Jun 20th, 3:00 PM - 3:15 PM

Pushing and Pulling I: Can Vibration or Electromagnetic Fields Guide Downstream Migrating Silver Eels?

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Presenter Information
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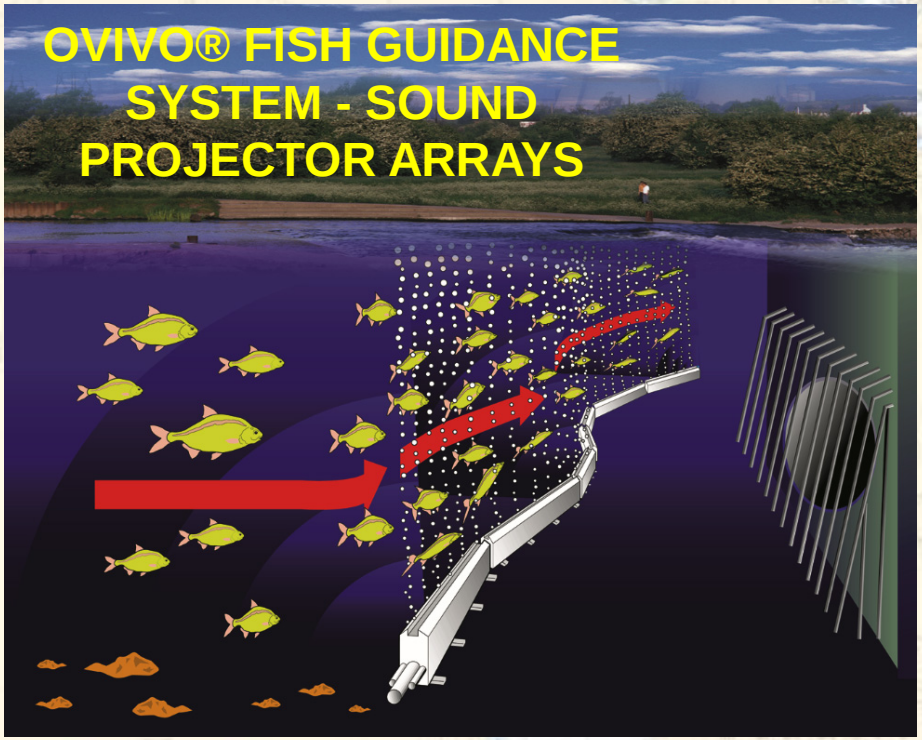
Challenge: Downstream Eel Passage on Large Rivers

- Eel Passage Research Center: a collaboration of hydro utilities and government agencies
- Research techniques that can be used to guide and collect silver eels for transportation and release downstream of the hydro projects

Vibration and Electromagnetic Fields



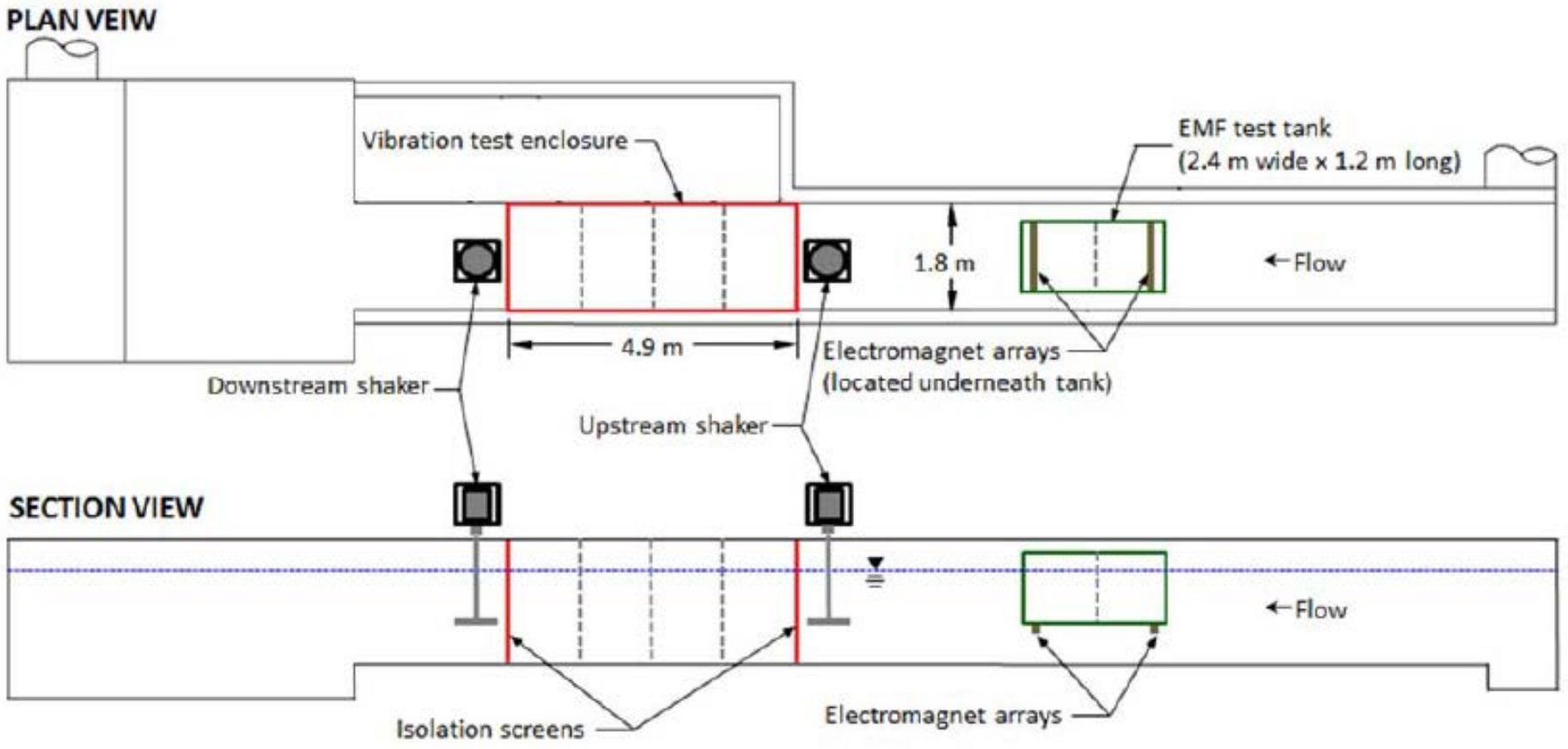
- Infrasound (vibration) has been successfully used to repel European eels in lab and field (Sand et al. 2001)
- Eels are sensitive to EMF changes, but we unsure about EMF's ability to repel eels

