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Fish Passage Studies IV: Horizontal and Vertical Screens: Efficacy in Guiding Fish Schools

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Horizontal & vertical screens: efficacy in guiding fish schools

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ICER

International Centre for Ecohydraulics Research



Outline

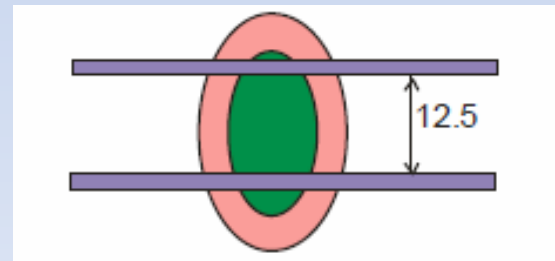
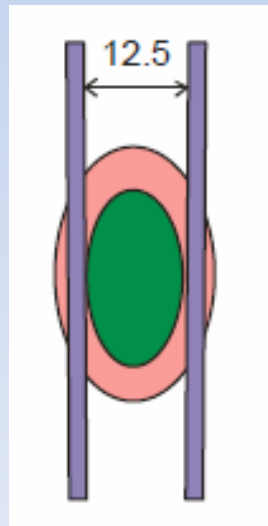
- Background
- Aim and objectives
- Methodology
- Results
- Conclusions

Background

- Variety of screening devices to block DS fish from entering harmful areas / guide them to safe bypass.
 - Behavioural / mechanical
 - Local changes in hydraulics (e.g., turbulent high flows)
 - Possible delay etc.
- Traditionally, bar racks/ trash racks/ wedge-wire screens have vertically oriented bars

Background

- It can be hypothesized that horizontal orientation of bars can be more effective:
 1. Aspect ratio of most fish implies that they are blocked earlier by horizontal bars
 2. Fish are better able to free themselves when impinged

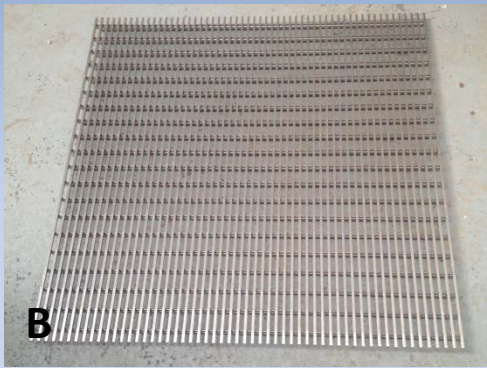
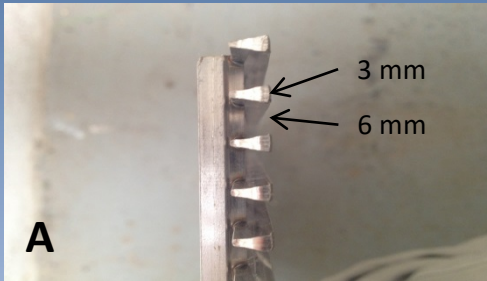


