)	Begin	N	45.27990	W	-88.58577
		End	N	45.28431	W	-88.57626
17-Oct-2011	Station 1	Begin	N	45.28186	W	-88.59974
		End	N	45.28886	W	-88.57165
18-Oct-2011	Station 2	Begin	N	45.28161	W	-88.59934
		End	N	45.28886	W	-88.57165