Predicting and responding to starry stonewort invasion in Minnesota lakes

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Photo: Dave Hansen
Acknowledgments

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Starry stonewort  
(*Nitellopsis obtusa*)

- Green macroalga
- Native to Eur. & Asia
- Rare species in native range
- First found in North America in 1974
- Minnesota in 2015

(Karol & Sleith 2017, Larkin et al. 2018)
Invasion history

Larkin et al. 2018
Current known distribution

Legend
Nitellopsis obtusa Reports
- Verified with voucher
- Unverified

Larkin et al. 2018
Known occurrences in Minnesota

2015
• Koronis/Mud
Known occurrences in Minnesota

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2016
• Cass
• Moose
• Turtle
• Upper Red
• Winnibigoshish
• Rice
• Sylvia
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2017
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2018
• Medicine
Our focus

- **Spread**
  - Where’s it going to end up?

- **Impacts**
  - What’s it going to do when it gets there?

- **Management**
  - How can we support rapid and effective responses?
Our focus

**Spread**
*Where’s it going to end up?*

**Impacts**
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**Management**
*How can we support rapid and effective responses?*
Where’s it going to end up?

Where can it survive in the world? CLIMATE
Where’s it going to end up?

Where can it survive in the world?
- CLIMATE

Which lakes provide suitable habitat?
- WATER CHEMISTRY
Where’s it going to end up?

Where can it survive in the world?  
CLIMATE

Which lakes provide suitable habitat?  
WATER CHEMISTRY

Which lakes can it get to?  
BOATER MOVEMENT + DESICCATION TOLERANCE
Potential distribution based on climate

Escobar et al. 2016. *Scientific Reports*
Potential distribution based on climate

Escobar et al. 2016. *Scientific Reports*
Potential distribution based on climate

- High potential for spread based on climate
- But need to incorporate habitat suitability
- Need lake-level predictions

Escobar et al. 2016. *Scientific Reports*
Scaling down to lake level

Chemistry of SSW lakes

• High pH
• High conductivity (Ca, Mg)
• Wide trophic-state ranges (N, P)

Based on data from NY (Sleith) and Europe (Boissezon et al.)

Dr. Ranjan Muthukrishnan (Postdoc)
Scaling down to lake level

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Regional risk map

a) Random forest

b) Boosted regression trees

Low risk

High risk
Regional risk map

b) Consensus high risk
Overland transport

Where to?

- Boater movement

Nick Phelps
Overland transport

Can it survive?

• Desiccation tolerance
Desiccation experiments

Bulbils and clumps

• Single fragments
• Small clumps
• Large clumps

Wes Glisson
(Research Fellow)
Desiccation experiments

Treatments

• Out of water for 15 mins. to 5 days
• Negative controls (wet, never dried)
• Positive controls (dried to constant mass)
Desiccation experiments

Returned to water, viability tested by:

• Sprouting (bulbils)
• Rehydration (fragments)
Desiccation experiments

- Bulbils viable for ~4 hours
Desiccation experiments

- Fragments/clumps viable for ~2 – 72 hours
- Strong size effect
Desiccation experiments

• Fragments/clumps viable for ~2 – 72 hours
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Desiccation experiments

- Fragments/clumps viable for ~2 – 72 hours
- Strong size effect
Implications for spread

• Reasonable effort will prevent spread

Photo: CA DFW

Zebra mussel veliger
Implications for spread

• Reasonable effort will prevent spread
• Risk is from non-compliance

Photo: NYS DEC
Implications for spread

• Reasonable effort will prevent spread
• Risk is from non-compliance
• And conditions that retain moisture

Photo: Blaine Barkley
Our focus

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Where’s it going to end up?

Impacts
What’s it going to do when it gets there?

Management
How can we support rapid and effective responses?
Ecological impacts

• High uncertainty
• Not enough research

Photo: Paul Skawinski
Ecological impacts

• High uncertainty
• Not enough research
• 212 peer-reviewed papers involving ssw (Web of Science, Jan. 2018)
  • But only 11 addressing as non-native species in North America
  • Only 1 of those documenting ecological impacts***

Ecological impacts

In 2017, established long-term monitoring plots to begin to quantify

• SSW abundance vs. native plant diversity
• Rates of local spread (within-lake)
Ecological impacts

2018: Masters research

- SSW abundance and native plant diversity
- Environmental conditions and SSW abundance
  - What drives nuisance growth?
A nearly universal pattern in ecology is that species are rare in most locations and abundant in a few.

What determines where starry stonewort is most abundant?
Time? Sediment type? Nutrient concentrations?
Our focus

Spread

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*What’s it going to do when it gets there?*

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*How can we support rapid and effective responses?*
Starry stonewort control
Starry stonewort control

- Collaboration w/ Koronis Lake Association
- Biomass reduced by mechanical and copper treatments

Glisson et al. 2018
Starry stonewort control

- Bulbils not killed by algaecide treatment

Glisson et al. 2018

![Bar graph showing the proportion of bulbils sprouted](image)
Starry stonewort control

Shows need for:
• Sustained, multi-pronged efforts
• Innovation / experimentation

Glisson et al. 2018
Starry stonewort control

• Seasonal growth patterns
Starry stonewort control

• Seasonal growth patterns

Trends in Starry Stonewort Abundance

Average Biomass (g)

Lake
- koronis
- moose

2017 2018

Jun Aug Oct Dec Feb Apr Jun Aug
Starry stonewort control

• Seasonal growth patterns
Starry stonewort control

• Laboratory algaecide trials

Rafael Contreras-Rangel
(M.S. Student)
Starry stonewort control

• Laboratory algaecide trials
Early detection – AIS Detectors

• 217 certified AIS Detectors trained in starry stonewort ID
Early detection – Starry Trek

• >200 participants each year
• Two SSW infestations found:
  • Grand Lake (2017)
  • Wolf Lake (2018)
Questions?