Aim & objectives

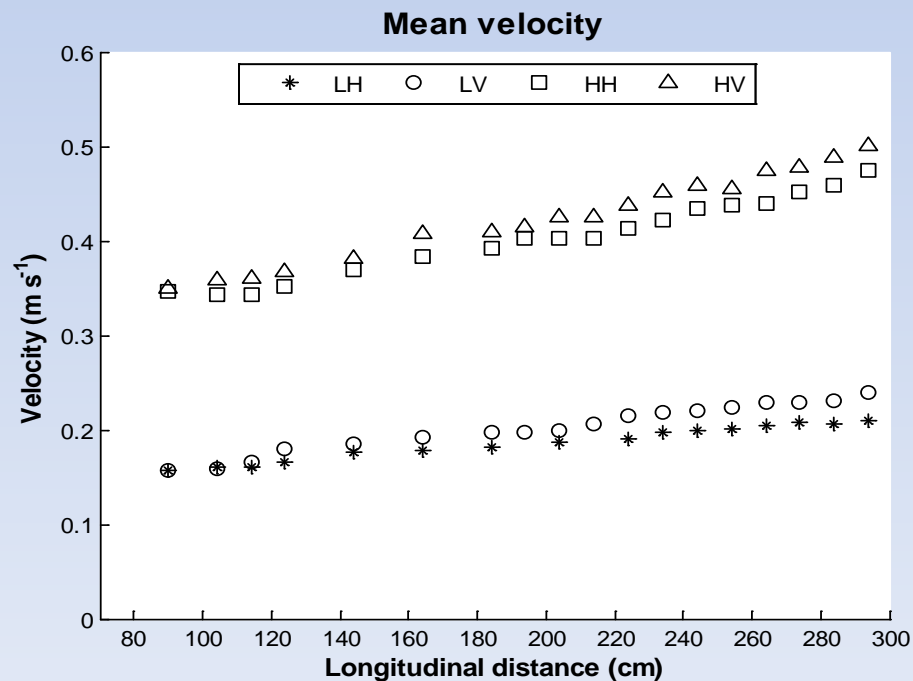
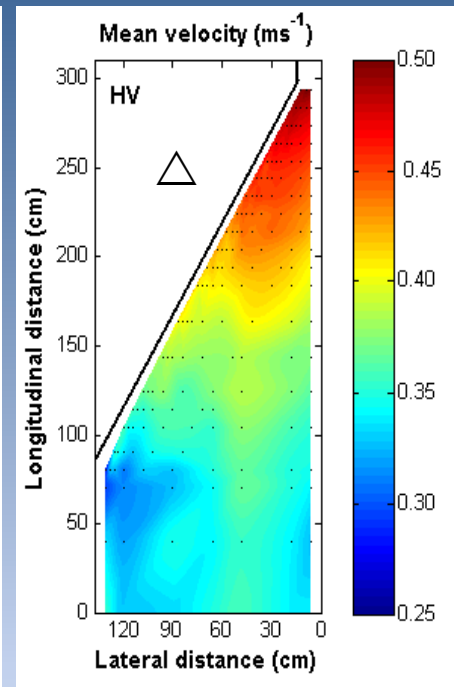
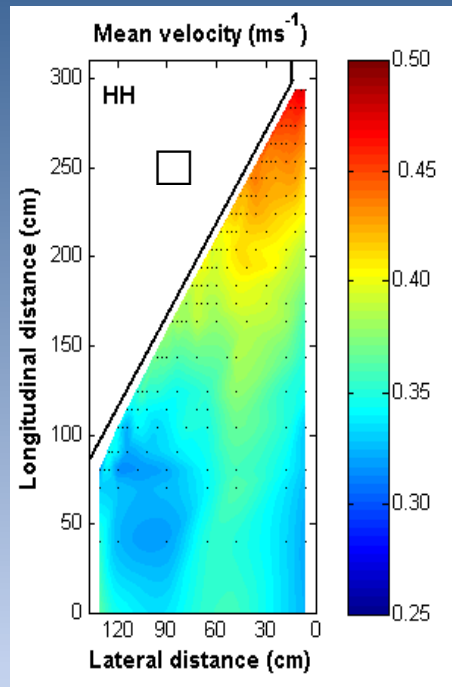
