

Pacific Lamprey Artificial Propagation: Lessons Learned & Path Forward



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Yakama Nation**

NW Fish Culture Conference
December 11 - 12, 2012



Outline

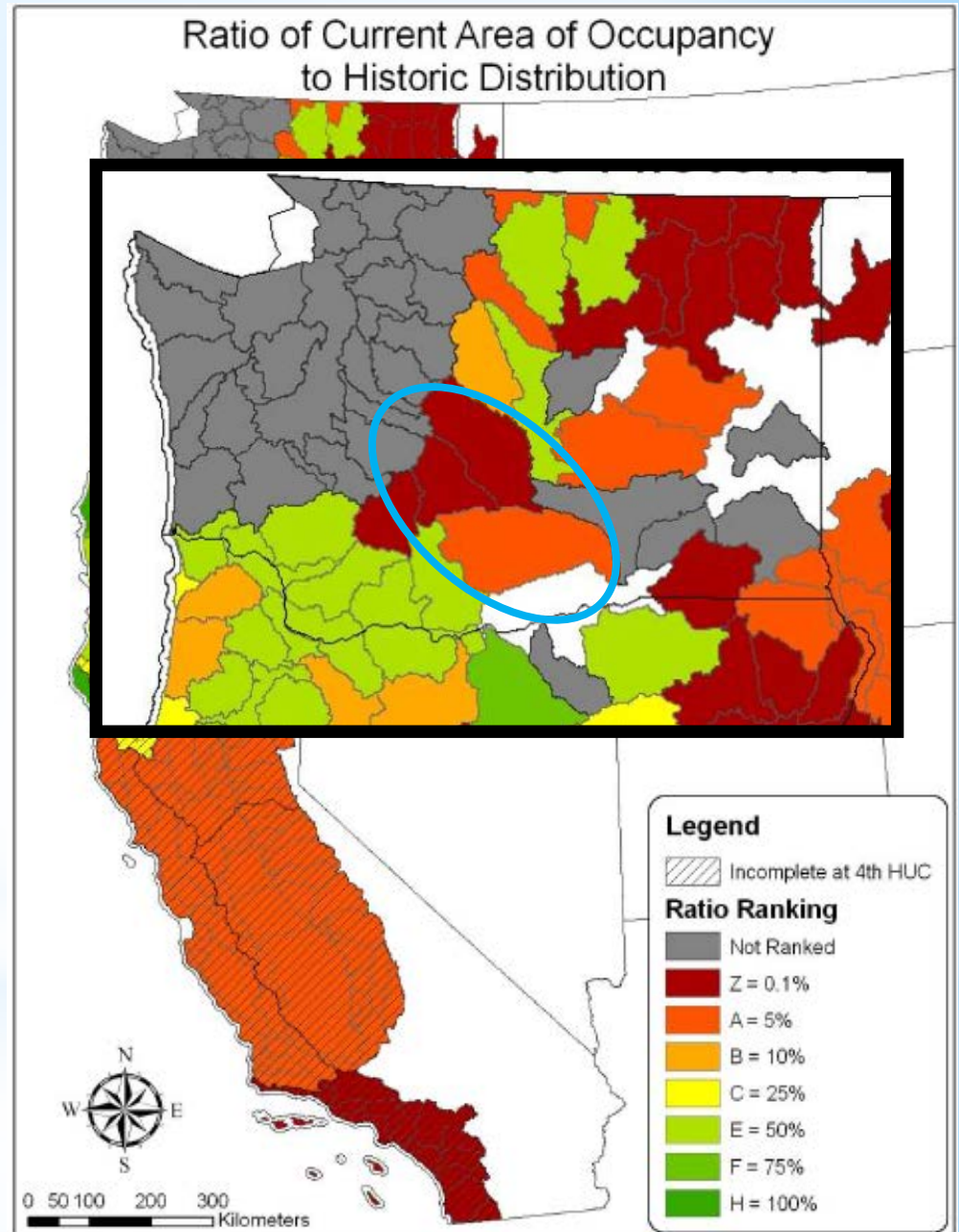
- **Intro & Background**
- **Spawning & Incubation**
- **Feeding Study**
- **Future Considerations**



Freshwaters Illustrated / USFWS

Background

- Reduced population in Upper Columbia & Southern CA
- Depressed populations in the Yakima Basin and neighboring watersheds





Why Artificial Propagation?

- **Yakima population functionally extirpated (genetic risks already low)**
- **To effectively assess limiting factors (& avoid extracting limited wild stocks)**
- **To recover lamprey numbers to a harvestable level**

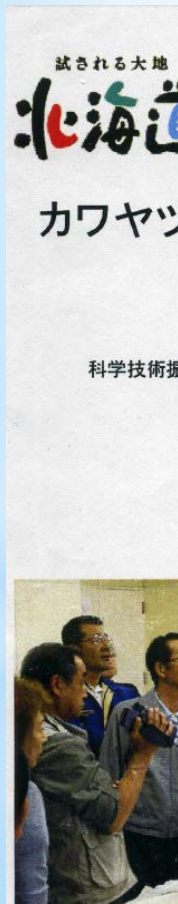
Past efforts in Artificial Propagation

1. Great Lakes - sea lamprey
2. Europe - sea & river lamprey (Finland, Denmark, Spain, etc.)
3. Japan - Arctic lamprey
4. Canada (Beamish), OR (Close et al.), WA (Meeuwig et al.) - Pacific lamprey
5. **Yakama Nation - Pacific lamprey - 2012**

