

# Migration Timing and Survival of Adult Salmonids from the Columbia River Estuary to Upstream Dams using Passive Integrated Transponder Tag Technology



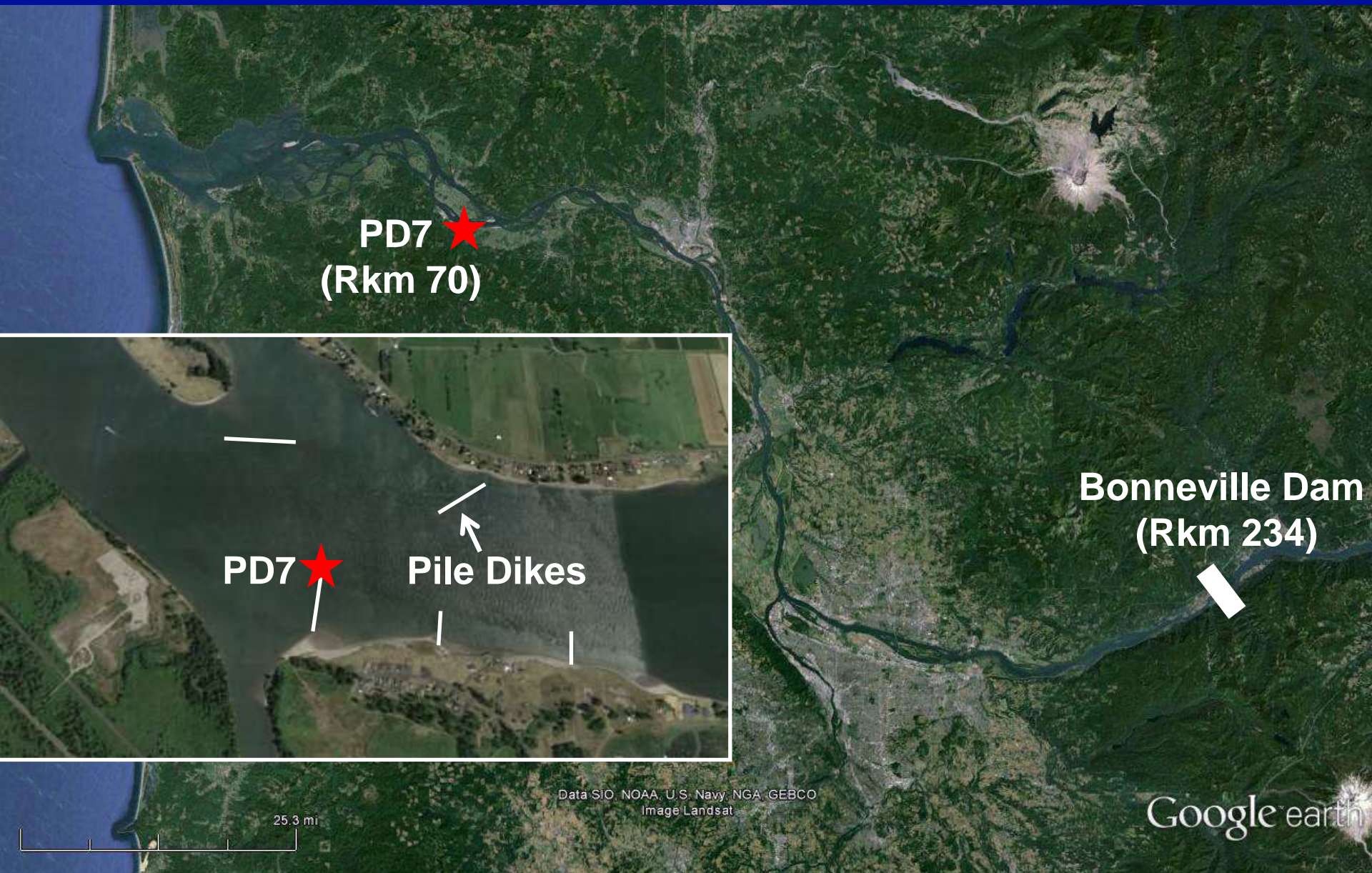
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# Columbia River Estuary and PD7



PD7 ★  
(Rkm 70)

Bonneville Dam  
(Rkm 234)

