What weevils want:

Managing your shoreland for biological control of Eurasian watermilfoil

University of Wisconsin-Stevens Point
Amy Thorstenson, Graduate Student
Dr. Ronald Crunkilton
Dr. Michael Bozek
Nancy Turyk

- Shoreland habitat
  - –You have the control
  - –You can change it


Eurasian watermilfoil
(*Myriophyllum spicatum*)

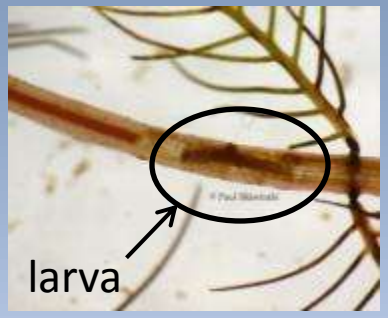
Eurasian watermilfoil
(*Myriophyllum spicatum*)

- Control methods
  - Chemical control
  - Mechanical harvesting
- Temporary relief
- Drawbacks and concerns

Eurasian watermilfoil (*Myriophyllum spicatum*)

- Biological control
  - Potential long-term, natural solution
  - Milfoil weevil (*Euhrychiopsis lecontei*)
    - Native to U.S.
    - Genus-specific feeder
    - Develops a feeding preference for Eurasian watermilfoil

Milfoil Weevil
(*Eurychiopsis lecontei*)



- **Eggs** laid on growing tips
- **Larvae** hatch, mines stem, damages plant the most
- **Pupae** develop within a pupal chamber inside stem
- **Adults** feed on leaves, lay eggs
  - **Fall** (Sep – Oct) → fly to shore
  - **Winter** → hibernate at the soil/duff interface
  - **Spring** (Apr – May)→ fly back to lake

Milfoil Weevil
(*Eurychiopsis lecontei*)

- Shoreland habitat critical link in lifecycle
- Adequate shoreland habitat is vital

OBJECTIVE

To find out what shoreline habitat features are there:

1) where weevils hibernate

vs.

2) where they do not

Thomas Lake, Portage County, WI

- 32-acre glacial lake
- Natural shoreline buffers
  - 12 residences
  - low disturbance
- Natural weevil population (0.03-0.34 N/stem)

Springville Pond, Portage County, WI

- 18-acre impoundment of the Little Plover River
  - Study area = Eastern end
- Natural and disturbed shoreline buffers
- Natural weevil population (0.06-4.43 N/stem)

Shoreline surveys

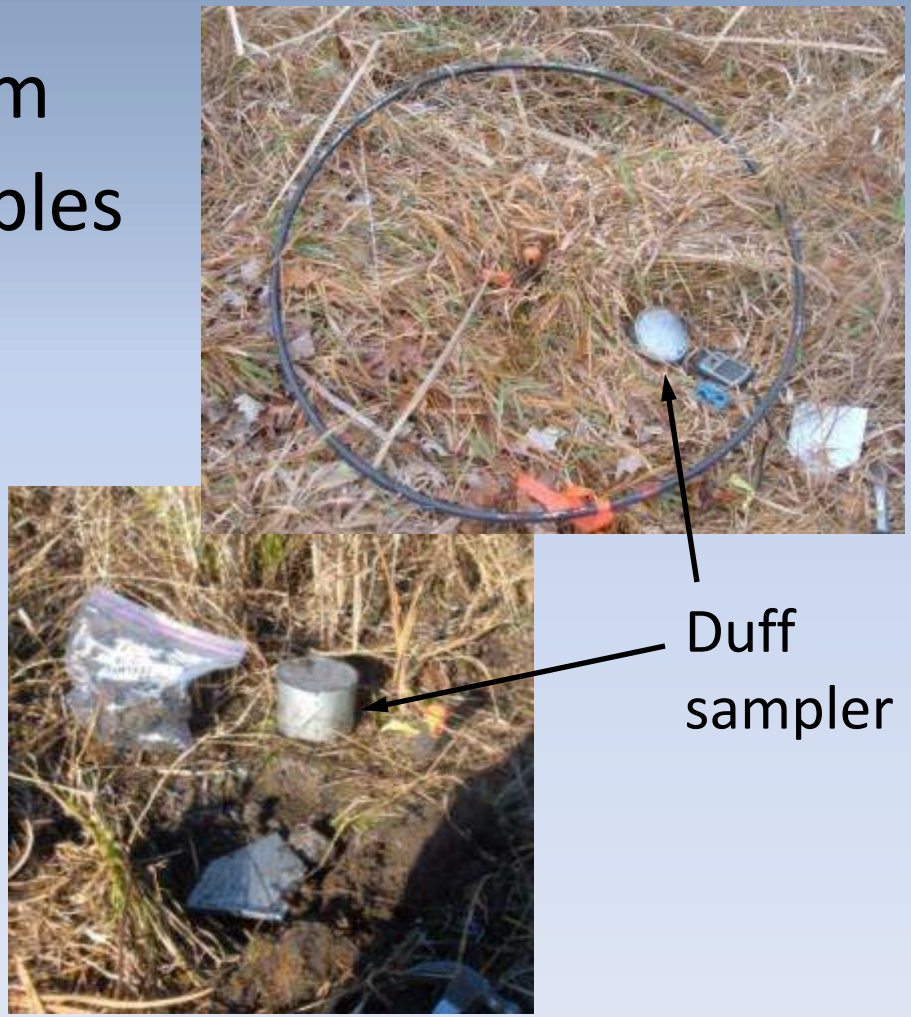
1. Weevils
   a) Presence/absence
   b) Abundance
2. Shoreline condition

