



Yakima Klickitat Fisheries Project

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Juvenile Salmonid Mortalities

- Yakima River Basin
- Yakima River
- Great Blue Heron
- Irrigation Diversions



Predation: Juvenile Salmonid Mortalities:

PIT tag surveys of the Yakima Basin

YKFP has Identified Two Location Types for PIT tag depositions

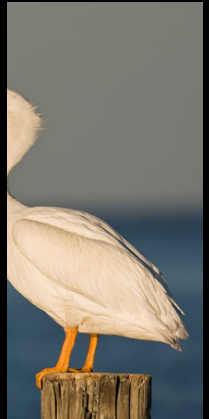
- *Great Blue Heron*
- *Fish Screening Structures at Irrigation Diversions*

PIT Tags

- Passive Integrated Transponders
- Small Surgically Implanted Tag
- Provides fish with unique identification
- Fix tracking locations along migratory paths
- Traditionally used to provide data for smolt to adult returns
- Many other uses

PIT tag Numbers: 2008 – 2011

- ~ 29,000 PIT tags Total (~27,000 YKFP)
- ~ 15,000 Heronries
- ~ 12,000 Fish Screening Structures
- ~ 2,000 American White Pelican Colony (PSMFC)



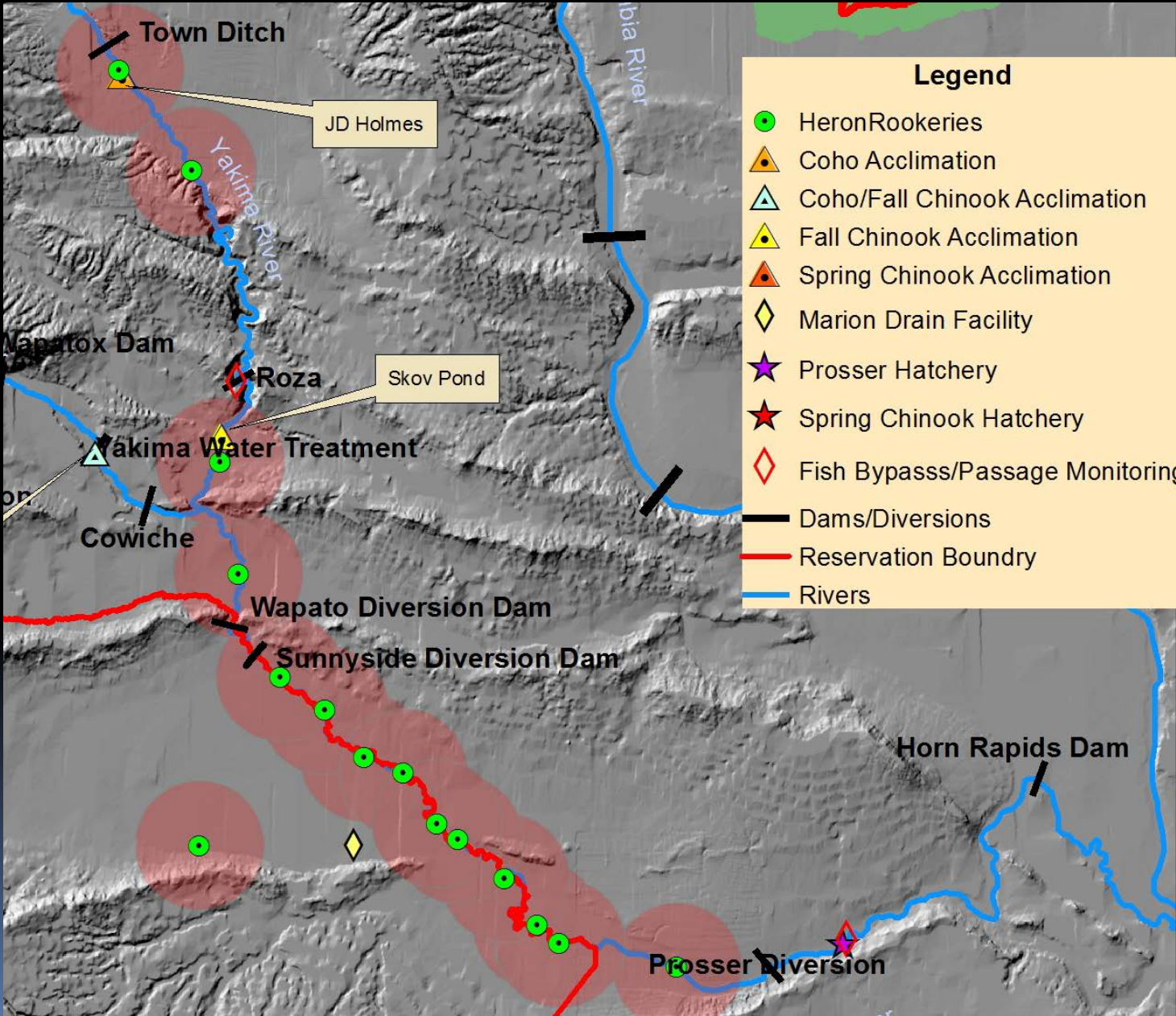
Heronry Study Methods

- Identify all Heronries in the Yakima Basin
- Population surveys in Heronry during nesting
- Detection efficiencies by seeding PIT Tags during nesting
- PIT tag surveys post fledge
- PIT tag removal (tag collision causes non-read)
- Aerial flights and River Surveys monitor population



