

Yakama Nation Pacific Lamprey Artificial Propagation: Lessons Learned & Path Forward



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Outline

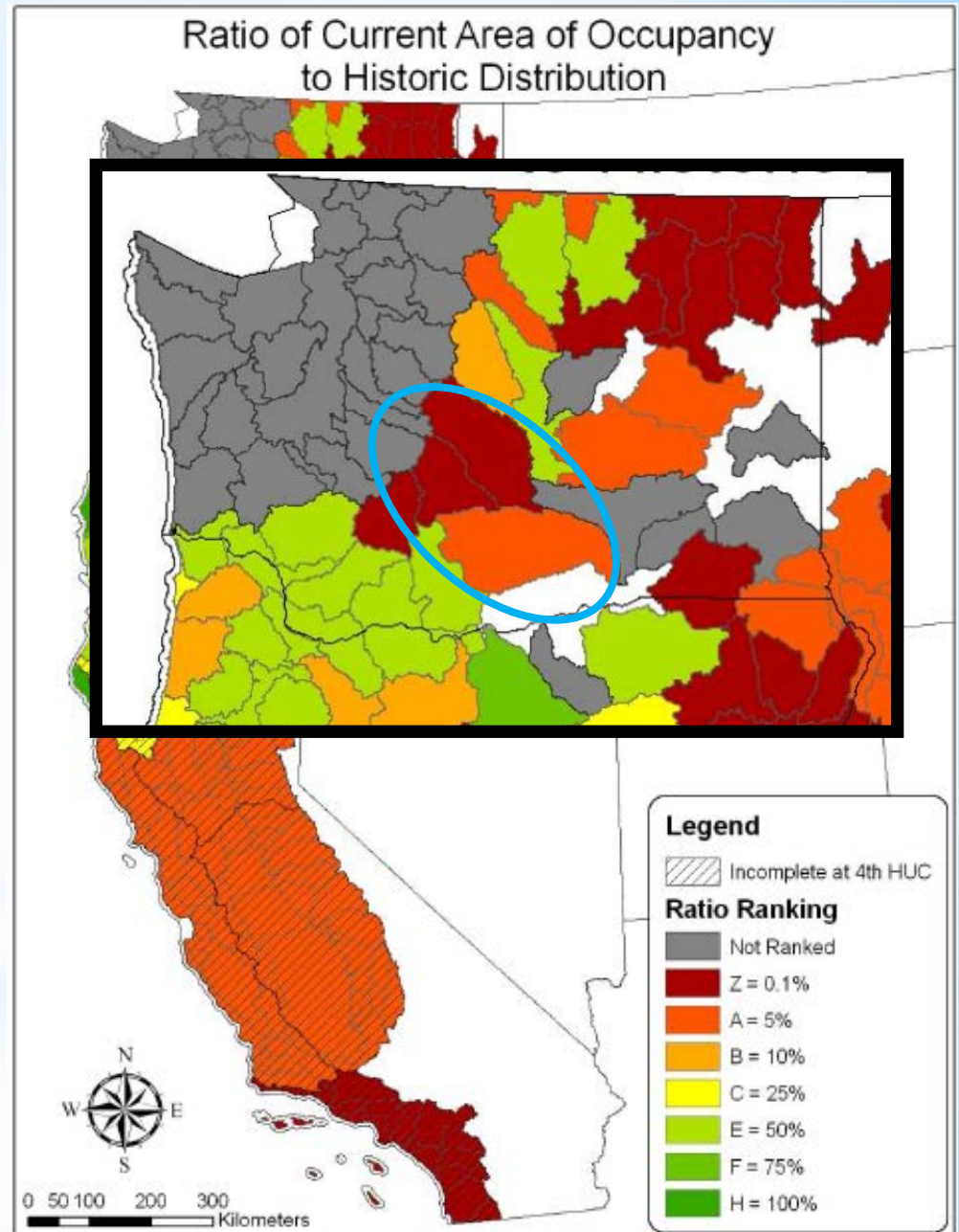
- **Intro & Background**
- **Spawning & Incubation**
- **Feeding Study**
- **Future Considerations**



Freshwaters Illustrated / USFWS

Background

- Reduced population in interior basins & 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**

1st International Forum for the Recovery and Propagation of Lamprey

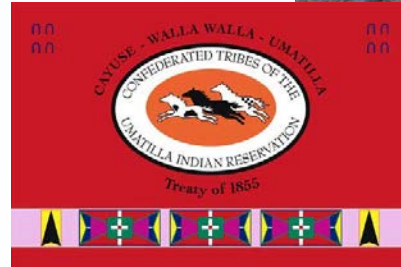
Japanese Manual

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

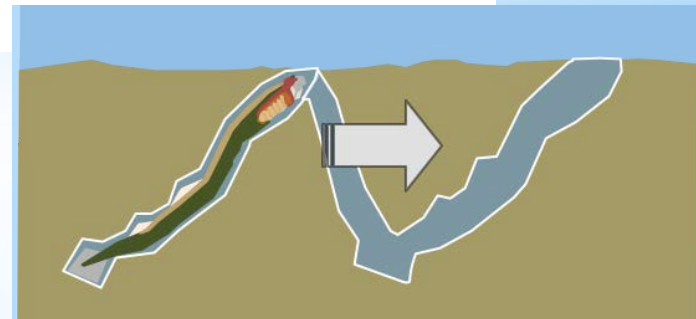
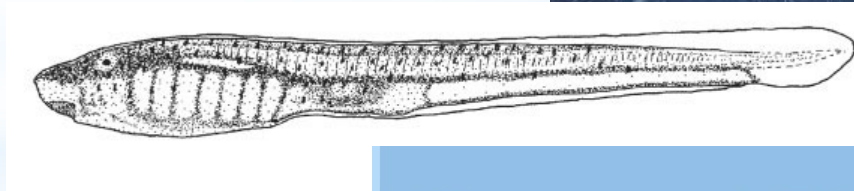
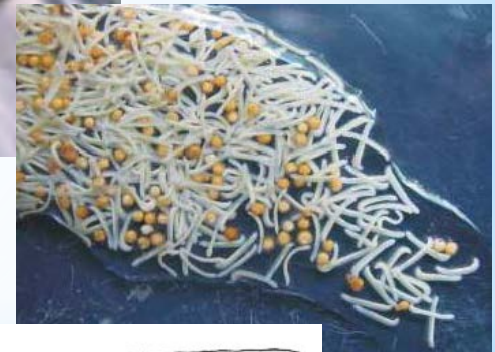
1. **Adult Holding**

