Effects of zebra mussel and spiny water flea on sport fish in Minnesota’s nine largest walleye lakes

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Little Critters, big impacts
Potential impacts
Or...?
Research questions

• Is growth of age-0 walleye and yellow perch affected by invasion?
  • Most directly affected by reduced zooplankton
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  • Most directly affected by reduced zooplankton

• Do AIS influence the reliance on different energy sources of sport fish?
  • More complicated
  • More potential for indirect effects
Minnesota’s Large Lakes

- Cass
- Kabetogama
- Lake of the Woods
- Leech
- Mille Lacs
- Rainy
- Red
- Vermilion
- Winnibigoshish
Minnesota’s Large Lakes
Research questions

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Bigger is Better

Larger fish:
• Eat a wider variety of prey
• Can escape predators better
• Have more energy reserves for winter
Do zebra mussels or spiny waterflea affect fish growth?

• Walleye & yellow perch (age-0)
• Historical beach seine data from DNR + new data (N=227,036)
• Compare size pre-and post invasion
• Standardize for temperature
How do we compare fish growth?

Seasonal growth
How do we compare fish growth?
How do we compare fish growth?

- **Fish size**: Small, Big
- **Degree Days**
- **Date**: May, October
- **Temperature**: Cooler, Warmer
How do we compare fish growth?

- Fish size: Small, Big
- Degree Days: No difference
- Date: May, October
- Temperature: Cooler, Warmer

No difference
How do we compare fish growth?

<table>
<thead>
<tr>
<th>Date</th>
<th>Fish size</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>Small</td>
<td>Warmer</td>
</tr>
<tr>
<td></td>
<td>Big</td>
<td></td>
</tr>
</tbody>
</table>

Degree Days

May +
Cooler

October
Warmer

Uninvaded

Invaded

No difference

Same starting size, different growth rate
How do we compare fish growth?

- **Uninvaded**
  - Same starting size, different growth rate
  - Different starting size, same growth rate

- **Invaded**
  - Same starting size, different growth rate
  - Different starting size, same growth rate

**Diagram Details:**
- **Fish size:** Small to Big
- **Date:** October + May
- **Temperature:** Cooler to Warmer
- **Degree Days**
How do we compare fish growth?

- Same starting size, different growth rate
- Different starting size, same growth rate
- Different starting size, different growth rate

Graph shows:
- Fish size (Small, Big)
- Date (May, October)
- Temperature (Cooler, Warmer)
- Degree Days

Uninvaded and Invaded sections indicate growth patterns under different conditions.
Preliminary results: Walleye growth

Zebra mussels
(Somewhat) smaller starting size, slower growth rate

Spiny water flea
Smaller starting size, (somewhat) slower growth rate

Degree Days

Status
- Uninvaded
- SWF
- ZM

Length (mm)

6.9 inches
6.1 inches
5.8 inches
Preliminary results: yellow perch growth

Zebra mussels
- Same starting size, slower growth rate

Spiny water flea
- Same starting size, same growth rate

2.9 inches

2.5 inches

Degree Days
Growth varies a lot among lakes and years.
Research questions

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3,064 samples and counting
Preliminary results: young of year walleye

Rely on nearshore

Rely on offshore
What’s next?

• Food web data from all 9 lakes
• Do small changes in first year growth of walleye affect later survival/growth/populations?
• Do the effects vary by lake?
• Is there a key component of a lake that helps to buffer against AIS effects?
Thanks!

• Funding
  • MAISRC
  • Environmental and Natural Resources Trust Fund
  • Federal Aid – Sport Fish Restoration

• Field work
  • Large Lake Staff
    • MN DNR and Red Lake DNR
  • Voyageurs National Park staff
Questions and Discussion
Preliminary results: Mille Lacs food web
Preliminary results: Mille Lacs food web