

Larval/Juvenile Lamprey Entrainment in Irrigation Diversions (Yakima Subbasin)

CTUIR & BOR



Yak **t:**
Tyler Bears, Ralph Lampman, Patrick Luke, Bob Rose,
Dave'y Lumley, and Ed Johnson

Overview

1. Background

- *What we know & don't know*

2. Diversion Dewatering Surveys

3. Mark-Release-Recapture Study

4. Potential Short-Term & Long-Term Fixes

3 Lamprey Species



Western River Lamprey



Lamprey

Photo by Gary Susac, ODFW

Coho
Salmon

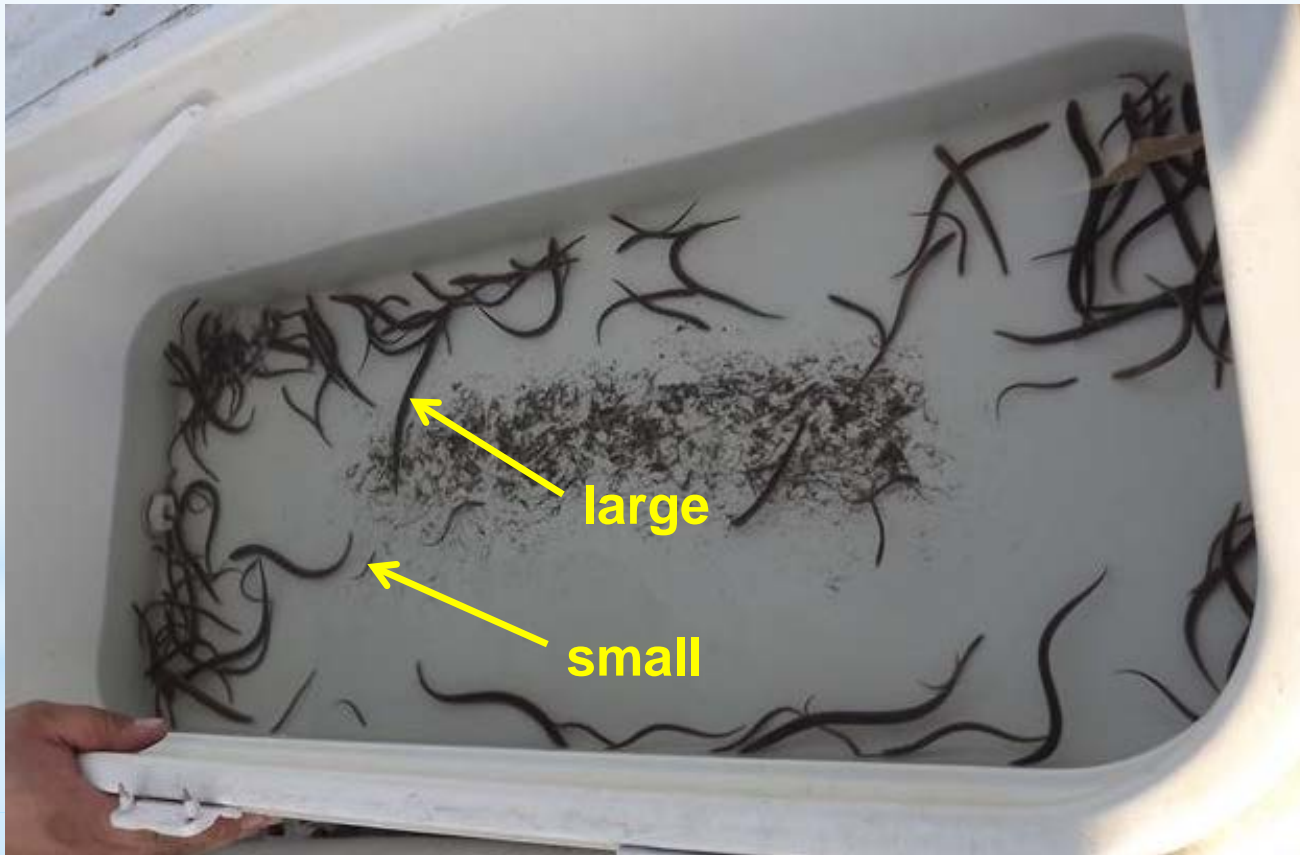


Lamprey

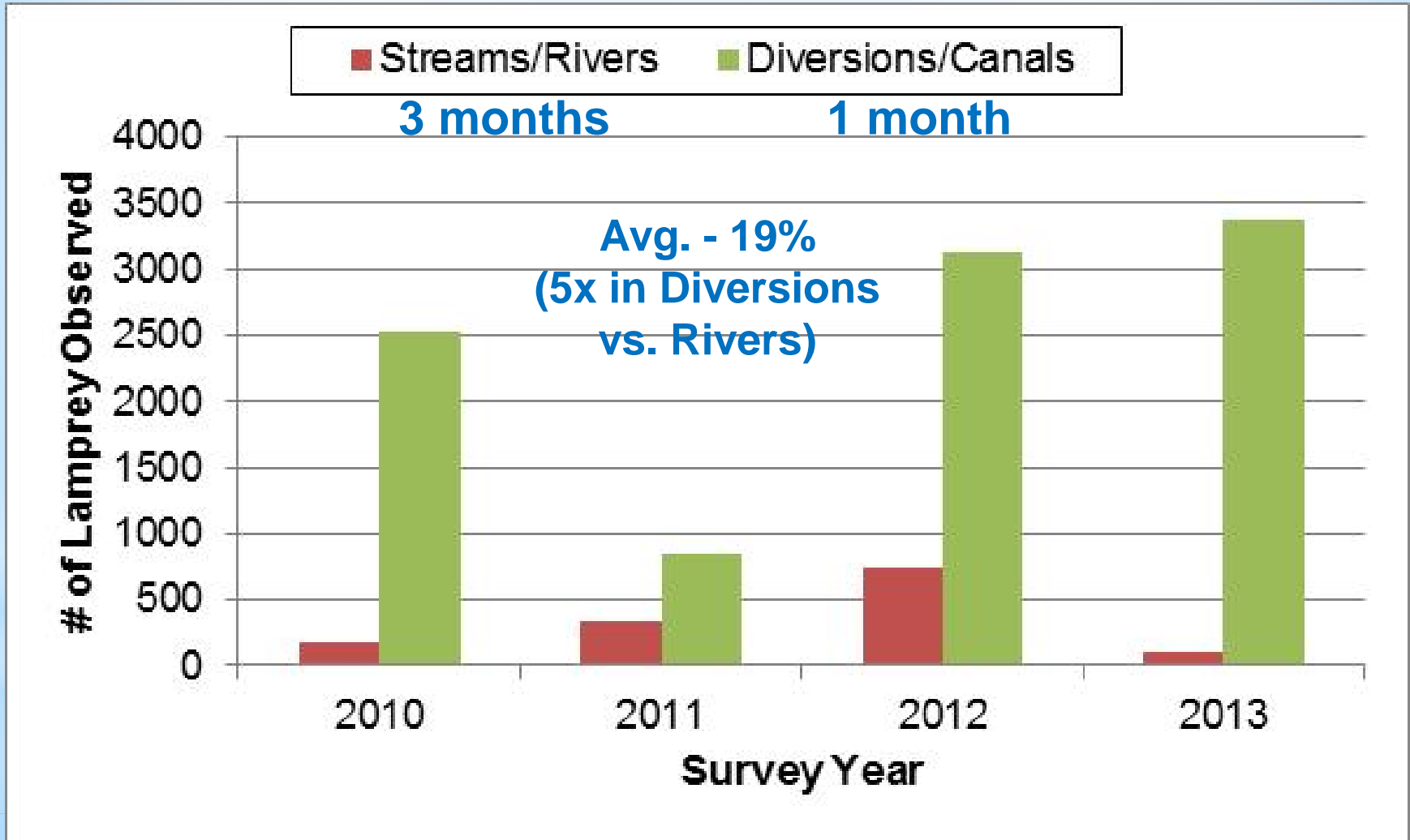


Background

