A

APPENDIX A

Public Participation Materials

Kick-off Meeting Presentation

Planning Meeting Presentation

Kettle Moraine Lake Association

Kettle Moraine Lake Management Plan Update

Kick-off Meeting

June 17, 2017

Eddie Heath
Onterra LLC
Lake Management Planning

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
  - Four field technicians
  - Four summer interns
- Services
  - Science and planning
- Philosophy
  - Promote realistic planning
  - Assist, not direct

Onterra LLC
Lake Management Planning

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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Why create a lake management plan?

- WDNR recommends lakes conducting active management update aspects of the plan every 5 years.
- Having a current and approved plan makes the sponsor eligible for WDNR grants that implement an action.
- Conducting large-scale management requires a current and approved plan.

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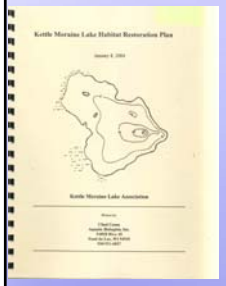
Past Projects



Habitat Restoration Plan
- January 2004

AIS Control Project
- January 2013

AIS Control Project
- Annual 2012-2016

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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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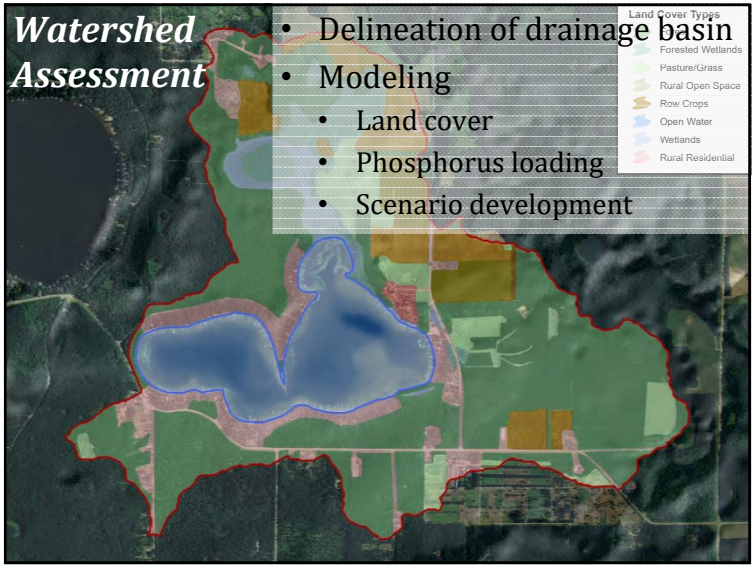

Aquatic Plant Surveys

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

Historic Data Available

Conducted In 2016

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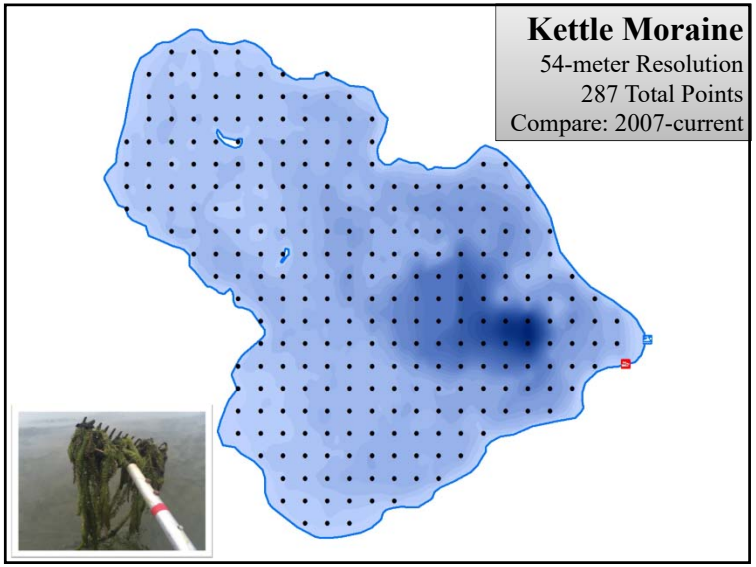
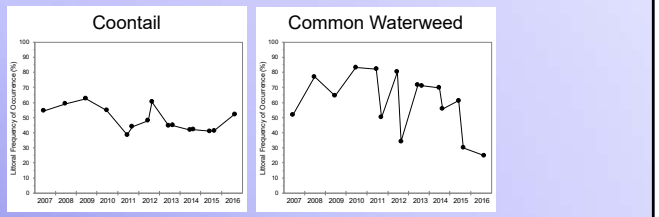


LFOO Compare



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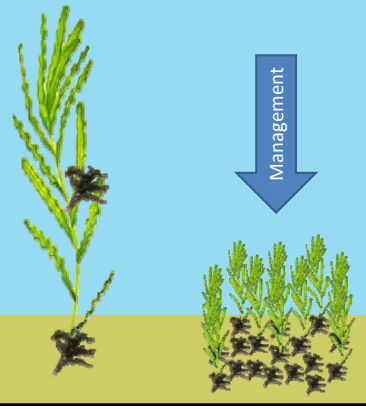
Non-Native Aquatic Plants

Curly-Leaf Pondweed

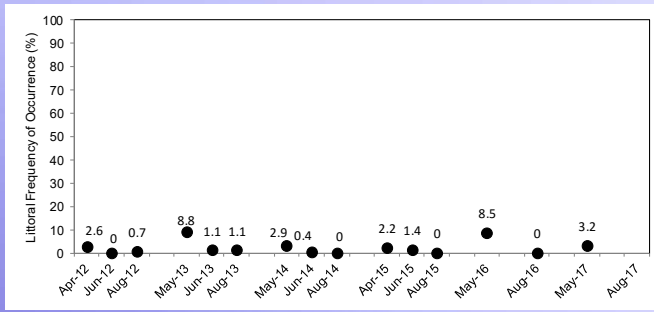
- First documented in 2004
- Late-summer point-intercept surveys occur after senescence (die-off)
  - Properly timed PI surveys
  - Mapping surveys

CLP Life-Cycle & Control Strategy Philosophy



- CLP respond well to herbicides (*easy to kill*)
- Herbicide strategy requires repetition (*5-7+ years in a row*)
- Hand-harvesting is analogous to single treatment (*ineffective for established populations)*
- Winter drawdown may result in multiple years of control

CLP Population



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Professional AIS Mapping

Point-Based Mapping

- Single plants to colonies or areas less than 40-feet in diameter
- Abundance descriptions:
  - Single or Few Plants
  - Clumps of Plants
  - Small Plant Colony

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Lake Management Planning

Professional AIS Mapping

Polygon-Based Mapping

- Colonies or areas over 40-feet diameter
- Boundary at target plant extent or morphological feature (depth contour, shoreline)
- Density ratings:

May not represent true colonies or "beds"

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting

Increase in Ecological Impact

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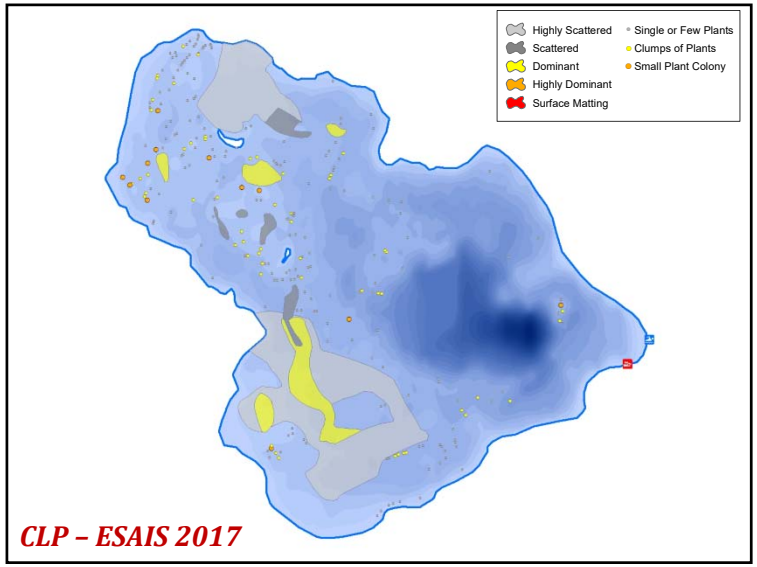
Lake Management Planning



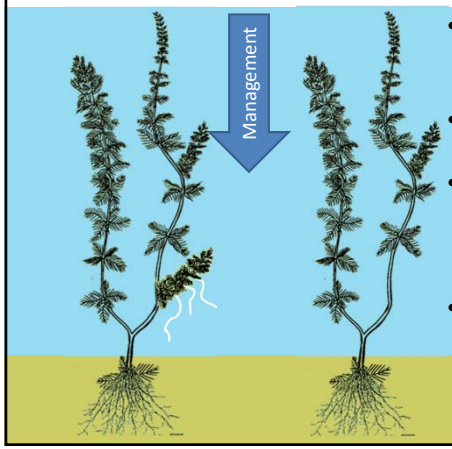
CLP – ESAIS 2017

Non-Native Aquatic Plants

Eurasian Water Milfoil

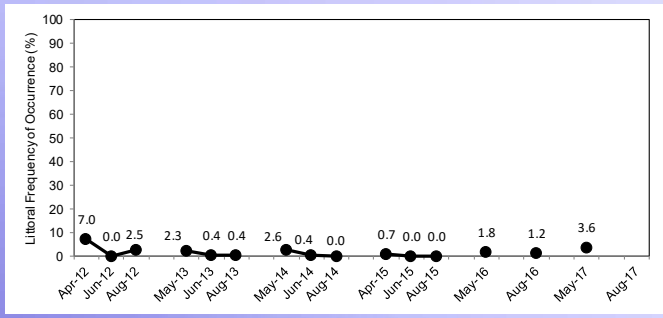
- **First "officially" documented in 1995**
- **DNA confirmed EWM as pure-strain on two occasions**
- **Mapping surveys are important to understanding population, as population is currently too low for point-intercept surveys to guide management**

EWM Life-Cycle & Control Strategy Philosophy



- Herbicide needs to translocate to root crown (*hard to kill*)
- Strategy is straight-forward
- Hand-harvesting is analogous to single treatment (*extremely time intensive)*
- Winter drawdown is effective tool

EWM Population



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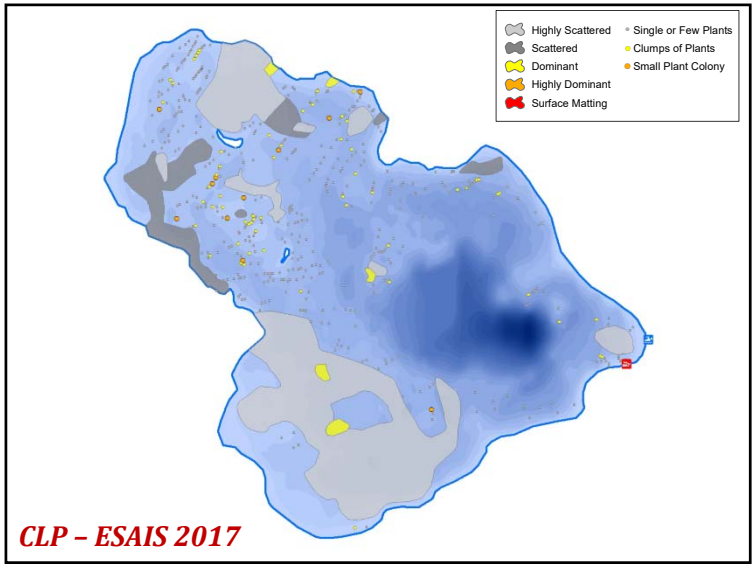
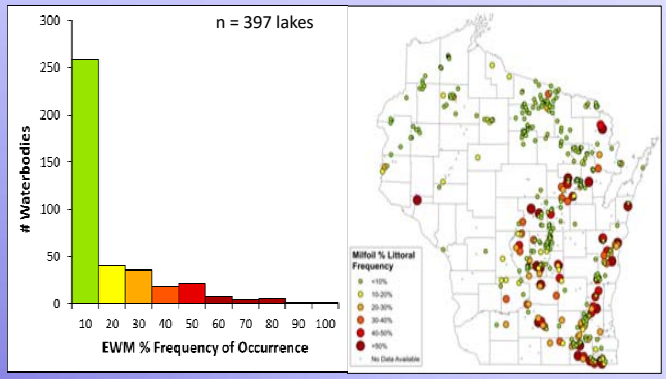
Lake Management Planning



CLP – ESAIS 2017

State-wide EWM Population Trends



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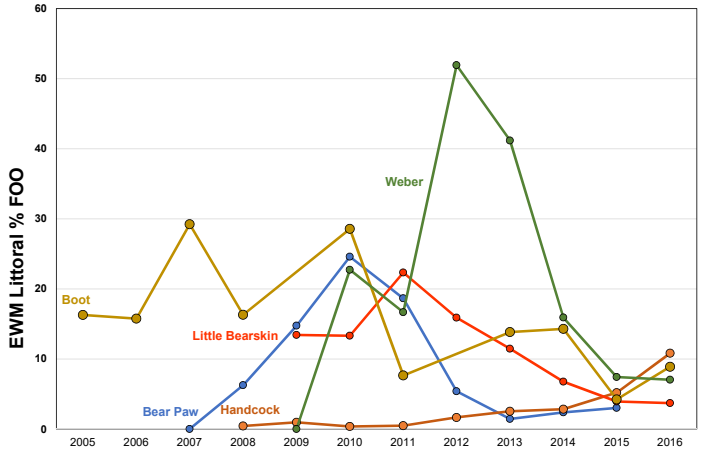
NLF Ecoregion – Unmanaged



AIS Active Management Discussion

Pros	Cons
• Keep AIS population low so native ecosystem can function as it did prior to AIS (***ecosystem restoration***)	• Management action itself may be damaging to the lake, so acknowledging potential known/unknown secondary impacts is important within the risk assessment.
• Keep AIS population low so it does not cause recreation, navigation, or aesthetic issues (***improve cultural ecosystem services***)	• Management action may not be fully supported by public
• Keep AIS population low so the lake is not a source population for other nearby lakes (***stewardship***)	• ***Unmanaged*** AIS population may be low enough to not cause measurable ecosystem impacts or reduce cultural ecosystem services

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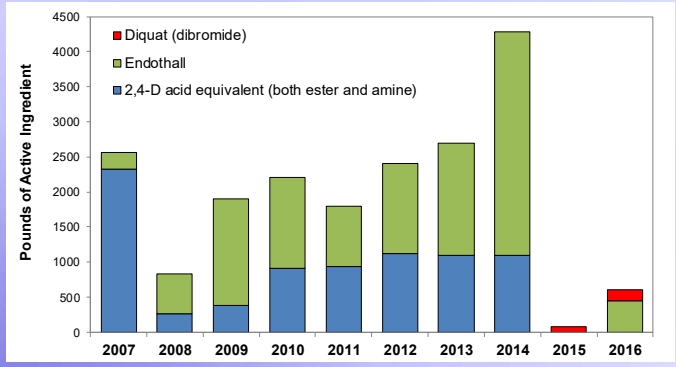
KML Treatment History



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Fisheries Data Integration

- No fish sampling completed
- Assemble data from WDNR and other available sources
- Fish survey results summaries (if available)
- Use information in planning as applicable

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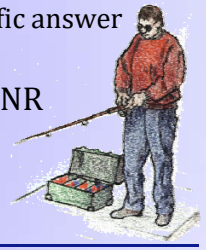
Stakeholder Survey

- 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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Thank You

Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept. of Natural Resources

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Lake Management Planning

Management Planning Project Overview

- Foster holistic understanding of Stratton Lake ecosystem
- Collect & analyze data
  - Technical & sociological
- Construct long-term & useable plan

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Lake Management Planning

Presentation Outline

- **Lake Management Planning Project Overview**
- **Study Results**
  - Aquatic Plants
    - Native Plants
    - Non-Native Plants (EWM & CLP)
  - Water Quality
  - Watershed
  - Shoreland
  - Fisheries (Next Discussion)

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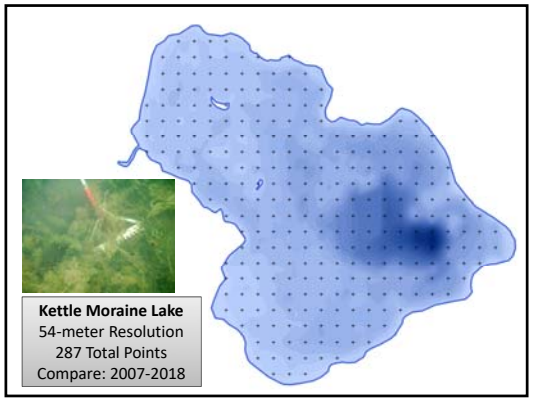
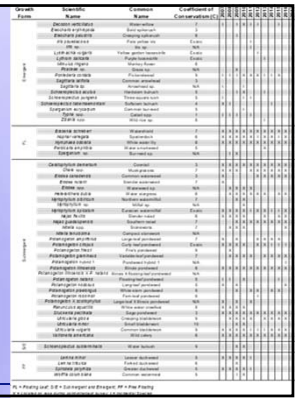


Aquatic Plant Species List

59 Native Species
5 Non-Native Species

- Curly-leaf pondweed
- Eurasian watermilfoil
- Pale yellow iris
- Yellow garden loosestrife
- Purple loosestrife



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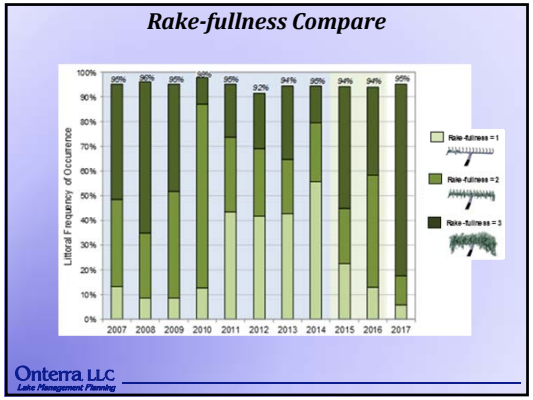
Rake-fullness Compare
Littoral Frequency of Occurence
Rake-fullness = 1
Rake-fullness = 2
Rake-fullness = 3
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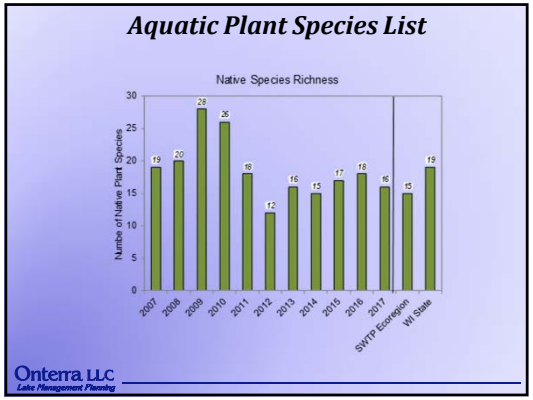
Aquatic Plant Species List
Native Species Richness
Number of Native Plant Species
SWTP Ecoregion
WI State
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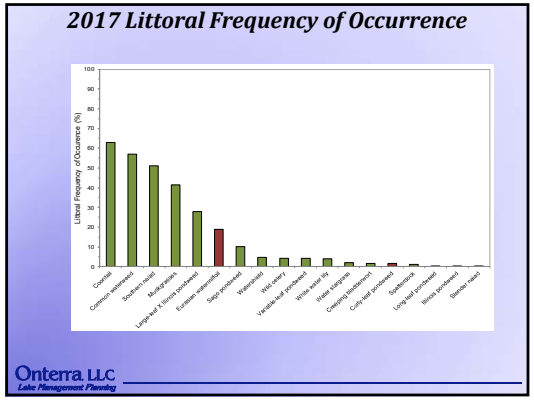
2017 Littoral Frequency of Occurrence
Littoral Frequency of Occurence (%)
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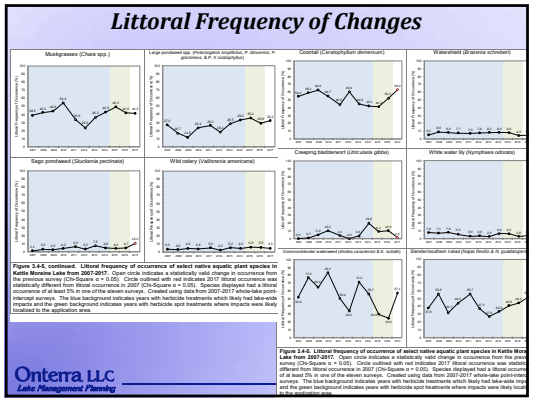
Littoral Frequency of Changes
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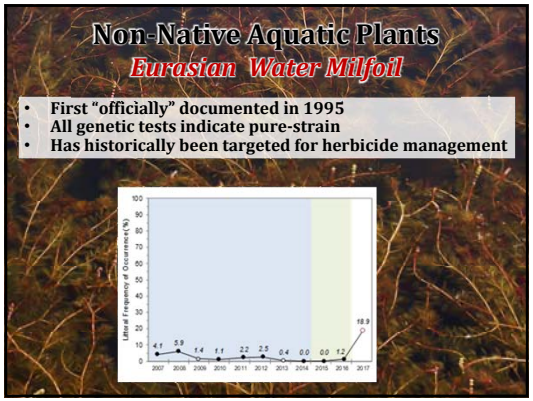
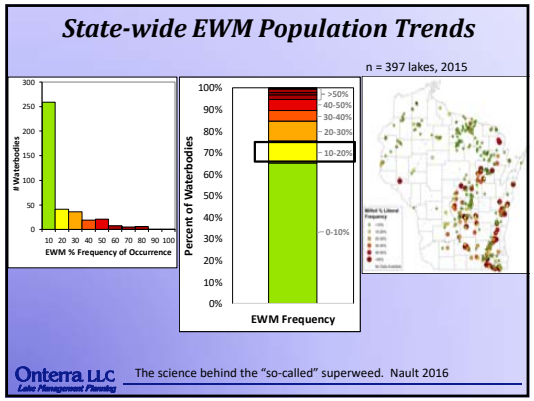

