Improving Adult Pacific Lamprey Passage at Bonneville Dam Using Lamprey Passage Structures and Refuges

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

University of Idaho
College of Natural Resources

NWFSC
NMFS

USGS
science for a changing world

Goal: Improve adult Pacific lamprey passage at Bonneville Dam

Lamprey Passage Structure (LPS)

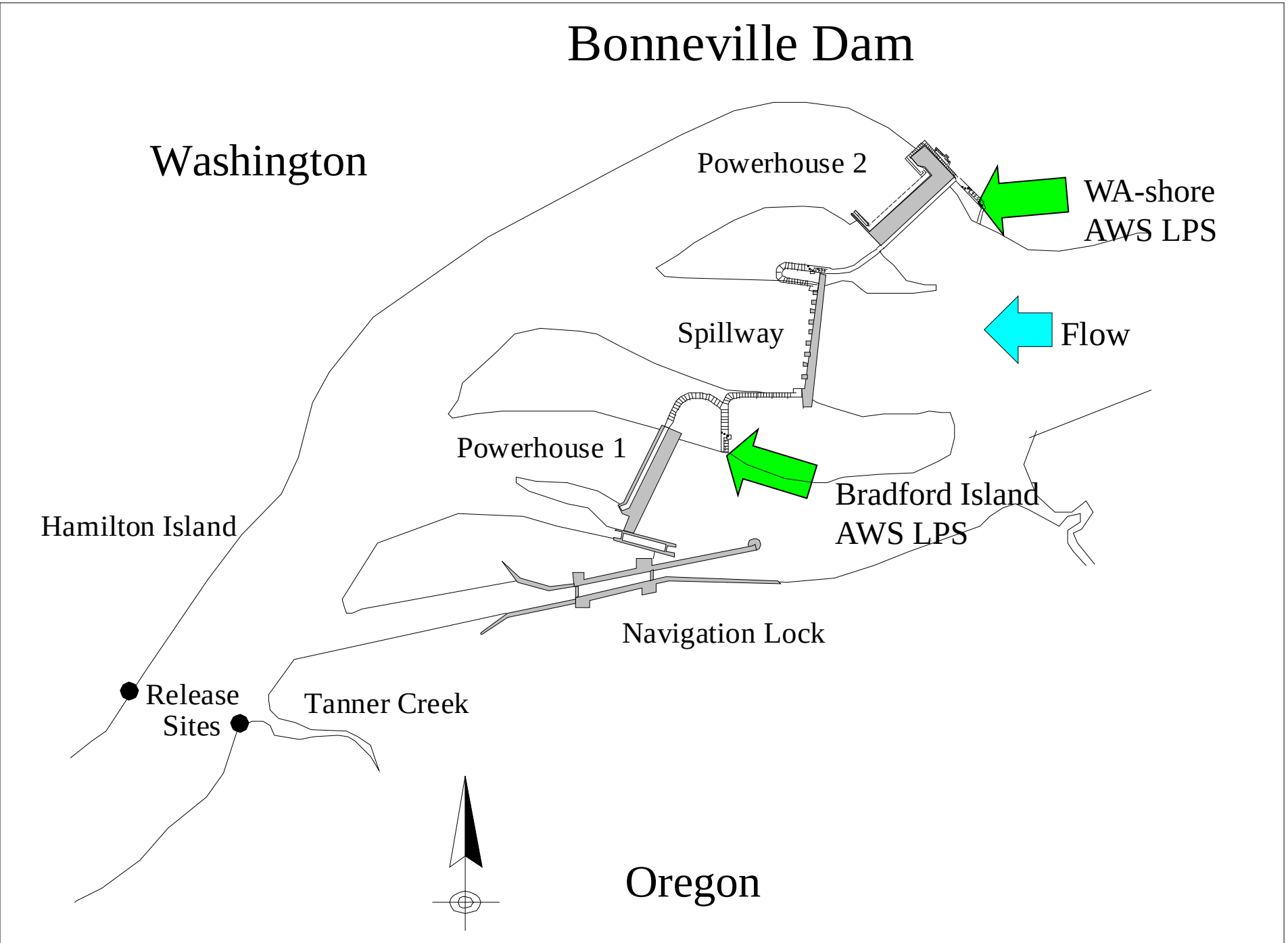
Objectives

-Improve access to and monitor lamprey use of LPSs at the Bradford Island and Washington-shore Auxiliary Water Supply channels

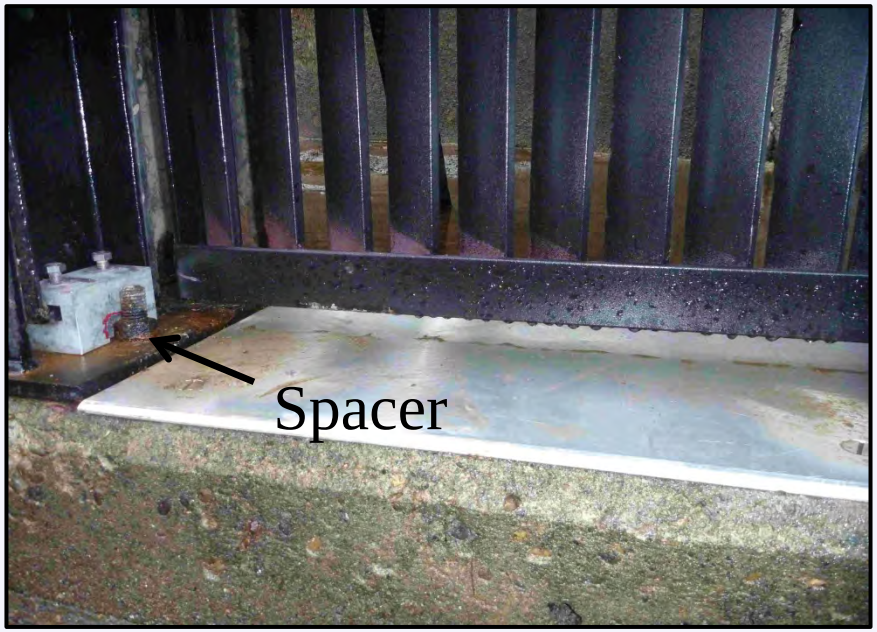
-Assess lamprey use of prototype refuges in the Washington-shore Auxiliary Water Supply channel