YKFP- Great Blue Heron Heronries

- Basin Wide
- 24 – Total Heronries
- 19 – Nested (active)
- 5 – Abandoned
- 8 – Surveyed for PIT tags



Yakima Basin

- 395 Nests ~ 700 GBHE
- Double Crested Cormorants in Sunnyside Wildlife Area Heronry
 - 2009 -2010 Herons and Cormorants sharing
 - 2011 – Cormorants only
 - 2012 – Nothing used heronry



The Big Two (providing the most data)

Selah Heronry

- Total number of PIT tags for 2011 - 1356
- 2960 PIT tags – all survey years combined
- Located along the “Roza Reach”
- Within foraging distance of Stiles Pond (YN fish releases)

Wapato Wildlife Heronry

- Total number of PIT tags for 2011 - 2187
- 4097 PIT tags – all survey years combined
- Located below both Parker and Sunnyside Dams



Efforts to determine -PIT Tag Detection Efficiency

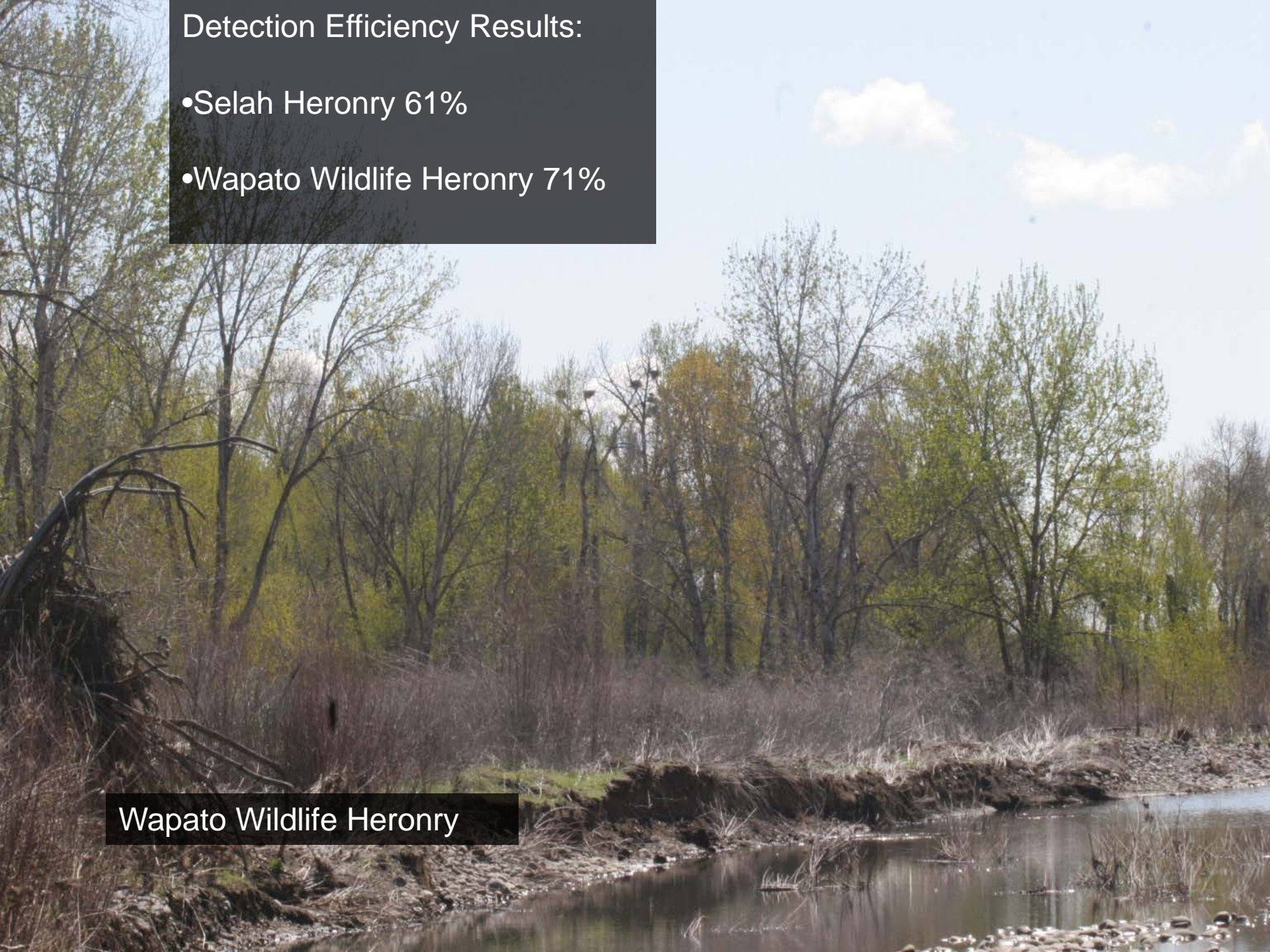
In the Wapato Wildlife Heronry and the Selah Heronry

- 100 PIT tags were seeded per heronry during nesting period
- Seeded in Mid-April (eggs are hatching)
- Second seeding in Mid-July (fledging)

Detection Efficiency Results:

- Selah Heronry 61%
- Wapato Wildlife Heronry 71%

Wapato Wildlife Heronry

A photograph of a riverbank with trees and a heronry. The river is in the foreground, with a rocky and brushy bank. The background is filled with trees, some with green leaves and some bare. The sky is blue with some clouds. The text 'Wapato Wildlife Heronry' is overlaid on the bottom left of the image.