Non-Native Aquatic Plants
Eurasian Water Milfoil
First "officially" documented in 1995
All genetic tests indicate pure-strain
Has historically been targeted for herbicide management


State-wide EWM Population Trends
n = 397 lakes, 2015
# Waterbodies
EWM % Frequency of Occurrence
Percent of Waterbodies
EWM Frequency
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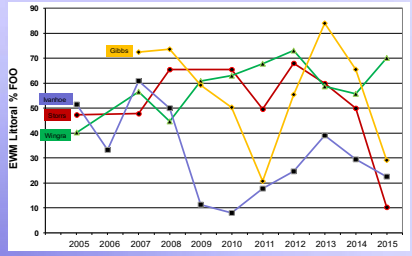
The science behind the "so-called" superweed. Nault 2016

EWM Long Term Trends Dataset



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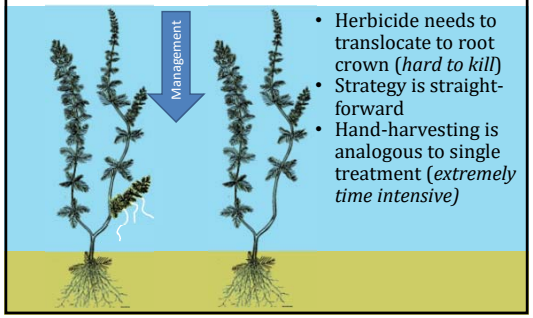
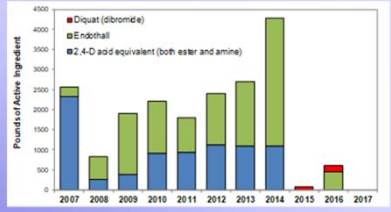
EWM Life-Cycle & Control Strategy Philosophy



- Herbicide needs to translocate to root crown (*hard to kill*)
- Strategy is straight-forward
- Hand-harvesting is analogous to single treatment (*extremely time intensive*)

KML Past Decade of Management



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Professional AIS Mapping

Point-Based Mapping

- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

Polygon-Based Mapping

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting

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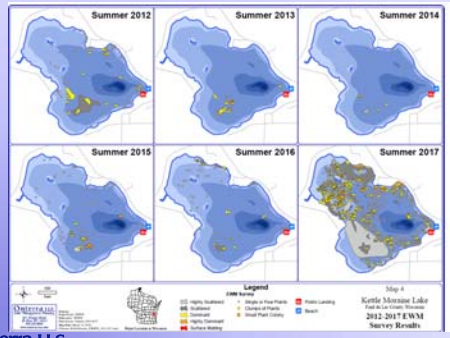
EWM Population



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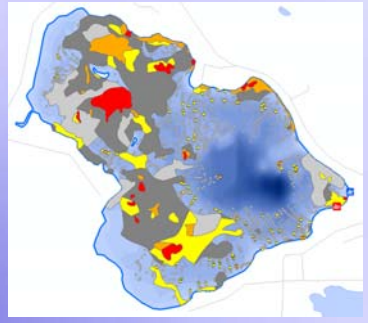
2018 EWM Population



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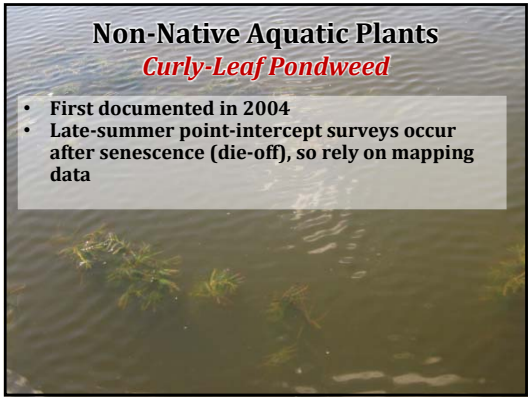
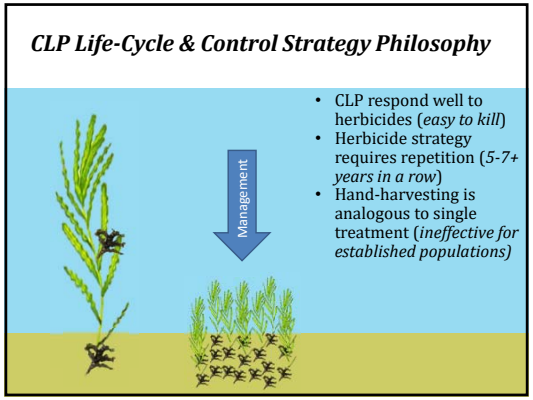
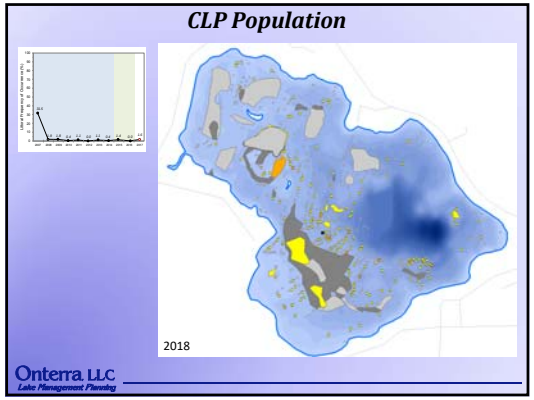
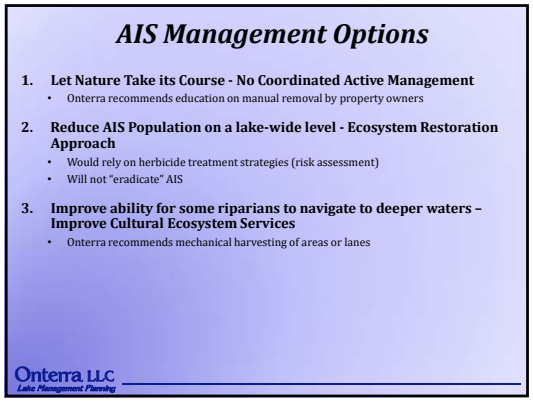

Non-Native Aquatic Plants
Curly-Leaf Pondweed
• First documented in 2004
• Late-summer point-intercept surveys occur after senescence (die-off), so rely on mapping data


CLP Life-Cycle & Control Strategy Philosophy
Management
• CLP respond well to herbicides (easy to kill)
• Herbicide strategy requires repetition (5-7+ years in a row)
• Hand-harvesting is analogous to single treatment (ineffective for established populations)


CLP Population
2018
Onterra LLC


AIS Management Options
1. Let Nature Take its Course - No Coordinated Active Management
• Onterra recommends education on manual removal by property owners
2. Reduce AIS Population on a lake-wide level - Ecosystem Restoration Approach
• Would rely on herbicide treatment strategies (risk assessment)
• Will not "eradicate" AIS
3. Improve ability for some riparians to navigate to deeper waters – Improve Cultural Ecosystem Services
• Onterra recommends mechanical harvesting of areas or lanes
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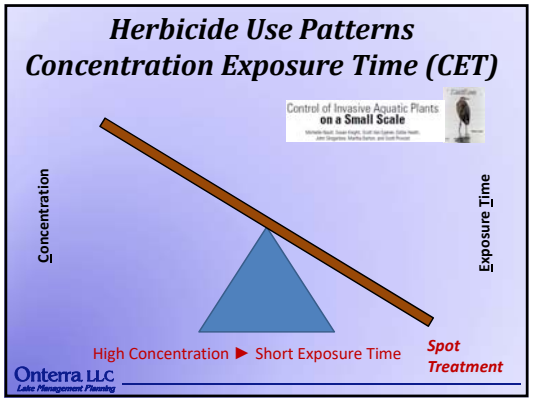
Herbicide Use Patterns
Concentration Exposure Time (CET)
Control of Invasive Aquatic Plants on a Small Scale
Concentration
Exposure Time
High Concentration ► Short Exposure Time
Spot Treatment
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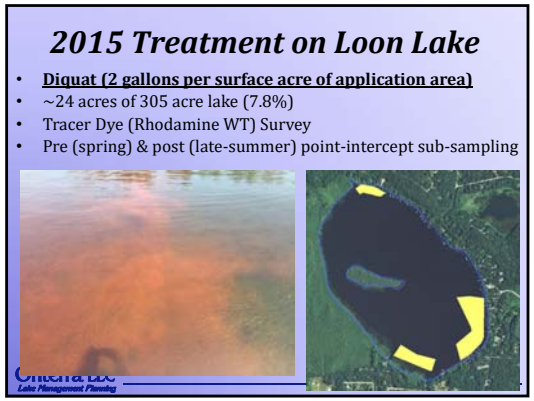
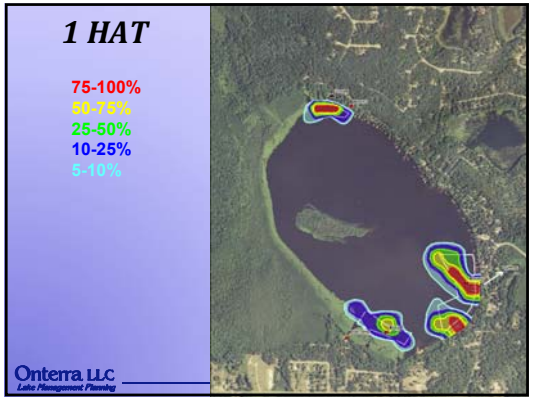
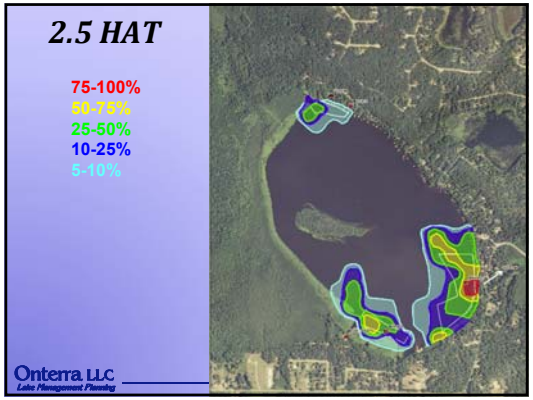
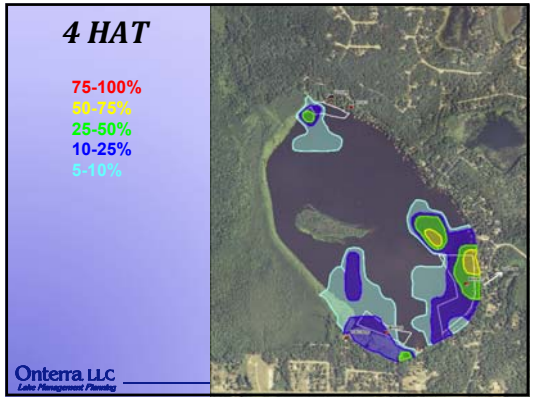
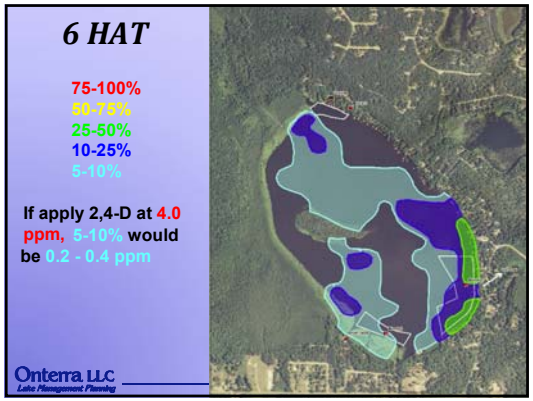
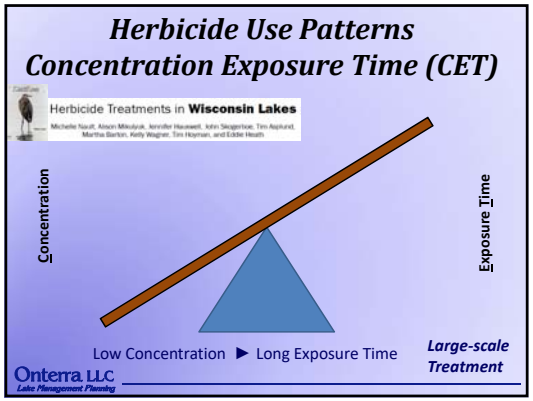

2015 Treatment on Loon Lake
• Diquat (2 gallons per surface acre of application area)
• ~24 acres of 305 acre lake (7.8%)
• Tracer Dye (Rhodamine WT) Survey
• Pre (spring) & post (late-summer) point-intercept sub-sampling











Large-Scale Aquatic Herbicides for Difficult Invasive Milfoil Control *(abridged)*

- **2,4-D + Endothall –** auxin hormone mimic + protein inhibitor – biological breakdown
- **Triclopyr + Endothall –** auxin hormone mimic + protein inhibitor – photolytic breakdown of auxin
- **Fluridone –** inhibits plant-specific enzyme (carotene) which protects chlorophyll from UV (sun) damage – breakdown from photolysis; requires "bumps" to sustain full growing season **10 in past decade, Onterra has planned 5 of them**

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Fluridone

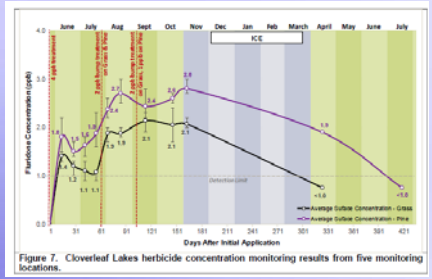

Figure 7. Cloverleaf Lakes herbicide concentration monitoring results from five monitoring locations.

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Are herbicides "safe?"

- Registration by the EPA does not mean that the use of the herbicide poses no risk to humans or the environment, only that the benefits have been determined to outweigh the risks .
- Because product use is not without risk, the EPA does not define any pesticide as "safe."
- Risk-Risk factors must be considered in determining treatment strategy
- Strategy objective must be to effectively control target species with minimal impact to native habitat

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KML Stakeholder Perceptions of AIS Management

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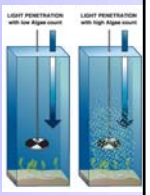
Introduction to Lake Water Quality

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in **most** WI lakes
Most often 'limiting plant nutrient' (shortest supply) **45:1**
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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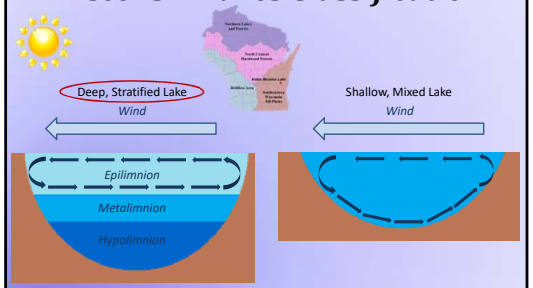
Wisconsin Lakes Classification



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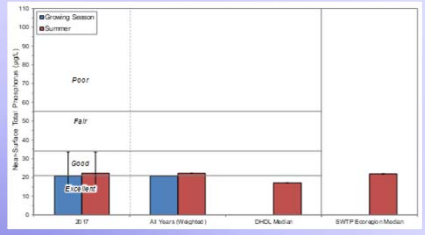
Total Phosphorus



Average summer = 22 µg/L
- *Good* for DHDL
- Slightly higher than DHDL median
- Similar to ecoregion median

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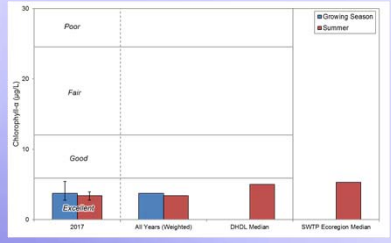
Chlorophyll-a



Average summer = 3 µg/L
- *Excellent* for DHDL
- Lower than ecoregion & DHDL medians

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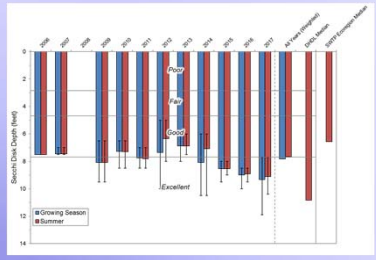
Secchi Disk Clarity



Average summer = 7.6 feet
- *Good* for DHDL
- Lower than DHDL median
- Exceeds ecoregion median

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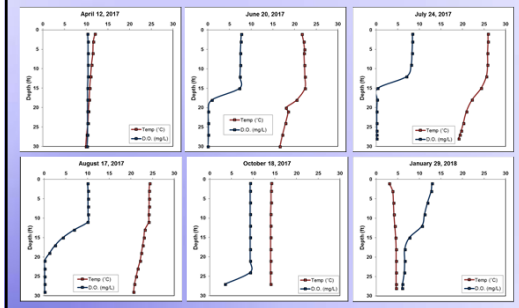
Dissolved Oxygen Levels



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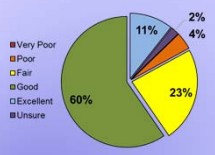
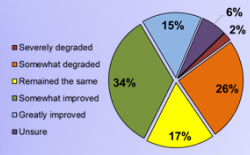
Kettle Moraine Lake Stakeholder Perceptions of Water Quality

How would you describe the current water quality of Kettle Moraine Lake?