Research Objectives

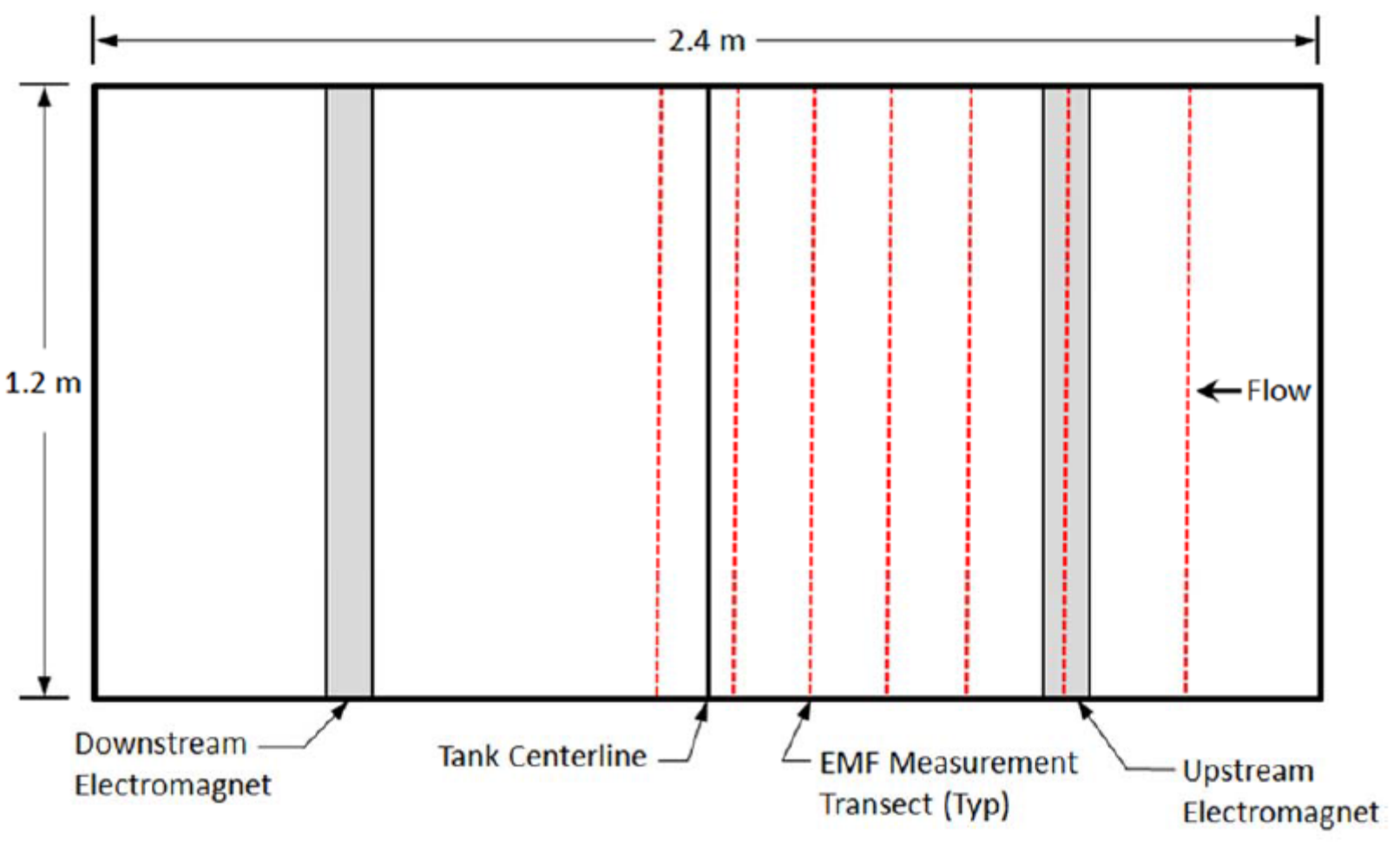
- We tested the response of silver American eels to vibration and EMF to determine if either stimulus could elicit directional avoidance behaviors that could be used to guide eels