PD7 ★  
Pile Dikes

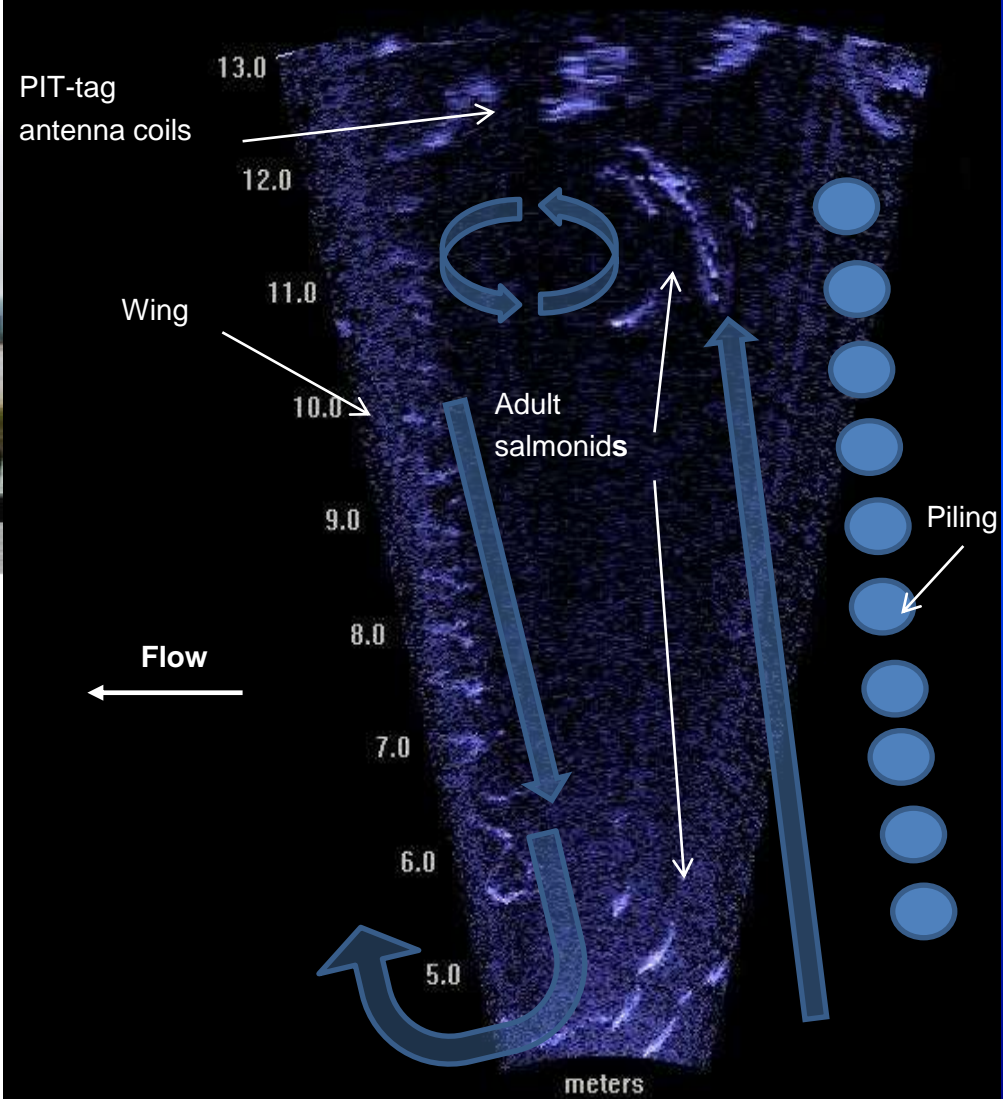
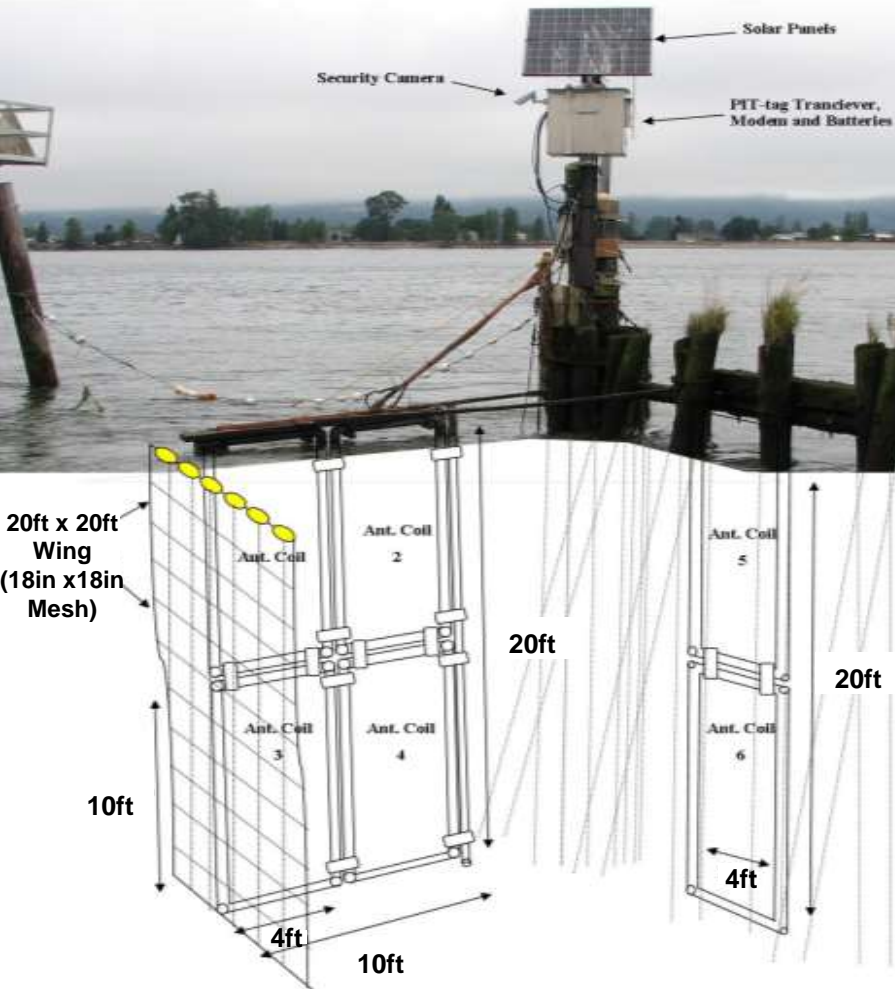
25.3 mi

Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image Landsat

Google earth

# Site Configuration and Fish Avoidance Behavior, 2012

2012 PD7 Configuration  
MUX PIT-tag Technology



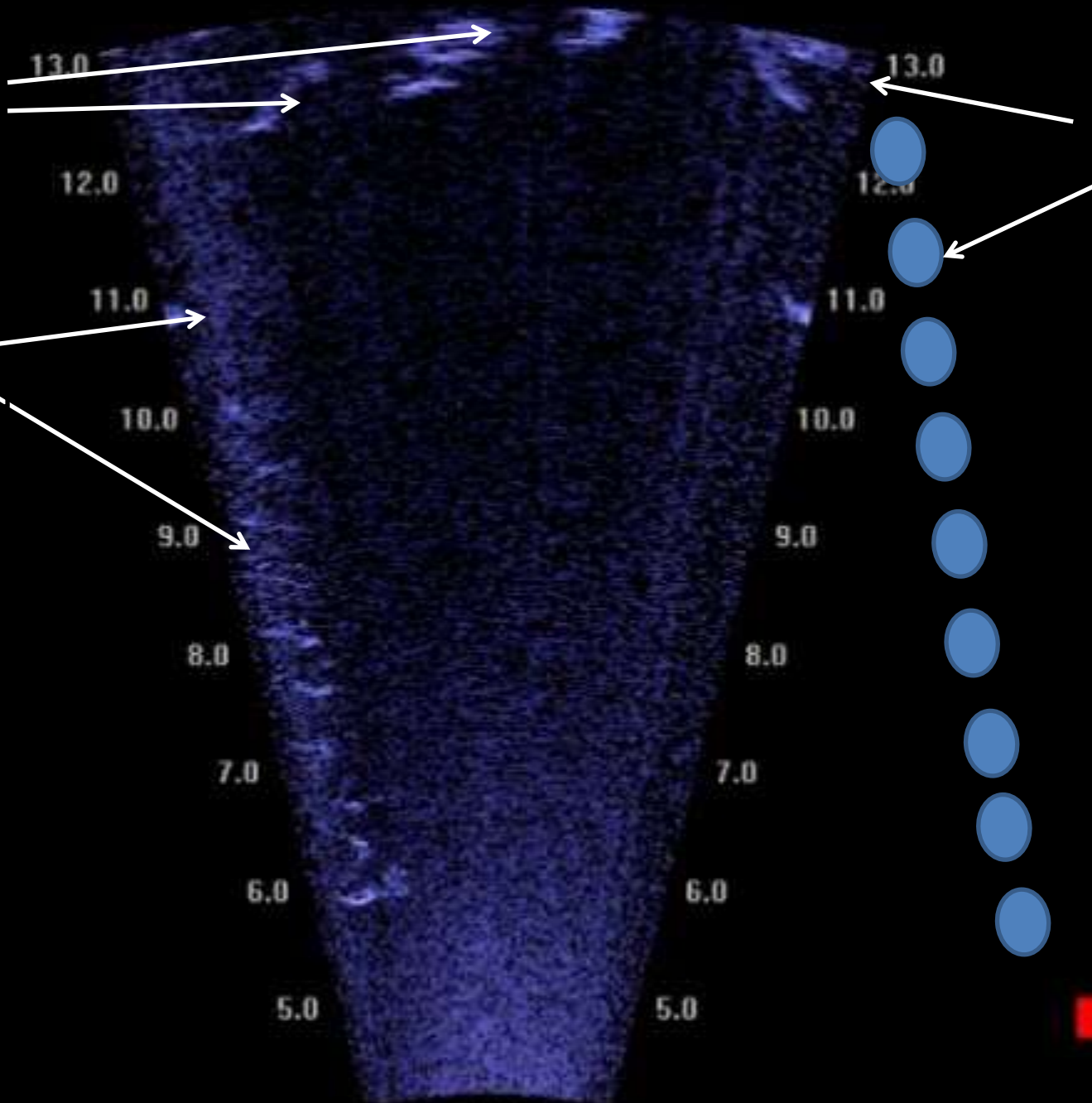
PIT-tag  
antenna coils

Pilings

Wing

00010

meters



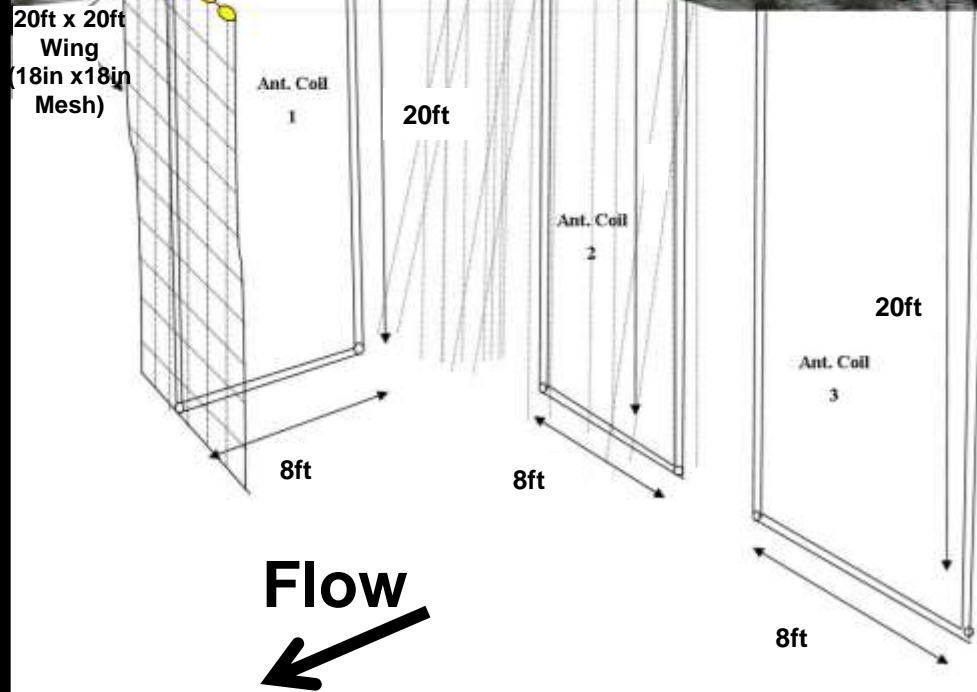
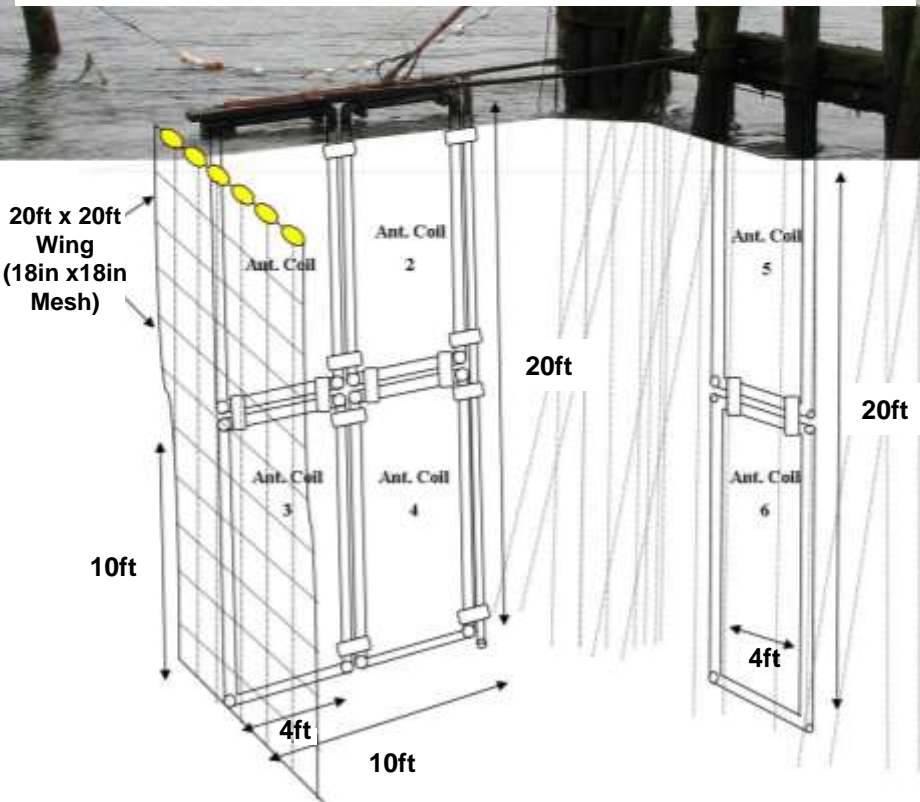
# PD7 Objectives 2013

- **Reduce avoidance behavior and improve detection efficiency of PIT-tagged adult salmonids**
  - **Test and Implement IS1001 Multiplexing Transceiver System (MTS) technology.**
  - **Develop larger antennas to minimize avoidance behavior**
- **Evaluate estuarine adult salmonid migration timing**
- **Evaluate travel rates from PD7 to Bonneville Dam**
- **Estimate survival for adult spring, summer and fall Chinook and Steelhead.**
- **Evaluate PIT-tag juvenile salmonid detection efficiency at PD7**

