

Updates on Adult Pacific Lamprey Passage Improvements in the Yakima Basin

Lamprey Summit December 6, 2017



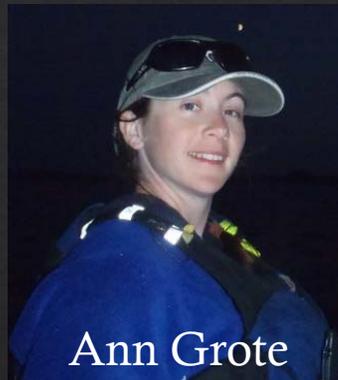
Ralph Lampman
Yakama Nation Fisheries

A black and white photograph of a man, Ralph Lampman, holding a large lamprey. He is wearing a light-colored shirt and dark pants. The lamprey is held horizontally in front of him. The background is dark and out of focus.

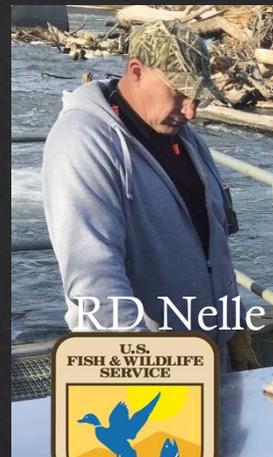
Acknowledgement / Credits



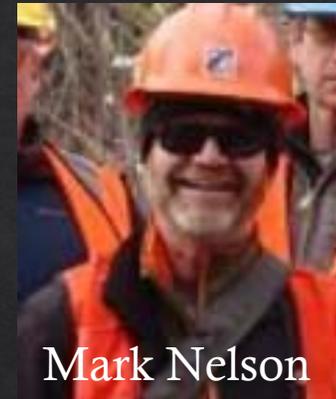
Jim Simonson
(Fishhead
Technology)



Ann Grote



RD Nelle



Mark Nelson



Susan Camp



Mark Briggs



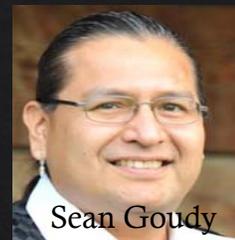
Leona Wapato



Tyler Beals



Shekinah
Saluskin



Sean Goudy



Darcy Rules
Dave'y Lumley



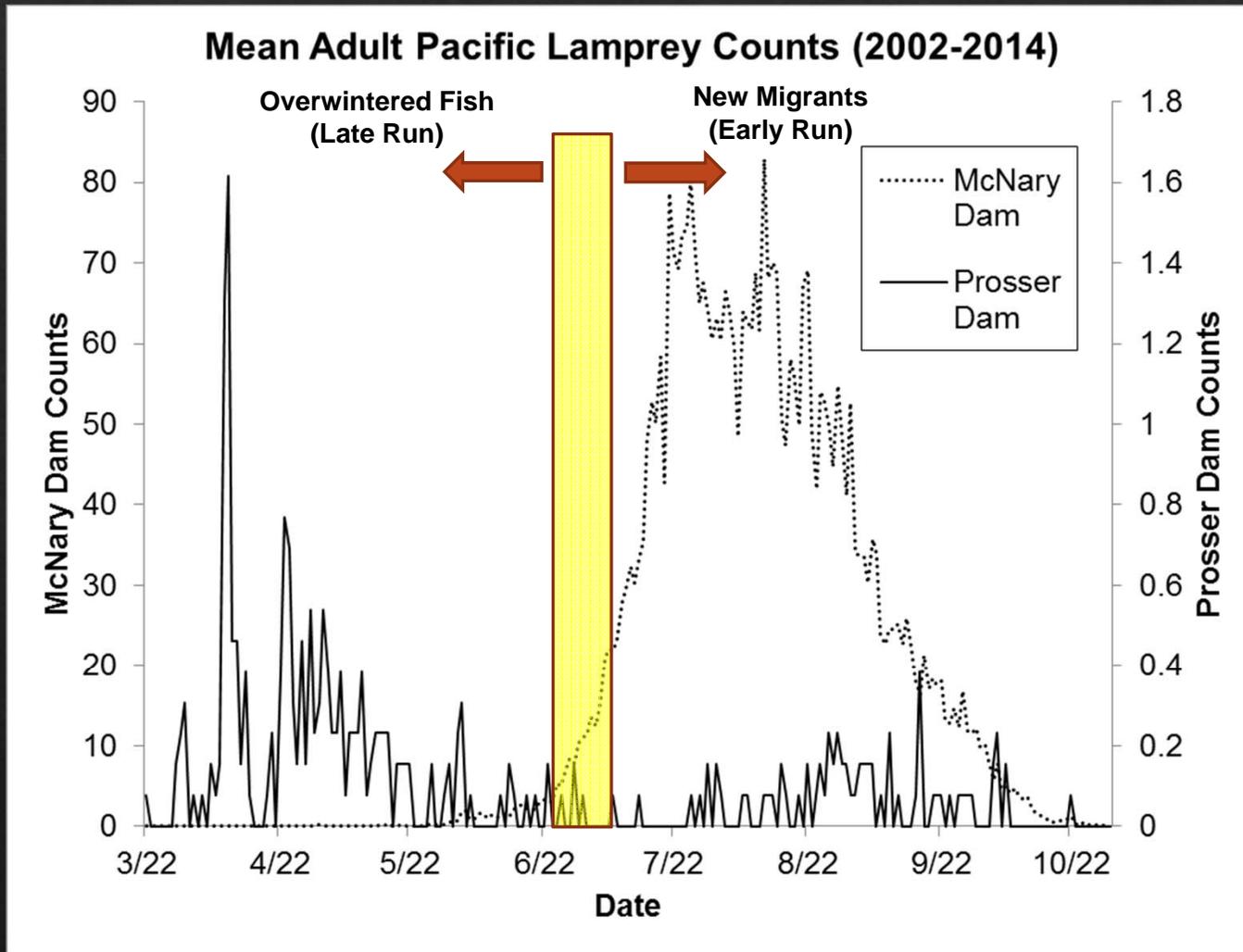
Hiroaki
Arakawa

Overview

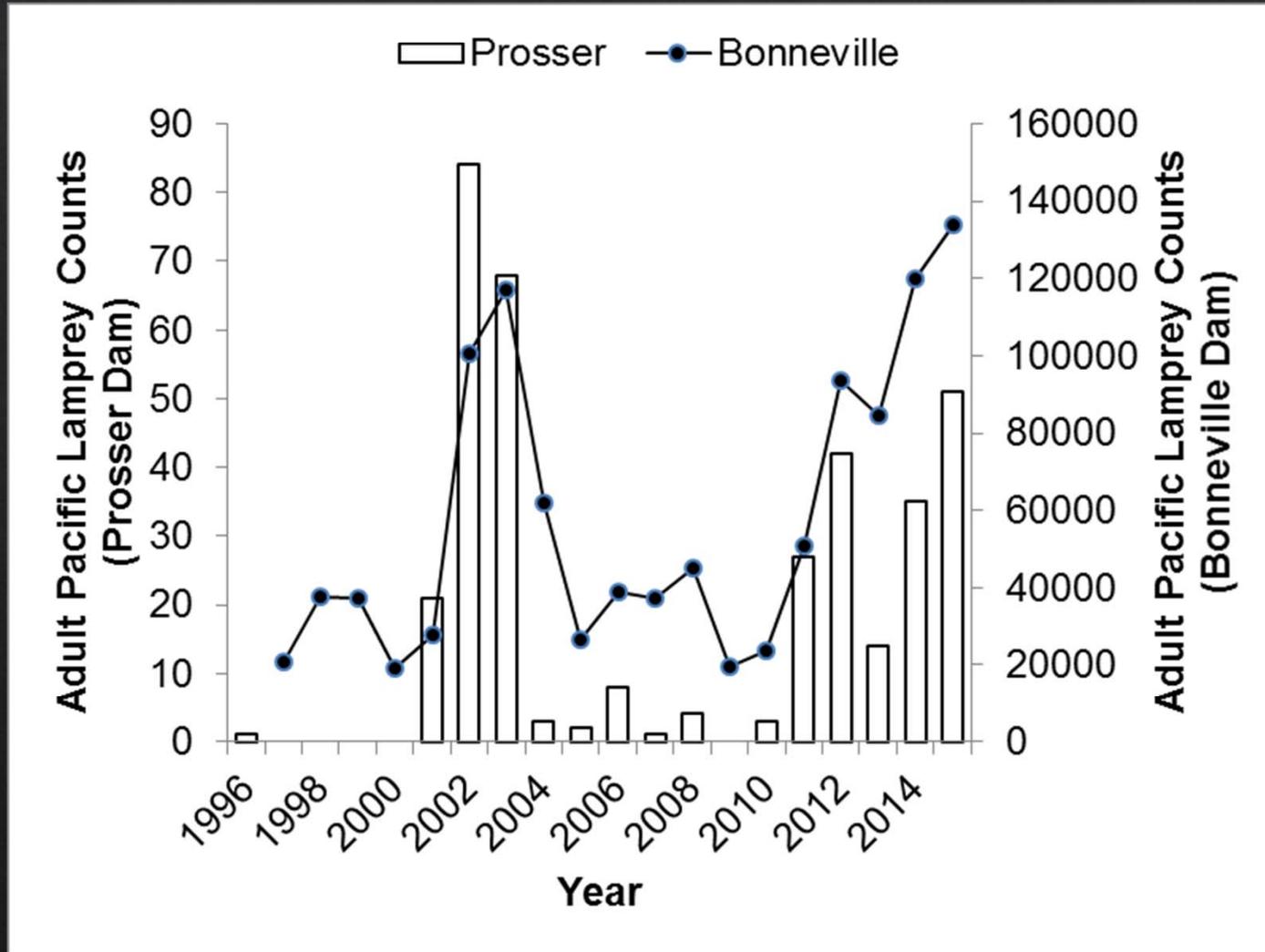
- ◆ Yakima Basin Passage Overview
- ◆ Vertical Wetted Wall (VWW) Passage Structure
- ◆ VWW Challenges and Solutions
- ◆ Other Passage Improvement Projects

