Lakewide Control of Eurasian Watermilfoil: A New Model for Success

Keegan Lund | MN DNR
Justine Dauphinais | Coon Creek Watershed District
James Johnson | Freshwater Scientific Services, LLC
1) History of EWM Management in Crooked Lake
2) 2016 Experimental “Lakewide” Treatment using SonarOne
3) Native Plant Response & Management Implications
History of EWM Management in Crooked Lake

Justine Dauphinais, Coon Creek Watershed District
DOW #2008400

Location: Anoka Co.

Surface Area: 115 ac

Max Depth: 26 ft

Littoral Area: 86 ac (75%)
Water Quality

2018 Growing Season Mean:

- Secchi Depth: 2.3 m
- Total Phosphorus: 24 µg/L
- Chlorophyll-a: 7.1 µg/L
Stakeholders Involved in Management

- Crooked Lake Area Association (CLAA)
- Cities of Andover & Coon Rapids
- Coon Creek Watershed District
- Anoka County
- MN DNR
- Private industry
  - Freshwater Scientific Services
  - PLM Lake & Land Management
  - SePRO
EWM Management Timeline

1990: Eurasian watermilfoil first discovered in Crooked

1992: Experimental whole-lake liquid fluridone treatment
Methods

• Funded by CLAA with support from MN DNR
• Target dose: 15 ppb Sonar A.S.
• 12 gallons applied on May 5, 1992

Results

• 15.3 ppb at 7 DAT, 8.7 ppb at 64 DAT
• 4 years of EWM control!
• Unacceptable damage to native plants
  - Mean taxa per sampling station ↓ from 5 to 1 and had not fully rebounded by year 6
  - Total native submersed richness ↓ from 10 to 5, but rebounded to 12 by 3rd year post-txt
• EWM returned to nuisance levels by 1998
EWM Management Timeline

1990: Eurasian watermilfoil first discovered in Crooked

1992: Experimental whole-lake liquid fluridone treatment

2002: 2nd Experimental whole-lake liquid fluridone treatment
2002 Whole-lake Fluridone Treatment

**Methods**
- Funded by MN DNR as pilot study
- Target dose: 4-6 ppb Sonar A.S.
- Applied May 2002

**Results**
- 4.3-1.9 ppb observed over 118 DAT
- 2-3 years of EWM control
- Some damage to native plants in year of treatment, but recovered to pre-treatment levels by year 2
  - DNR Fisheries concerns over decline in water lilies, but not substantiated by plant survey data
  - Concurrent pilot studies by DNR in Eutrophic lakes showed long-term damage to native plants & declines in water clarity
- EWM returned to nuisance levels by 2007
EWM Management Timeline

1990: Eurasian watermilfoil first discovered in Crooked

1992: Experimental whole-lake liquid fluridone treatment

2002: 2\textsuperscript{nd} Experimental whole-lake liquid fluridone treatment

2008-2015: Annual spot treatments (2,4-D or triclopyr)

2008-2012: <15\% littoral

2013-2015: DNR LVMP + Variance
2008-2015 Annual Spot Treatments

2008-2012: <15% littoral
• Treated 9-12 ac per year using 2,4-D or triclopyr

2013-2015: Approved LVMP + variance for >15% littoral
• Treated 23-34 ac per year using 2,4-D

Results
• Poor control; EWM remained at nuisance levels
• Native plant community remained suppressed
EWM Abundance Over Time

Whole lake fluridone treatment

Whole lake fluridone treatment

Annual 2,4-D or triclopyr spot treatments

Eurasian Watermilfoil

Density (1-4)
- In vicinity
- 1
- 2
- 3
- 4

Darker shaded area >15ft

2016
Native Submersed Species Richness Over Time

- Whole lake fluridone treatment
- Whole lake fluridone treatment
- Annual 2,4-D or triclopyr spot treatments
1990: Eurasian watermilfoil first discovered in Crooked

1992: Experimental whole-lake liquid fluridone treatment

2002: 2nd Experimental whole-lake liquid fluridone treatment

2008-2015: Annual spot treatments (2,4-D or triclopyr)

