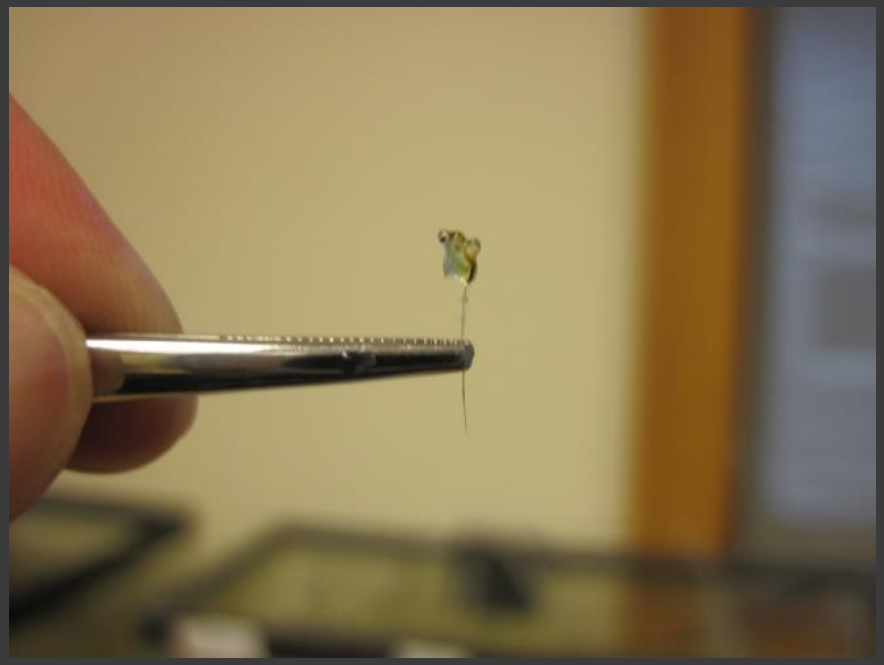
Interactions between the spiny waterflea (*Bythotrephes longimanus*) and pumpkinseed sunfish (*Lepomis gibbosus*)



Overview

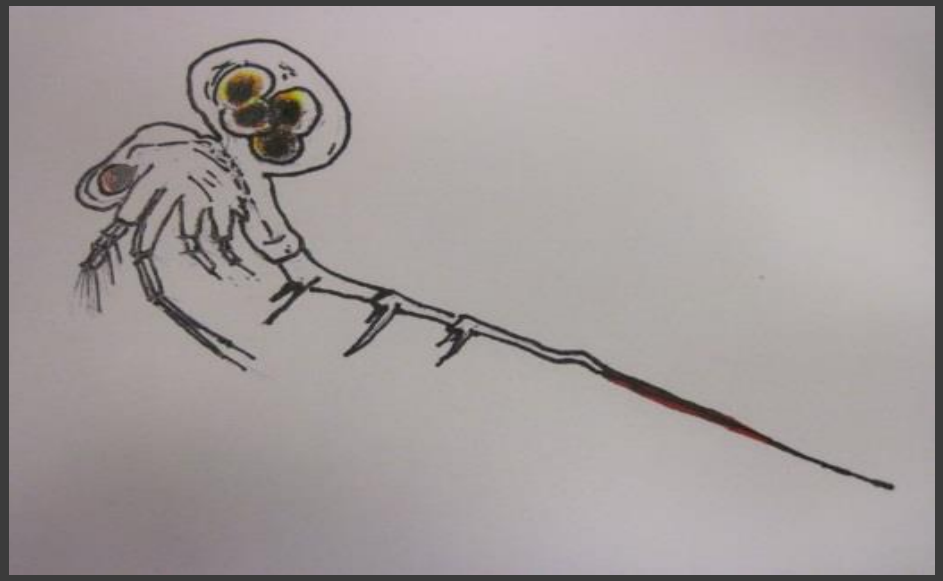
- Specific Research Objectives
- Background
  - Spiny waterflea
    - Impacts/adaptations
  - Pumpkinseed
    - Specialized feeding habits-breakthrough
- Specific Research Questions
- Methods/Results
- Discussion/Questions/Feedback