Weevils

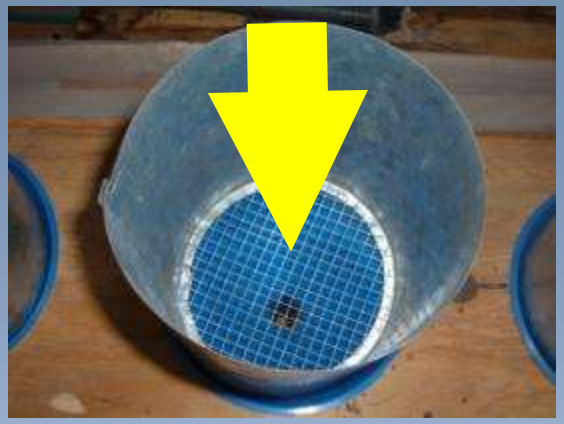
- Sampled in Nov. 2009
- Evenly-spaced transects
  - 27 on Thomas Lake
  - 21 on Springville Pond
- All transects sampled at 4m and 6m from water
- Three randomly chosen transects were also sampled at 10m from water

Weevils

- Sample point = 1 m diam
- Collected soil/duff samples
  - 4 samples per site
  - Composite samples
  - Sample size = 0.05 m^2
  - Soil depth = 5 cm



Tullgren Funnels



Shoreland Condition

- Distance from water
- Height above water
- Habitat type
- Presence of milfoil fragments at shoreline
- Duff layer depth
- Duff composition

Shoreland Condition

- Habitat type
  1. Tamarack/Black Spruce
  2. Wetland – Alder
  3. Wetland – non-forested
  4. Forested – conifer dom.
  5. Forested – deciduous
  6. Forested – mixed
  7. Grass/woody mix
  8. Grass/forbs
  9. Low disturbance
  10. Mod disturbance
  11. High disturbance

