

Migration, Survival, Growth, and Fate of Hatchery Juvenile Chinook Salmon Released Above and Below Dams in the Upper Willamette River Basin

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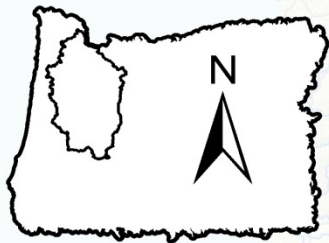
Study Code JPL-11-02-MF and JPL-11-02-DET

Oregon Department of Fish and Wildlife
Corvallis Research Laboratory

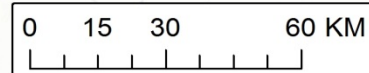
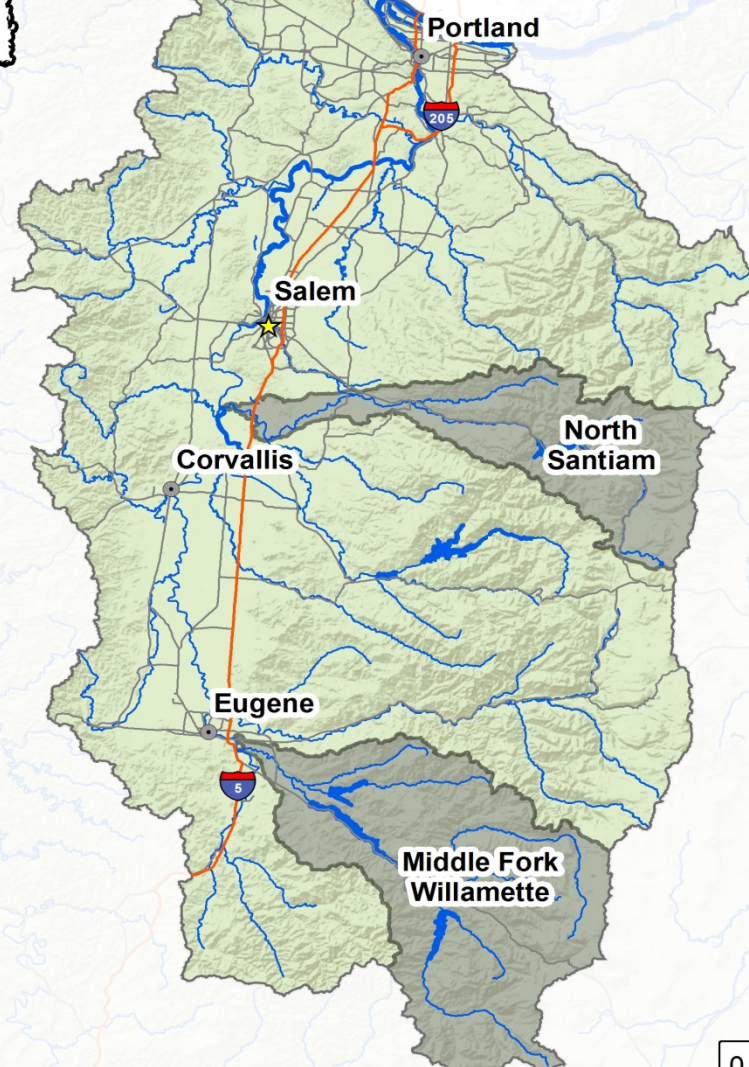
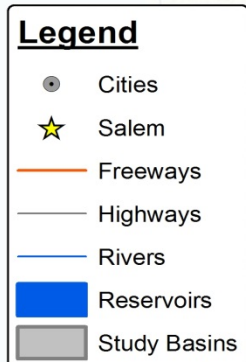


Objectives

- Estimate the effect that passage through dams and reservoirs has on outmigration success of juvenile hatchery Chinook salmon
- Estimate the effect that passage through dams and reservoirs has on survivorship to adulthood
- Useful ancillary data: migration rate, growth and fate