1st International Forum for the Recovery and Propagation of Lamprey

Japanese Manual

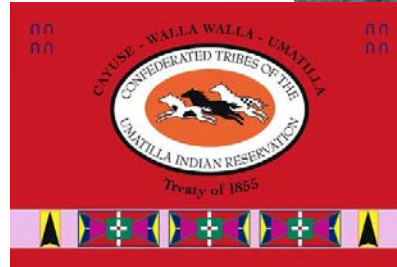
Finnish Manual



江別市野幌公民館で開催した孵化技術研修会の様子（左写真）
孵化後4日目の仔魚（右写真）



Shout-Out for Everyone Helping



5 Key Phases

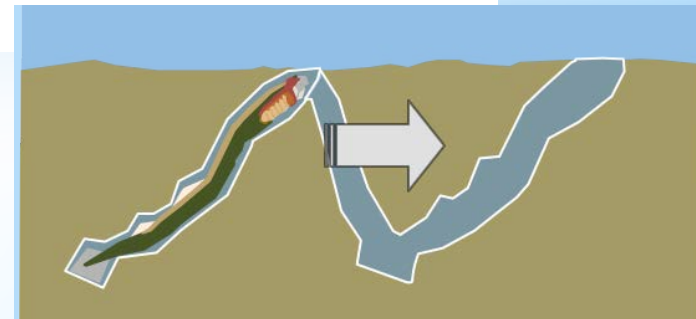
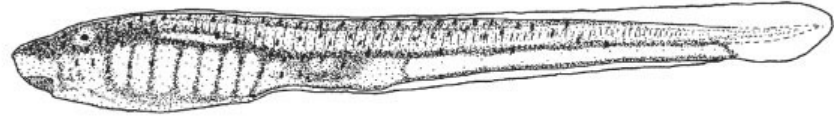
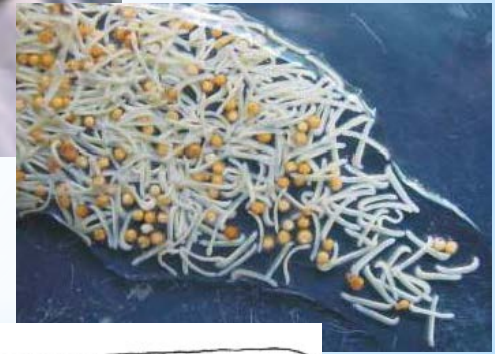
1. Adult Holding

2. Spawning

3. Egg Incubation

4. Prolarvae

5. Larvae



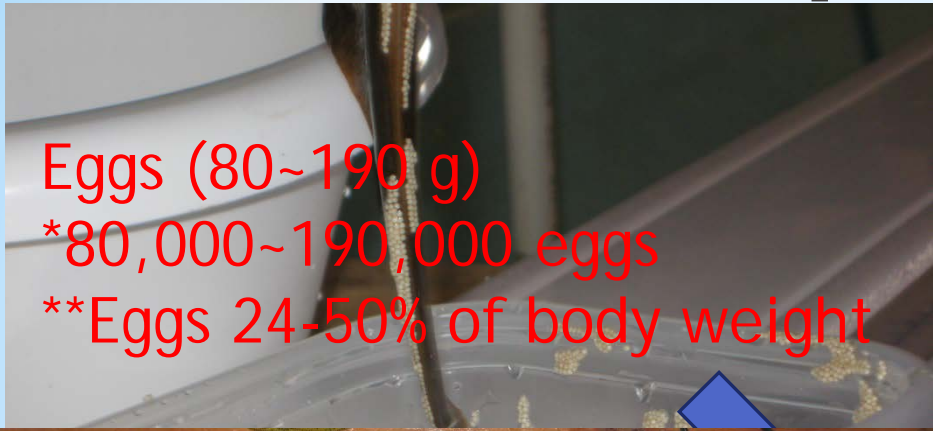
1. Adults



- i. Circular tanks allow them to swim around in circles (at night)
- ii. Shallow tanks work great for monitoring maturation level
- iii. Temperature control is critical to induce spawning (~50% never sexually matured this year)



2. Spawning

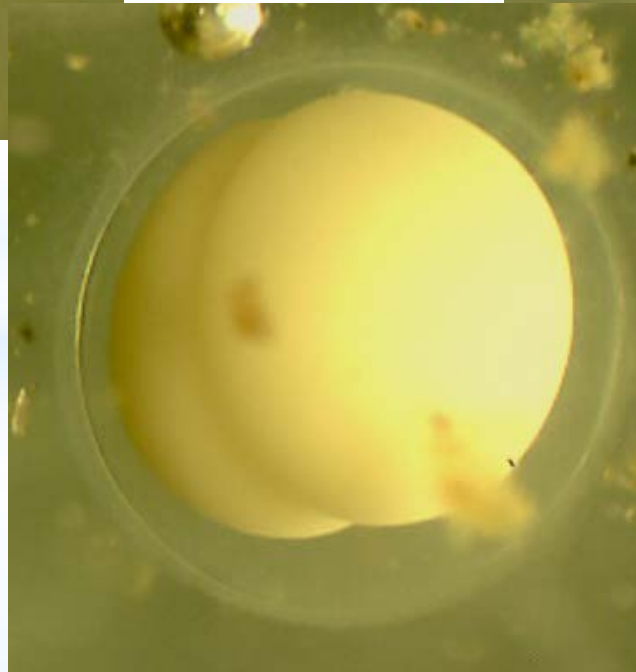
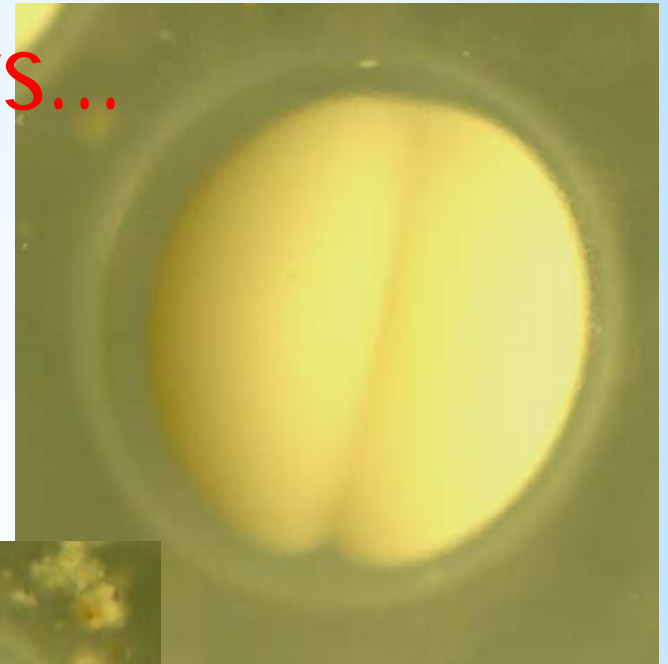
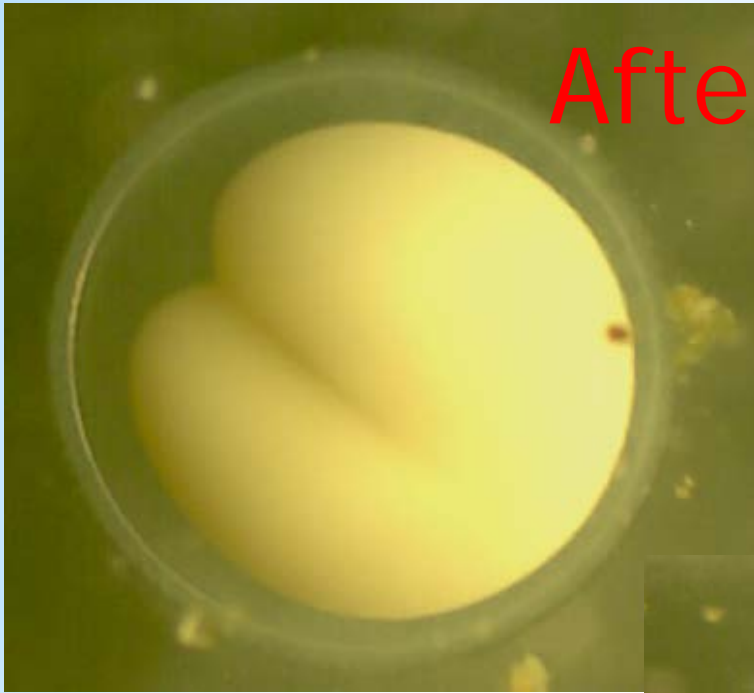