Pacific Lamprey Migration Timing

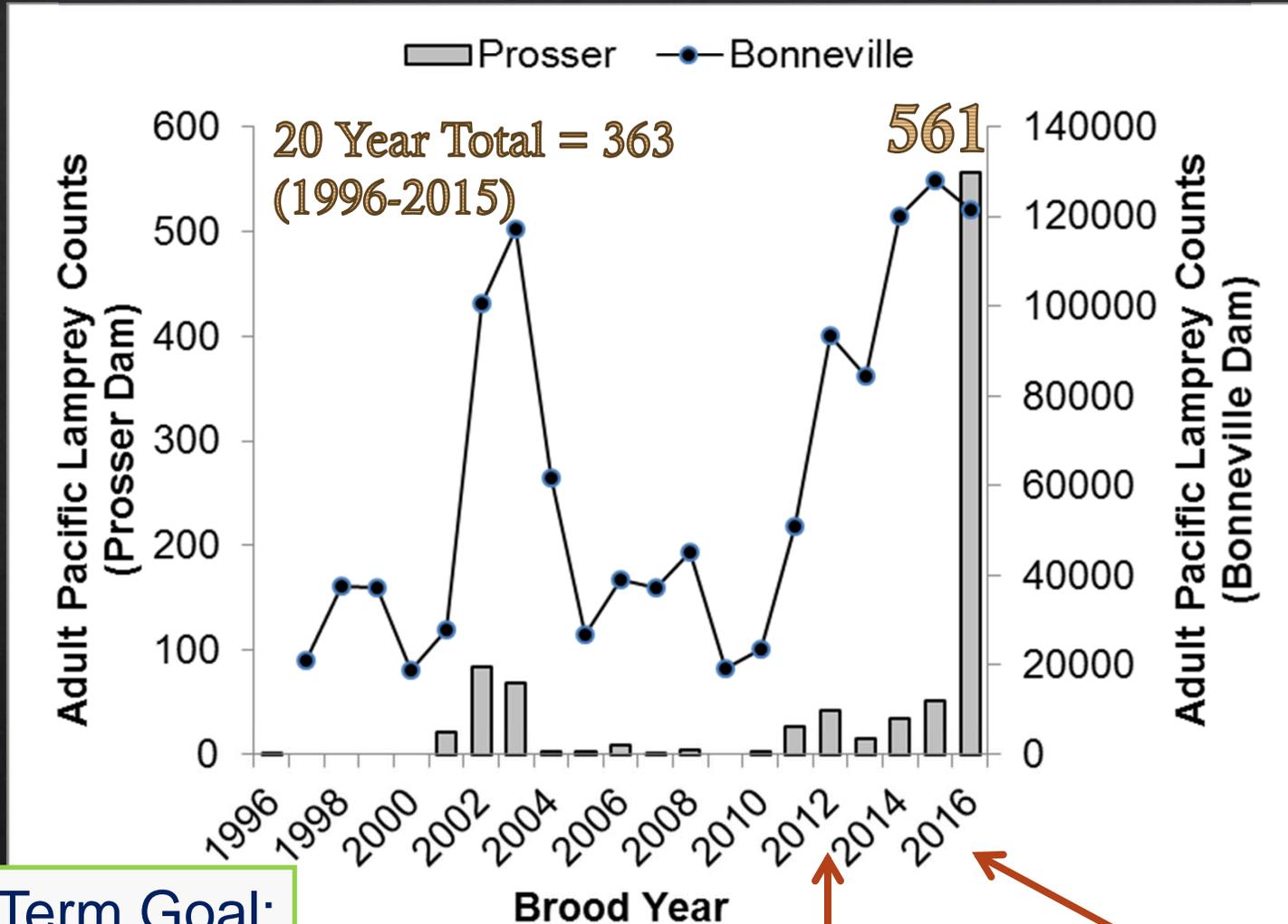
Oct 22 – March 22 = Overwintering (Hybernation) Period



Prosser vs. Bonneville Counts (1996-2015 Broodstock)



Prosser vs. Bonneville Counts (1996-2015 Brood)

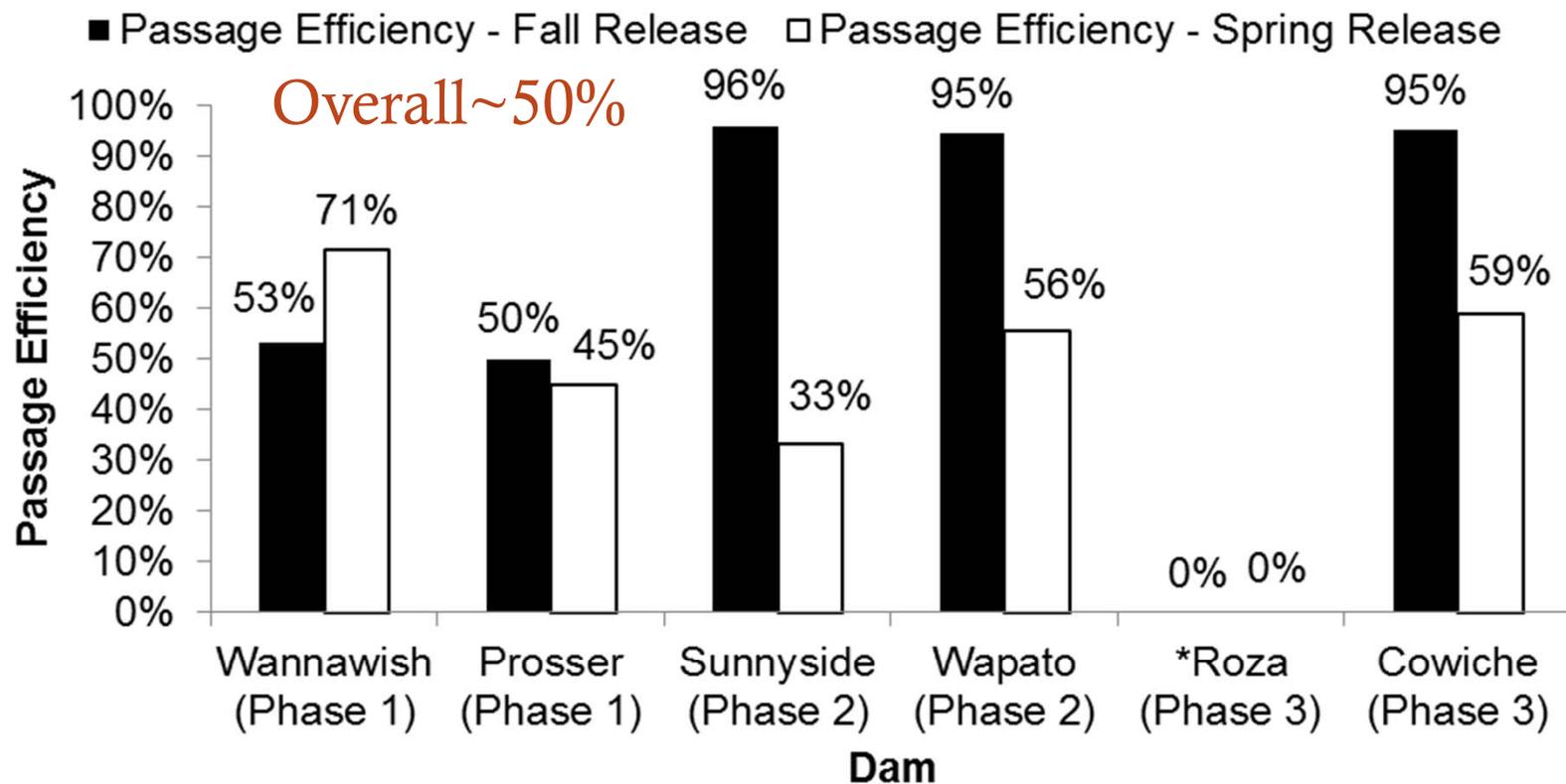


Long Term Goal:
35,000

Start of
Translocation

X10 increase
(4 years later)

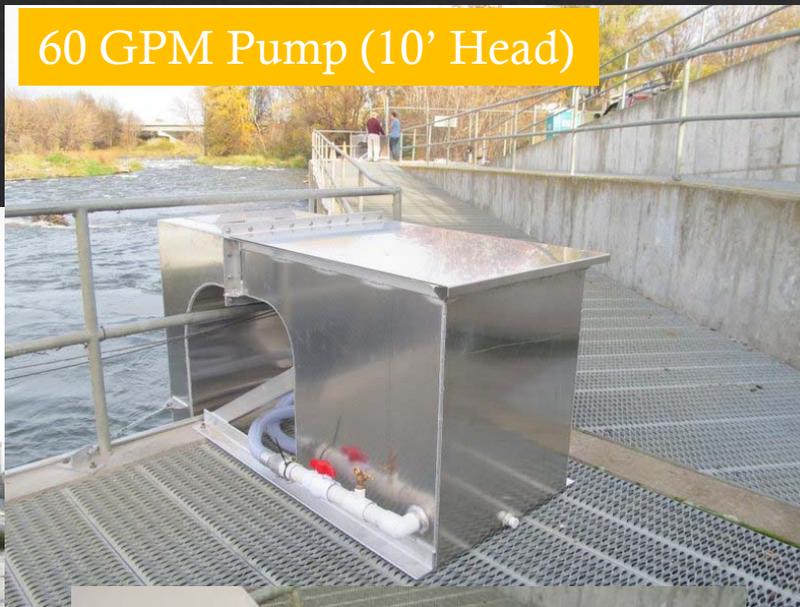
USFWS Radio Telemetry Results (2011-2014)



