

# An Experimental Assessment of Mollusk Vulnerability to Juvenile Black Carp (*Mylopharyngodon piceus*) Predation

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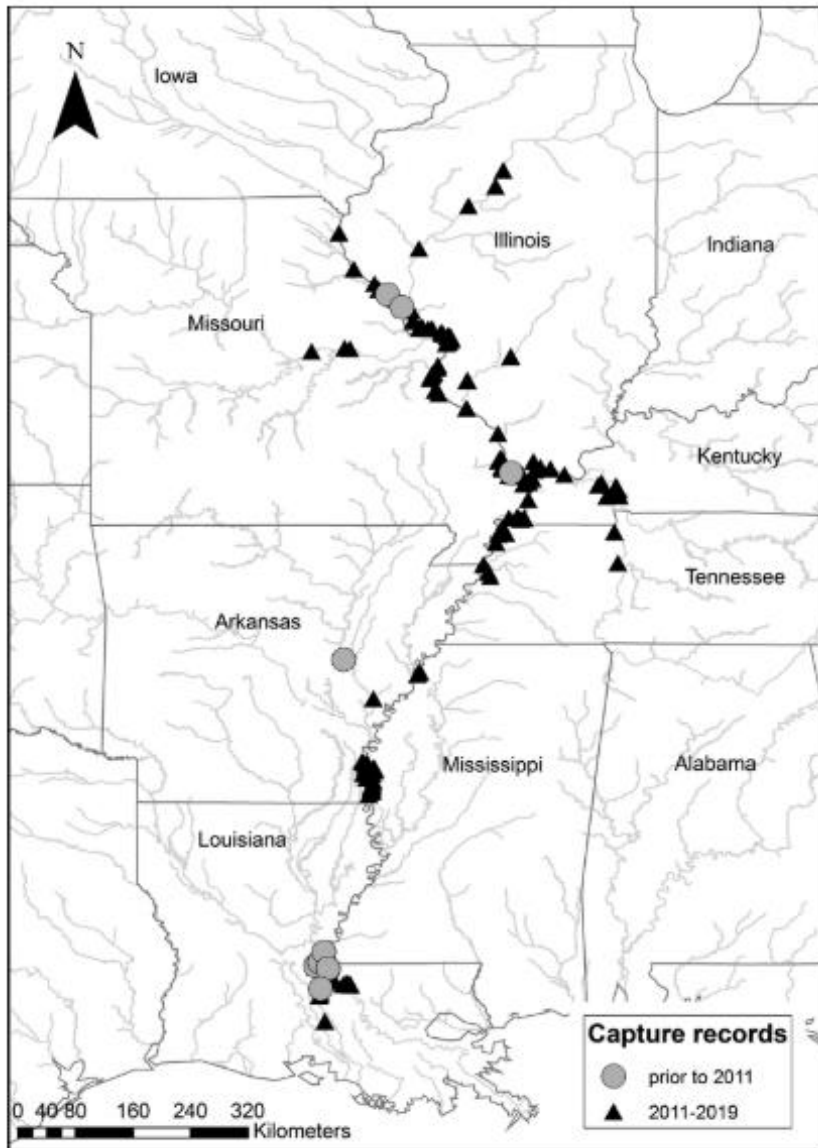


# Black Carp Invasion

First imported in the 1970s from Eastern China for use in aquaculture

First captured in the wild in the 1990s escaped from fish farms in the southern United States

A freshwater, benthic, molluscivorous fish that feeds mainly on bivalves and snails