- i. When & how to mix eggs, milt & water
- ii. Early vs. late season (i.e. stickiness & buoyancy)
- iii. Timing of sexual maturation varies!!!
(collaboration is key! preservation methods?)

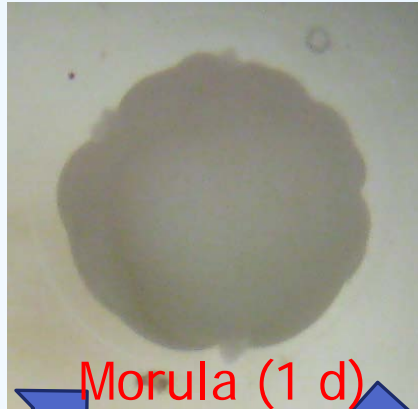


Egg Development

After 6 hours...



Egg Development



Morula (1 d)



Crested (8 d)



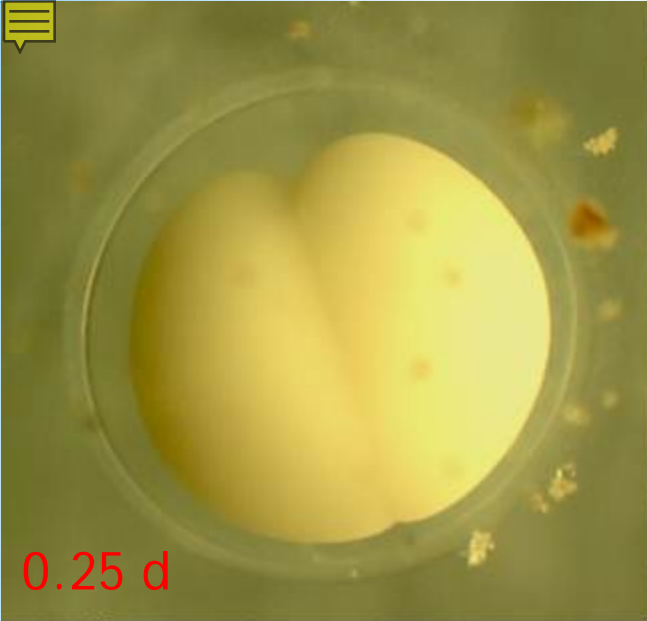
Cleavage (0.5 d)



Lemon (4 d)



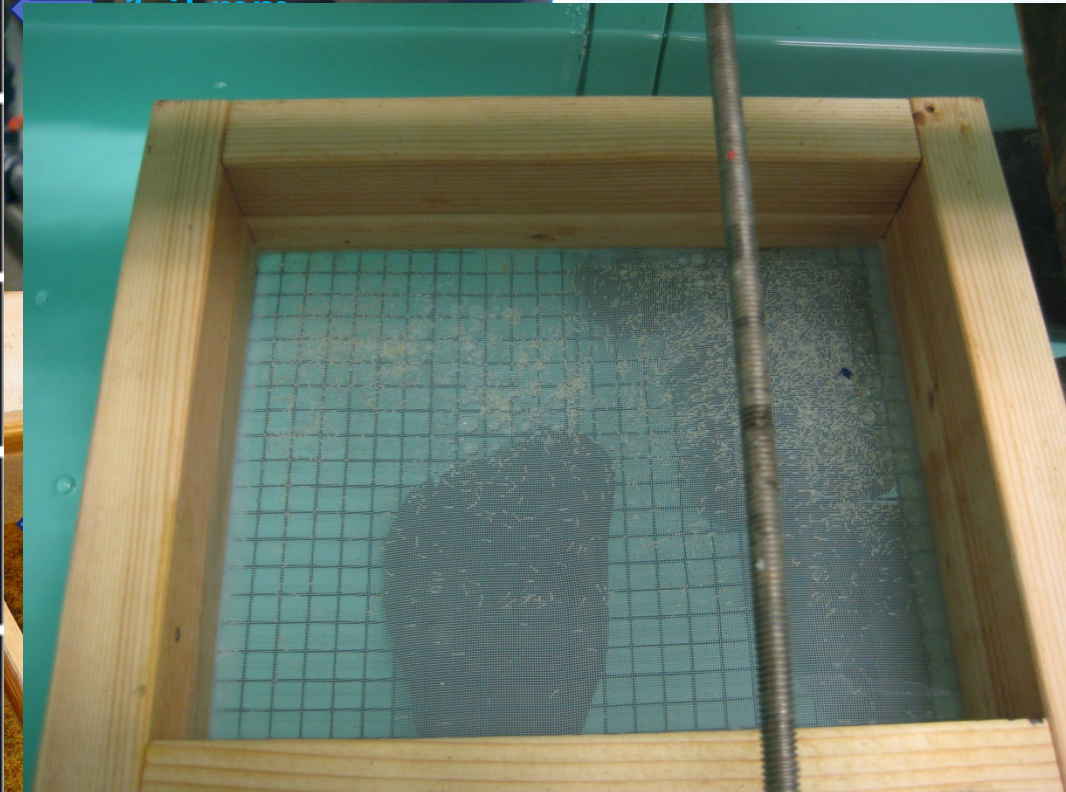
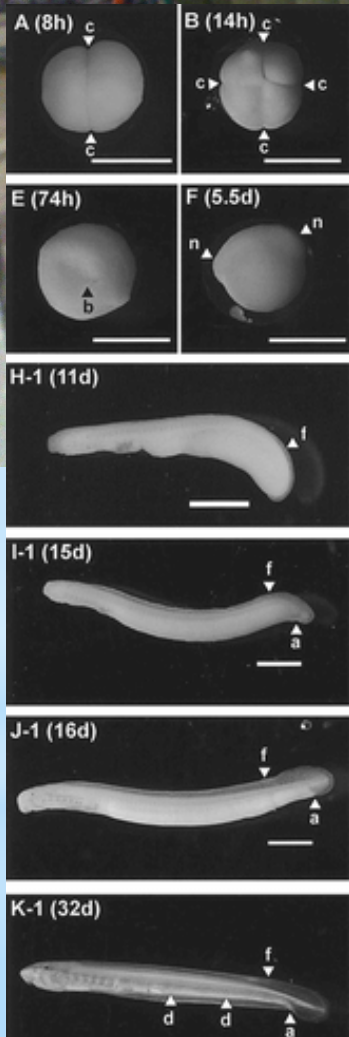
Clam (11 d)