Roza Dam



Roza Dam creates a river reach of low flow which provides predation opportunities for wading birds

- Irrigation
- Power
- Roza Reach Distance - 18.3 Km (Roza Dam to Naches River)

Naches River

Selah Heron Rookery

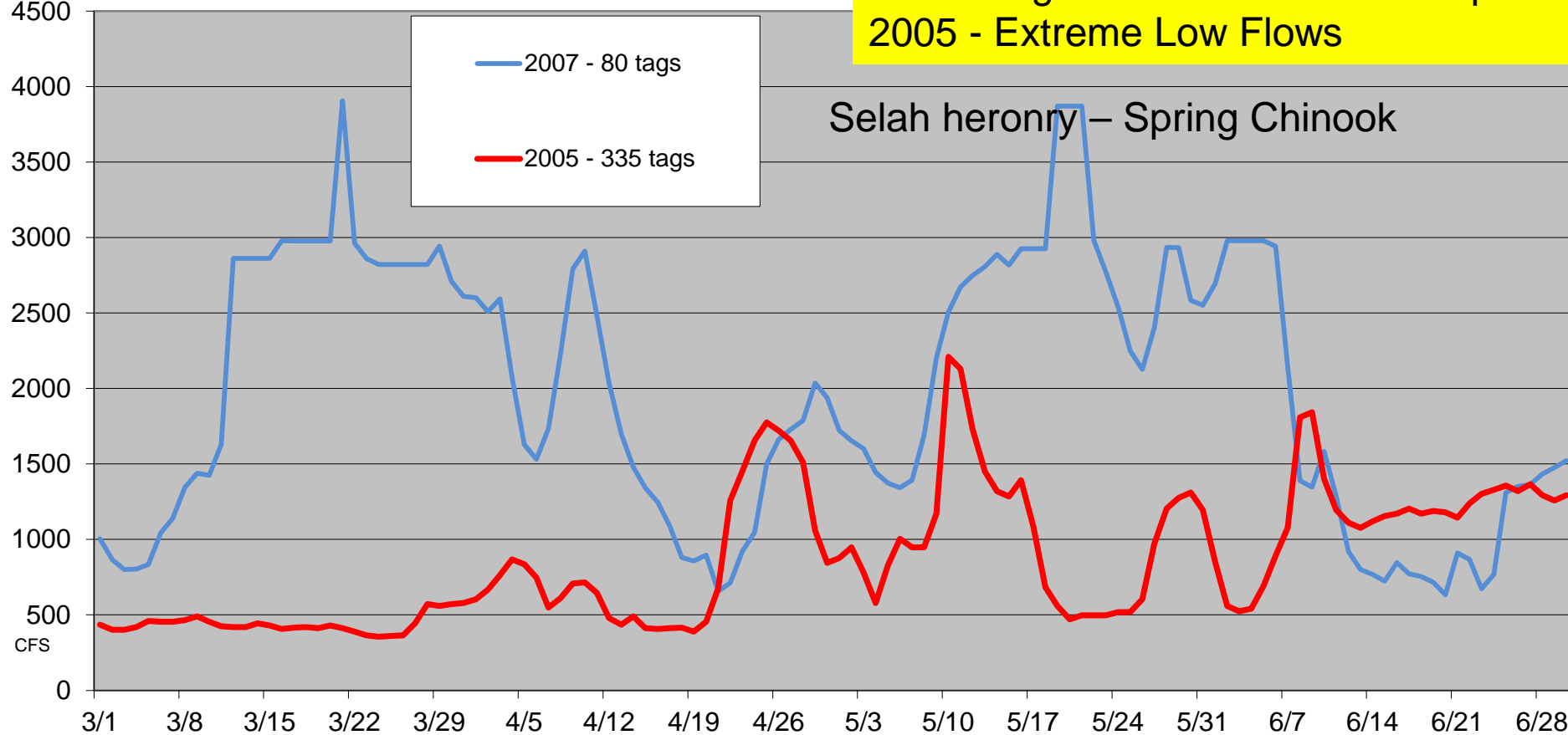
SOAC - Determined Smolt Flushing Flows are to be at least 1000 CFS for a period of three days



Number of Flushing Flows for 2008		Number of Flushing Flows for 2007		Number of Flushing Flows for 2006		Number of Flushing Flows for 2005	
March	0	March	0	March	0	March	0
April	4	April	3	April	6	April	2
May	10	May	10	May	5	May	3
June	3	June	3	June	5	June	8
Total	16	Total	16	Total	20	Total	14
Average QD	1187		1988		1240		860