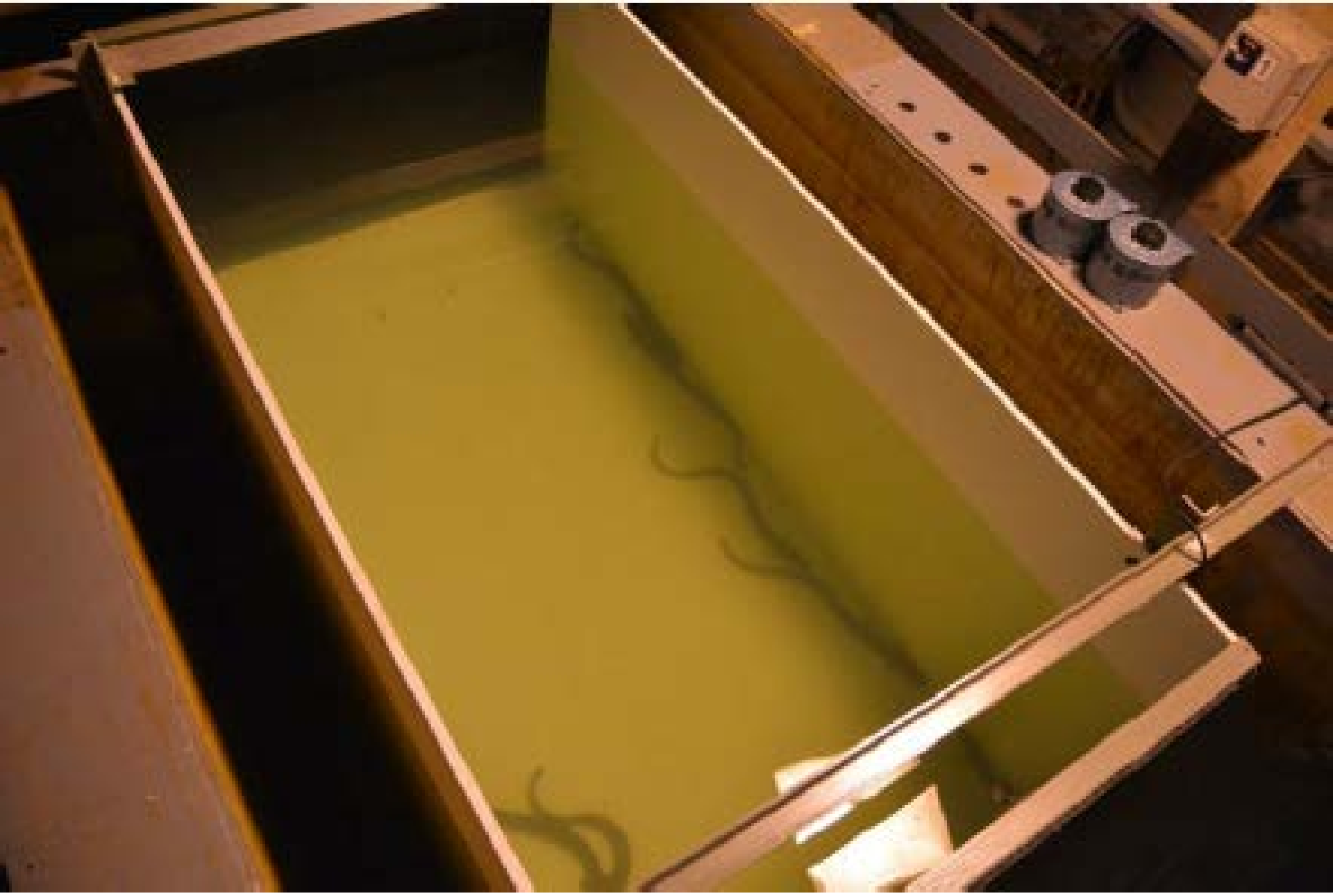
Methods

- Tested in Alden's small flume testing facility under low flow (2.8 m^3/s)