2008-2012: <15% littoral

2013-2015: DNR LVMP + Variance

2015: Genetic Identification of Hybrid milfoil

2016: LVMP amendment & experimental “lakewide” granular fluridone treatment
Lake-Wide Treatment with Fluridone

Advantages

• True lake-wide dosing
• About one-half the cost of triclopyr
• Recent success in curlyleaf lakes

Disadvantages

• Potential for damage to natives
• Tight concentration window 2-4 µg/L
• Requires a long contact time (90+ days)
Lake-Wide Treatment with Fluridone

Effort to Minimize Impact to Native Plants

- Detailed dosing plan
- Used a “slow-release” granular formulation
- Applied product only to beds of milfoil
- Monitoring of fluridone concentration
- Detailed aquatic plant surveys
- Transplanting native plants in nursery plots
Detailed Dosing Plan

Target is 2 to 4 µg/L

Dose = \( \frac{\text{Mass of Fluridone}}{\text{Volume of Water}} \)

Mixed Water Volume is Key
Volume of Layers

Detailed Dosing Plan

250 acre-ft
200
150
100
80
50
30
10
Detailed Dosing Plan

Volume of Layers

Temperature Profile

250 acre-ft
Detailed Dosing Plan

Pounds of SonarOne to Increase Conc by 1 µg/L
Application of Granular Fluridone

<table>
<thead>
<tr>
<th>Application</th>
<th>Lbs</th>
<th>Acres</th>
<th>Lbs/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 17</td>
<td>160</td>
<td>25</td>
<td>6.4</td>
</tr>
<tr>
<td>Jun 28</td>
<td>100</td>
<td>25</td>
<td>4.0</td>
</tr>
<tr>
<td>Aug 16</td>
<td>50</td>
<td>25</td>
<td>2.0</td>
</tr>
</tbody>
</table>
EWM Abundance Over Time

Whole-lake treatment
Partial treatments

Frequency of Occurrence (%)
Crooked Lake, Anoka County: EWM survey results

• 2016 % occurrence: 60%*
• 2017 % occurrence: 1%
• 2018 % occurrence: 6%
Natives submersed taxa/point

• Unchanged if not slight increase
### Summary Table

Summary of aquatic submersed plants in Crooked Lake, Anoka, Minnesota (DOW# 02-0084-00) as indicated by results of Point-Intercept surveys. Values were calculated from littoral depth range (0-15 feet).

| Survey Date | Treatment [W,P,N] | % Frequency of EWM* | Max Depth of Growth in feet [95%] | % Points w/ Native Submersed Taxa | Mean Native Submersed Taxa/Point | # Submersed Taxa | Secchi Depth [m] |
|-------------|-------------------|---------------------|-----------------------------------|----------------------------------|-------------------------------|-----------------|----------------|}
| AUG 2011    | P                 | 65                  | 12                                | 60                               | 0.8                           | 10              | 2.4            |
| OCT 2012    | P                 | 51                  | 10                                | 67                               | 1.0                           | 8               | 2.3            |
| AUG 2013    | P                 | 11                  | 14                                | 77                               | 1.0                           | 5               | 2.9            |
| AUG 2014    | P                 | 29                  | –                                 | 55                               | 0.7                           | 7               | 2.4            |
| AUG 2015    | P                 | 38                  | 6                                 | 46                               | 0.9                           | 5               | 2.3            |
| AUG 2016    | W                 | 60                  | 14                                | 91                               | 1.5                           | 10              | –              |

Treatment: W (whole lake), P (partial lake), N (no treatment)

*EWM is short for Eurasian watermilfoil

\(^{95\text{th}}\) percentile calculated based on all vegetated sampling points (values in red are absolute max depth of growth, not 95\(^{th}\) percentile)