Shoreland Condition

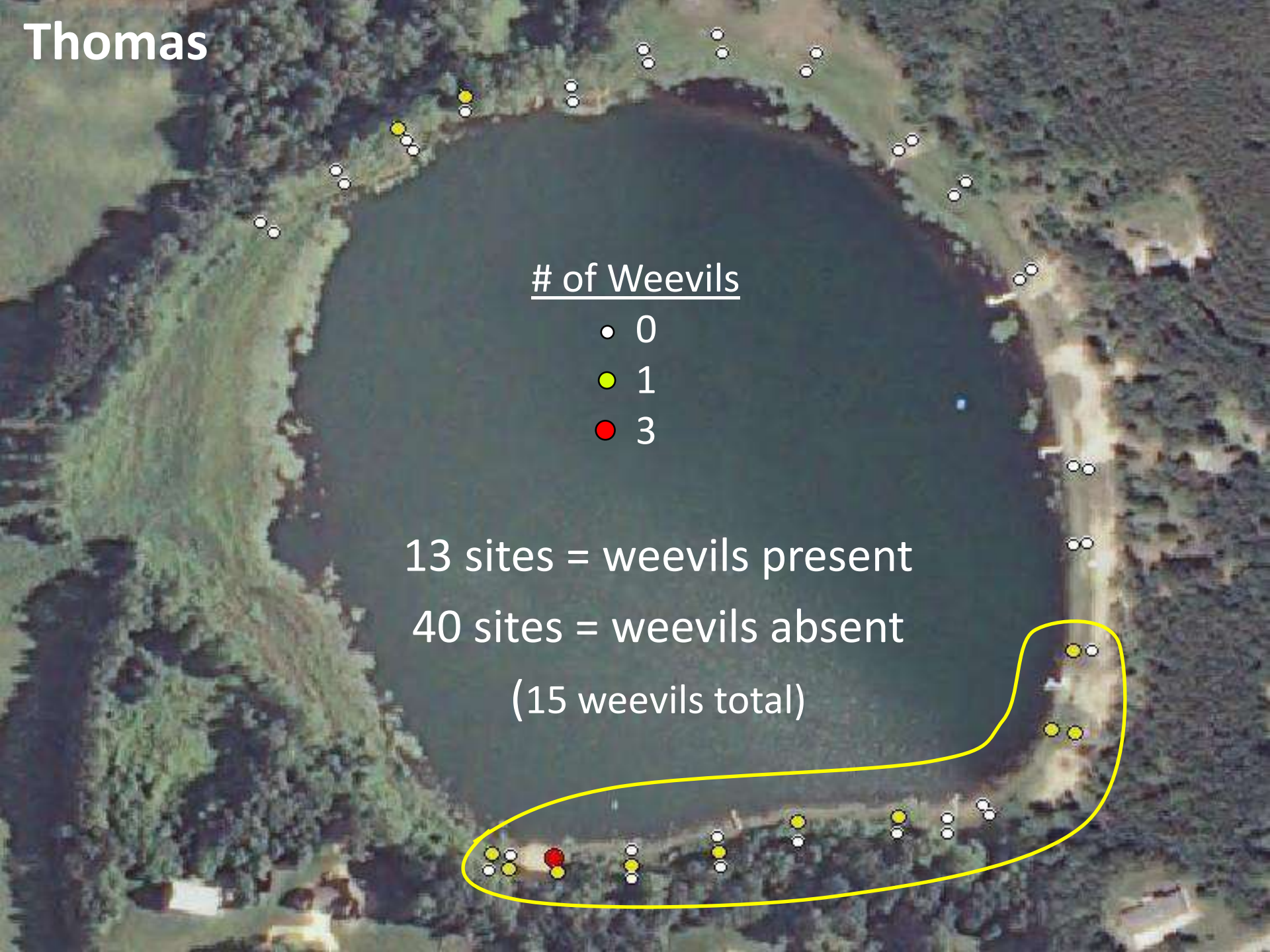
- Duff composition
  (% cover)
  - Woody
  - Deciduous tree leaves
  - Conifer needles
  - Grasses
  - Forbs
  - Rock
  - Bare soil

Shoreland Condition

- Soil/duff samples analyses
  - Composite samples
  - % Moisture
  - % Organic matter
  - Soil texture

Analyses

- Pearson correlation
- Logistic regression
- Discriminant analysis


Thomas
# of Weevils
0
1
3
13 sites = weevils present
40 sites = weevils absent
(15 weevils total)


Springville
17 sites = weevils present
28 sites = weevils absent
(28 weevils total)
Number of Milfoil Weevils Found
0
1
2
3
5

Habitat Type

Springville Pond

- Included 9“highly disturbed” sites
  - Mowed lawns, beaches, landscaping

	Weevils Present
Disturbed sites	11% of sites (1 of 9)*
“Natural” sites	44% of sites (16 of 36)

Habitat Type

Springville Pond

- 96% of the weevils found were at “natural sites”
- This corroborates existing research

Pearson Correlations

Springville Pond

- Correlated with Weevil Quantity
  - **Distance from Water** (R = -0.30, p = 0.04)
  - **Duff Depth** (R = 0.42, p = 0.00)

Weevil presence/absence

Springville Pond

- Logistic Regression
  - **Distance from Water** (p = 0.05)
  - **Duff Depth** (p = 0.02)

- Multiple Logistic Regression (model p = 0.01)
  - **Distance from Water** (p = 0.01)
  - **Duff Depth** (p = 0.06)

Pearson Correlations

Thomas Lake

- Correlated with Weevil Quantity
  - **Distance from Water** ($R = -0.33$, $p = 0.01$)
  - **% Leaves** ($R = 0.28$, $p = 0.04$)

Weevil presence/absence

Thomas Lake

- Logistic Regression
  - **Distance from Water** (p = 0.03)
  - **% Leaves** (p = 0.04)

- Multiple Logistic Regression (model p = 0.00)
  - **Distance from Water** (p = 0.02)
  - **Ht above Water** (p = 0.02)

Discriminant Analyses

- **Discriminates between two groups based on multiple available measurements**

Thomas Lake

Canonical Function	Variables Included	Structure Coefficient	Correct Classification Rate
BEST	Dist From Shore Ht Above Water	0.856 -0.092	**75%**

So what did our data tell us?

