

Swimming and Jumping Performance of Barrens Topminnow and Invasive Mosquitofish: Implications for Barrier Design



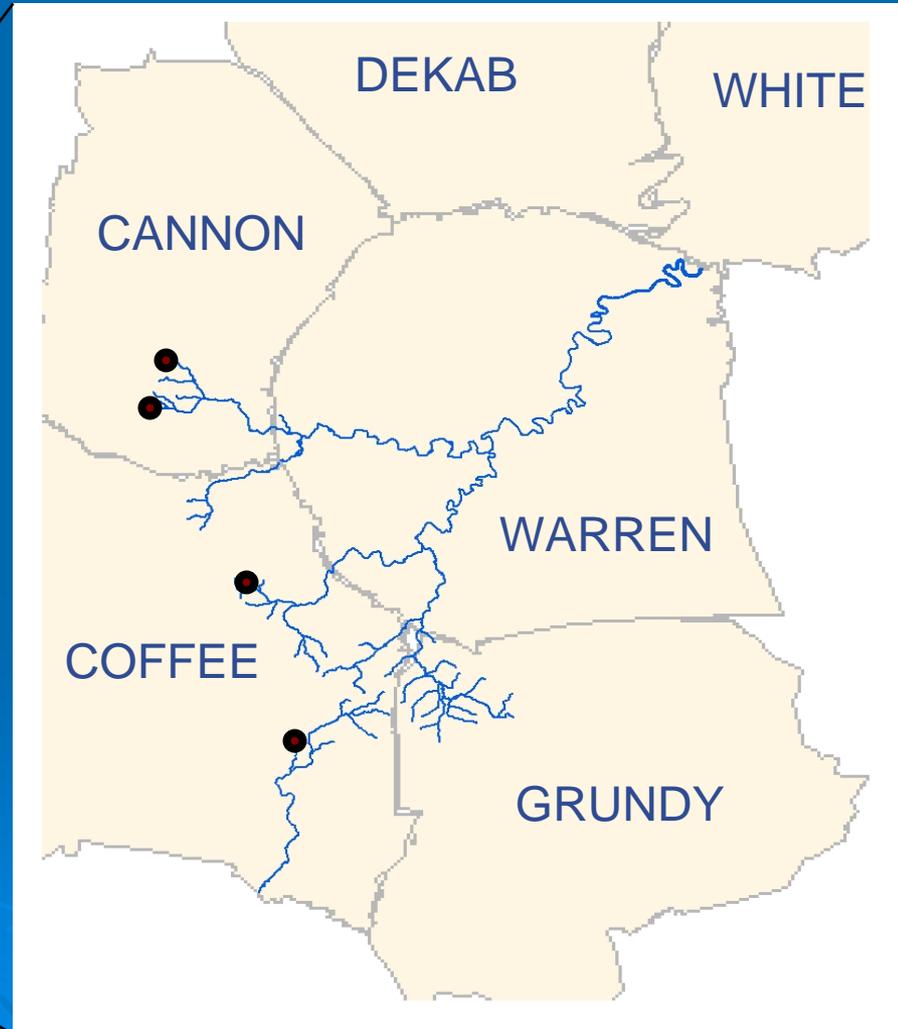
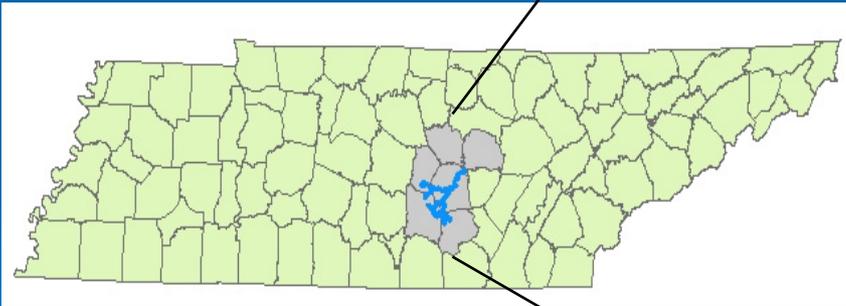
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Barrens Topminnow: Background



Distribution

Historical Range:
Headwaters of Elk,
Duck and Caney Fork
River Systems in
Middle TN



Topminnow Reintroduction Sites



Invasive Mosquitofish

- Highly successful invaders
- Negative effects on native species





Vervilla: Antimycin Fish Kill



Exclusion Barrier?



Selective Permeability



Research Objectives

- Determine swimming performance of topminnows and mosquitofish in a flume
- Determine maximum jumping height of topminnows and mosquitofish