Specific Research Objectives

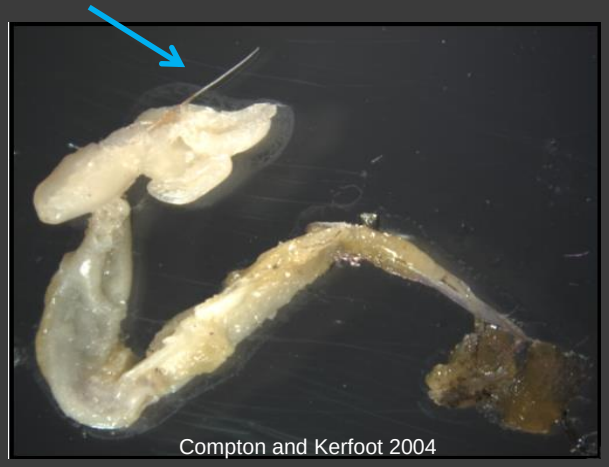
- Establish whether or not the feeding behavior of pumpkinseeds is population specific
- Quantify how frequently pumpkinseeds exhibit the spine removal behavior
- Determine if they are more efficient at ingesting *Bytho.* than other fishes

The Spiny Waterflea

- Predatory cladoceran that competes directly with juvenile fish
- Drastically affects native zooplankton communities
  - Abundance and species richness reduced
  - Alterations in zooplankton body sizes and structures



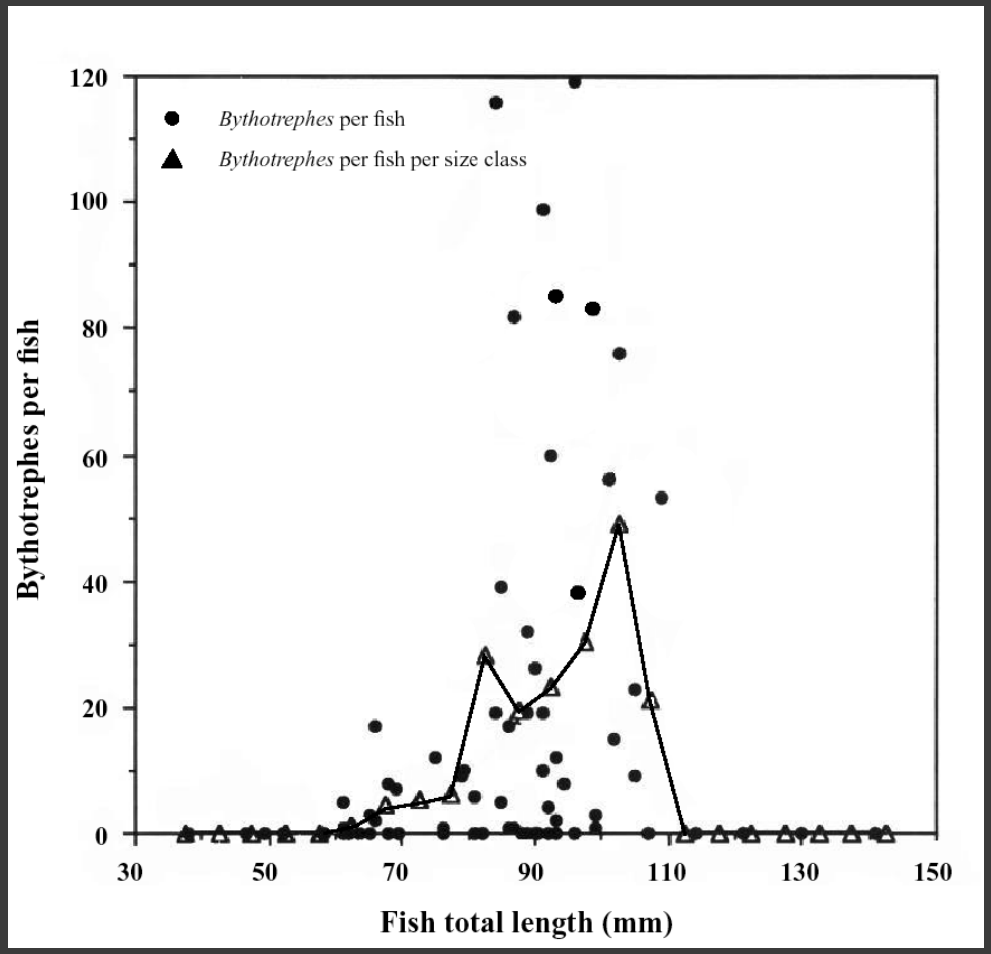
Spine puncturing
fish stomach



YOY fishes have difficulty ingesting

- Reject and recapture
- Whole-body convulsions
- Learned aversion

- Small fish avoid eating the spiny waterflea
- Large fish switch to feeding on larger prey