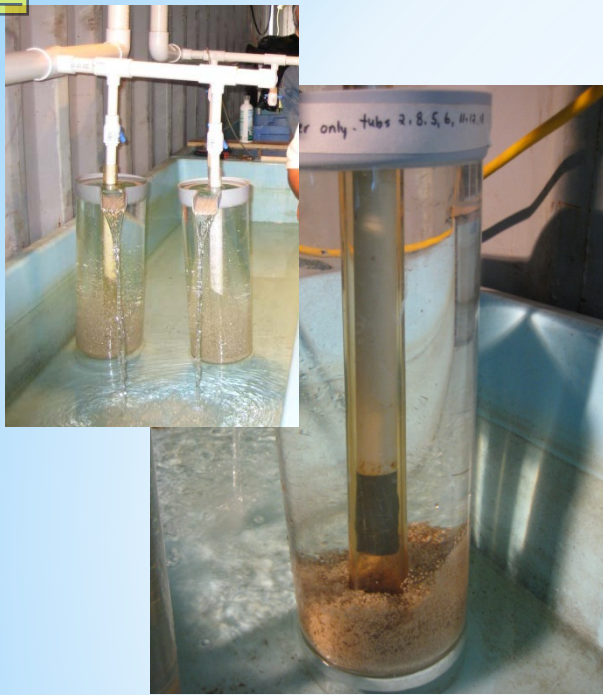


3. Egg Incubation

Finnish Style

Propagation





McDonald Jars

Pros:

- Keeps the eggs in flowing water
- Holds a large amount of eggs (2-3 females)

Cons:

- Flow rate varies on the bottom (require daily monitoring)
- Egg tends to float (early in the season)
- Silty, turbid water can plug it up



Eager Upwelling Jars

Pros:

- Keeps the eggs in slow, constant flow
- Eggs stay on the bottom
- No daily maintenance needed
- Holds a large amount of eggs (>99%)

Cons:

- Silty turbid water can plug it up

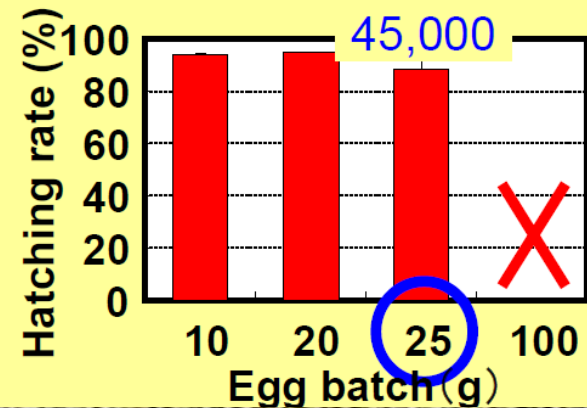


Japanese Style Propagation

Container of 16 L
A BA is 1,350cm²
(4.6 times)



$$25\text{g} \div 1,350\text{cm}^2 \times 100 = 1.9\text{g}/100\text{cm}^2$$



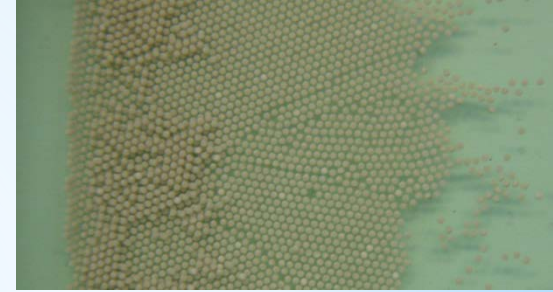
Plastic Tubs

Pros:

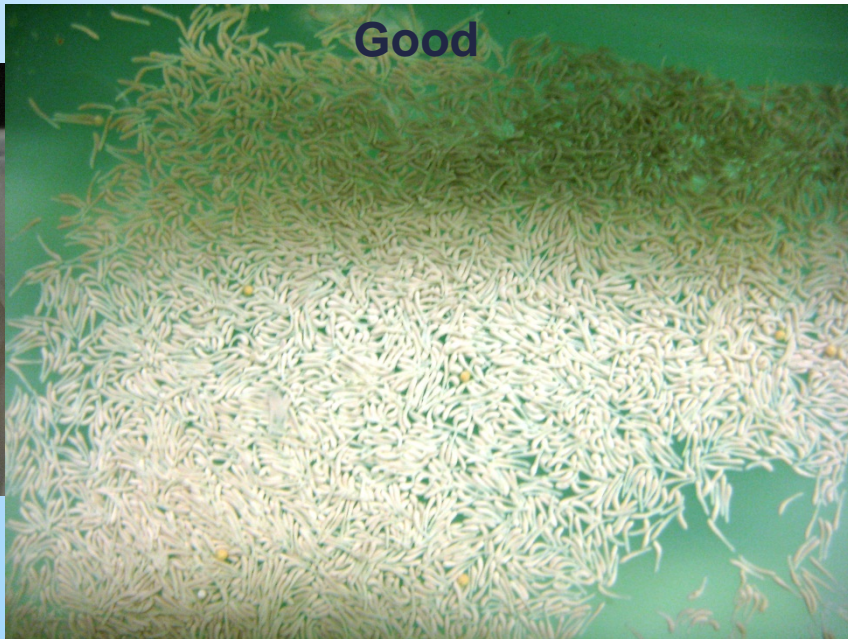
- Controlled flow
- Easy to monitor (fugus, etc.)