Kroboth et al 2019





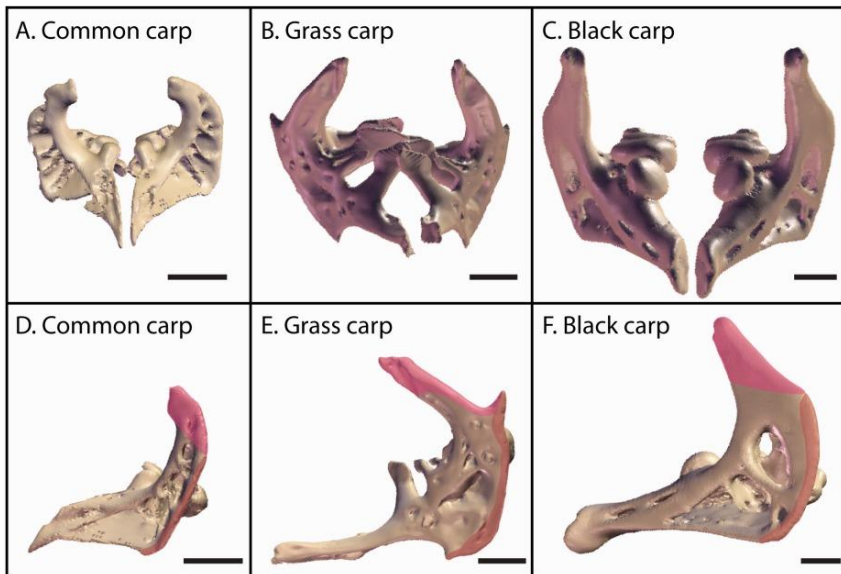
# Durophagous (Shelled prey eating) Predator

Uses molariform pharyngeal teeth and mastication pad to crush the shells of prey

Juveniles have only been studied in aquaculture settings

Wild spawning may result in massive numbers of juveniles

The potential impacts of juveniles in the wild are not well known





# Mississippi River Basin Mollusk Community

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147 species of mussel are endemic to the Mississippi River basin, and approximately 75% of these are threatened or endangered

Native species of snails and mussels have been harmed by habitat degradation as well as biological invasions of competitors

Predicting the predator prey interactions with black carp and mollusks is important for management





# Study Objective

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Quantify size-specific vulnerability of select native and non-native mollusks to predation by juvenile black carp.



# Black Carp Captive Population

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Acquired from an Arkansas fish farm