2. **Spawning**

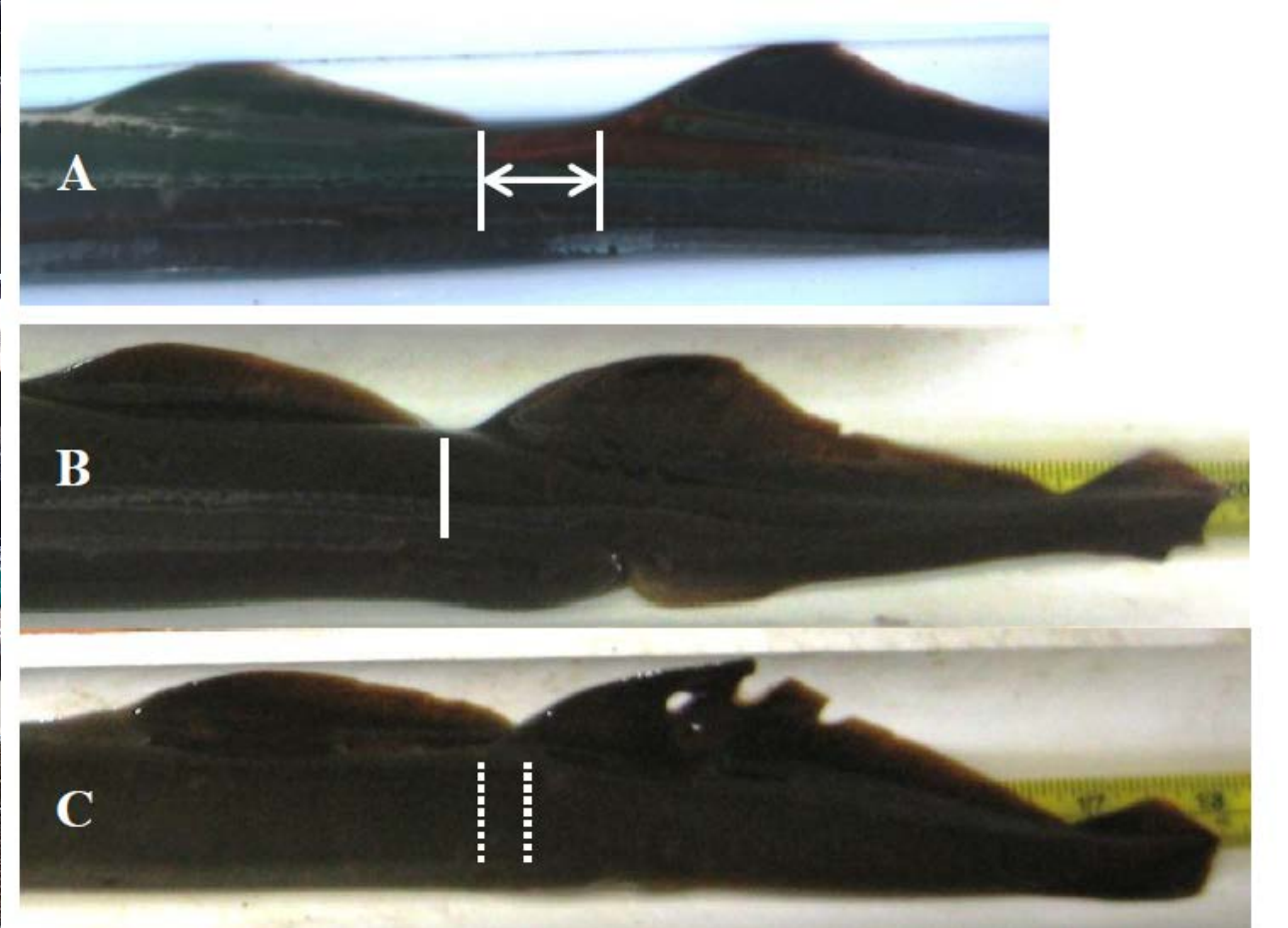
3. **Egg Incubation**

4. **Prolarvae**

5. **Larvae**



1. Adults



em to
(at night)
at for
level
critical to
, never
ear)