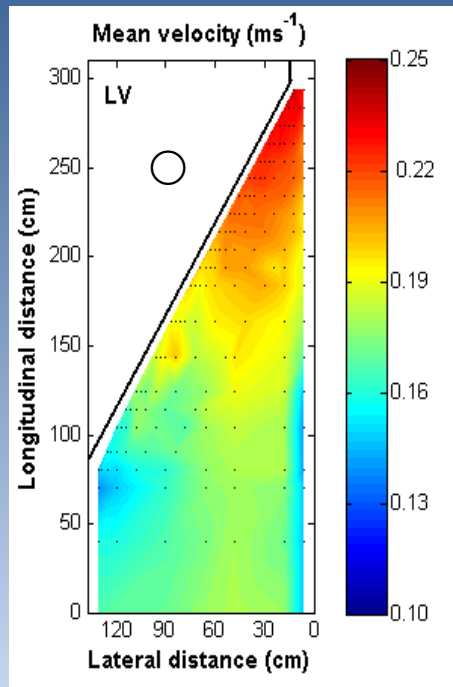
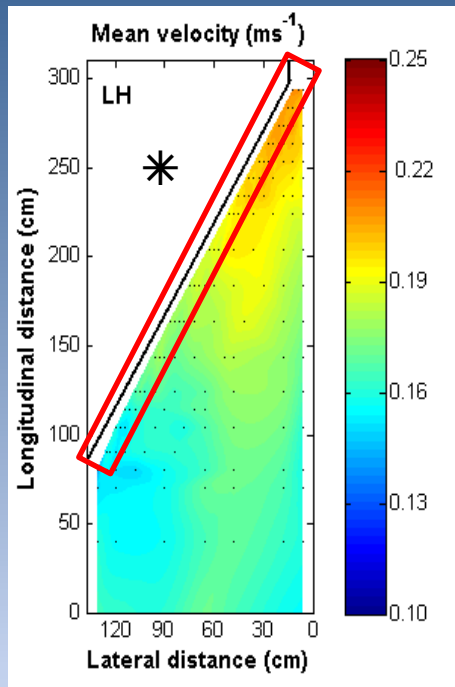
Investigate effect of wedge-wire screens (horz. & vert.) on behaviour and passage of fish schools

