

Screening Options to Protect Larval Lamprey

Fish Screening Oversight Committee

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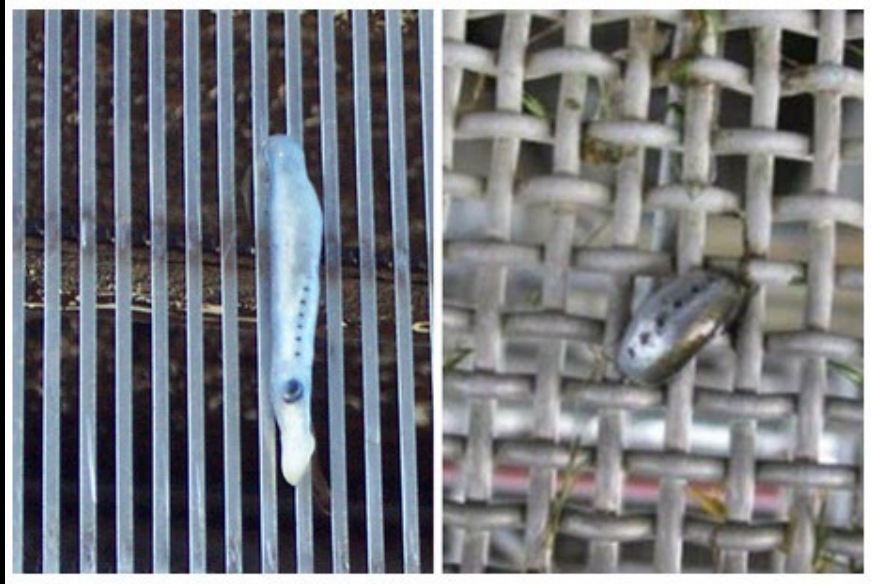
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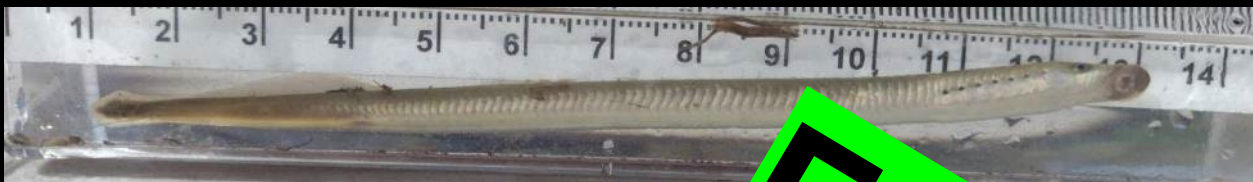


Joe Skalicky, USFWS, 9/14/2023

Can we do better?



Some small-bodied fish of the Pacific Northwest



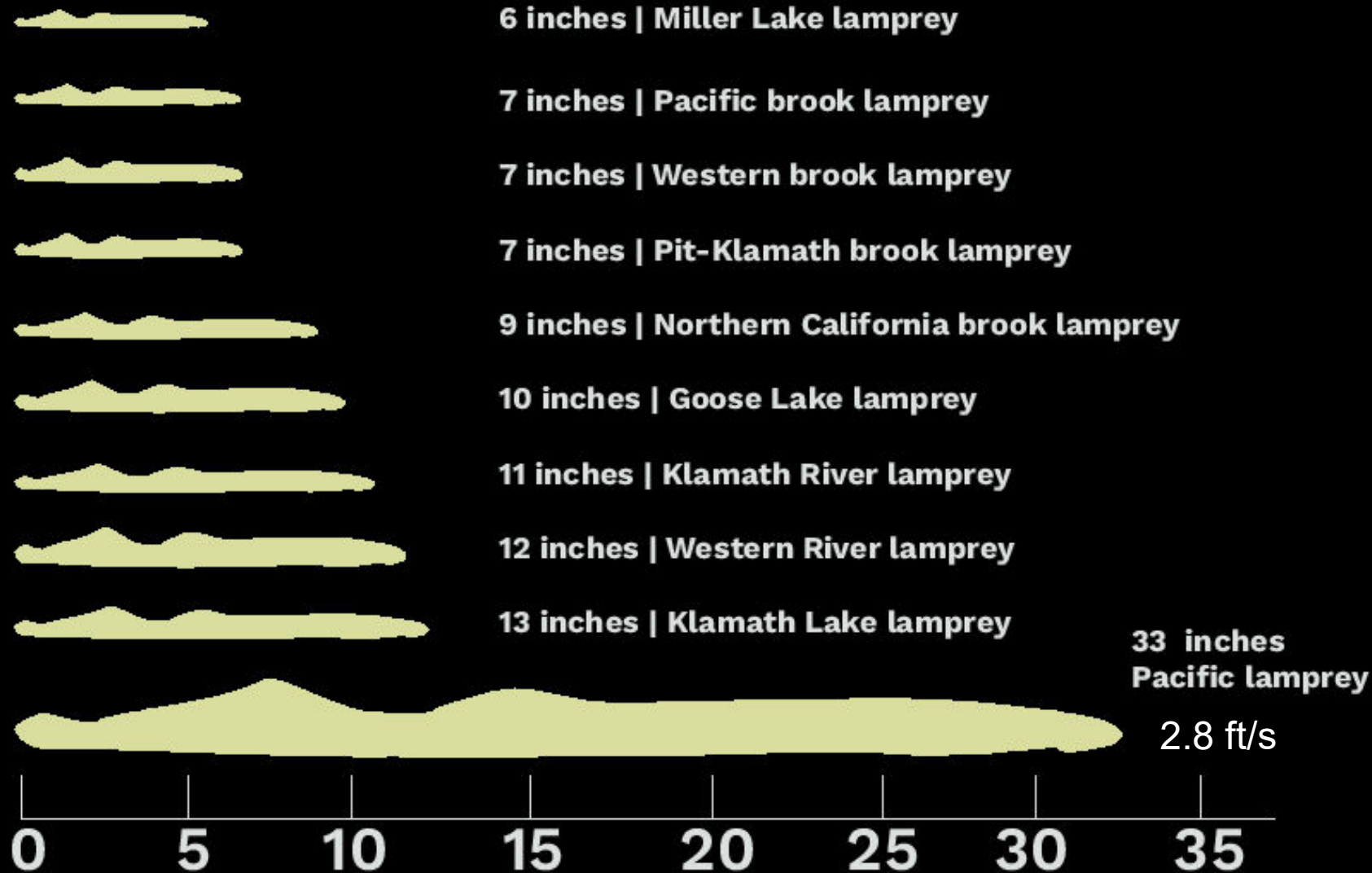
Future Proof!