New Passage Structures at Prosser Dam Vertical Wetted Wall (VWW) Structures



Wall Height = 8~14 ft



60 GPM Pump (10' Head)

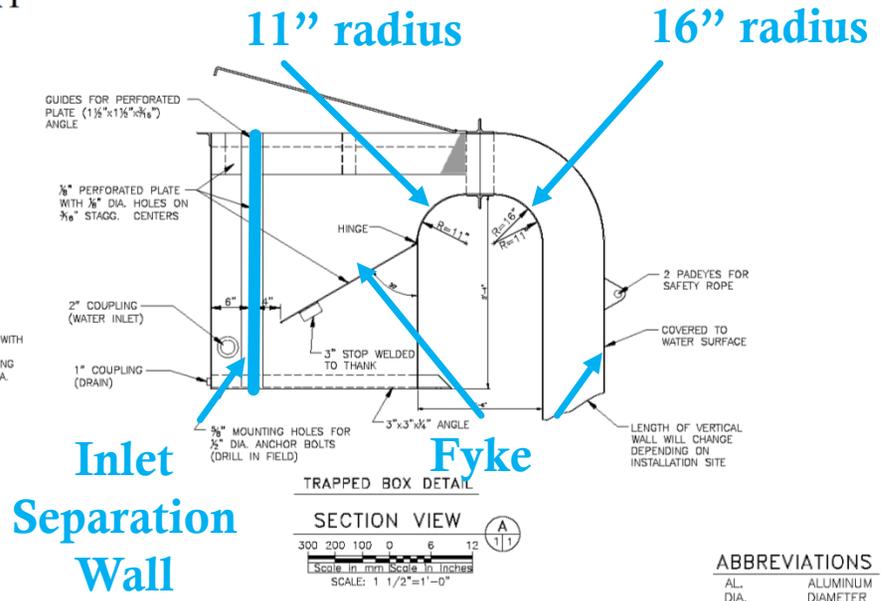
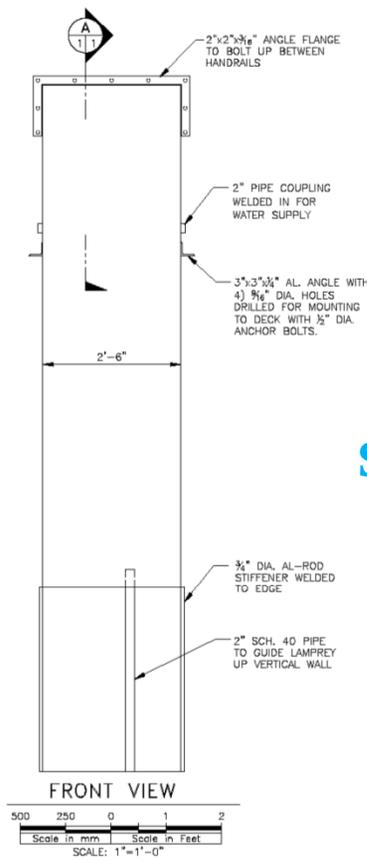
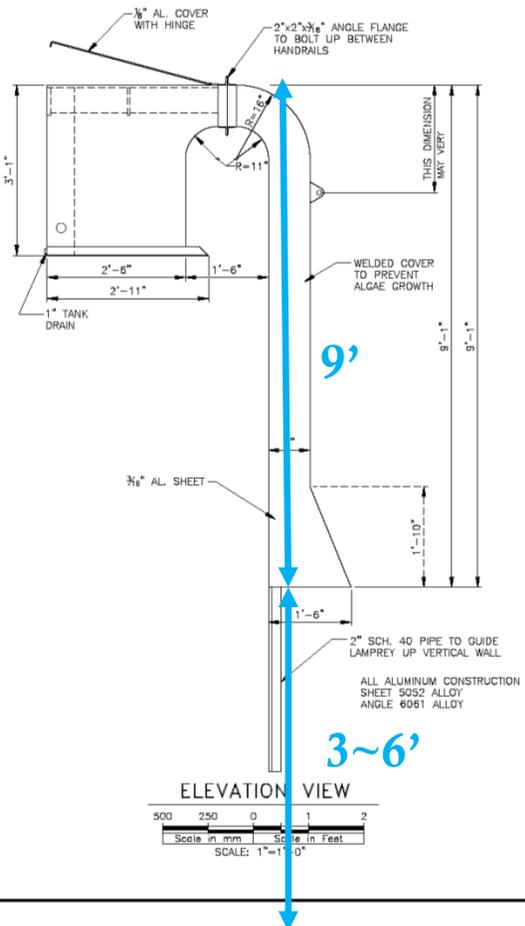


Designed By Fish Head Technology
(Jim Simonson)
Partners = USFWS, BOR, YN

VWW Design



LAMPREY PASSAGE SYSTEM MID-COLUMBIA RIVER FISHERY RESOURCE OFFICE LEAVENWORTH NATIONAL FISH HATCHERY



Inlet Separation Wall

Fyke

ABBREVIATIONS

AL.	ALUMINUM
DIA.	DIAMETER
PER.	PERFORATED
R	RADIUS
SCH.	SCHEDULE
STAGG.	STAGGERED

VERIFY SCALE
THIS BAR IS ONE INCH ON ORIGINAL DRAWING
ADJUST SCALES ACCORDINGLY, IF NOT ONE INCH ON THIS SHEET

DETAILING CONVENTIONS

SECTIONS:	DETAILS:
SECTION LETTER SHEET WHERE DETAIL IS SHOWN SHEET WHERE DETAIL IS TAKEN	DETAIL NUMBER SHEET WHERE SECTION IS SHOWN SHEET WHERE SECTION IS TAKEN

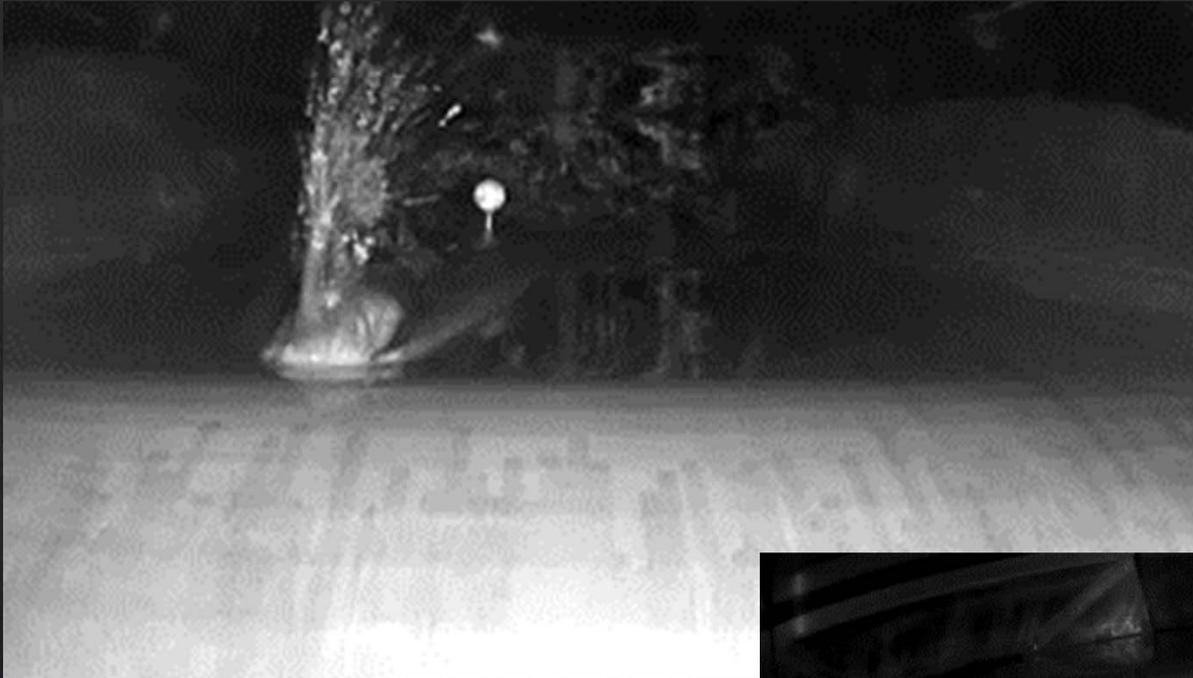
SUBMITTED BY PROJECT MANAGER REVIEWED FOR SHEET COMPLIANCE REVIEWED FOR ENVIRONMENTAL COMPLIANCE REVIEWED FOR AIR COMPLIANCE CHECKED FOR OHS COMPLIANCE (SHEDS)	UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE REGIONS 1, 7 & 8 OFFICE OF ENGINEERING PORTLAND, OREGON LEAVENWORTH NFH MID-COLUMBIA RIVER FISHERY RESOURCE OFFICE VERTICAL WET WALL LAMPREY PASSAGE SYSTEM SITE PLAN / COVER SHEET
SUBMITTED BY REGIONAL OFFICE SURVEYED DATE: 6/9/15	WASCOC COUNTY OREGON DESIGNED DRAWN CHECKED DRAWING NO. 1F-WA-257A-149-1.0