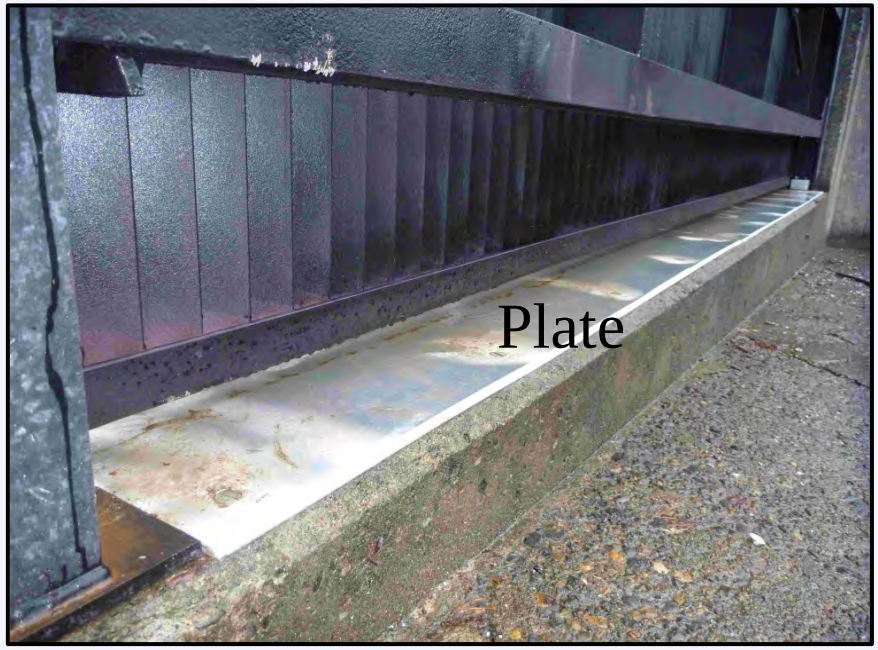
-Modify flows and rest box entry fykes at the Cascades Island LPS and evaluate lamprey passage

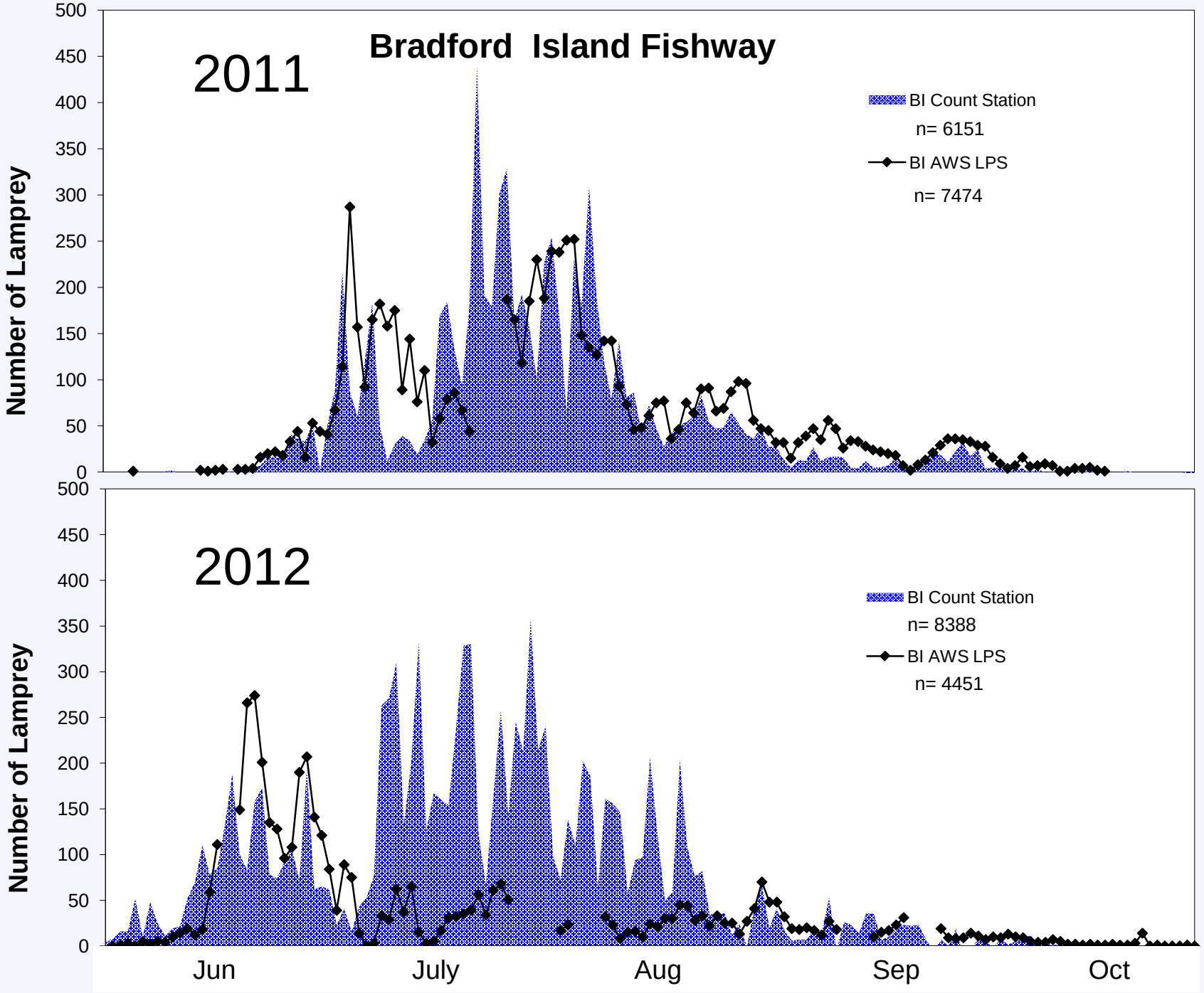
-Evaluate alternative lamprey trapping locations


Bonneville Dam
Washington
Powerhouse 2
WA-shore
AWS LPS
Spillway
Flow
Powerhouse 1
Bradford Island
AWS LPS
Hamilton Island
Navigation Lock
Release
Sites
Tanner Creek
Oregon