Pacific Lamprey (*Entosphenus tridentatus*)

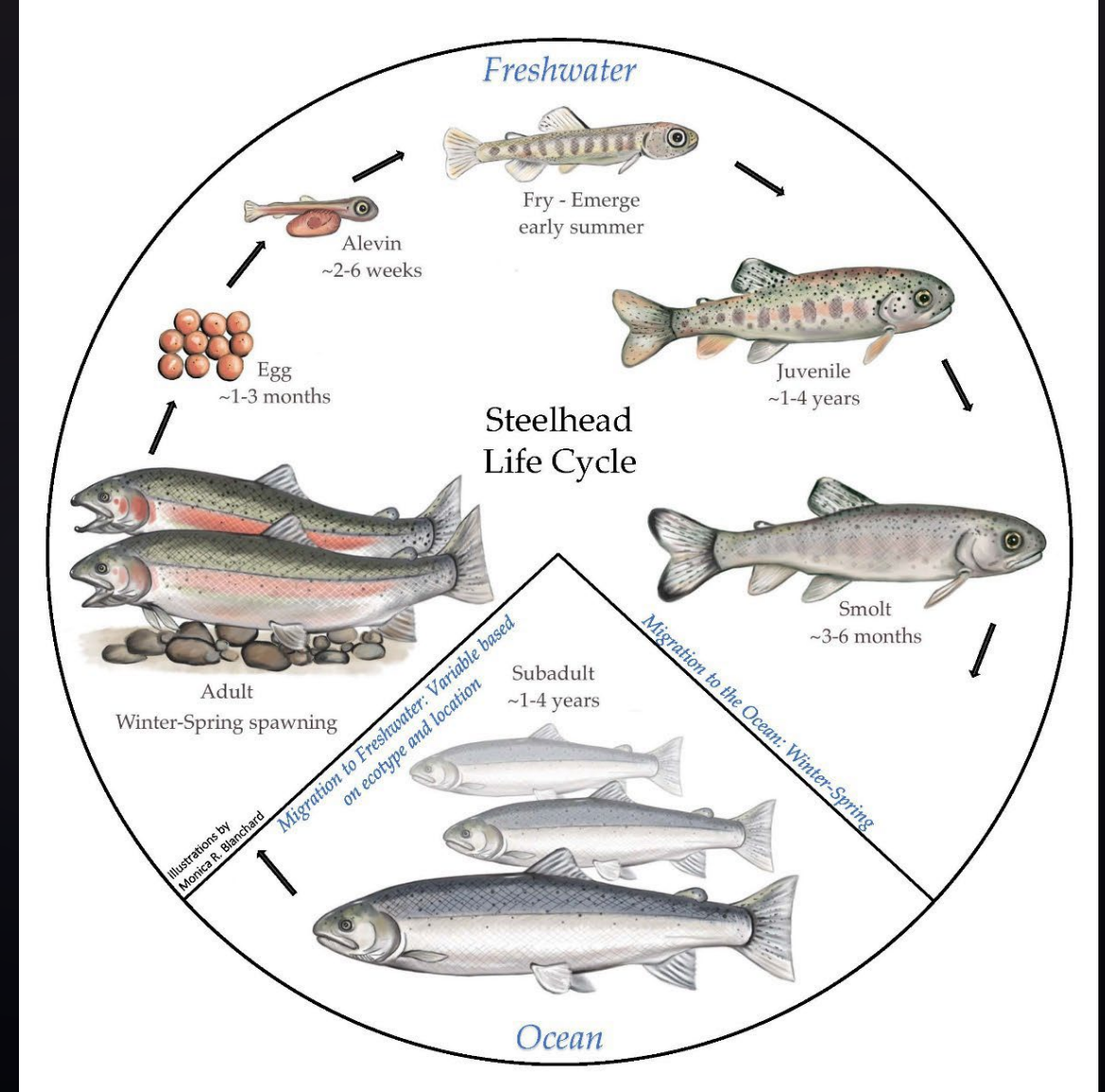
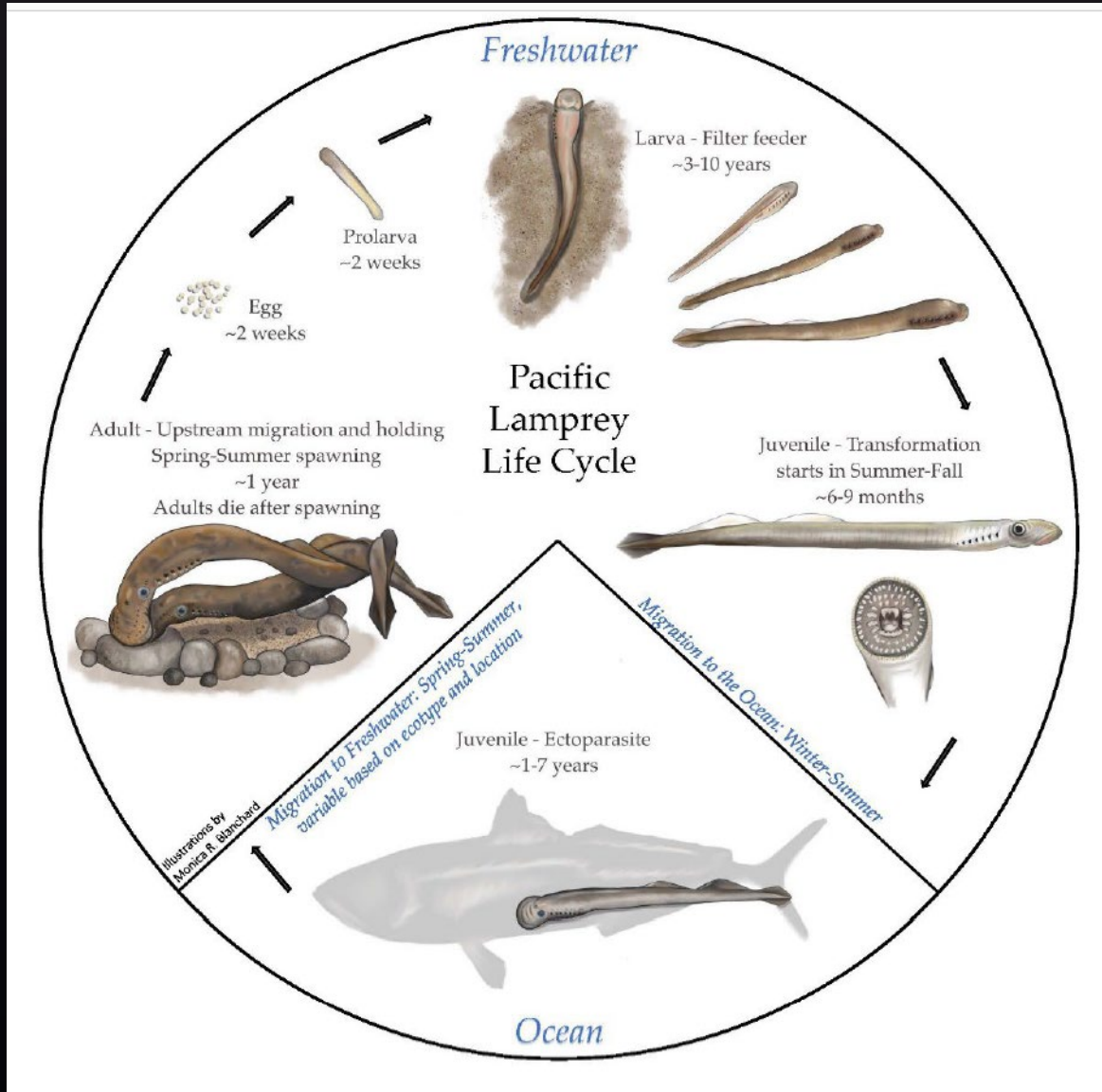


