

A juvenile lamprey is shown swimming in clear water over a rocky riverbed. The lamprey has a long, slender, brownish body with a lighter, translucent underbelly. Its head is pointed towards the right, and its eye is visible. The background consists of large, smooth, light-colored rocks.

Impact of Irrigation Diversion Screens on Juvenile Lamprey in the Columbia River Basin

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Background

- Water diversions common, but can harm fish populations
- Fish screens are for protection, yet injury and mortality still occur
- Screen criteria developed for salmonids
- Many other fishes may be vulnerable to screens
 - Delta smelt
 - Anguilliformes

Pacific Lamprey



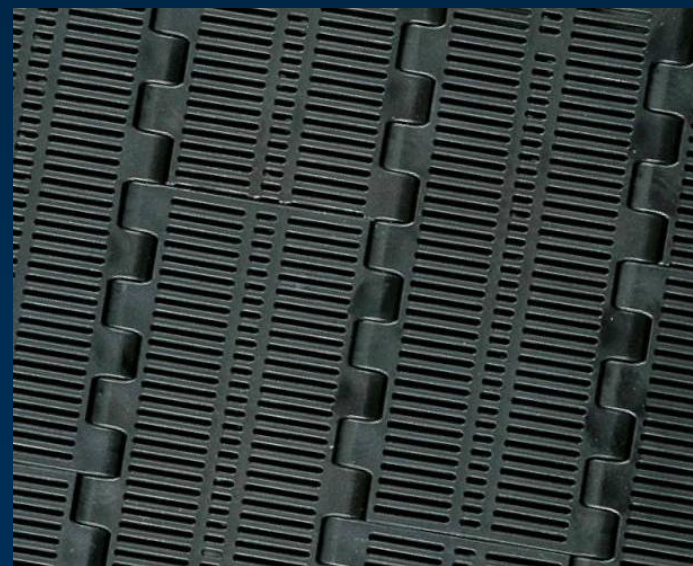
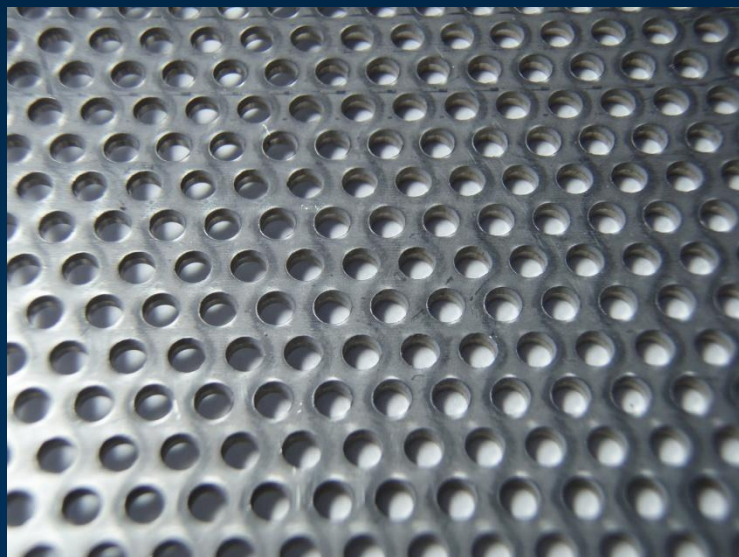
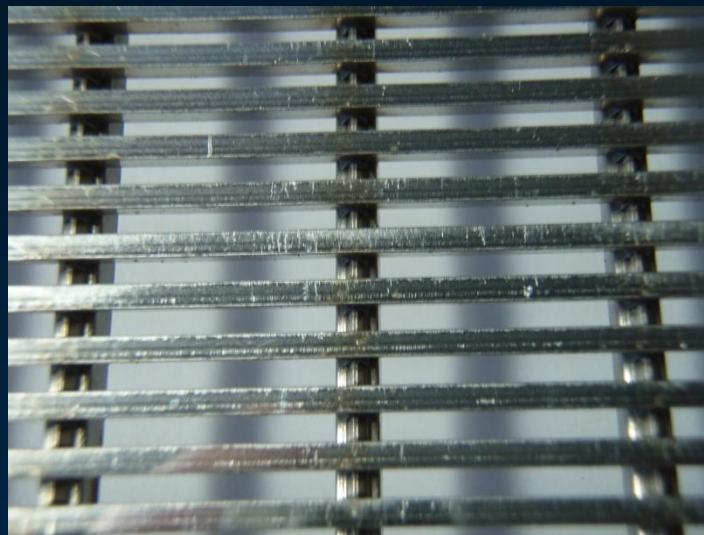
- Populations declining
- Vulnerable at screens
 - Prolonged larval life
 - Poor swimmers
 - Elongated body
- No criteria for protection