Taxa refers to groups of submersed aquatic plant species or genera

2017 EWM Frequency of Occurrence: 1
2018 EWM Frequency of Occurrence: 6
Native Submersed Species Richness Over Time

Year

2000
2010
2011
2012
2013
2014
2015

# native species

0
2
4
6
8
10
12
14
16

2018
(18)
Post fluridone plant summary

<table>
<thead>
<tr>
<th>PLANT TAXA</th>
<th>COMMON NAME</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL TAXA (combined)</td>
<td></td>
<td>72</td>
<td>73</td>
<td>75</td>
</tr>
<tr>
<td>SUBMERSED TAXA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myriophyllum spicatum*</td>
<td>Eurasian watermilfoil</td>
<td>60</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Ceratophyllum demersum</td>
<td>Coontail</td>
<td>50</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>Chara sp.</td>
<td>Muskgrass</td>
<td>41</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>Potamogeton illinoensis</td>
<td>Illinois pondweed</td>
<td>29</td>
<td>38</td>
<td>28</td>
</tr>
<tr>
<td>Stuckenia pectinata</td>
<td>Sago pondweed</td>
<td>17</td>
<td>38</td>
<td>23</td>
</tr>
<tr>
<td>Najas guadalupensis</td>
<td>Southern naiad</td>
<td>6</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Eleocharis accicularis</td>
<td>Needle spikerush</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Potamogeton crispus*</td>
<td>Curly-leaf pondweed</td>
<td>1</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>Potamogeton pusillus</td>
<td>Small pondweed</td>
<td>1</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Heteranthera dubia</td>
<td>Water stargrass</td>
<td>1</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Najas flexilis</td>
<td>Slender naiad</td>
<td>–</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Utricularia vulgaris</td>
<td>Common bladderwort</td>
<td>–</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Potamogeton gramineus</td>
<td>Variable pondweed</td>
<td>–</td>
<td>P</td>
<td>3</td>
</tr>
<tr>
<td>Potamogeton zosteriformis</td>
<td>Flat-stem pondweed</td>
<td>–</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Utricularia minor</td>
<td>Small bladderwort</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Potamogeton nodosus</td>
<td>Long-leaf pondweed</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
</tbody>
</table>
Propagule Selection & Collection

• Make a species list
• Find a similar lake close by (analog)
• Get a permit from the DNR
• Make sure there are no invasives
• Get the resources
• Go collect!
Planting

1. [Image of containers with seeds]
2. [Image of hand holding seeds]
3. [Image of group of people planting]
4. [Image of person planting in water]
5. [Image of person underwater, planting]
6. [Image of person planting in water]
Plot Locations

- Map showing the location of each transplanted plot
- 4’x4’ area planted in burlap and fenced
- Installed in late June 2017
- Assessed fall 2017 and fall 2018
# Results – 2017

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Plot 1</th>
<th>Plot 2</th>
<th>Plot 3</th>
<th>Plot 4</th>
<th>Plot 5</th>
<th>Plot 6</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild Celery</td>
<td>0.2</td>
<td>0.4</td>
<td>1.2</td>
<td>0.8</td>
<td>0.6</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Fern-leaf Pondweed</td>
<td>0.8</td>
<td>0.6</td>
<td>0.6</td>
<td>1.6</td>
<td>0.6</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Clasping-leaf Pondweed</td>
<td>0.6</td>
<td>0</td>
<td>1.2</td>
<td>0.4</td>
<td>0.6</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Flat-stem Pondweed</td>
<td>na</td>
<td>0</td>
<td>0.2</td>
<td>na</td>
<td>0</td>
<td>1.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Water Stargrass</td>
<td>0.4</td>
<td>0</td>
<td>1.2</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Plot Mean</strong></td>
<td><strong>0.5</strong></td>
<td><strong>0.2</strong></td>
<td><strong>0.9</strong></td>
<td><strong>0.8</strong></td>
<td><strong>0.4</strong></td>
<td><strong>0.8</strong></td>
<td><strong>0.8</strong></td>
</tr>
</tbody>
</table>
Results - 2018

• 6 sites planted in 2017
• 1 site no survival / 1 site lost
• 2 sites had minimal Vallisneria & Heteranthera
• 1 site had 3 species
• 1 site had considerable expansion and 4 species persisting
• Success rate: maybe 30%
Acknowledgements:

Chip Welling & Mike Netherland
Thank You!

Keegan Lund

Keegan.Lund@state.mn.us

651-259-5828