2. Spawning

Eggs (80~190 g)
*80,000~190,000 eggs
**Eggs 24-50% of body weight

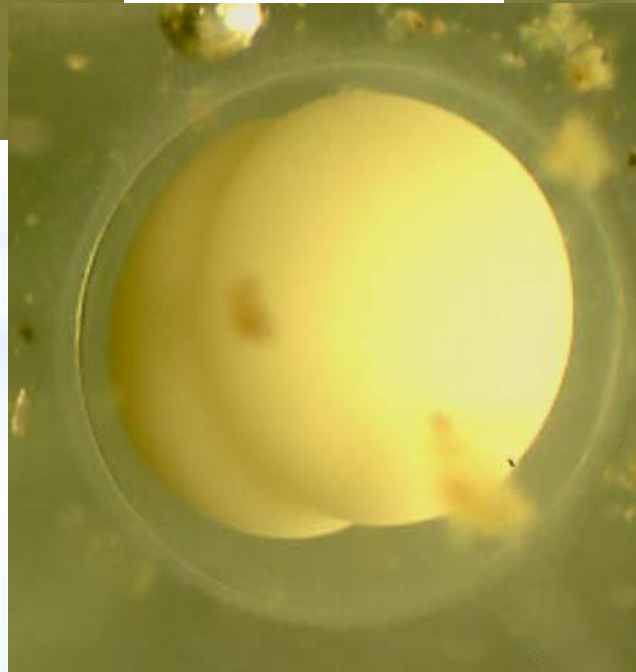
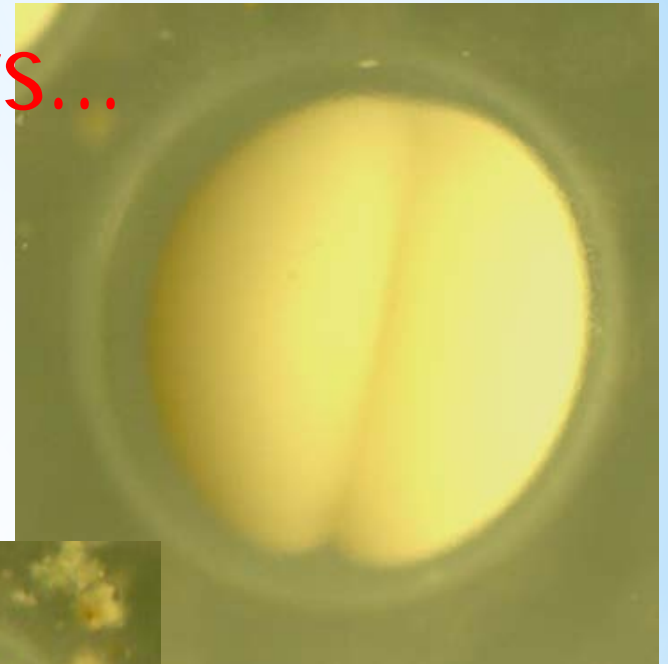
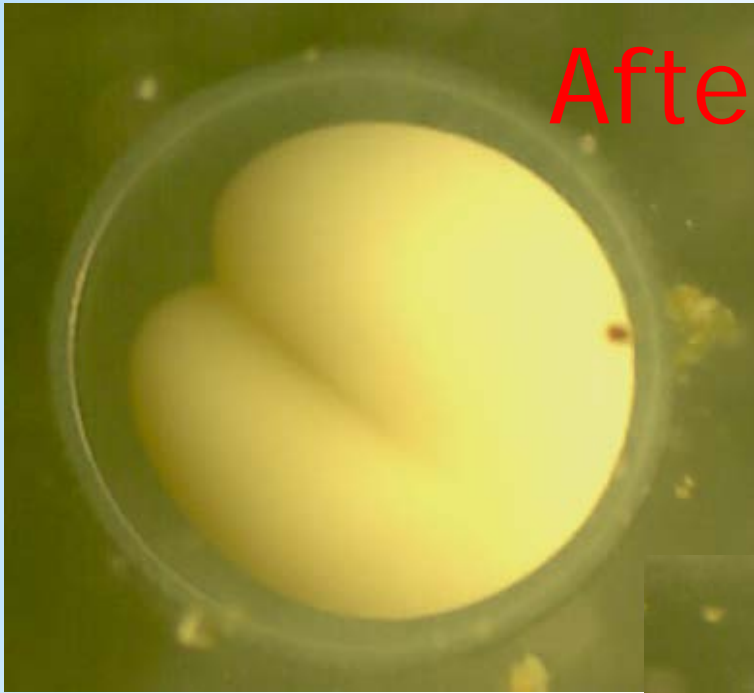
Milt (0.1~7.0 g)
*45% milt in 4 days
75% milt in 8 days



- 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)

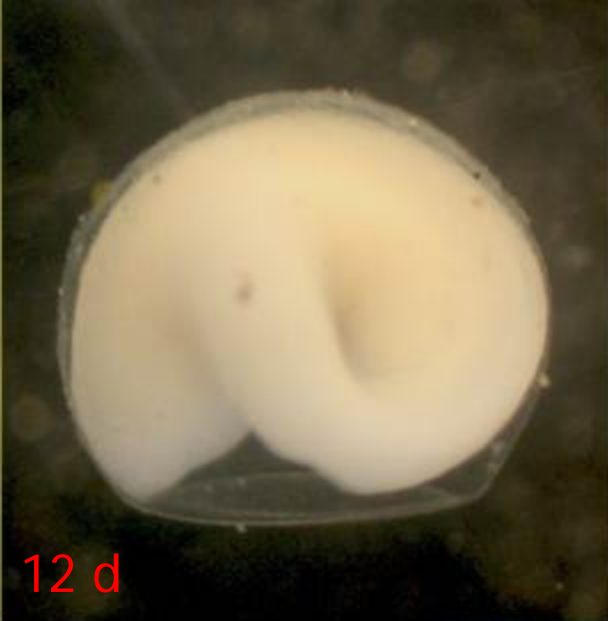


Clam (11 d)





0.25 d



12 d



14 d



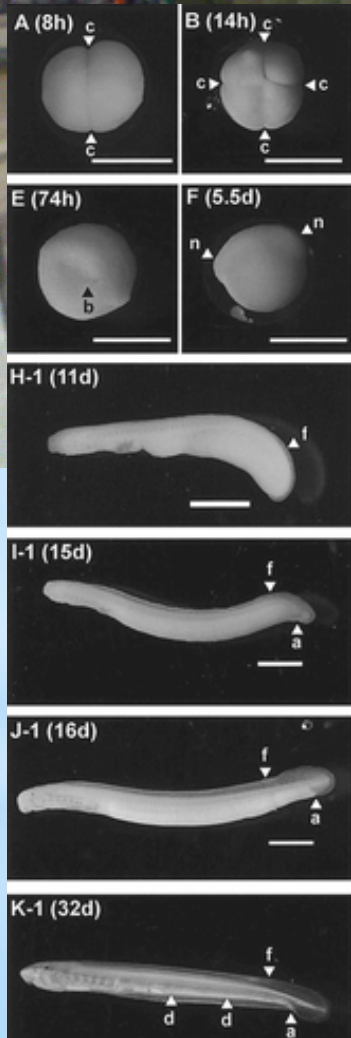
31 d (~10 d w/ yolk sac)