1. Determine hydraulic differences between screens for different flows
2. Determine behavioural response to screens
3. Link hydraulics and behaviour to provide insight into efficiency of screens

Methodology



- 30° angle to the flow
- Low ($U_a \sim 17$ cm/s) and High ($U_a \sim 35$ cm/s) discharge
- ADV measurements above channel floor
- 5 chub (*Squalius cephalus*) released per 2hr trial & record DS movements



Gradient along screen

($\text{cm s}^{-1} \text{m}^{-1}$)

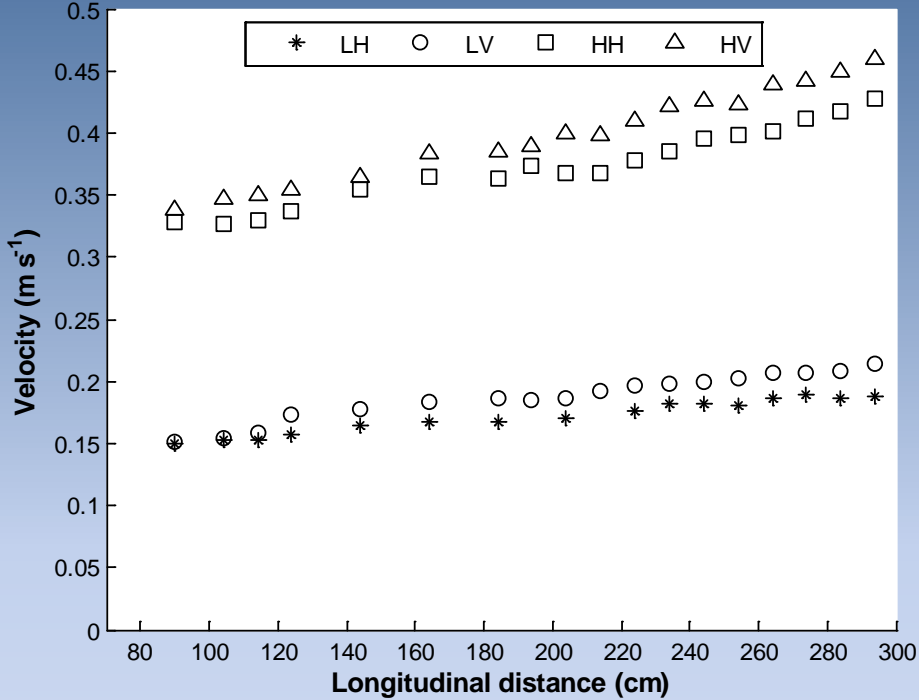
LH: 1.6

LV: 2.4

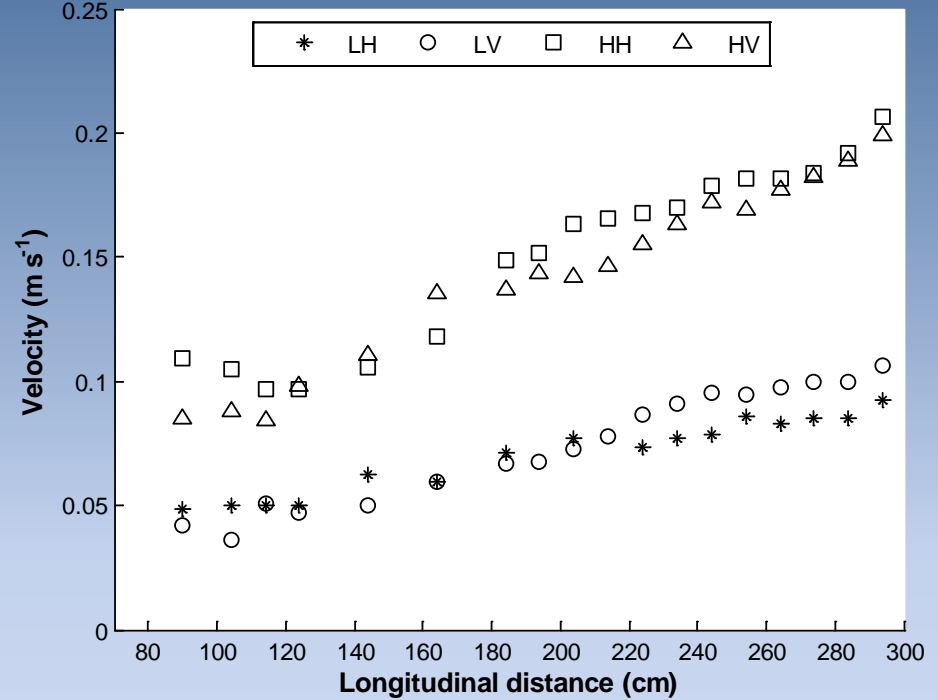
HH: 5.2

HV: 6.0

Cross-sweeping velocity



Escape velocity

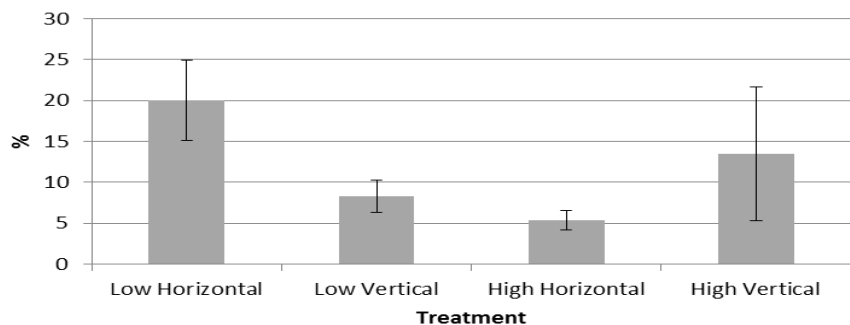


- Both cross-sweeping and escape velocity increase toward bypass
- Horizontal screens generally lower components compared to vertical screens