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



Onterra LLC Lake Management Planning

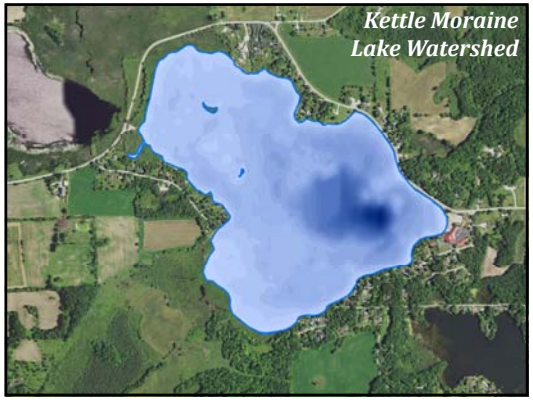
Management Goal: Maintain Current Water Quality Conditions

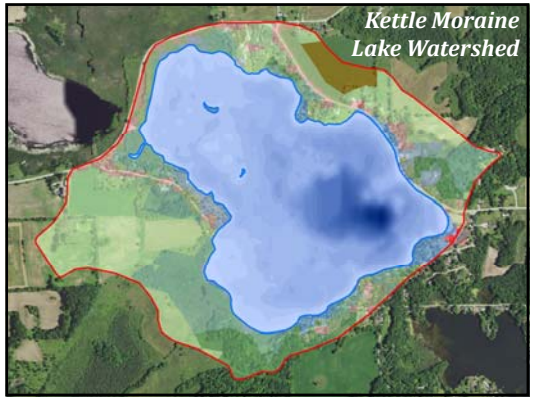
Possible Management Actions

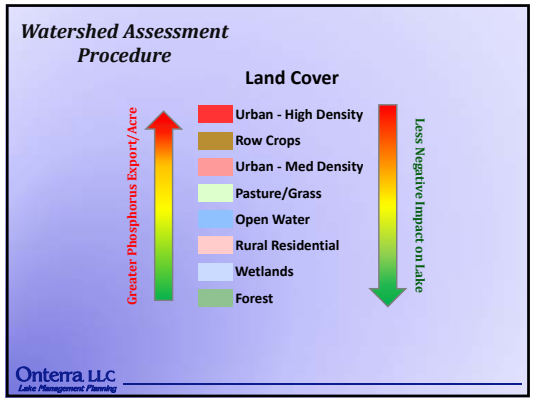
1. **Monitor water quality through WDNR Citizens Lake Monitoring Network.**
   Requires volunteer commitment

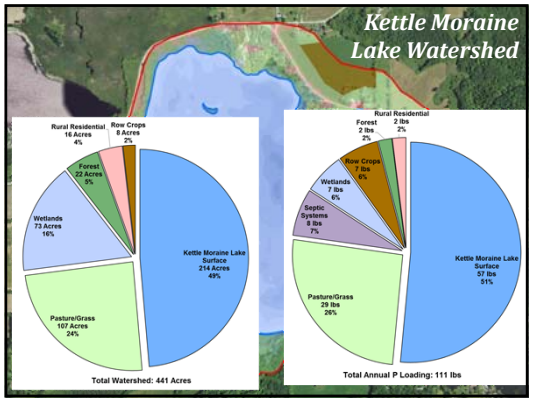
Onterra LLC Lake Management Planning


Watershed
Onterra LLC


Kettle Moraine
Lake Watershed


Kettle Moraine
Lake Watershed


Watershed Assessment
Procedure
Land Cover
Urban - High Density
Row Crops
Urban - Med Density
Pasture/Grass
Open Water
Rural Residential
Wetlands
Forest
Greater Phosphorus Export/Acre
Less Negative Impact on Lake
Onterra LLC


Kettle Moraine
Lake Watershed
Rural Residential
16 Acres
4%
Row Crops
8 Acres
2%
Forest
22 Acres
5%
Wetlands
73 Acres
16%
Kettle Moraine Lake
Surface
214 Acres
49%
Pasture/Grass
107 Acres
24%
Total Watershed: 441 Acres
Rural Residential
2 lbs
2%
Forest
2 lbs
2%
Row Crops
7 lbs
6%
Wetlands
7 lbs
6%
Septic
Systems
8 lbs
7%
Kettle Moraine Lake
Surface
57 lbs
51%
Pasture/Grass
29 lbs
26%
Total Annual P Loading: 111 lbs


Shoreline Condition
Onterra LLC

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 negative 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 Range **Natural**

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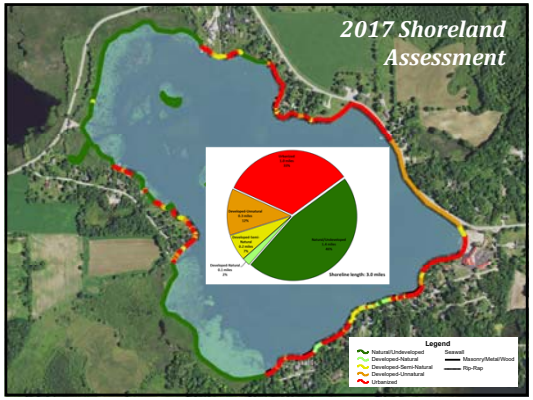
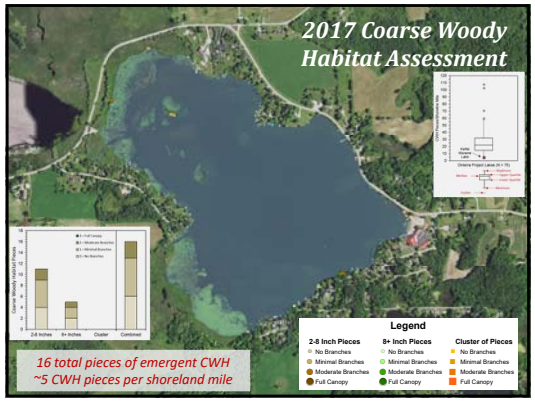


Coarse Woody Habitat

- 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 Kettle Moraine Lake

Onterra LLC Lake Management Planning



Management Goal:

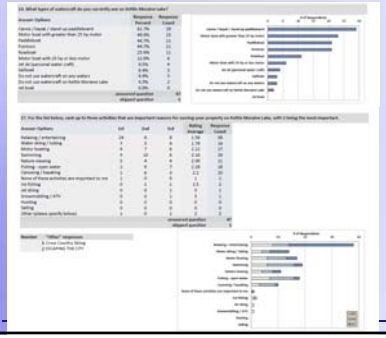
Maintain and Improve Lake Resource of KML

Possible Management Actions

1. **Educate Stakeholders on the Importance of Shoreland Condition, Shoreland Restoration, and Coarse Woody Habitat (Fish Sticks Program)**
2. **Protect natural shoreland zones**

Onterra LLC Lake Management Planning

Kettle Moraine Lake Stakeholder Perceptions of Recreational Use



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Kettle Moraine Lake Stakeholder Perceptions of Recreational Use

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Management Goal:
Promote Safe Boating

Possible Management Actions

1. Create courtesy code (additional education)
2. Increase enforcement
3. Additional ordinances (current SNW 6pm to 10 am, 200ft from shore, 30 mph)

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Additional topics

Possible Management Actions/Goals

1. Communication Capacity
2. Loon watch
3. Geese control
4. Mechanical harvesting
5. Education topics

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B

APPENDIX B

Stakeholder Survey Response Charts and Comments

Kettle Moraine Lake - Anonymous Stakeholder Survey

Surveys Distributed: 104
Surveys Returned: 48
Response Rate: 46%

Kettle Moraine Lake Property

1. Do you rent or own your property on or near Kettle Moraine Lake? Please select one choice.

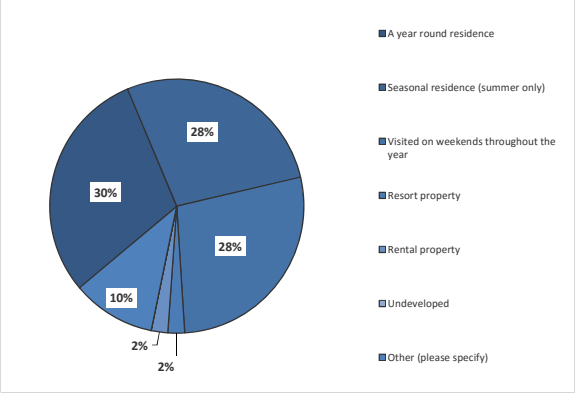
Answer Options	Response Percent	Response Count
Own	97.9%	46
Rent	2.1%	1
answered question		47
skipped question		1

2. Is your property from Question 1 on the lake or off the lake? Please select one choice.

Answer Options	Response Percent	Response Count
On the lake	89.4%	42
Off the lake	10.6%	5
answered question		47
skipped question		1

3. How is your property on Kettle Moraine Lake utilized?

Answer Options	Response Percent	Response Count
A year round residence	29.8%	14
Seasonal residence (summer only)	27.7%	13
Visited on weekends throughout the year	27.7%	13
Resort property	2.1%	1
Rental property	2.1%	1
Undeveloped	0.0%	0
Other (please specify)	10.6%	5
answered question		47
skipped question		1

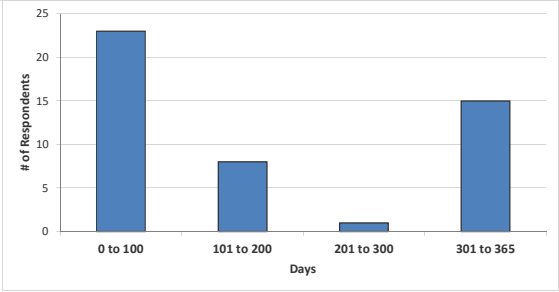


Number	Other (please specify)
1	visit off and on all year long.
2	6 months Kettle Moraine, 6 months Florida
3	visited on weekends or weekdays for swimming
4	Mostly summer but year round
5	April through October and occasional winter

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

Answer Options	Response Count
	47
answered question	47
skipped question	1

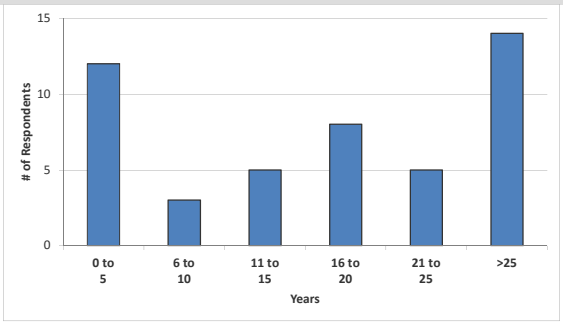
Category (# of days)	Responses	
0 to 100	23	49%
101 to 200	8	17%
201 to 300	1	2%
301 to 365	15	32%



5. How long have you owned your property on Kettle Moraine Lake?

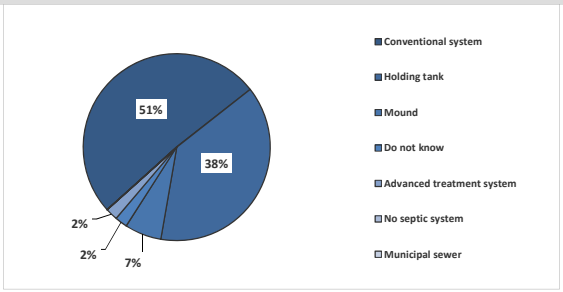
Answer Options	Response Count
	47
answered question	47
skipped question	1

Category (# of years)	Responses	% Response
0 to 5	12	26%
6 to 10	3	6%
11 to 15	5	11%
16 to 20	8	17%
21 to 25	5	11%
>25	14	30%



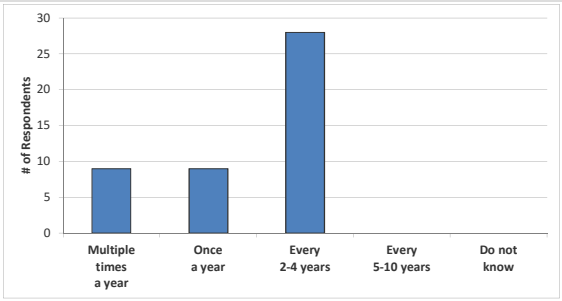
6. What type of septic system does your property utilize?

Answer Options	Response Percent	Response Count
Conventional system	51.1%	24
Holding tank	38.3%	18
Mound	6.4%	3
Do not know	2.1%	1
Advanced treatment system	2.1%	1
No septic system	0.0%	0
Municipal sewer	0.0%	0
answered question		47
skipped question		1



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

Answer Options	Response Percent	Response Count
Multiple times a year	19.6%	9
Once a year	19.6%	9
Every 2-4 years	60.9%	28
Every 5-10 years	0.0%	0
Do not know	0.0%	0
answered question		46
skipped question		2

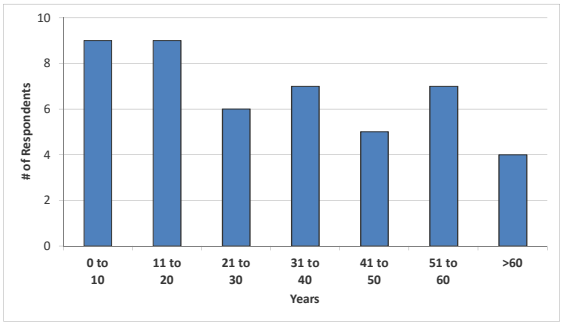


Recreational Activity on Kettle Moraine Lake

8. How many years ago did you first visit Kettle Moraine Lake?

Answer Options	Response Count
	47
answered question	47
skipped question	1

Category (# of days)	Responses	% Response
0 to 10	9	19%
11 to 20	9	19%
21 to 30	6	13%
31 to 40	7	15%
41 to 50	5	11%
51 to 60	7	15%
>60	4	9%



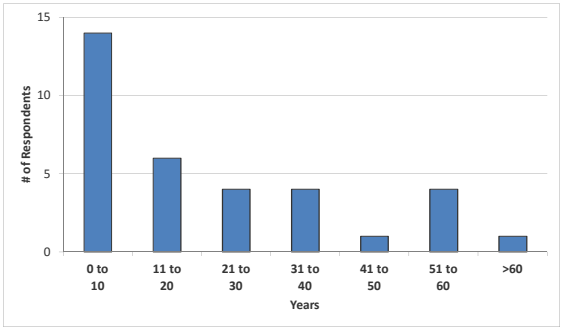
9. Have you personally fished on Kettle Moraine Lake in the past three years?

Answer Options	Response Percent	Response Count
Yes	72.3%	34
No	27.7%	13
answered question		47
skipped question		1

10. For how many years have you fished Kettle Moraine Lake?

Answer Options	Response Count
	34
answered question	34
skipped question	14

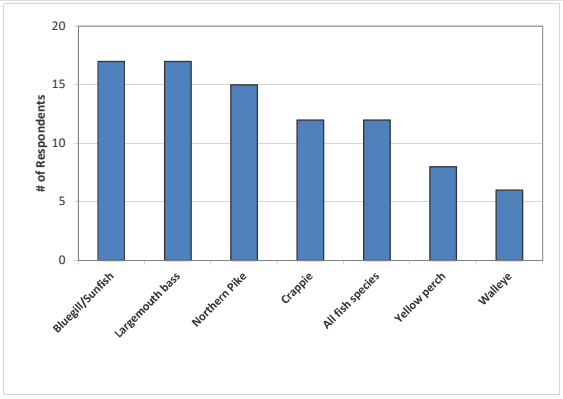
Category (# of years)	Responses	% Response
0 to 10	14	41%
11 to 20	6	18%
21 to 30	4	12%
31 to 40	4	12%
41 to 50	1	3%
51 to 60	4	12%
>60	1	3%



11. What species of fish do you like to catch on Kettle Moraine Lake?

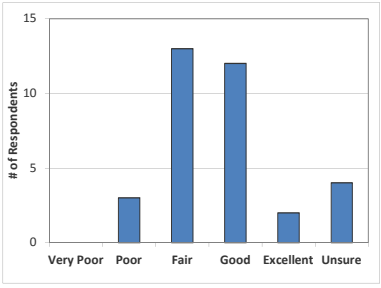
Answer Options	Response Percent	Response Count
Bluegill/Sunfish	50.0%	17
Largemouth bass	50.0%	17
Northern Pike	44.1%	15
Crappie	35.3%	12
All fish species	35.3%	12
Yellow perch	23.5%	8
Walleye	17.7%	6
Other (please specify)	11.8%	4
answered question		34
skipped question		14

Number	Other (please specify)
1	bullhead
2	An occasional bull head
3	bull head
4	Catch and release all fish



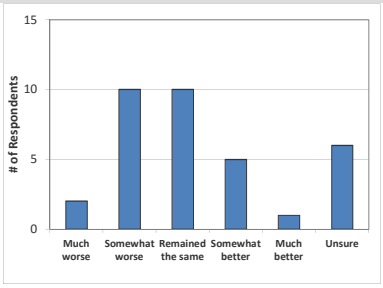
12. How would you describe the current quality of fishing on Kettle Moraine Lake?

Answer Options	Very Poor	Poor	Fair	Good	Excellent	Unsure	Response Count
	0	3	13	12	2	4	34
answered question							34
skipped question							14



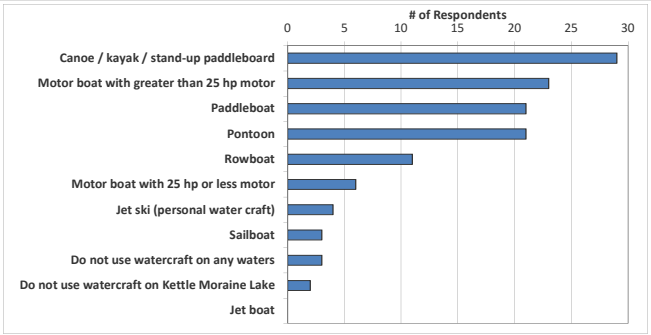
13. How has the quality of fishing changed on Kettle Moraine Lake since you have started fishing the lake?

Answer Options	Much worse	Somewhat worse	Remained the same	Somewhat better	Much better	Unsure	Response Count
	2	10	10	5	1	6	34
					answered question		**34**
					skipped question		**14**



14. What types of watercraft do you currently use on Kettle Moraine Lake?

Answer Options	Response Percent	Response Count
Canoe / kayak / stand-up paddleboard	61.7%	29
Motor boat with greater than 25 hp motor	48.9%	23
Paddleboat	44.7%	21
Pontoon	44.7%	21
Rowboat	23.4%	11
Motor boat with 25 hp or less motor	12.8%	6
Jet ski (personal water craft)	8.5%	4
Sailboat	6.4%	3
Do not use watercraft on any waters	6.4%	3
Do not use watercraft on Kettle Moraine Lake	4.3%	2
Jet boat	0.0%	0
answered question		**47**
skipped question		**1**



15. Do you use your watercraft on waters other than Kettle Moraine Lake?

Answer Options	Response Percent	Response Count
Yes	22.7%	10
No	77.3%	34
answered question		**44**
skipped question		**4**

16. What is your typical cleaning routine after using your watercraft on waters other than Kettle Moraine Lake?

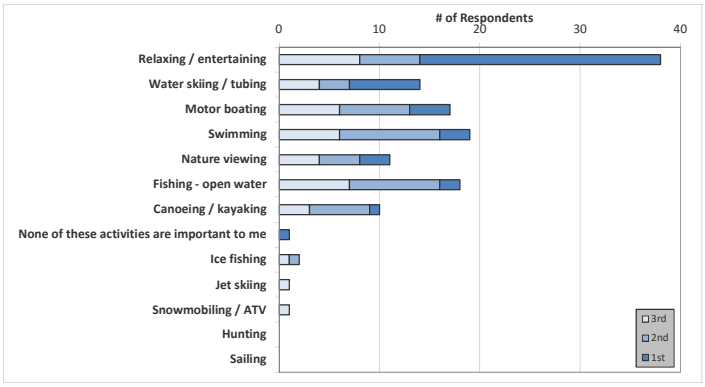
Answer Options	Response Percent	Response Count
Remove aquatic hitch-hikers (ex. - plant material, clams, mussels)	88.9%	8
Drain bilge	77.8%	7
Rinse boat	66.7%	6
Power wash boat	11.1%	1
Apply bleach	11.1%	1
Do not clean boat	0.0%	0
Other (please specify)	0.0%	2
answered question		**9**
skipped question		**39**

Number	Other (please specify)
1	do not leave this lake
2	wait 5 days to put in another lake

17. For the list below, rank up to three activities that are important reasons for owning your property on Kettle Moraine Lake, with 1 being the most important.