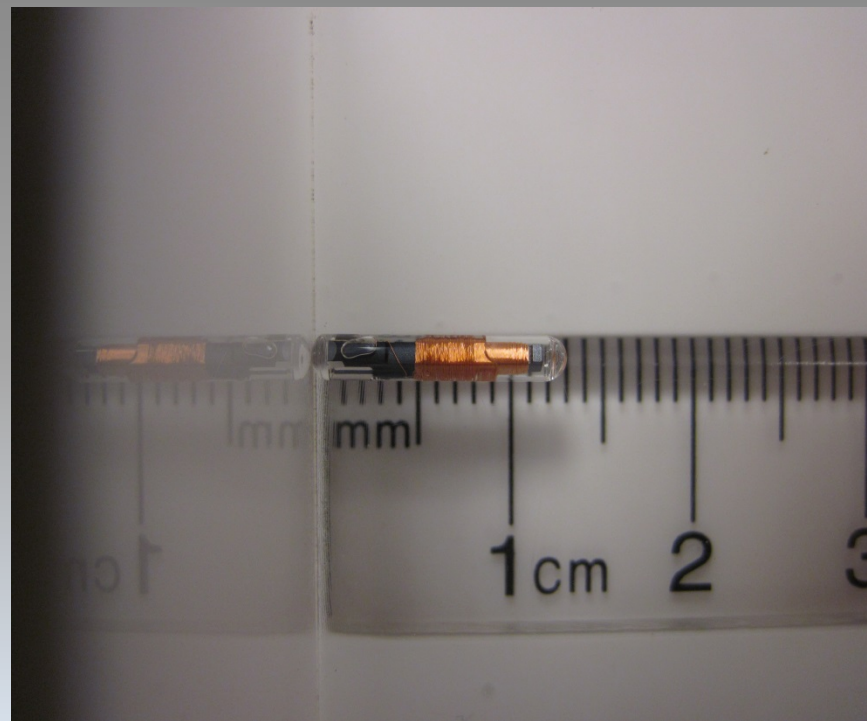


Study Area



Tagging

Major assumption: hatchery fish are phenotypically similar to naturally-produced fish entering the reservoir (size, timing, behavior, condition, etc.)



Detection & Recovery

PIT tags (2011-2019):

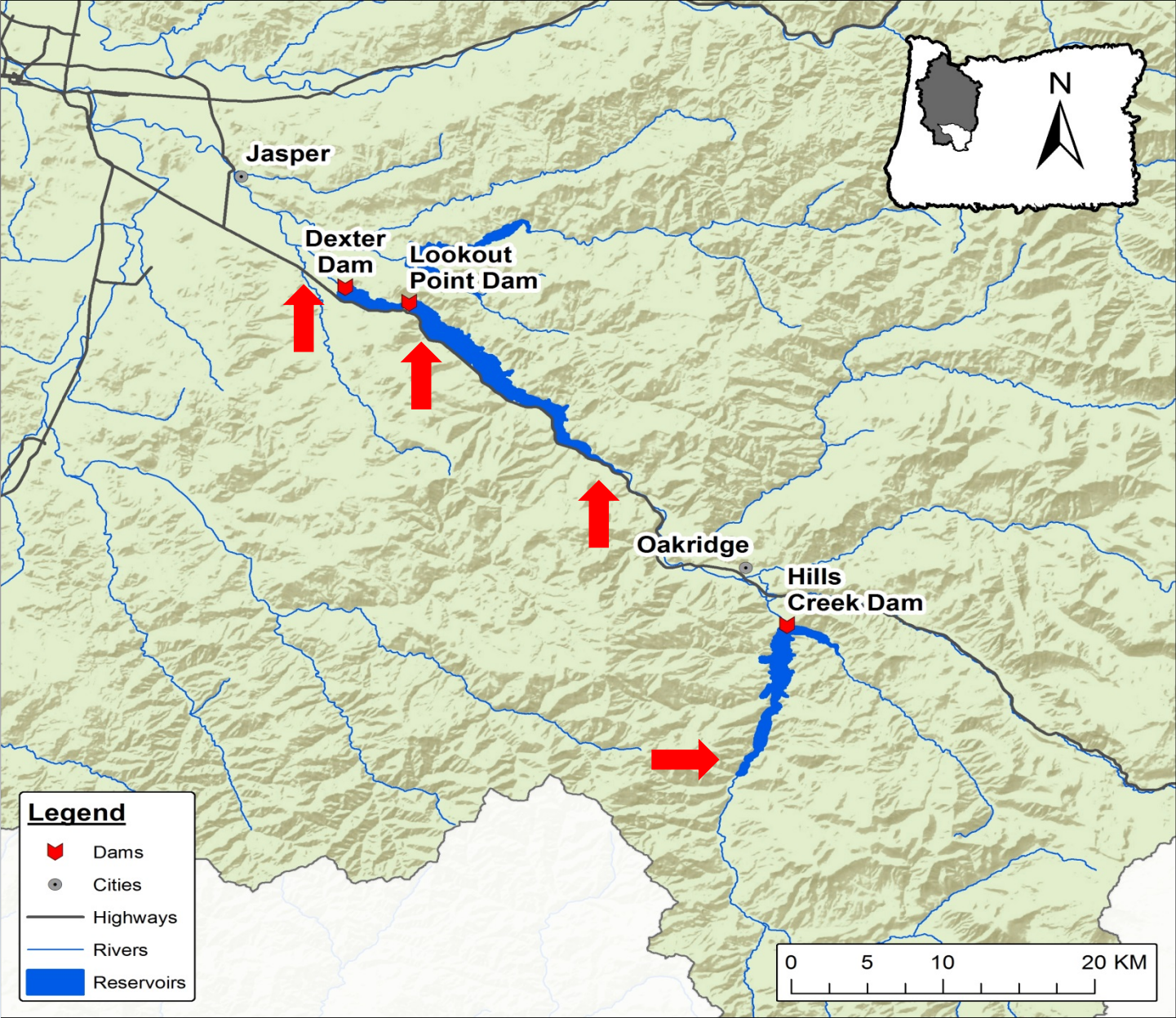
- Outmigrants at Willamette Falls, <10% DE
- Adults at Willamette Falls, 100% DE
- Other researchers