21 d

3. Egg Incubation

Finnish Style Propagation



1.2 mm

0.6 mm

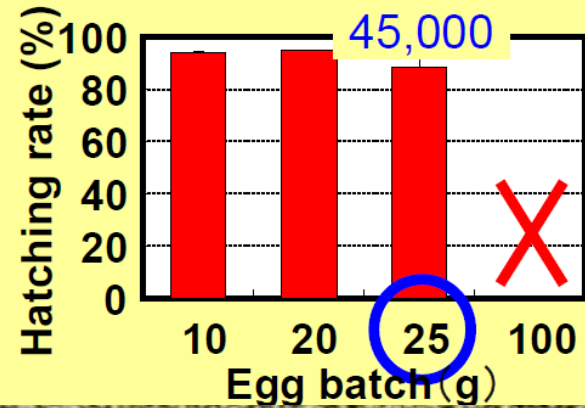


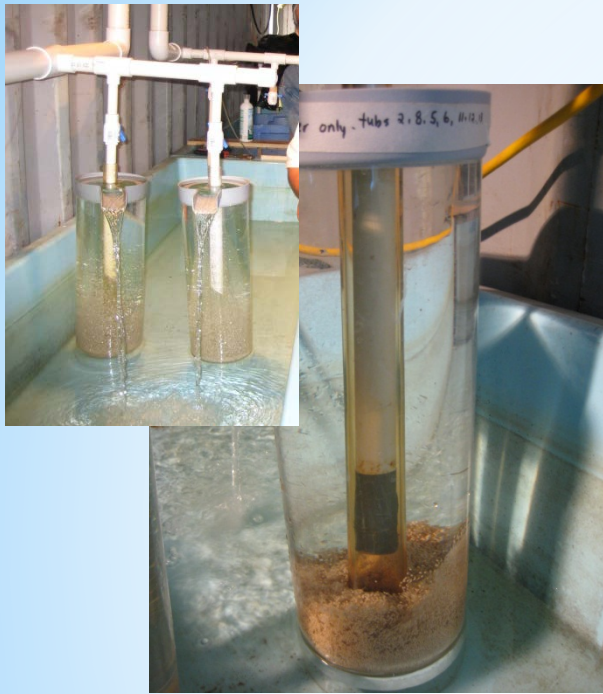
Japanese Style Propagation

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



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





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





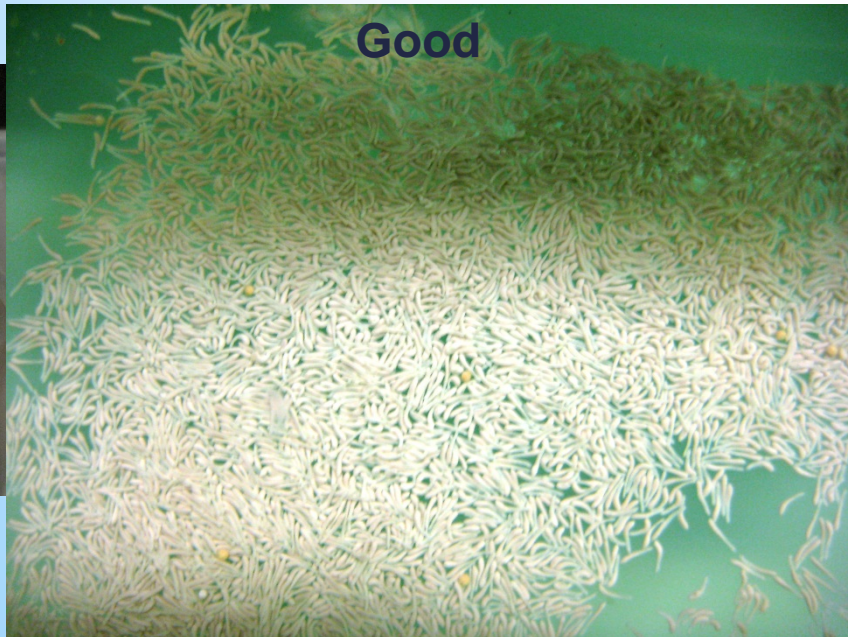
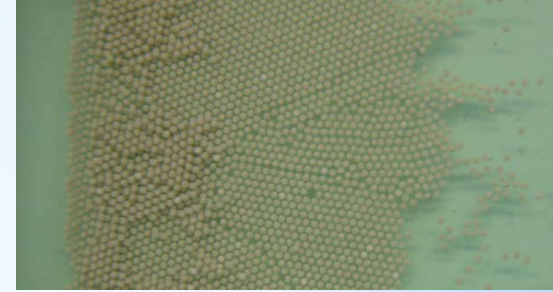
Plastic Tubs

Pros:

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

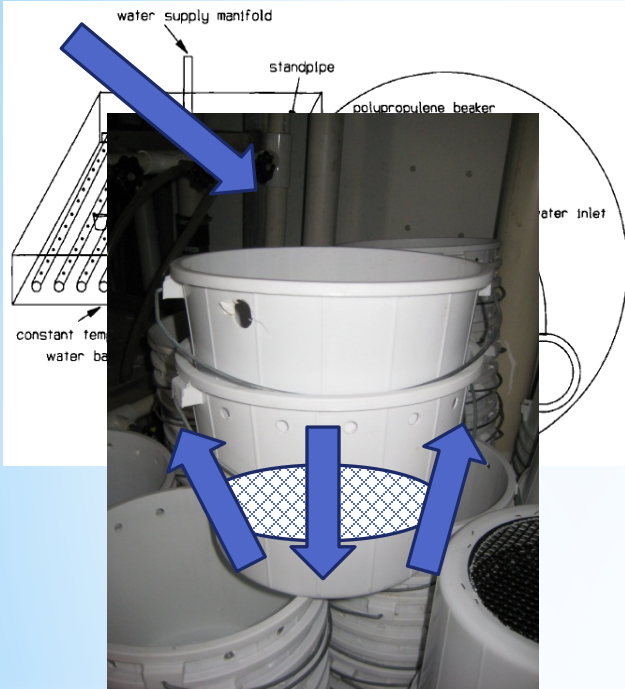
Cons:

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



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Fredricks and Seelye (1995)
Great Lakes sea lamprey