North Umpqua R. VWW



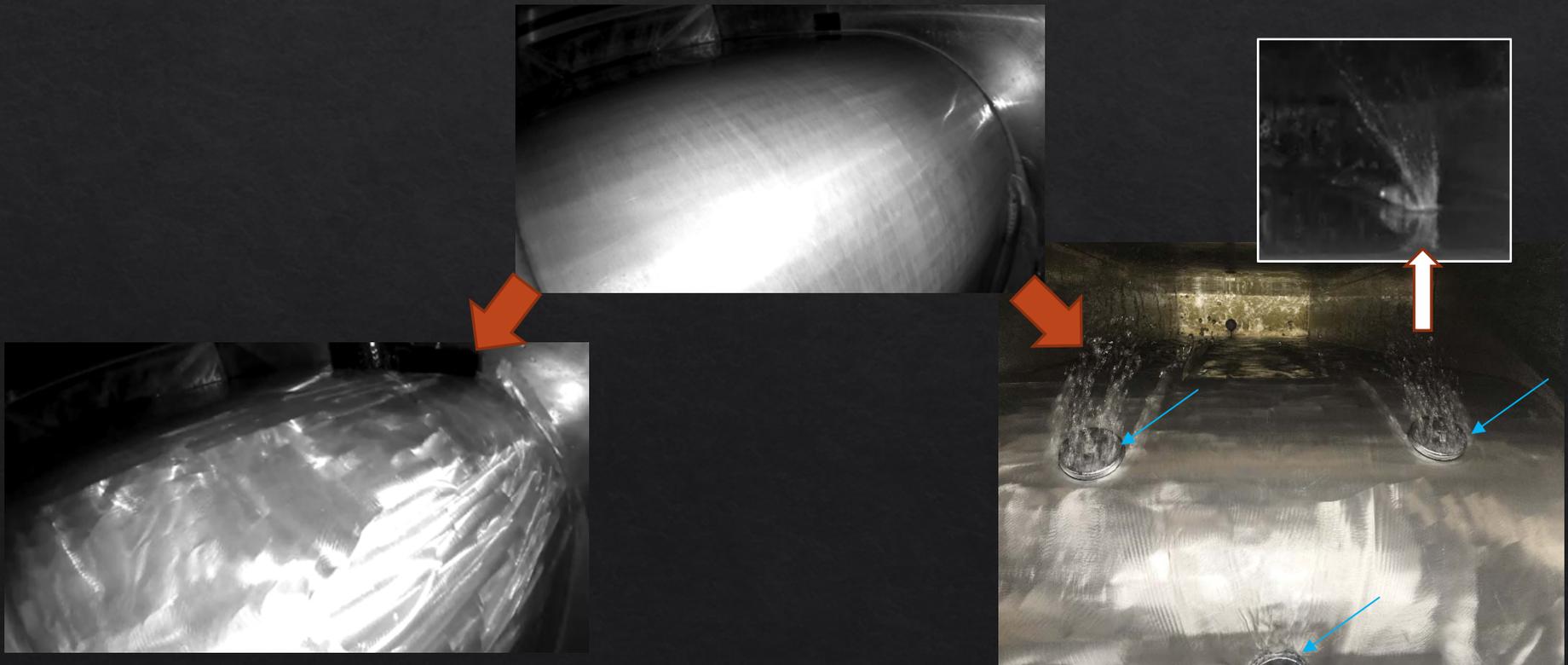


Challenge #1 - Issues at the Radius

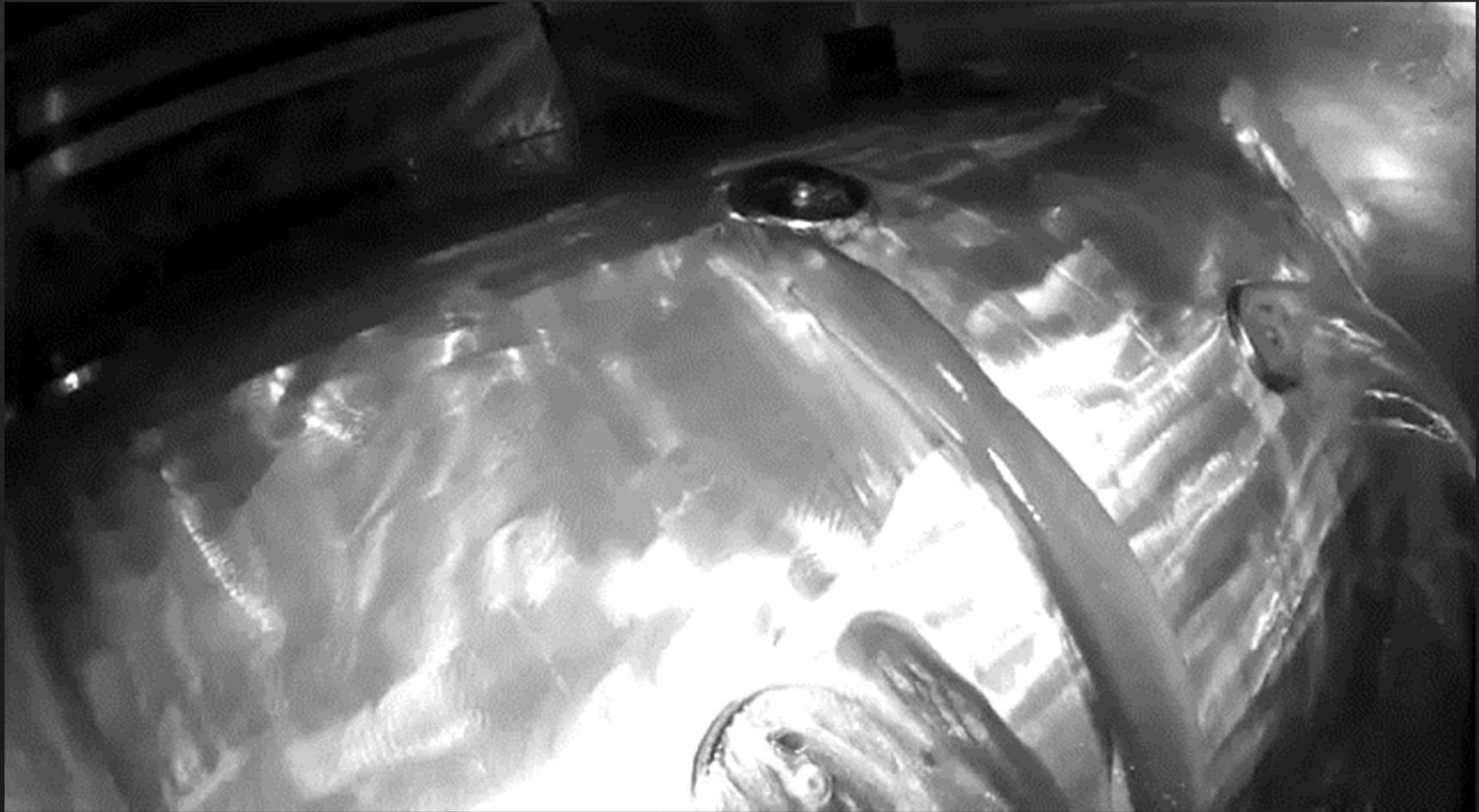


Solutions

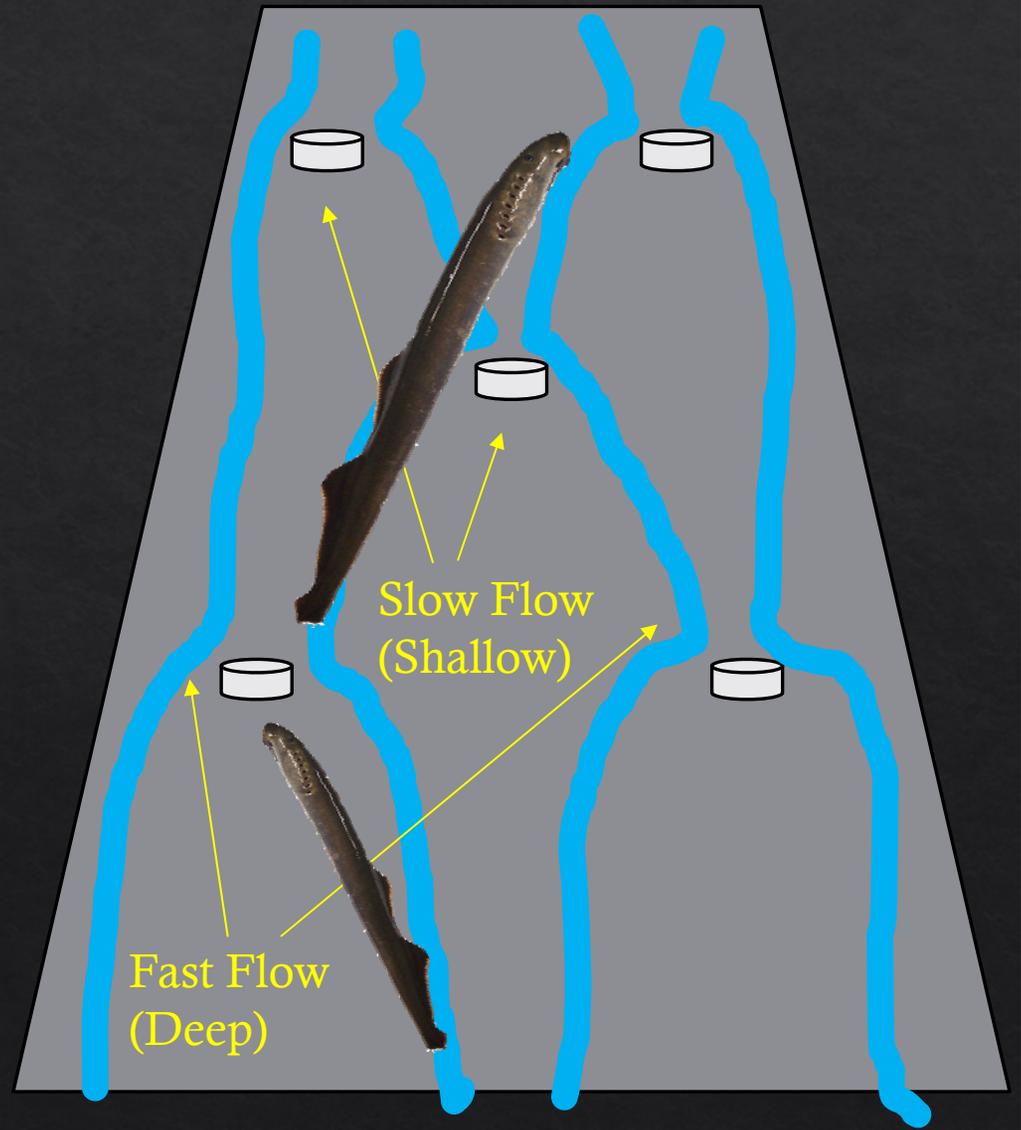
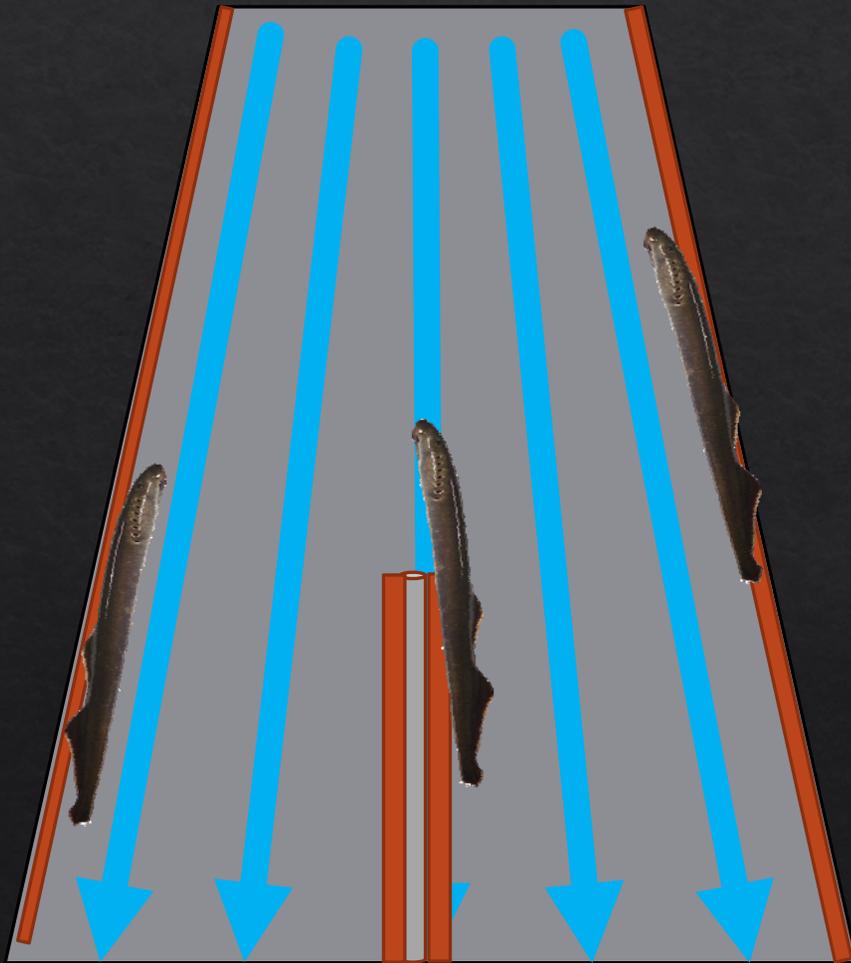
- ◇ Grind down the ridge lines (smooth out the radius)
- ◇ Added magnets to break up the flow and add flow “diversity”
- ◇ Discovered that magnets act very similar to another lamprey holding upstream!!!