Answer Options	1st	2nd	3rd	Rating Average	Response Count
Relaxing / entertaining	24	6	8	1.58	38
Water skiing / tubing	7	3	4	1.79	14
Motor boating	4	7	6	2.12	17
Swimming	3	10	6	2.16	19
Nature viewing	3	4	4	2.09	11
Fishing - open water	2	9	7	2.28	18
Canoeing / kayaking	1	6	3	2.2	10
None of these activities are important to me	1	0	0	1	1
Ice fishing	0	1	1	2.5	2
Jet skiing	0	0	1	3	1
Snowmobiling / ATV	0	0	1	3	1
Hunting	0	0	0	0	0
Sailing	0	0	0	0	0
Other (please specify below)	1	0	1	2	2
			answered question		**47**
			skipped question		**1**

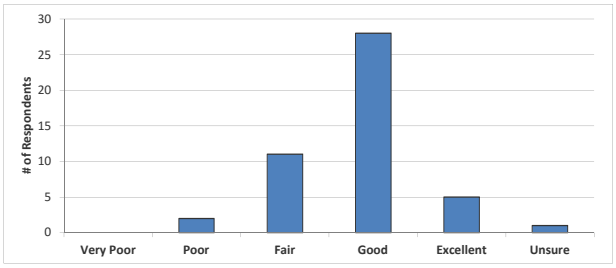
Number	"Other" responses
1	Cross Country Skiing
2	ESCAPING THE CITY



Kettle Moraine Lake Current and Historic Condition, Health and Management

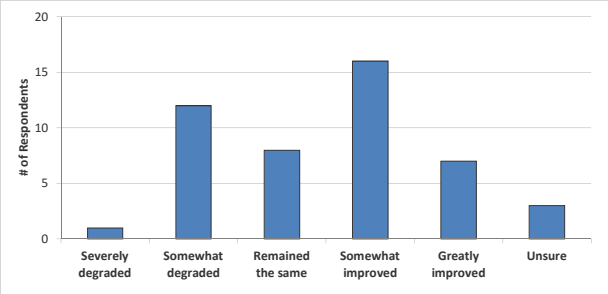
18. How would you describe the current water quality of Kettle Moraine Lake?

Answer Options	Very Poor	Poor	Fair	Good	Excellent	Unsure	Response Count
	0	2	11	28	5	1	47
					answered question		**47**
					skipped question		**1**



19. How has the current water quality changed in Kettle Moraine Lake since you first visited the lake?

Answer Options	Severely degraded	Somewhat degraded	Remained the same	Somewhat improved	Greatly improved	Unsure	Response Count
	1	12	8	16	7	3	47
						answered question	**47**
						skipped question	**1**



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

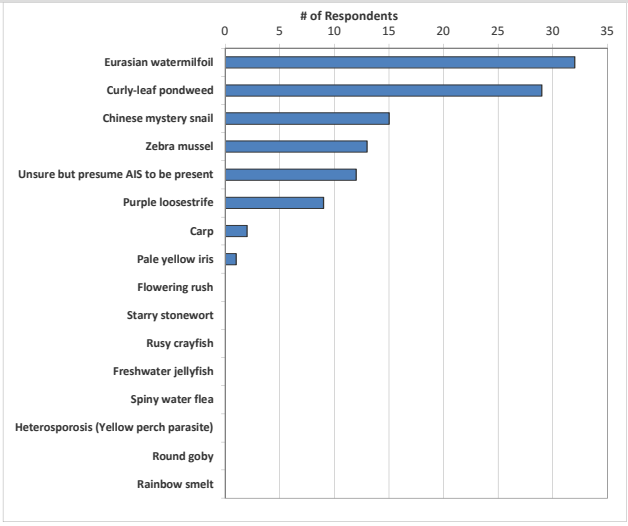
Answer Options	Response Percent	Response Count
Yes	100.0%	47
No	0.0%	0
answered question		**47**
skipped question		**1**

21. Do you believe aquatic invasive species are present within Kettle Moraine Lake?

Answer Options	Response Percent	Response Count
Yes	78.7%	37
I think so but am not certain	14.9%	7
No	6.4%	3
answered question		**47**
skipped question		**1**

22. Which aquatic invasive species do you believe are in Kettle Moraine Lake?

Answer Options	Response Percent	Response Count
Eurasian watermilfoil	72.7%	32
Curly-leaf pondweed	65.9%	29
Chinese mystery snail	34.1%	15
Zebra mussel	29.6%	13
Unsure but presume AIS to be present	27.3%	12
Purple loosestrife	20.5%	9
Carp	4.6%	2
Pale yellow iris	2.3%	1
Flowering rush	0.0%	0
Starry stonewort	0.0%	0
Rusy crayfish	0.0%	0
Freshwater jellyfish	0.0%	0
Spiny water flea	0.0%	0
Heterosporosis (Yellow perch parasite)	0.0%	0
Round goby	0.0%	0
Rainbow smelt	0.0%	0
Other (please specify)	4.6%	2
answered question		**44**
skipped question		**4**

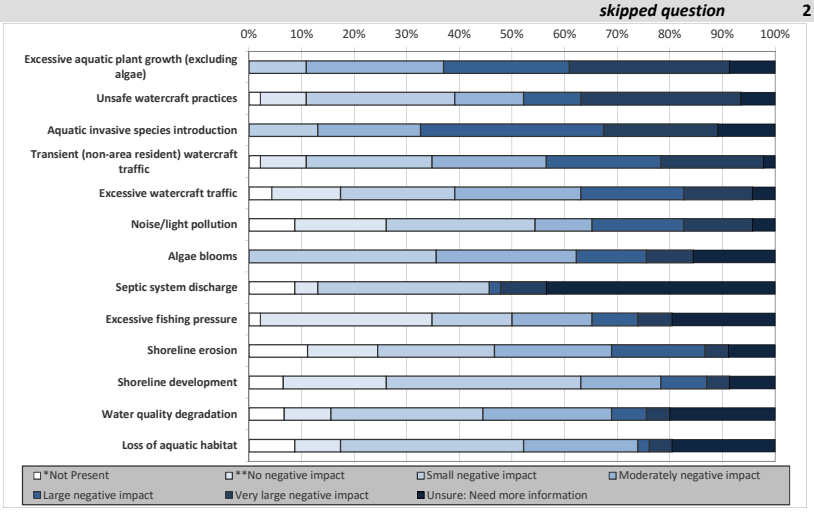


Number	"Other" responses
1	unsure
2	I know there are several plants that are not native

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

Answer Options	*Not Present	**No negative impact	Small negative impact	Moderately negative impact	Large negative impact	Very large negative impact	Unsure: Need more information	Rating Average	Response Count
Excessive aquatic plant growth (excluding algae)	0	0	5	12	11	14	4	2.57	46
Unsafe watercraft practices	1	4	13	6	5	14	3	2.09	46
Aquatic invasive species introduction	0	0	6	9	16	10	5	2.43	46
Transient (non-area resident) watercraft traffic	1	4	11	10	10	9	1	2.11	46
Excessive watercraft traffic	2	6	10	11	9	6	2	1.80	46
Noise/light pollution	4	8	13	5	8	6	2	1.54	46
Algae blooms	0	0	16	12	6	4	7	1.64	45
Septic system discharge	4	2	15	0	1	4	20	0.74	46
Excessive fishing pressure	1	15	7	7	4	3	9	0.98	46
Shoreline erosion	5	6	10	10	8	2	4	1.38	45
Shoreline development	3	9	17	7	4	2	4	1.11	46
Water quality degradation	3	4	13	11	3	2	9	1.16	45
Loss of aquatic habitat	4	4	16	10	1	2	9	1.02	46
Other (please specify)									4
								answered question	**46**
								skipped question	**2**

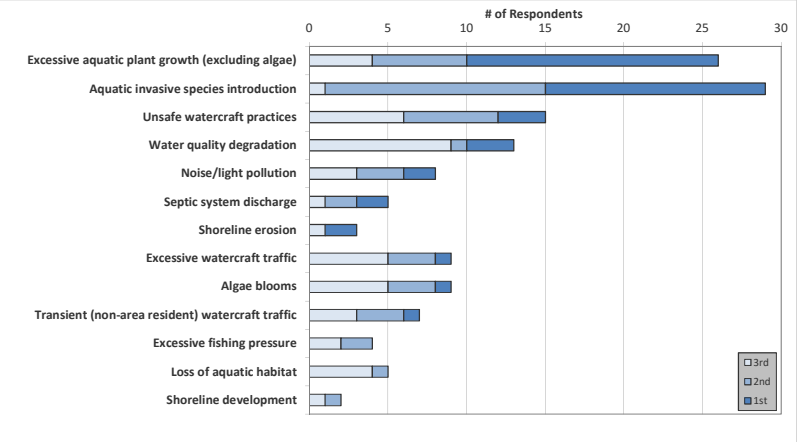
Number	Other (please specify)
1	live bands at bar
2	Canadian Geese, are our #1 concern. droppings unhealthy, nuisance, know 2 people who slipped on them and broke bones, can make areas of yard unusable
3	No longer access to boat landing / have not used in a year.
4	Being new this year the resort off of hwy F caused a lot of additional boat/jetski traffic from what appeared to be people who either didn't know the rules and regulations for driving a boat/jetski or simply refused to follow the rules. Twice while kayaking a jetsku came within a few yards of my kayak.



24. From the list below, please rank your top three concerns regarding Kettle Moraine Lake, with 1 being your greatest concern.

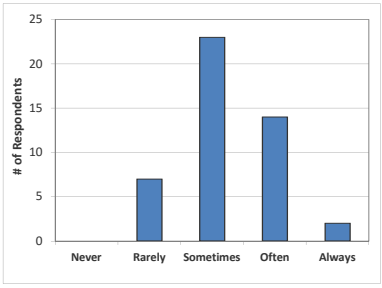
Answer Options	1st	2nd	3rd	Response Count
Excessive aquatic plant growth (excluding algae)	16	6	4	26
Aquatic invasive species introduction	14	14	1	29
Unsafe watercraft practices	3	6	6	15
Water quality degradation	3	1	9	13
Noise/light pollution	2	3	3	8
Septic system discharge	2	2	1	5
Shoreline erosion	2	0	1	3
Excessive watercraft traffic	1	3	5	9
Algae blooms	1	3	5	9
Transient (non-area resident) watercraft traffic	1	3	3	7
Excessive fishing pressure	0	2	2	4
Loss of aquatic habitat	0	1	4	5
Shoreline development	0	1	1	2
Other (please specify)	1	0	0	1
			answered question	**46**
			skipped question	**2**

Number	"Other" responses
1	Geese dropping problem #1



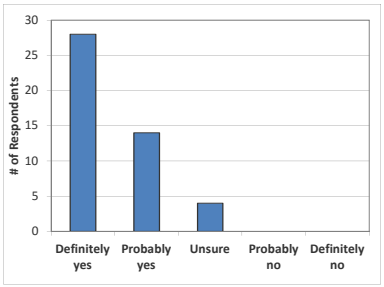
25. During open water season how often does aquatic plant growth, including algae, negatively impact your enjoyment of Kettle Moraine Lake?

Answer Options	Never	Rarely	Sometimes	Often	Always	Response Count
	0	7	23	14	2	46
				answered question		**46**
				skipped question		**2**



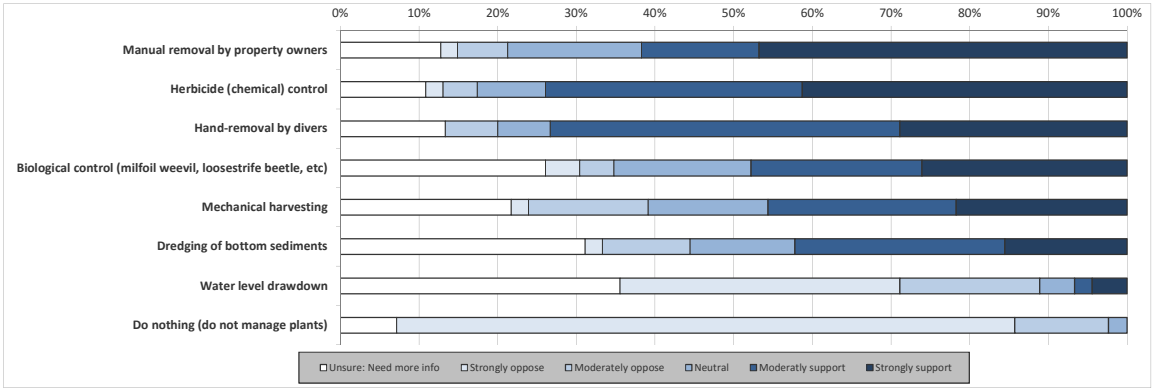
26. Considering your answer to the question above, do you believe aquatic plant control is needed on Kettle Moraine Lake?

Answer Options	Definitely yes	Probably yes	Unsure	Probably no	Definitely no	Response Count
	28	14	4	0	0	46
				answered question		46
				skipped question		2



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

Answer Options	Strongly oppose	Moderately oppose	Neutral	Moderatly support	Strongly support	Unsure: Need more info	Rating Average	Response Count
Manual removal by property owners	1	3	8	7	22	6	3.6	47
Herbicide (chemical) control	1	2	4	15	19	5	3.74	46
Hand-removal by divers	0	3	3	20	13	6	3.56	45
Biological control (milfoil weevil, loosestrife beetle, etc)	2	2	8	10	12	12	2.83	46
Mechanical harvesting	1	7	7	11	10	10	2.83	46
Dredging of bottom sediments	1	5	6	12	7	14	2.49	45
Water level drawdown	16	8	2	1	2	16	1.16	45
Do nothing (do not manage plants)	33	5	1	0	0	3	1.1	42
						answered question		47
						skipped question		1



28. Did you know that aquatic herbicides were being applied in Kettle Moraine Lake to help control AIS?

Answer Options	Response Percet	Response Count
Yes	86.4%	38
I think so but can't say for certain	2.3%	1
No	11.4%	5
answered question		44
skipped question		4

29. How do you feel about the past use of herbicides to treat AIS in previous years?

Answer Options	Completely support	Moderately support	Unsure/ Neutral	Moderately oppose	Completely oppose	Rating Average	Response Count
	25	15	3	2	1	1.67	46
					answered question		46
					skipped question		2

30. What is your level of support or opposition for future aquatic herbicide use to target AIS in Kettle Moraine Lake?

Answer Options	Completely support	Moderately support	Unsure/ Neutral	Moderately oppose	Completely oppose	Rating Average	Response Count
	26	12	5	2	1	1.7	46
					answered question		**46**
					skipped question		**2**

31. What is the reason(s) you oppose the future use of aquatic herbicides to target AIS in Kettle Moraine Lake?

Answer Options	Response Percet	Response Count
Potential cost of treatment is too high	25.0%	1
Potential impacts to native aquatic plant species	25.0%	1
Potential impacts to native (non-plant) species such as fish, insects, etc.	50.0%	2
Potential impacts to human health	75.0%	3
Future impacts are unknown	75.0%	3
Another reason (please specify)	0.0%	0
answered question		**3**
skipped question		**45**

Kettle Moraine Lake Association (KMLA)

32. Before receiving this mailing, have you ever heard of the KMLA?

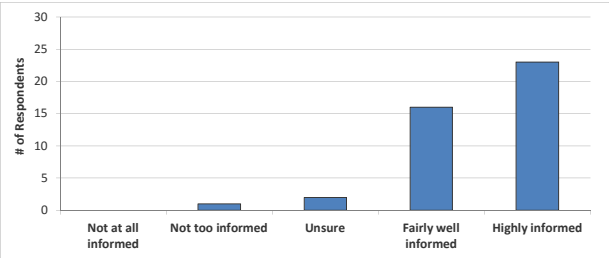
Answer Options	Response Percent	Response Count
Yes	100.0%	45
No	0.0%	0
answered question		**45**
skipped question		**3**

33. What is your membership status with the KMLA?

Answer Options	Response Percent	Response Count
Current member	84.8%	39
Former member	6.5%	3
Never been a member	8.7%	4
answered question		**46**
skipped question		**2**

34. How informed has (or had) the KMLA kept you regarding issues with Kettle Moraine Lake and its management?

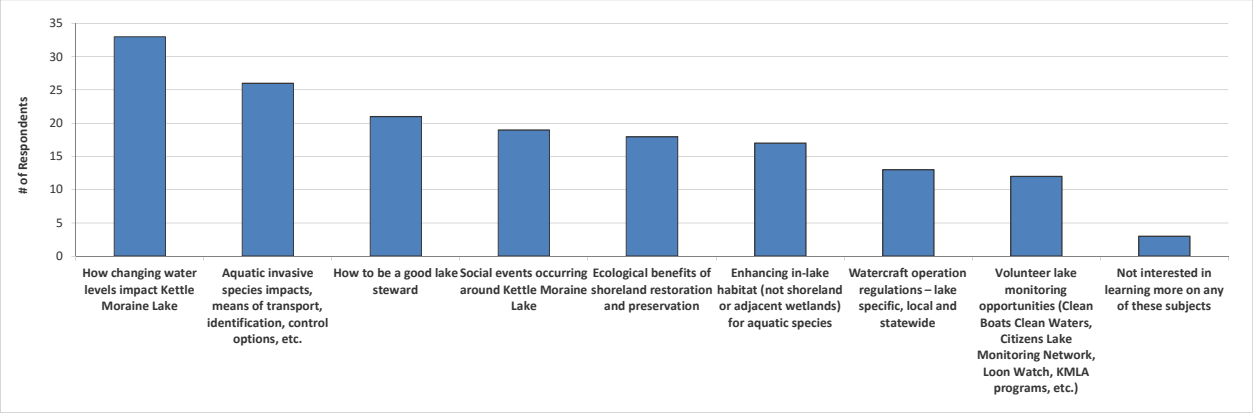
Answer Options	Not at all informed	Not too informed	Unsure	Fairly well informed	Highly informed	Response Count
	0	1	2	16	23	42
					answered question	**42**
					skipped question	**6**



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

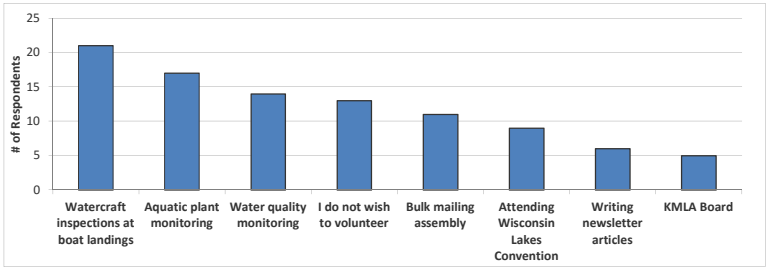
Answer Options	Response Percent	Response Count
How changing water levels impact Kettle Moraine Lake	70.2%	33
Aquatic invasive species impacts, means of transport, identification, control options, etc.	55.3%	26
How to be a good lake steward	44.7%	21
Social events occurring around Kettle Moraine Lake	40.4%	19
Ecological benefits of shoreland restoration and preservation	38.3%	18
Enhancing in-lake habitat (not shoreland or adjacent wetlands) for aquatic species	36.2%	17
Watercraft operation regulations – lake specific, local and statewide	27.7%	13
Volunteer lake monitoring opportunities (Clean Boats Clean Waters, Citizens Lake Monitoring Network, Loon Watch, KMLA programs, etc.)	25.5%	12
Not interested in learning more on any of these subjects	6.4%	3
Other (please specify)	6.4%	3
	answered question	**47**
	skipped question	**1**

Number	Other (please specify)
1	Geese Control
2	meetings and newsletter are very beneficial for information gathering
3	Lowering lake level to 1950 -60 levels.



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

Answer Options	Response Percent	Response Count
Watercraft inspections at boat landings	45.7%	21
Aquatic plant monitoring	37.0%	17
Water quality monitoring	30.4%	14
I do not wish to volunteer	28.3%	13
Bulk mailing assembly	23.9%	11
Attending Wisconsin Lakes Convention	19.6%	9
Writing newsletter articles	13.0%	6
KMLA Board	10.9%	5
answered question		**46**
skipped question		**2**



37. Please feel free to provide written comments concerning Kettle Moraine Lake, its current and/or historic condition and its management.