Joe Tomelleri

Ten Native Species in the PNW



Biology and Life History

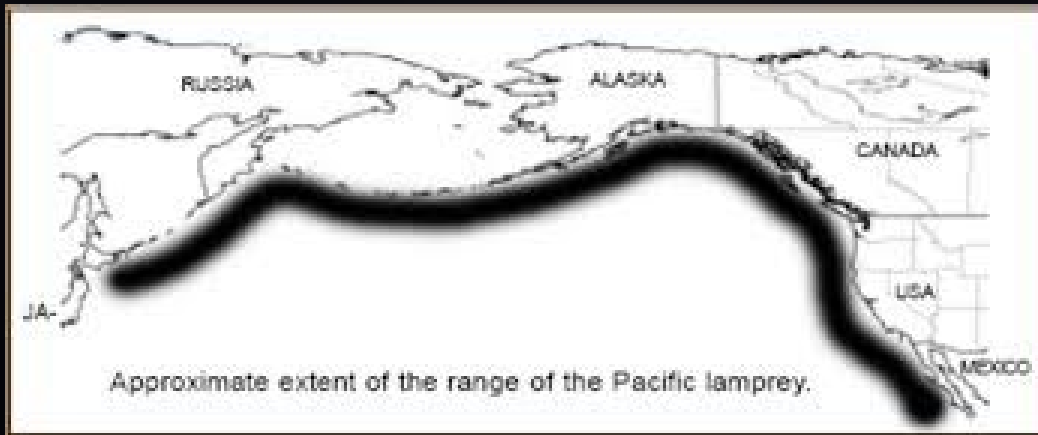




Trees evolve 360 million years ago!!



Range and Distribution of Pacific Lamprey



Unique Characteristics

- No scales, bones, bladder, or paired fins
- Sucker-like mouth, eel-like body
- Climb vertical surfaces
- About 40 species worldwide
 - Parasitic and Non-parasitic
 - Anadromous and Resident