Hundreds of thousands of larvae are found in dewatered diversions



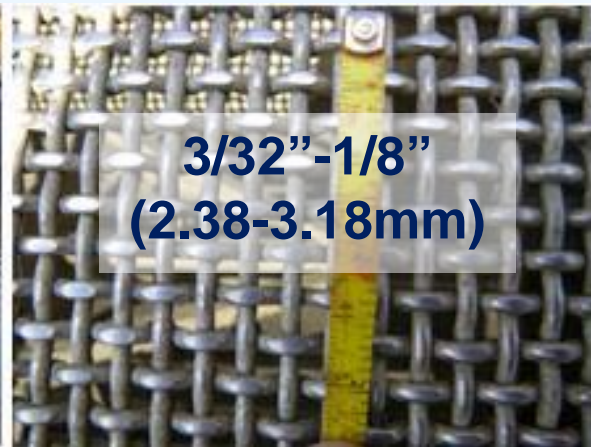
Diversions vs. Streams/Rivers



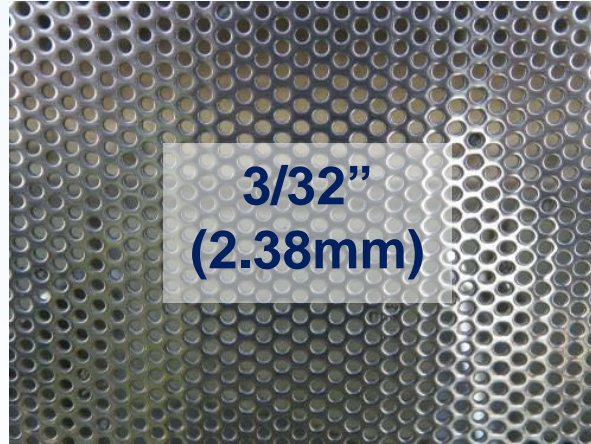
Background

Most diversions provide ideal habitat (Type I) for larval lamprey





**Wire Cloth
/ Rotary Drum**

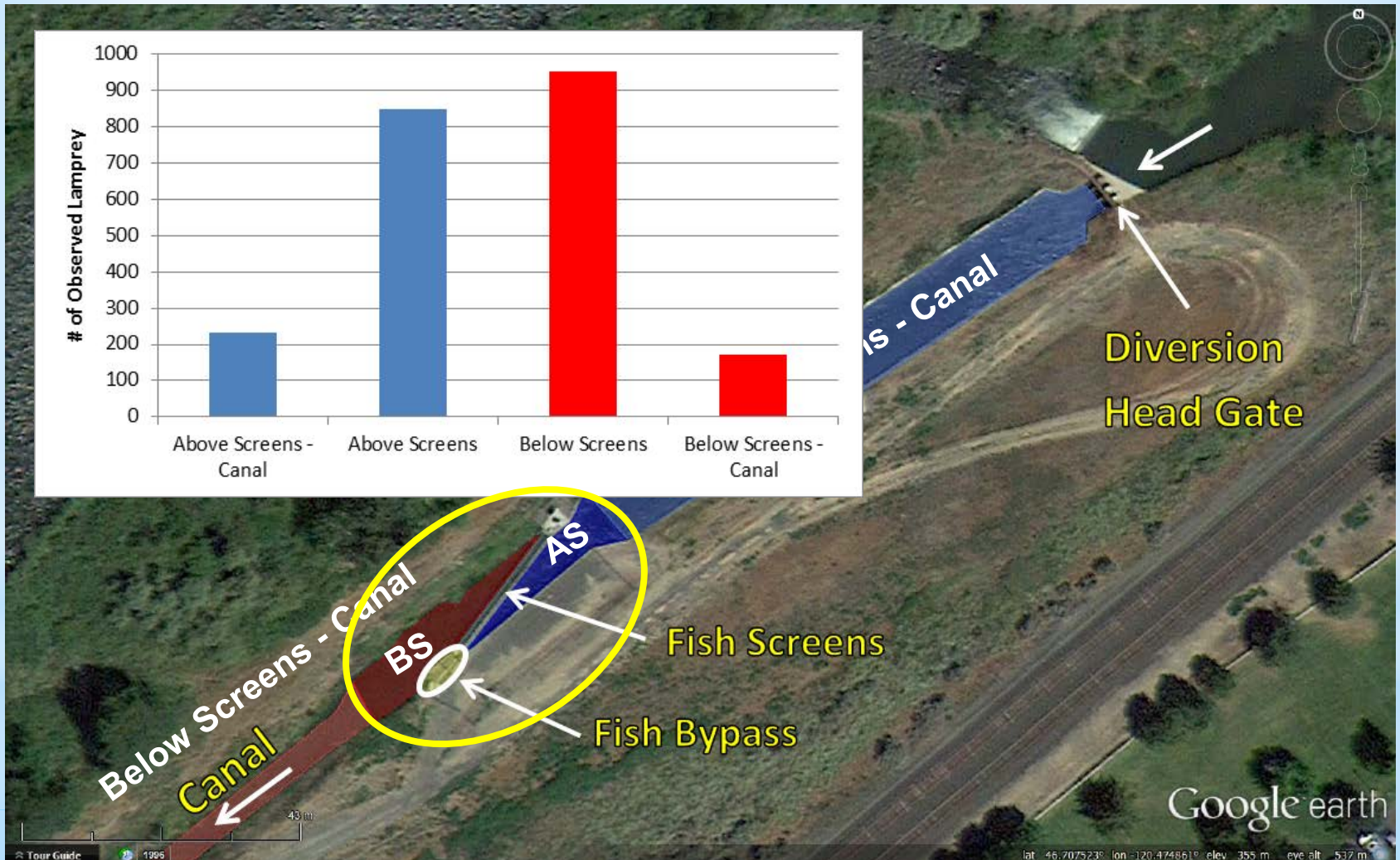


**Perforated Plate
/ Vertical**



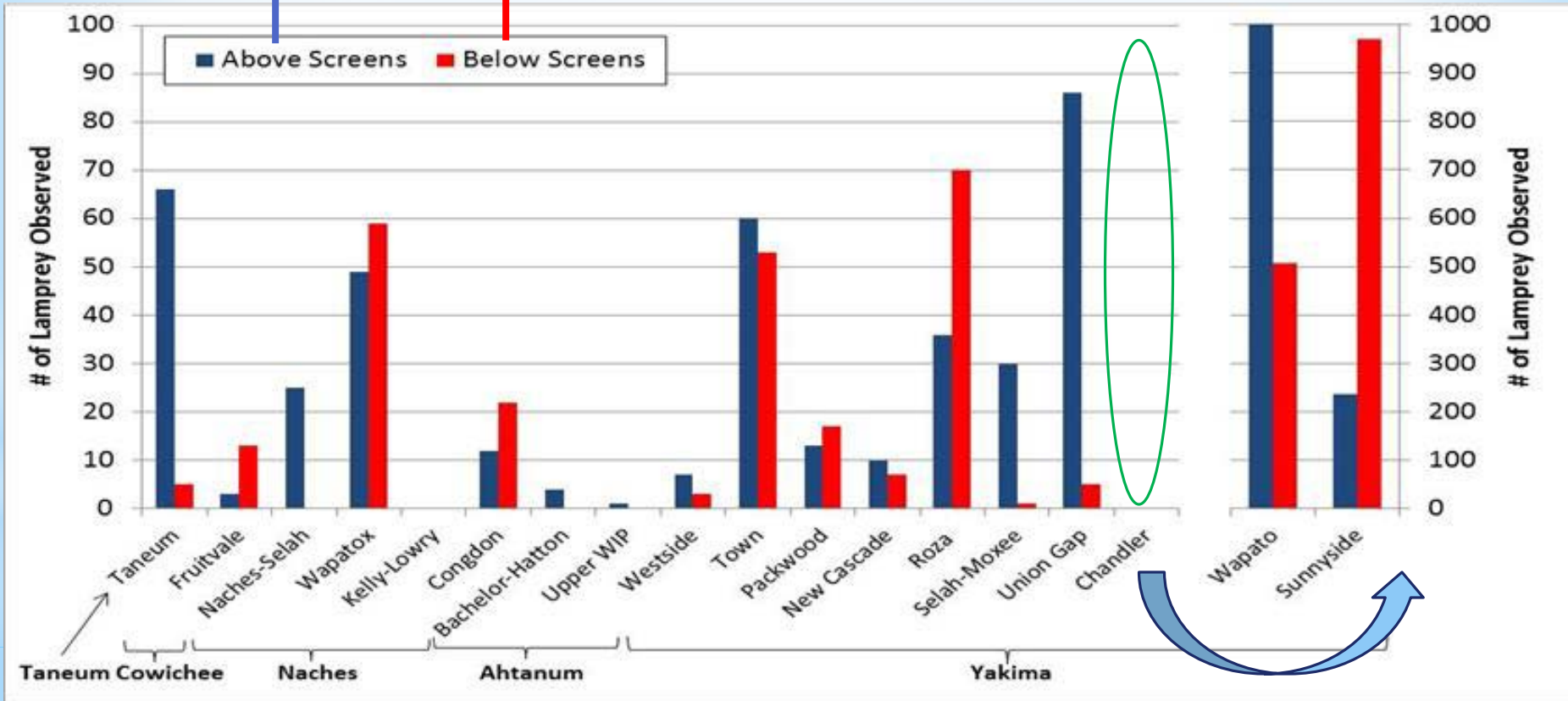
**Vertical Bar
/ Vertical**

2013 Diversion Dewatering Surveys



of Observed Lamprey

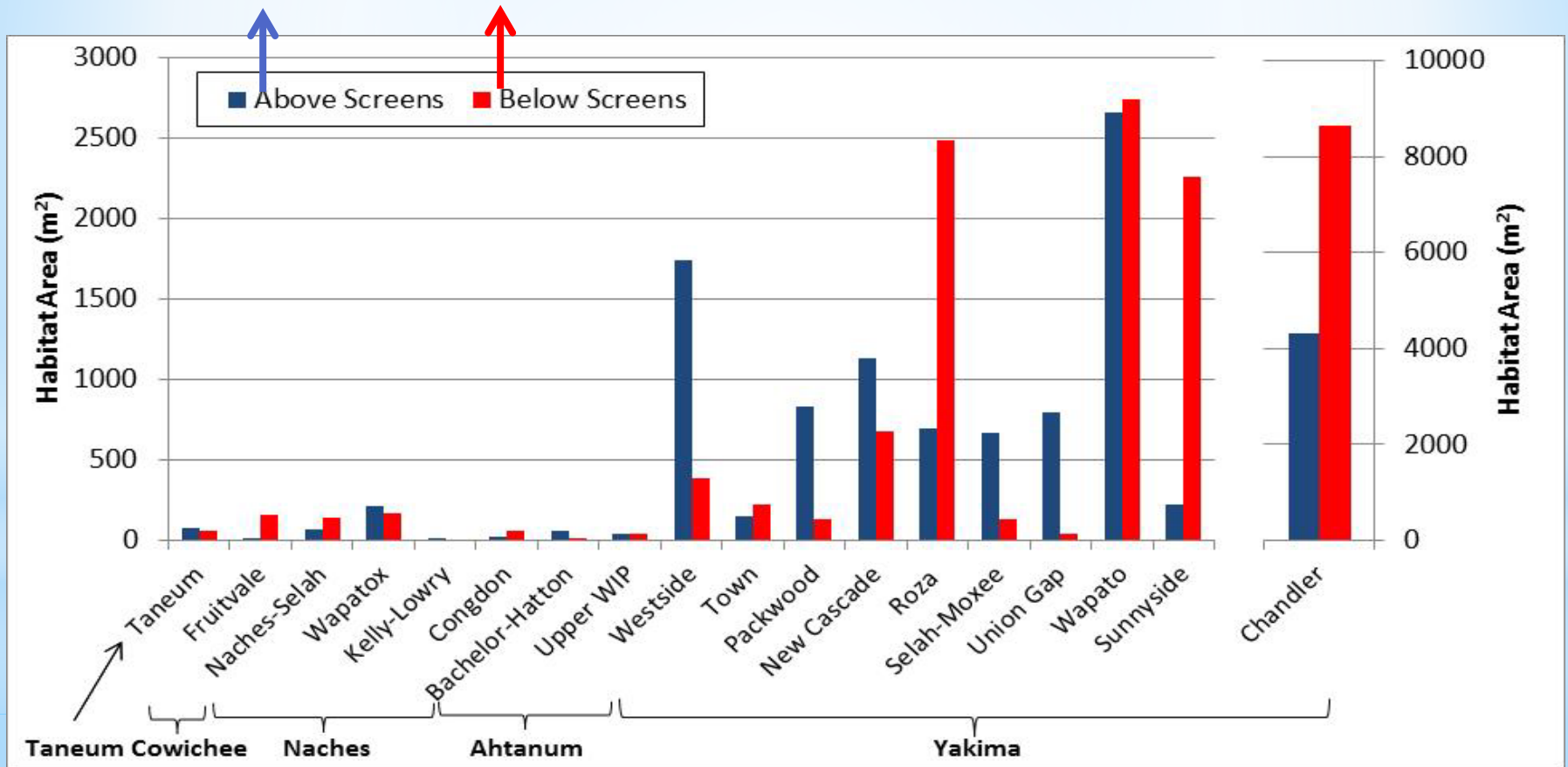
% **48.5%** **51.5%**
 Total **1639** **1739** **Total = 3378**