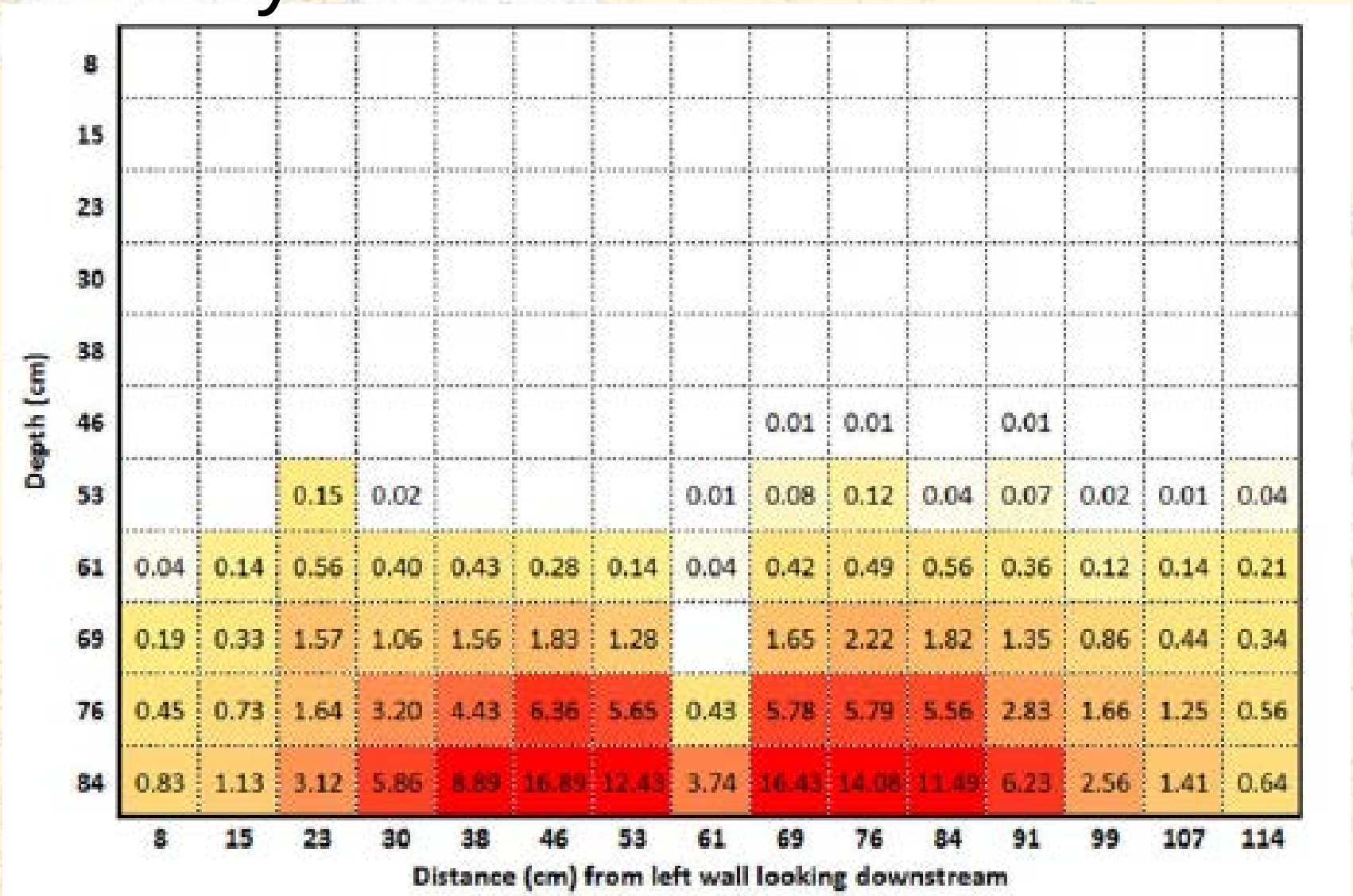


EMF test enclosure

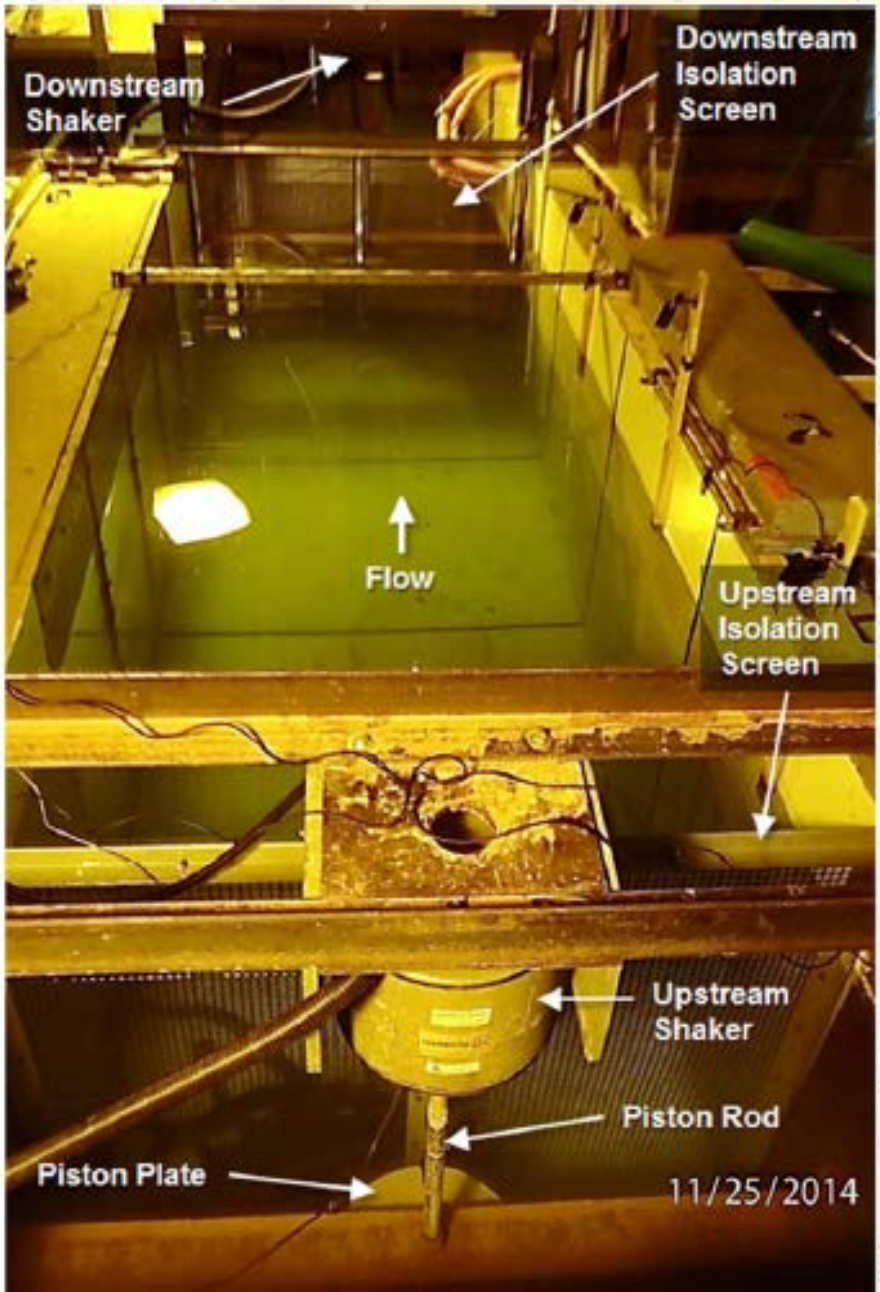




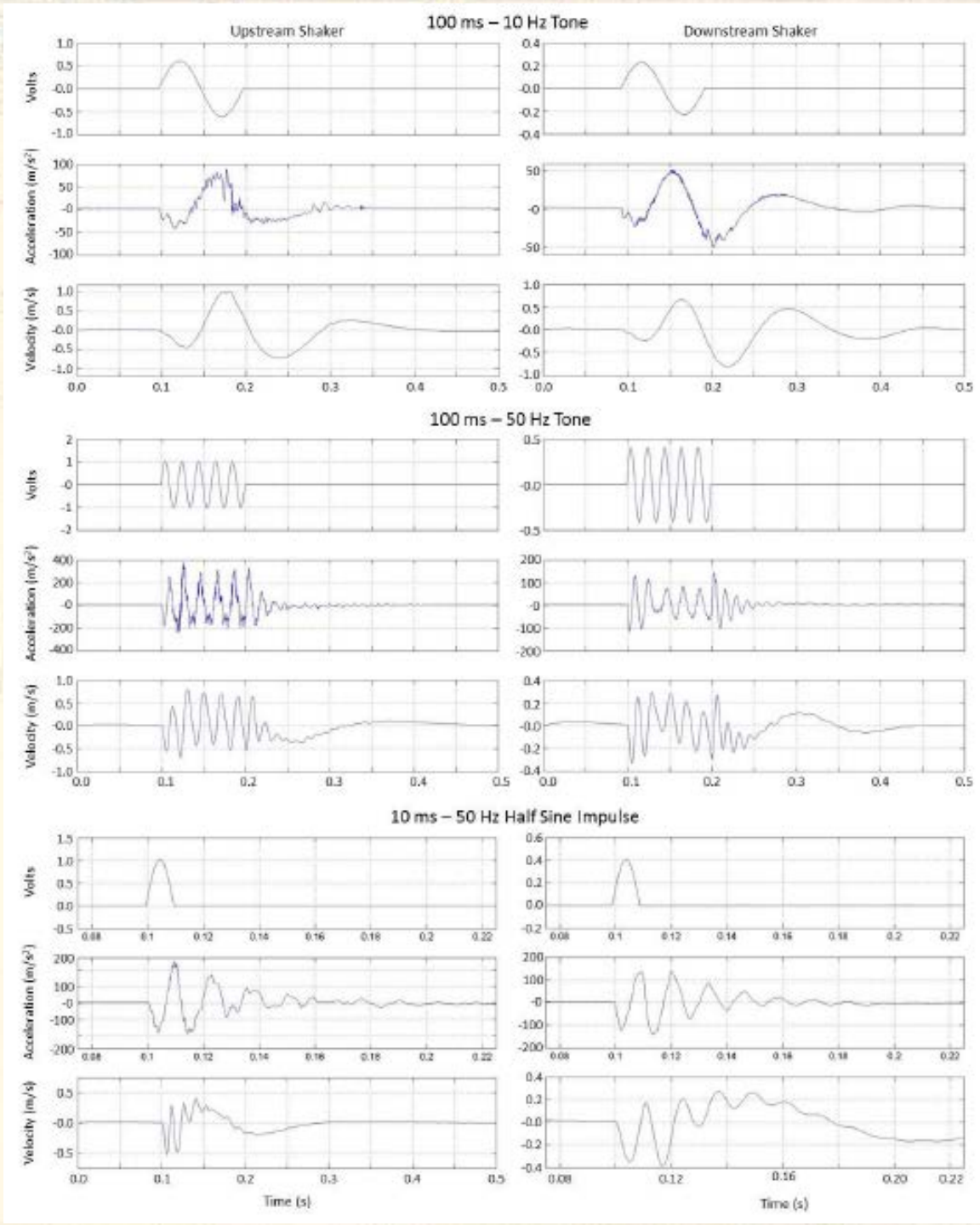
- EMF measurement (Gs) 15 cm away from source



Vibration test enclosure




Flow
Piston Rod
Piston Plate
Upstream Isolation Screen

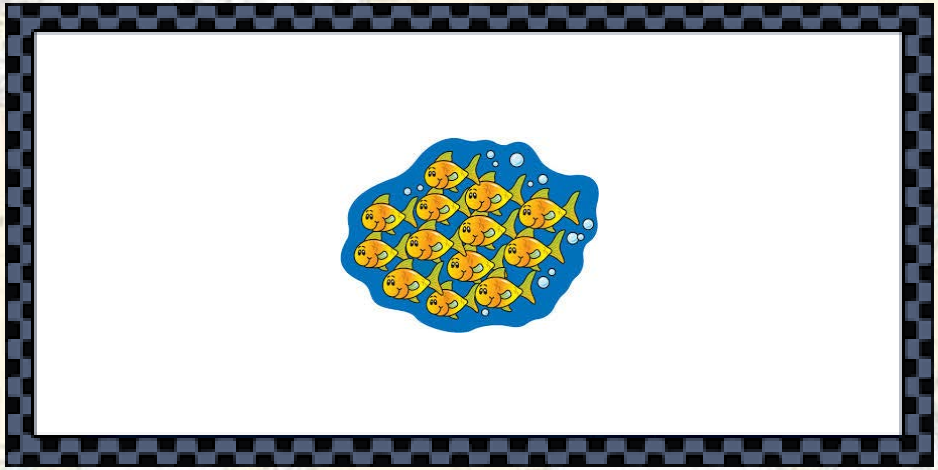


- Three vibration signals were selected to test:
  1. 100 ms, 10 Hz tone burst;