Damon Goodman, USFWS

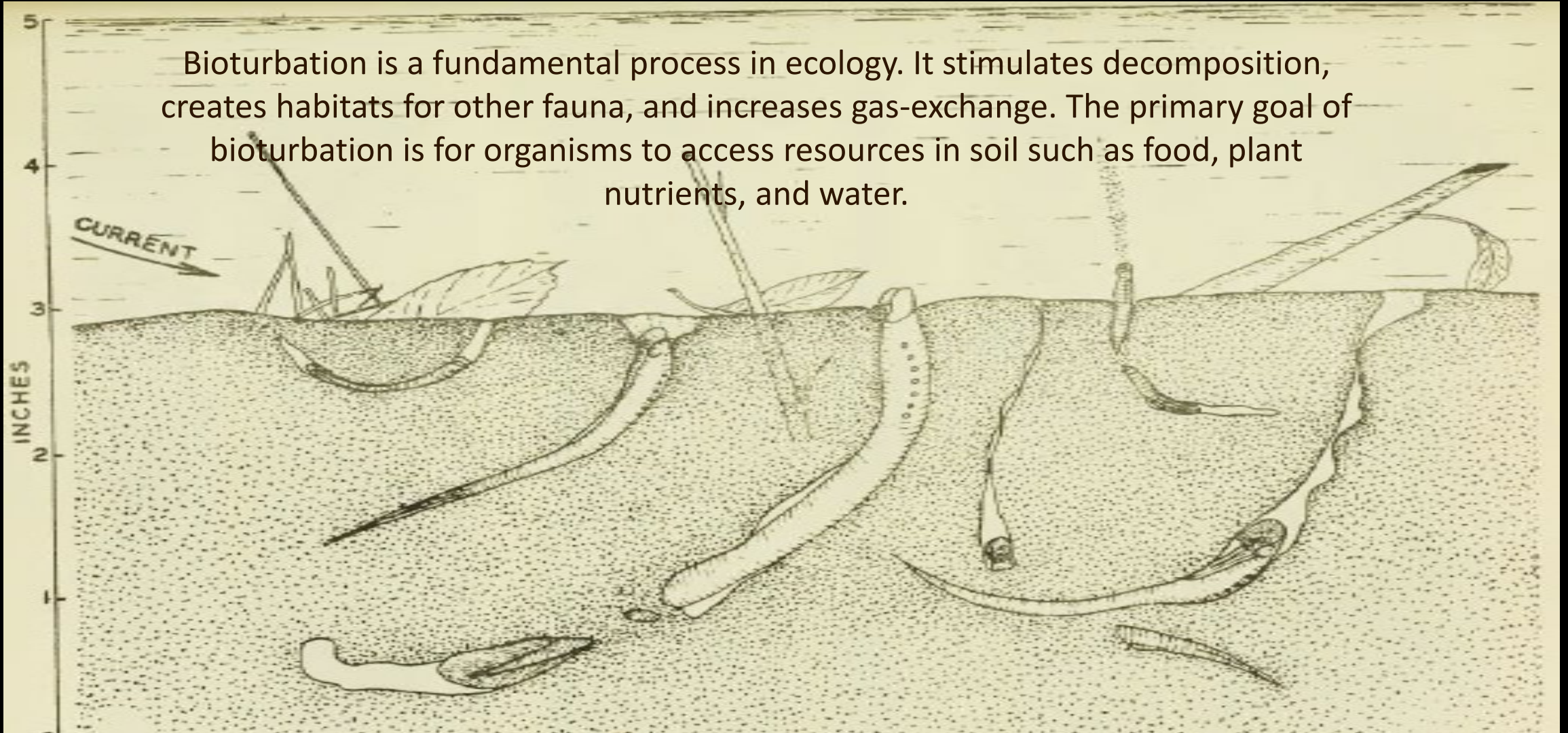


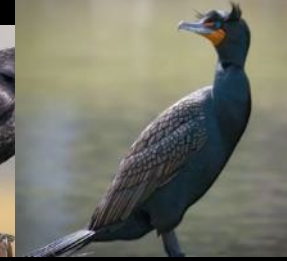
NAIAD.org

Dave Herasimtschuk © FI

Filter Feeders - Bioturbation

Bioturbation is a fundamental process in ecology. It stimulates decomposition, creates habitats for other fauna, and increases gas-exchange. The primary goal of bioturbation is for organisms to access resources in soil such as food, plant nutrients, and water.





Ben Clemens

Upstream Adult Passage - Warm Spring National Fish Hatcher, Fishway, Barrier Dam, and Lamprey Passage System



1 Division 412
2 FISH PASSAGE



3 **635-412-0001**

4 **Purpose of the Fish Passage Policy**

→ » ODFW Home » Fish Division » Fish Passage

5 (1) The purpose of these rules is to further clarify and implement the State's fish passage statutes (ORS
6 509.580 through 509.910) and the Department's Climate and Ocean Change Policy (OAR 635-900-0001
7 through 635-900-0020) through the application of consistent standards.

(20) "Fish passage" means the ability, by the weakest native migratory fish and life history stages determined by the Department to require passage at the site, to move either volitionally or by trap collection and transport if consistent with requirements of OAR 635-412-0035(6), with minimal stress, minimal delay, and without physical or physiological injury upstream and downstream of an artificial obstruction.

167 (33) "Native migratory fish" means naturally or hatchery produced native fish (as defined under OAR 635-
168 007-0501) indigenous (i.e., not introduced) to Oregon that migrate for their life cycle needs. These fish
169 include all sub-species and life history patterns of the following species listed by scientific name in use as
170 of 2022. Common names are provided for reference but are not intended to be a complete listing of
171 common names, sub-species, or life history patterns for each species.



193

(v) *Lampetra ayresii* — Western river lamprey;

194

(w) *Lampetra pacifica* -- Pacific brook lamprey;

195

(x) *Lampetra richardsoni* -- Western brook lamprey;

Lamprey Technical Workgroup

Recent LTWG Publications

- *Comparison of Pacific Lamprey and Pacific Salmon Life Histories, Habitat and Ecology (LTWG; 2023)*
- *Review of Factors Affecting Larval and Juvenile Lamprey Entrainment and Impingement at Fish Screen Facilities (LTWG; 2022)*
- *Practical Guidelines for Incorporating Adult Pacific Lamprey Passage at Fishways, Version 2.0 (LTWG; 2022)*
- *Barriers to Adult Pacific Lamprey at Road Crossings: Guidelines for Evaluating and Providing Passages (LTWG; 2020)*
- *Best Management Guidelines for Native Lampreys During In-Water Work (LTWG; 2020 (Updated 2022))*
- *Monitoring and Minimizing the Effects of Dredging on Lampreys (LTWG; 2021)*
- *Overview of eDNA and Applications for Research and Monitoring of Lampreys (LTWG; 2021)*

Review of Factors Affecting Larval and Juvenile Lamprey Entrainment and Impingement at Fish Screen Facilities