Kept in recirculating system with biofiltration

150mm-400mm Total Length



# Mollusk Study Species

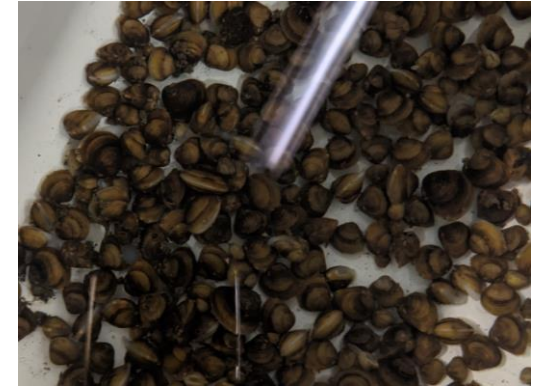
\*non-native



**Chinese Mystery Snail (*Cipangopaludina chinensis*)\***



**Zebra Mussel (*Dreissena polymorpha*)\***



**Asian Clam (*Corbicula fluminea*)\***



**Bladder Snail (*Physella* sp.)**



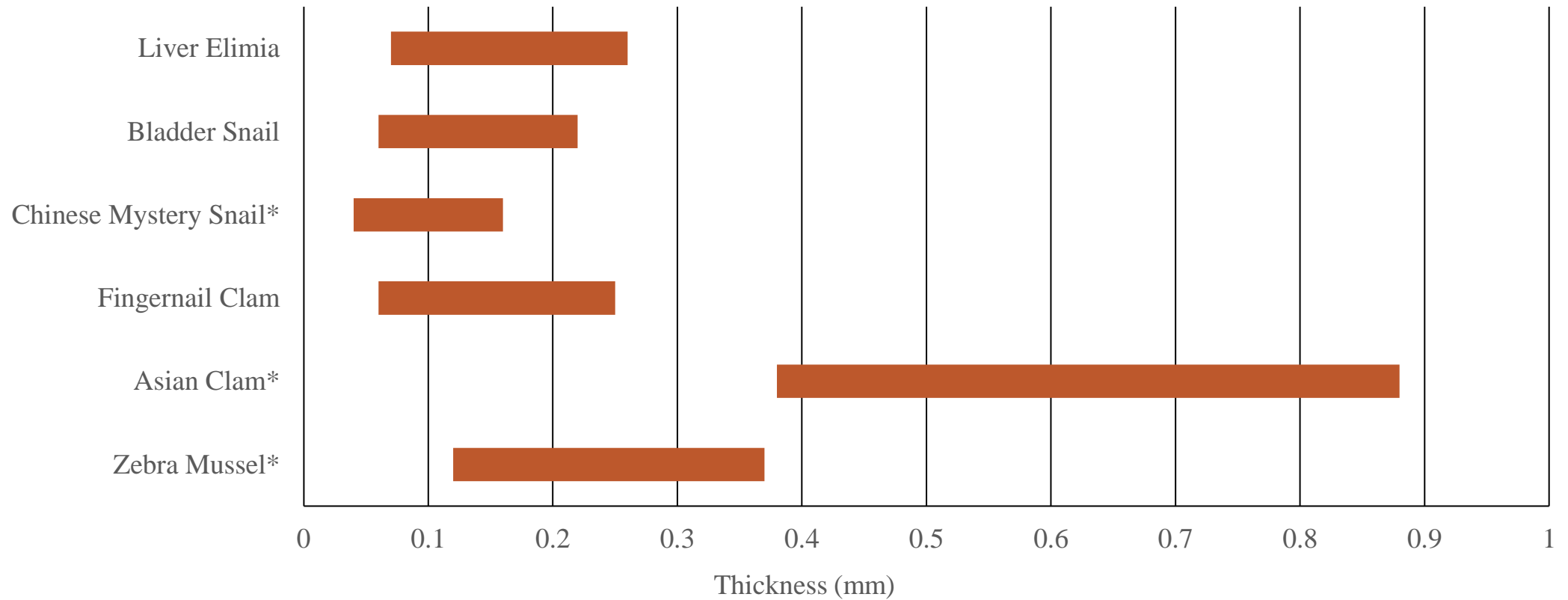
**Liver Elimia (*Elimia livescens*)**



**Fingernail Clam (*Sphaerium* sp.)**

# Shell Thickness Range Estimates

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# Size-specific Vulnerability Methodology

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Total Length measured and their mouth gape estimated from a gape/total length equation (Based on Nico et al 2005)

Black carp were then transferred to individual experimental aquariums for three acclimation days

284-L aquariums (121.9 x 45.7 x 53.3cm)

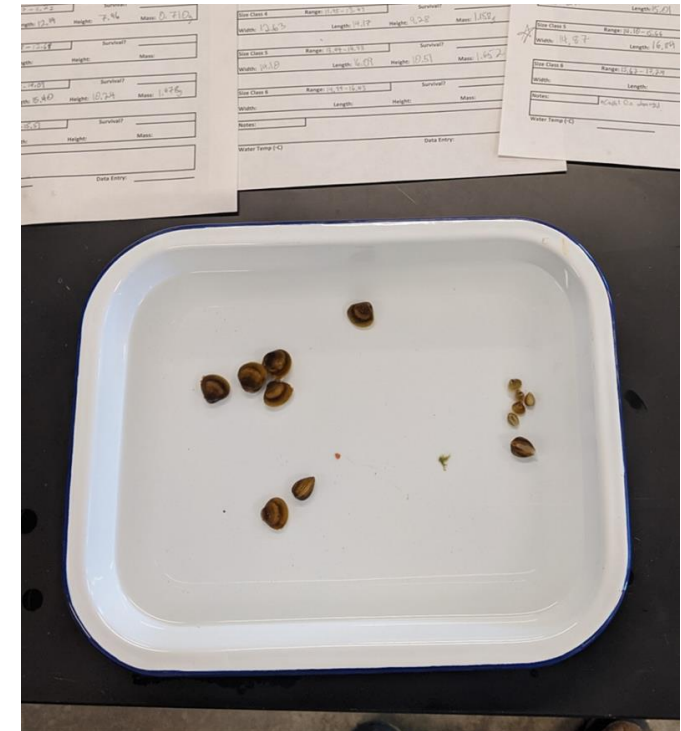
# Methodology Cont.