  2. 100 ms, 50 Hz tone burst
  3. 10 ms, 50 Hz half sign impulse

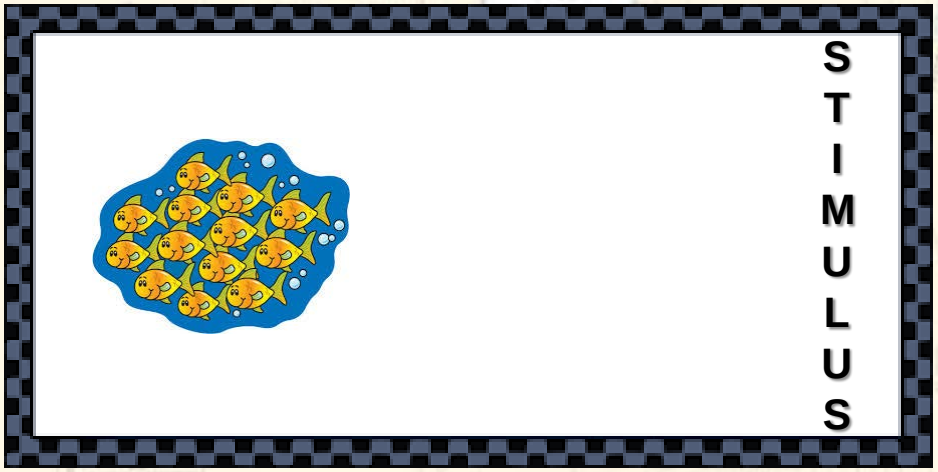
Methods Continued…

- Trials conducted at night and lasted one hour (20 min pre-exposure, exposure, and post-exposure observation periods)
- Vibration tests used 15 eels/trial, and there were three trials per stimulus
- EMF tests used 10 eels/trial over three trials
- Both tests also included three control trials