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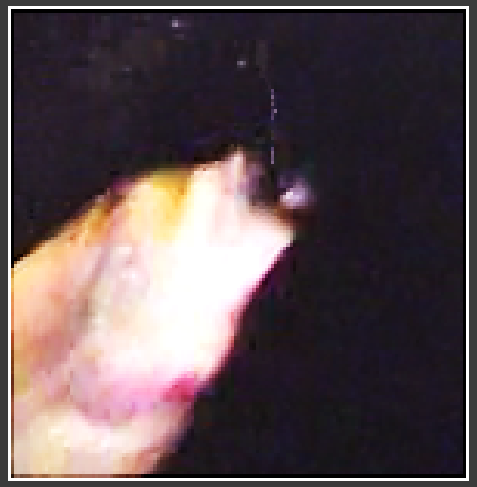
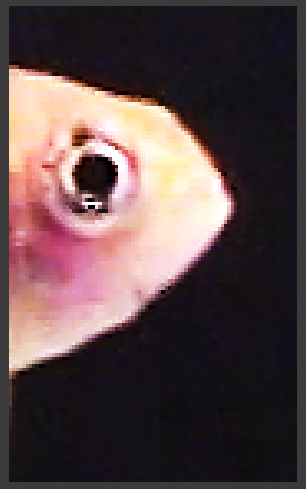
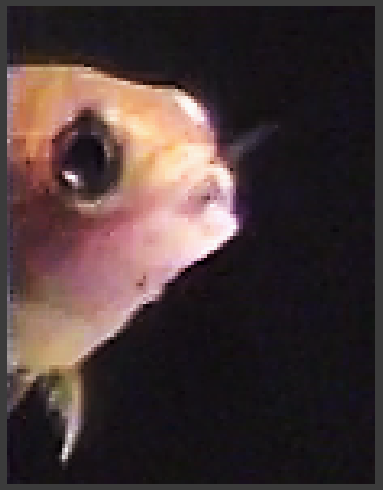
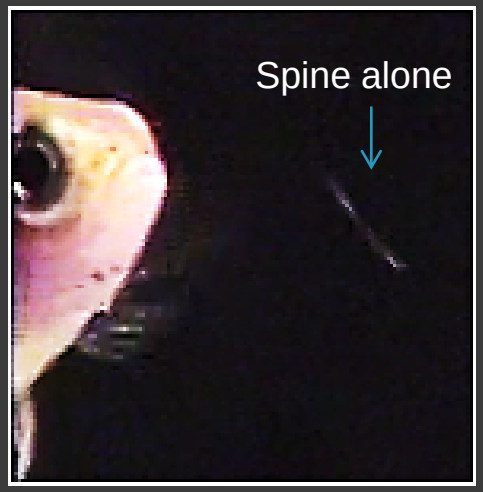
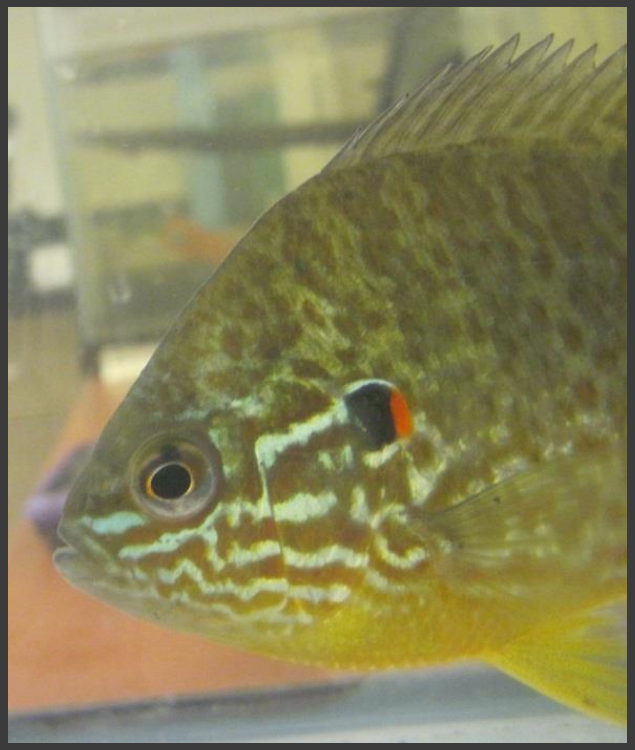