After three days each carp was given six different size classes of a single mollusk species to attempt to eat

Size classes are based on relative mollusk size to carp mouth gape

- Snail Height/Mouth Gape or Bivalve Width/Mouth Gape
- Range from 0.5-1.1 mouth gape

Feeding trials last 48 hours, after which time the condition of the mollusks was recorded



# Zebra Mussel Attachment Methodology

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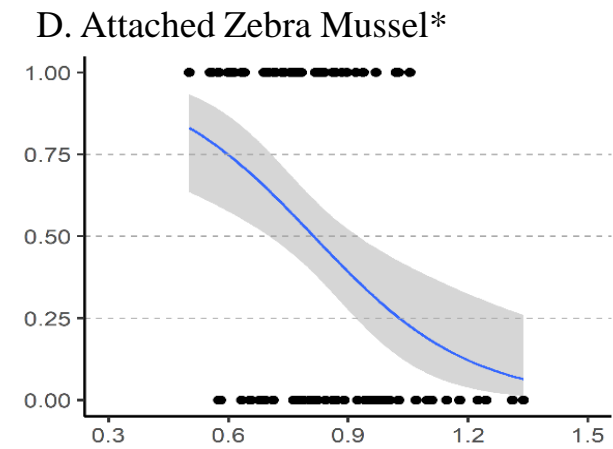
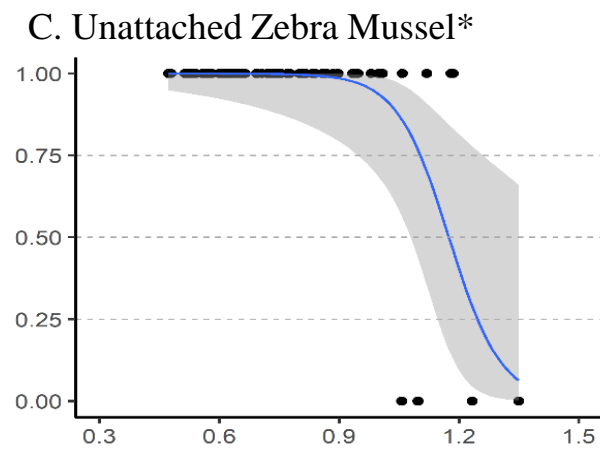
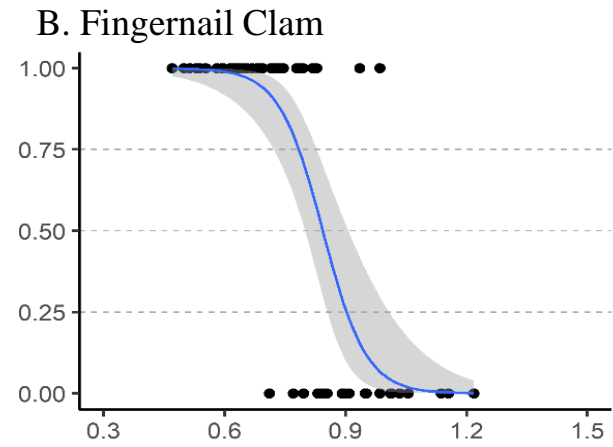
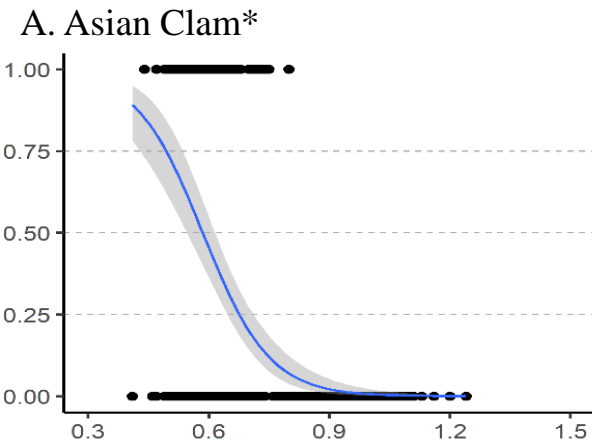