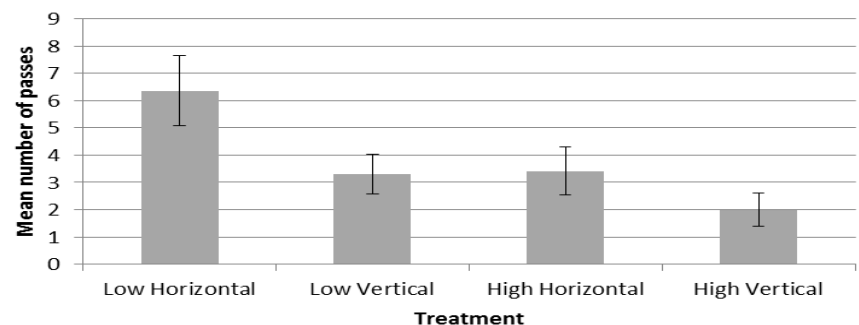
Behavioural results

- School cohesion was weak
 - Both approaches and passage for different group sizes
- Passage success > 80%
- Screen passage efficiency:
 - Total number of fish that passed along the screen as percentage of number of approaches at the screen, per replicate
- Number of fish that passed along the screen

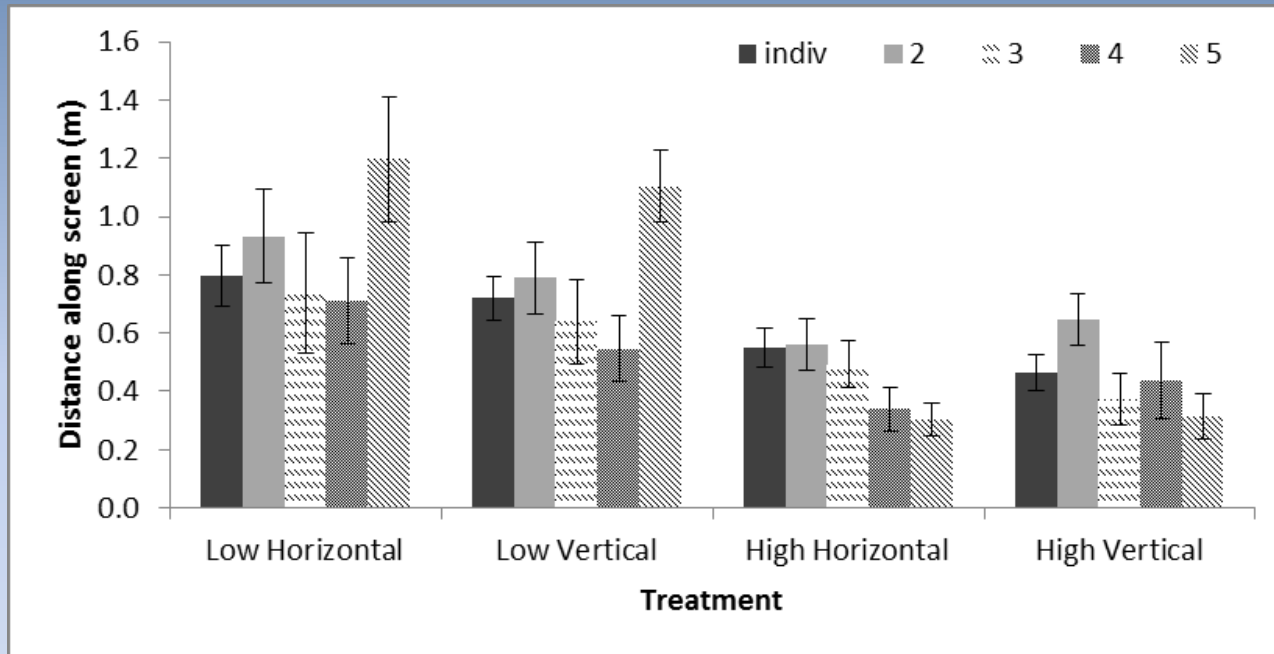
Screen passage efficiency



Screen passed fish



- Distance travelled before upstream retreat



Conclusions

- Vertical screens divert more water --> higher flow gradient towards bypass
- Horizontal screens must have lower head losses
 - useful from HP perspective
- Both flow and screen affect passage efficiency
- Horizontal screens see more passed fish
- Distance along screen influenced by discharge
- **Horizontal screens offer benefits for guiding fish!**

Thank you

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