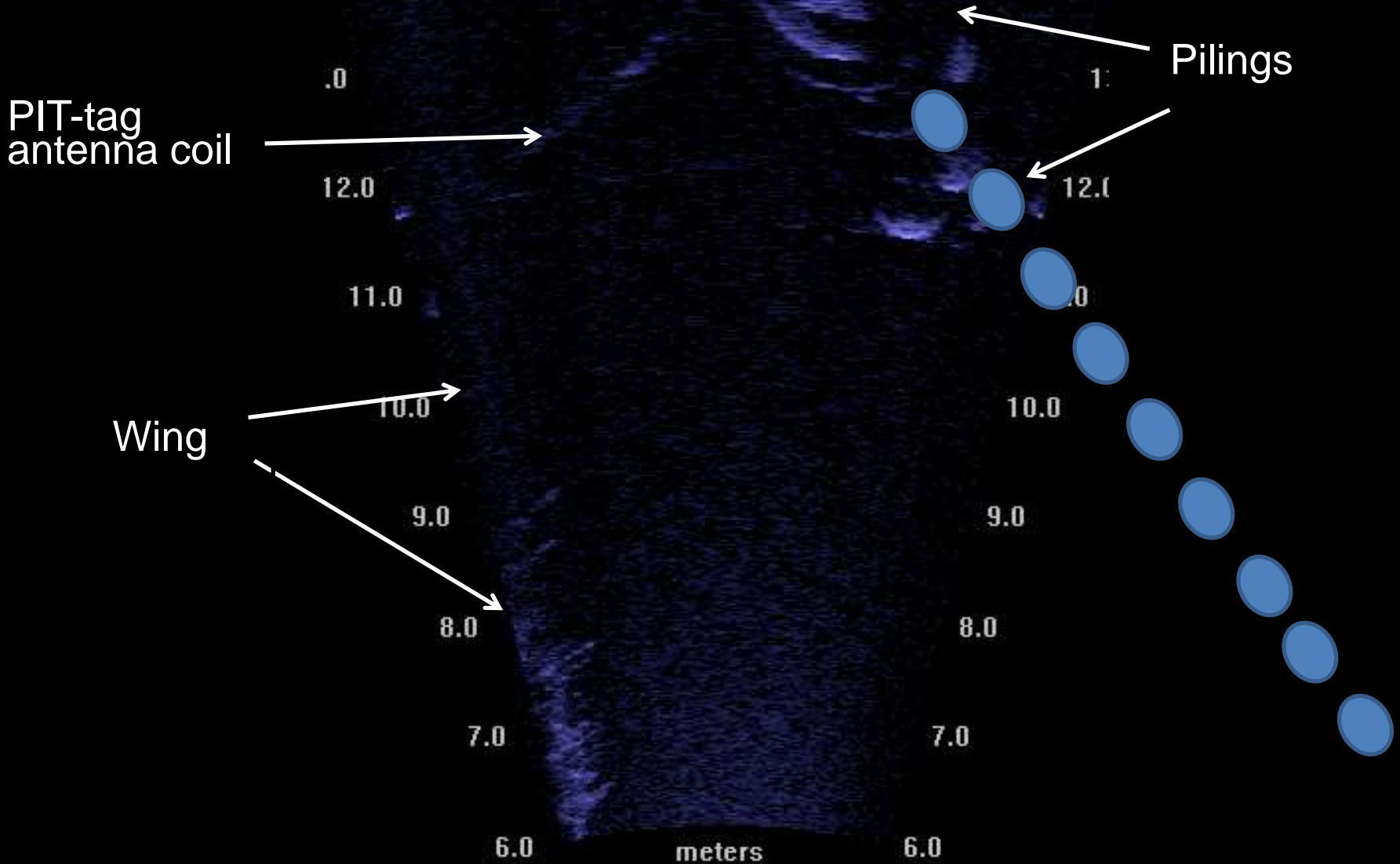
# MUX vs. IS1001 MTS Technology

- 4x larger antennas are possible
- Read range increased by 25%
- 3/4" diameter flex hose antennas
- Cost of construction is reduced (labor/materials)
- Increased detection coverage
- Increased number of antennas
- Greater distance between antennas
- For more details see Matt's poster

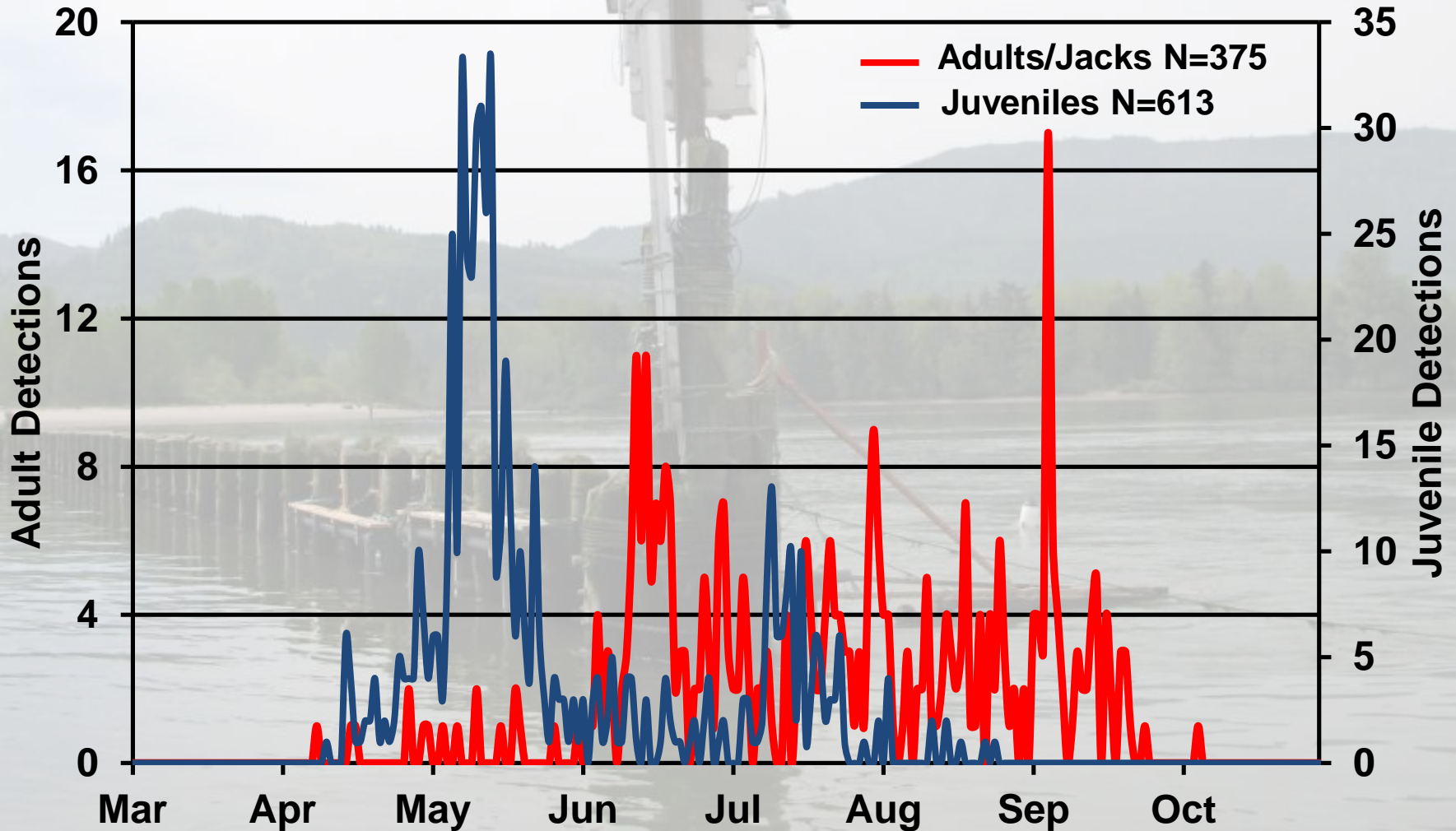
# 2013 PD7 Configuration IS 1001 PIT-tag Technology