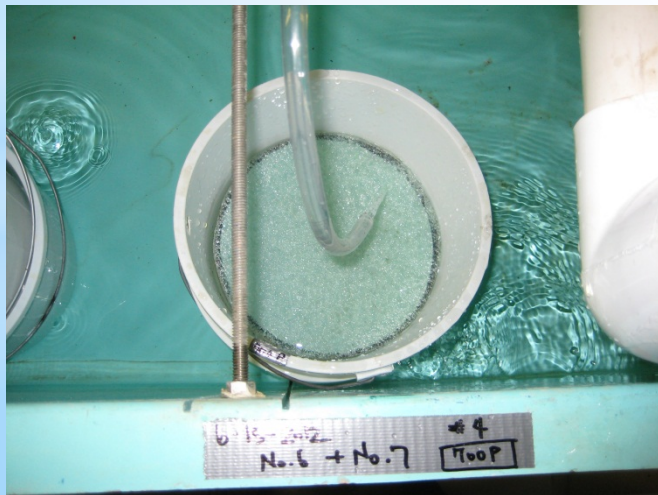
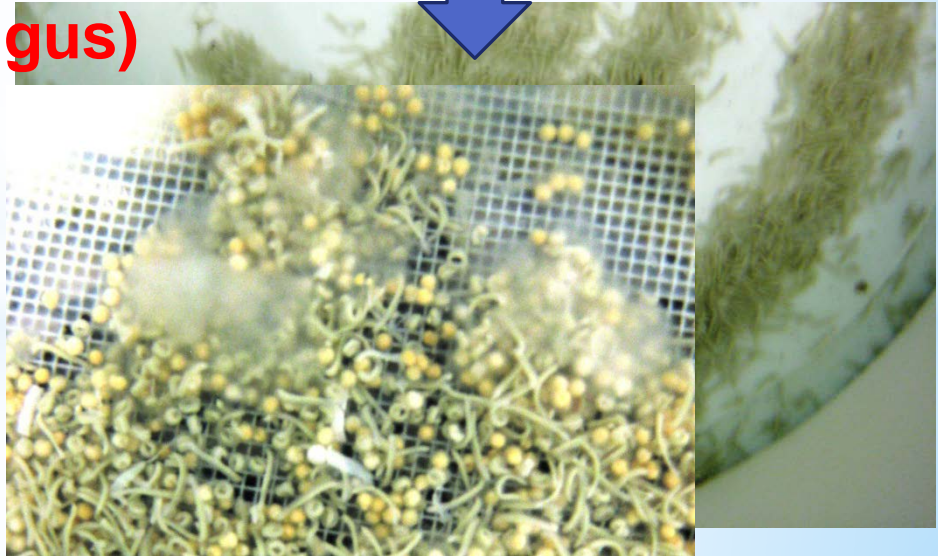
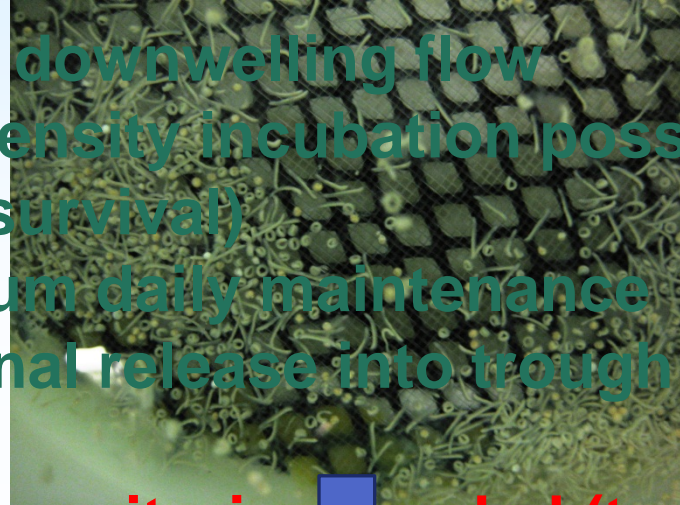
Flow-Through Buckets

Pros:

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

Cons:

- Some monitoring needed (to remove fungus)

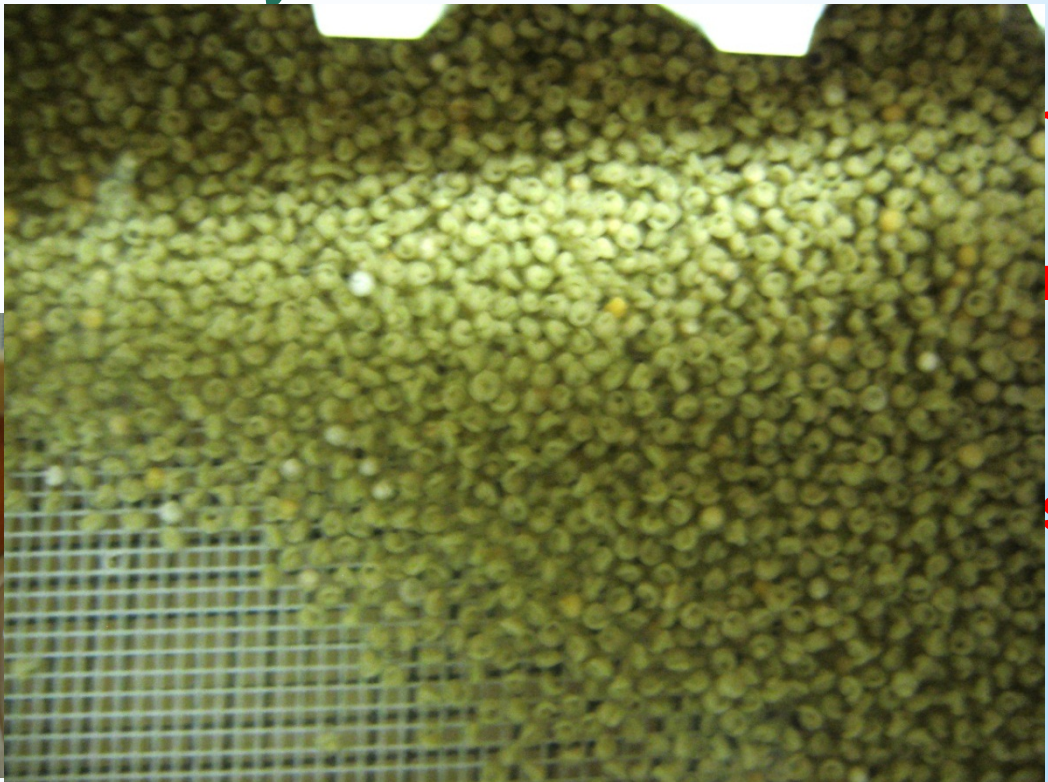
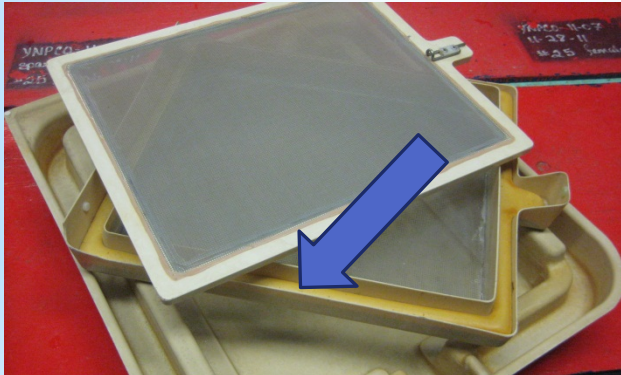