2012 Structural Modifications at Bradford Island

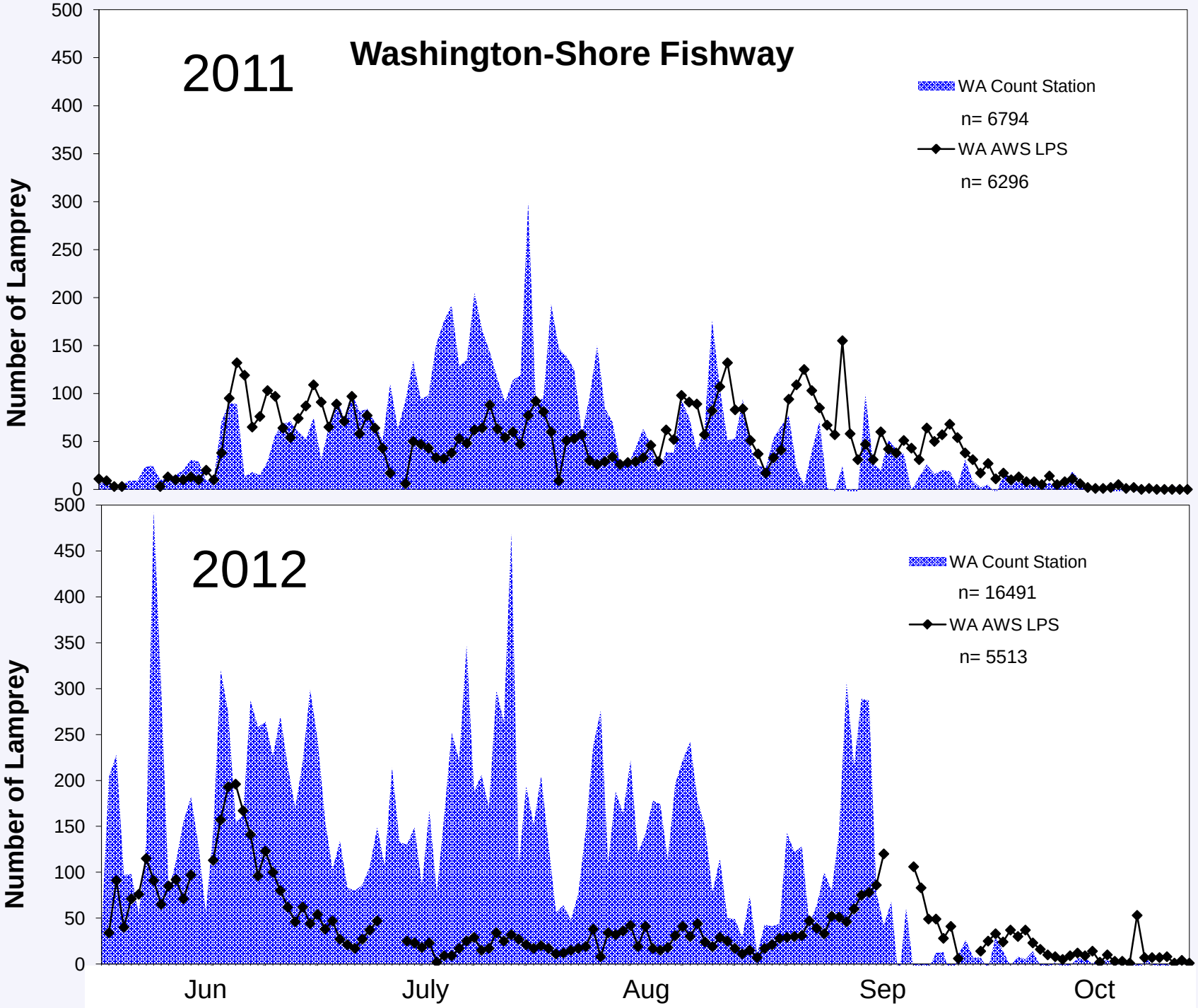





Bradford Island Fishway
2011
BI Count Station
n= 6151
BI AWS LPS
n= 7474
Number of Lamprey
500
450
400
350
300
250
200
150
100
50
0
2012
BI Count Station
n= 8388
BI AWS LPS
n= 4451
Number of Lamprey
Jun
July
Aug
Sep
Oct

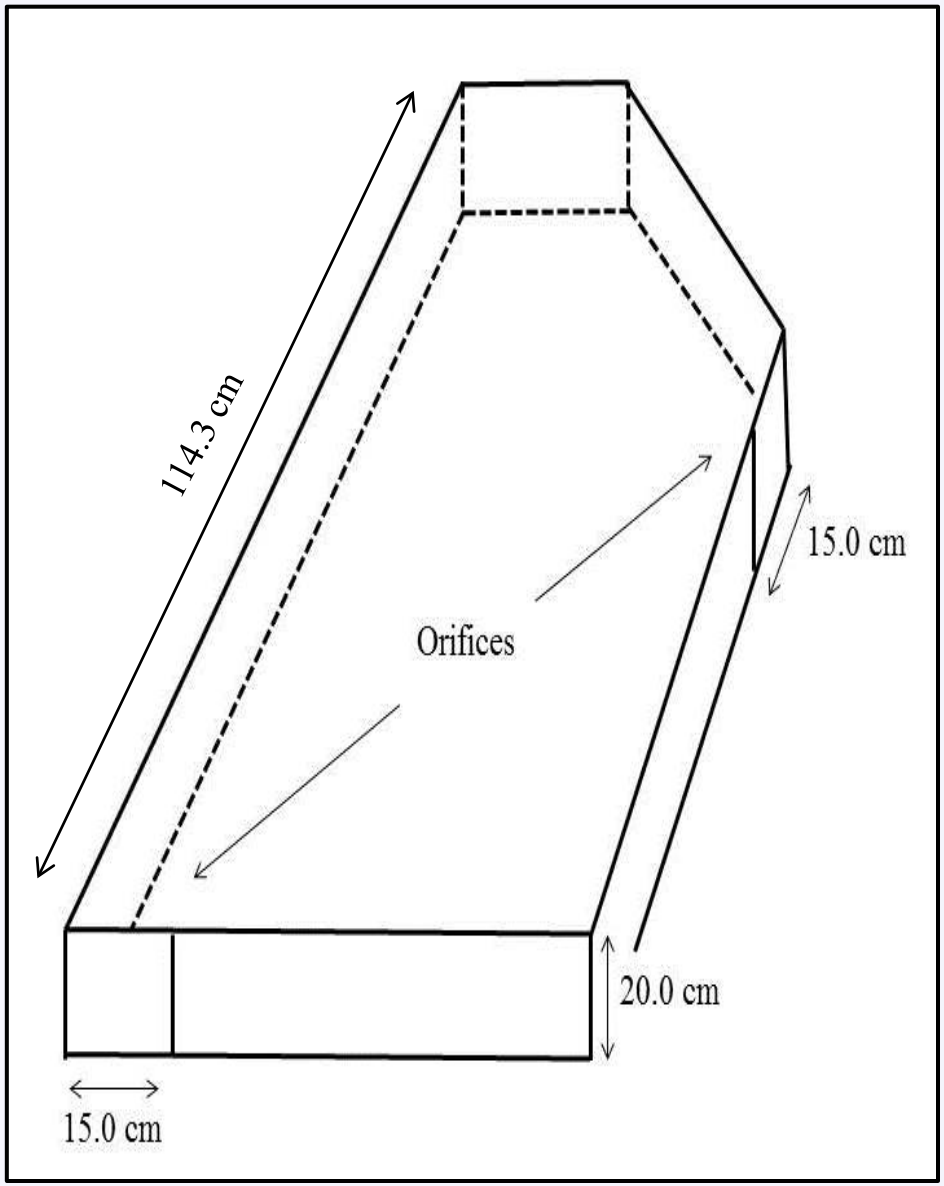
	Bradford Island				Picketed Lead Treatment
	Count Station	Estimated Abundance	AWS LPS Count	%	
2009	2,199	6,597	3,302	50	Lowered (original)
2010	1,653	4,959	1,933	39	Lowered (original)
2011	6,151	18,453	7,474	41	Raised 3.8 cm Apr-Jun
2012	8,388	25,164	4,451	18	Raised 2.54 cm