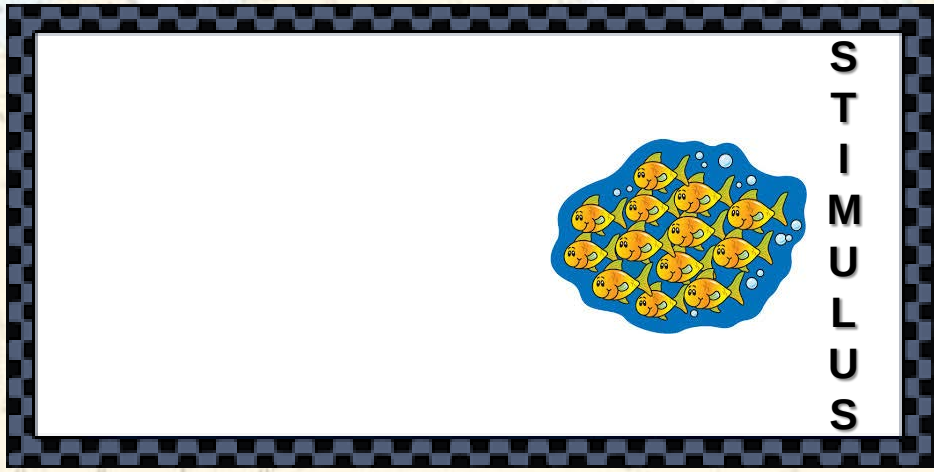
Center-of-School Approach



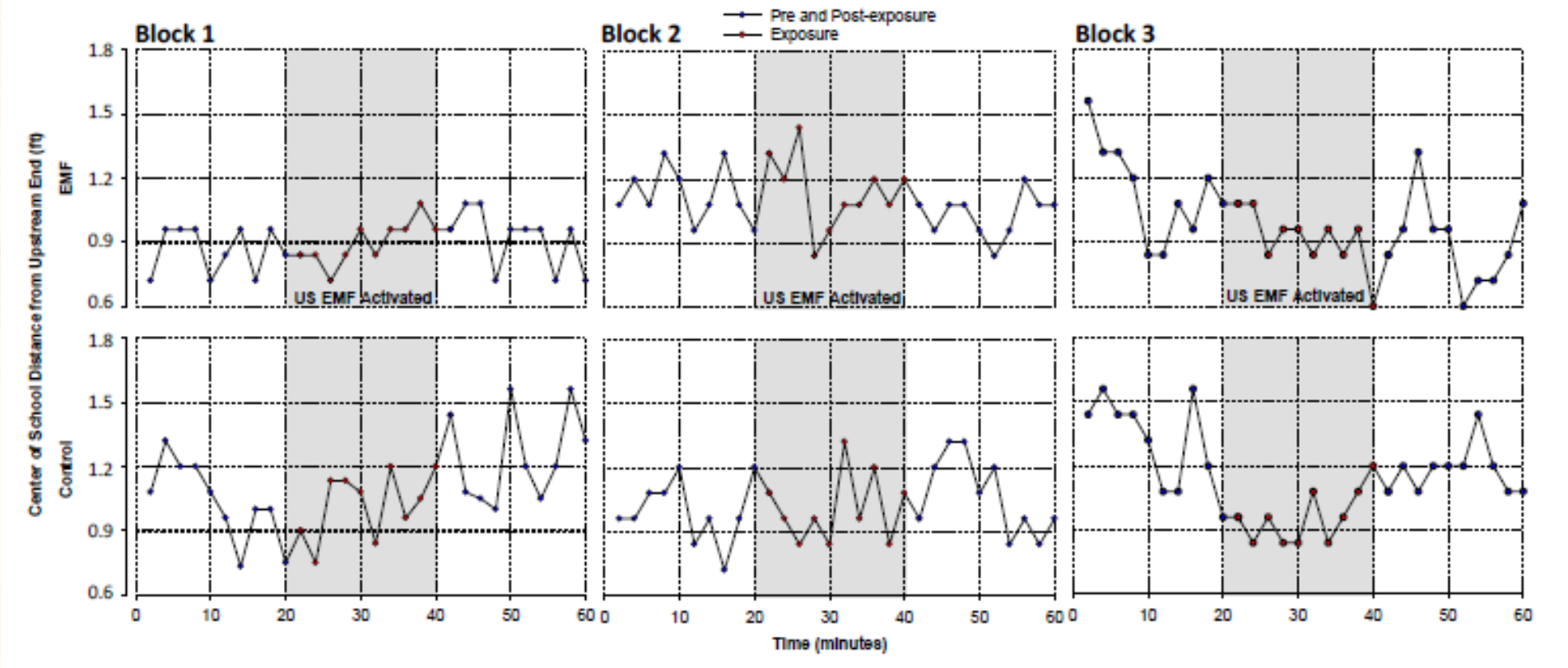
Avoidance



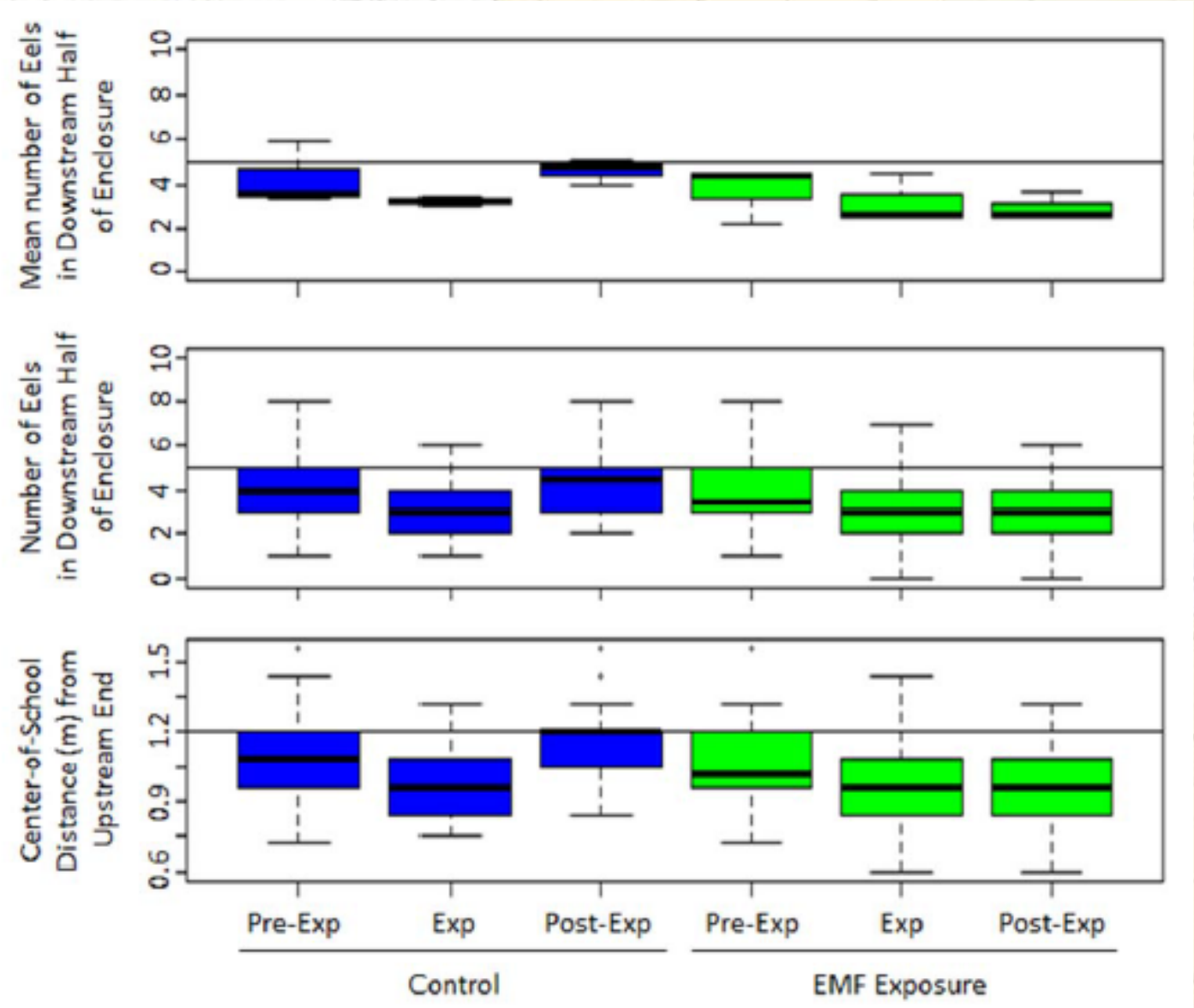
Attraction



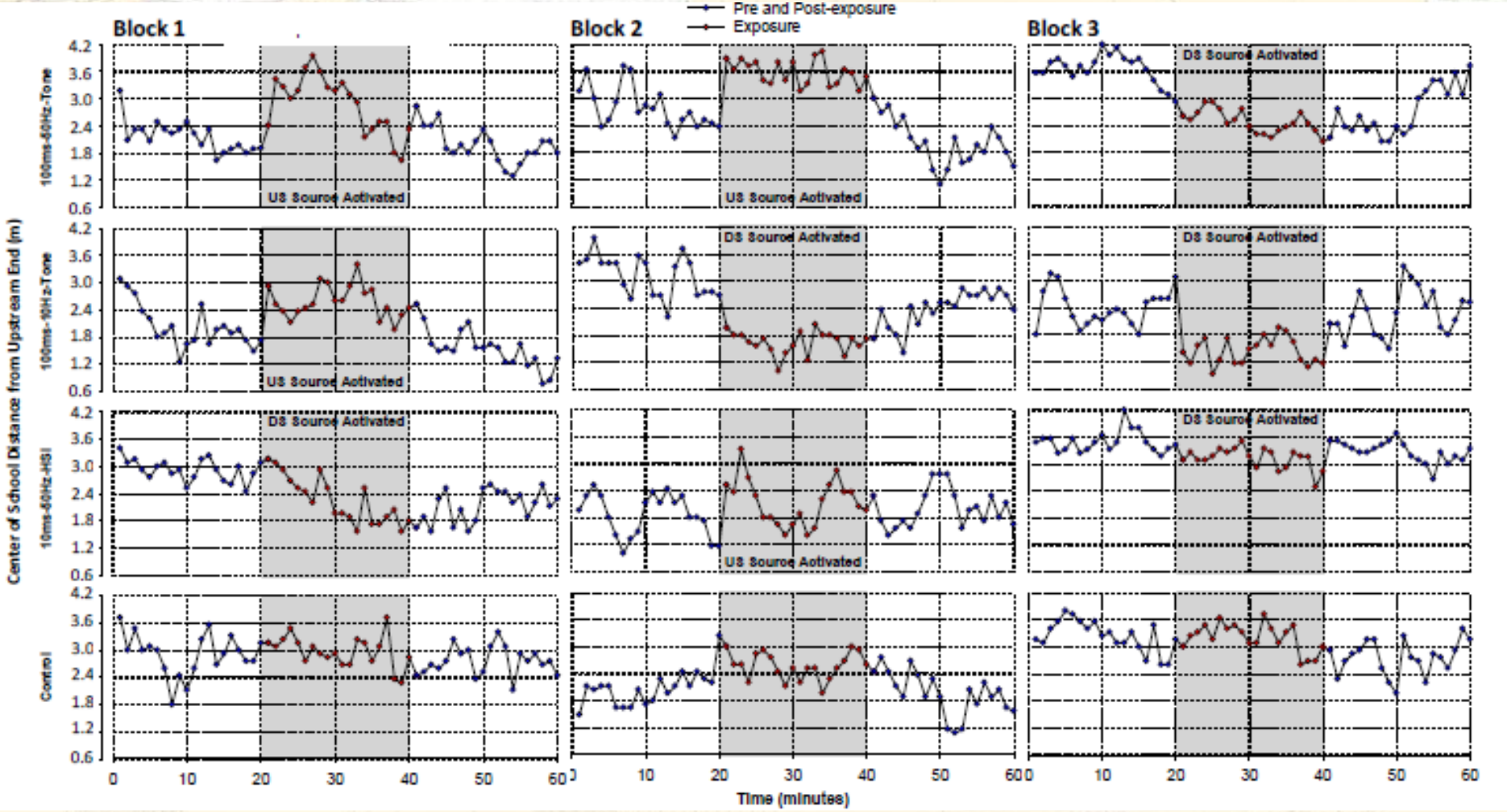
Results - EMF


Block 1
Block 2
Block 3
Pre and Post-exposure
Exposure
US EMF Activated
US EMF Activated
US EMF Activated
EMF
Control
Center of School Distance from Upstream End (ft)
Time (minutes)
1.8
1.5
1.2
0.9
0.6
0
10
20
30
40
50
60

Results - EMF

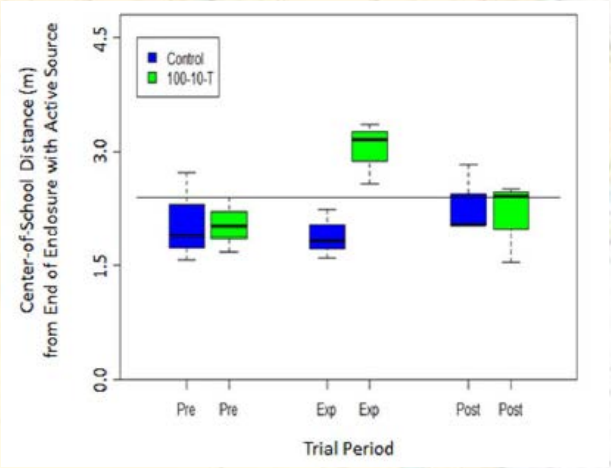