Characteristics of test fish

- Female mosquitofish:
38-54 mm TL
- Topminnows:
28-83 mm TL

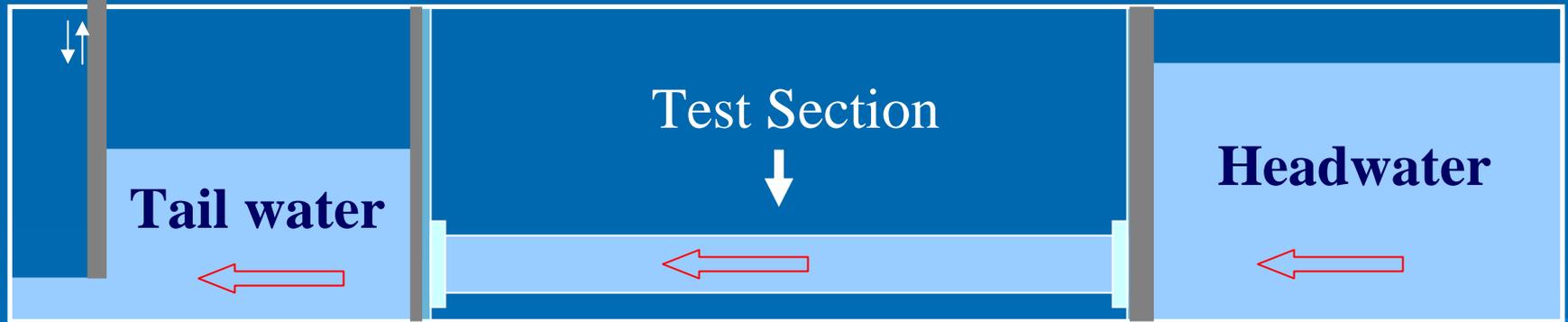


Flume design

Adjustable
sluice gate

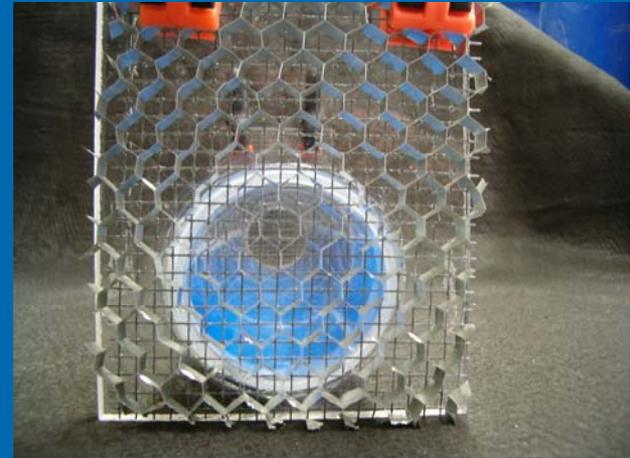
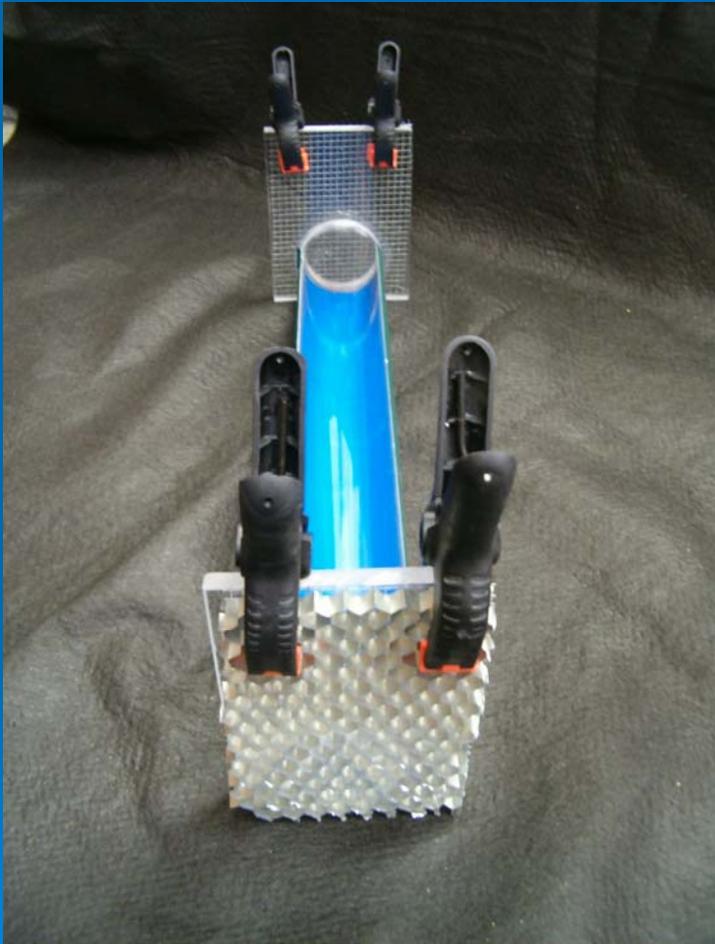
Removable
screen

Fixed Screen and
honeycomb baffle

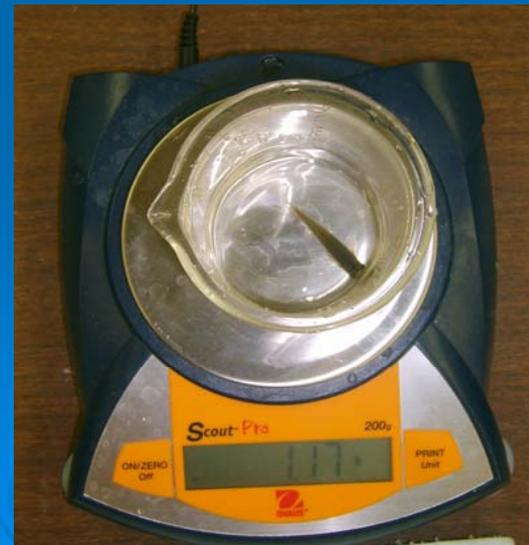


LONGITUDINAL PROFILE VIEW

Test Section of the flume



Methods: Endurance Trials



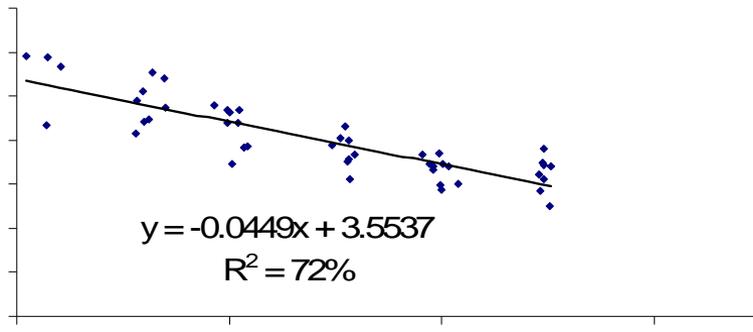
Swimming Trial



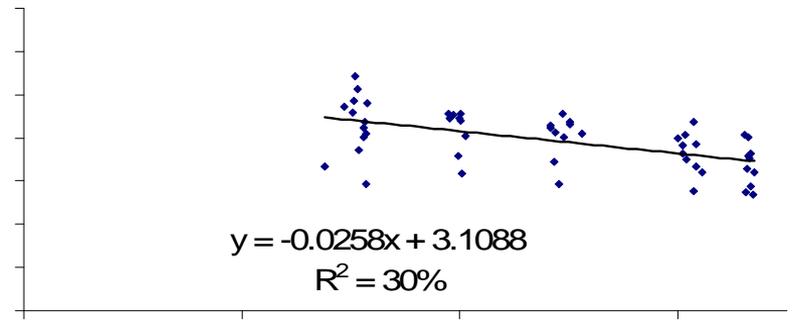
Endurance Models

Log₁₀ Endurance (s)