Spine alone

Pumpkinseed (*Lepomis gibbosus*)

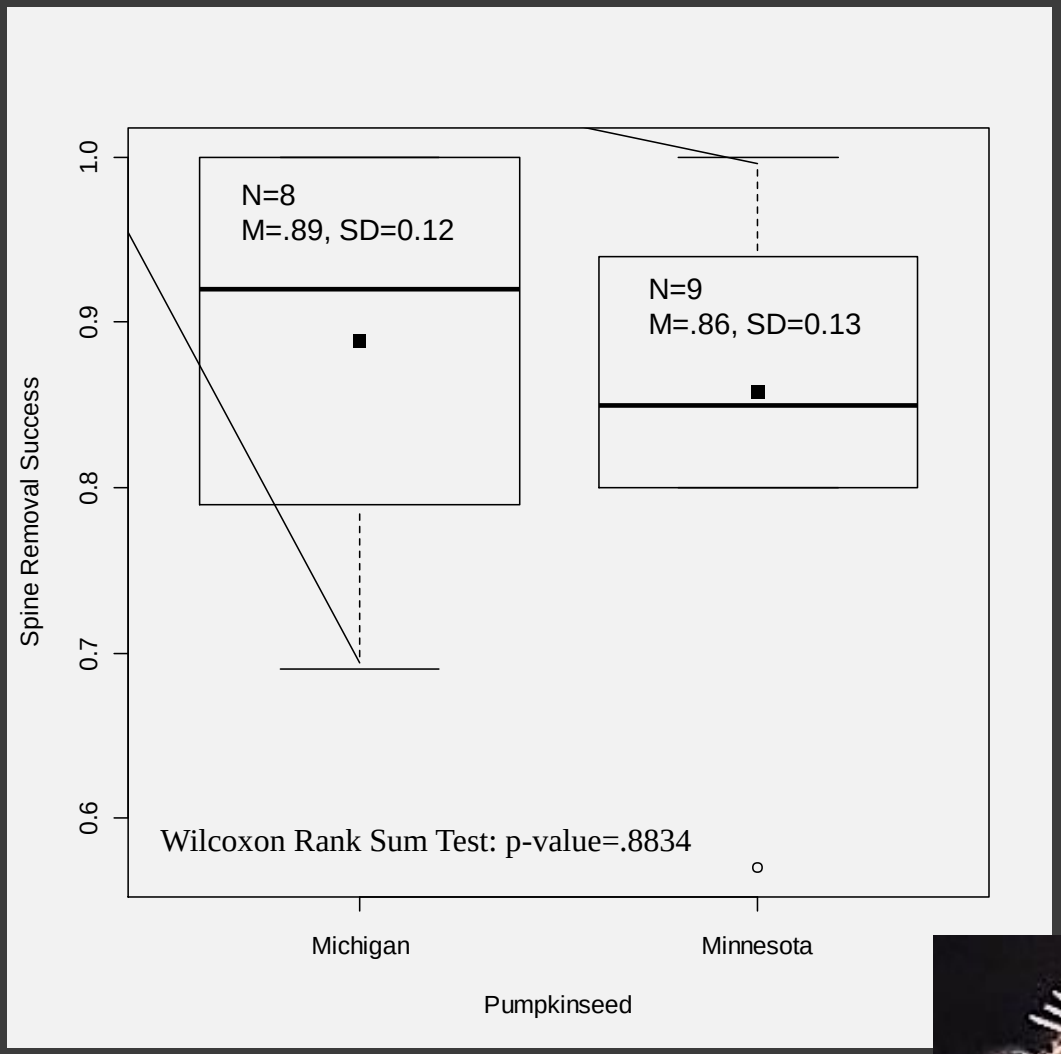


- Eat snails as adults
- Specialized jaw with neuromuscular motor pattern
- Analogous to manipulating, separating, and ejecting the spine from the spiny waterflea?