# Adult Salmonid Passage Through PD7



# 2013 PIT-tagged Salmonid Detections at PD7



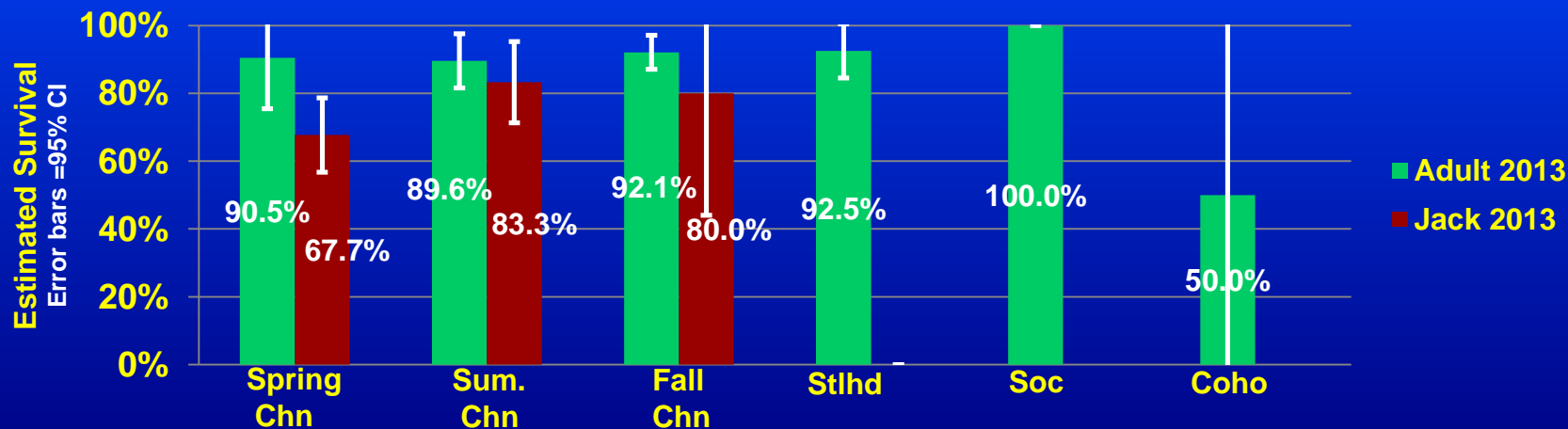


# 2013 PD7 Adult/Jack Data Summary

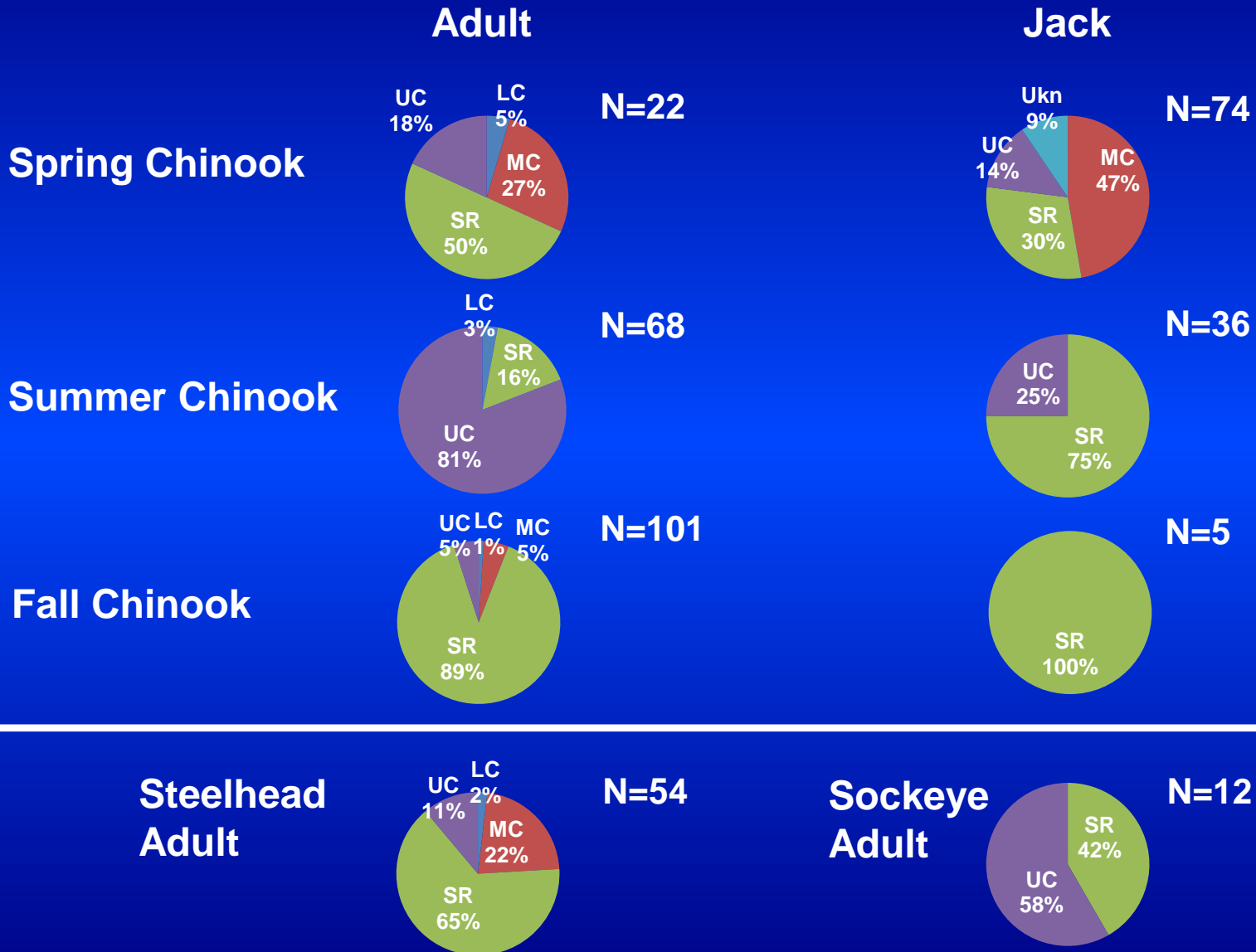
## PD7 Detections, Travel Time to Bon and Site Efficiency