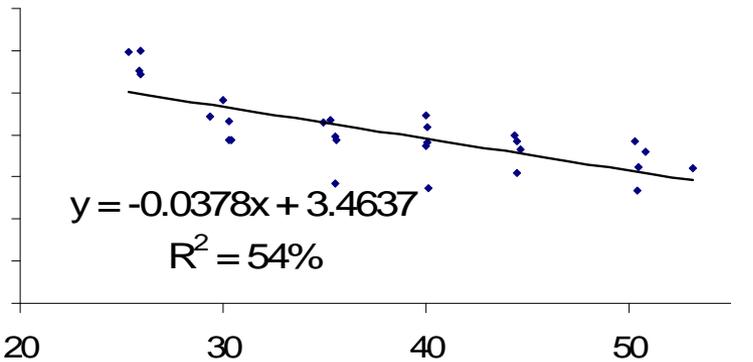
BTM 30- 49 mm TL



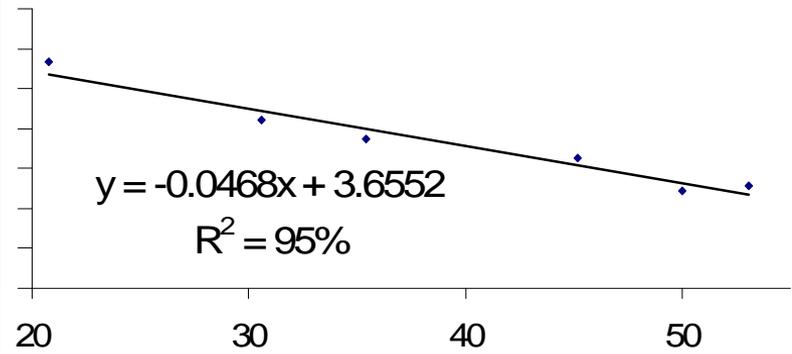
BTM 60+ mm TL



BTM 50-59.9 mm TL



Top mosquitofish



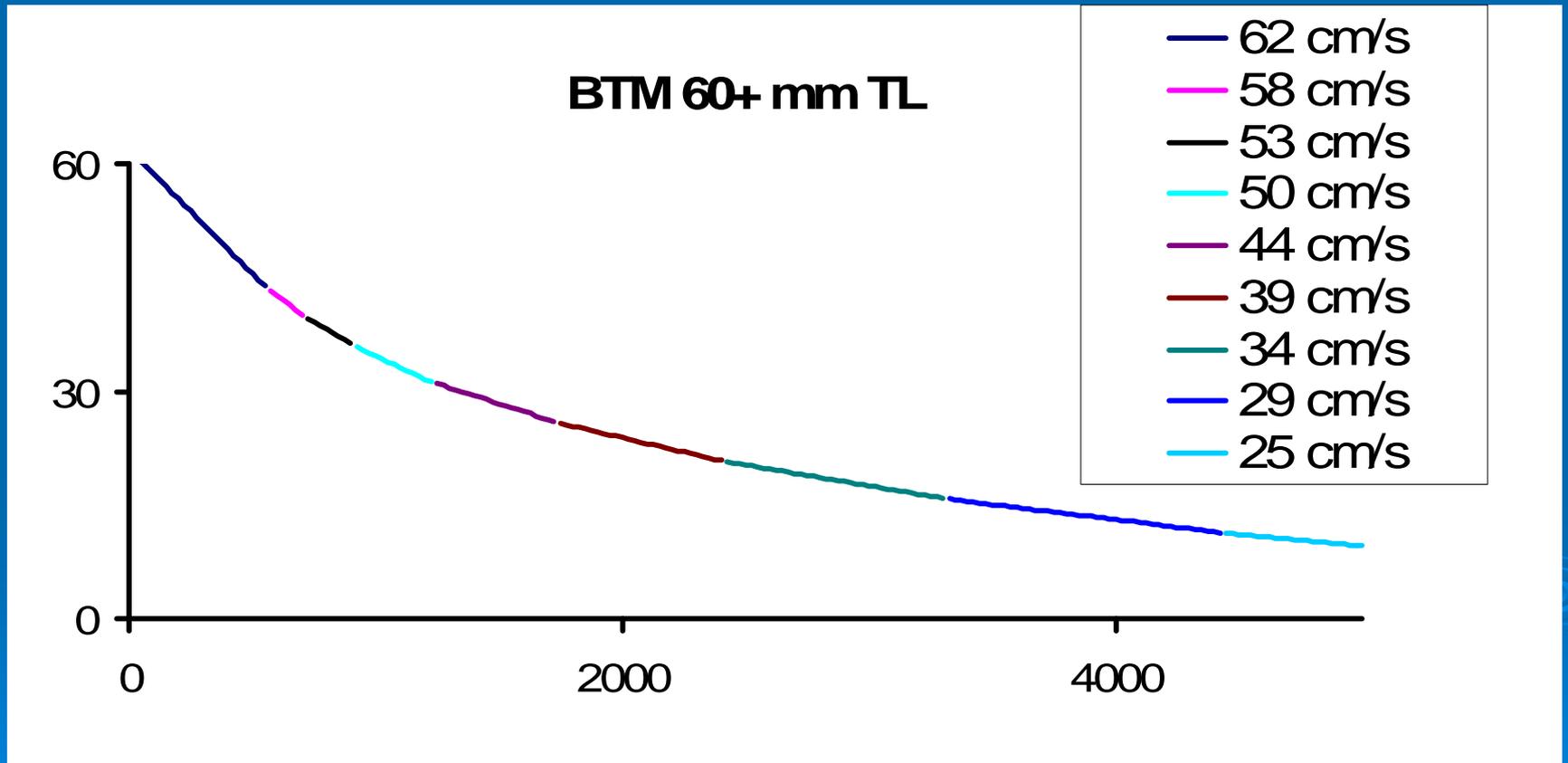
Test Velocity (cm/s)

$$V_f = V_s - (L/E_{vs})$$

- Predicts maximum passable water velocity
- V_s = test velocity
- E_{vs} = endurance at V_s
- L = barrier length