Answer Options	Response Count
	23
answered question	**23**
skipped question	**25**

Number	Response Text
1	Excessive lily pad growth and excessive muck along my property shoreline are detractors not only of the value of my property but also to the recreational enjoyment of my family and our lake neighbors. I understand the need and importance of addressing the invasive species present in our lake and fully support the efforts to combat this in the past and going forward. Any efforts to address excessive developed shoreline muck conditions and lily pad growth would be very welcome from my perspective. Further control of the goose population would also be appreciated. Thank You!
2	The weeds on the lake bad last year.
3	The KMLA has done an excellent job managing the health if the lake.
4	Thanks to KMLA for providing a forum for stakeholders and opportunities for residents to give back to our beautiful lake!
5	Our Board does a great job. Much appreciated. Overall I think we have a beautiful lake that is in pretty good shape. We have supported the chemical treatment of the weeds, because we thought that was our only option. But I see they can be diver removed and mechanically removed, also. Chemicals are suppose to be safe, but how often have we heard that before and years later side effects show up. We swim and eat fish out of the lake, the less chemicals (as far as I'm concerned) the better. Geese droppings are our biggest concern and annoyance. Hope we can round them up again.
6	There was no mention of home owners treating lawns with chemicals. Many homes have lawns that grow right up to the water and have trucks come in and spray chemicals so intensely that I can literally taste it from 400 yards away. Multiply that by all the homes doing it and what do you suppose this is doing to the lake? I can't believe that is even in compliance with DNR standards.
7	Thank you to everyone who is working to keep Kettle Moraine Lake great!
8	Kettle Moraine use to be a nice quiet lake to fish on but, not since last year the sale of Nancy Seas has changed everything. Will be looking for a different place to fish now.
9	The lake has become part of our life and we want to make sure it is in the best possible condition now and for the furture
10	We feel the board is hard-working and has done an excellent job of keeping us informed. It would be wonderful to see all lake residents involved in the Association but that probably won't happen. Have hated to see the lake get so busy and noisy. It used to be a very calming place to be and enjoy.
11	Love the highly active KMLA association.Not only the work but the events that bring us together.
12	We love this little lake and want to preserve the water quality, natural beauty and serenity
13	my husband refuses to join or give any money because he blames the boats for all the problems. It also does not help having grandchildren in the water swimming and boaters feel they can zoom right past them without any concern for safety, It is the motors chopping up all the weeds that is causing the spread of the weeds.
14	Summer fishing quality, especially for northerns & pan fish, I've seen over the years, is much better in years where ice conditions prevent much ice fishing. I feel ice fishing gives local non lake residents easy and prolonged access and does significantly impact open water fishing. Since most years this is true, it's after the rare poor ice year you see the impact. Another factor to be avoided and those that guard against this are really appreciated, is a fish freeze out. It's been a very long time since we've gone through one but that was a very impactful event and took years to recover. A third factor I'd point to is water levels. The last couple of years, water levels seem to be running much higher than "normal". Usually by late summer we have a foot or two of "beach" we call it, water level falls to expose some shoreline. The last couple of years levels have been much higher. This year especially high which makes me wonder and worry spring thaw water could lead to flooding. Has something changed beyond just "a rainier year"?
15	Beautiful lake with the best possible management.
16	My residence is in jeopardy of a flooded basement if lake level raises a few inches. The current level is approximatelly 18 inches above 1960 levels.
17	The KMLA officers and board members do an excellent job looking after the health and condition of our lake .
18	I think KMLA is doing a great job with lake and there are good people running it keep up the good work
19	More people must get involved to keep our lake healthy
20	People work very hard to preserve the lake. It would be great if more people would help both in person and financially
21	Personally, I very much appreciate the hard work that a small group of individuals have put into keeping Kettle Moraine Lake a great place to recreate
22	Our Board for KML is doing a wonderful job. It is all volunteer time and is appreciated.
23	With the current owner of the Tiki Resort allowing use of kayaks by strangers on the lake, need to re-institute the use of water traffic lanes. The kayaks are encroaching in water ski lanes, dangerous for both.

C

APPENDIX C

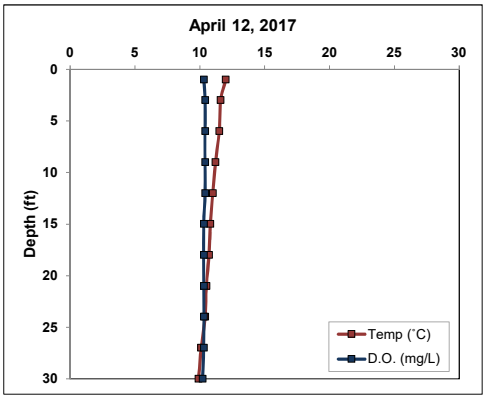
Water Quality Data

Kettle Moraine Lake

Date: 4/12/2017
Time: 12:00
Weather: 95% clouds, 54F, light breeze
Entry: EEH

Max Depth: 31.2
KMLS Depth (ft): 3.0
KMLB Depth (ft): 27.0
Secchi Depth (ft): 7.7

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	12.0	10.3		
3	11.6	10.4	8.1	
6	11.5	10.4		
9	11.2	10.4		
12	11.0	10.4		
15	10.8	10.3	8.0	
18	10.7	10.3		
21	10.5	10.3		
24	10.4	10.3		
27	10.1	10.3	8.0	
30	9.9	10.2		



Parameter	KMLS	KMLB
Total P (µg/L)	21.20	22.60
Dissolved P (µg/L)	2.80	2.60
Chl-*a* (µg/L)	5.43	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)	776.00	753.00
Lab Cond. (µS/cm)	276.00	276.00
Lab pH	8.29	8.29
Alkalinity (mg/L $CaCO_3$)	122.00	123.00
Total Susp. Solids (mg/L)	ND	ND
Calcium (mg/L)	33.20	NA
Magnesium (mg/L)	13.40	NA
Hardness (mg/L)	138.00	NA
Color (SU)	15.00	NA
Turbidity (NTU)	NA	NA

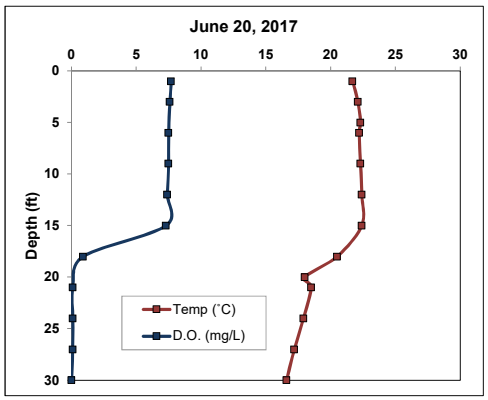
Data collected by LJS and EEH (Onterra).

Kettle Moraine Lake

Date: 6/20/2017
Time: 13:00
Weather: 60F, 75% clouds
Entry: JLW

Max Depth: 31.1
KMLS Depth (ft): 3.0
KMLB Depth (ft): 27.0
Secchi Depth (ft): 7.7

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	21.7	7.7		
3	22.1	7.6		
5	22.3		9.0	
6	22.2	7.5		
9	22.3	7.5		
12	22.4	7.4		
15	22.4	7.3		
18	20.5	0.9		
20	18.0		8.1	
21	18.5	0.1		
24	17.9	0.1		
27	17.2	0.1		
30	16.6	0.0		



Parameter	KMLS	KMLB
Total P (µg/L)	33.70	110.00
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	3.96	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)	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

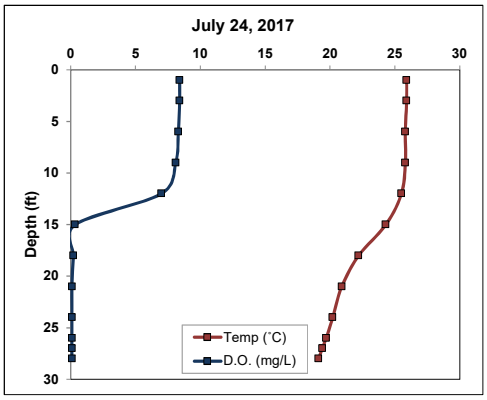
Data collected by TWH and AMS (Onterra).

Kettle Moraine Lake

Date: 7/24/2017
Time: 11:40
Weather: 40% clouds, 80F, light breeze
Entry: EEH

Max Depth: 29.6
KMLS Depth (ft): 3.0
KMLB Depth (ft): 26.0
Secchi Depth (ft): 9.7

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	25.9	8.4		
3	25.9	8.4		
6	25.8	8.3		
9	25.8	8.1		
12	25.5	7.0		
15	24.3	0.3		
18	22.2	0.2		
21	20.9	0.1		
24	20.2	0.1		
26	19.7	0.1		
27	19.4	0.1		
28	19.1	0.1		



Parameter	KMLS	KMLB
Total P (µg/L)	15.00	137.00
Dissolved P (µg/L)	3.80	31.40
Chl-*a* (µg/L)	2.75	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)	669.00	1470.00
Lab Cond. (µS/cm)	212.00	243.00
Lab pH	9.08	7.57
Alkalinity (mg/L $CaCO_3$)	86.00	103.00
Total Susp. Solids (mg/L)	NA	7.60
Calcium (mg/L)	15.50	NA
Magnesium (mg/L)	11.50	NA
Hardness (mg/L)	86.20	NA
Color (SU)	15.00	NA
Turbidity (NTU)	NA	NA

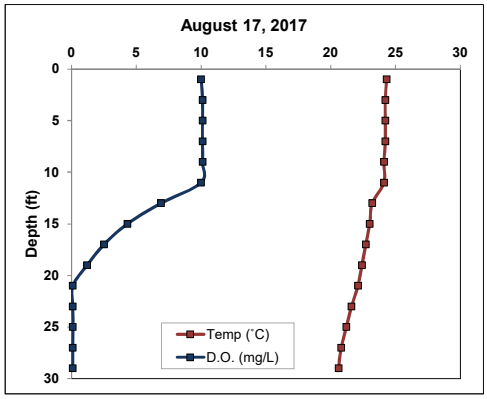
Data collected by JMB & AMS (Onterra)

Kettle Moraine Lake

Date: 8/17/2017
Time: 13:40
Weather: 75F,80% clouds
Entry: EEH

Max Depth: 29.9
KMLS Depth (ft): 3.0
KMLB Depth (ft): 27.0
Secchi Depth (ft): 10.4

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	24.3	10.0		
3	24.2	10.1		
5	24.2	10.1		
7	24.2	10.1		
9	24.1	10.1		
11	24.1	10.0		
13	23.2	6.9		
15	23.0	4.3		
17	22.7	2.5		
19	22.4	1.2		
21	22.1	0.1		
23	21.6	0.1		
25	21.2	0.1		
27	20.8	0.1		
29	20.6	0.1		



Parameter	KMLS	KMLB
Total P (µg/L)	17.80	177.00
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	3.43	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)	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

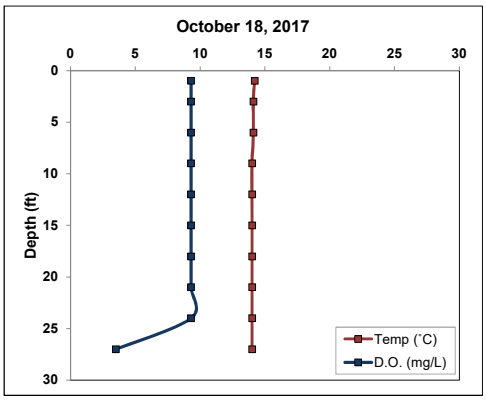
Data collected by TWH (Onterra)

Kettle Moraine Lake

Date: 10/18/2017
Time: 11:45
Weather: 69F, 0% clouds, 5 mph wind
Entry: EEH

Max Depth: 27.6
KMLS Depth (ft): 3.0
KMLB Depth (ft): 24.0
Secchi Depth (ft): 11.9

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	14.2	9.3		
3	14.1	9.3		
6	14.1	9.3		
9	14.0	9.3		
12	14.0	9.3		
15	14.0	9.3		
18	14.0	9.3		
21	14.0	9.3		
24	14.0	9.3		
27	14.0	3.5		



Parameter	KMLS	KMLB
Total P (µg/L)	15.80	18.50
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	3.15	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

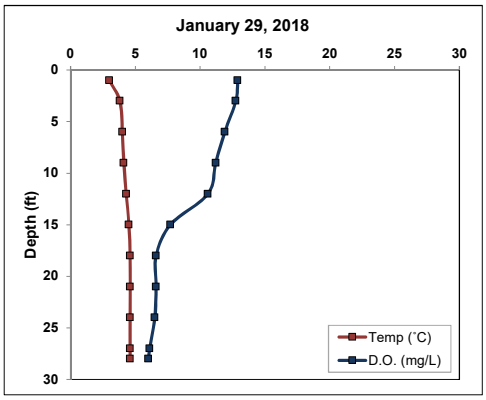
Data collected by JMB & CJF (Onterra)

Kettle Moraine Lake

Date: 1/29/2018
Time: 10:20
Weather: 17F, 100% clouds
Entry: JLW

Max Depth: 29.9
KMLS Depth (ft): 3.0
KMLB Depth (ft): 27.0
Secchi Depth (ft): 5.8

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	3.0	12.9		
3	3.8	12.8		
6	4.0	11.9		
9	4.1	11.2		
12	4.3	10.6		
15	4.5	7.7		
18	4.6	6.6		
21	4.6	6.6		
24	4.6	6.5		
27	4.6	6.1		
28	4.6	6.0		



Parameter	KMLS	KMLB
Total P (µg/L)	24.90	16.60
Dissolved P (µg/L)	ND	ND
Chl-*a* (µg/L)	NA	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)	945.00	968.00
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: 1.5 ft.

Water Quality Data

2017-2018	Surface		Bottom	
Parameter	Count	Mean	Count	Mean
Secchi Depth (feet)	6	8.9	NA	NA
Total P (µg/L)	6	21.4	6	80.3
Dissolved P (µg/L)	3	3.3	3	17.0
Chl a (µg/L)	5	3.7	0	NA
TKN (µg/L	0	NA	0	NA
NO_3+NO_2-N (µg/L)	0	NA	0	NA
NH_3-N (µg/L)	0	NA	0	NA
Total N (µg/L)	3	796.7	3	1063.7
Lab Cond. (µS/cm)	2	244.0	2	259.5
Alkal (mg/l $CaCO_3$)	2	104.0	2	113.0
Total Susp. Solids (mg/l)	2	ND	3	7.6
Calcium (mg/L)	2	24.4	0	NA
Magnesium (mg/L)	2	12.5	0	NA
Hardness (mg/L)	2	112.1	0	NA
Color (SU)	2	15.0	0	NA
Turbidity (NTU)	0	NA	0	NA

Trophic State Index (TSI)

Year	TP	Chl-a	Secchi
2006			48.1
2007			48.2
2008			
2009			47.0
2010			48.5
2011			47.5
2012			50.5
2013			49.3
2014			48.9
2015			46.2
2016			45.6
2017	48.8	42.5	45.3
All Years (Weighted)	48.8	42.5	45.3
DSL Median	43.2	43.2	42.4
SWTP Ecoregion Median	48.7	47.0	50.0

	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
2006	9	7.5	8	7.5								
2007	10	7.5	9	7.4								
2008	0		0									
2009	12	8.1	12	8.1								
2010	11	7.3	10	7.3								
2011	12	7.8	10	7.8								
2012	13	7.3	9	6.3								
2013	16	6.9	12	6.9								
2014	13	8.1	7	7.1								
2015	13	8.5	12	8.5								
2016	8	9.0	6	8.9								
2017	6	9.3	4	9.1	5	3.7	3	3.4	5	20.7	3.0	22.2
All Years (Weighted)		7.8		7.6		3.7		3.4		20.7		22.2
DSL Median				11.2				3.6				15.0
SWTP Ecoregion Median				6.6				5.3				22.0

D

APPENDIX D

2012 Comprehensive Fisheries Report

Travis Motl and Adam Nickel (Plymouth Fisheries Team)

Kettle Moraine Lake (Round Lake)

2012 Comprehensive Survey Report

Fond Du Lac County, Wisconsin

Plymouth Fisheries
Adam Nickel – Fisheries Technician
Travis Motl – Fisheries Biologist

Abstract

In 2012, a comprehensive fish survey was conducted on Kettle Moraine Lake (KML) using fyke nets and boat electrofishing. The objectives of this survey were to assess the status of the fishery; particularly the northern pike, largemouth bass, walleye, and panfish populations in order update management recommendations.

The 2012 survey indicated an improving northern pike size structure since the enactment of the no minimum length and 5 fish daily bag limit in 2008; however, the PSD of 32 indicates that smaller fish are still abundant. Low mean relative weight (84) also indicated reduced condition of northern pike likely due to high competition for food resources or limited cool water thermal refuge. Conversely, the largemouth bass population is doing well, demonstrating good size structure (PSD = 72) and condition (Wr = 103). Only 1 walleye was captured in the 2012 survey indicating that walleye stocking during the 1990's was unsuccessful in establishing any natural reproduction. Bluegill continued to be small and slow growing; whereas, black crappie had good size structure indicating that KML can produce large crappies. Bullheads continue to be a dominant fish species, but size structure is good providing a unique fishing opportunity that is sought for by some local anglers.

Management of the fish community in KML poses many challenges, including the extensive growth of aquatic vegetation and increased risk for winter kill events. The extensive aquatic vegetation continues to limit the bluegill fishery. Predation on bluegill is likely reduced, resulting in poor size structure. As a result, management options continue to be limited due to poor habitat conditions.

Management recommendations include:

1. Continue aquatic plant treatments to control Eurasian water milfoil and curly-leaf pond weed, increasing potential for predation on bluegill by gamefish species.
2. Continue lake aeration during the winter months in order to reduce the risk of fish die off from low dissolved oxygen.
3. Monitor the northern pike population to further assess the size structure and impacts of the regulation change in 2008.
4. Evaluate walleye stocking, if an adult population of at least 1 per acre is not established discontinue stocking.
5. Monitor largemouth bass and panfish populations for trends in size structure.

Introduction

Kettle Moraine Lake (KML), formerly known as Round Lake, is a shallow "public access" seepage lake covering 227 acres in eastern Fond du Lac County. The maximum depth is 30 feet, but only 1% of the lake area exceeds 20 foot depths (Figure 1). A high percentage of shallow water and fertility have led to abundant submergent and emergent vegetation, covering approximately 70% of the lake surface area during mid-summer. Consequently, the lake has a long history of periodic winterkill that has been mitigated using winter aeration; however, oxygen depletion in the lower water column has also been documented during summer months. The Trophic State Index (Secchi Tube) for KML ranged from 47-51 from 2009-2012, indicating a mesotrophic status that is progressing towards eutrophic. Water clarity is fair; the reported mean secchi depth was 6 feet in 2012. Invasive species are a continual problem including the Chinese mystery snail, zebra mussel, curly-leaf pondweed, and Eurasian water-milfoil.

KML is the second-largest lake in the Northern Kettle Moraine area and has an active Lake Association. There is considerable residential shoreline development, including County Highway F that runs along the northeast side of the lake. Although there is no state forest access, the public can launch at Nan-Sea's Tiki Bar and Grill on the east side of the lake. KML supports fish populations including northern pike, largemouth bass, a variety of panfish species, and bullheads. Private conservation clubs did attempt to establish a walleye population in the late 1980s through fry stockings, but the attempt largely failed (Table 1). Periodic walleye stockings still occur, including the stocking of 7,920 small fingerling in 2013 and 2,300 large fingerling in 2012.

Several fish surveys have been conducted on KML with the earliest conducted in 1951, 1953, 1960, and 1980. The surveys all indicated that the lake was predominantly a northern pike, largemouth bass, and panfish lake. Bluegills were slow growing and the fish population was considered unstable due to frequent winter kill events. In 1998 a comprehensive fish survey was conducted to evaluate relative health of the fish community and develop management recommendations. The survey indicated that northern pike and bluegill were abundant, but slow growing. Largemouth bass were common, but also slow growing and walleye were scarce. Bullheads were noted as abundant and were reaching quality size.