Downstream

Type I Habitat Area

% **42.8%** **57.2%**
 Total **13,729 m²** **18,372 m²** Total = **32,102 m²**



Downstream

Matched Pair Analysis

of Lamprey

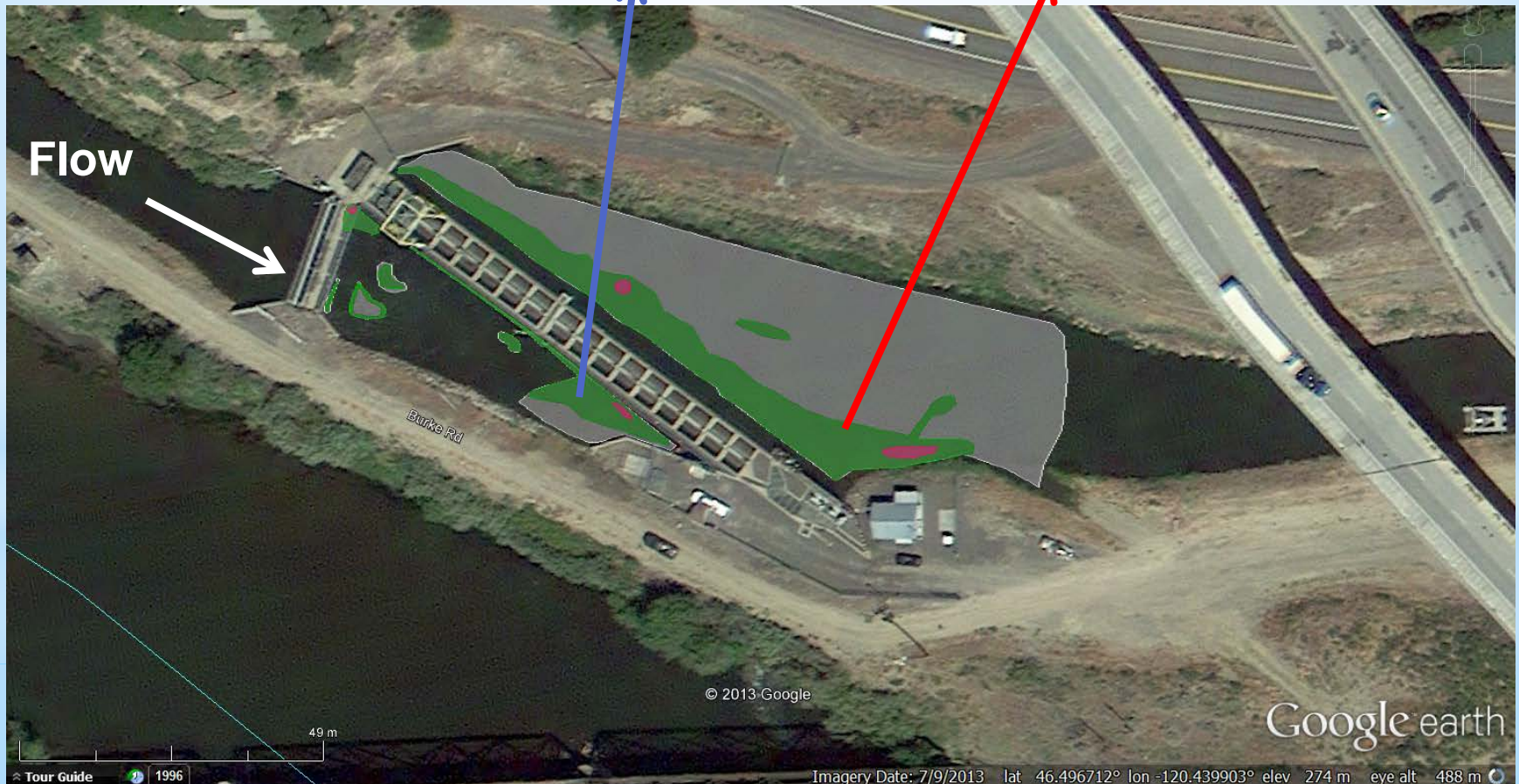
236 (19.6%)

970 (80.4%)

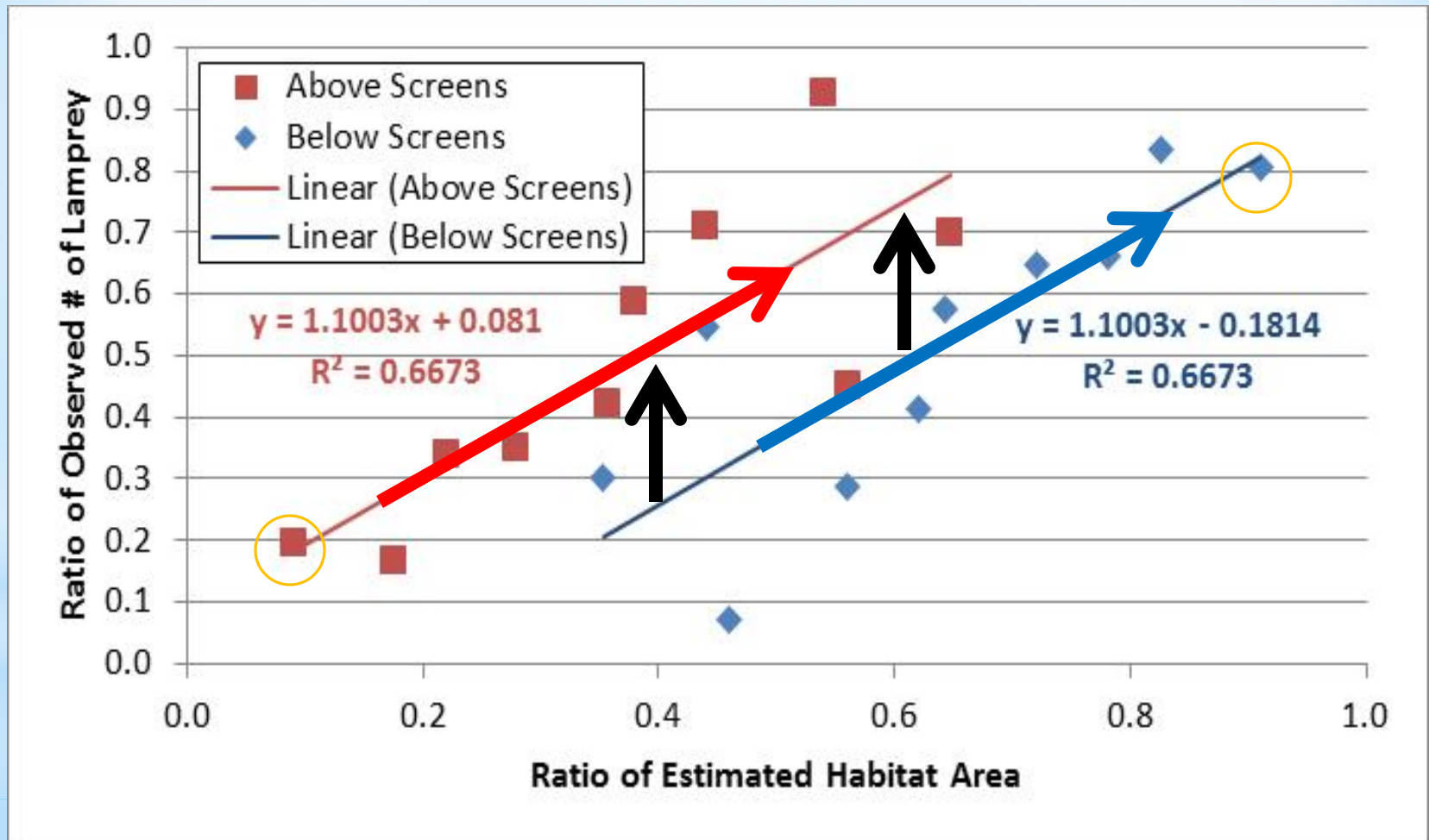
Habitat (m²)

223 (9.0%)

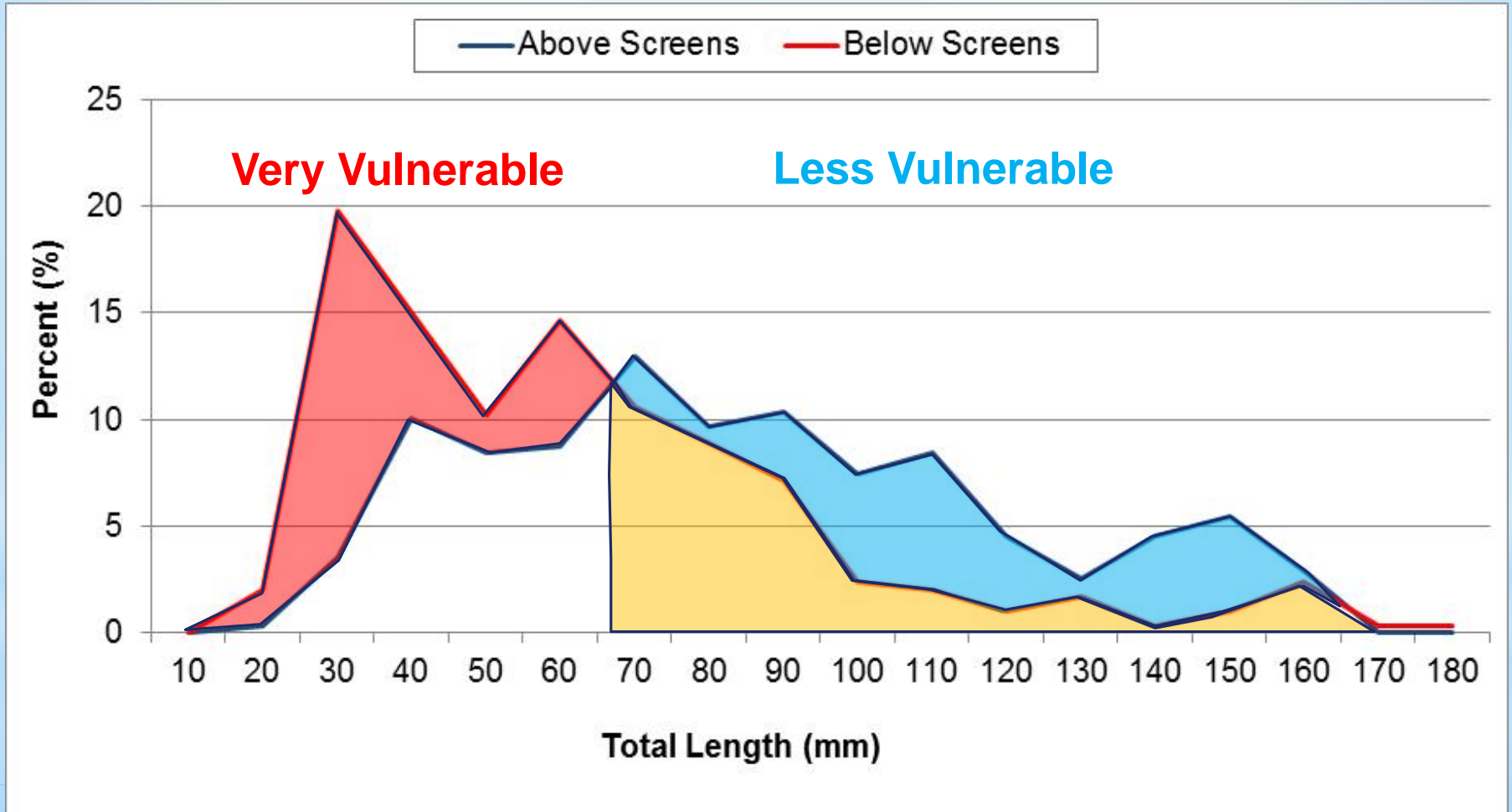
2261 (91.0%)