Living Document, Original Version 1.0

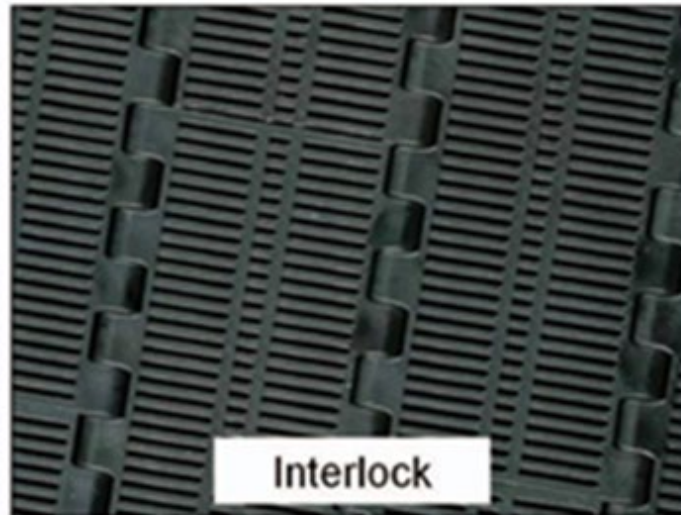
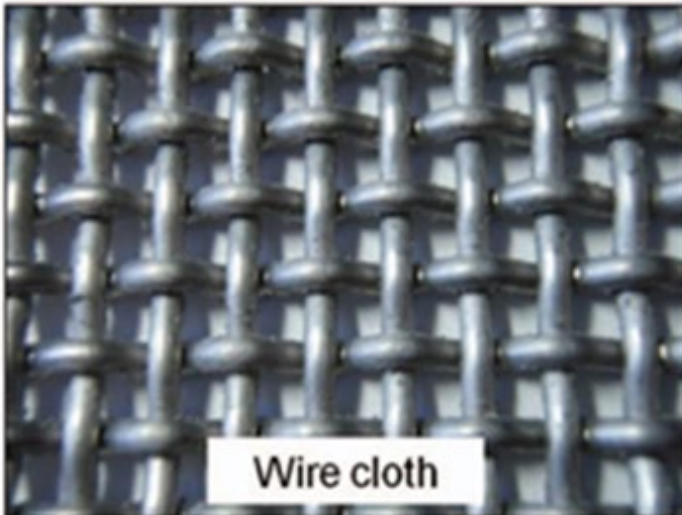
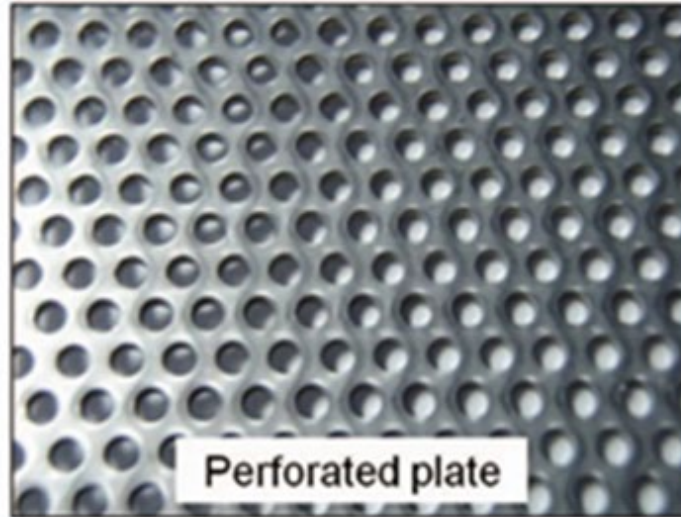
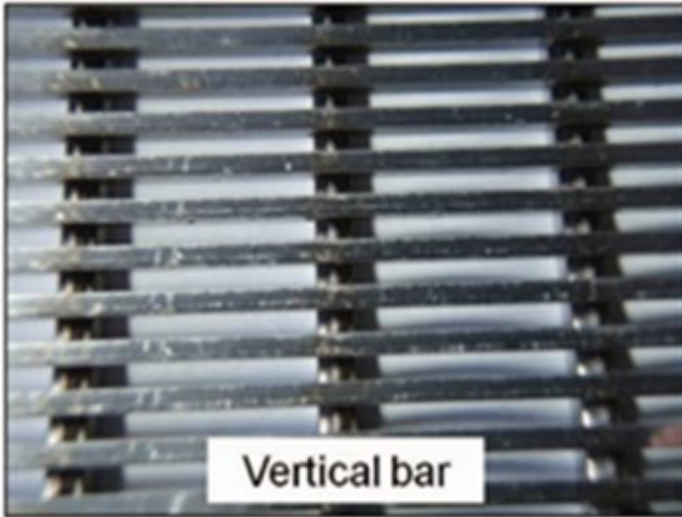
June 2022



Lamprey Technical Workgroup

<https://www.pacificlamprey.org/ltwg/>

Standard screen materials used to protect fishes



Available in a wide variety of hole sizes to meet your well-informed needs

We want to avoid this



Screen opening sizes required to prevent entrainment of Pacific Lamprey eggs and larvae during artificial propagation and irrigation canal field studies

Life Stage	Total Length (mm)	Screen Opening (mm)
Embryo	~1	≤0.85
Larva (newly hatched)	7-10	≤0.35
Larva (YOY)	≥13.0	≤0.8
Larva (YOY)	≥15.0	≤1.0
Larva (growing)	≥23.5	≤1.5
Larva (growing)	≥32.5	≤2.0
Larva (age 1+)	≥40.0	≤2.0
Larva (age 2+)	≥80.0	≤3.0
Transformer & Larva (age 3+)	≥135.0	≤4.0