Goal & objective

- Develop criteria for design and operation of fish screens that minimize injury and mortality to lamprey
- Test performance of 5 screen face materials for protecting larval lamprey

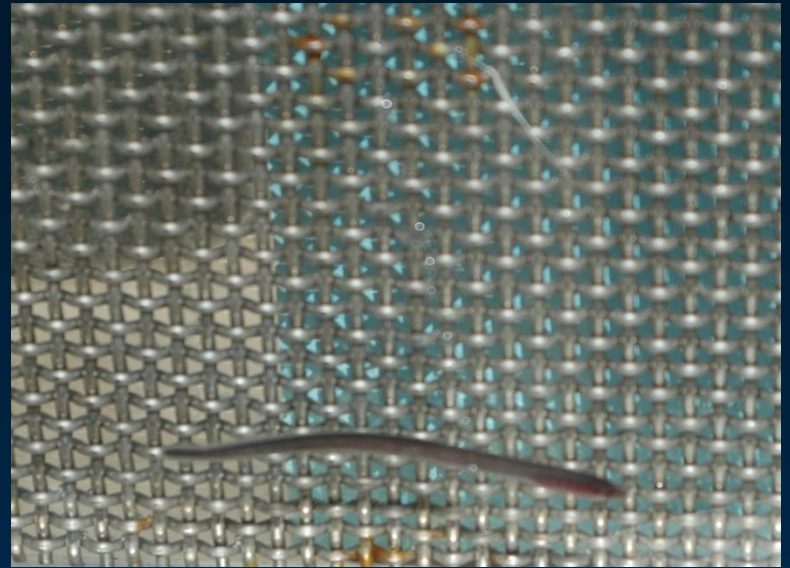
Screen types

- 3 NOAA compliant screens
 - Profile bar (1.75 mm)
 - Interlock (1.7 mm)
 - Perforated plate (2.4 mm)



Screen types

- 2 “non compliant” screens
 - 12 & 14 ga woven wire cloth (4–5 mm)