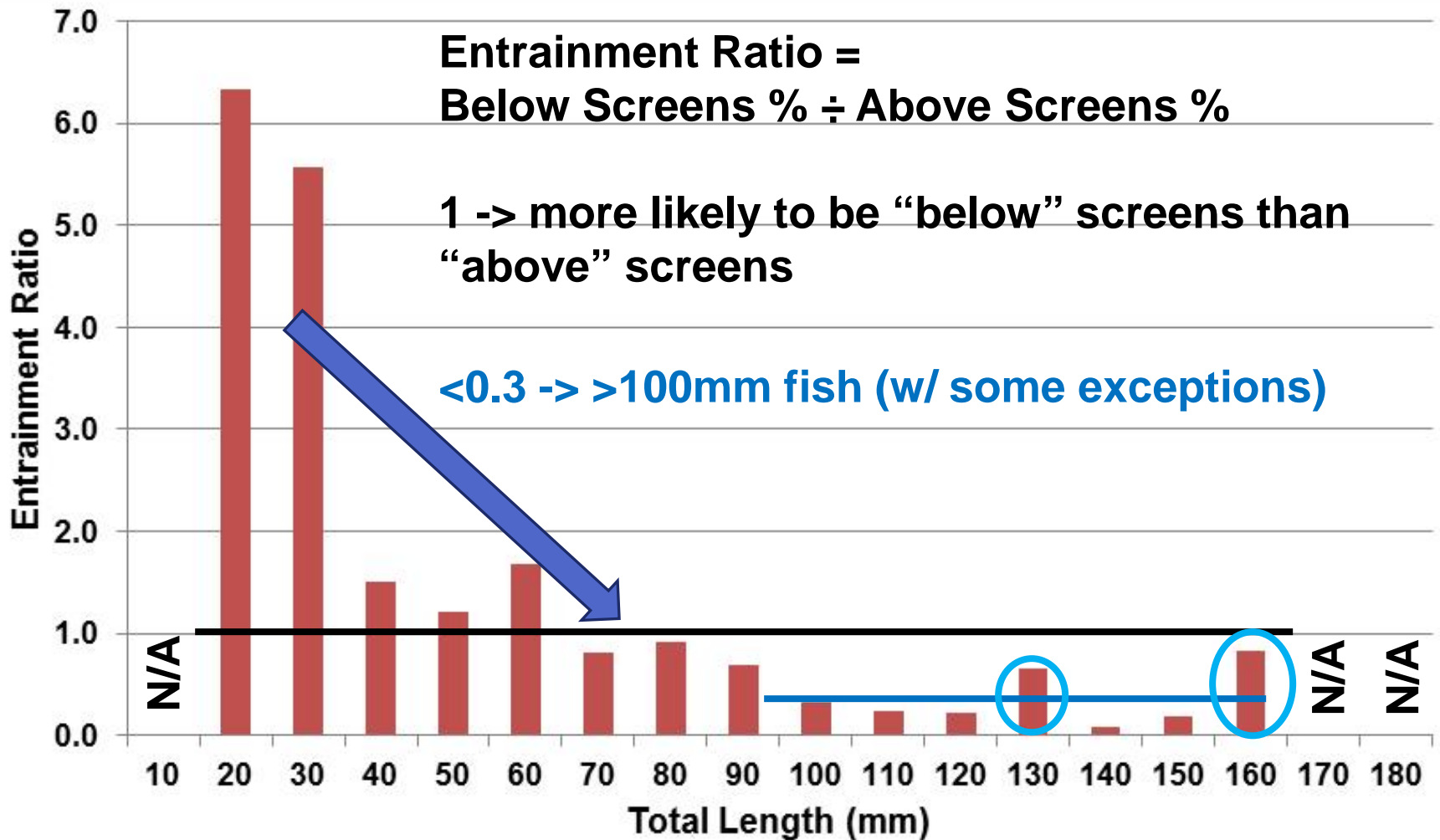
Matched Pair Analysis



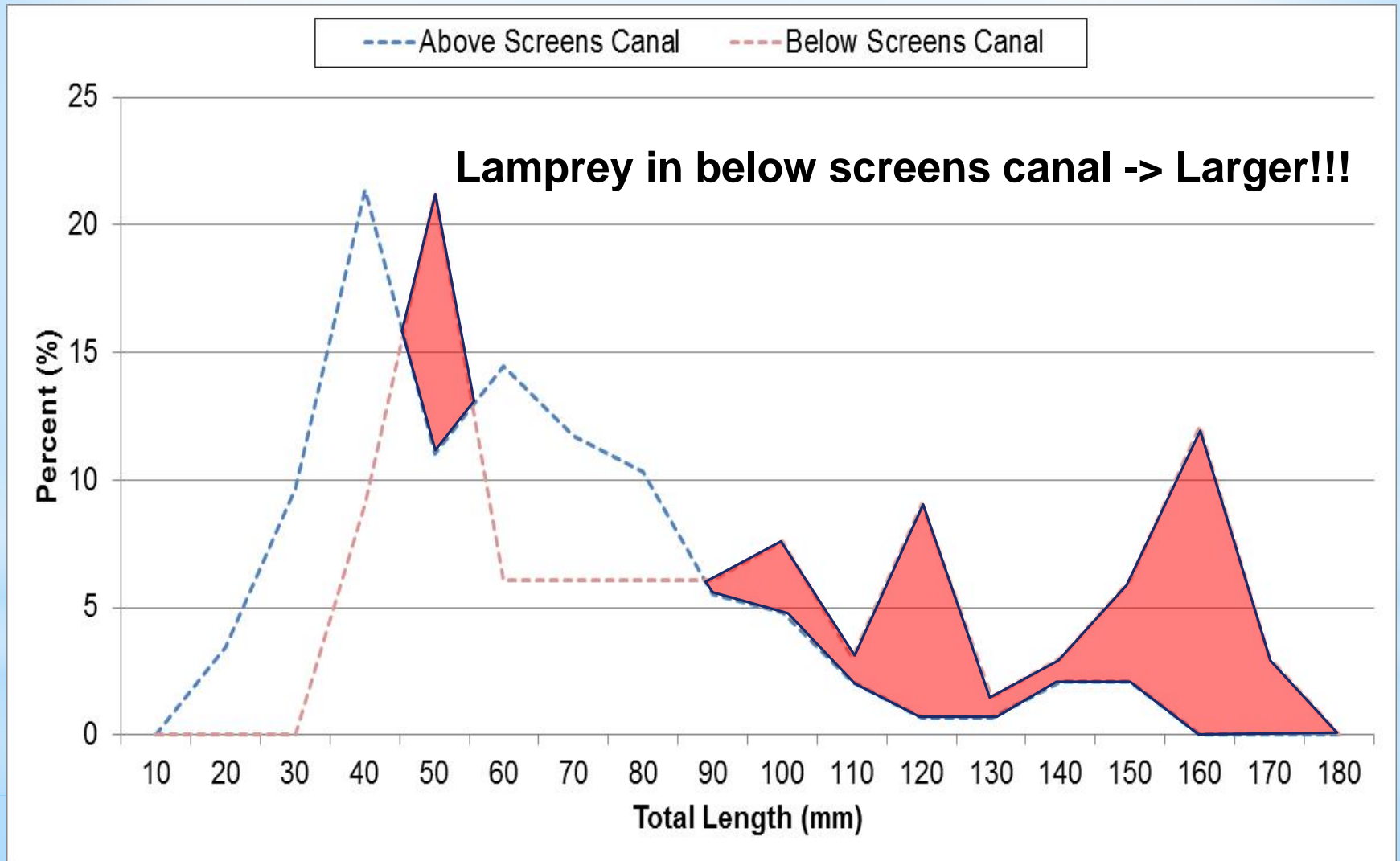
Size Class Analysis

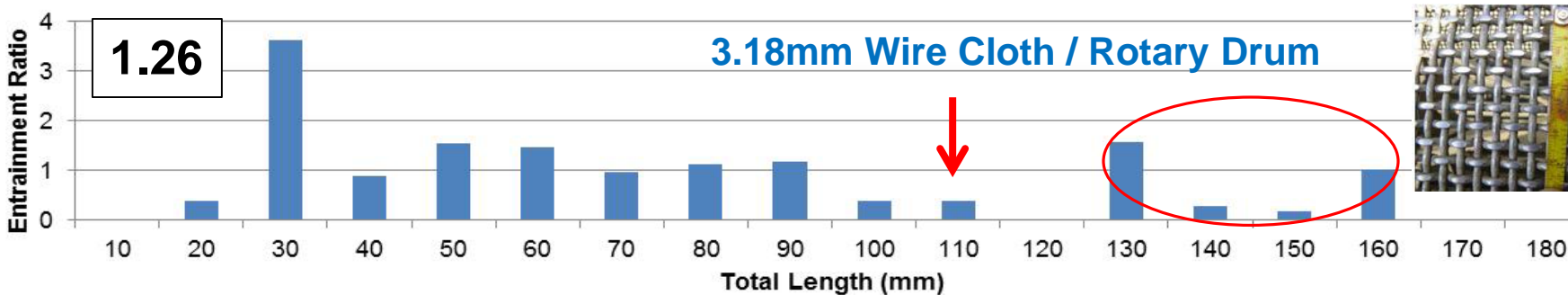
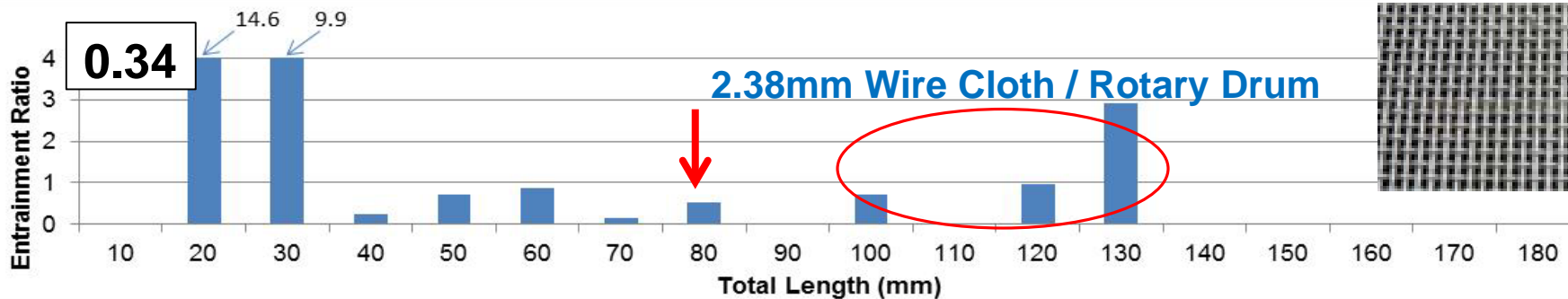
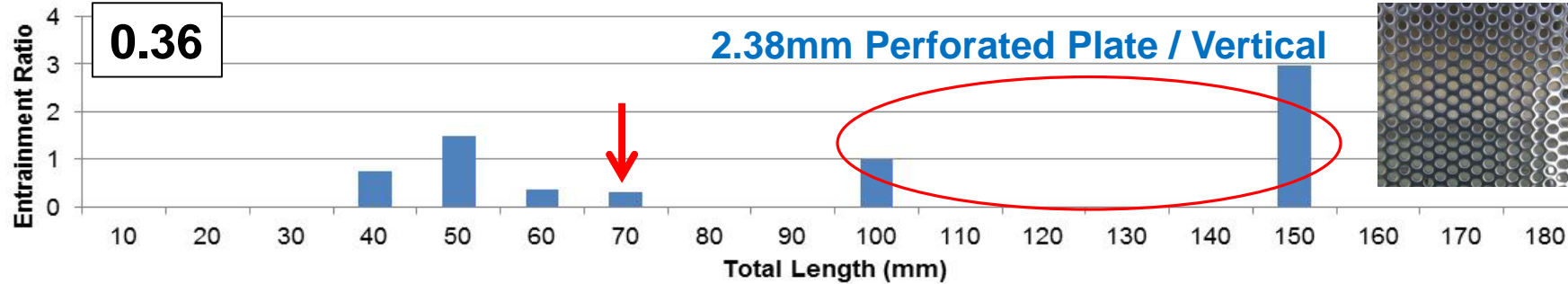
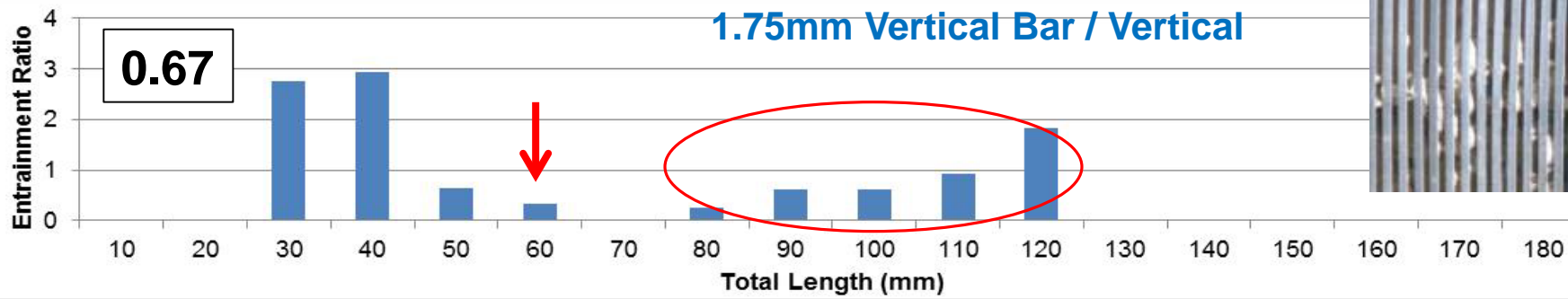


Size Class Analysis