CWTs (2013-2017):

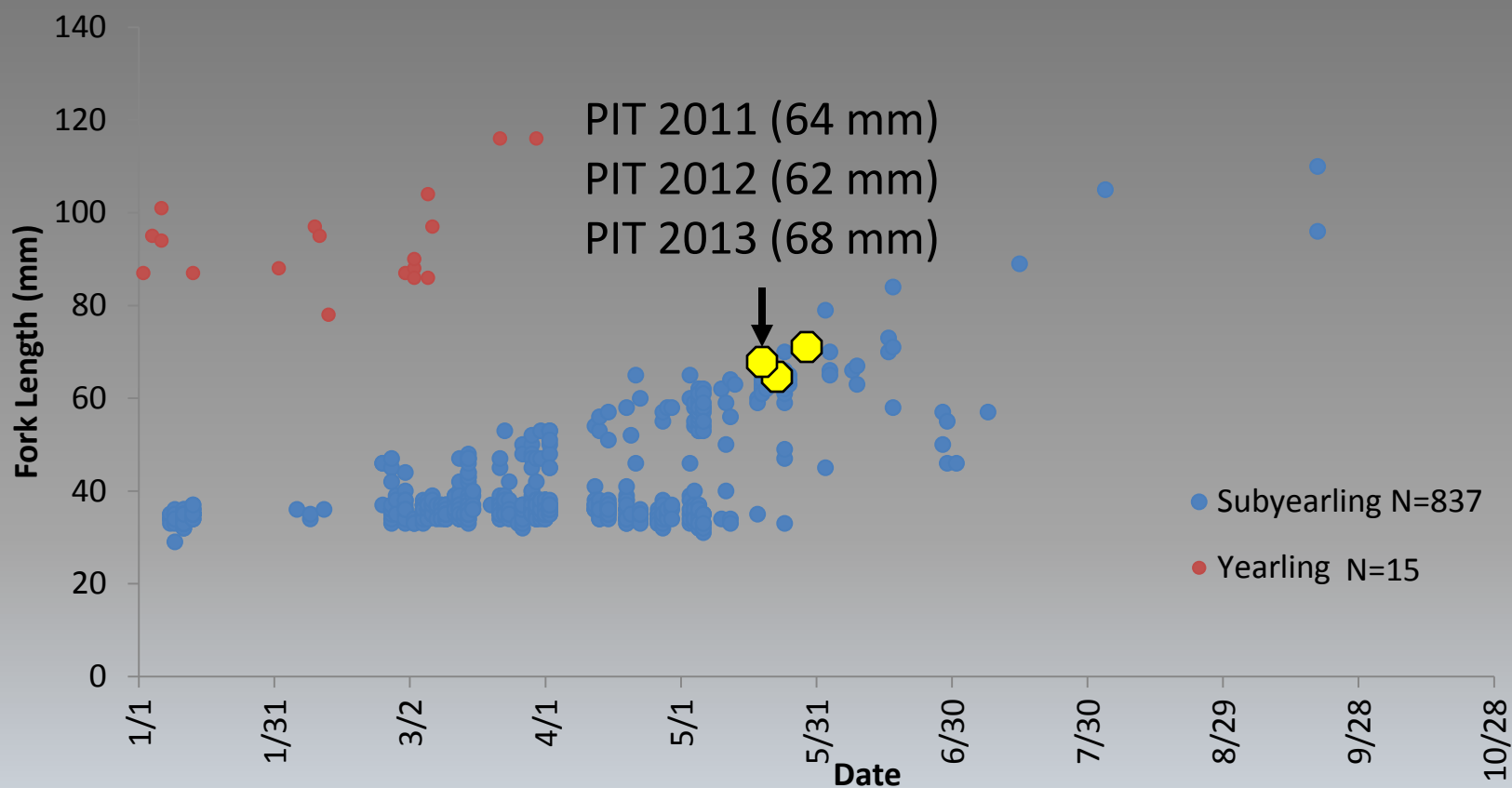
- Fisheries, hatcheries, spawner surveys