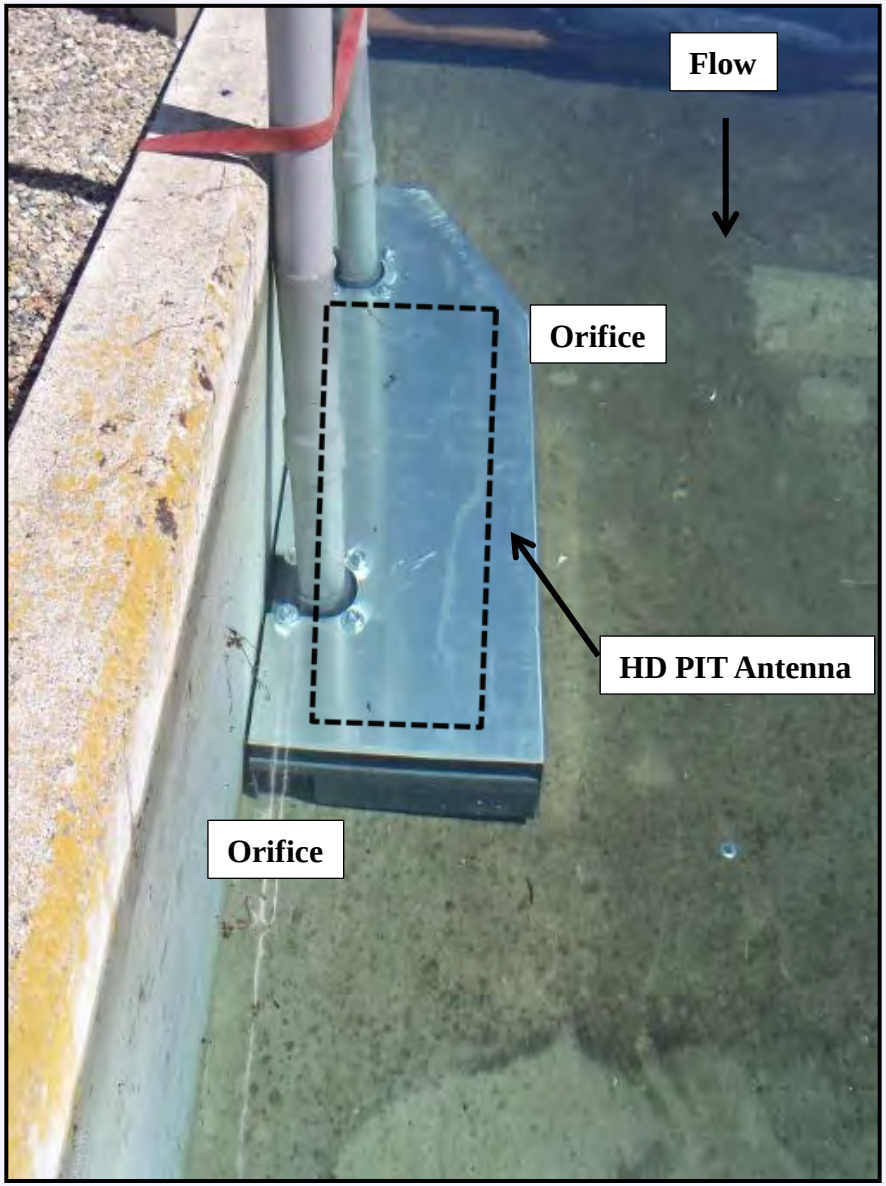
Washington-shore: reduced access to area behind crowder and increased access to AWS channel via metal ramp

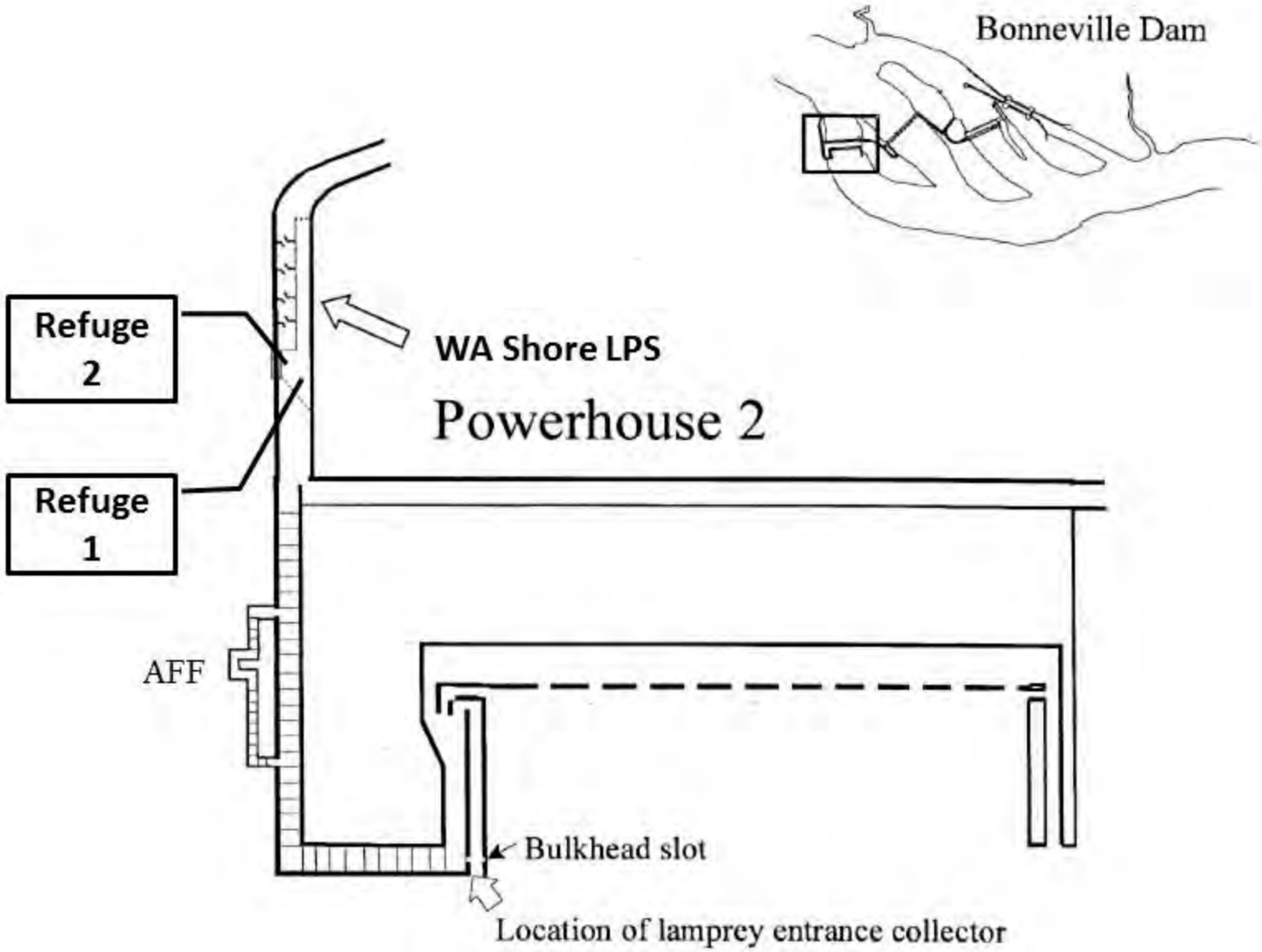

Washington-Shore Fishway
2011
WA Count Station
n= 6794
WA AWS LPS
n= 6296
Number of Lamprey
0
50
100
150
200
250
300
350
400
450
500
2012
WA Count Station
n= 16491
WA AWS LPS
n= 5513
Number of Lamprey
0
50
100
150
200
250
300
350
400
450
500
Jun
July
Aug
Sep
Oct