Unattached individuals vs.  
Attached individuals

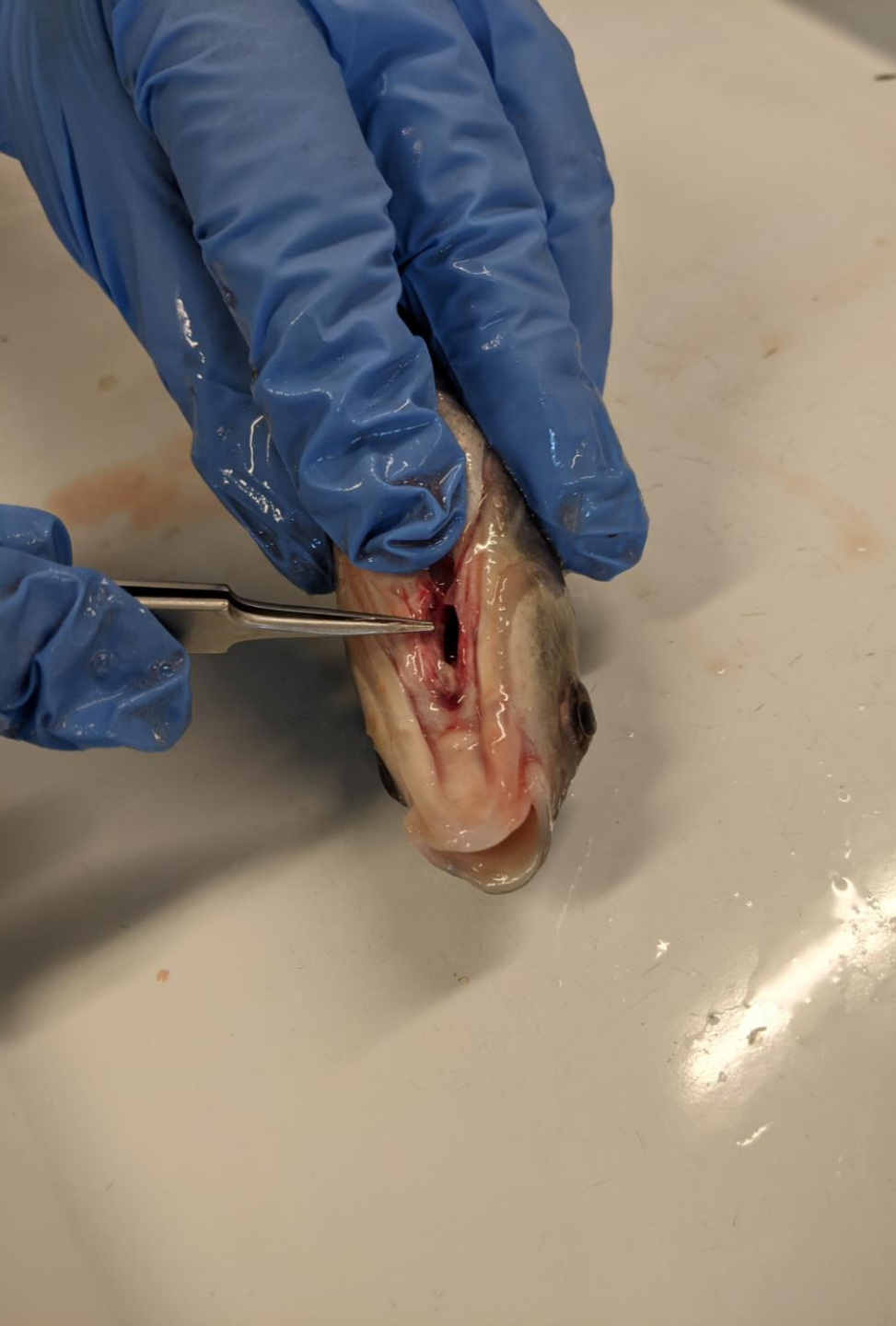
Attached Zebra Mussels were provided with a ceramic tile to attach to, and allowed a minimum of four days to attach