Size Class Analysis

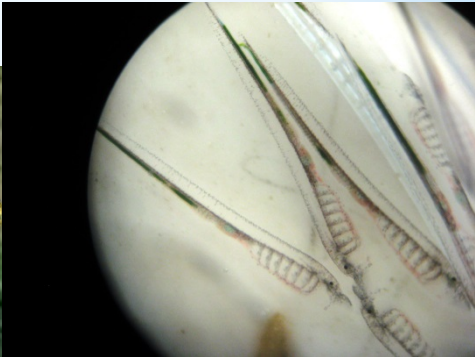
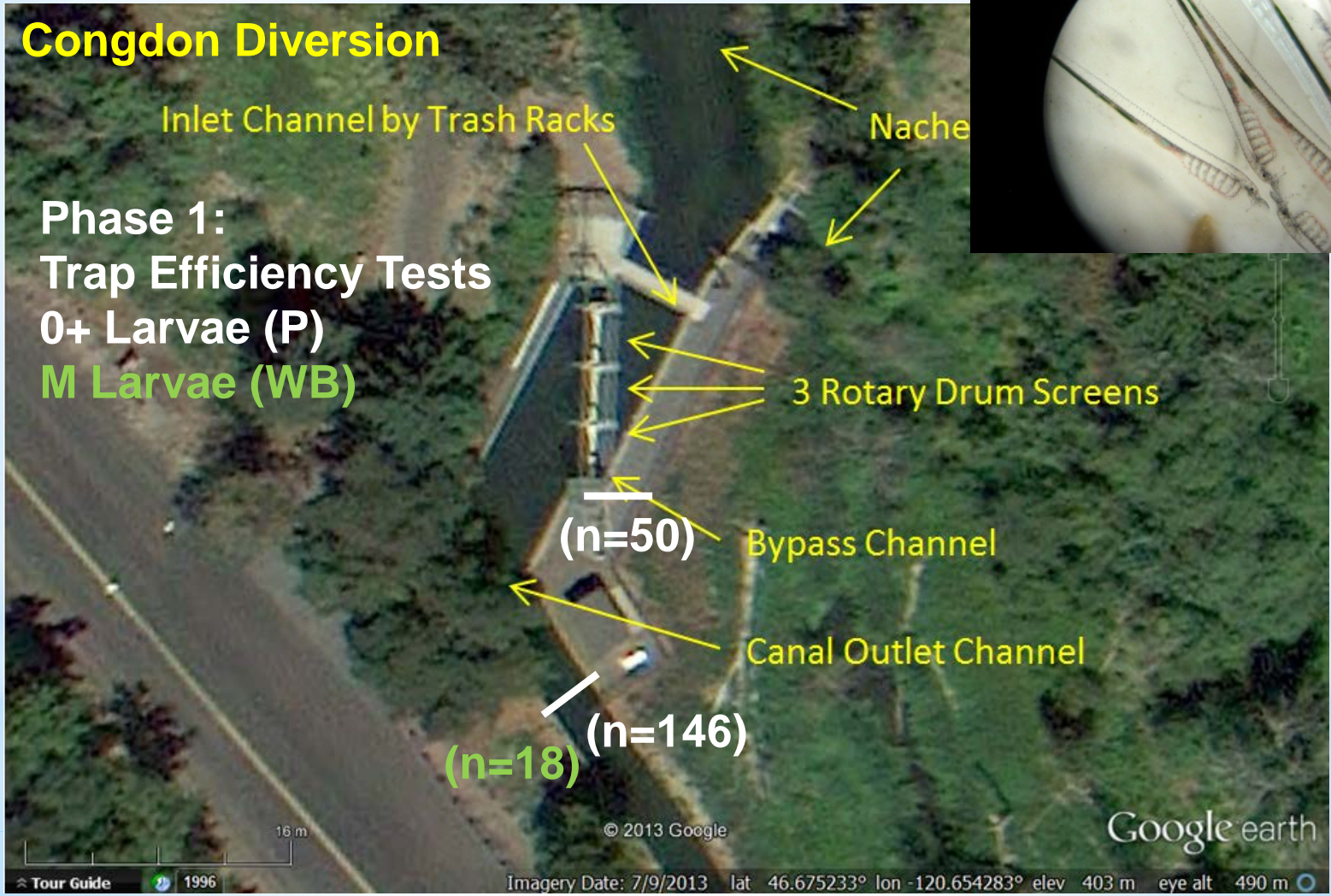




Mark-Release-Recapture Study

Congdon Diversion

Phase 1:
Trap Efficiency Tests
0+ Larvae (P)
M Larvae (WB)



Phase 1: Trap Efficiency Tests

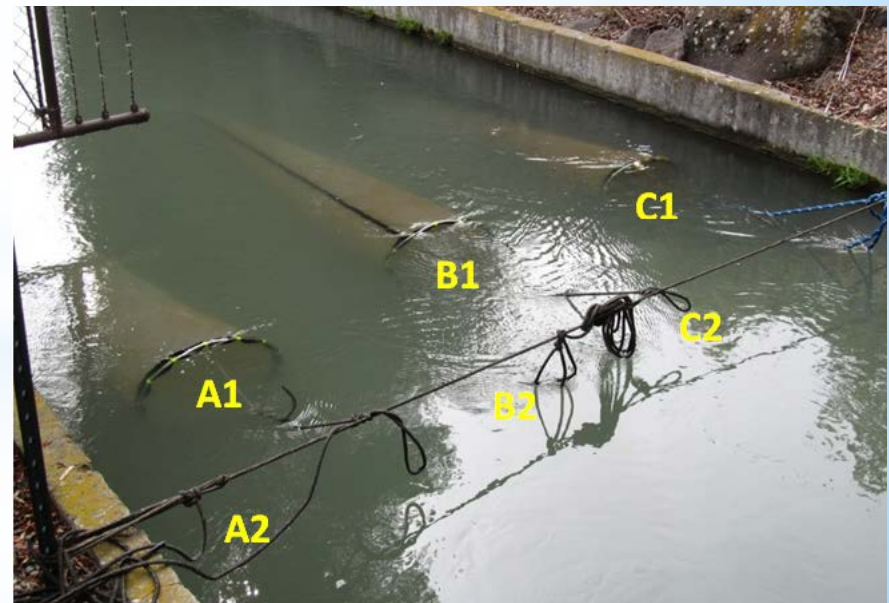
Bypass (covers ~100%):