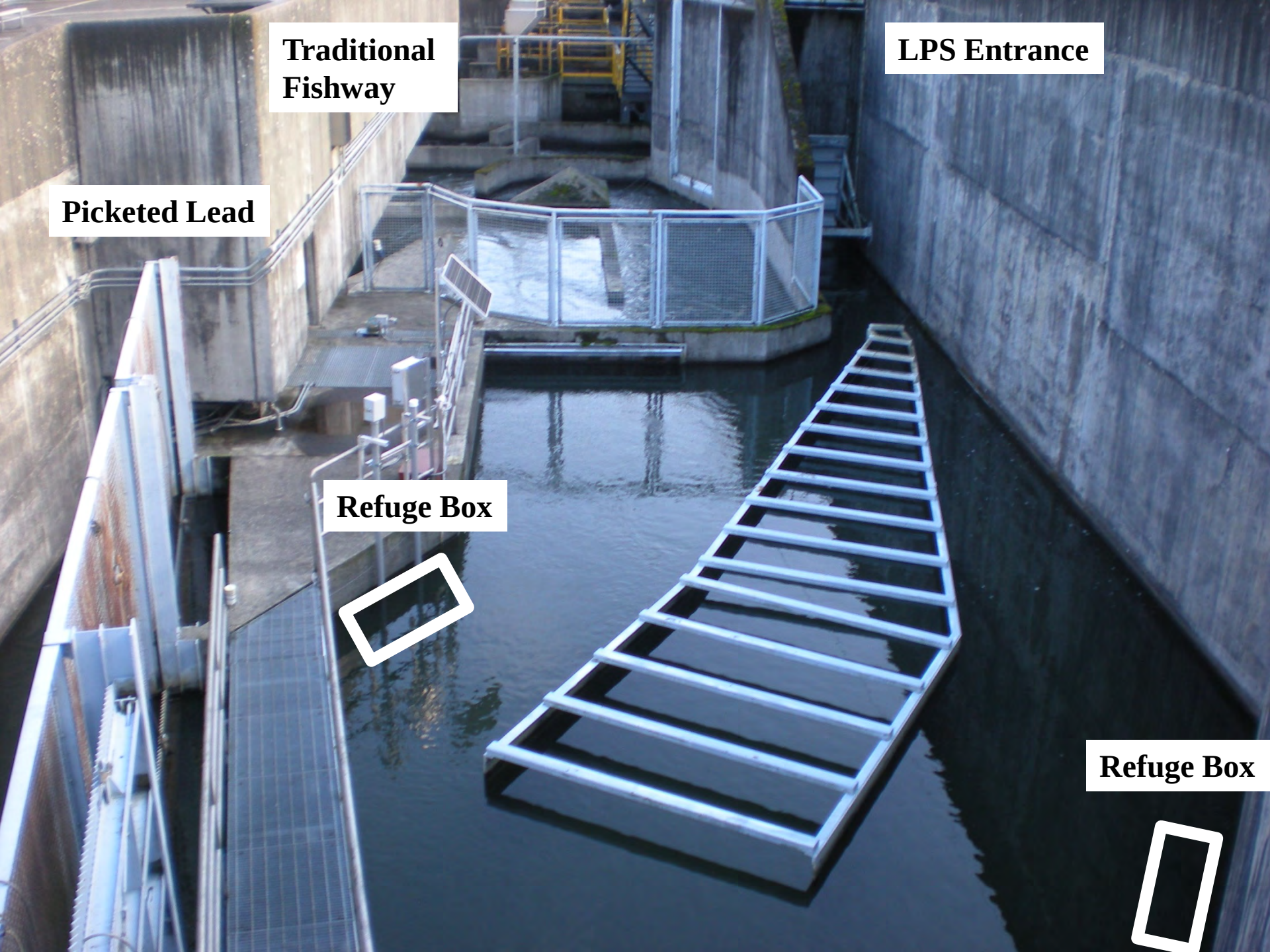
	Washington-shore Count Station	Estimated Abundance	AWS LPS Count	%	Picketed Lead and Ramp Treatment
2009	3,962	11,886	1,199	10	Lowered and no ramp (original)
2010	3,381	10,143	2,961	29	Raised 3.8 cm, no ramp
2011	6,794	20,382	6,296	31	Raised 3.8 cm Apr-Jun, ramp, reduced picket spacing
2012	16,491	49,473	5,513	11	Lowered, ramp, reduced spacing

Prototype Lamprey Refuge






Bonneville Dam
Refuge 2
Refuge 1
WA Shore LPS
Powerhouse 2
AFF
Bulkhead slot
Location of lamprey entrance collector