	Mean Travel		Mean Travel		Bon PIT (N)	% of Bon
	Adults	Time (d)	Jacks	Time (d)		
Spring Chinook	22	5.4	74	4.8	4569	2.1%
Summer Chinook	68	4.0	36	3.7	3083	3.3%
Fall Chinook	101	3.8	5	4.2	8765	1.2%
Steelhead	54	5.5	na	na	5771	0.9%
Sockeye	12	3.4	na	na	384	3.1%
Coho	2	3.0	1	na	692	0.4%
<b>Total</b>	<b>259</b>		<b>116</b>		<b>23264</b>	<b>1.6%</b>

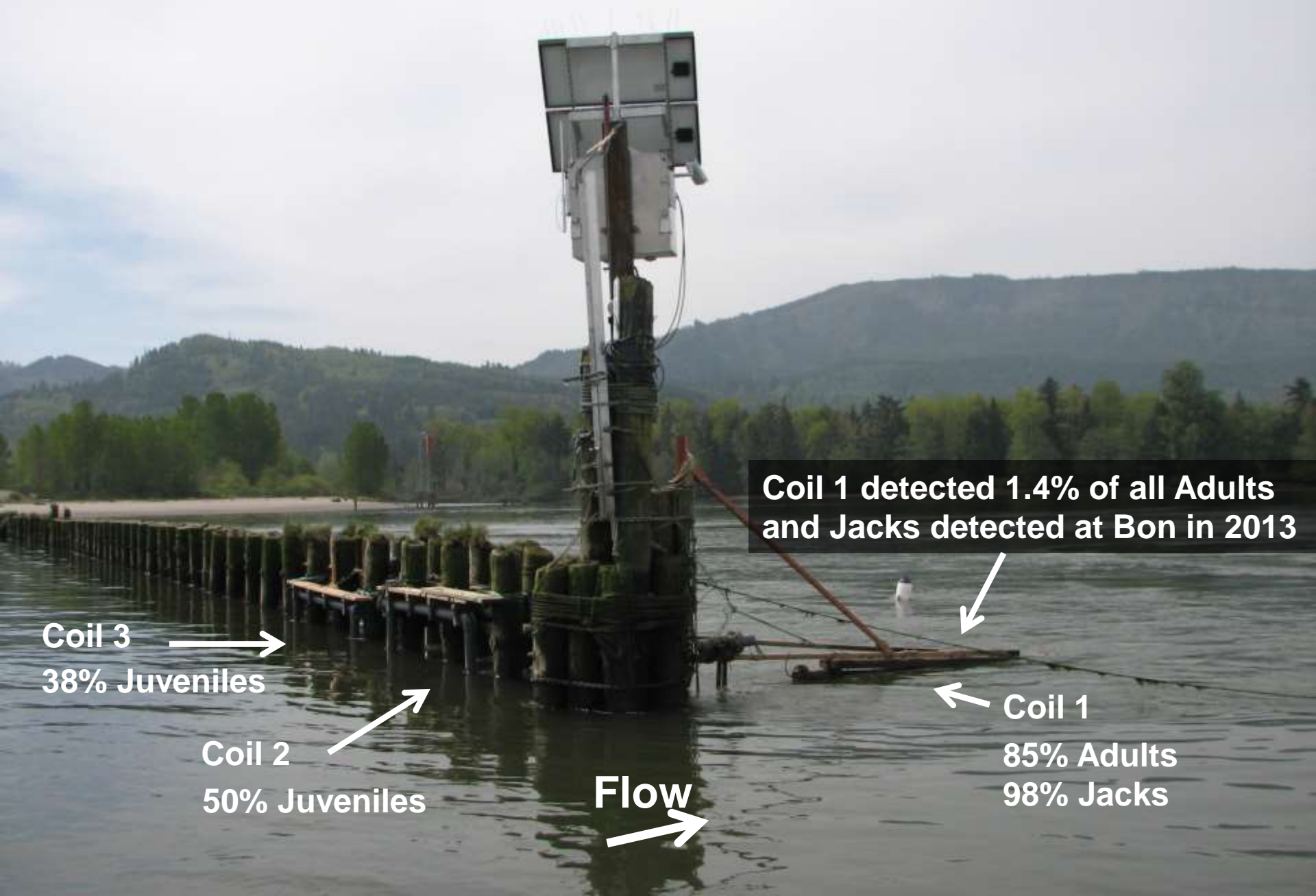
## Survival to Bonneville Dam



# PD7 2013 Adult/Jack Basin Source



# Coil Efficiency by Life History Type at PD7



Coil 3  
38% Juveniles

Coil 2  
50% Juveniles

Flow

Coil 1 detected 1.4% of all Adults and Jacks detected at Bon in 2013

Coil 1  
85% Adults  
98% Jacks

# Adult Fall Back Behavior



# PD7 Sturgeon Detections, 2013



## May

Mo	Tu	We	Th	Fr	Sa	Su
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

## June

Mo	Tu	We	Th	Fr	Sa	Su
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

## July

Mo	Tu	We	Th	Fr	Sa	Su
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

## August

Mo	Tu	We	Th	Fr	Sa	Su
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

## September

Mo	Tu	We	Th	Fr	Sa	Su
30						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