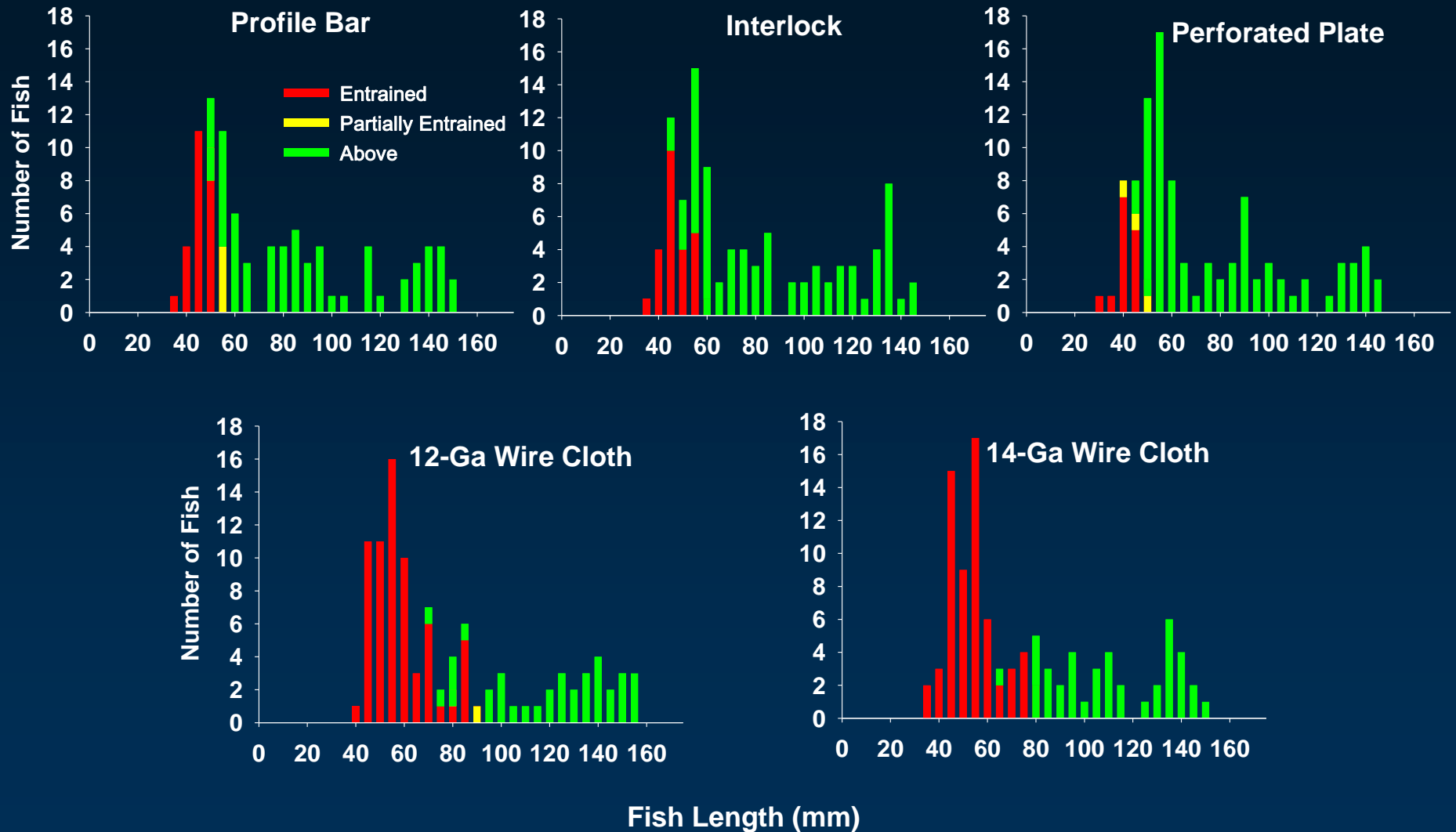


Methods

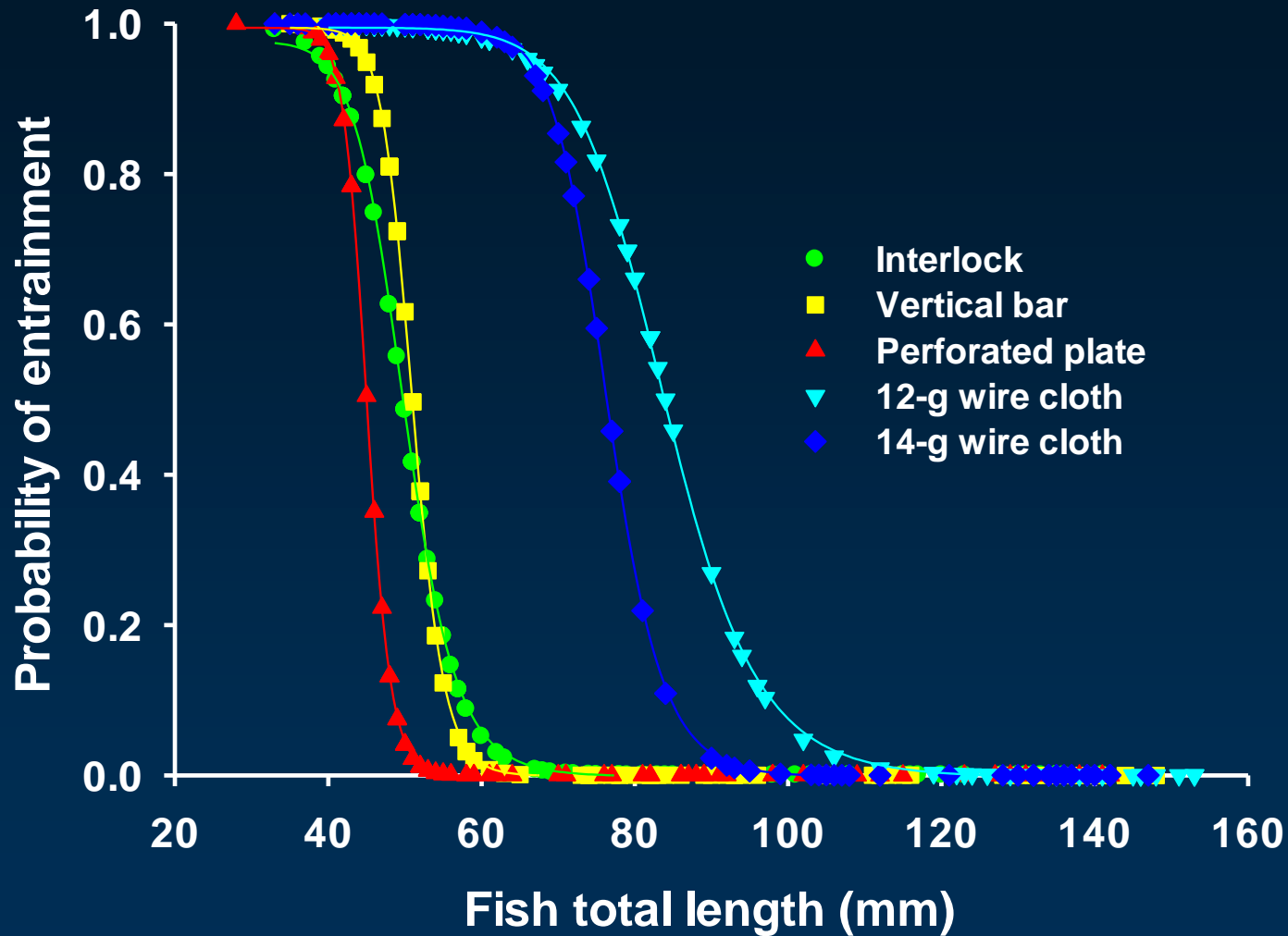
- 5 size classes (mean TL= 40, 50, 60, 100, 130 mm)
- 2 releases per size class
- 6–13 fish per release
- 1 h test at 12 cm/s AV
- Evaluated
 - Sizes of fish entrained
 - Timing of entrainment and impingement
 - Injury and delayed mortality relative to control
- Worse case scenario