Mean number of Eels in Downstream Half of Enclosure
0 2 4 6 8 10
Number of Eels in Downstream Half of Enclosure
0 2 4 6 8 10
Center-of-School Distance (m) from Upstream End
0.6 0.9 1.2 1.5
Pre-Exp
Exp
Post-Exp
Pre-Exp
Exp
Post-Exp
Control
EMF Exposure

Results - Vibration

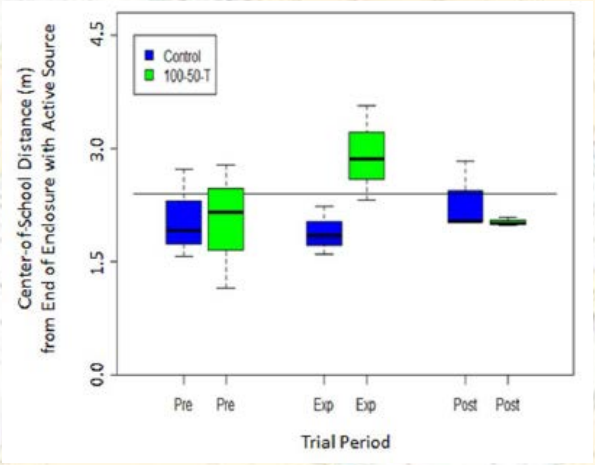


Results - Vibration

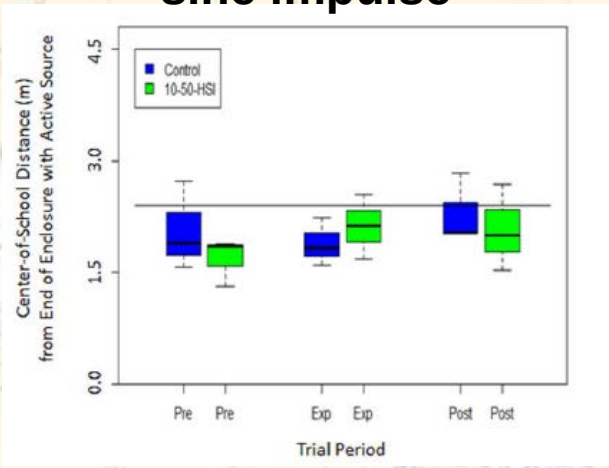
100 ms-10-Hz tone



100 ms-50-Hz tone



10 ms-50-Hz half sine impulse



- Vibration exposed eels showed significant displacement in both the 100 ms-10-Hz and 100 ms-50-Hz tone treatments
- A weaker response to the 10 ms-50-Hz half sine impulse treatment

Summary

- No avoidance behavior was observed during EMF exposure trials
- Vibration trials demonstrated avoidance, particularly for two tone burst signals (100 ms pulse duration at 10 and 50 Hz, respectively)
- Next step for EPRC – a vibration white paper to hopefully direct a larger scale field trial

Acknowledgments and Questions

Eel Passage Research Center Steering Committee
Alden Research Laboratory, Inc.