Probability of Being Crushed or Consumed



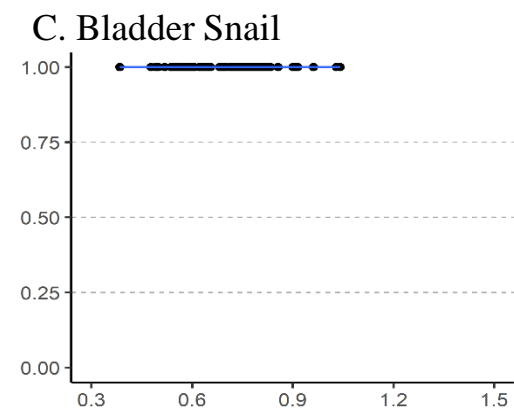
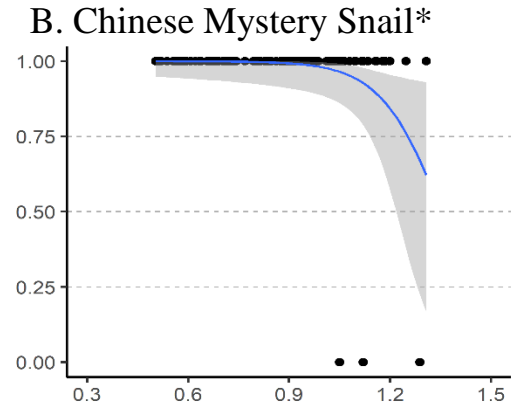
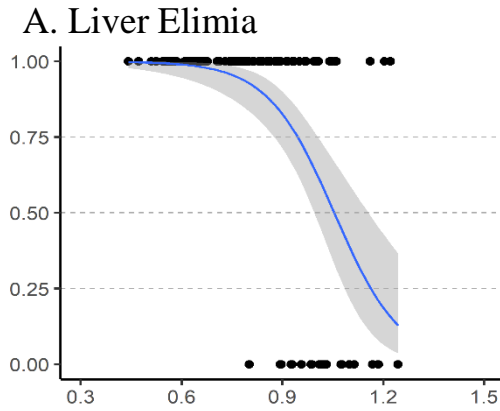
Shell Width to Mouth Gape Ratio



# Trial Casualty

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Probability of Being Crushed or Consumed



Shell Height to Mouth Gape Ratio



# Conclusions

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## **Bivalve Threshold of Vulnerability (Shell width/mouth gape ratio):**

Asian Clam (0.57)  $\leq$  Attached Zebra Mussel (0.77)  $\leq$  Fingernail Clam (0.82)  $\leq$  Unattached Zebra Mussel (1.129)

## **Snail Threshold of Vulnerability (Shell height/mouth gape ratio):**

Liver elimia (1.02)  $\leq$  Chinese Mystery Snail (1.276)  $\leq$  Bladder snail (NA)



# Acknowledgments

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Thanks to the staff and students of the Kaskaskia Biological Station and Dr Joe Parkos's Lab for wet lab and field assistance!

Thanks to Dr. Jeremy Tiemann with the INHS for Assistance on collecting mollusks!

A close-up photograph of a person's hand holding a small, dark-colored fish. The fish's mouth is open, and its eye is clearly visible. The background is slightly blurred, showing what appears to be a white sink and a wooden chair leg. The overall lighting is soft and natural.

Questions?

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