Success!!!



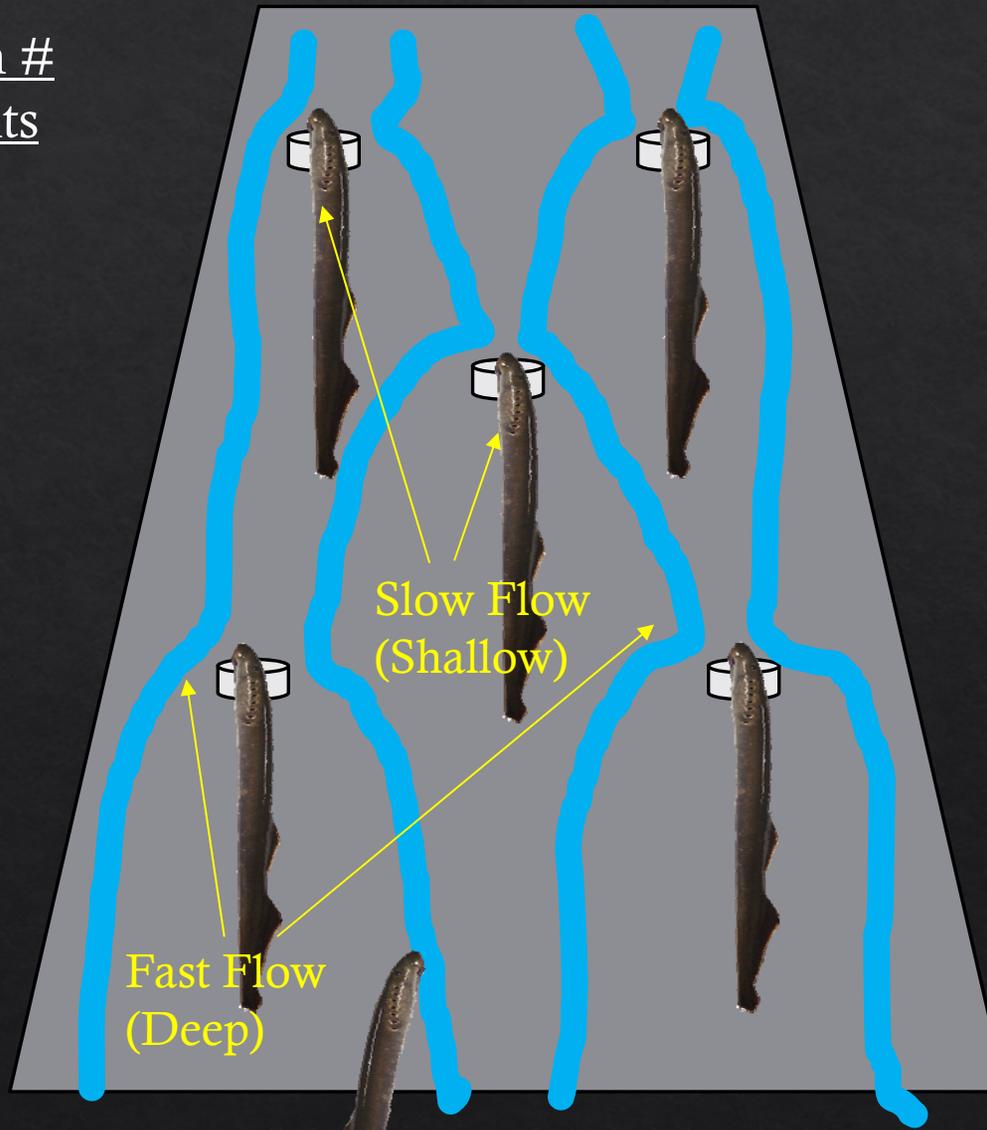
Magnets creating flow diversity



Lamprey “Buddy” System

- Magnets act as “lamprey” positioned upstream
- Larger Population = Creates More Flow Barriers = Enables Better Passage for Lamprey

Explains the high #
of lamprey counts
in 1940-60s



Challenge #2... Escapement from Trap Box



Solutions

<0.5" Gap

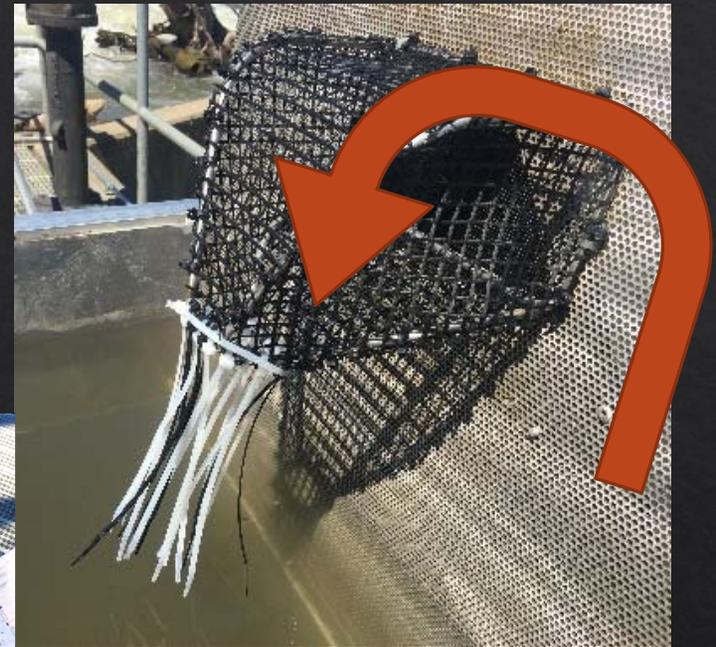


Zip Ties

Drinking Straws



Challenge #3...Hesitation in Entering the Trap Box



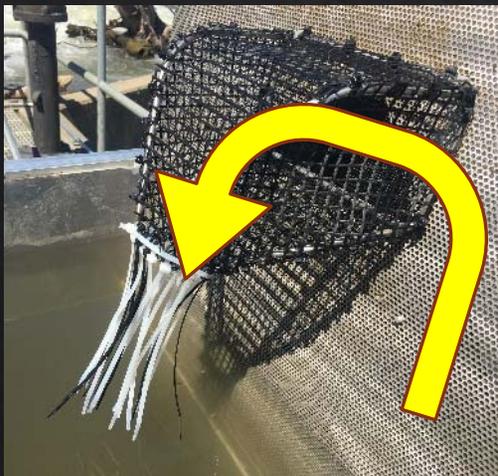
Sharp Angles
Problematic for Entry

Solutions



Enlarged the opening (made it a round shape)

Added curvature to the opening (& removed the sharp edge)



Reduced the sharp angle (easier access)

Monitoring / Counting



Netgear Arlo Wireless Cameras

Pros

- Once base station hooked to Ethernet cable, can set cameras up to **150-300 ft** away
- Weather / water proof & excellent night vision footages

Cons

- Motion sensor doesn't work on lamprey (passive infrared) – need video frame motion detection
- All footages were captured by staying up late in the wee hours and manually recording them
- Tested audio motion detection – lamprey splashing sound can be detected

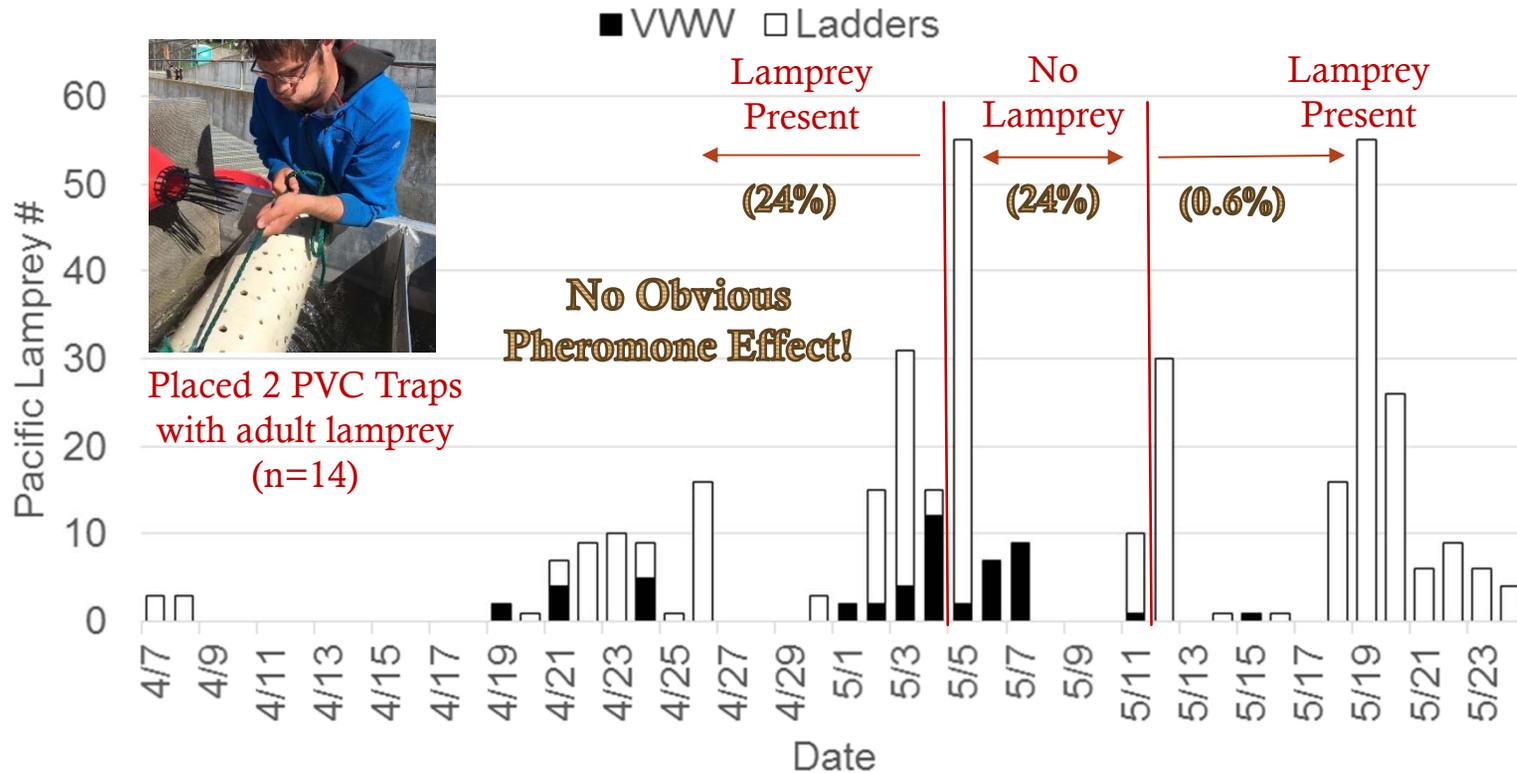
Mechanical Counters

- Double counting or under counting can be an issue (set up is critical)
- Can add time stamp and get real time notification if hooked to the internet



Overall VWW Performance (& Effect of Adult Pheromone?)