Cons:

- Needs lots of space (1 layer)
- Require daily water change
- Air temperature matters
- “Egg shocking” during water change



Good



Bad

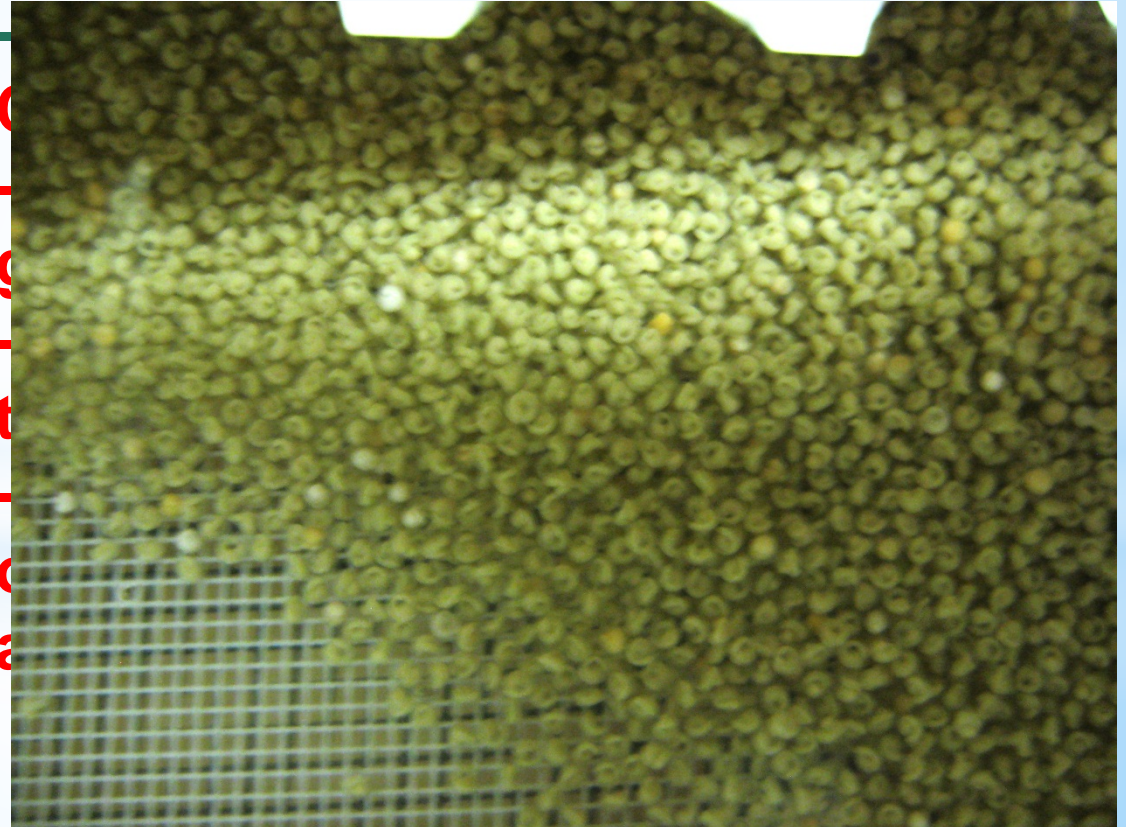
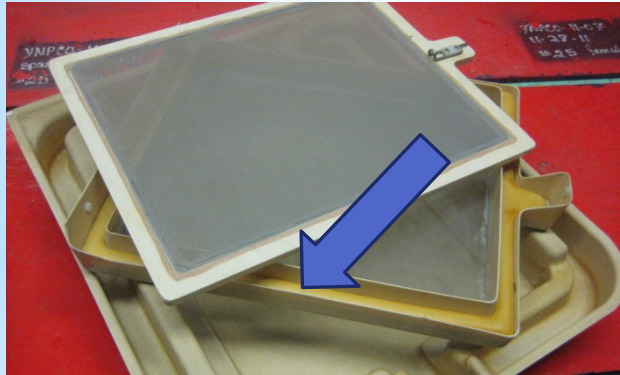




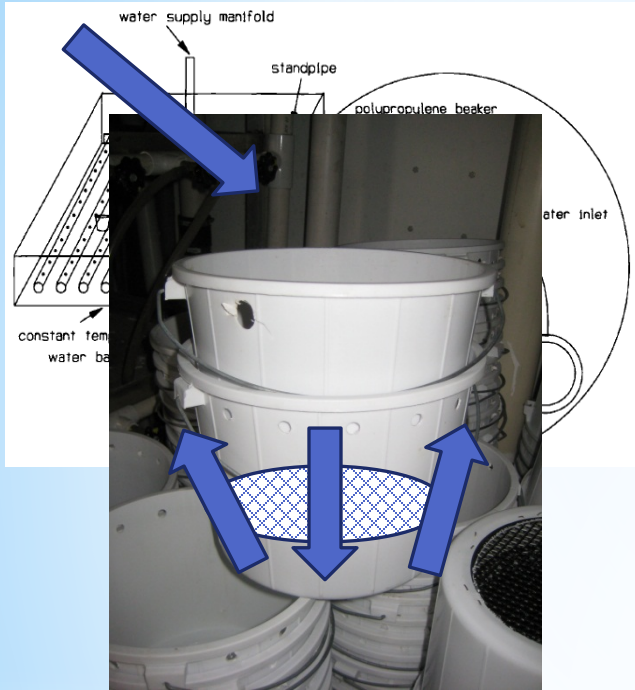
Vertical Incubation (Heath) Trays (2 Screens)

Pros:

- Gentle upwelling flow
- High density incubation possible (~97% survival)