Between March 1 to June 30

2007 - High Flows in March and April
2005 - Extreme Low Flows



PIT tags numbers are being found in greater numbers at heronries

- Survey more heronries (less than half of known rookeries surveyed)
 - Holmes Heronry on the Yakima River near the Holmes property (fish releases)
- Improved clearing methods with power tools allow for greater survey coverage
 - Consecutive surveys of areas produce more tags from previous migration years

Buena Heronry

- Previously surveyed in 2009
- 2009 – 488 unique tags
- 2011 – 1242 unique tags
- Total PIT tags – 1407

		Total	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
<i>Chinook</i>	<i>Fall</i>	324							4	303	5	3		9	
<i>Chinook</i>	<i>Spring</i>	528	1	46	37	7	11	45	159	36	72	38	49	12	15
<i>Chinook</i>	<i>Summer</i>	37											1	10	26
<i>Coho</i>		447		229	30	13	23	26	117	40	45	44	36	34	10
<i>Steelhead</i>	<i>Resident</i>	1									1				
<i>Steelhead</i>	<i>Summer</i>	48						4	19	4	12		8	1	
<i>Steelhead</i>	<i>Unknown</i>	1						1							
<i>Steelhead</i>	<i>Winter</i>	1							1						



Irrigation Diversion PIT tags

- Surveys are conducted in front of fish screens and behind screens
- Timing of scanning coincides with BOR annual maintenance

The Big Three (again providing the most data)

Wapato Irrigation Diversion

- Total number of PIT tags for 2011 - 912
- 2144 PIT tags – all survey years combined

Sunnyside Irrigation Diversion

- Total number of PIT tags for 2011 - 2248
- 3880 PIT tags – all survey years combined

Chandler Irrigation Diversion

- Total number of PIT tags for 2011 - 1143
- 4401 PIT tags – all survey years combined
- *Includes in River tags below outlet pipe*

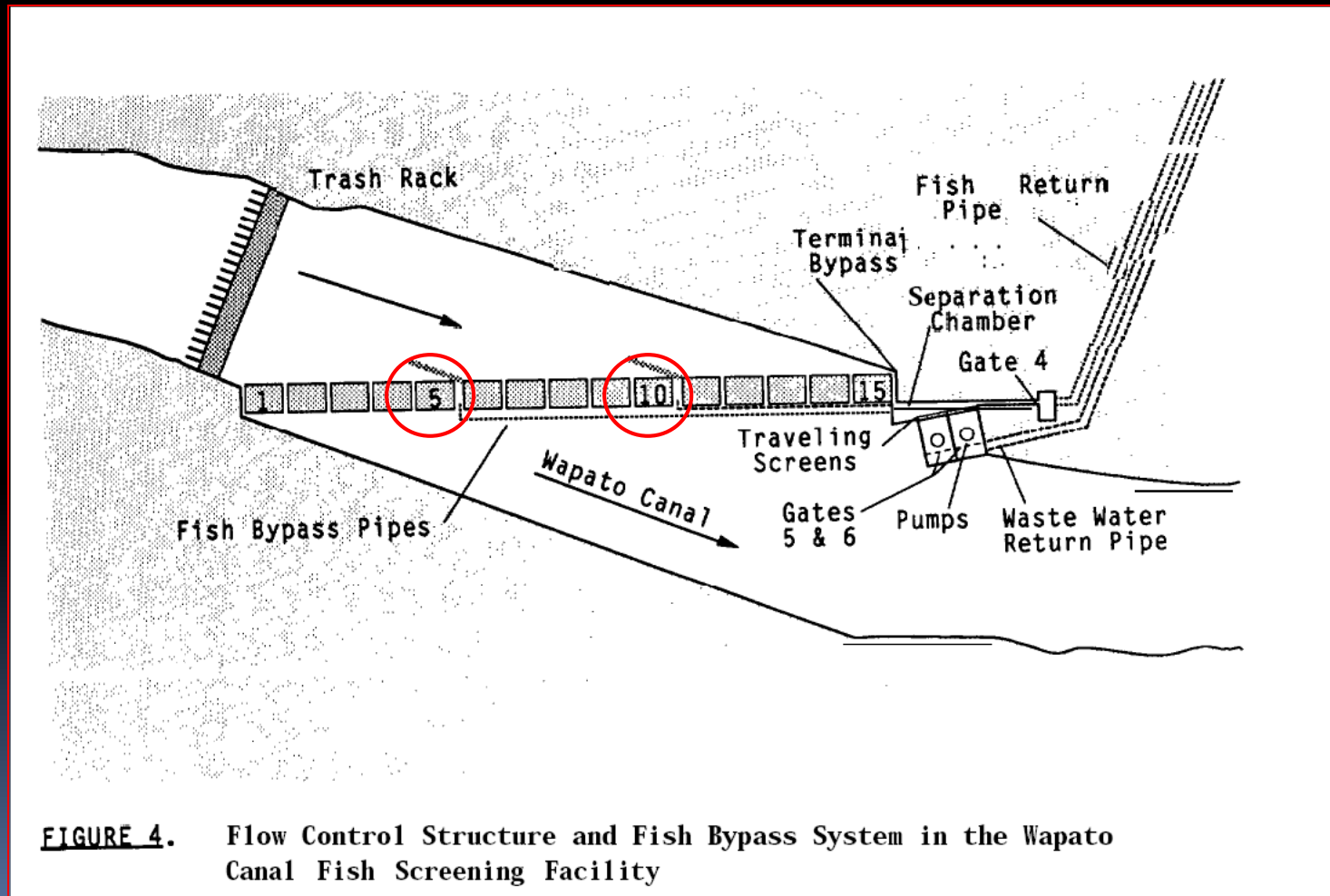
Why are there Mortalities? (*PIT tags*)