Maximum Passable Velocity Curve

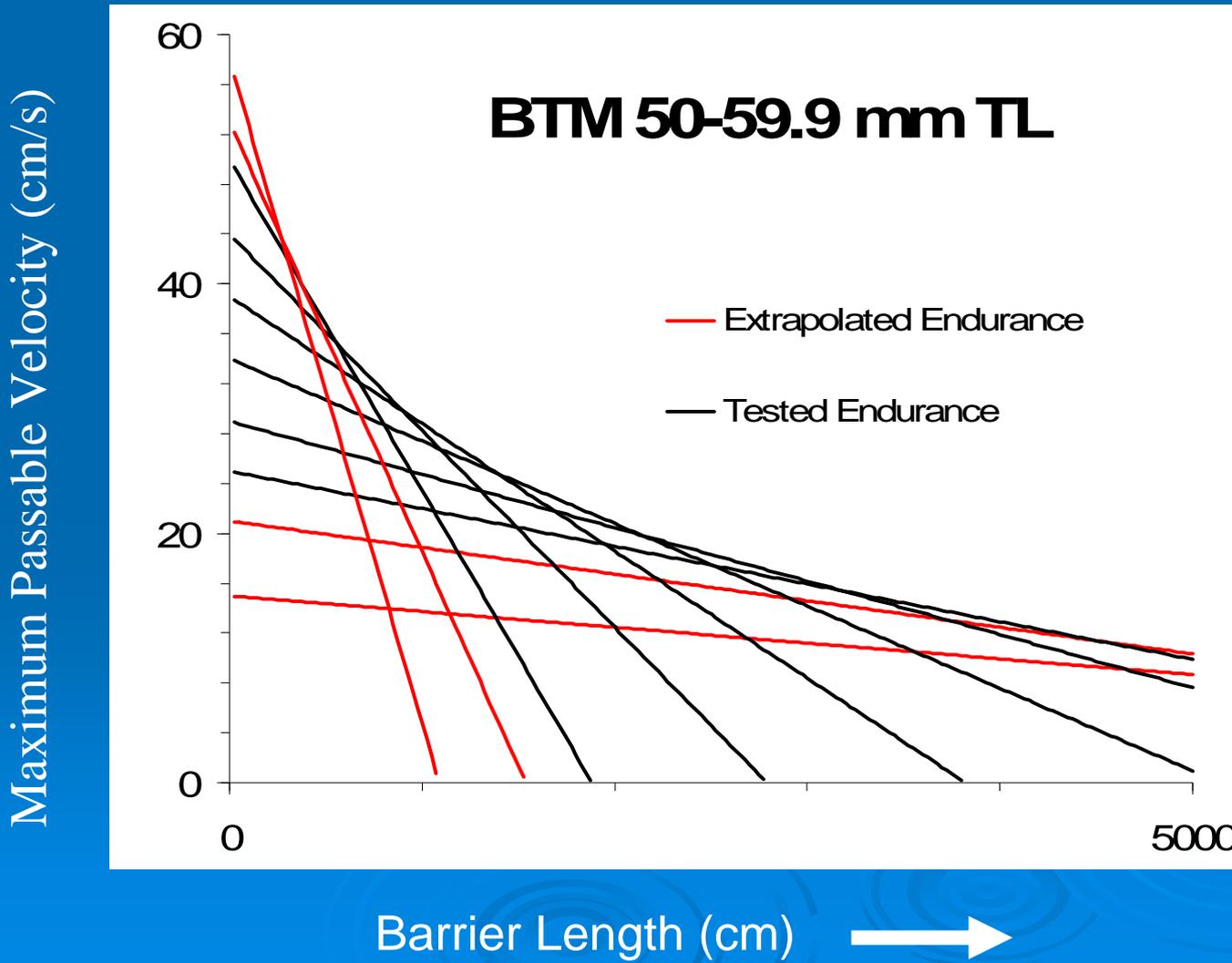
Maximum Passable Velocity (cm/s)