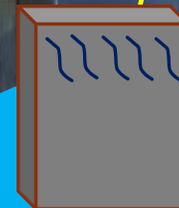
Prosser Dam Pacific Lamprey Counts (VWW vs. Ladders)



Lower Performance in High Flow Conditions?

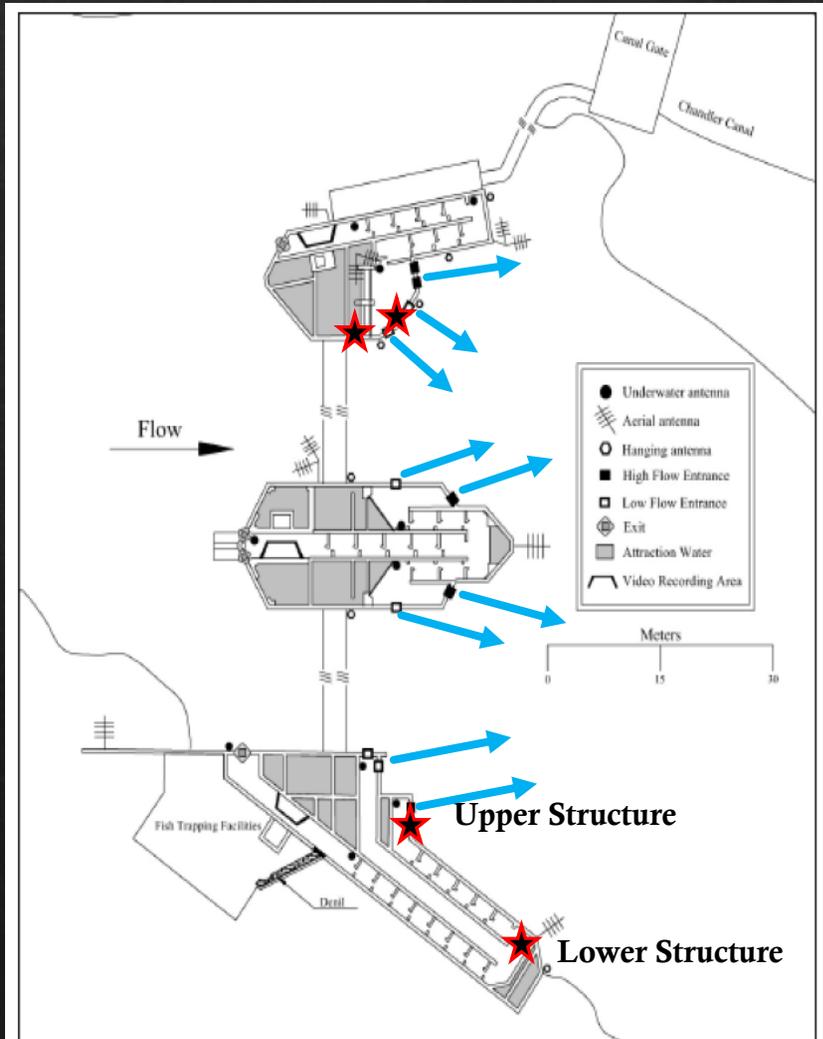


High water reduced the attraction? (less splashing)



??

Location, Location, Location

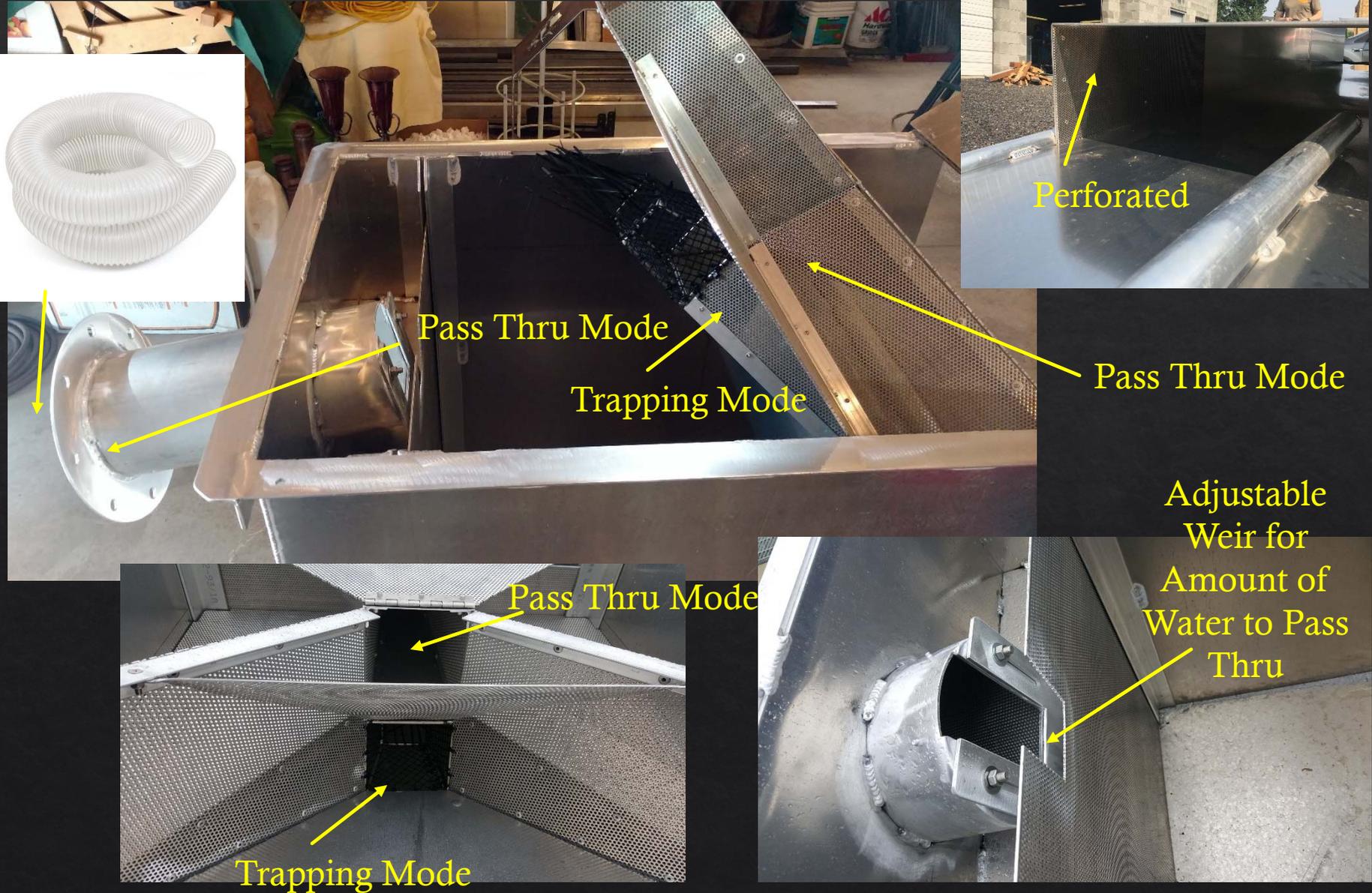


Upper Structure = 51 Adults
Lower Structure = 0 Adults

Upper Structure is near fish ladder entrance (mixture of fast attraction water and slow water)

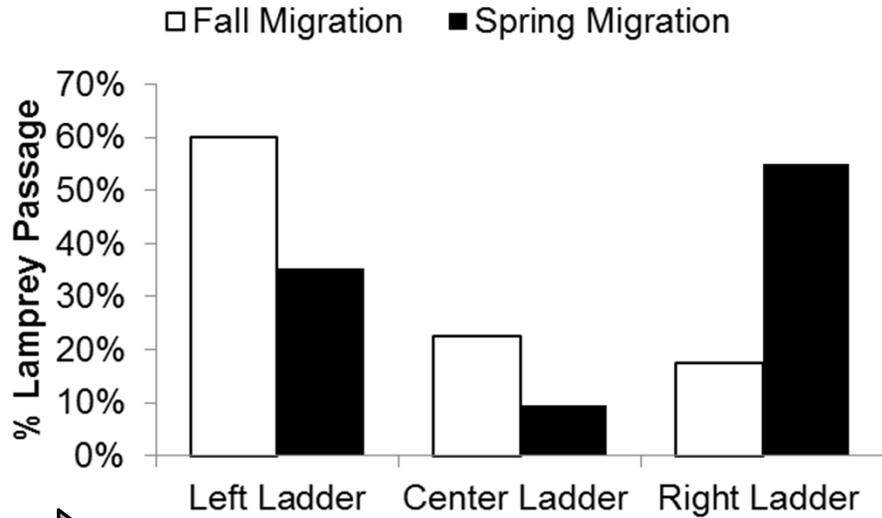
**Importance of proximity to attraction water*

New Design (Pass Thru Option)