Screen Opening Type	mm
Slotted/Rectangular	1.75
Circular/Square	2.38

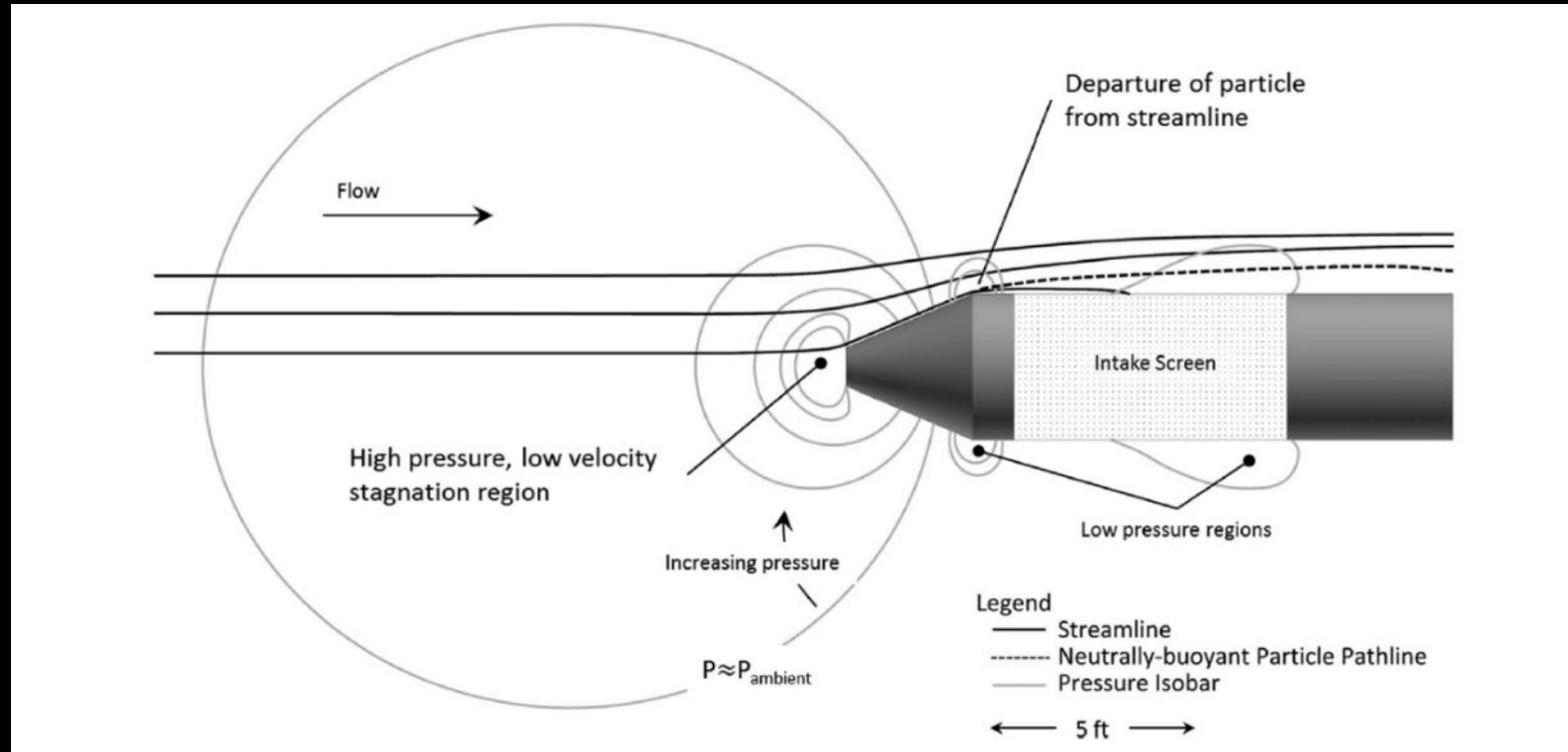
NMFS Guidelines

USFWS Screen updates

- Abernathy Fish Technology Center
 - 1.0 mm & 1.75 wedge wire screens
 - Compare entrainment rates
- Klamath Marsh National Wildlife Refuge
 - 0.75 mm wedge wire screens (TBT)



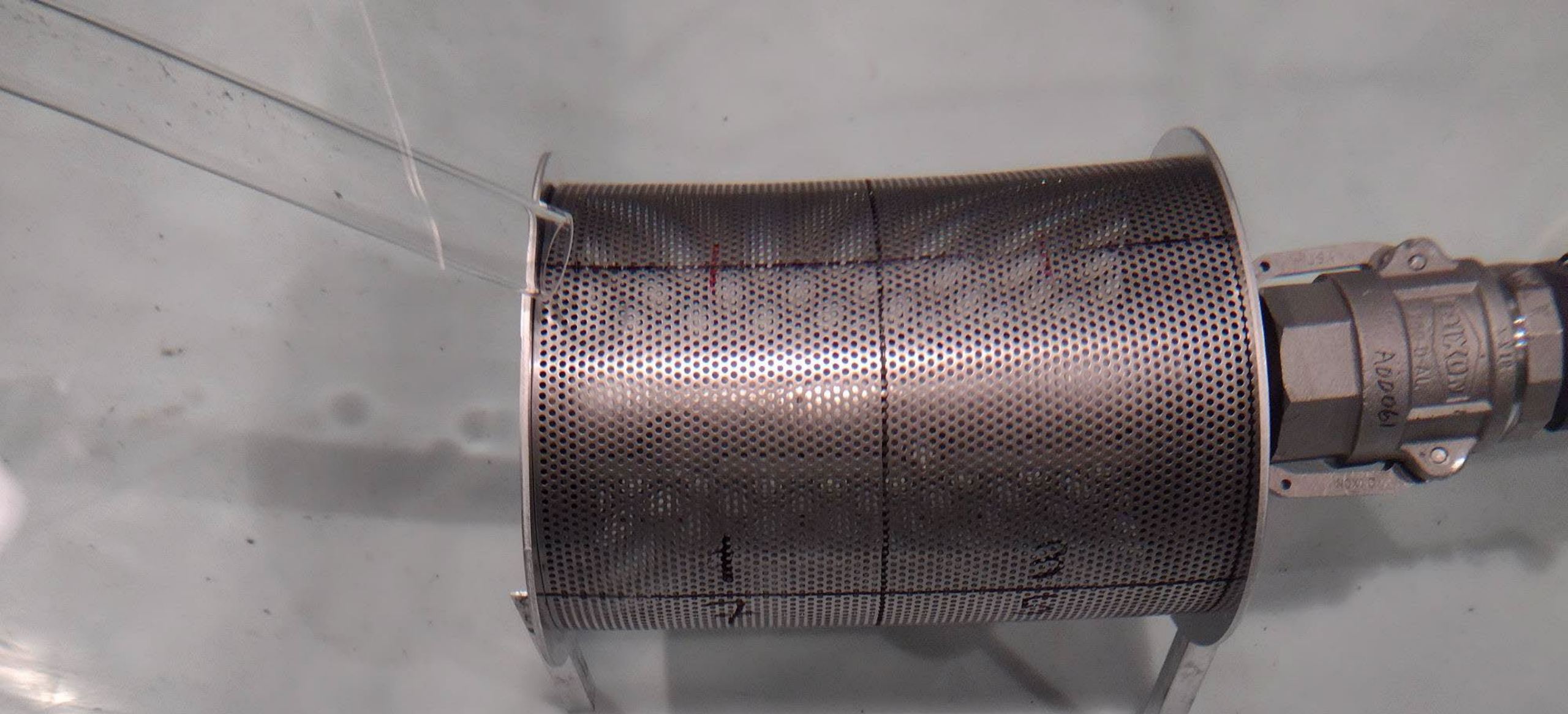
Additional Studies Needed



Conceptual view of flow streamlines and altered pressure and velocity around the upstream end of a cylindrical screen structure in a river, illustrating hydraulics of a 'bow wave' that would keep fish from entering a screen either hydraulically or by avoidance of pressure/velocity changes—drawing by B. Mater. Figure used with permission from Coutant (2021).