Traditional Fishway
LPS Entrance
Picketed Lead
Refuge Box
Refuge Box

Two Prototype Refuge Boxes

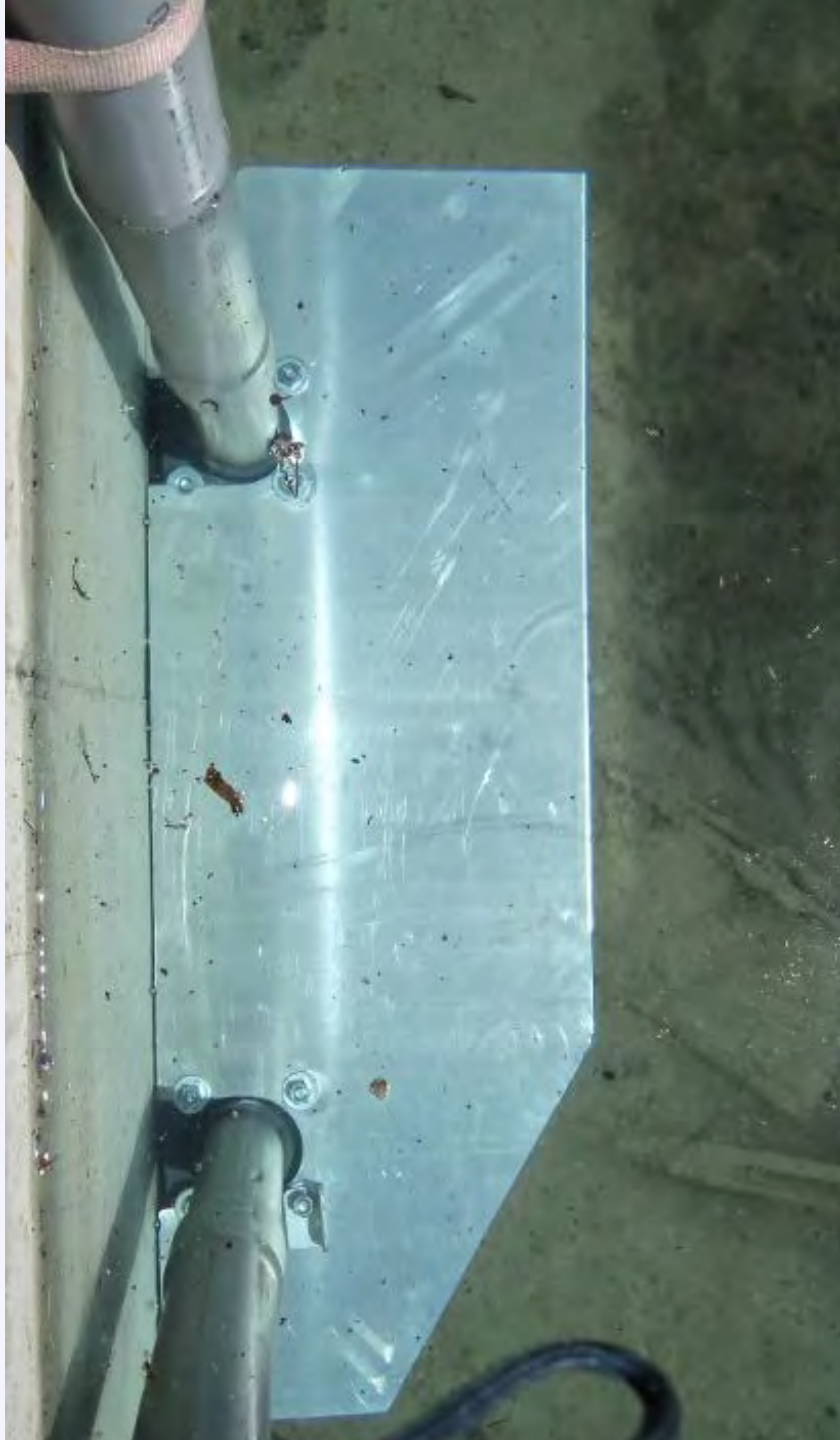
WA-shore AWS Channel

36 of 977 (3.7%) detected

28 (77.8%) of these entered LPS

25 of 212 (11.8%) detected exiting LPS or fishway had previously used a refuge

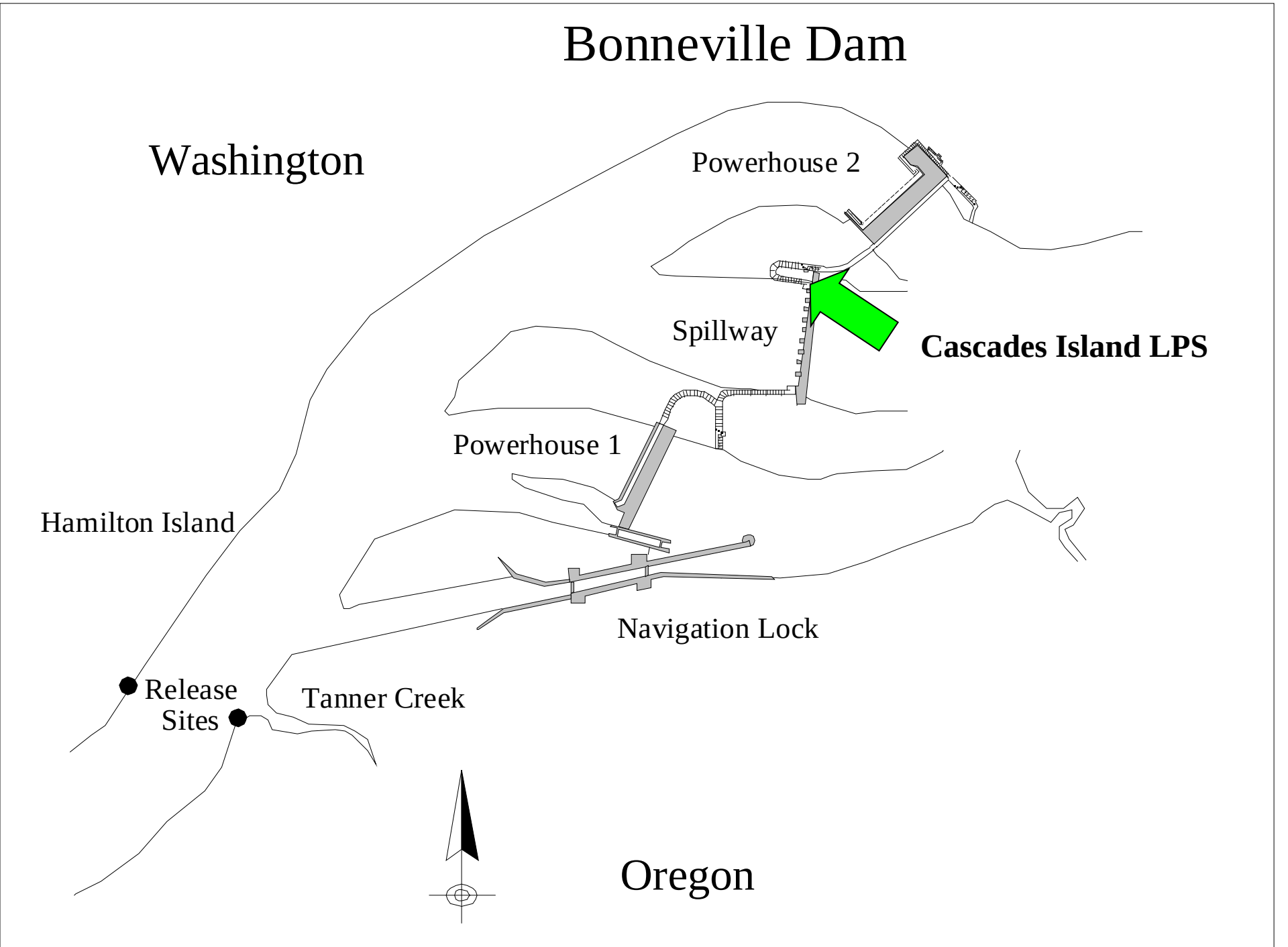
Mean residence time 49.7 h (±76.2 h, range = 0 - 355.6 h)



PIT tags (3 x 32 mm half-duplex)

823 PIT-only released below Bonneville Dam
154 double-tagged with JSATS transmitter

	2008	2009	2010	2011	2012
BI AWS LPS					
PIT only	55 (9 %)	25 (7%)	0	59 (6%)	40 (5%)
Double tag	14 (5 %)	13 (4%)	11 (3%)	0	5 (3%)
WA-shore AWS LPS					
PIT only	16 (3%)	5 (1%)	5 (39%)	60 (6%)	56 (7%)
Double tag	0	3 (1%)	17 (5%)	3 (3%)	6 (4%)


Bonneville Dam
Washington
Powerhouse 2
Spillway
Cascades Island LPS
Powerhouse 1
Hamilton Island
Navigation Lock
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Tanner Creek
Oregon