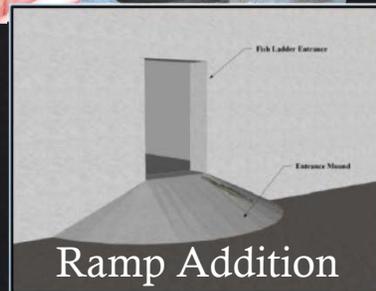
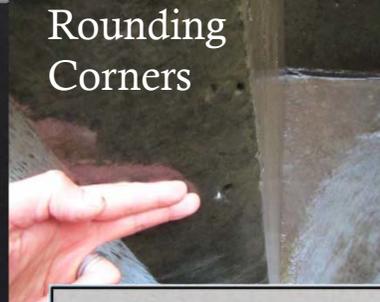
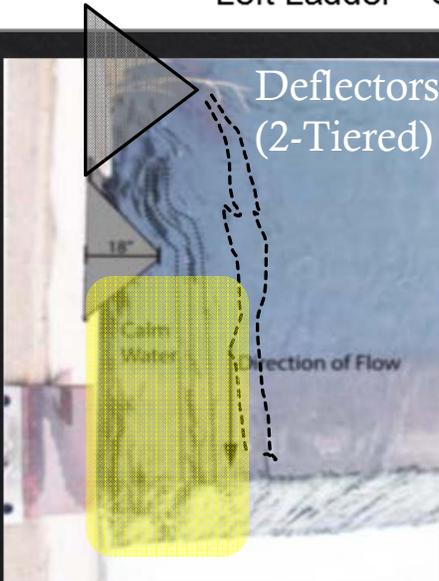
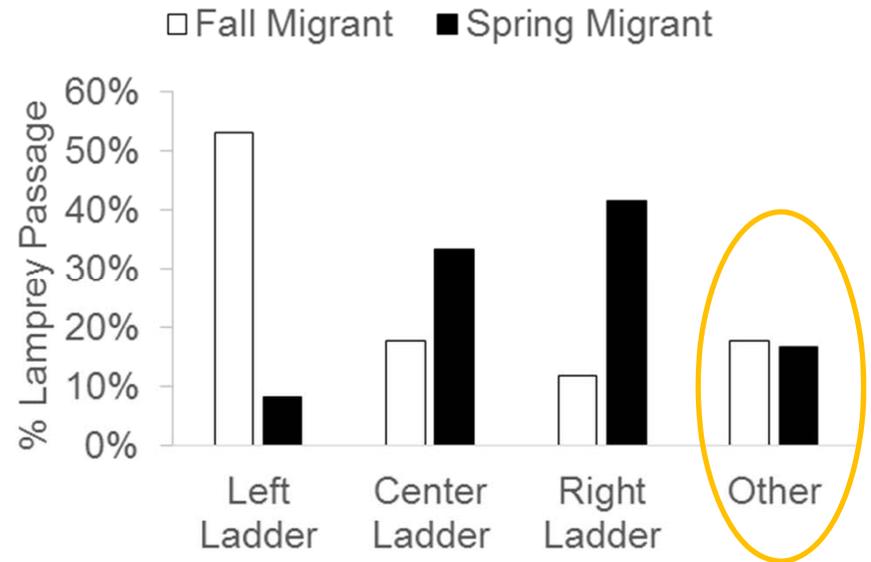


Migration Routes by Season

Prosser Dam



Wapato Dam

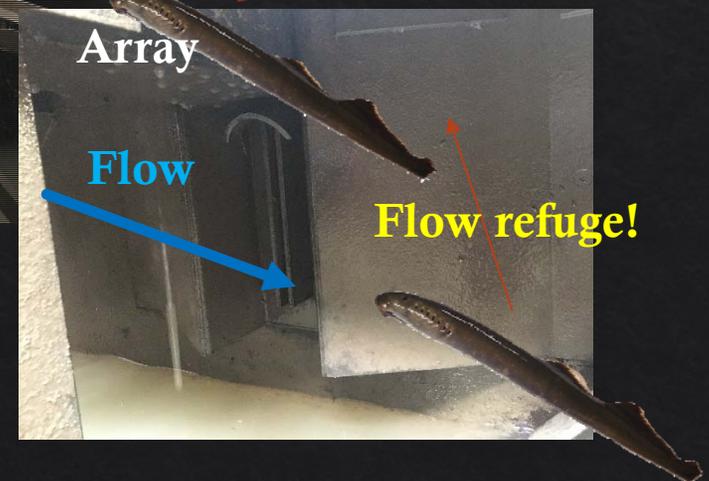


Lamprey are sneaky! (like a ninja)

- ◆ Lamprey can enter areas that fish are not supposed to go...
 - ◆ Auxillary water channels
 - ◆ Outlet pipes
 - ◆ Ladder bottom grates
 - ◆ Past picketed lead areas (for fish counting stations)
- ◆ Most picketed lead gaps are 1"
- ◆ Gap of 0.75" to block fall migrant entry
- ◆ Gap of 0.5" to block spring migrant entry
- ◆ Pros & Cons for allowing entrance...



Lamprey holding behavior at Prosser Dam PIT arrays



Applied Vexar Sheeting to Prevent Holding

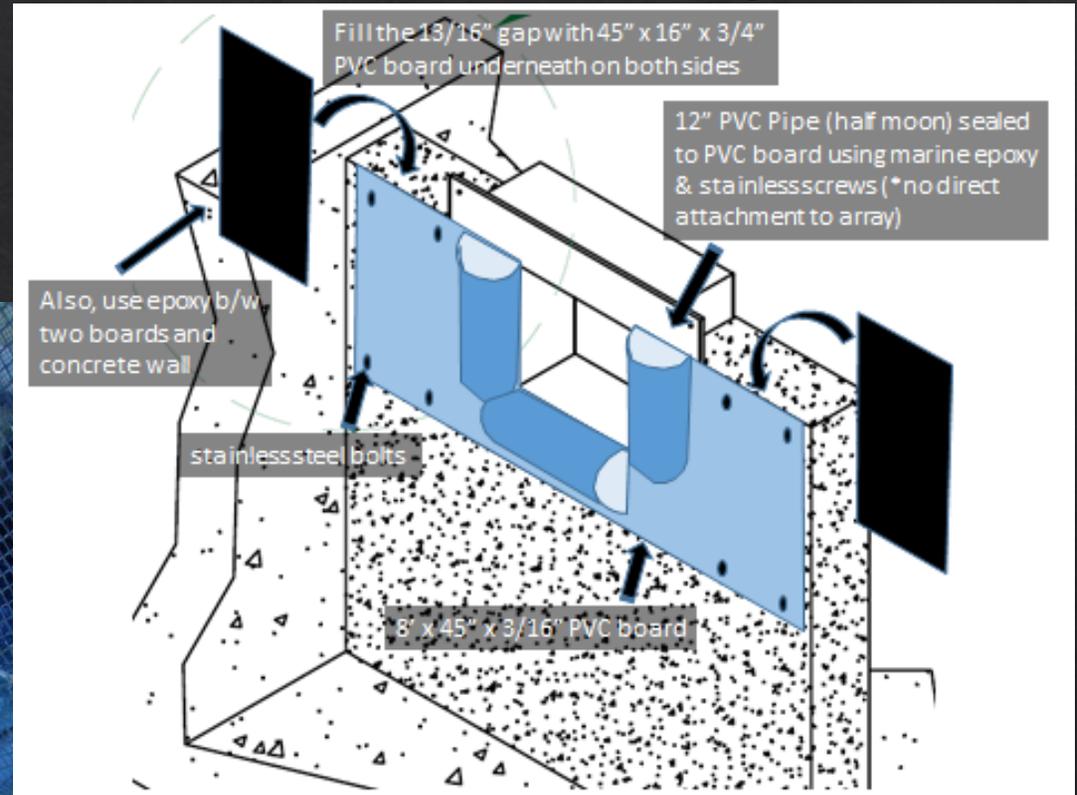
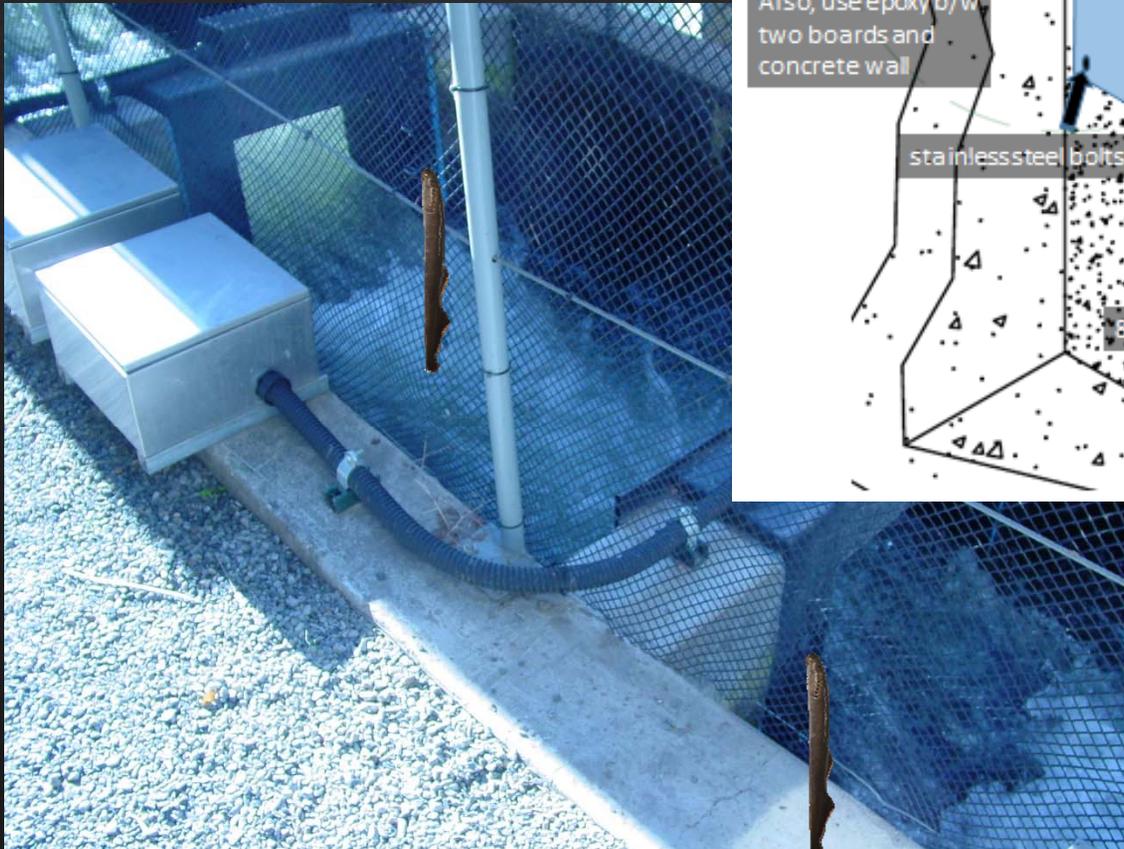