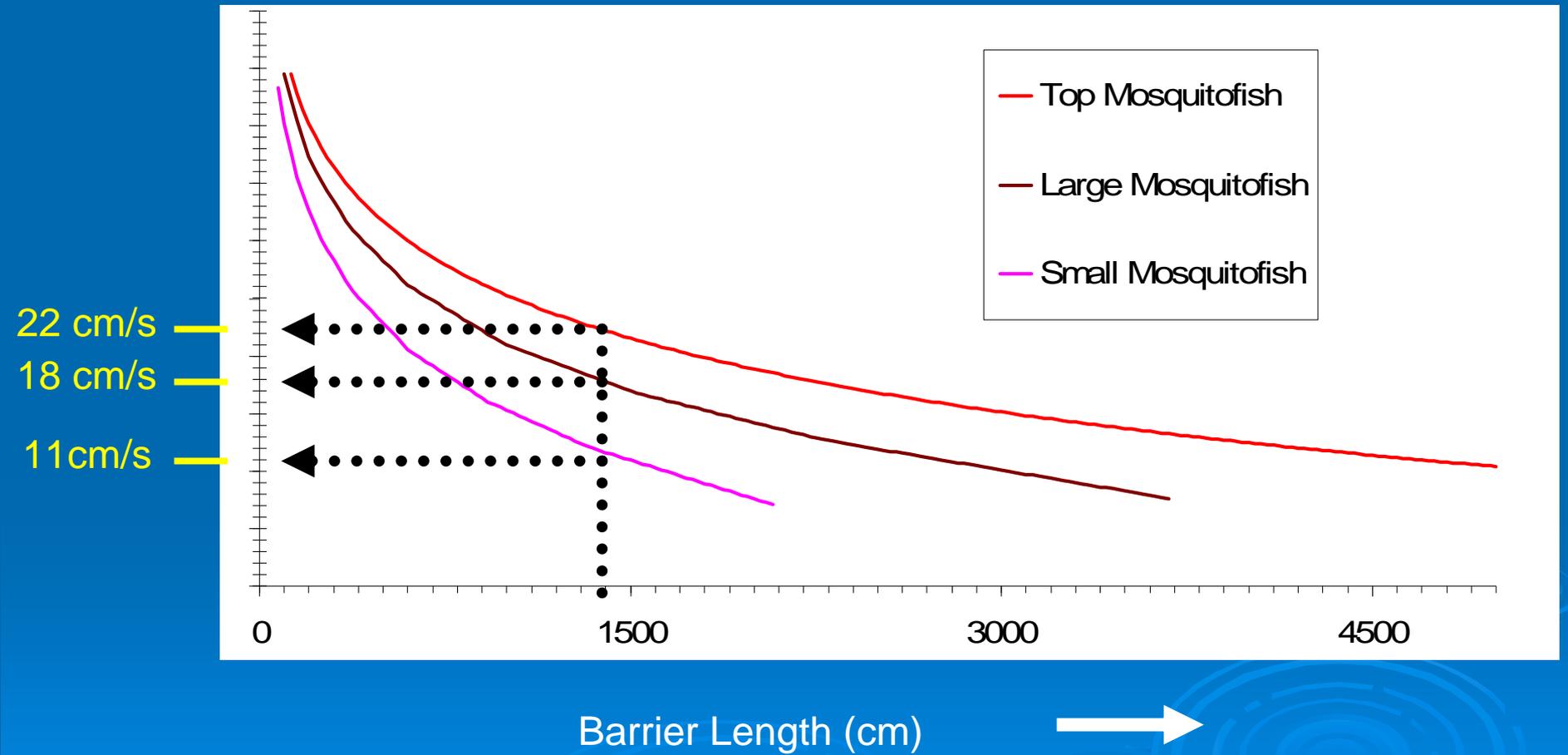
Barrier Length (cm)