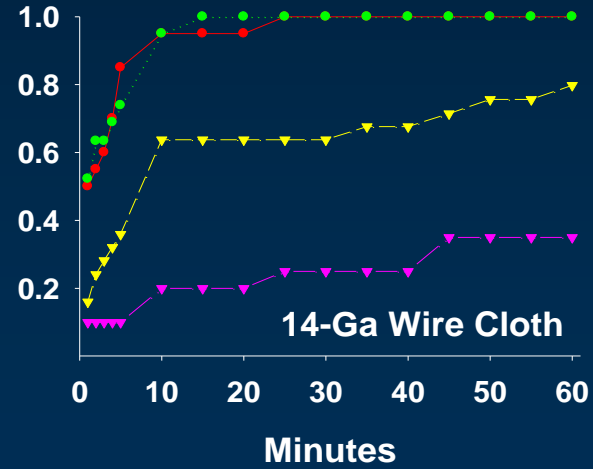
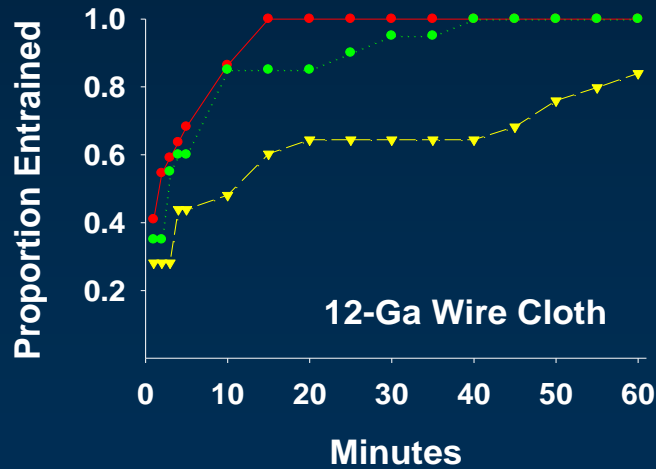
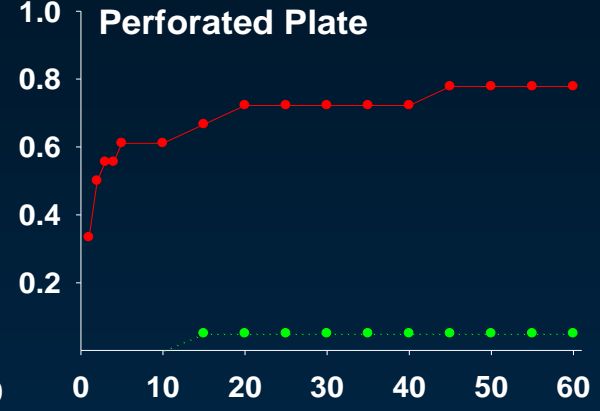
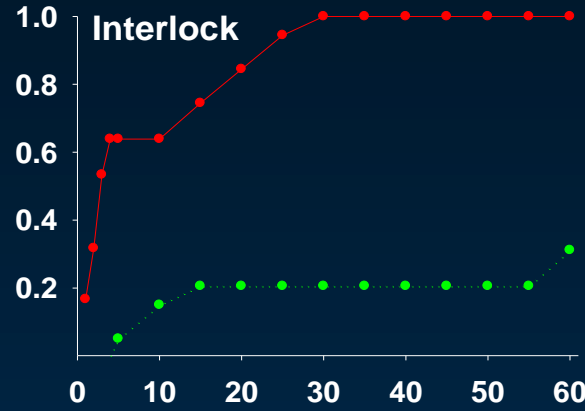
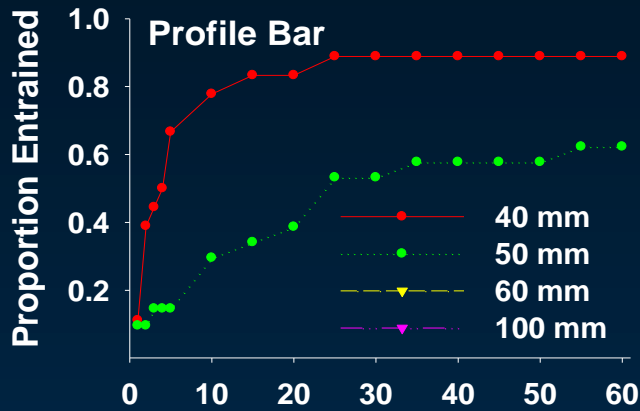
No. of fish entrained