Research Question 1

- Is the feeding behavior displayed by local pumpkinseed fed *Bythotrephes* population specific?
  - i.e. compare pumpkinseed over geographic regions

- Seined fish from Minnesota and Michigan

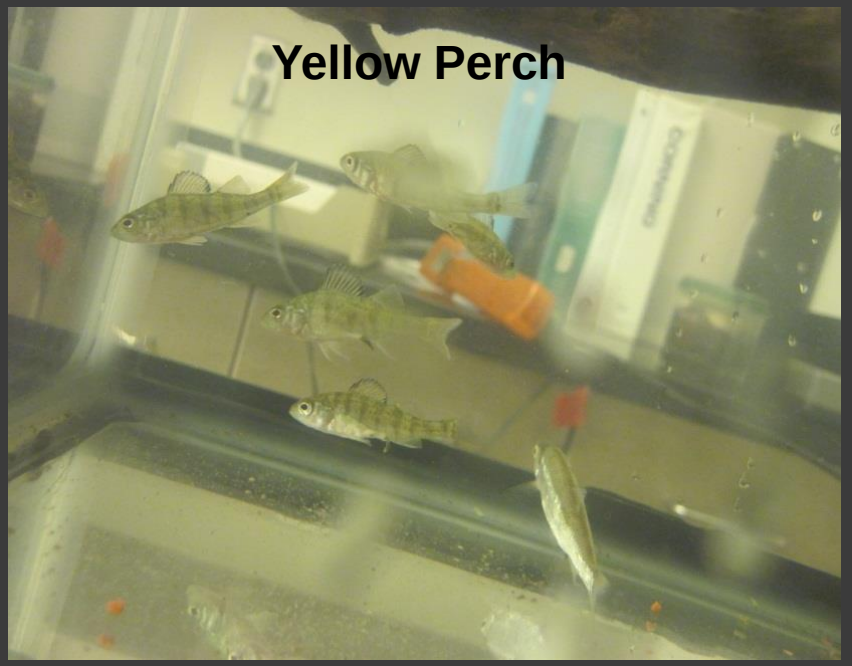


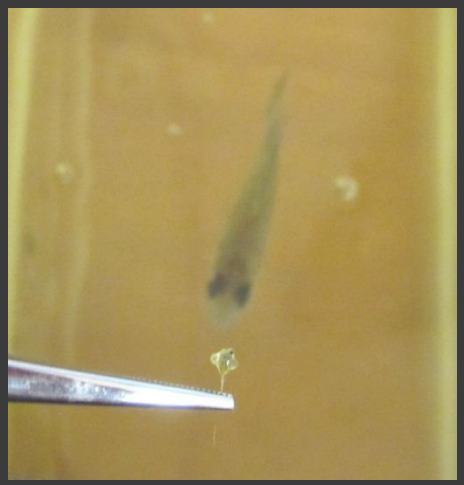
Spine removal success: proportion of instances spine was removed by individual fish