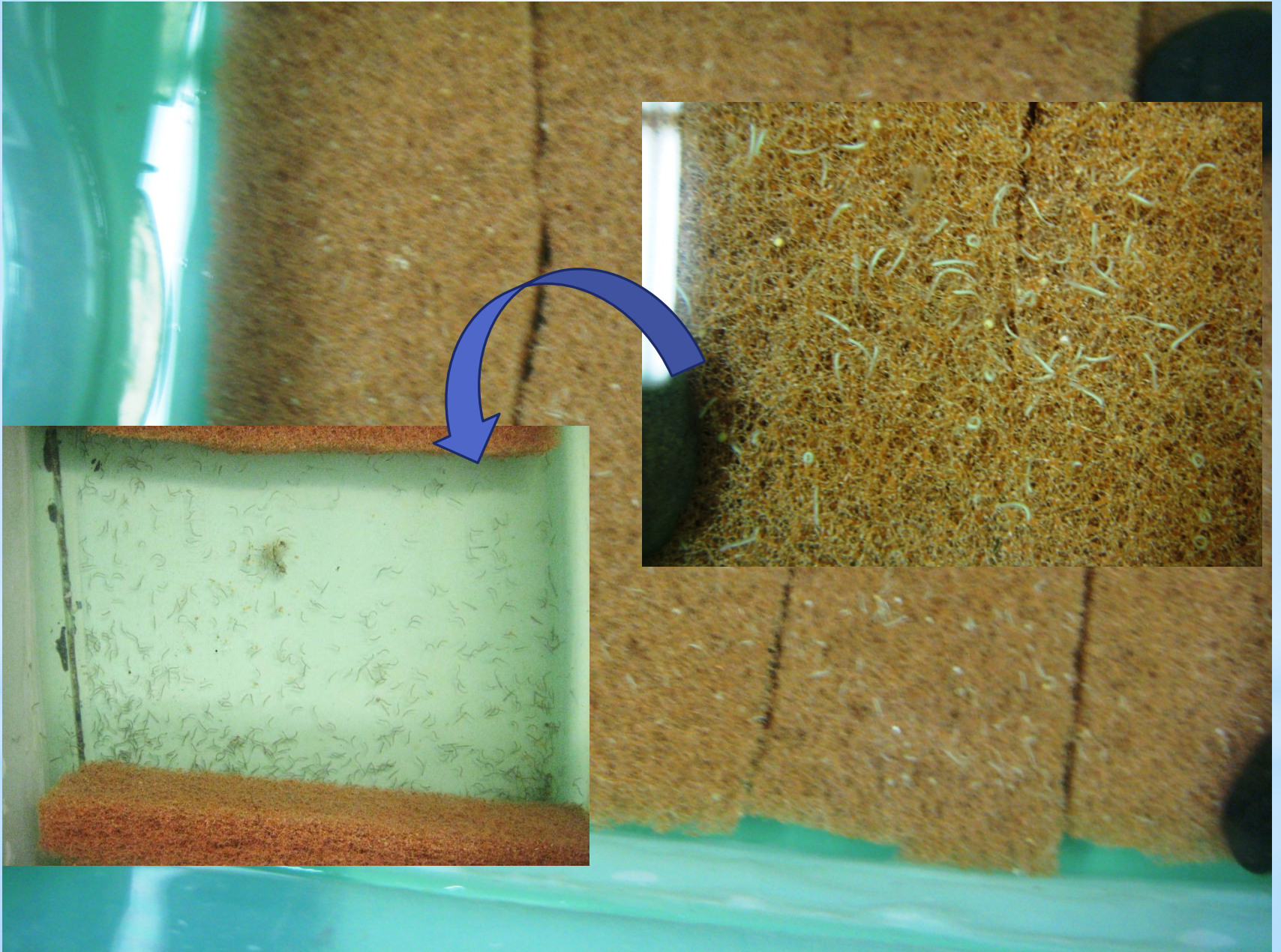
Vertical Incubation (Heath) Trays (2 Screens)

Pros:

- Gentle upwelling flow
- High density incubation possible (~97% survival)
- No daily maintenance needed



Small
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What to Do with Prolarvae?