**Recaptured 84 & 88% of 0+ Larvae (P)
(2 releases)**

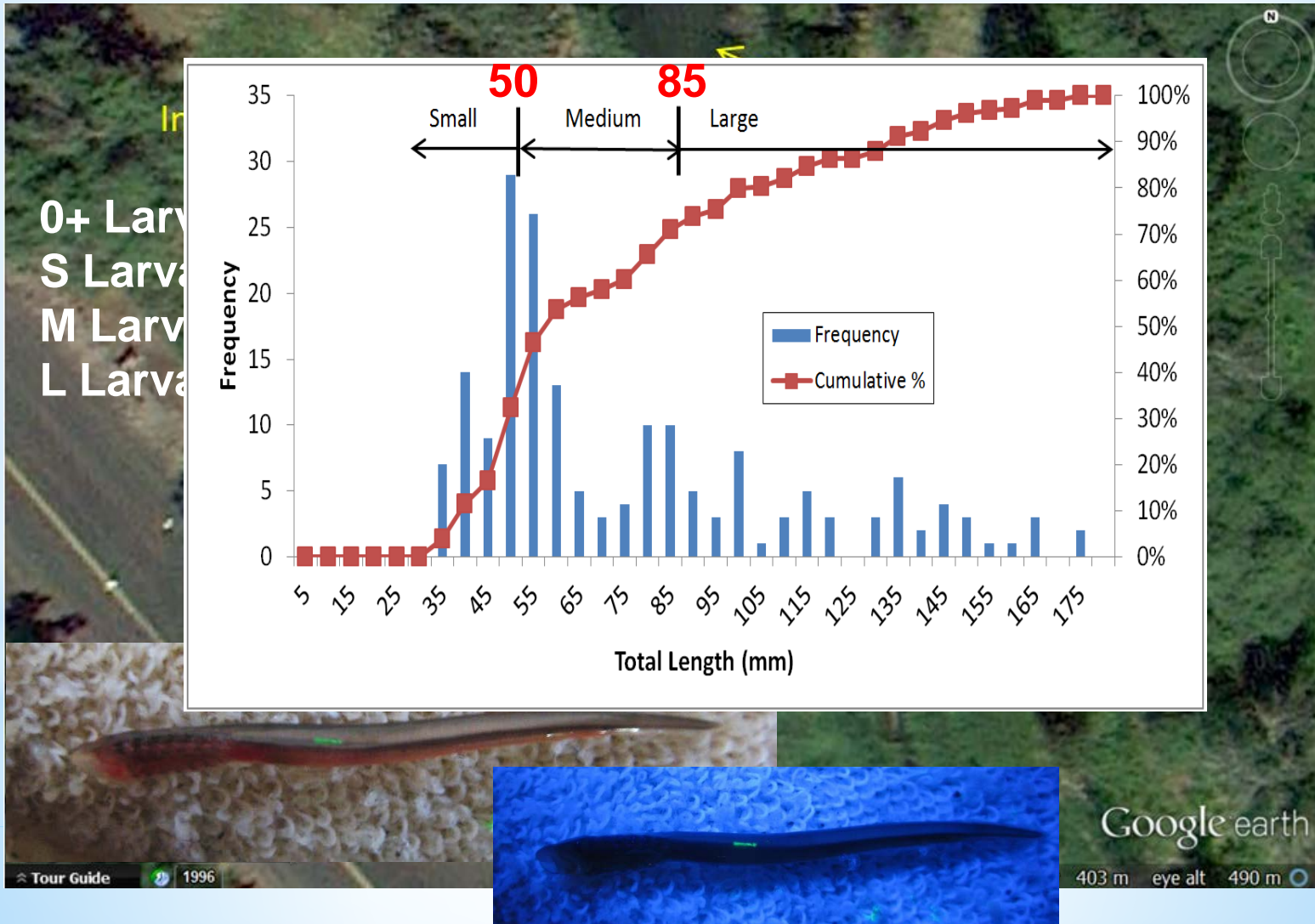
Canal Outlet Channel (covers ~18%):

**Recaptured 10 & 19% of 0+ Larvae
(2 releases)**

**Recaptured 22% of M Larvae
(WB)**



Phase 2: Upstream Release



Phase 2: Upstream Release

No S/M/L larvae were recaptured
<0.7% for bypass

<3.3% for canal outlet

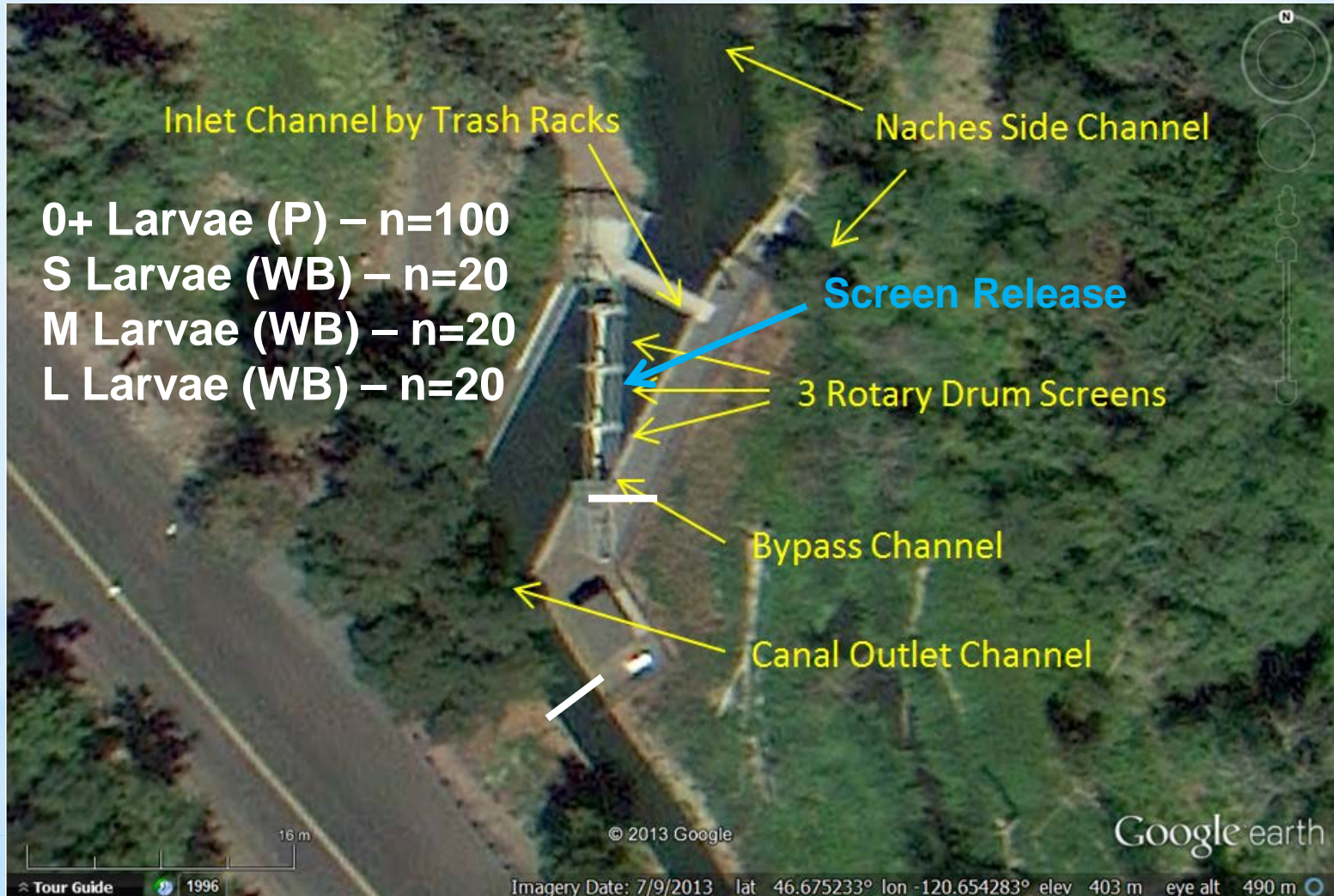
What happened to the rest?

Few 0+ larvae were recaptured
0.8~3.0% for bypass
0~2.4% for canal outlet



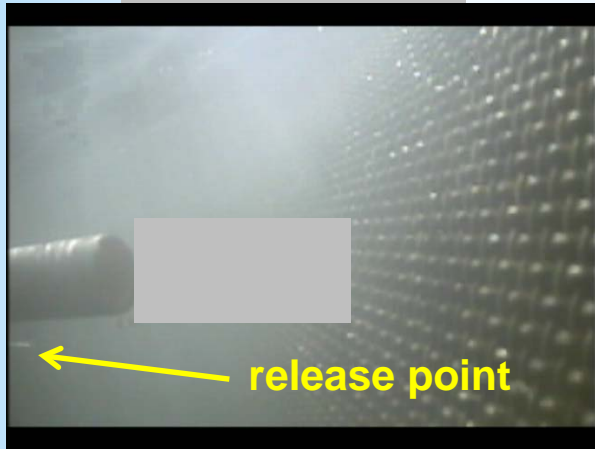
Release		#			Estimated	Estimated
Sample #	Location	Released	# Recap.	% Recap.	#	% Passage
1	Bypass	230	6	2.6	7	3.0
2	Bypass	300	2	0.7	2	0.8
3	Bypass	300	6	2.0	7	2.3
1	Canal Outlet	230	1	0.4	6	2.4
2	Canal Outlet	300	1	0.3	6	1.9
3	Canal Outlet	300	0	0.0	<6	<1.9