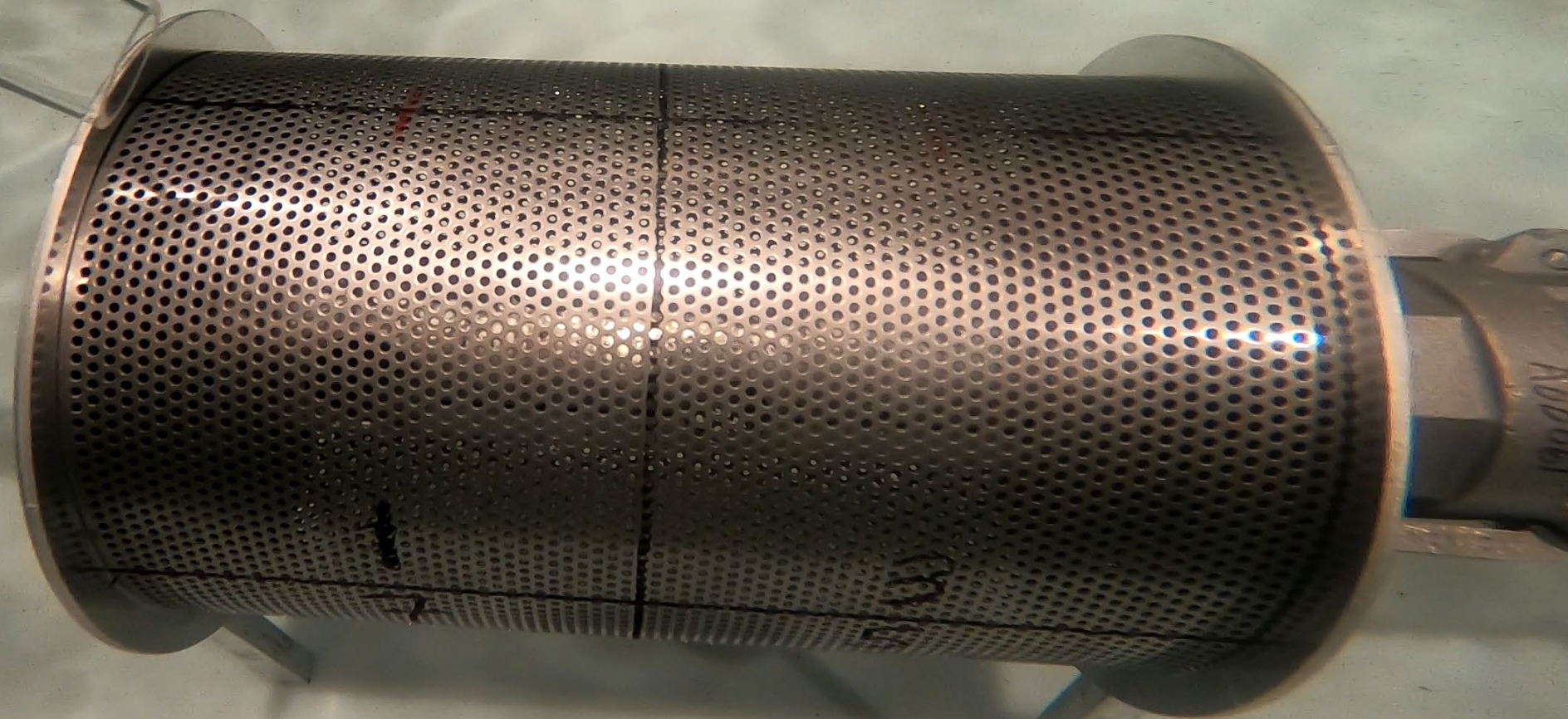
USGS/WDFW lab tank used for screening studies