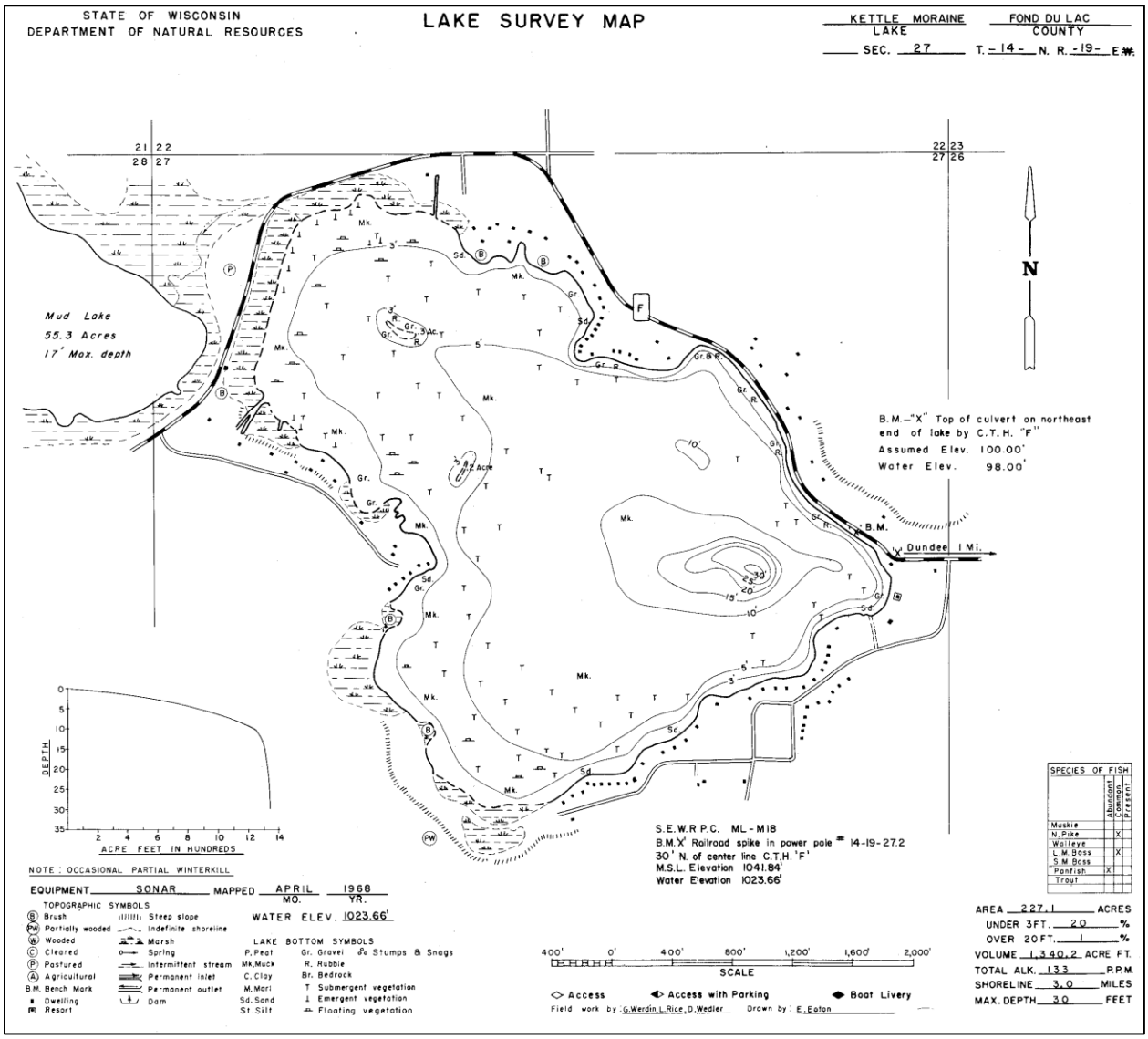

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES
LAKE SURVEY MAP
KETTLE MORAINE LAKE
FOND DU LAC COUNTY
SEC. 27 T. -14- N. R. -19- E. W.
21 22
28 27
22 23
27 26
N
Mud Lake
55.3 Acres
17' Max. depth
B.M.—"X" Top of culvert on northeast end of lake by C.T.H. "F"
Assumed Elev. 100.00'
Water Elev. 98.00'
B.M.
Dundee 1 Mi.
S.E.W.R.P.C. ML-M18
B.M.'X' Railroad spike in power pole # 14-19-27.2
30' N. of center line C.T.H. 'F'
M.S.L. Elevation 1041.84'
Water Elevation 1023.66'
DEPTH
ACRE FEET IN HUNDREDS
NOTE: OCCASIONAL PARTIAL WINTERKILL
EQUIPMENT SONAR MAPPED APRIL 1968
MO. YR.
WATER ELEV. 1023.66'
TOPOGRAPHIC SYMBOLS
Brush
Partially wooded
Wooded
Cleared
Pastured
Agricultural
B.M. Bench Mark
Dwelling
Resort
Steep slope
Indefinite shoreline
Marsh
Spring
Intermittent stream
Permanent inlet
Permanent outlet
Dam
LAKE BOTTOM SYMBOLS
P. Peat
Mk. Muck
C. Clay
M. Marl
Sd. Sand
St. Silt
Gr. Gravel
R. Rubble
Br. Bedrock
T Submergent vegetation
Emergent vegetation
Floating vegetation
Stumps & Snags
400' 0' 400' 800' 1,200' 1,600' 2,000'
SCALE
Access
Access with Parking
Boat Livery
Field work by: G. Werdin, L. Rice, D. Wedler
Drawn by: E. Eaton
SPECIES OF FISH
Abundant
common
Present
Muskie
N. Pike
Walleye
L.M. Bass
S.M. Bass
Panfish
Trout
AREA 227.1 ACRES
UNDER 3FT. 20 %
OVER 20FT. 1 %
VOLUME 1,340.2 ACRE FT.
TOTAL ALK. 133 P.P.M.
SHORELINE 3.0 MILES
MAX. DEPTH 30 FEET

Figure 1. Lake survey map for Kettle Moraine Lake in Fond Du Lac County, Wisconsin.
Table 1. Stocking events conducted on Kettle Moraine Lake indicating year, species, age class, and number stocked.

Year	Species	Age Class	Number Stocked
2013	WAE	SMALL FINGERLING	7,920
2012	WAE	LARGE FINGERLING	2,300
1992	WAE	FINGERLING	11,350
1990	WAE	FRY	227,000
1989	WAE	FRY	227,000
1988	WAE	FRY	200,000
1987	WAE	FRY	681,000
1986	WAE	FRY	227,000
1977	NOP	FRY	20,000
1976	LMB	FINGERLING	10,000

In 2012 a comprehensive fish survey was conducted using fyke nets and boat electrofishing. The objectives of this survey were to assess the status of the fishery, attain a northern pike population estimate and evaluate implementation of northern pike regulation change, evaluate adult walleye density and stocking success, evaluate largemouth bass and panfish size structure and calculate growth of bluegill. The final objective of this fish survey was to update management recommendations.

Methods

Data Collection

The comprehensive 2012 fish survey on KML included the use of fyke net and electrofishing gear. There were eight white nylon fyke nets (¾"bar mesh) that were used in the fyke net survey from March 15 – March 26. All gamefish captured were measured and weight was taken on northern pike. In order to attain a northern pike population estimate all northern pike sampled were marked: males received a left pectoral fin clip, females a right pectoral fin clip, and unknowns received a top caudal clip. Throughout the survey northern pike were assessed for marks and noted as recaptures if marks were found. A population estimate was also going to be calculated for walleye; however, only one was sampled during survey. A subsample of panfish lengths were also randomly collected to provide length frequency data, but the major focus of the fyke net effort was to attain a northern pike population estimate.

Boat electrofishing was also conducted during the 2012 KML fish survey. The entire shoreline (approximately 3.2 miles) was electrofished at night on 05/09/2012 with all fish species collected in the first 0.5 miles and gamefish only during the rest of the effort. There were 39 bluegills that were taken back to the laboratory for otolith removal and aging procedures. An additional boat electrofishing gamefish survey was conducted at night on 05/15/2012 for 1.25 miles before the survey was ended due to adverse weather conditions.

Data Analysis

Fyke net total catch and CPUE (#/net night; NN) were calculated for northern pike and walleye. The multiple recapture population estimator (Schnabel Method) was used to calculate a population estimate for northern pike with 95% confidence intervals. Electrofishing total catch and CPUE (#/mile) were calculated for largemouth bass and all panfish species sampled. Length frequency histograms were constructed for northern pike, largemouth bass, bluegill, black

crappie, and pumpkinseed to assess size structure. Furthermore, Proportional Size Distribution (PSD) was also calculated for northern pike, largemouth bass, bluegill, and pumpkinseed to assess population balance. Relative weight (Wr) was also calculated for northern pike and largemouth bass. Lastly, a subsample of bluegill was collected for otolith aging and growth was compared to statewide and regional averages.

Results and Discussion

Northern Pike

There were 186 northern pike sampled in the 2012 fyke net survey with a catch rate of 2.6/net night (see Appendix 1 for 2012 catch results). The mean length was 19.0" and the largest fish sampled was 31.0". Catch rate was higher during the 1998 survey (3.8/NN), whereas as the mean length was slightly lower (18.7"; see Appendix 2 for 1998 catch results). The Schnabel population estimate for northern pike in 2012 was 717.2 (95% CI [465.2, 1564.8]), equaling 3.2 fish/acre compared to an estimate of 6.2/acre in 1998. In 2012, the PSD was 32 and mean relative weight of northern pike was 84.

Prior to 1994, the northern pike regulation for KML was no minimum length limit and a 5 daily bag limit. From 1995-2007, the regulation was changed to a 26" minimum length limit and 2 daily bag limit, before reverting back to a no minimum length and 5 daily bag limit in 2008. The 2012 survey indicated an improving size structure, with a greater number of females > 25 inches; however, the PSD of 32 indicates that smaller fish are still abundant (Figure 2). The lower mean relative weight (84) also indicates reduced condition of northern pike likely due to high competition for food resources or limited cool water thermal refuge. Northern pike growth in 1998 was noted as similar to statewide average, but below regional averages.

The current no minimum length and 5 fish daily bag limit regulation appears to have reduced northern pike density in KML; however, size structure is still limited. Despite an abundance of small panfish, thick vegetation may be providing too much protection for prey and result in reduced feeding efficiency for northern pike. In addition, KML lacks abundant protein rich forage such as white suckers. Aquatic plant management has been conducted to control

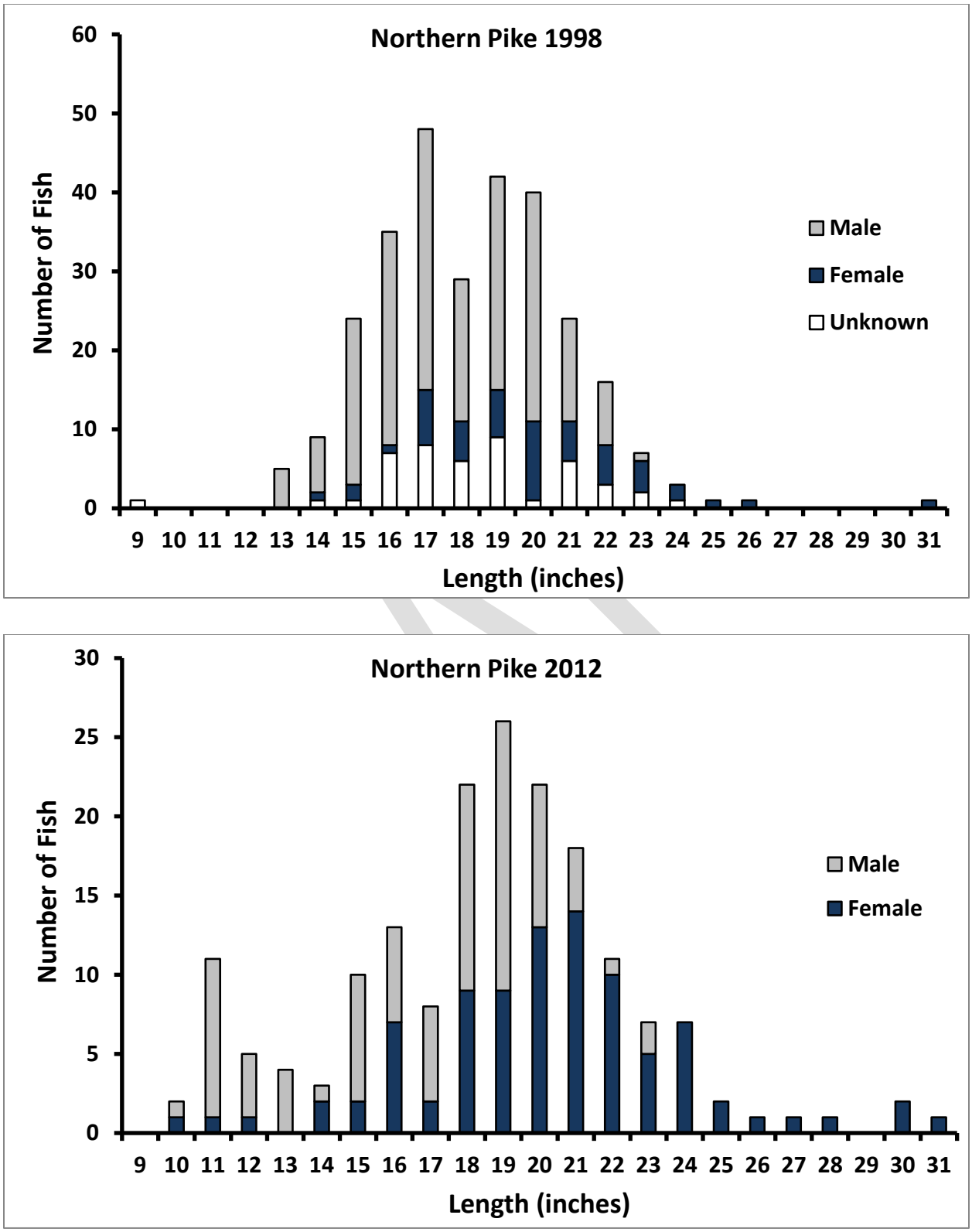


Figure 2. Length frequency histogram indicating northern pike fyke net catch in 2012 and 1998 at Kettle Moraine Lake, WI. Male, female, and unknown sex designations are also indicated.

Eurasian water milfoil and curly-leaf pondweed in recent years and this may reduce the amount of protection for prey panfish species. Growth of northern pike may also be thermally limited as little cool water refuge exists in this shallow, seepage lake.

Walleye

Only one 24.6 inch walleye was captured during the 2012 fyke net survey and none were captured during electrofishing surveys. Moreover, a 2013 fall YOY walleye electrofishing assessment found no YOY walleye. However, three age-1walleyes were captured ranging from 9.0-10.6 inches. Those walleye could likely be attributed to the 2012 stocking of 2,300 large fingerlings. Similar to the 2012 fyke net survey, only 16 walleye were captured in 1998 with a low catch rate of 0.3/NN. Growth assessments from the 1998 survey indicated that growth rates of KML walleye exceeded state and regional averages. This was not unexpected due to the abundant prey availability in KML and indicated that walleyes were successfully finding prey despite the presence of excessive aquatic vegetation. Nonetheless, despite several stocking efforts a walleye fishery has never developed in KML. The dense aquatic vegetation, shallow lake morphology, and abundant largemouth bass and northern pike populations all contribute to poor conditions for walleye. Therefore, KML should not be primarily managed as a walleye fishery and gamefish management should focus on northern pike and largemouth bass. However, walleye stocking efforts should continue to be assessed, specifically large fingerling stockings. Justification for future stocking may be to continue evaluating stocking success and possibly improve predation on abundant small panfish, but not to develop a primary walleye fishery.

Largemouth Bass

The 2012 electrofishing survey captured 91 largemouth bass catch rate of 20.5/mile. The mean length was 12.8” and maximum length was 20.5”. Electrofishing catch rate was lower during the 1998 survey (16.4/mile) and the mean length was also lower (11.2”). In 2012, the PSD was 72 and mean relative weight of largemouth bass was 103. From 1970-1990, the largemouth bass regulation for KML was no minimum length limit and a 5 daily bag limit. From 1991-1997, the daily bag limit was increased to 10 prior to reverting back to 5 daily bag limit in 1998. In the 1998 survey few fish > 15” were sampled; however, size structure was improved in 2012 with a greater number of larger fish sampled (Figure 3). The PSD of 72 also indicates a

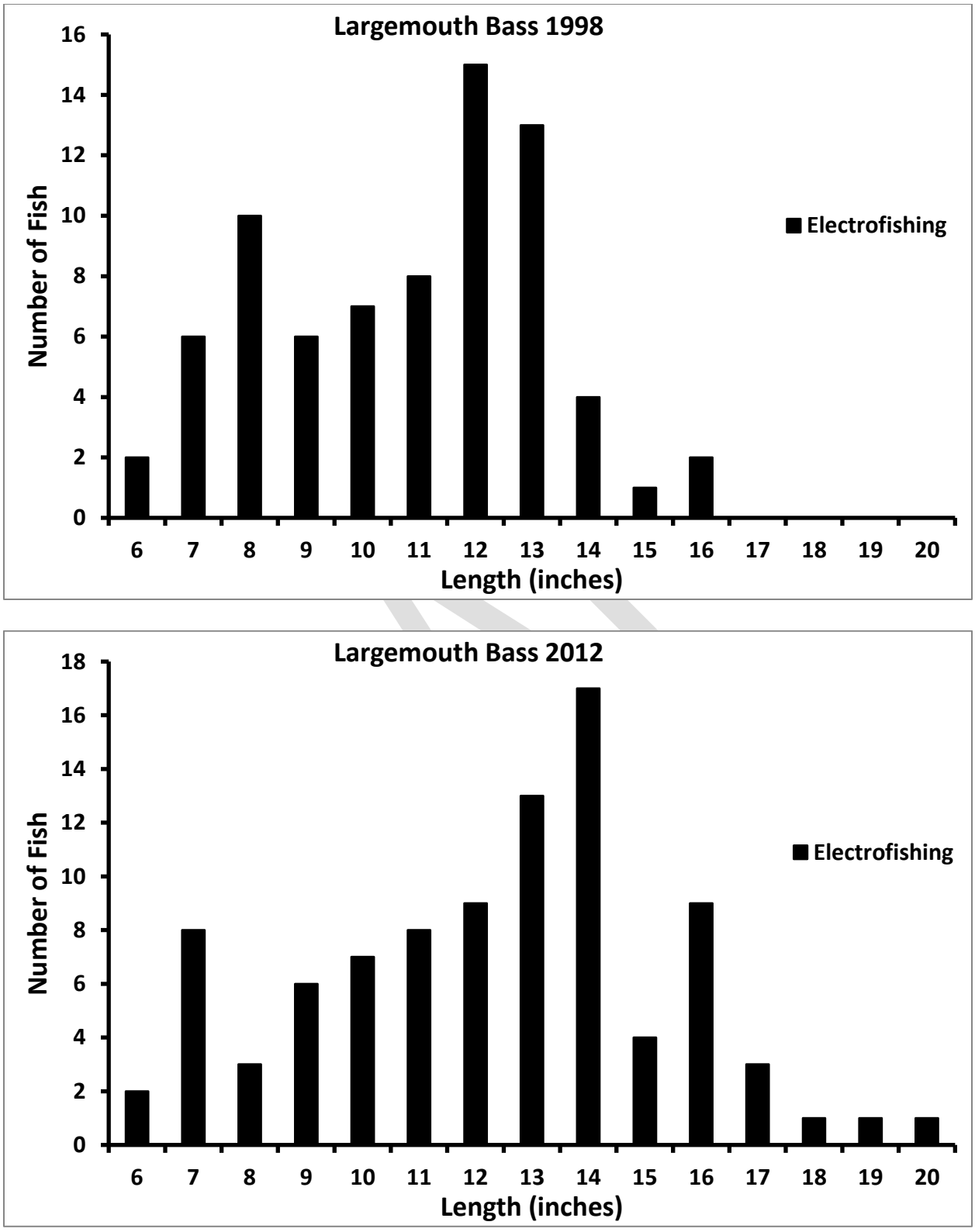


Figure 3. Length frequency histogram indicating largemouth bass electrofishing catch in 2012 and 1998 at Kettle Moraine Lake, WI.

relatively balanced largemouth bass population with some larger individuals. The relative weight of 103 also indicates that largemouth bass are in good condition and that the food resources are plentiful. Unlike the northern pike, the largemouth bass appear to be finding panfish prey successfully and no management action is needed for bass at this time.