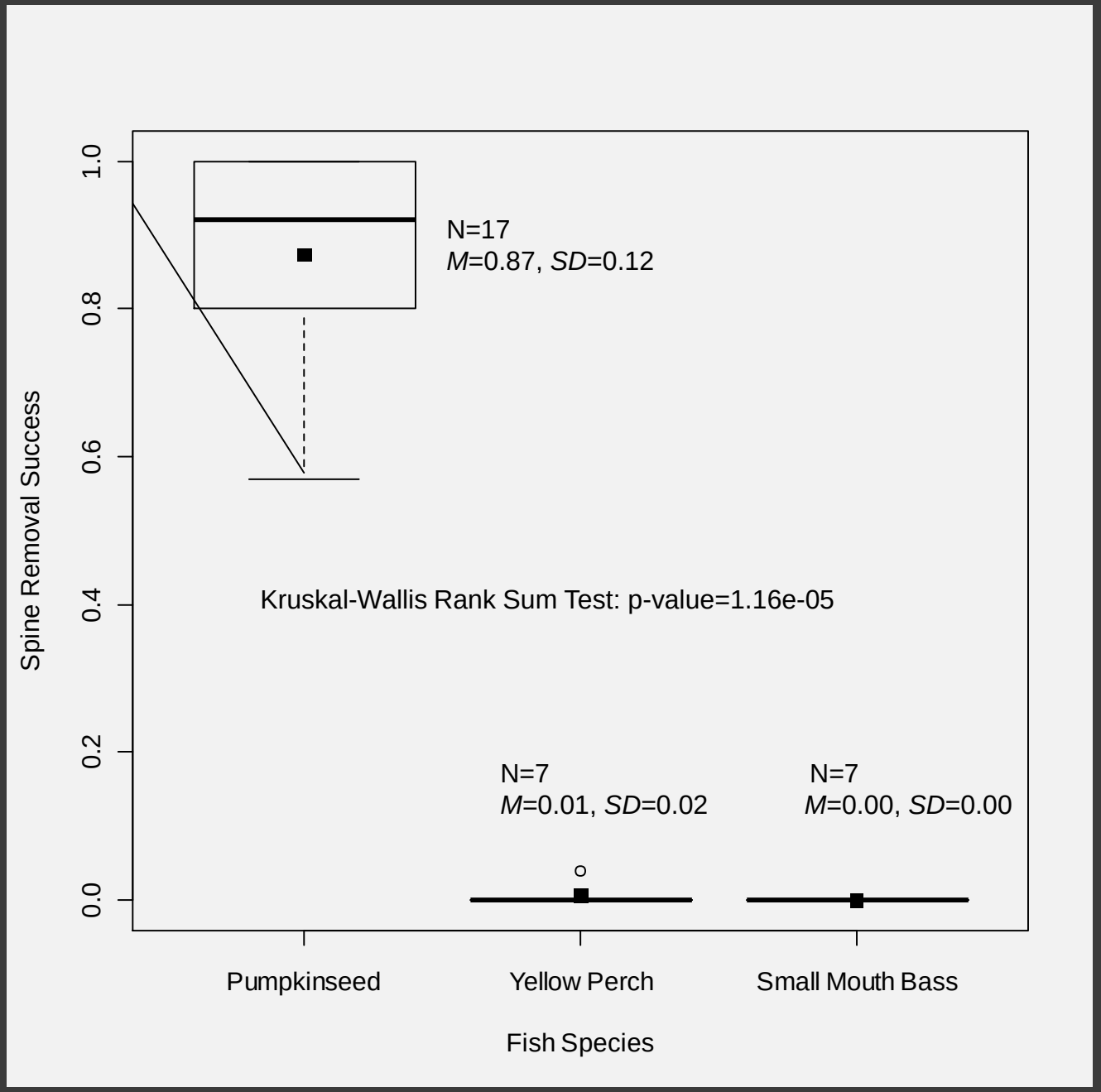
Research Question 2

- How frequently do pumpkinseed exhibit the spine removal behavior compared to other species?

Species	# of Fish	Location	Sizes (mm)
Pumpkinseed	8	UP MI	45-70
Pumpkinseed	9	Northern MN	48-65
Yellow Perch	7	Northern MN	49-57
Smallmouth Bass	7	UP, MI	50-57