Success!!!
(Eliminated all lamprey holding at Prosser Dam)



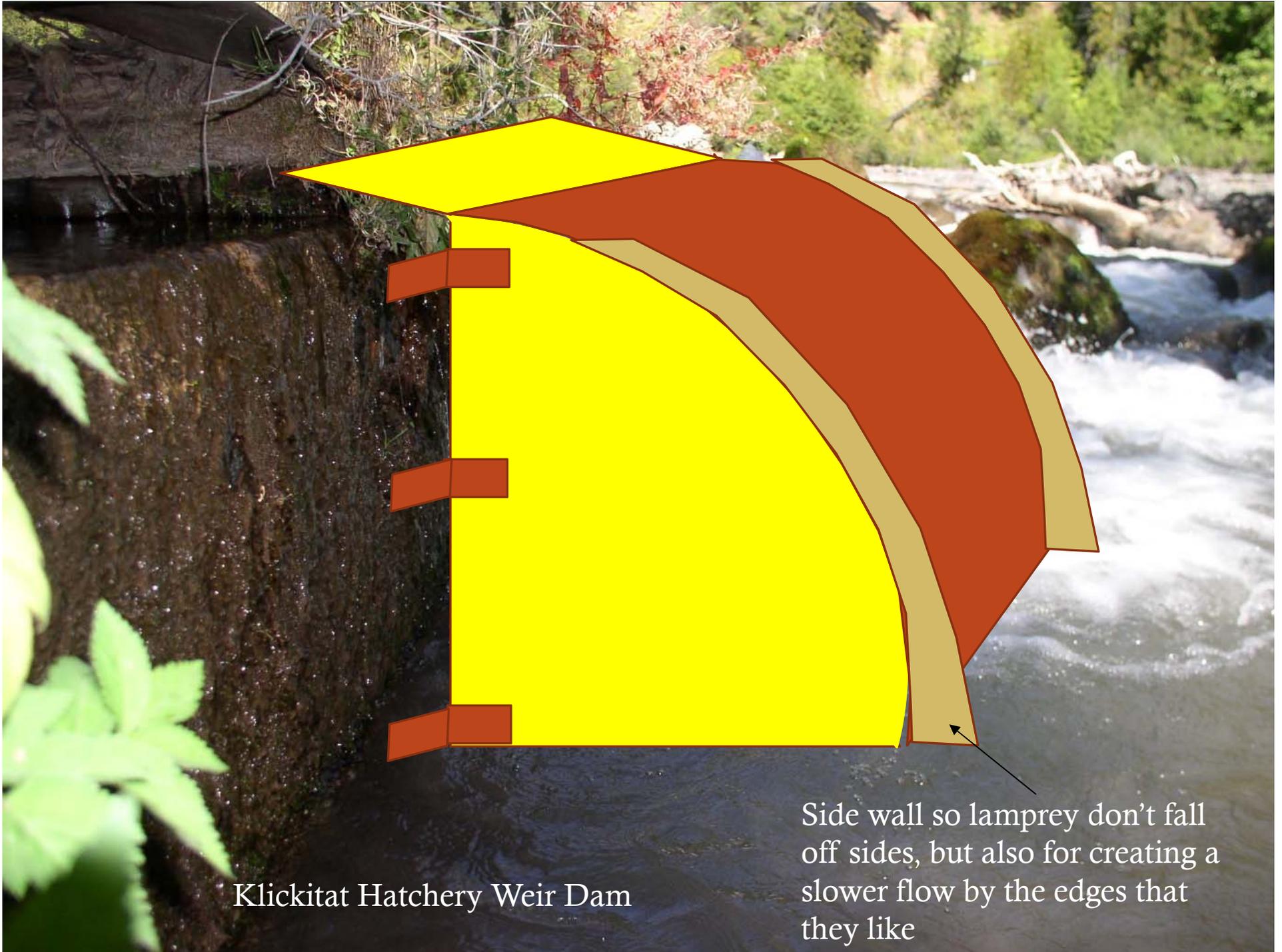
Roza Dam Adult Holding

1. Eliminate holding
2. Improve passage



Klickitat Hatchery Weir Dam
(Potential Solutions)





Klickitat Hatchery Weir Dam

Side wall so lamprey don't fall off sides, but also for creating a slower flow by the edges that they like

Please Keep Us in Mind!!!
(we need “your” help)



Ralph Lampman

lamr@yakamafish-nsn.gov

509-388-3871 (Lamprey Hotline)

Future Plans

Yakima River:

- ◇ 2 Passage Structures at Prosser Dam (Left Ladder) -> 2017-2018
 - ◇ Eventually make it all volitional (complete passage)
- ◇ Sunnyside & Wapato Dams -> 2018-2019 (NRCS Funding)

Toppenish Cr:

- ◇ Unit 2 Diversion Dam -> 2018-2019 (NRCS Funding)

Wenatchee River:

- ◇ Tumwater Dam -> 2018-2020 (Chelan County PUD)

Key Considerations for Pacific Lamprey Passage



- ◆ Lamprey are nocturnal -> excessive light can hinder movement
- ◆ Lamprey are slow swimmers
 - ◆ $> 1.0 \text{ m/s}$ (3.3 ft/s), mostly use “burst & attach” locomotion (lots of rests in between)
 - ◆ $> 2.4 \text{ m/s}$ (7.9 ft/s), “burst & attach” is inefficient & unsuccessful
- ◆ Most weirs are $1.8 - 2.5 \text{ m/s}$ (6-8 ft/s), fishway entrance = up to 3.0 m/s (10 ft/s)
 - ◆ Mismatch between “salmon criteria” & lamprey ability
 - ◆ High physiological cost for repeated & extensive use of burst swimming & attachment
 - ◆ “Cumulative effect” of multiple challenges may be the issue
- ◆ Attachment surface (for oral disc) crucial
- ◆ Large variation in ability depending relative size, condition, temp, & even temperament -> one size “doesn’t” fit all

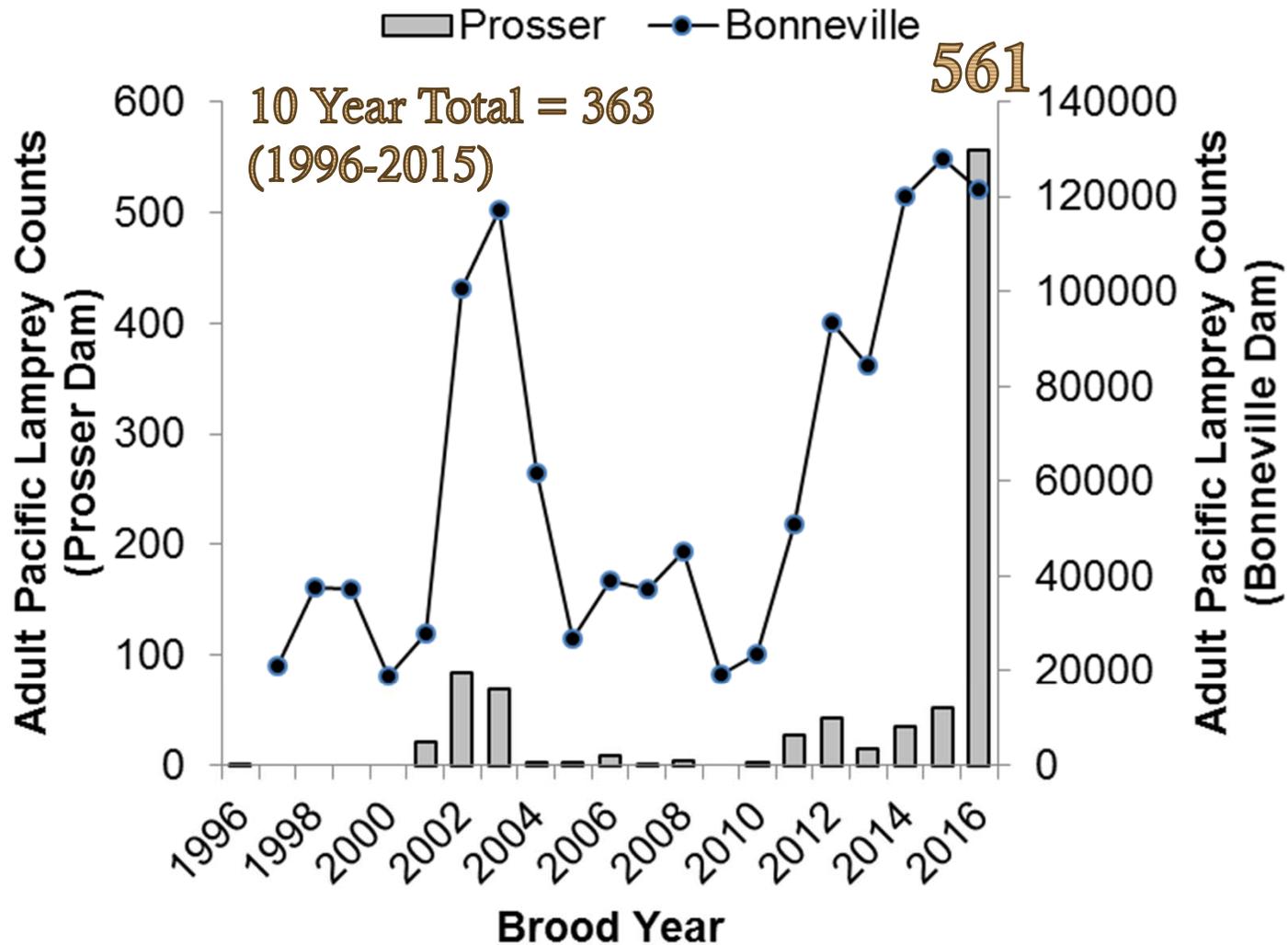


Fall Migrant

Spring Migrant



Prosser vs. Bonneville Counts (1996-2016 Broodstock)



What contributed to this increase??

- ◆ New passage structures (51 adults)
- ◆ Released 150 PIT tagged adults (~50% passage, & only ~45% are detected passing = ~50 extra adults)
- ◆ Still can't explain 400~450 extra adults??
 - ◆ From translocation???
 - (4 years since we began)