Bluegill

The 2012 electrofishing survey captured 91 bluegill at catch rate of 182/mile. The mean length was 4.2" and maximum length was 7.0". Electrofishing catch rate was 50% lower during the 1998 survey (91.8/mile) and the mean length was (4.4"). The electrofishing and fyke net length frequency histogram indicated that smaller fish in the 3"-5" range were abundant, that was also demonstrated by the very low PSD of 6 (Figure 4). The length frequency histogram also depicted a sharp decline in bluegill > 5". This sharp decline could be attributed to stunting of growth or harvest by anglers. The 2012 bluegill otolith aging analysis indicated that growth in KML was well below the state and SCR averages (Table 2 and Figure 5). Therefore, it is likely that fewer individuals are recruiting to larger length classes due to stunting, but angler harvest may also be a limiting factor. The extensive aquatic vegetation may be aiding smaller bluegill in hiding from predators and resulting in the inability for predators to control the bluegill population. Few options exist to improve the bluegill size structure in KML. Attempts to improve the size structure of similar populations by reducing vegetative cover have largely failed. The goal of such efforts was to increase predation and reduce the number of bluegill present, thus reducing the competition for a limited food supply.

Black Crappie

Only 2 black crappie were captured in the 2012 electrofishing survey at catch rate of 4.0/mile compared to 4.7/mile in 1998. Catch rates were not attained during the northern pike fyke netting survey in 2012, but a subsample of fish were measured to attain length frequency data. The mean length for the 2012 fyke net subsample was 7.7" and maximum length was 15.8". The length frequency histogram indicated good black crappie size structure and that there was a fair number of fish reaching quality length (8"; Figure 6). Therefore, overharvest by anglers does not appear to be a major limiting factor of the black crappie population and KML is showing good potential for producing large crappie.

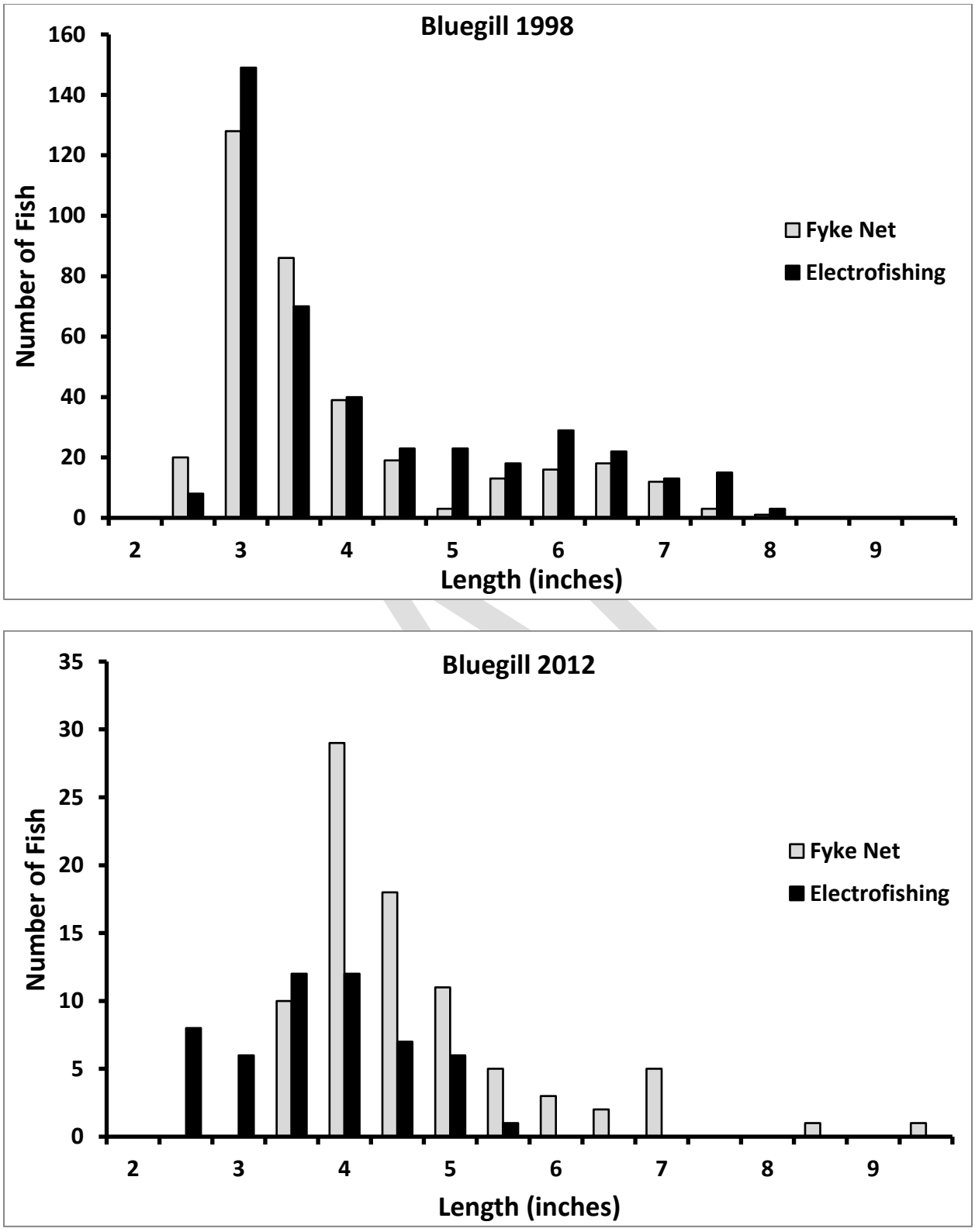


Figure 4. Length frequency histogram indicating bluegill electrofishing and fyke net catch in 2012 and 1998 at Kettle Moraine Lake, WI. Note: fyke net catch reflects a subsample of fish taken to attain length frequency data.

Table 2. Bluegill length at age determined using otoliths collected from Kettle Moraine Lake in 2012. Statewide and South Central Region (SCR) average length were gathered from spring (January-May) surveys.

Age	2	3	4	5	6	7
# of Fish	6	5	6	11	9	2
Ave. Length (in)	2.7	3.2	3.9	4.7	5.8	6.4
SD	0.3	0.2	0.2	0.5	0.5	0.1
Size Range (in)	2.4-3.2	2.8-3.4	3.7-4.3	3.6-5.5	5.1-7.0	6.3-6.4
Statewide Ave. (in)	4.0	4.9	5.8	6.6	7.2	7.7
SCR Ave. (in)	5.8	6.8	8.0	8.4	8.3	9.2

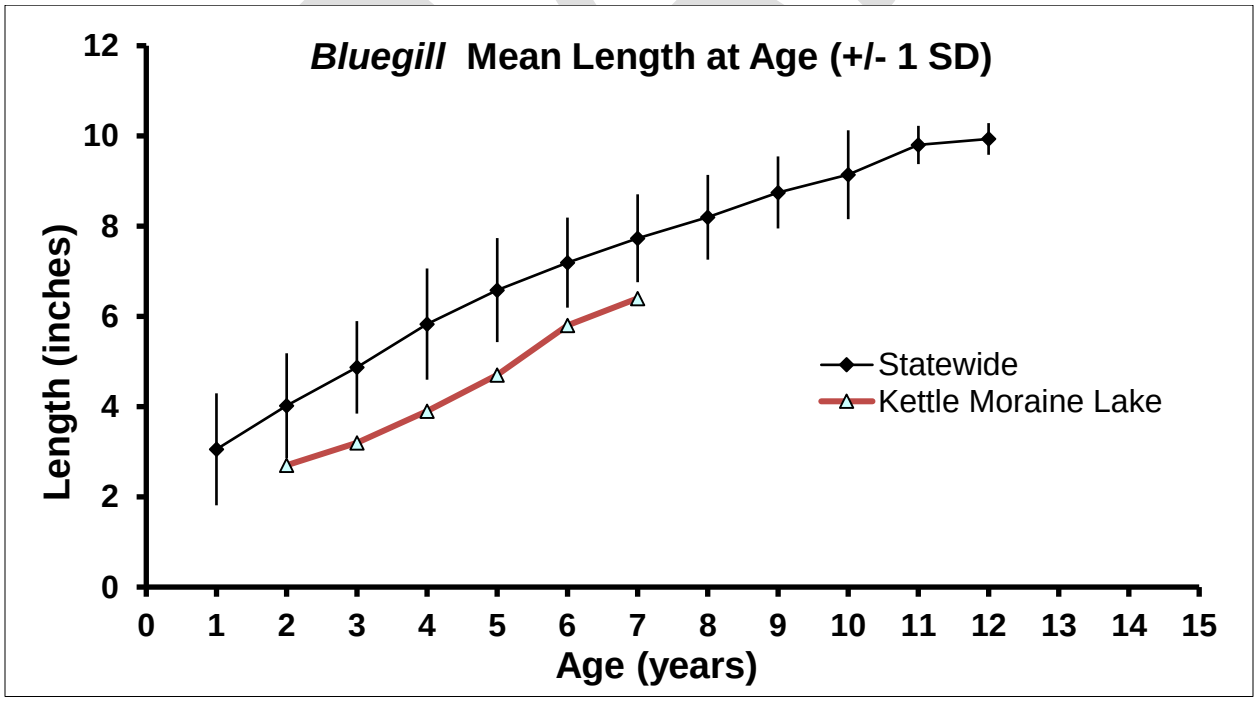


Figure 5. Bluegill mean length at age determined using otoliths collected from Kettle Moraine Lake in 2012 and statewide mean length at age from spring (January-May) surveys.

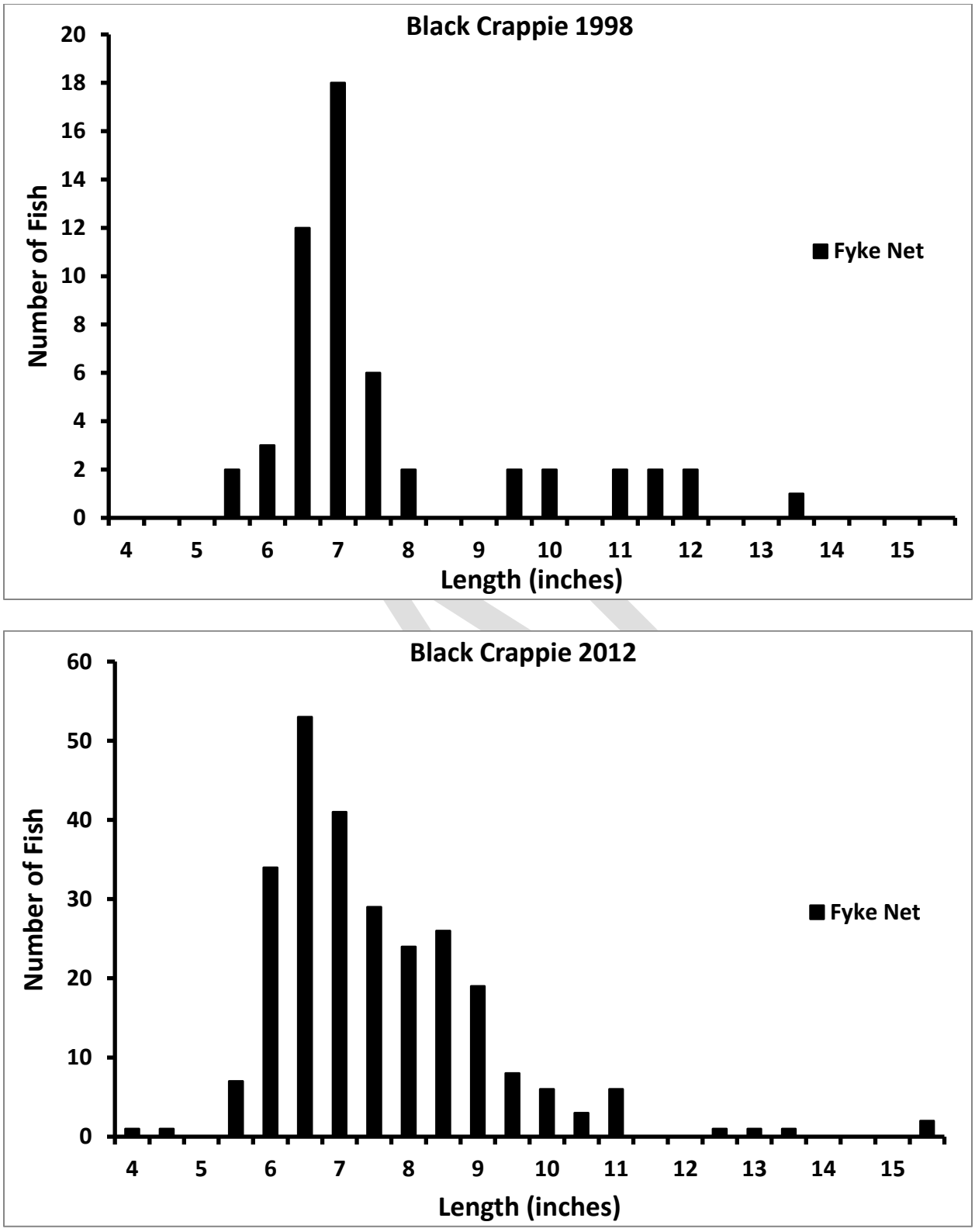


Figure 6. Length frequency histogram indicating black crappie electrofishing and fyke net catch in 2012 and 1998 at Kettle Moraine Lake, WI. Note: fyke net catch reflects a subsample of fish taken to attain length frequency data.

Pumpkinseed

There were 21 pumpkinseed captured in the 2012 electrofishing survey at a catch rate of 42.0/mile compared to 30.0/mile in 1998. The mean length from the 2012 electrofishing survey was 5.6" that was similar to the 1998 mean length (5.5"). Catch rates were not attained in the northern pike fyke net survey in 2012, but a subsample of fish were measured to attain length frequency data. Length frequency histograms indicate an abundance of fish in the 5-6" range and a PSD of 29 also indicated that the pumpkinseed population is mainly comprised of small fish; however, it should be noted that sample size was low in 2012 (Figure 7). Nonetheless, high catch rates indicate that pumpkinseed in KML are abundant. This is not surprising considering ecosystems that experience periodic winterkills often have high pumpkinseed density due to their ability to survive lower dissolved oxygen concentrations compared to other centrarchids.

Other Fishes

Bullheads continue to be dominant in the KML fish community and the bullhead fishery is very popular with some local anglers. The population has good size structure and is diverse with good numbers of yellow, black, and even brown bullhead. Due to the continuous risk of winter kill, bullhead will likely continue to persist in KML. Yellow perch, rock bass, green sunfish, channel catfish, and white sucker were also sampled during the 2012 survey, but catch was low for all species (Appendix 1).

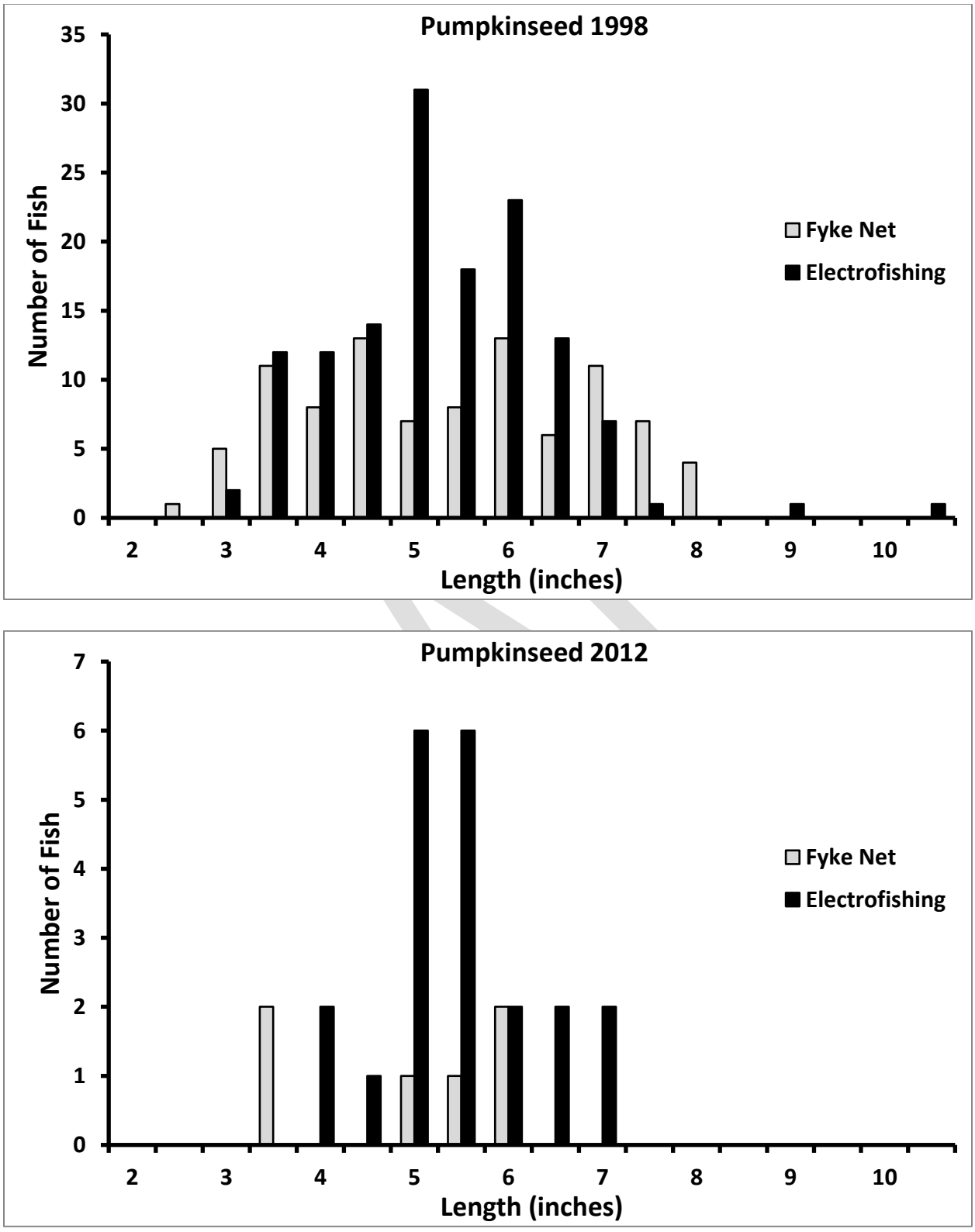


Figure 7. Length frequency histogram indicating pumpkinseed electrofishing and fyke net catch in 2012 and 1998 at Kettle Moraine Lake, WI. Note: fyke net catch reflects a subsample of fish taken to attain length frequency data.

Conclusions and Recommendations

Management of the fish community in KML poses many challenges, including the extensive growth of aquatic vegetation and increased risk for winter kill events. Growth rates for northern pike, largemouth bass, bluegill and pumpkinseed have historically been well below statewide averages. The reinstatement of the no minimum length limit and daily bag limit of 5 for northern pike appears to be leading to an improved size structure with more fish > 25". However, the low PSD and relative weights in 2012 continue to indicate high competition and inability to utilize food resources or being thermally limited as little cool water refuge exists in this shallow, seepage lake. The slow growing high density bluegill population also indicates that there is high competition for food resources resulting in stunting. The extensive aquatic vegetation in KML likely contributes to the northern pike and bluegill short falls, by providing too much cover for small panfish thereby inhibiting predation. However, angler exploitation may also be a contributing factor to the lack of northern pike > 25" and bluegill > 5". Future aging data for northern pike would be helpful to determine factors contributing to a limited size structure. Conversely, largemouth bass and black crappie size structure was good with several large fish present. Walleye stocking continues to be largely unsuccessful, and future efforts should focus on large fingerling stockings in order to further assess survival. Continued aquatic plant management may help to increase predation on small panfish during the summer months, and future winter kill events may be reduced due to aeration systems ran by the lake association.

Management recommendations include:

1. Continue aquatic plant treatments to control Eurasian water milfoil and curly-leaf pond weed, increasing potential for predation on bluegill by gamefish species.
2. Continue lake aeration during the winter months in order to reduce the risk of fish die off from low dissolved oxygen.
3. Monitor the northern pike population to further assess the size structure and impacts of the regulation change in 2008.
4. Evaluate walleye stocking, if an adult population of at least 1 per acre is not established discontinue stocking.
5. Monitor largemouth bass and panfish populations for trends in size structure.

