Planning & Evaluating Large-Scale Herbicide Treatments for Control of Invasive Milfoil in Challenging Scenarios

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Adaptive Management Strategies

• Project goals are to reduce lake-wide target population
• Early-season herbicide control strategies
  • Increase selectivity towards native plants
  • Longer exposure times of some herbicides
  • Potential increased uptake rates of target plants
• Herbicide use patterns
  • Spatially-targeted spot treatments
  • Large-scale (whole-lake) treatments
Herbicide Use Patterns
**Herbicide Use Patterns**

- **Max Label Rate**
- **Control**
- **Hours**
- **Exposure Time**

- High Concentration ➤ Short Exposure Time

**Treatment Type**
- Spot
Initial High Dose
Rapid Dissipation
Herbicide concentrations too low outside of Treatment Area to cause impact
Large-Scale Use Pattern

Initial High Dose
Rapid Dissipation
Low-dose lake-wide concentration significant to cause impact (control)
Herbicide Use Patterns

- **Treatment Type**
  - Spot
  - Large-Scale (whole-Lake)

- **Herbicide Use Patterns**
  - High Concentration ➤ Short Exposure Time
  - Low Concentration ➤ Long Exposure Time

- **Control**
  - Max Label Rate
  - Low end of Label Rate

- **Axes**
  - Concentration
  - Exposure Time
  - Hours
  - Weeks to Months
Horizontal Herbicide Mixing (Dissipation)

- 25 acres of 305 acre lake (8%)
- Tracer Dye (Rhodamine WT) Survey
1 HAT

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

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

75-100%
50-75%
25-50%
10-25%
5-10%
If 2,4-D was applied at 4.0 ppm, 5-10% would be 0.2 - 0.4 ppm
Lessons Learned in Large-Scale Invasive Milfoil Management

• Predictability of horizontal and vertical mixing
• Uncertainty – variation in degradation rates
• Differences in EWM vs HWM control
• Native plant responses
Challenging Scenario: Size (large) & Hybridity
Shawano Lake

- 6,258-acre drainage lake, mean depth 9.8 ft
- Location: EWM HWM
- 930 acres applied 2,4-D @ 3-4 ppm ae
- 12,984 gal. liquid 2,4-D amine
- Lake-wide Target: 0.35-0.4 ppm ae
- Measured: 0.45 ppm (1-7 DAT Ave)
- 2,4-D Half-life: 8 days
2,4-D Degradation
Shawano Lake

EWM/HWM
Efficacy of Large-Scale 2,4-D Treatments

**EWM**

**HWM**
Challenging Scenario: Size (small) & Hybridity
Frog Lake

- 18-28-acre seepage lake, max depth 14-18 ft
- Location: HWM

Entire lake applied fluridone @ 6 ppb
Goal: 6-bump-6, but not executed properly
5.3 gallons liquid fluridone, no bumps
9.6 ppb surface (3 DAT), 6.8 ppb (14 DAT), 2.2 ppb (118 DAT)
Challenging Scenario: Shape (steep) & Hybridity
Big Silver Lake

- 352-acre seepage lake, mean depth 21 ft
- Location: HWM

- 87 acres applied fluridone @ 10-26 ppb
- 941 lbs pelletized fluridone (initial)
- Goal: 1.5-3 ppb for growing season
- 2 – 2 ppb bumps conducted
- > 1 ppb for 407+ days
Big Silver Lake

HWM
Conclusions
Conclusions

- Herbicide mixing is rapid
  - Factor limits success of spot treatments, but makes large-scale treatments more predictable
  - If spot-treatments are more than 5-10% of lake area, it is likely a large-scale (aka whole-lake) treatment
- 2,4-D degradation is variable
  - Half-life positively correlated with water clarity (clearer water = longer degradation)
  - Seepage lakes had significantly longer half-lives than other lake types
  - WDNR currently investigating role of microbial community on 2,4-D degradation
- Hybridity matters
  - Less initial control and less longevity of HWM vs EWM
- Highlighted case studies offer insight into scale and new herbicide use-patterns
Questions
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Lake Management Planning