Fredricks and Seelye (1995) Great Lakes sea lamprey



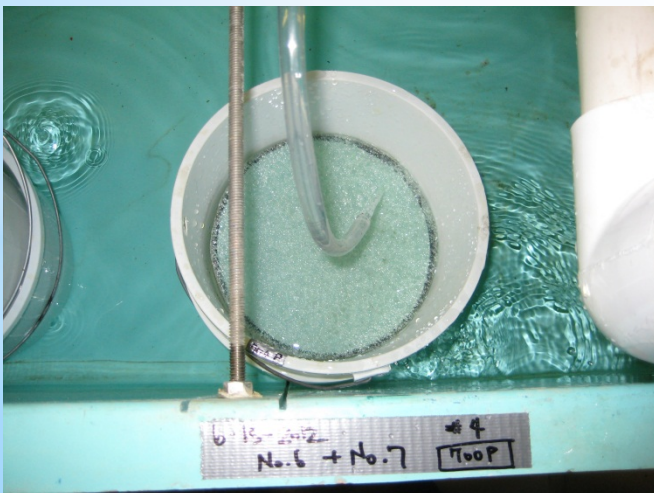
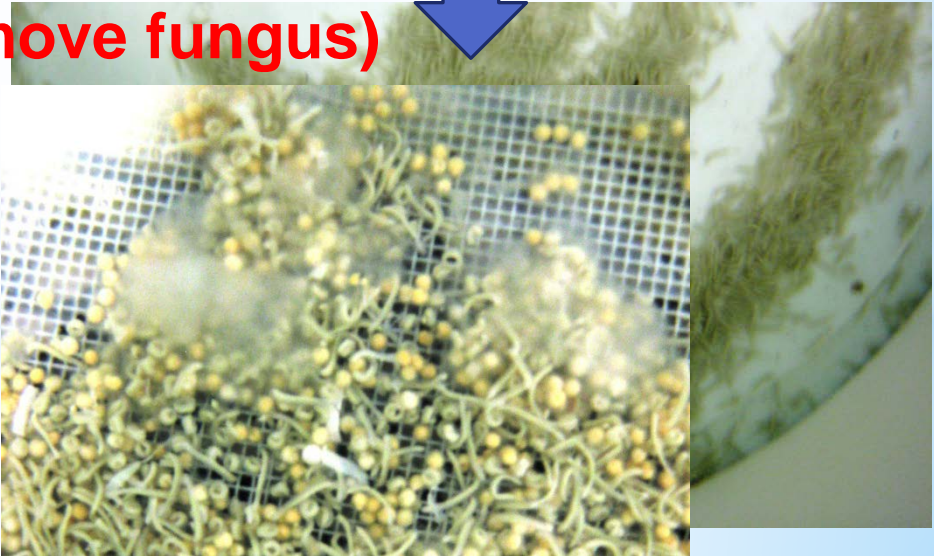
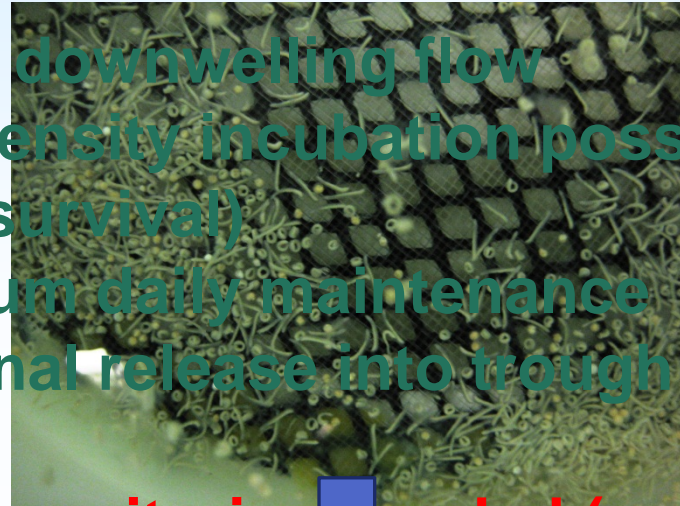
Flow-Through Buckets

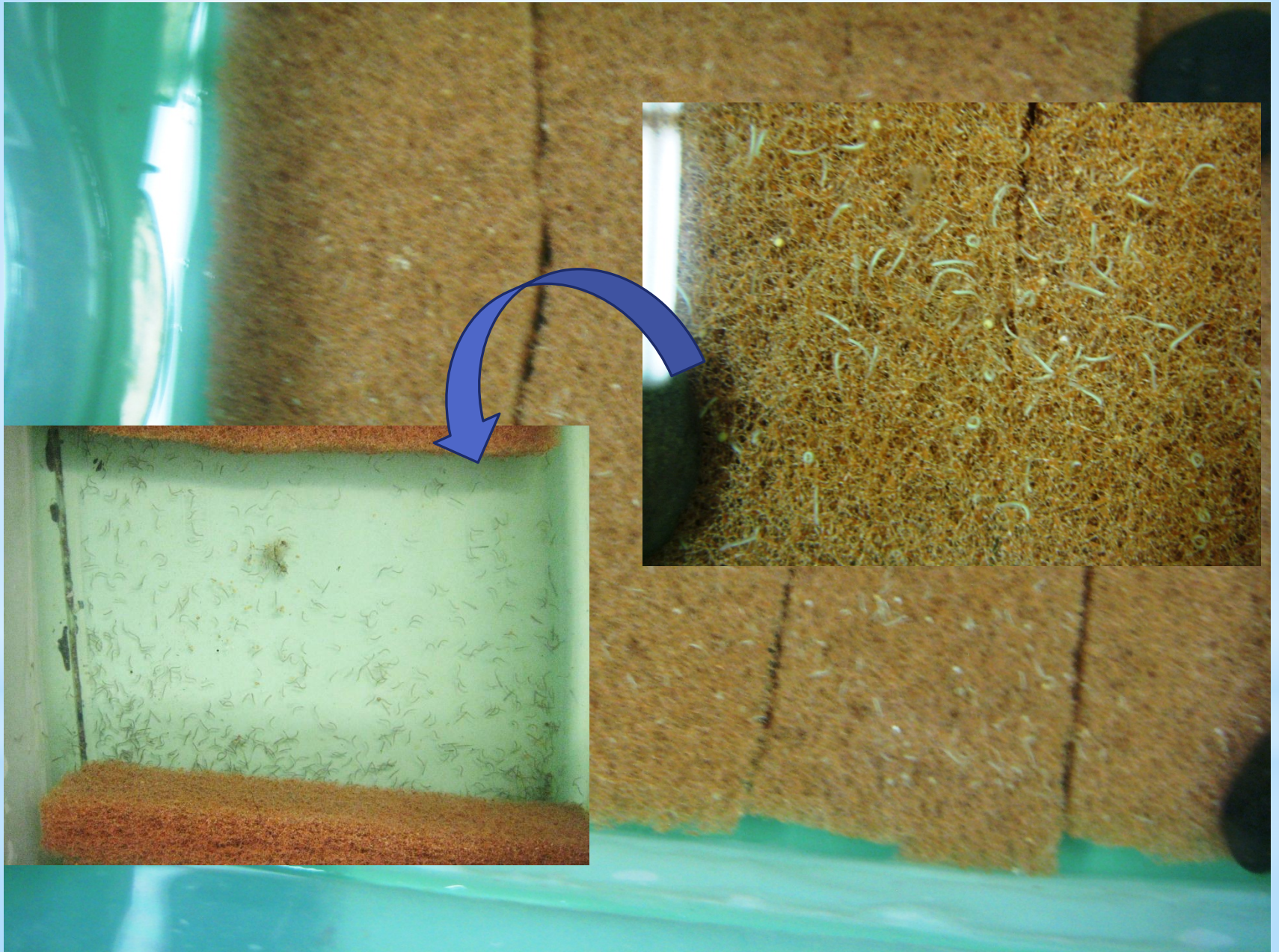
Pros:

- Gentle downwelling flow
- High density incubation possible (~90% survival)
- Minimum daily maintenance
- Volitional release into trough water

Cons:

- Some monitoring needed (need to remove fungus)







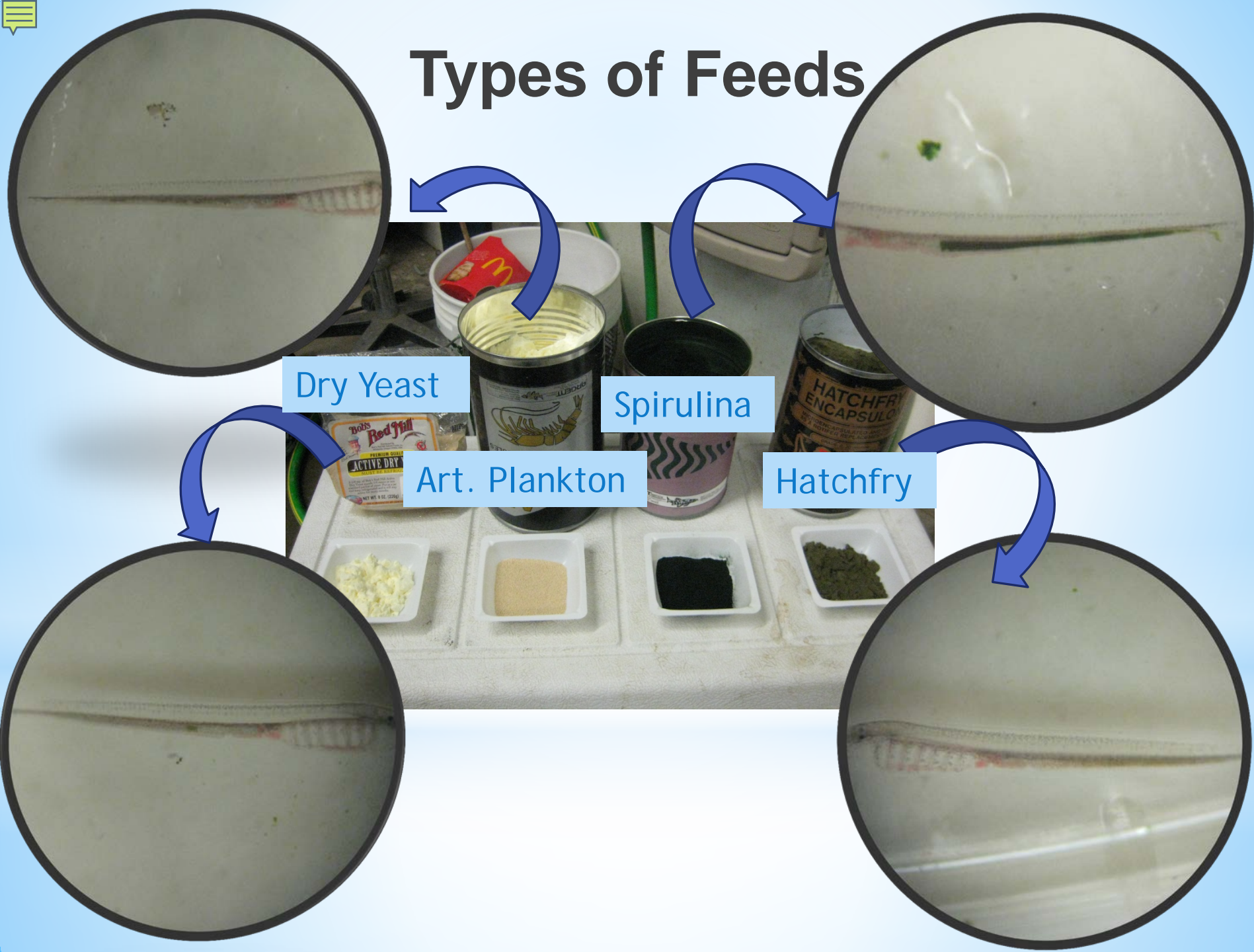
Types of Feeds

Dry Yeast

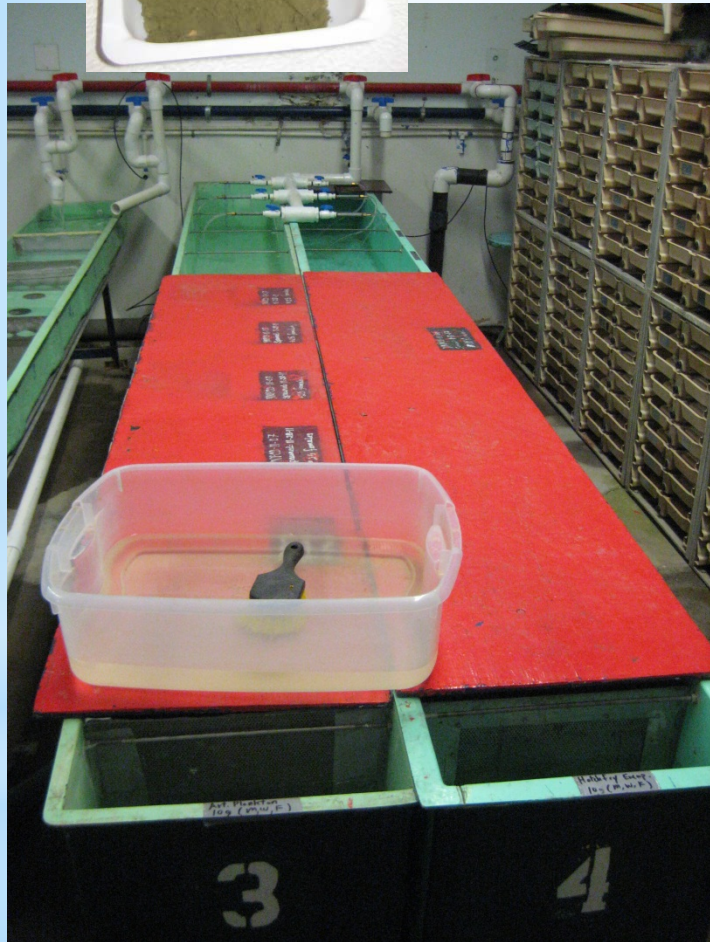
Spirulina

Art. Plankton

Hatchfry



Feeding Ration



Feeding: 10g x3 per week per trough
(each trough has 10,000~25,000 larvae)
Ration: 3.4~8.6% of body weight /day
(7% is standard for small fish)

Calculations:

10mm larva weight: ~0.005g

Trough surface area: 1.9 m²

Trough total larvae weight: 50~125g

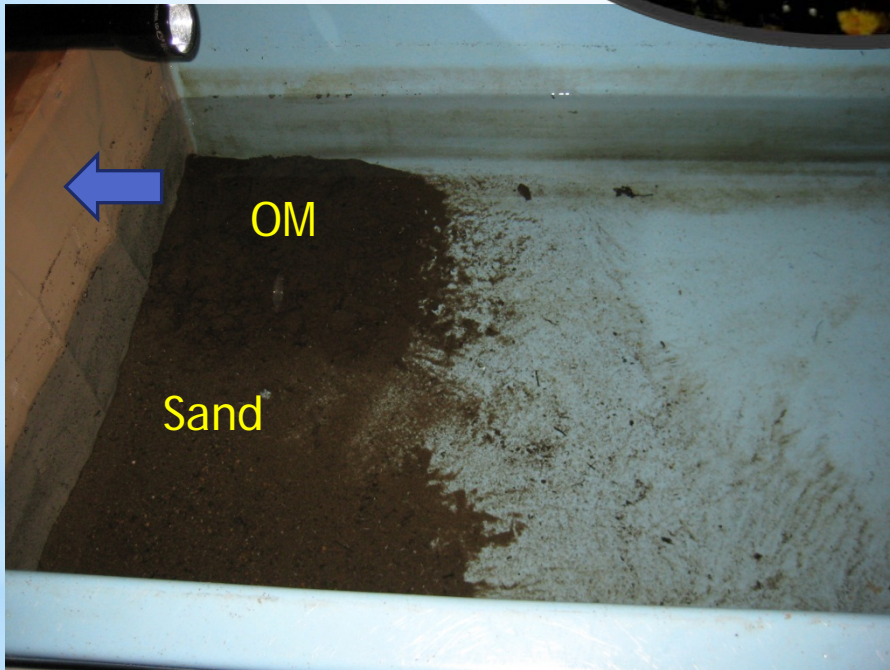
Trough density (weight): 26~66 g/m²

What to Do with Prolarvae?



Outlet

Inlet





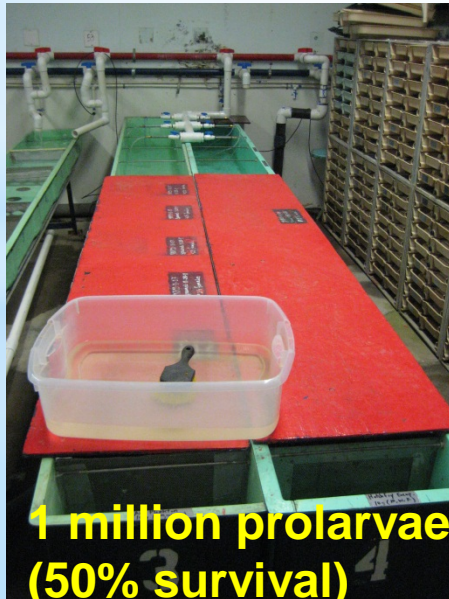
Lamprey Production Scenario

20 females



2 million eggs
(100,000/female)

30,000 prolarvae / trough
-> 33 troughs (16' x 1.5')



1 million prolarvae
(50% survival)

10,000 larvae / tank
-> 50 tanks (9' circular)



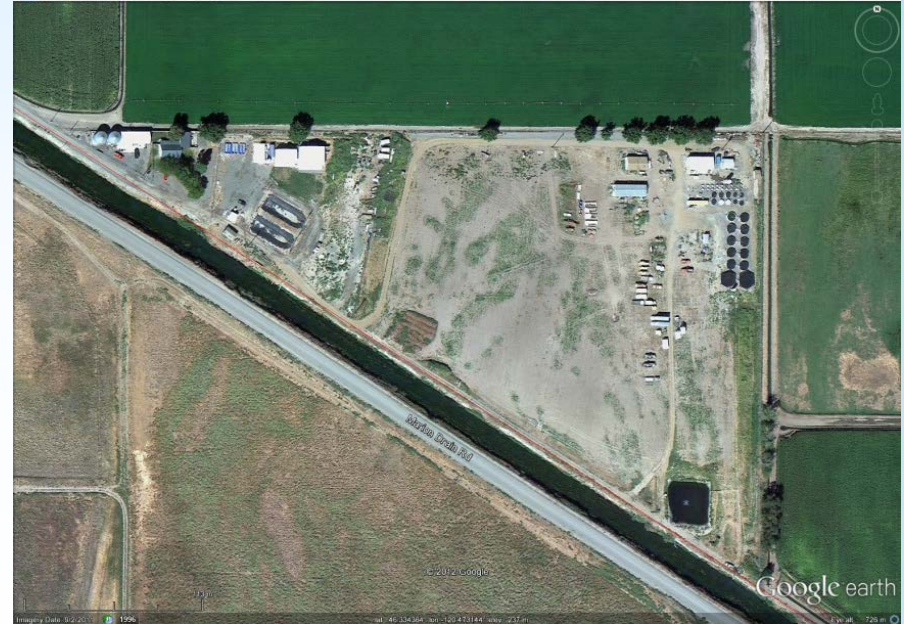
0.5 million larvae
(50% survival)

Lamprey Production Hatchery

Prosser Hatchery (Lower Yakima)



Marion Drain (Mid Yakima)



Cle Elum Hatchery (Upper Yakima)



Potential Release Sites

Side Channels



Canals




Acclimation
Ponds



Acknowledge and Questions






US Army Corps
of Engineers
Portland District

**Pacific Lamprey Passage Improvements
Implementation Plan
2008 - 2018**


Columbia River Basin Lamprey Technical Workgroup
Columbia Basin Fish and Wildlife Foundation
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Portland, OR 97204
columbia@cbffw.org




*Columbia River Basin
Lamprey Technical Workgroup*

Critical Uncertainties for Lamprey in the Columbia River Basin: Results from a strategic planning retreat of the Columbia River Lamprey Technical Workgroup

**Tribal Pacific Lamprey
Restoration Plan for the
Columbia River Basin**



Formal Draft
May 15, 2008
Nez Perce, Umatilla, Yakama and Warm Springs
Tribes



Pacific Lamprey Conservation Initiative
U.S. Fish and Wildlife Service
September 2007

The Pacific Lamprey Conservation Initiative is an effort presently led by the U.S. Fish and Wildlife Service (FWS) to facilitate communication and coordination relative to the conservation of Pacific lampreys throughout their range. The goal of the initiative is to develop a Pacific Lamprey Conservation Plan that will lead to restored Pacific lamprey populations and improvement of their habitat.