Appendices

Appendix 1. Catch per unit effort for fyke net and electrofishing samples from Kettle Moraine Lake, Fond du Lac County – 2012.

Species	Fyke Net Results				Electrofishing Results			Combined
	#	NN	/NN	Ave.”	#	/mi	Ave”	Range – Inches
Northern pike	186	72	2.6	19.0	---	---	---	10.5 – 31.0
Largemouth bass	---	---	---	---	91	20.5	12.8	6.0 – 20.5
Walleye	1	72	0.0	24.8	---	---	---	24.8
Bluegill	---	---	---	---	91	182.0	4.2	2.0 – 7.0
Black crappie	---	---	---	---	2	4.0	9.0	8.0 – 9.5
Pumpkinseed	---	---	---	---	21	42	5.7	4.0 – 7.0
Yellow perch	---	---	---	---	5	10	6.3	3.5 – 6.3
Green Sunfish	---	---	---	---	1	2.0	4.3	4.0

Appendix 2. Catch per unit effort for fyke net and electrofishing samples from Kettle Moraine Lake, Fond du Lac County – 1998.

Species	Fyke Net Results				Electrofishing Results			Combined
	#	NN	/NN	Ave.”	#	/mi	Ave”	Range – Inches
Northern pike	325	86	3.8	18.7	9	2.0	20.0	9.4” – 31.6”
Largemouth bass	7	86	0.1	14.7	74	16.4	11.2	6.5” – 19.9”
Walleye	16	53	0.3	21.9	---	---	---	19.1” – 24.6”
Bluegill	358	37	9.7	4.1	413	91.8	4.4	2.6” – 8.3”
Black crappie	54	37	1.5	7.9	21	4.7	6.7	5.5” – 13.8”
Pumpkinseed	94	37	2.5	5.6	135	30.0	5.5	2.9” – 10.5”
Yellow perch	363*	---	---	4.7	---	---	---	3.8” – 8.8”
Bullhead	393	28	14.0	9.7	40	18.2	10.2	6.5” – 11.4”
Green sunfish	---	---	---	---	15	3.3	5.1	14.8” – 20.7”
White sucker	14	28	0.5	18.6	---	---	---	3.9” – 6.8”

* All except 2 perch caught on one date in one net

E

APPENDIX E

Herbicide Toxicology Materials

- WDNR Chemical Fact Sheet on Fluridone
- WDNR Chemical Fact Sheet on Triclopyr

Fluridone Chemical Fact Sheet

Formulations

Fluridone is an aquatic herbicide that was initially registered with the EPA in 1986. The active ingredient is 1-methyl-3-phenyl-5-3-(trifluoromethyl)phenyl|-41H|-pyridinone. Both liquid and slow-release granular formulations are available. Fluridone is sold under the brand names Avast!, Sonar, and Whitecap (product names are provided solely for your reference and should not be considered endorsements).

Aquatic Use and Considerations

Fluridone is an herbicide that stops the plant from making a protective pigment that keeps chlorophyll from breaking down in the sun. Treated plants will turn white or pink at the growing tips after a week and will die in one to two months after treatment as it is unable to make food for itself. It is only effective if plants are growing at the time of treatment.

Fluridone is used at very low concentrations, but a very long contact time is required (45-90 days). If the fluridone is removed before the plants die, they will once again be able to produce chlorophyll and grow.

Fluridone moves rapidly through water, so it is usually applied as a whole-lake treatment to an entire waterbody or basin. There are pellet slow-release formulations that may be used as spot treatments, but the efficacy of this is undetermined. Fluridone has been applied to rivers through a drip system to maintain the concentration for the required contact time.

Plants vary in their susceptibility to fluridone, so typically some species will not be affected even though the entire waterbody is treated.

Plants have been shown to develop resistance to repeated fluridone use, so it is recommended to rotate herbicides with different modes of action when using fluridone as a control.

Fluridone is effective at treating the invasive Eurasian watermilfoil (*Myriophyllum spicatum*). It also is commonly used for control of invasive hydrilla (*Hydrilla verticillata*) and water hyacinth (*Eichhornia crassipes*), neither of which are present in Wisconsin yet. Desirable native species that are usually affected at concentrations used to treat the invasives 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 swimming, eating fish from treated water bodies, human drinking water or pet/livestock drinking water. 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 fluridone (the time it takes for half of the active ingredient to degrade) ranges from 4 to 97 days depending on water conditions. After treatment, the fluridone concentration in the water is reduced through dilution due to water movement, uptake by plants, adsorption to the sediments, and break down from light and microbial action.

There are two major degradation products from fluridone: n-methyl formamide (NMF) and 3-trifluoromethyl benzoic acid. NMF has not been detected in studies of field conditions, including those at the maximum label rate.

Fluridone residues in sediments reach a maximum in one to four weeks after treatment and decline in four months to a year depending on environmental conditions. Fluridone adsorbs to clay and soils with high organic matter, especially in pellet form, and can reduce the concentration of fluridone in the water. Adsorption to the sediments is reversible; fluridone gradually dissipates back into the water where it is subject to chemical breakdown.

Impacts on Fish and Other Aquatic Organisms

Fluridone does not appear to have any apparent short-term or long-term effects on fish at application rates.

Fish exposed to water treated with fluridone absorb fluridone into their tissues. Residues of fluridone in fish decrease as the herbicide disappears from the water. The EPA has established a tolerance for fluridone residues in fish of 0.5 parts per million (ppm).

Studies on Fluridone's effects on aquatic invertebrates (i.e. midge and water flea) have shown increased mortality at label application rates.

Studies on birds indicate that fluridone would not pose an acute or chronic risk to birds. No studies have been conducted on amphibians or reptiles.

Human Health

The risk of acute exposure to fluridone would be primarily to chemical applicators. The acute toxicity risk from oral and inhalation routes is minimal. Concentrated fluridone may cause some eye or skin irritation. No personal protective equipment is required on the label to mix or apply fluridone.

Fluridone does not show evidence of causing birth defects, reproductive toxicity, or genetic mutations in mammals tested. It is not considered to be carcinogenic nor does it impair immune or endocrine function.

There is some evidence that the degradation product NMF causes birth defects. However, since NMF has only been detected in the lab and not following actual fluridone treatments, the manufacturer and EPA have indicated that fluridone use should not result in NMF concentrations that would adversely affect the health of water users. In the re-registration assessment that is currently underway for fluridone, the EPA has requested additional studies on both NMF and 3-trifluoromethyl benzoic acid.

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/

Hamelink, J.L., D.R. Buckler, F.L. Mayer, D.U. Palawski, and H.O. Sanders. 1986. Toxicity of Fluridone to Aquatic Invertebrates and Fish. Environmental Toxicology and Chemistry 5:87-94.

Fluridone ecological risk assessment by the Bureau of Land Management, Reno Nevada:
http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/veis.Par.91082.File.tmp/Fluridone%20Ecological%20Risk%20Assessment.pdf

Triclopyr Chemical Fact Sheet

Formulations

Triclopyr was initially registered with the EPA in 1979 and was reregistered in 1997. Triclopyr acid has different formulations for aquatic and terrestrial use. The active ingredient triethylamine salt (3,5,6-trichloro-2-pyridinyloxyacetic acid), commonly called triclopyr, is the formulation registered for use in aquatic systems. It is sold both as a liquid (Renovate 3™) as well as a granular form (Renovate OTF™) for control of submerged, emergent and floating-leaf vegetation. There is also a liquid premixed formulation (Renovate Max G™) that contains triclopyr plus 2,4-D, another aquatic herbicide.

Aquatic Use and Considerations

Triclopyr is used to treat the invasive Eurasian watermilfoil (Myriophyllum spicatum). Desirable native species that may also be affected include native milfoils, water shield (*Brasenia schreberi*), pickerelweed (*Pontederia cordata*), and lilies (*Nymphaea* spp. and *Nuphar* spp.).

Triclopyr is a systemic herbicide that moves throughout the plant tissue and works by interfering with cell growth and division. Following treatment, plant growth will be abnormal and twisted, and then plants will die within two to three weeks after application. Plants will decompose over several weeks.

Triclopyr needs to be applied to plants that are actively growing. A water body should not be treated with triclopyr if there is an outlet, or in moving waters such as rivers or streams. If there is water movement at a treated site, higher concentrations or a repeated application may be required.

Post-Treatment Water Use Restrictions

There are no restrictions on swimming, eating fish from treated water bodies, or pet/livestock drinking water use. Before treated water can be used for irrigation, the concentration must be below one part per billion (ppb), or at least 120 days must pass. Treated water should not be used for drinking water until concentrations of triclopyr are less than 400 ppb.

Herbicide Degradation, Persistence and Trace Contaminants

Triclopyr is broken down rapidly by light and microbes and has a half-life (the time it takes for half of the active ingredient to degrade) of about a day. Dissipation studies in lakes indicate that the half-life in natural systems ranges from 0.5 to 7.5 days. Lakes with more organic matter in the soil will have more rapid degradation.

The initial breakdown products of triclopyr are TCP (3,5,6-trichloro-2-pyridinol) and TMP (3,5,6-trichloro-2-methoxypridine). TCP and TMP appear to be slightly more toxic to aquatic organisms than triclopyr; however the peak concentration of these degradates is very low following treatment, so that they do not pose a concern to aquatic organisms. The half-lives for TCP and TMP are similar to those of triclopyr.

Triclopyr doesn't bind to soil, and limited leaching of triclopyr and its degradation products may occur. It likely is not mobile enough to contaminate groundwater, and EPA has determined that the evidence of possible leaching is not sufficient to require further study.

Impacts on Fish and Other Aquatic Organisms

Testing indicates that the aquatic formulation of triclopyr is practically non-toxic to fish and invertebrates. Species tested included catfish, trout, bluegill, minnows, crayfish and water fleas (*Daphnia* sp.). Triclopyr is slightly toxic to mallards, but at concentrations well above (400x) the highest allowed application rate. Water pH will affect toxicity because greater exposure to triclopyr will occur in low pH water. Tests have not been conducted in low pH water except for salmon species. However, the margin of safety in the toxicity tests that were conducted suggest that even in low pH water there would not be toxic effects on fish.

Tests on the degradation product TCP indicate that acute effects to bluegill and rainbow trout would not occur at label usage rates, although it is slightly more toxic than triclopyr. The degradation product TMP is moderately toxic to fish, but after treatment is found only in low proportions if it is detected at all. The EPA has requested additional data to evaluate the fate of the degradation product TCP in aquatic systems as well as its chronic toxicity to fish.

Triclopyr and TCP do not bioaccumulate and clear from fish and crayfish tissues at rates similar to that which occurs in the water. TMP does appear to bioaccumulate in fatty fish tissues, such as inedible and visceral tissues, but does not persist in fish following TMP disappearance from the water.

Human Health

The risk of acute exposure to triclopyr would be primarily to chemical applicators. Concentrated triclopyr does not pose an inhalation risk, but can cause skin irritation and eye corrosion. Persons who mix or apply triclopyr need to protect their skin and eyes from contact. In its consideration of exposure risks, the EPA believes no significant risks will occur to recreational users of water treated with triclopyr.

Triclopyr does not show evidence of birth defects, reproductive toxicity or genetic mutations in mammals tested. Triclopyr is not metabolized by humans and the majority is excreted intact. Some tumors of breast tissue occurred in tests on rodents; however there was no consistent pattern and insufficient evidence to list triclopyr as a carcinogen. Based on its low acute toxicity to mammals, and its rapid disappearance from the water column due to light and microbial degradation, triclopyr is not considered to pose a risk to water users.

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/

Wisconsin Department of Natural Resources
Box 7921
Madison, WI 53707-7921

DNR PUB-WT-963 2012

F

APPENDIX F

Comment Response Document for the Official First Draft (11/20/2018)

- WDNR Fisheries Biologist
- WDNR Water Resources Management Specialist

Comments to Kettle Moraine Lake Draft Comprehensive Management Plan (November 20, 2018)

Response Comments by Eddie Heath (Onterra Aquatic Ecologist)

12/10/2018 Comments from Adeline Dutton (WDNR Fisheries Biologist)

Both Travis and I looked over the Kettle Moraine Lake Management Plan. We both thought it looked great. Only change is that I should be listed as the biologist contact and that Kettle Moraine will have the full comprehensive survey completed in 2019. Change has been made.

12/19/2018 Comments from Mary Gansberg (WDNR Water Resources Management Specialist)

Thank you for the opportunity to review the draft plan. I have scheduled a lakes tech team call on December 13. I will provide comments regarding the potential whole lake Fluridone recommendation after that call. But in the meantime, I am providing some minor comments on the draft for your consideration.

1. Page 59, last sentence says….some lakes have hand increases in this…Change has been made
2. Page 79 and 99 – The Fisheries Biologist for KML is now Addie Dutton (not Travis). I sent the draft to her for review. If or when I receive comments from her, I will forward on to you. Change has been made

(920) 893-8549	Adeline.Dutton@wisconsin.gov

3. Page 99, the Warden is now Nick Miofsky (not Kyle) Change has been made

(920) 579-2751	Nicholas.Miofsky@wisconsin.gov

4. Page 99, under contact basis for Long Lake – says Town water guard program. Do you mean water patrol? Change has been made.

5. Page 99, I though Dave Murphy was president of Long Lake? http://www.longlakepreservation.org/contacts.php

6. Page 100, under action steps on the top half of the page it says see table guidelines on the (should it say previous) page? Change has been made

7. Page 97, under management goal 3, it says Board od Directors Change has been made

8. I added KML to the wish list to be added to the CLMN chemistry lakes. Within the next couple months we should know if any lakes are able to be added. If KML does not get selected, I may have the opportunity to conduct water quality monitoring for them in 2019. Greatly appreciated

9. Page 88, last paragraph says …two submergent exotics t are …Change has been made

10. Page 94, under the short term management strategy talking about Fluridone it says within each of the lakes and it says from each of the lakes…Change has been made and text shifted to Non-Native Aquatic Plants Subsection of 3.4

11. Page 94, curious how you would use the zooplankton monitoring data? Abundance/absence pre-post treatment? Clarity was added and text shifted to Non-Native Aquatic Plants Subsection of 3.4 for consideration during potential future fluridone treatment

1/4/2019 Comments from Mary Gansberg (WDNR Water Resources Management Specialist)

This email is a follow-up to the comments I previously provided to Onterra regarding the Draft Kettle Moraine Lake Comprehensive Management Plan.

After a lengthy discussion with the DNR lakes technical review team regarding the management recommendation listed on Page 94 under Short Term Population Management Strategy Specifics, I have concluded that a whole-lake low-dose pelletized fluridone treatment on Kettle Moraine Lake is not in the best interest of the lake. Therefore, I would not approve that management recommendation in the comprehensive management plan nor would I issue a NR107 permit for that management action. This decision is based on the following reasons:

1. Department records show annual chemical treatments on Kettle Moraine Lake date back to 1990 with several of these chemical treatments likely having whole-lake herbicide concentrations which would be capable of impacting the native aquatic plant community. Another whole-lake chemical treatment would likely further impact native aquatic plant habitat in the lake. The data presented in the report suggests that increased herbicide use in previous years resulted in a measured decline in native plant biomass during years of large-scale chemical management. Statement of fact, no action taken.

2. Three of the most commonly found native aquatic plant species in Kettle Moraine Lake (coontail, southern naiad, and common waterweed) have been shown to be particularly sensitive to fluridone treatments (i.e. Valley et al. 2006, Wagner et al. 2007). Based on 2018 data, these three native species account for >50% of the relative frequency of all aquatic plants in Kettle Moraine Lake, and non-target impacts to these species would have significant lakewide effects on the overall plant community and health of the lake. Including the target species (EWM) would result in >70% of the relative frequency of these four plants potentially being significantly impacted following treatment. All photosynthetic plants have carotenoids and therefore are all likely sensitive to fluridone. And with a max application rate of 150 ppb, it is suspected that most submergent plants are susceptible to fluridone within label rates. The data suggest a dose-dependent response for some plants. The limited data from the pelletized case studies (low concentration, long exposure, no high concentration peaks that often associate liquid fluridone applications) show different patterns of sensitivity than historic liquid treatments. Additional information was added to document, including Figure 3.4-22.

3. Kettle Moraine is a relatively shallow lake with limited species diversity and straddles the cut-off between mesotrophic and eutrophic. Large reductions in aquatic plants are more likely to lead to reduced water quality in this type of lake as opposed to deep, oligotrophic lakes. Previous research (i.e. Valley et al. 2006, Wagner et al. 2007) in eutrophic lakes with limited species

which treated with low-dose fluridone (6 ppb) have observed large amount of submersed vegetation die-off following treatment, declines in water clarity/quality following treatment, and recovery of EWM within 1-3 years after treatment. Some lake managers and fisheries biologists have been more supportive of fluridone control options as the plant biomass takes months to be impacted by the treatment so there is not a sudden loss of habitat for fisheries or plankton that could impact ecological function of the system. The relatively slow EWM die-off and subsequent decomposition of plant material is also likely to minimize a resulting reduction of oxygen levels within the lake compared with faster acting whole-lake auxin treatments.

4. As soon as chemical treatments were suspended on Kettle Moraine Lake (as was the case in 2017 and 2018), the Eurasian watermilfoil population rebounded rapidly. This is an indication that chemical treatments are not providing more than seasonal control of milfoil. The mechanisms for lakewide EWM recovery following lake-scale chemical management need to be further investigated in order to understand why past large-scale chemical treatments did not result in achieving long-term control and to increase the possible success of future management activities. Onterra supports research directed towards this hypothesis.

5. The plan should include a more detailed discussion on other alternative and integrated management strategies and how these activities *specifically* relate to the APM goals of Kettle Moraine (beyond just a generalized discussion of these alternative techniques which is included on pg. 42-49). I encourage the Kettle Moraine Lake Association to further explore mechanical harvesting to provide nuisance aquatic plant control. Additional elaboration of the goal development process is now included in the *Future AIS Management* sub-section starting on page 71. This new sub-section includes the discussion that occurred in relation to nuisance control with mechanical harvesting.

Additional comments on the draft management plan from members of the lakes technical review team are noted below:

- Pg. 51: "A total of 60 species of plants have been located" is not accurate. This includes hybrids and plants only identified to genus (i.e. Milfoil sp., Elodea sp.). The actual number of true unique species documented is much lower than this (on pg. 4 it states 28 native plant species). Kettle Moraine Lake relative plant abundance is also very skewed, with coontail, EWM, southern naiad, and common waterweed making up the vast majority of the biomass (~71% relative frequency). Figure 3.4-9. These plants are all known to be susceptible to fluridone. Text added to increase clarity. We believe the data suggest a dose-dependent response for some plants. The pelletized formulation allows a concentration profile different that avoids high peaks that are often associated with liquid fluridone applications. See response comment #2 above.

- Also, only 18 of these have been documented on the rake, and so the vast majority of these "60" species are very sparse and/or marginal wetland plants. Update Table 3.4.2 [and note that part of the '2018' column is currently cut-off in report]. The legend of Table 3.4-2 indicates that X=found on rake and I=incidental Species. Figure 3.4-7 shows the number of species found on the rake during each years' late summer survey.

- PI data was collected by DNR regional staff and is available for spring & fall for many years (i.e. 2011, 2012, 2013). This data should be included somewhere in this report. Please let DNR know

if you do not have access to this spring/fall PI data and we will gladly send. Data is explored for EWM, but not for other species.

- Figure 3.4-5: red trend lines, p-values and r2 values are missing - please add. Figure 3.4-6 shows the entirety of plants that have a statistically valid linear relationship. Species shown in Figure 2.4-5 did not have statistically valid tends and therefore non-valid lines are not shown (nor corresponding p-values or r2 values)

- Typo: pg. 64: 2019 late-summer EWM surveys have not been conducted yet…Change has been made

- Typo: pg. 69: Silver Lake, Kenosha Co. fluridone treatment had initial rate of 5 ppb, not 5 ppm. Change has been made

- Several of the fluridone study lakes outlined in Figure 3.4-15 (pg. 70) conducted integrated pest management (IPM) such as hand-removal, DASH, and strategically implemented spot-treatment following the fluridone treatments. These IPM activities should be explicitly mentioned in the text discussing results of previous fluridone treatment to avoid potential bias. Additional discussion on level of known IPM on each project lake is added.