Maximum Passable Velocity Curve

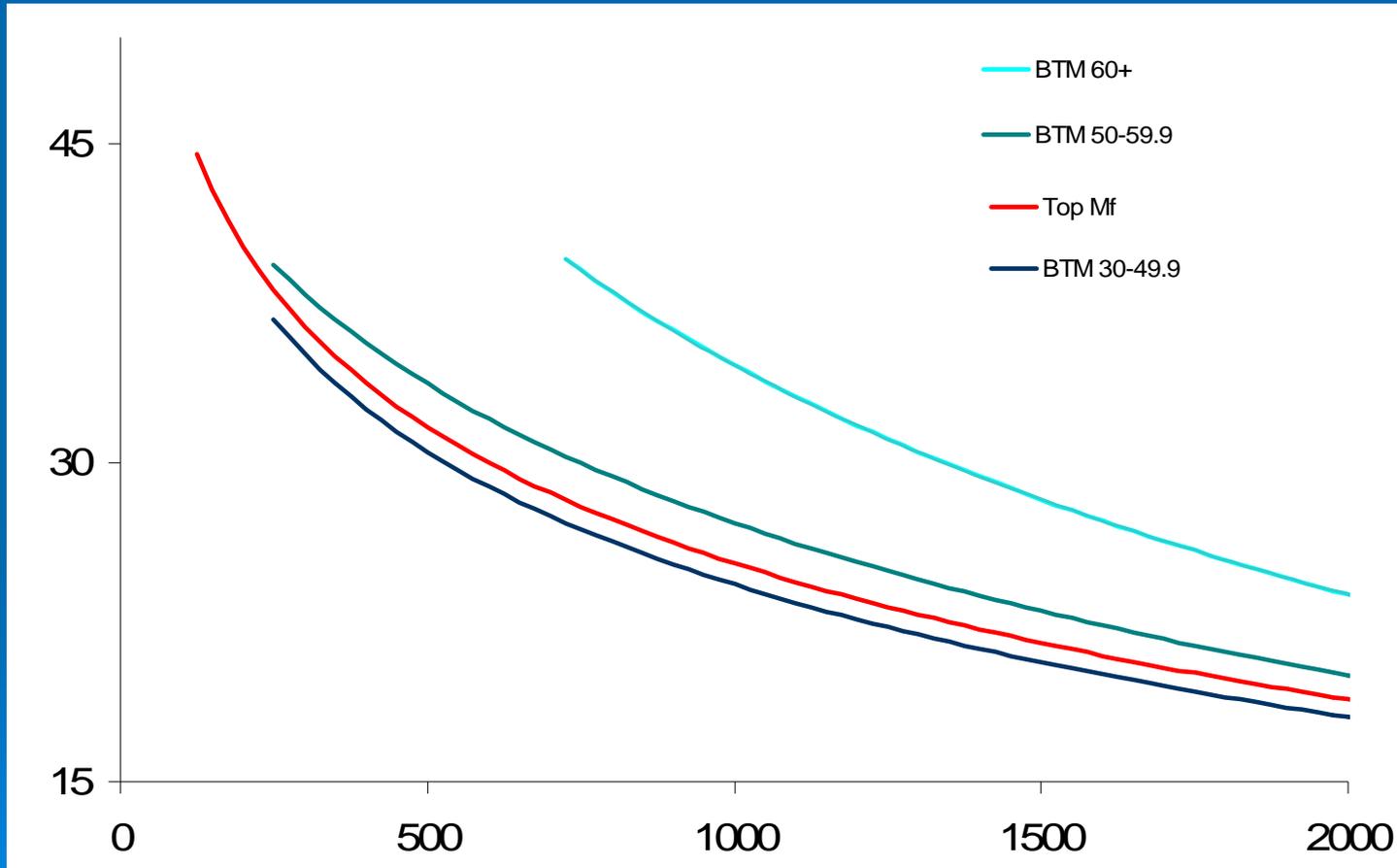


MPV Curve for Mosquitofish



Species Comparison

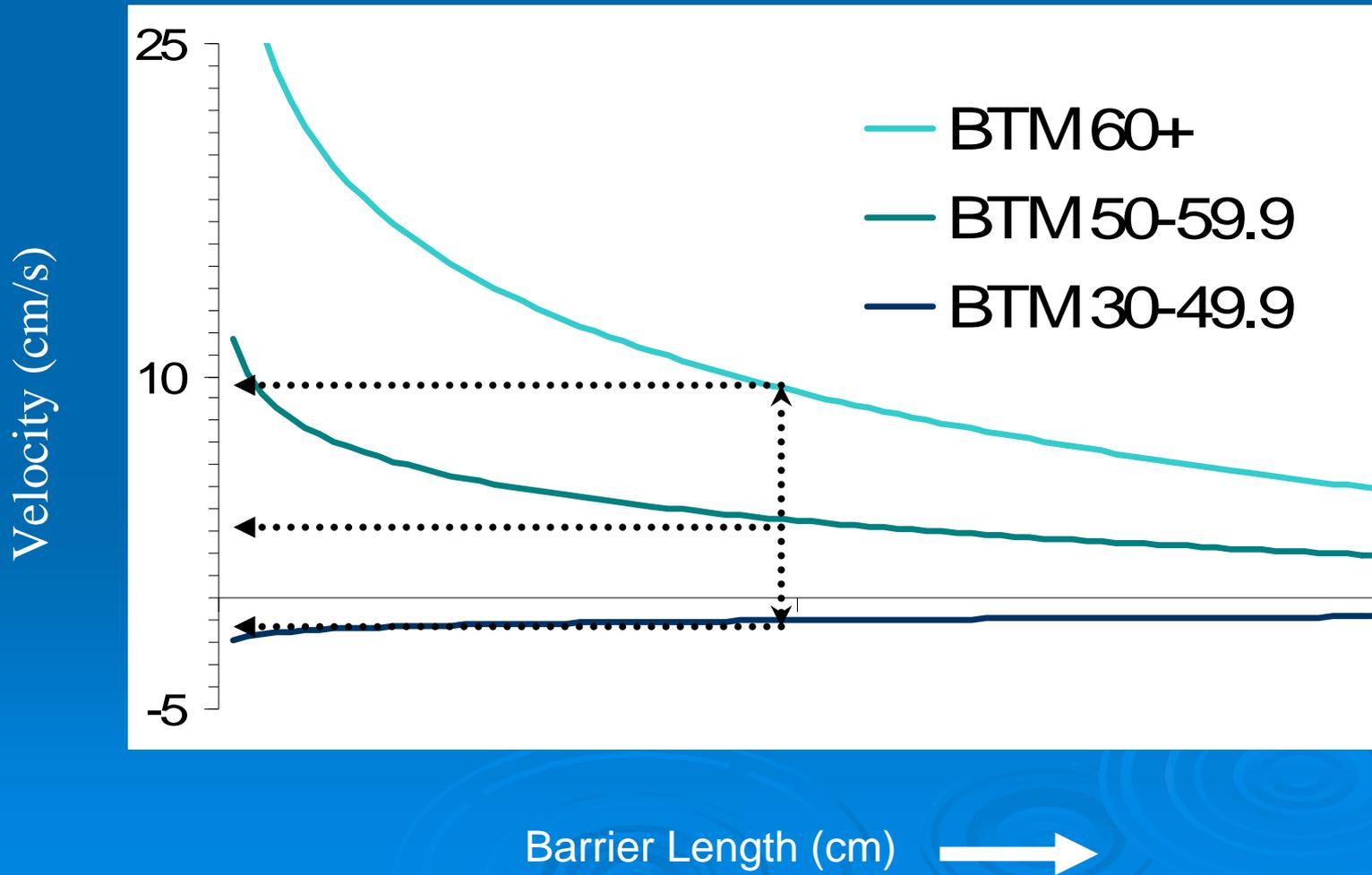
Maximum Passable Velocity (cm/s)



Barrier Length (cm)