## October

Mo	Tu	We	Th	Fr	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

## November

Mo	Tu	We	Th	Fr	Sa	Su
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

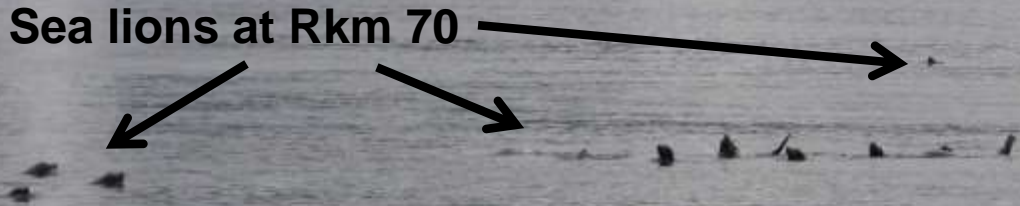
## December

Mo	Tu	We	Th	Fr	Sa	Su
30	31					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

- 3D6.00087E56F9
- 3D6.0009F7125E
- 3D6.00087E56CB
- 3D6.00087E4796
- 3D9.1C2C456F19
- 3D6.0009F715C0
- 3D6.0009F71B2D
- 3D6.0009F71E6B
- 3D6.0009F720B6
- 3D6.0009F719F2

# Acknowledgments

Sea lions at Rkm 70



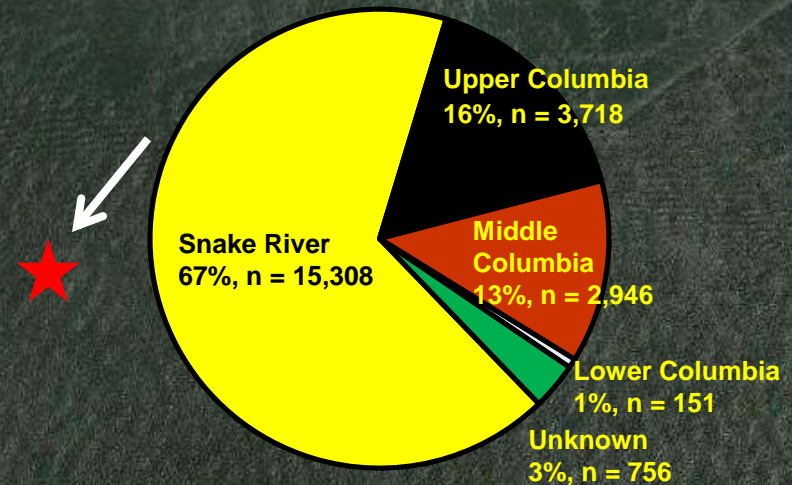
Richie Graves -NOAA  
Gary Fredricks -NOAA  
Trevor Conder -NOAA  
Jeremy Bender -PSMFC  
Gabriel Brooks -NOAA  
Sandy Downing –NOAA  
Steve Anglea -Biomark



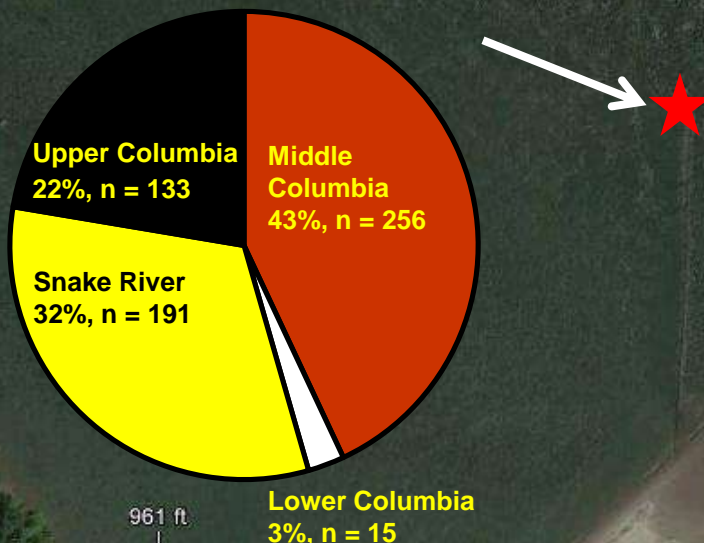
# PD7 Juvenile Detections

Species/run	Total
Spring/summer Chinook salmon	241
Fall Chinook salmon	215
Coho salmon	52
Steelhead	97
Sockeye salmon	4
Unknown	4
<b>Grand total</b>	<b>613</b>

## PIT-trawl Detections



## Pile Dike Detections



961 ft



# 2013 Adult PIT-tagged Salmonid Travel Speed and Survival From Pd7 to Bonneville Dam

Species/Run	Bonneville Dam				Willamette Falls Dam		
	Number Detected (N)	Travel spd (k/d)	Travel time (d)	Survival % (95% CI+-)	Travel (N)	Travel time (d)	Survival (%)
<b>Salmonids</b>							
<b>Spring Chinook</b>							
Adult	22	43.2	5.4	90.5% (15)	1	7.9	100% (0.0%)
Jack	74	48.8	4.8	67.7% (11)	--	--	
<b>Summer Chinook</b>							
Adult	68	59.1	4.0	89.6% (7)	1	--	0.00%
Jack	36	63.2	3.7	83.3% (12)	--	--	
<b>Fall Chinook</b>							
Adult	101	61.6	3.8	92.1% (5)	--	--	
Jack	5	55.7	4.2	80.0% (36)	--	--	
<b>Steelhead</b>							
Adult	54	42.6	5.5	92.5% (7)	--	--	
<b>Sockeye</b>							
Adult	12	68.8	3.4	100% (0)	--	--	
<b>Coho</b>							
Adult	2	78.0	3.0	50.0% (71)	--	--	
Jack	1	0.0	0.0	0% (0)	--	--	
<b>Juveniles, indeterminate life stage and non-salmonid species 2013</b>							
Sturgeon	10						
Juvenile salmonids	613						
Other salmonid	12						
Northern Pikeminnow	1						
Orphans	14						
<b>Total fish all species</b>	<b>1025</b>						