Phase 3: Screen Release



Phase 3: Screen Release

6. Unseen



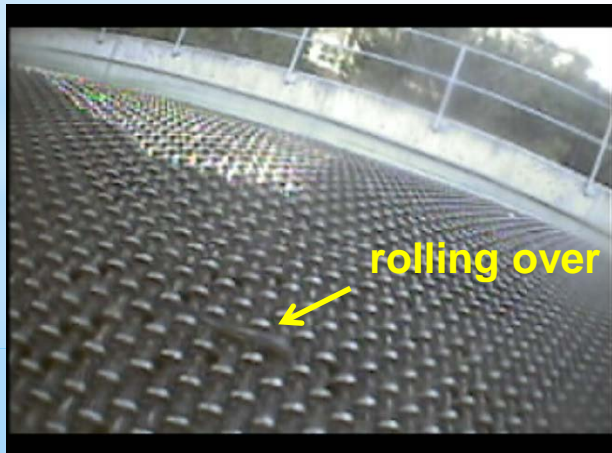
1. Escaped



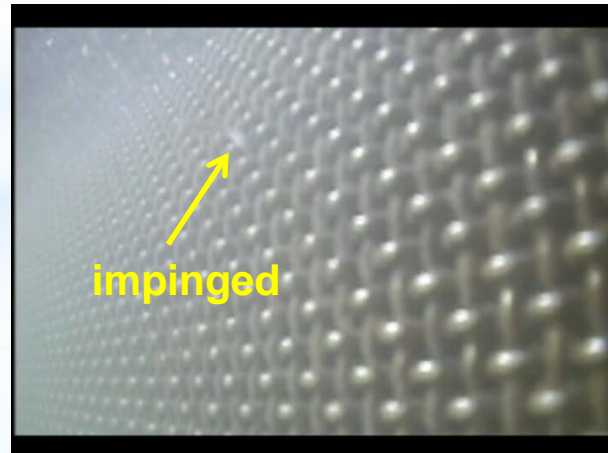
2. Averted



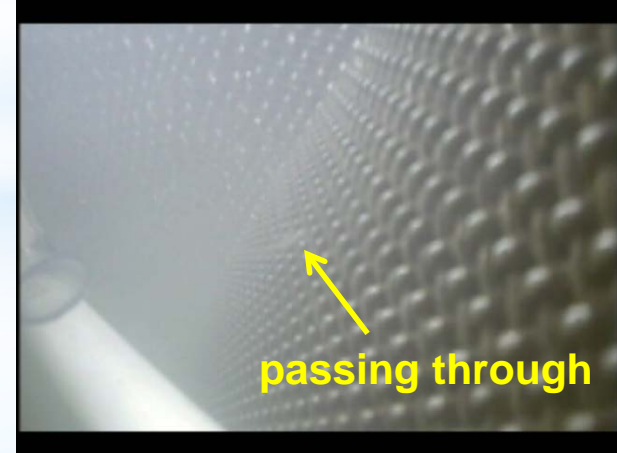
3. Rolled



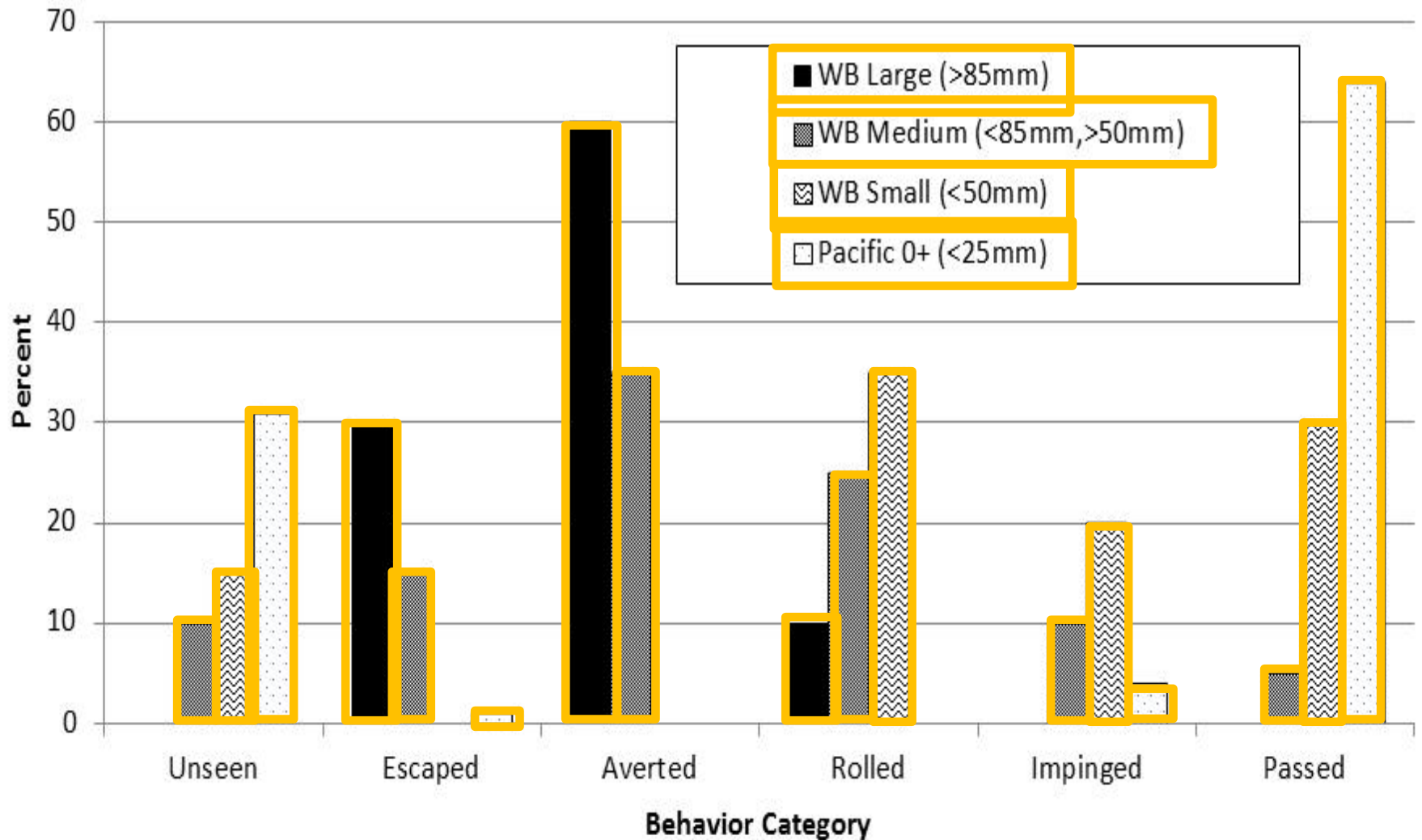
4. Impinged

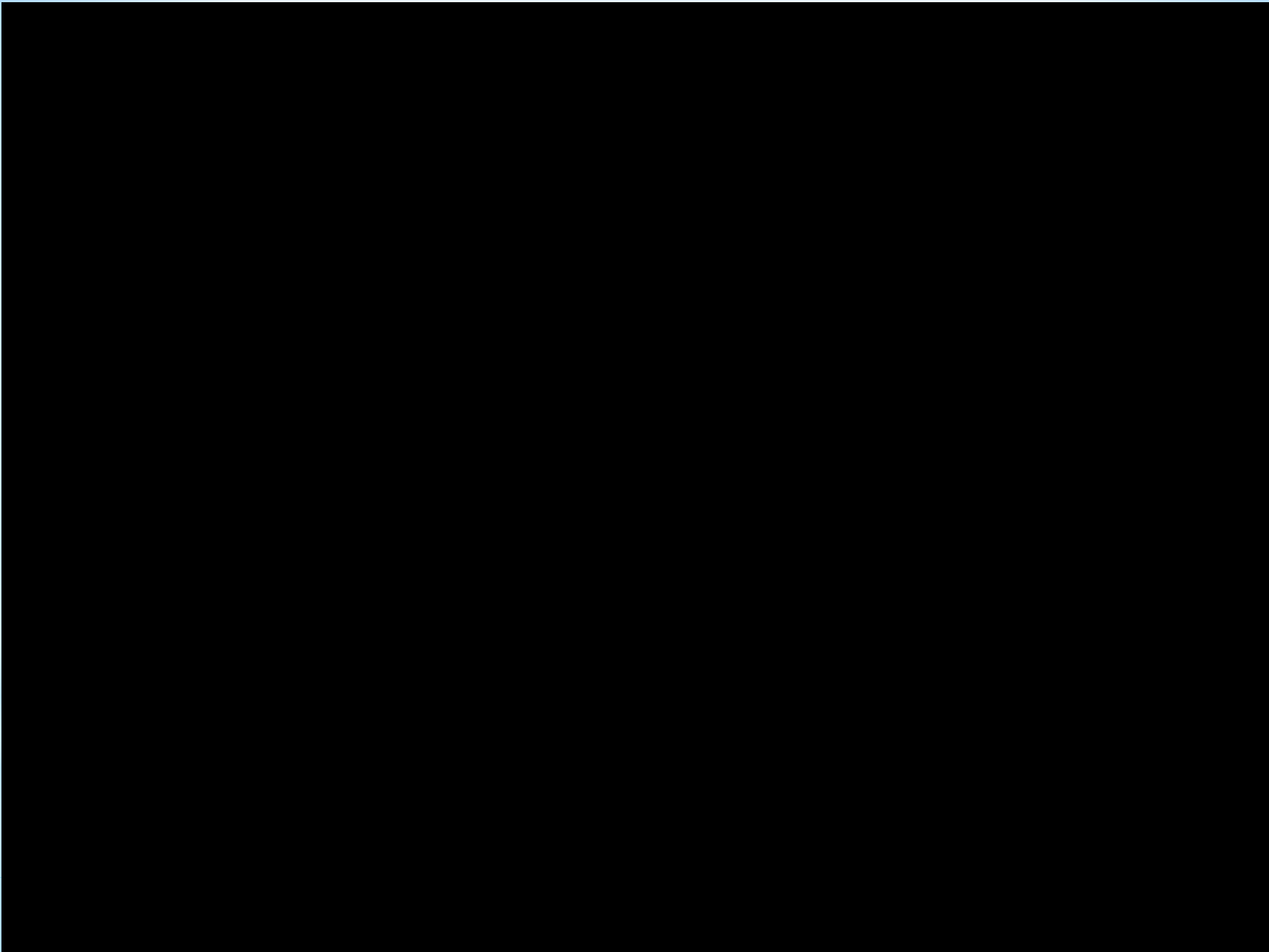


5. Passed



Phase 3: Screen Release





Phase 3: Screen Release

Why didn't they show up in nets??

Lamprey burrowed into fine sediment!