Assuming uniform fish distribution above Sunnyside Dam, about 75% of the fish in the Yakima River may be diverted through the Sunnyside Canal Fish Screening Facility. - *A FISHERIES EVALUATION OF THE SUNNYSIDE CANAL FISH SCREENING FACILITY, SPRING 1985*

- Irrigation Diversions pull ~ 1,000 CFS
- Entrainment into the diversions increases as flow decreases
- Late migration during lower flows (higher probabilities of entrainment)
- Summer Chinook released June 2009 higher mortalities
- Numerous tags behind trash screens
- Underwater cameras behind trash screens show fish predation

2010 Wapato fish screening facility PIT surveys led to the discovery that two of the fish bypass pipes were inoperable and one operating less than 15% efficiency.

This was due to sediment accumulation which has been addressed



Wapato Diversion PIT Tag Numbers from 2010 & 2011 surveys

<i>Specie</i>	<i>Run</i>	<i>Total PIT</i>	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Chinook	Fall	362						47	117	82	116				
Chinook	Spring	649	6	43	7	11	20	176	25	34	177	90	60		
Chinook	Summer	483										445	38		
Coho	Unknown	436	2	5	1	18	6	65	31	42	78	81	79	2	
Steelhead	Summer	3						1			2				
Totals		1933	2	48	8	29	26	289	173	158	373	616	177	2	
<i>Specie</i>	<i>Run</i>	<i>Total PIT</i>	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Chinook	Fall	370						47	121	84	118				
Chinook	Spring	682	7	46	7	11	21	178	26	36	181	91	63	15	
Chinook	Summer	588										454	41	93	
Coho	Unknown	490	3	5	1	20	6	66	32	43	79	82	83	31	39
Sockeye	Summer	4												4	
Steelhead	Summer	4						1			2			1	
Totals		2138	10	51	8	31	27	292	179	163	380	627	187	144	39

Annual Surveys in Fish Screening Facilities

- Unique in that tag collision seems not to be a factor
- Tags from previous surveys years increase in number
- Function of flow moving sediment
- Reclamation's annual maintenance removes sediment

American White Pelican Predation on Juvenile Salmon

PSMFC -12,184 PIT tags on Badger Island - 2760 YINN fish



Badger Island

~ 30 Miles from Horn Rapids (Wanawish Dam)

~ 40 Miles from Prosser (Chandler Juvenile Screening Facility)

Round trip foraging distance AWPE documented up to 611 kilometers.