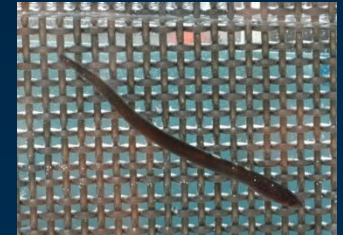
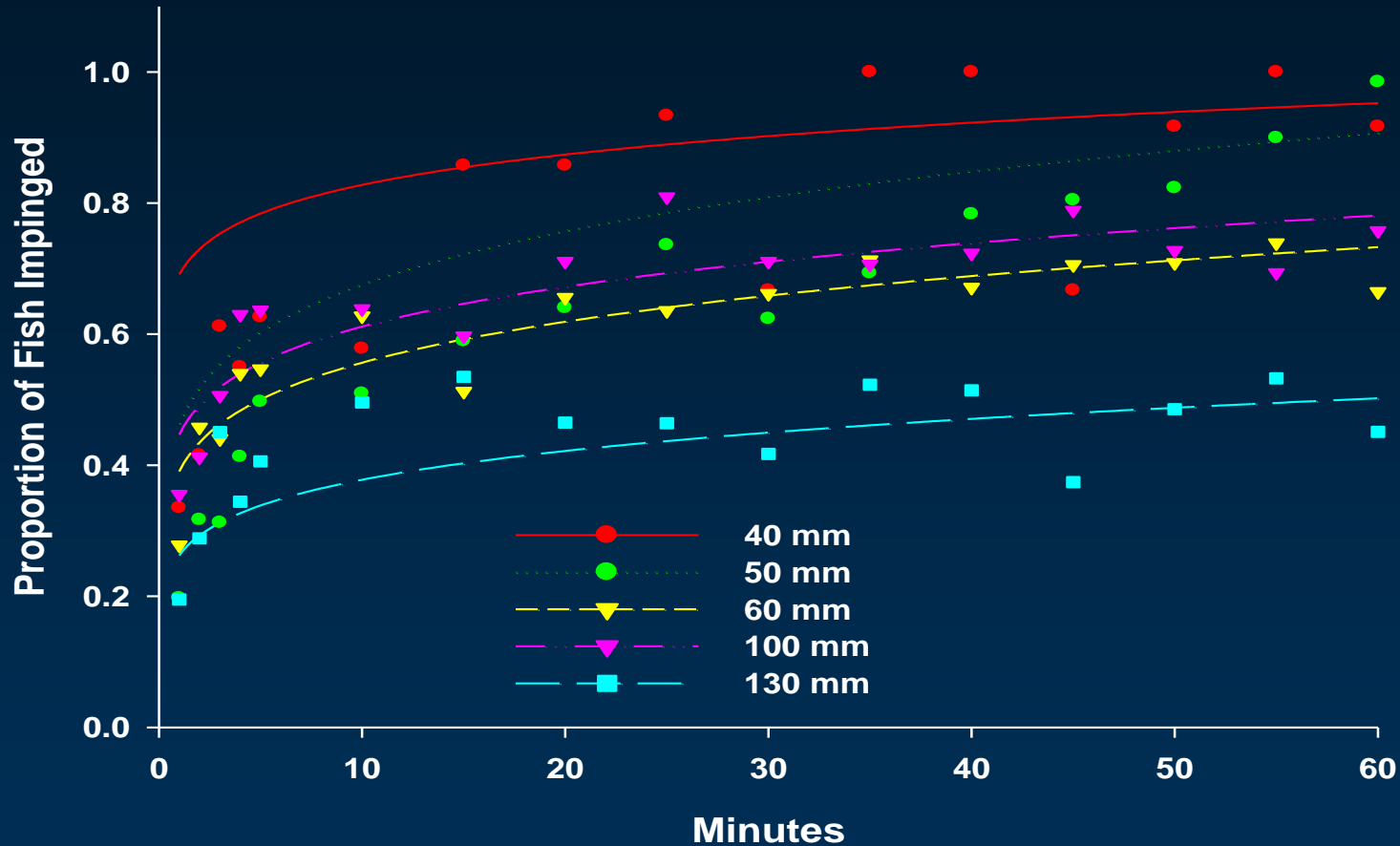
Probability of entrainment