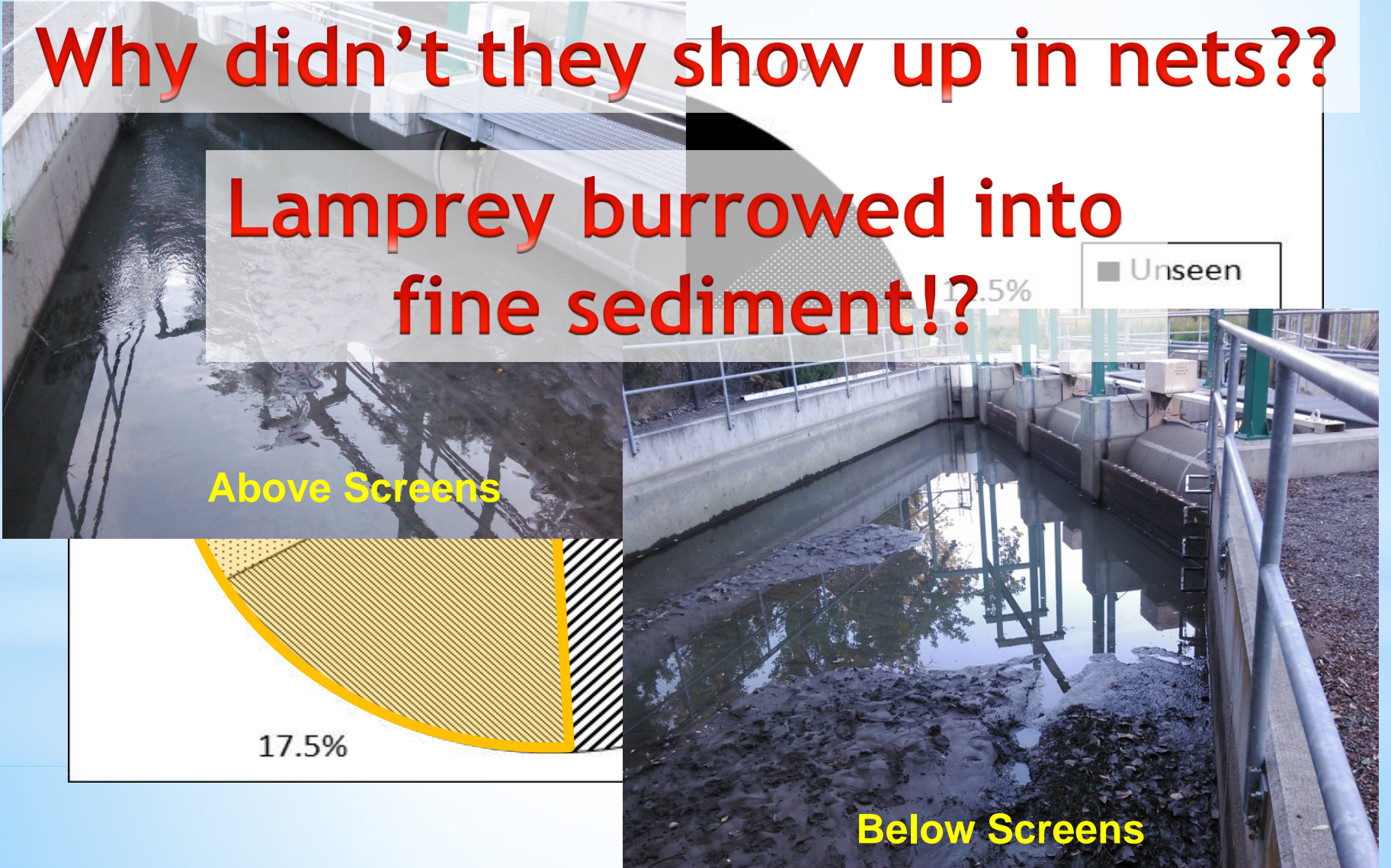
Above Screens

17.5%

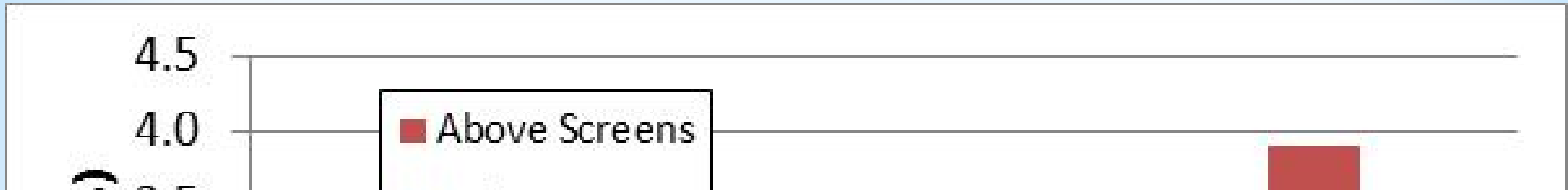
17.5%

Unseen

Below Screens



After Dewatering



Short Term = burrowed into fine sediment

Long Term = ??

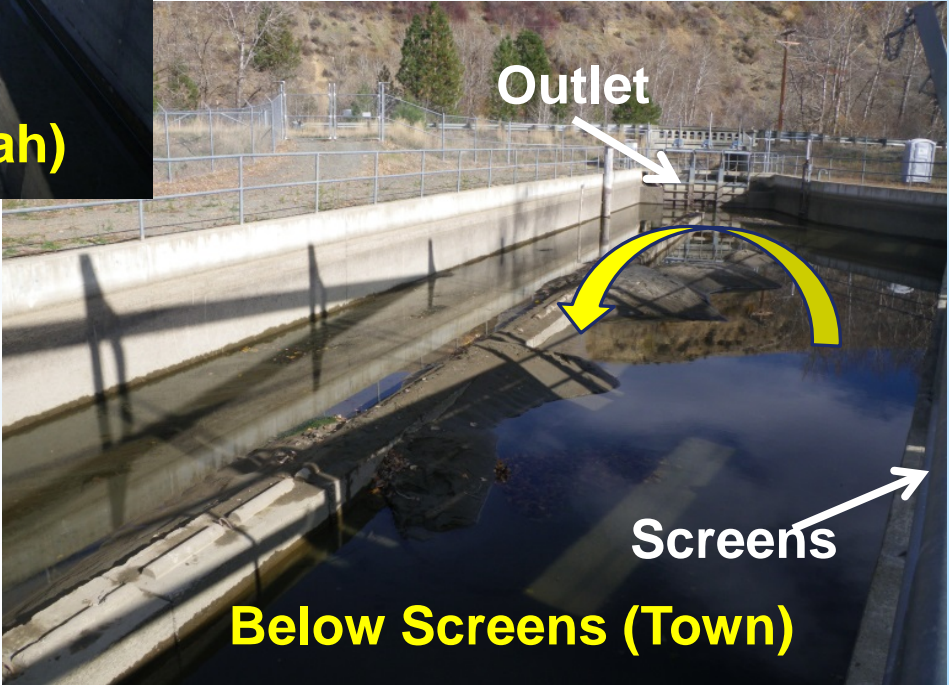
-> bypass & canal outlet (size-based)



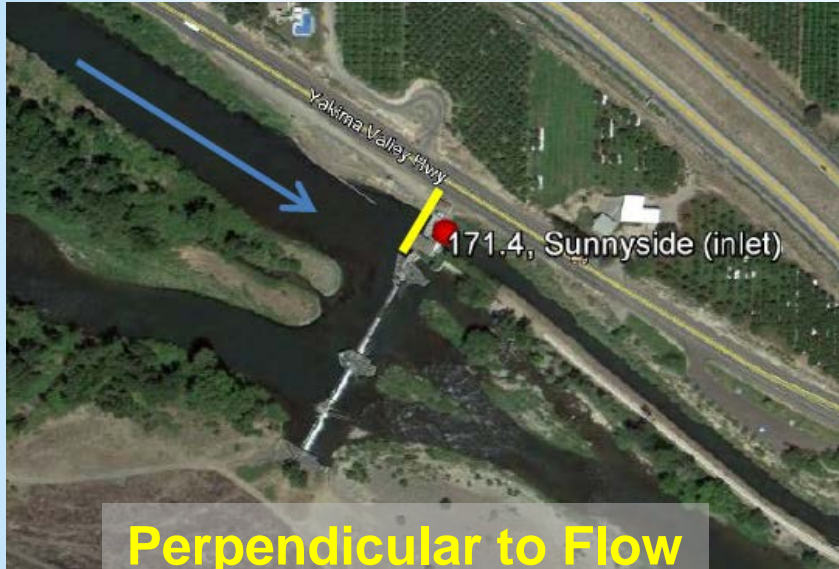
Conclusions

- 1. Diversions act as “refuge habitat” (until dewatering)**
- 2. Distribution of fine sediment habitat can effectively predict larval lamprey distribution in diversions**
- 3. Size-dependent entrainment likelihood (smaller ones more likely)**
- 4. Size of screen affects entrainment likelihood**
- 5. Various “modes” of entrainment (by size classes)**
- 6. Presence of fine sediment can prevent screen interaction (at least in short-term)**
- 7. Managing fine sediment may be key to managing lamprey!!!**

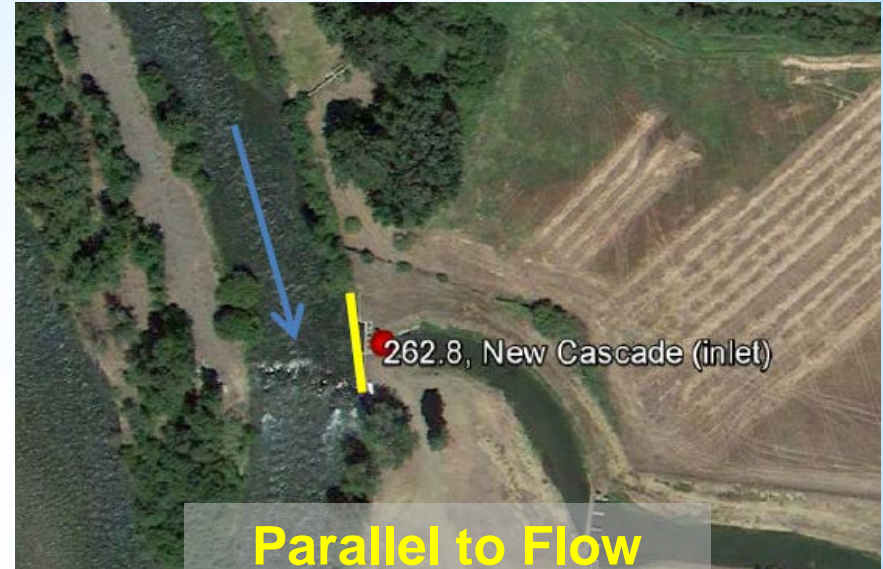
Short-Term Fixes



Long-Term Fixes



**Perpendicular to Flow
-> More Sediment**



**Parallel to Flow
-> Less Sediment**



Mid-Term(?) Fixes