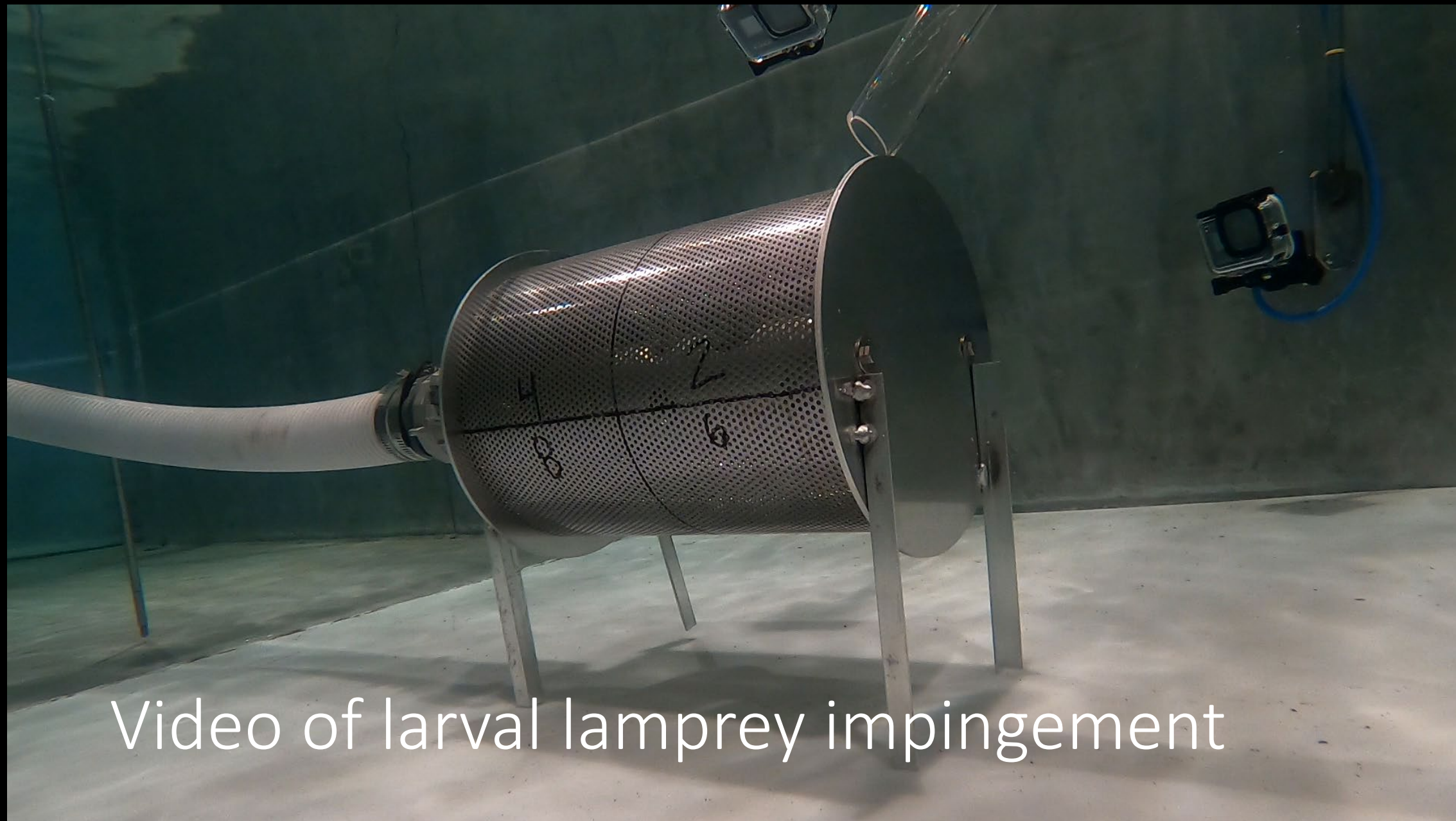




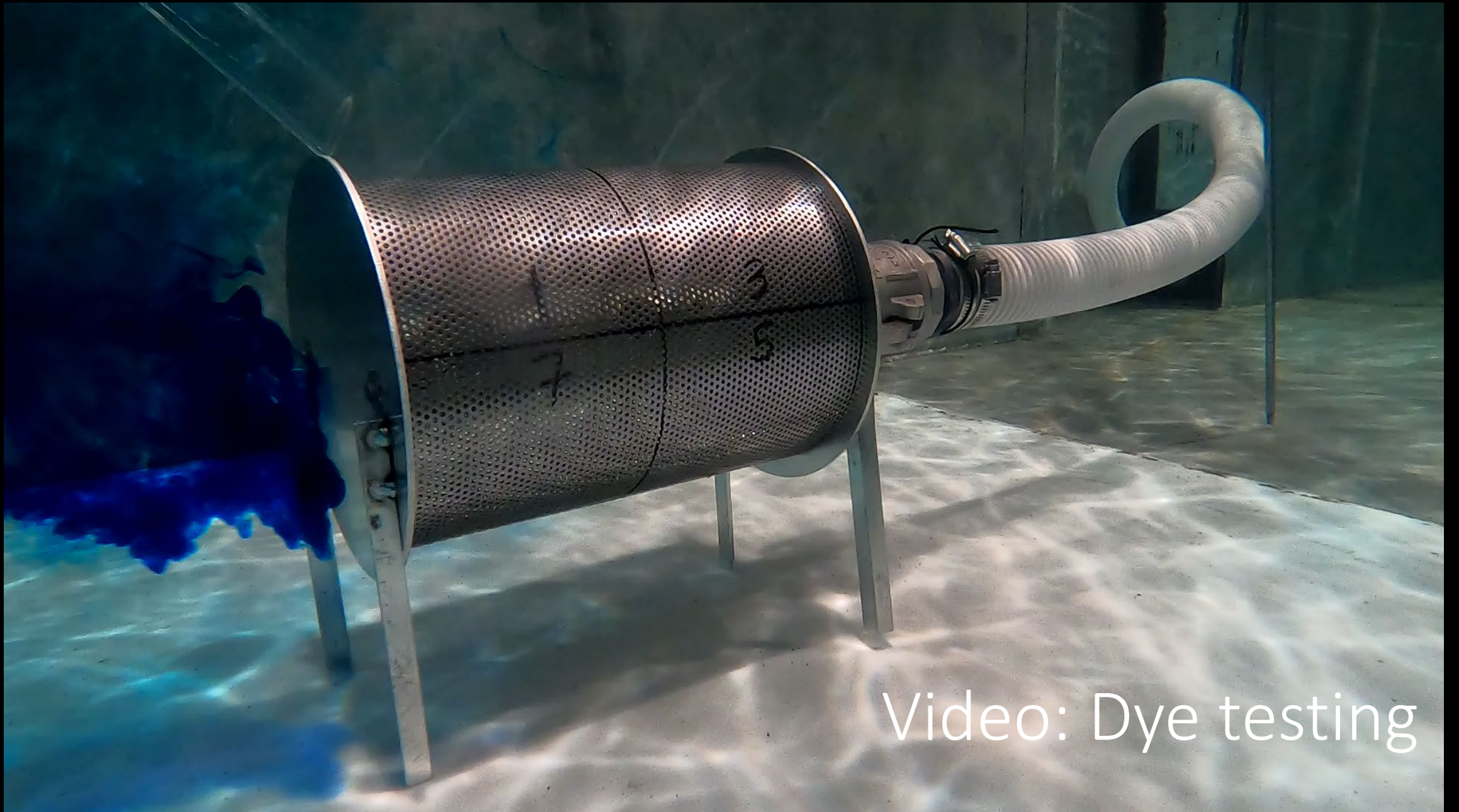
Experimental setup

Video of larval lamprey entrainment





Video of larval lamprey impingement

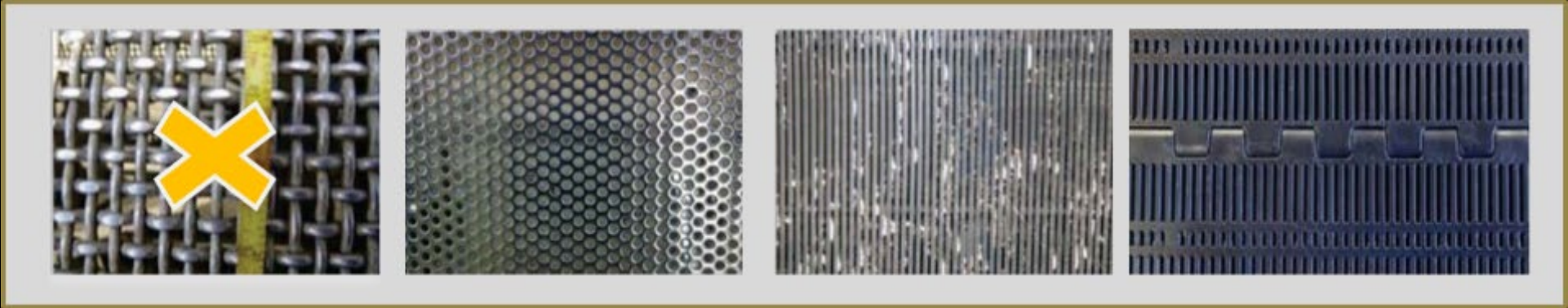


Video: Dye testing

Video: Entrainment of
Chinook, no screen



Take home points



- Future Proof it!
- Lamprey likely entrained at rates higher than other fish
- Avoid woven wire
- High sweeping velocities
- Negligible cost difference
- 0.5 and 0.75 mm screens currently in use
- Check your gaps.



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