Differences among BTM size classes and top mosquitofish

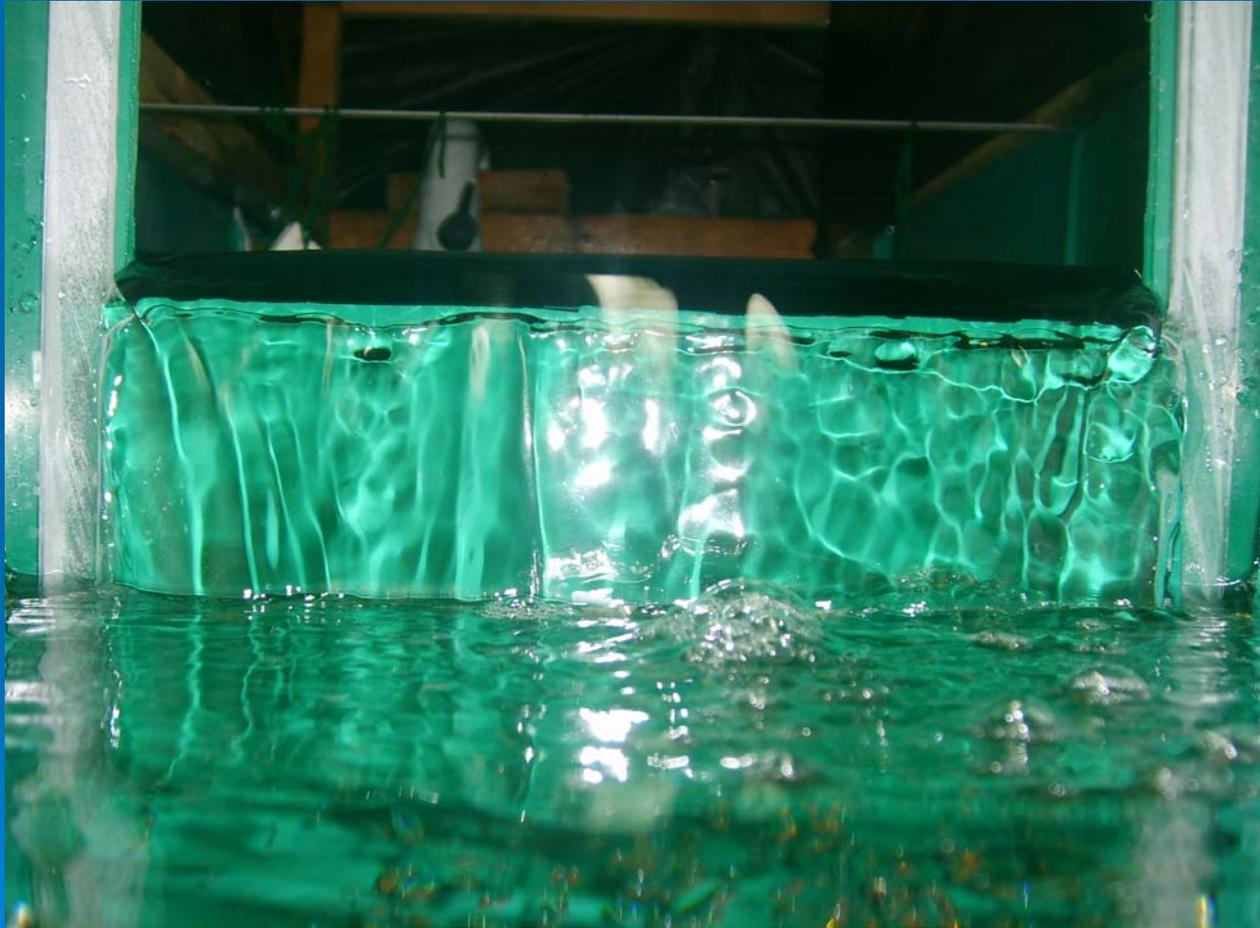


Applications

- Test models in lab
- Design parameters of permeable barrier
- Predict movement through road culverts
- Identify culverts that prevent mosquitofish movement