Operated 5/23 – 9/20

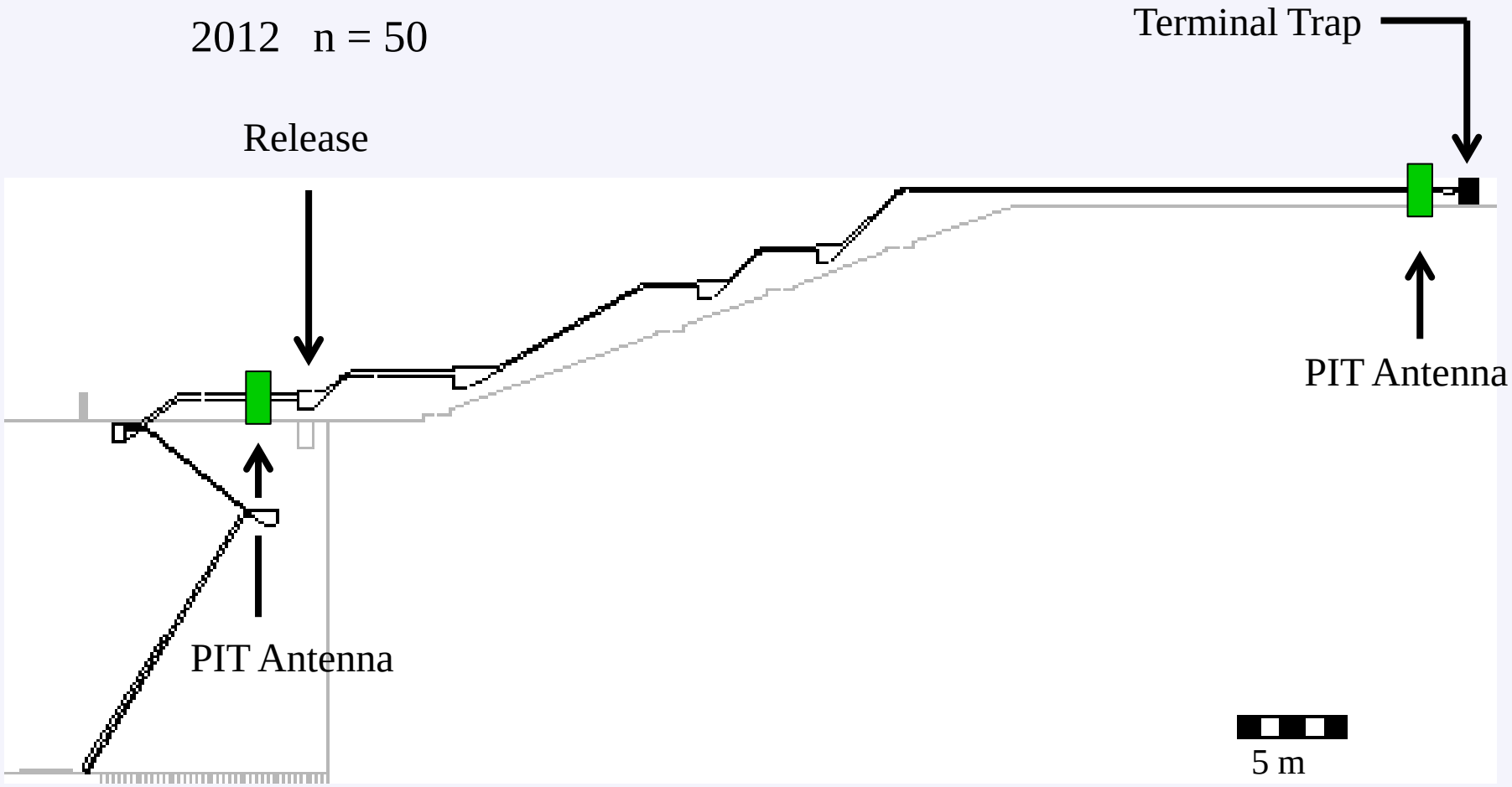
2,472 lamprey ascended

2010(1.4%) 2011(3.8%) 2012(13.4%)

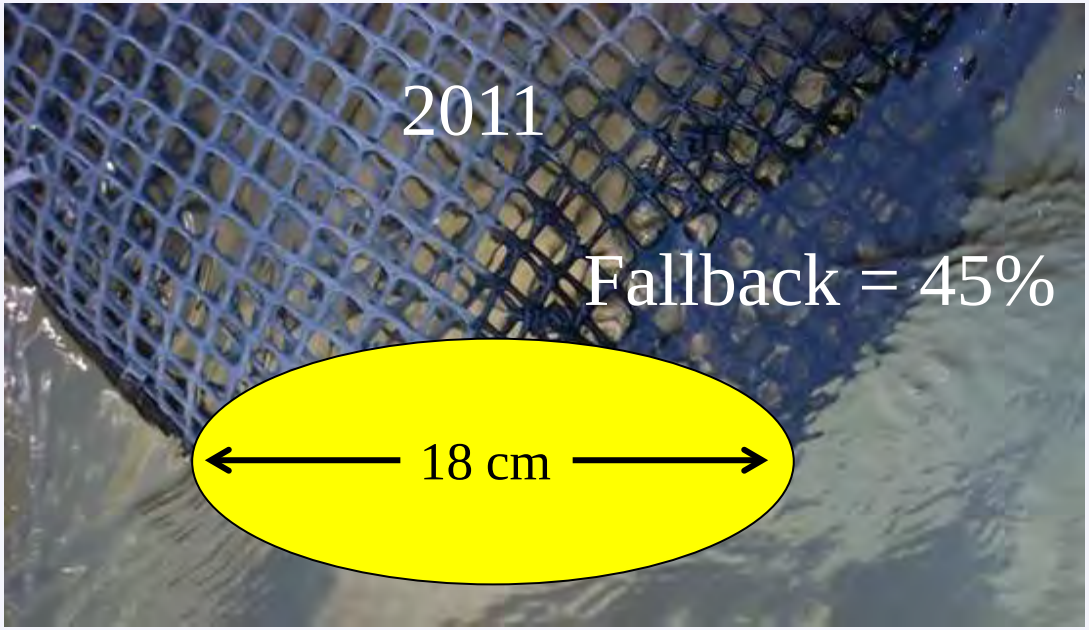
Cascades Island LPS Passage Success

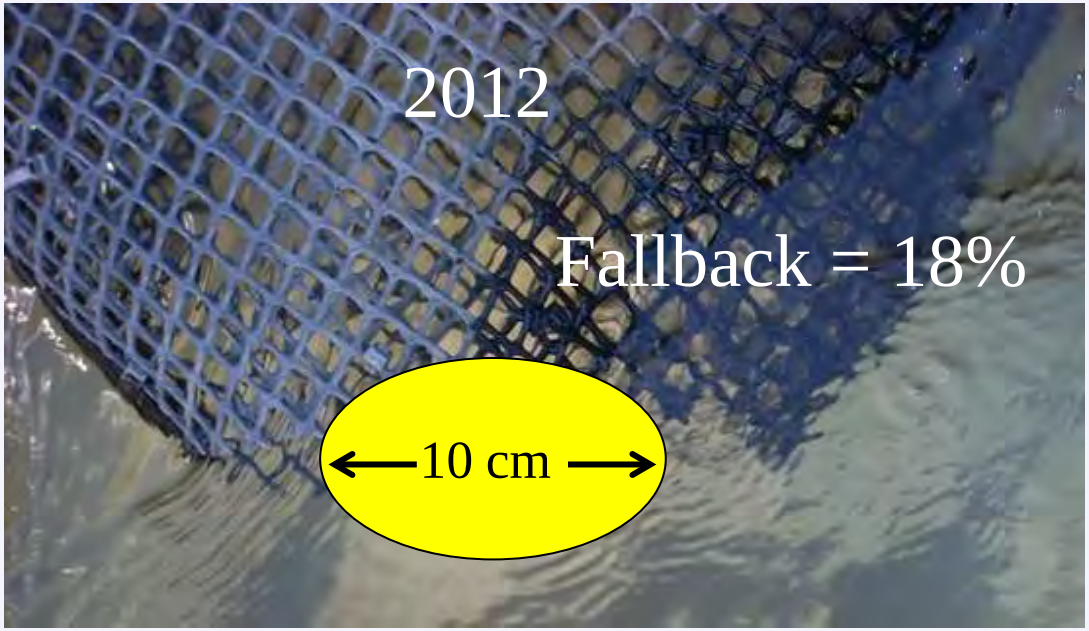
HD PIT-Only lamprey released to lower rest box