% of fish entrained



% impingement



Fish injury

- Severe injuries rare
- Most were minor abrasions to the skin and caudal fin
 - 2–13% for all fish
 - 0–9% for those above the screen
 - 5% for control fish
- Injuries more common in smaller fish
- Higher for screens that offered the best protection against entrainment



Summary

- Screen panels offered varying levels of protection for lamprey
- Fish < 46 mm entrained by all screen types
- Impingement common for all sizes of fish
- PP and IL performed the best
- Wire cloth screens performed the worst

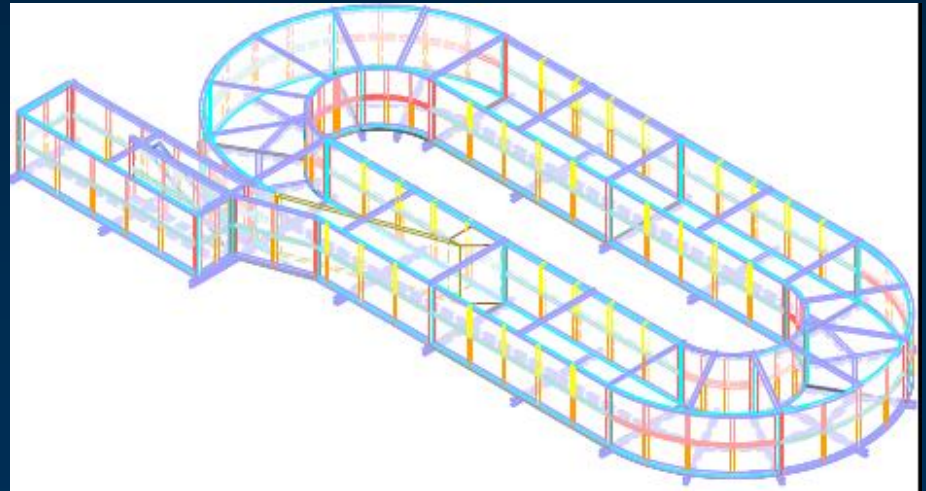
Recommendations

- Use PP or IL
- Replace wire cloth screens



Future research

- Screen hydraulics
 - SV and AV scenarios
- Screen design
 - Fixed plate vertical, rotary drum, etc.
 - Cleaning structures
- Test criteria at field sites



Acknowledgments