Simple

1. Add organisms into the bucket



Accurate

2. Press COUNT

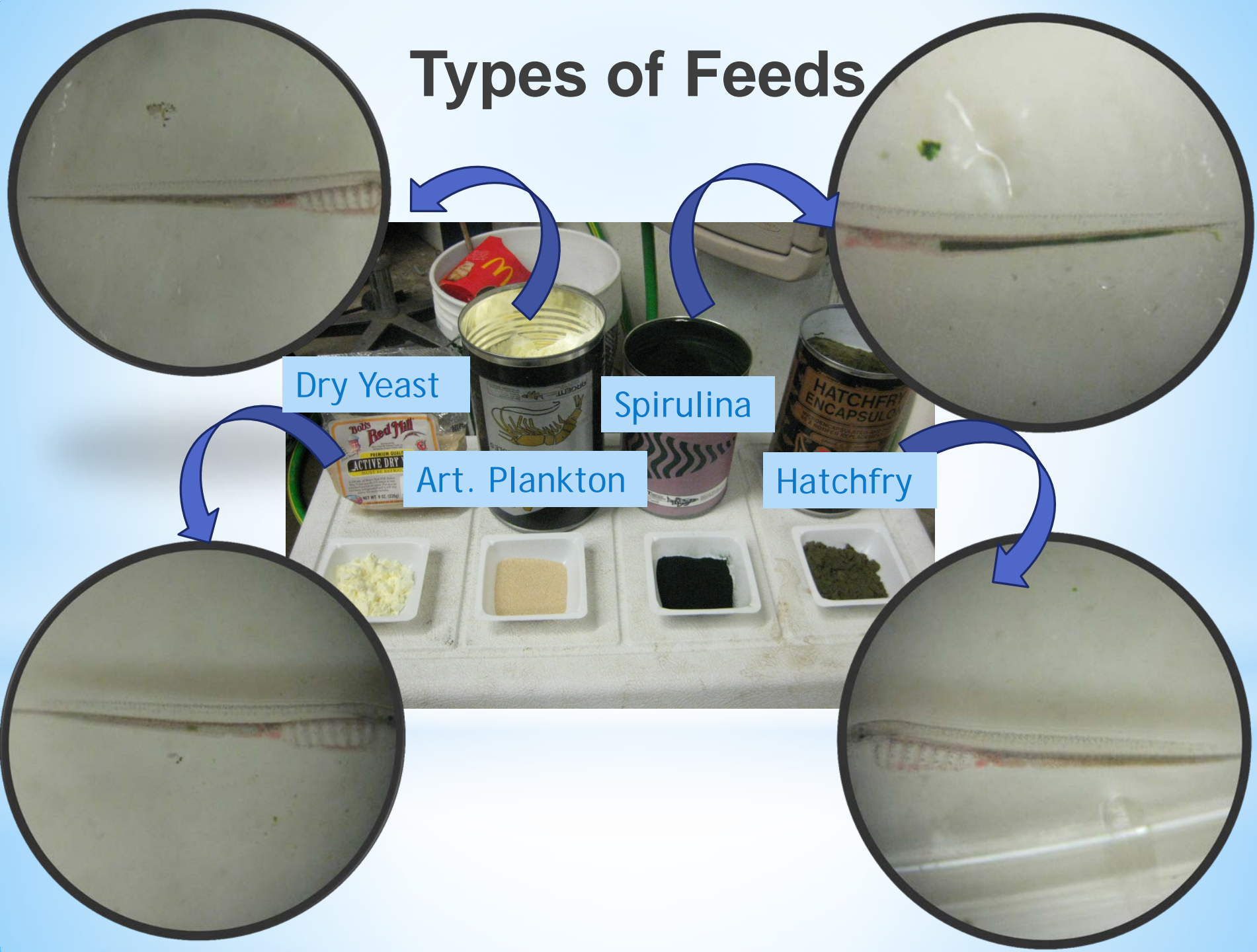


Versatile

3. Witness accurate results in seconds



Types of Feeds

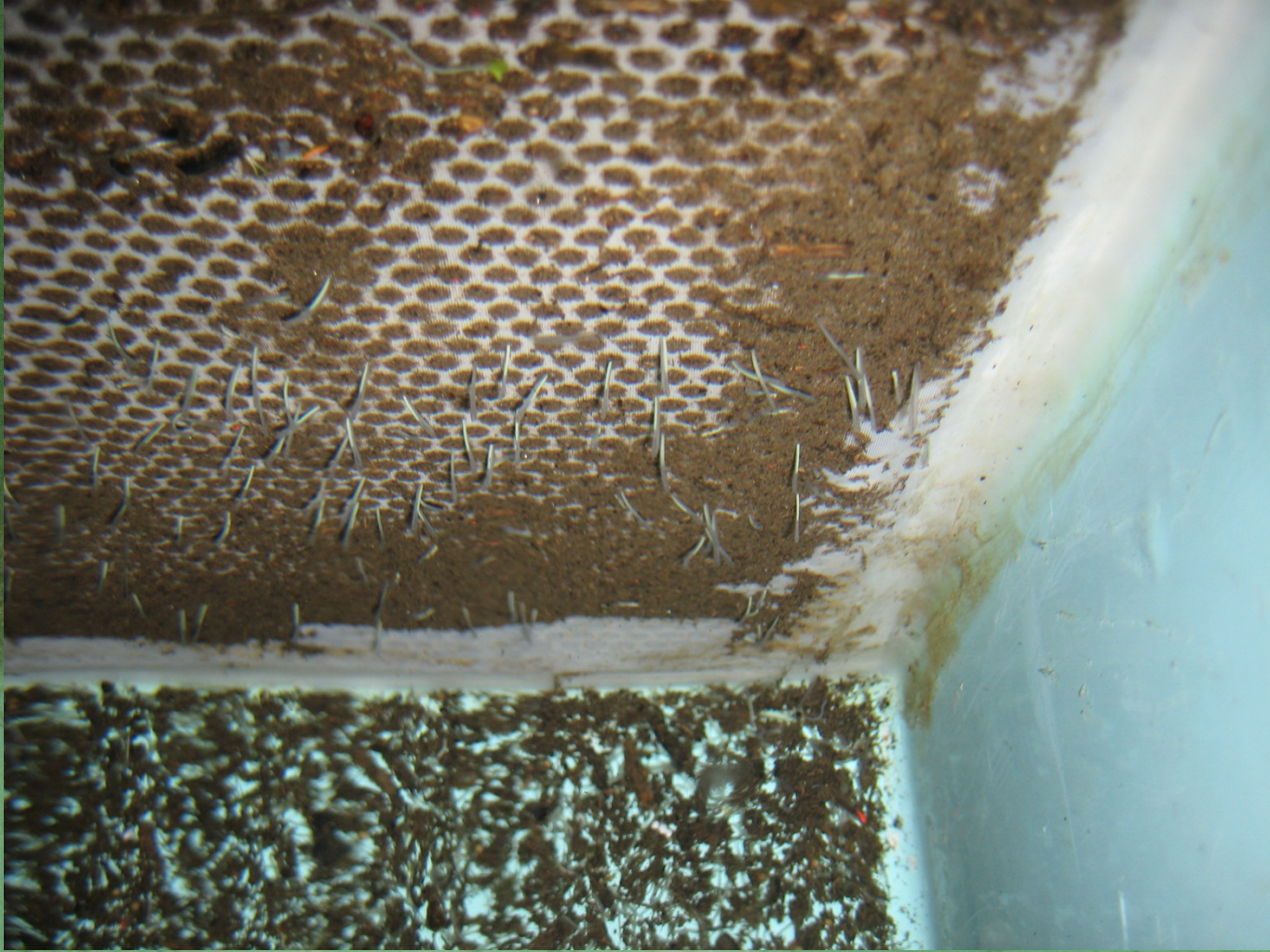


Dry Yeast

Spirulina

Art. Plankton

Hatchfry

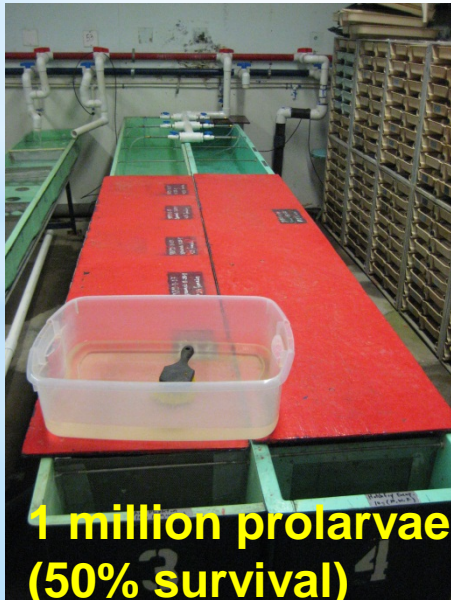


Lamprey Production Scenario

20 females



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



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