Jumping Study



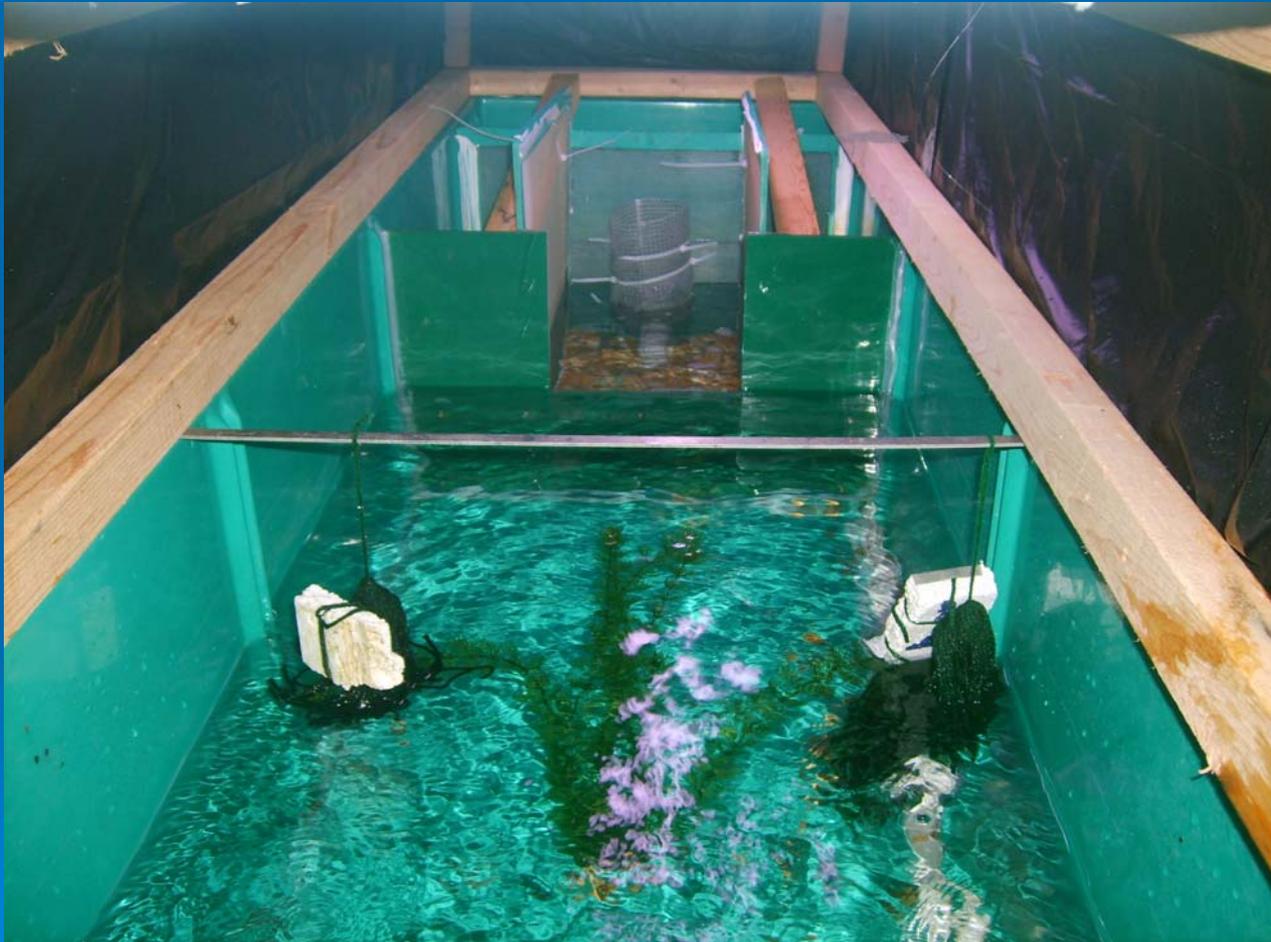
The Numbers

- Six jumping heights: 3, 4, 5, 7, 9, 11 cm
 - 30 fish tested at each height
 - Three day trials
 - Species evaluated separately
- 
- The background of the slide features several concentric, light blue circular ripples that resemble water droplets hitting a surface, scattered across the lower half of the frame.

Below the fall



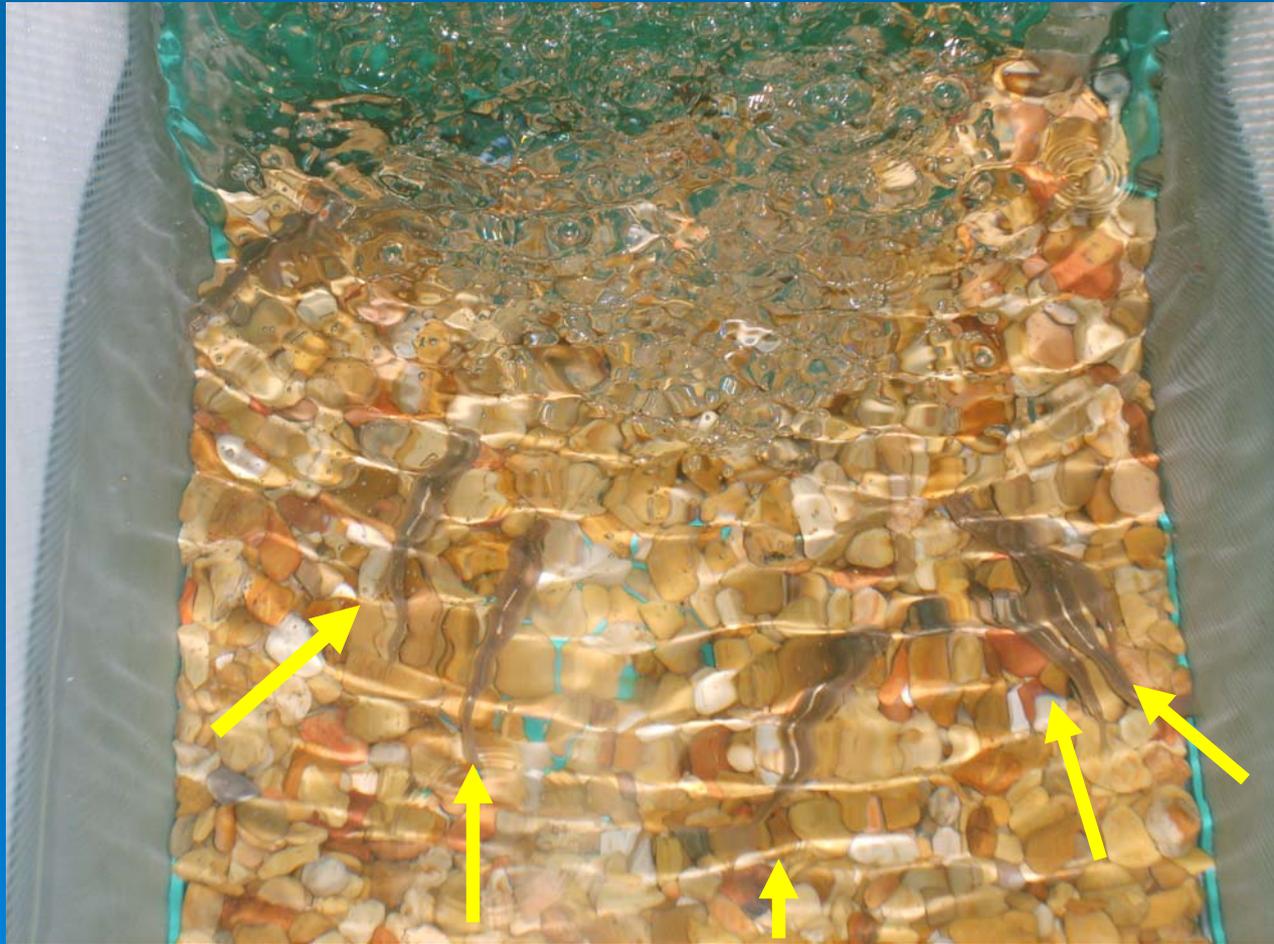
Above the Fall



Water Fall: 11 cm



Contemplating a jump?



Acknowledgements

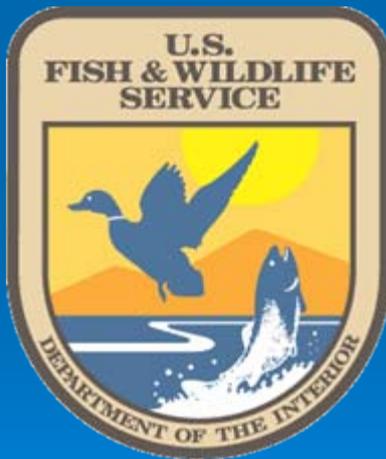


Photo credit: Geoff Call, USFWS (Cookeville FO)

Questions?