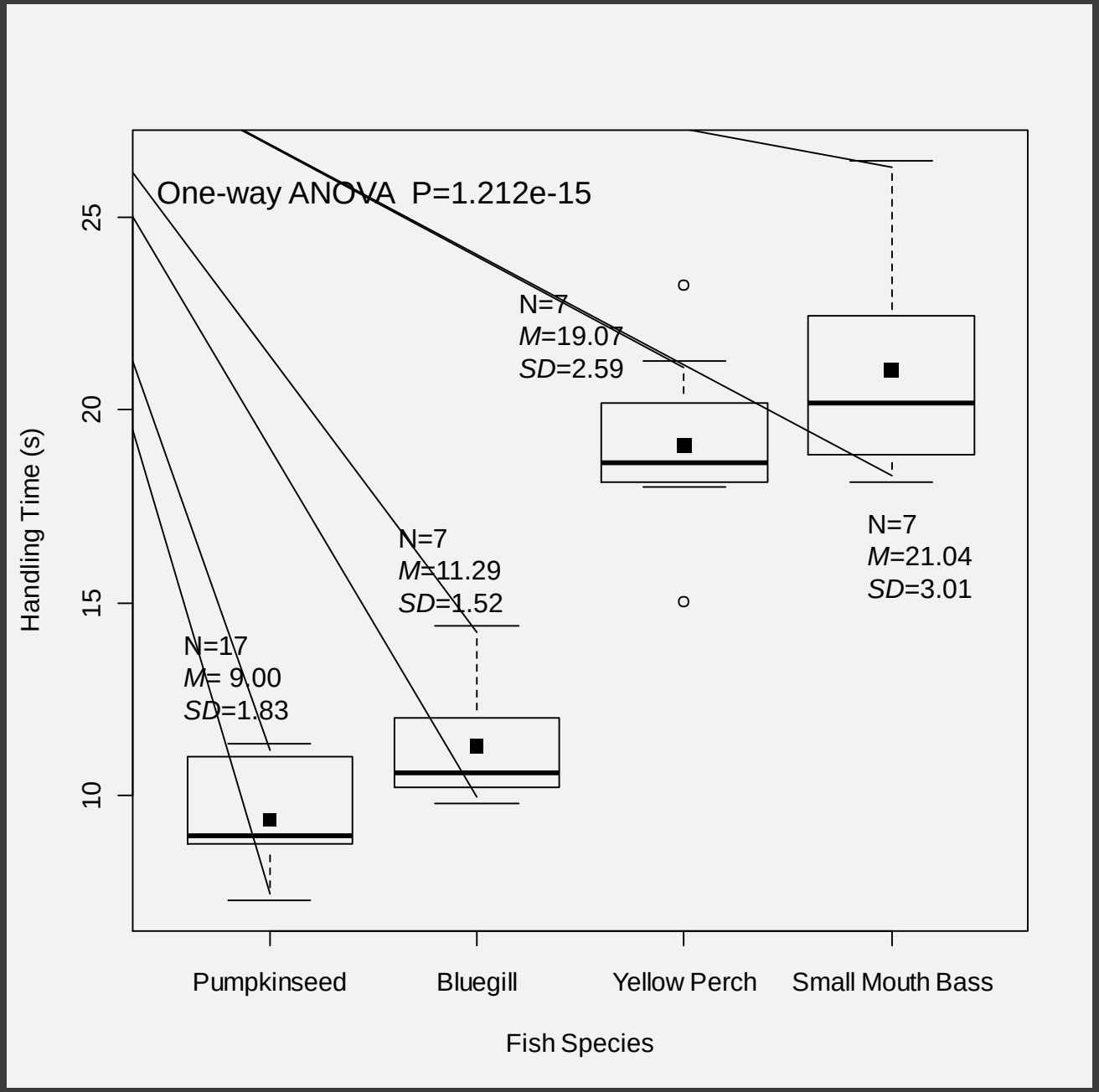





Spine Removal Success
0.0
0.2
0.4
0.6
0.8
1.0
N=17
M=0.87, SD=0.12
Kruskal-Wallis Rank Sum Test: p-value=1.16e-05
N=7
M=0.01, SD=0.02
N=7
M=0.00, SD=0.00
Pumpkinseed
Yellow Perch
Small Mouth Bass
Fish Species

Research Question 3

- Are pumpkinseed more efficient at ingesting *Bythotrephes* than other fishes?


One-way ANOVA P=1.212e-15
N=17
M= 9.00
SD=1.83
N=7
M=11.29
SD=1.52
N=7
M=19.07
SD=2.59
N=7
M=21.04
SD=3.01
Handling Time (s)
10
15
20
25
Pumpkinseed
Bluegill
Yellow Perch
Small Mouth Bass
Fish Species

Summary

- The pumpkinseeds from multiple geographic regions were more successful at removing *Bythotrephes'* spine, and more efficient at ingesting *Bythtorephes* than the yellow perch and smallmouth bass used in the study.

Do pumpkinseeds have the ability to influence the distribution of *Bythotrephes*? Could they be used as a control agent?