Cormorants, Darters and Pelicans of the World. Paul Johnsgard 1993



YKFP – Surveys of the Chandler outlet pipe

In river PIT tag surveys of area below outlet pipe structure

American White Pelican Chandler Outlet Pipe PIT tag surveys

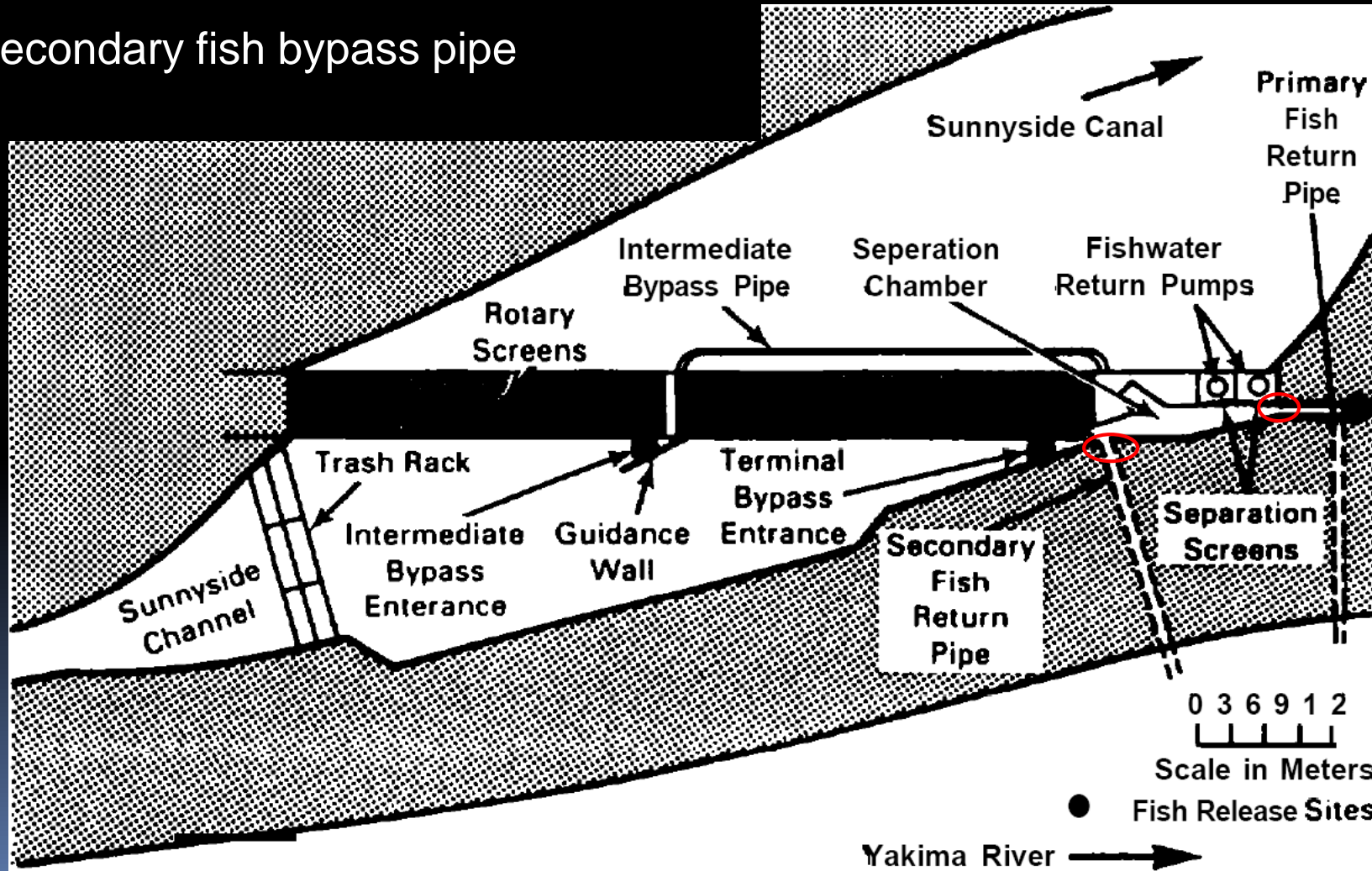
	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	
Summer	40										
Spring	23	56	37	13	14	6	7	3	2	5	
Fall	2	106	121	18	26	38	7		3	4	
Coho	4	23	28	6	6	1		2	2	1	
Steelhead	3	1			5			1			
Total	72	186	186	37	51	45	14	6	7	10	614

Data shows the American White Pelican is not biased towards taking larger fish



Sunnyside Fish Screening Facility:

- YKFP installed fixed PIT tag antennas
- Entry to primary fish bypass pipe
- Entry to secondary fish bypass pipe



Primary Fish Bypass Pipe PIT tag antenna



Secondary Fish Bypass Antenna



- Constructed using USFWS guide
- RM 310 Reader Board
- Acumen Data Logger
- CAT 6 Ethernet Cable
- Foam Spacers within PVC