Lamprey Production Hatchery

Prosser Hatchery (Lower Yakima)



Marion Drain (Mid Yakima)

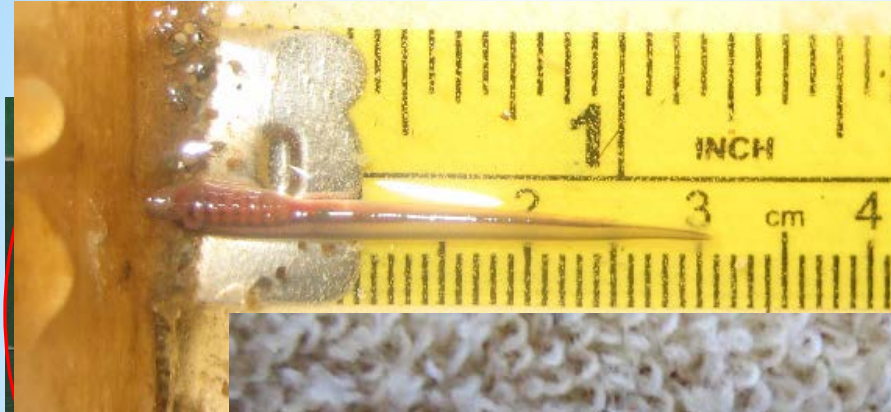


Cle Elum Hatchery (Upper Yakima)

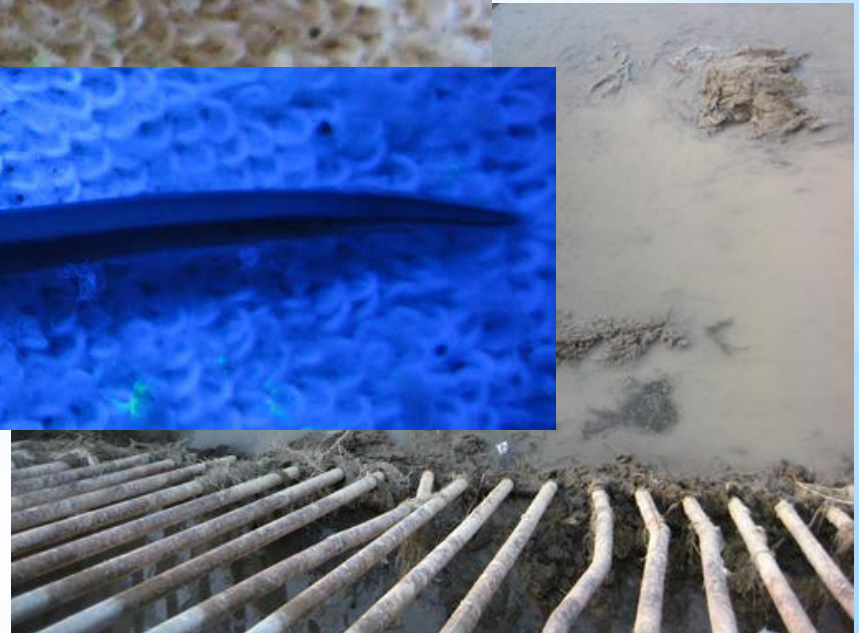


Potential Release Sites

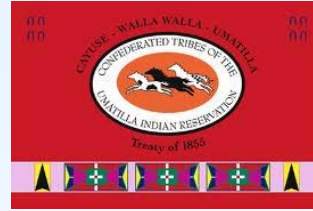
Acclimation
Ponds



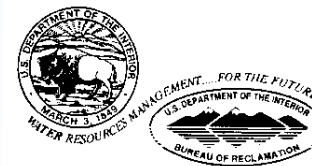
Canals



Acknowledge and Questions



**US Army Corps
of Engineers®**



Partnership is key to our success!