DISTANCE

Weevils decreased with distance

- Near shore habitat is most important, although weevils were recorded as far as 27 ft from water
  - WI law requires shoreland buffers of 35 ft
  - May provide adequate support
  - Newman et al. 2001 documented weevils @ 65 ft

35 ft buffer is good, but more is better!

HEIGHT

Weevils *increased* with height

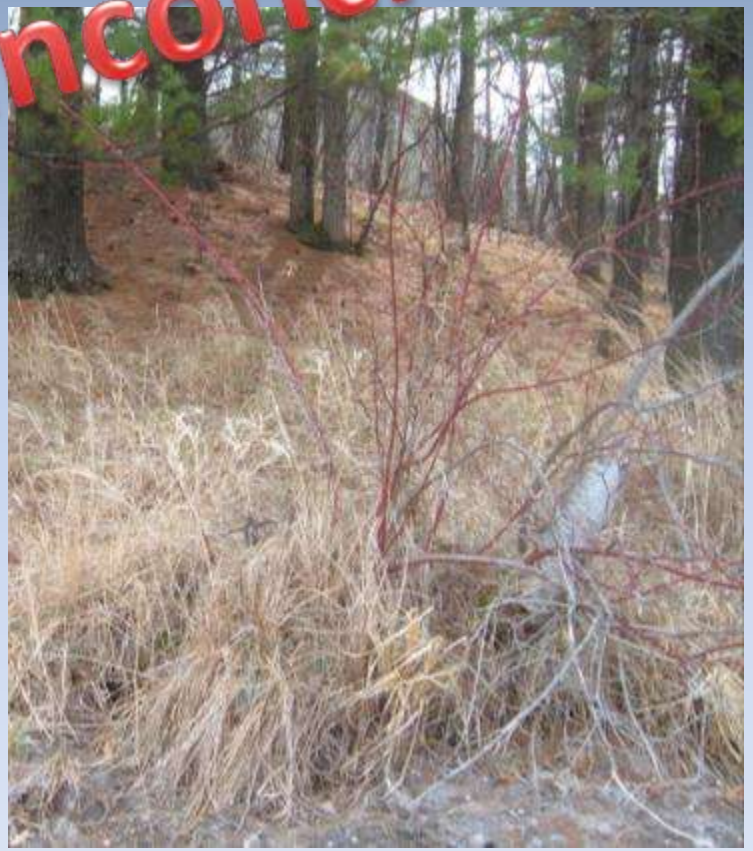
- Newman et al 2001
  = threshold @ 15% soil moisture
- Buffers in low, boggy areas may need to be extended into uplands

Samples from a cattail marsh
= 0 weevils

DUFF COMPOSITION

Weevils *may* increase with leaves

- Colinear relationship between Leaves & Distance
- Requires more research
- Newman et al. 2001: shoreline study on lake surrounded by prairie



Samples from upland grassy shoreline = 4 weevils

DUFF DEPTH

Weevils *may* increase with duff depth

- Duff layer **depth** was marginally significant
- Corroborates past research
  - Jester et al 2000:
    - Positive correlation between weevils and "natural" shoreland
  - "Natural" sites offer what advantage?

DUFF DEPTH

- **Springville Pond:**

  96% of weevils found = natural/low disturbance sites

  - Natural/low disturbance
    = 3.3 cm average duff
  - Med/high disturbance
    = 1.7 cm average duff

Unraked, unmowed shoreland buffers provide “good duff”.

Recommendations

- Think holistically
  - Think big
  - Think long-term

Buffers are your lake's immune system

Summary in a nutshell

- **Weevils want:**
  - **high and dry habitat**
  - **close to shore**
  - **with deep duff**

Acknowledgements

Funding
DNR Aquatic Invasive Species Grant Program
UWSP College of Natural Resources

Field/Lab Assistance
Charles Boettcher
James Brodzeller
Benjamin Balika
Nathan Thomas

Additional Committee Members
Dr. Robert Freckmann, UWSP
Patrick Sorge, WI DNR

Photo Credits
Paul Skawinski
Adam Skadsen
UWSP Center for Watershed Science & Education

HEIGHT

Weevils *increased* with height

- Results on McDill Pond = ht threshold @ 50 cm