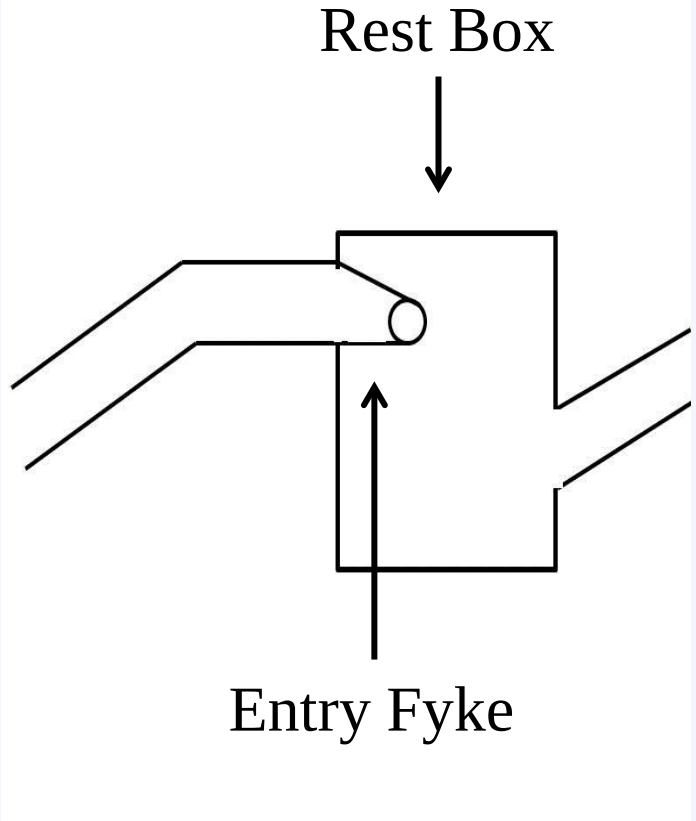
2011 n = 20
2012 n = 50



LPS Rest Box Entry Fyke Design







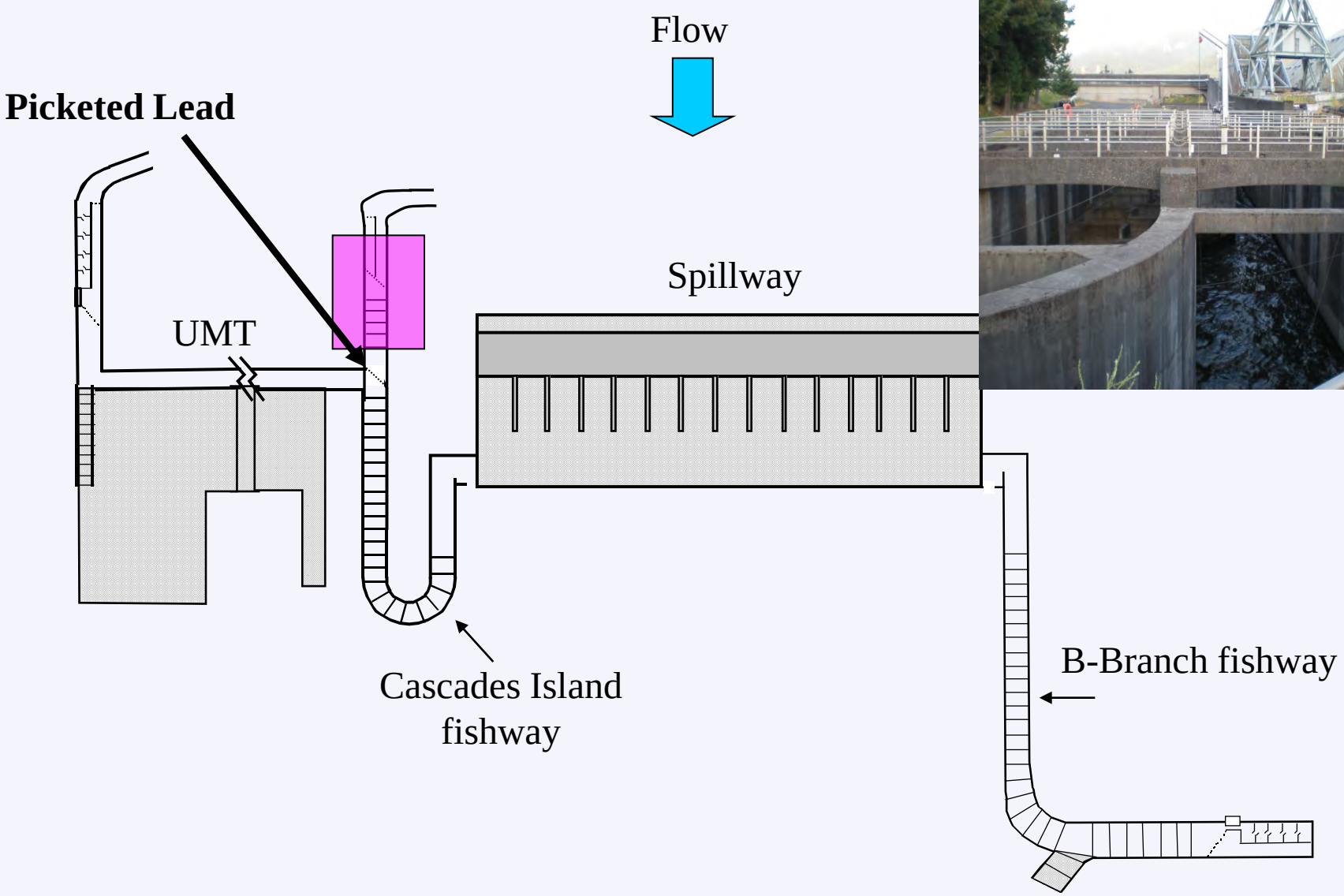
Flow Manipulation Experiment

		Mean # Lamprey Per Day		
	Trials	Low Flow	High Flow	*P* =
2011	9	8.2	5.1	0.21
2012	19	45.8	47.5	0.88

Alternative Trapping Locations

Alternative Trapping Locations

Trap Site	Date Range	Nights Deployed	Lamprey Captured	CPUE
WA NDE	5/23-8/7	64	1	.02
WA SDE	5/23-8/3	37	1	.03
CI AWS	8/16-9/20	30	268	8.9
CI LPS	8/16-9/20	36	59	1.6
WA AFF	8/16-9/20	12	135	11.3



Cascades Island Auxiliary Water Supply Channel

Conclusions

-Reduced access to AWS channels resulted in lower LPS use; picketed leads should be raised higher than 1”.

-11% of PIT-tagged lamprey used the AWS LPSs while 29% used traditional fishway exits.

-Lamprey use of the Cascades Island LPS increased, fallback decreased but further modifications to rest boxes are needed.

-Lamprey refuge boxes may help to retain lamprey in fishways.

-Trapping in the CI AWS indicates that lamprey accumulate in this area. 9% of PIT-tagged lamprey detected at CI AWS.

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