PIT tag Antennas Function

- Near Steel (concrete)
- Near Electric pulley system

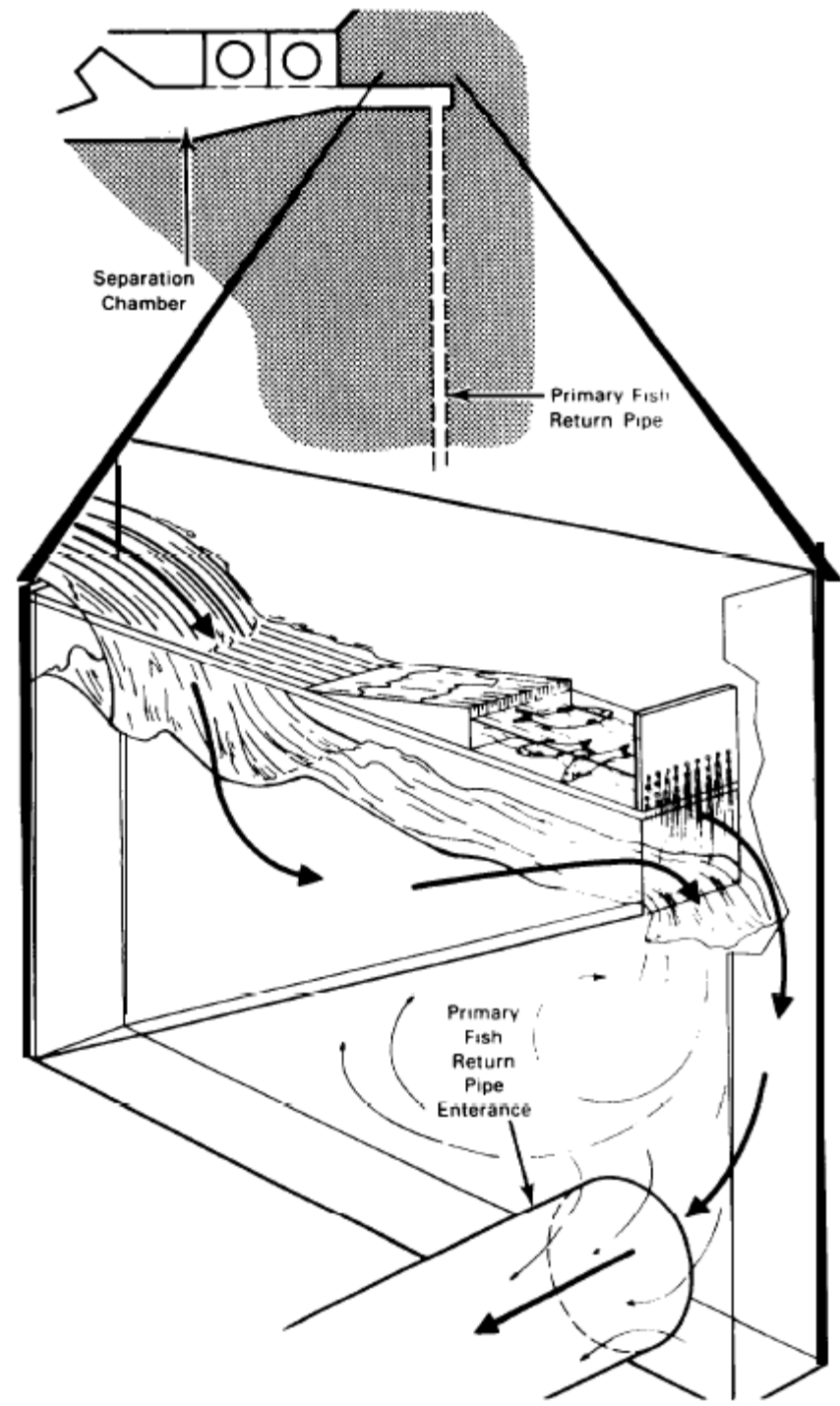


Sunnyside PIT tag Antennas - tag totals

- Data Presented - 4/19/2012 to 6/12/2012
- Primary bypass pipe antenna – 904 PIT tags
- Secondary bypass pipe antenna – 627 PIT tags
 - *This bypass pipe only recently put into operation*
- Total PIT tags – 1531
- Functioning antennas in the Wapato Reach can provide a gap in migration data from release site to down river interrogation sites
- Aid in monitoring fish screening facilities impacts on smolts

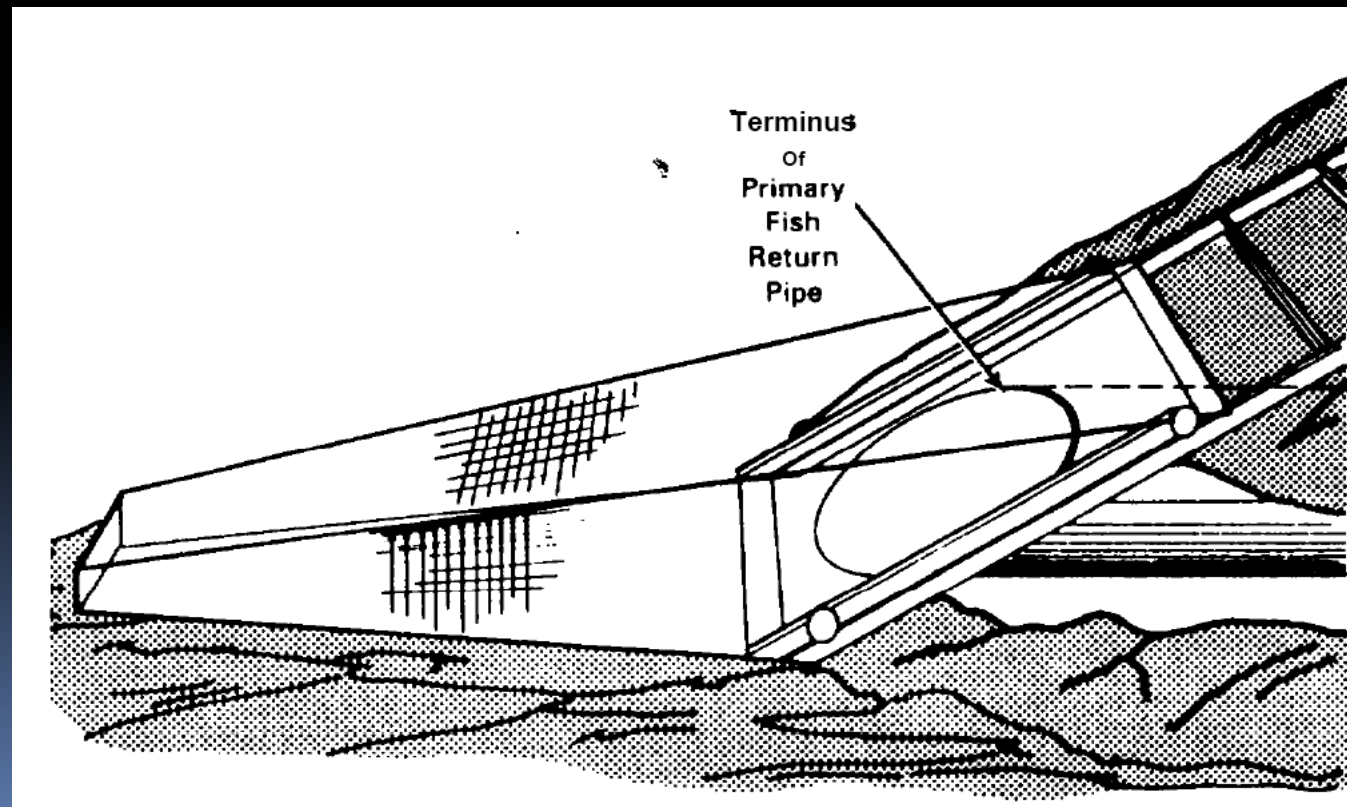
Potential Future projects:

- Antennas in Series
- PIT tag Detection Efficiencies
- Controlled Fish Releases
- In River releases – Entrainment
- Head gates Antennas

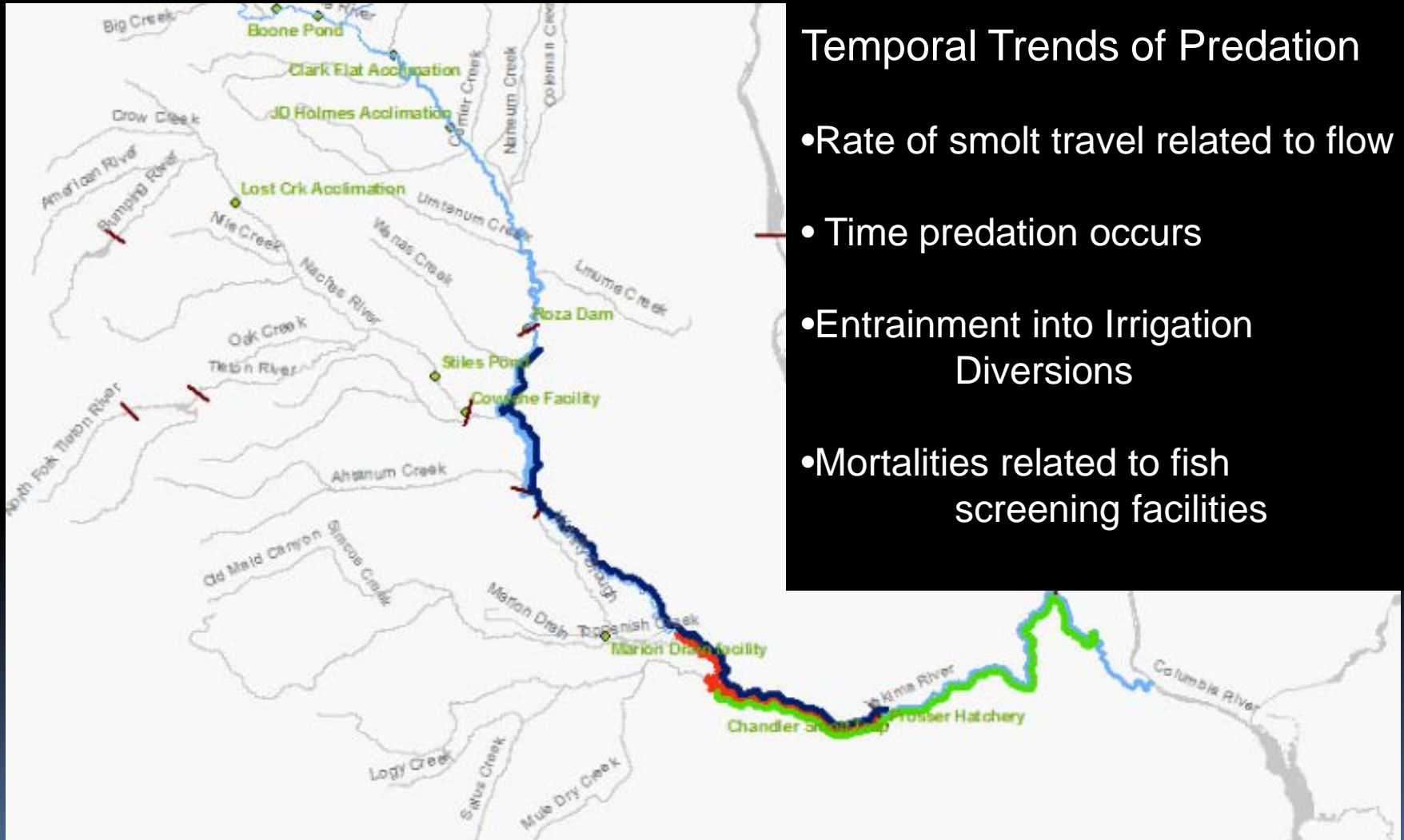


Potential Future projects:

- Antennas at outlet Pipes
- In River applications



Implement a Basin Wide fixed PIT array system at all Fish Screening Facilities in the Yakima Basin



Temporal Trends of Predation

- Rate of smolt travel related to flow
- Time predation occurs
- Entrainment into Irrigation Diversions
- Mortalities related to fish screening facilities

Questions?