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Questions/Comments

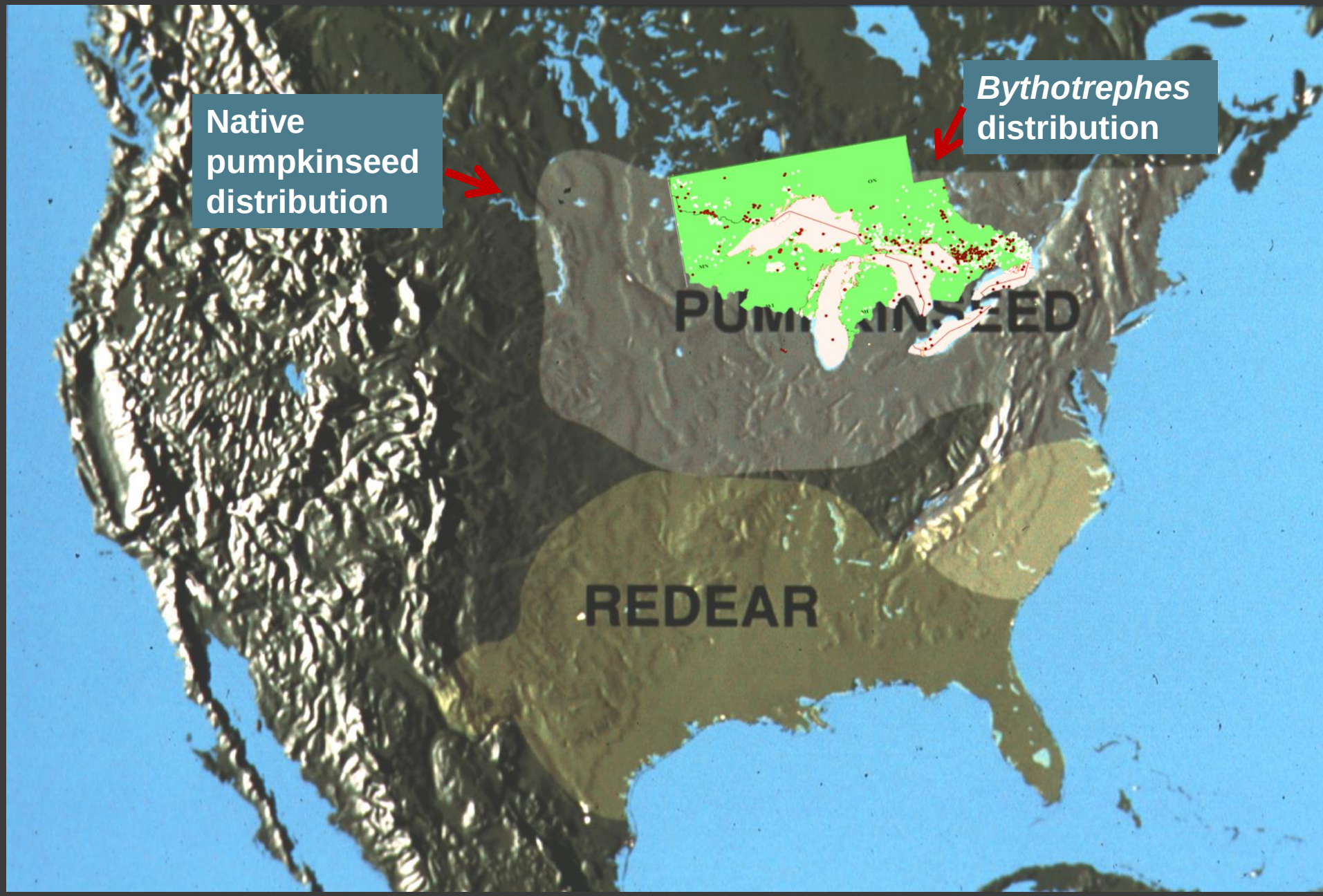

Figure by Dr. Casey Huckins and Kerfoot et al. 2011

Phenotypic Polymorphism

- In lakes where pumpkinseed and bluegill coexist, pumpkinseed remain in littoral zone.
- In lakes where bluegill are historically absent there are two forms of pumpkinseed
  - Littoral-feeds mainly on snails
  - Limnetic- planktivorous