Middle Fork Willamette Release Sites



Lookout Point Reservoir entry, naturally-produced Chinook (Romer et al. 2012)

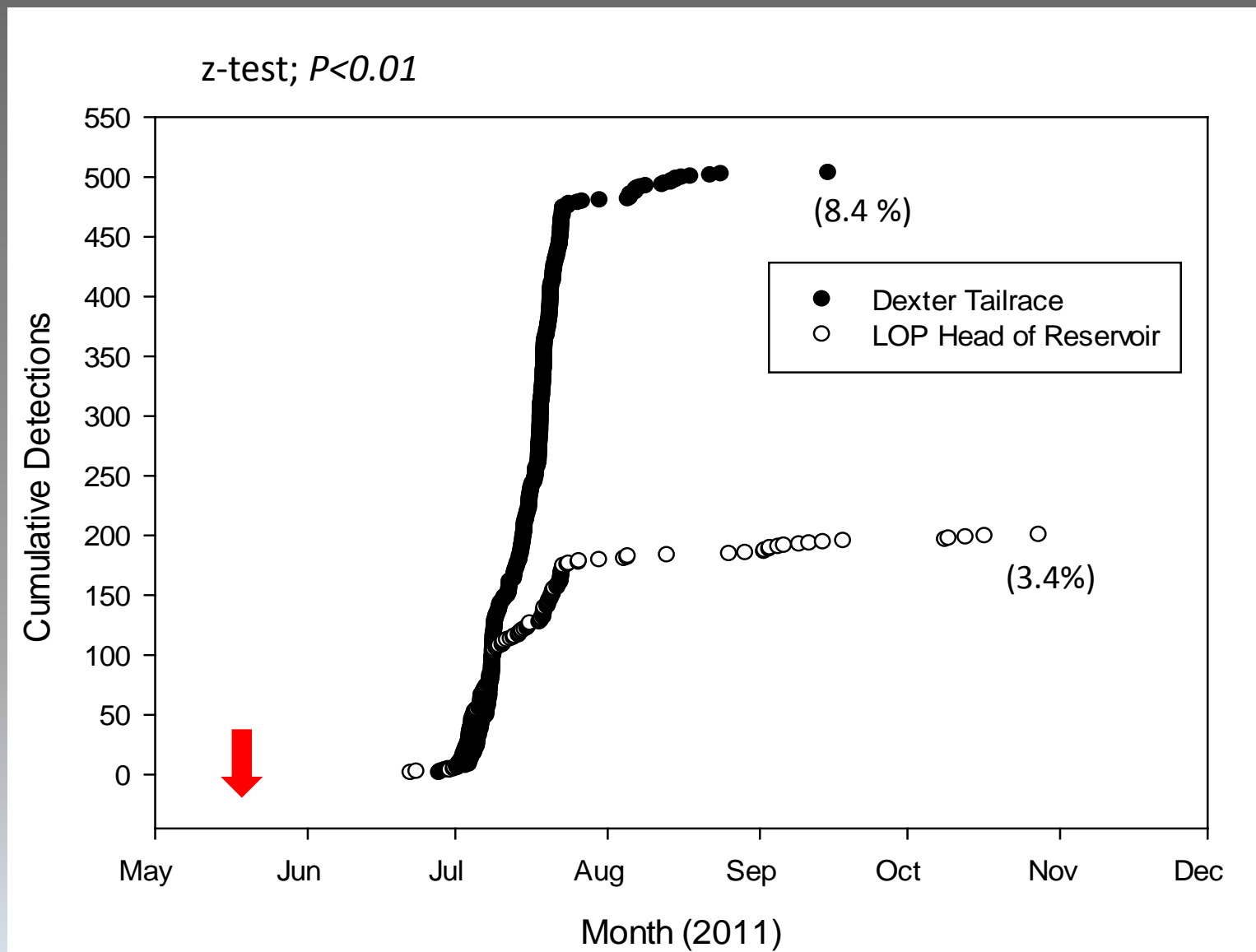


Tagging & Release - MFW

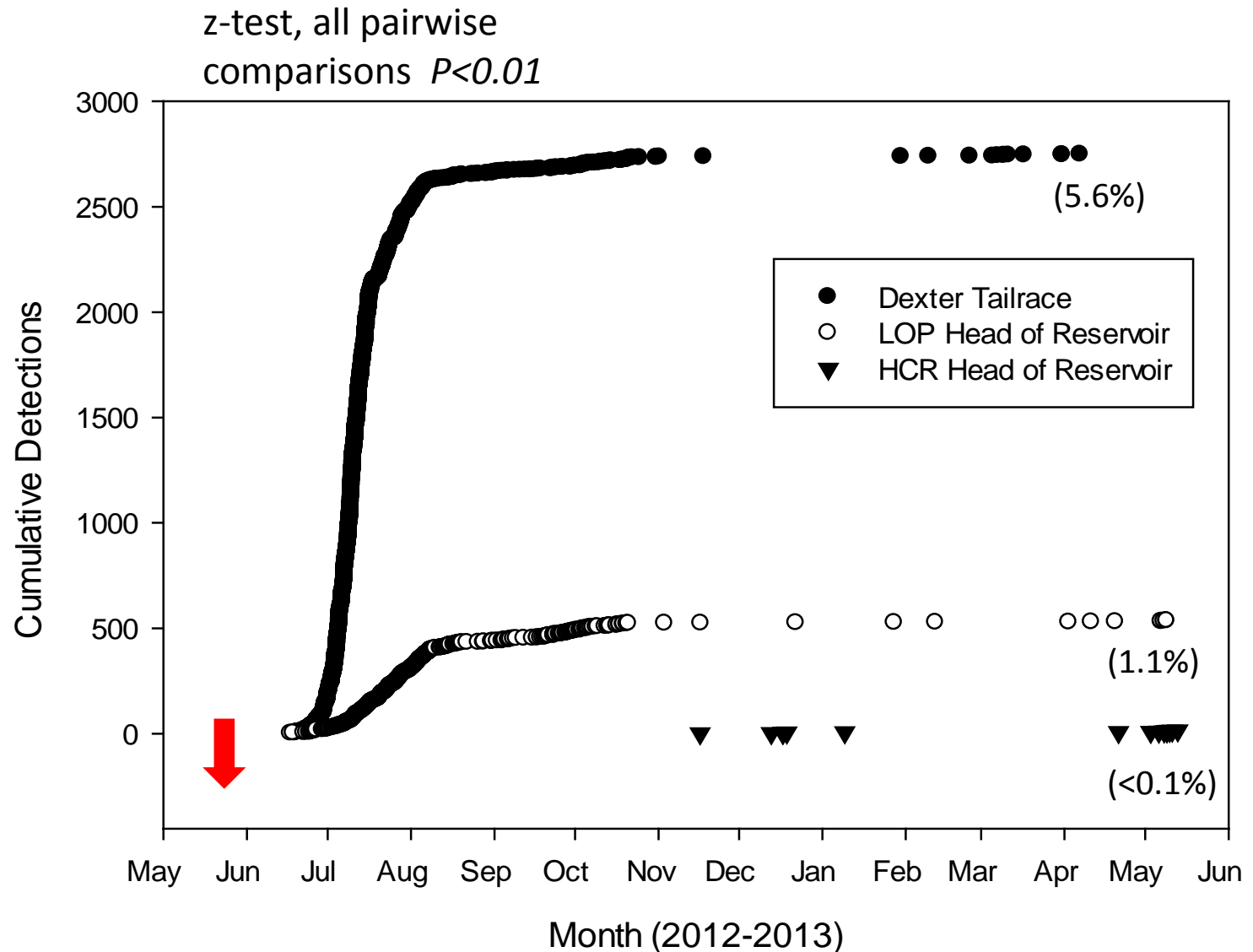
Release Year	Release Location			
	Dexter Tailrace	LOP Forebay	LOP Head of Reservoir	Hills Creek Reservoir
2011	6,000	--	6,000*	--
2012	50,000	--	50,000	50,000
2013	33,000	33,000	33,000	33,000

*200,00 CWT fish released in addition to PIT tags

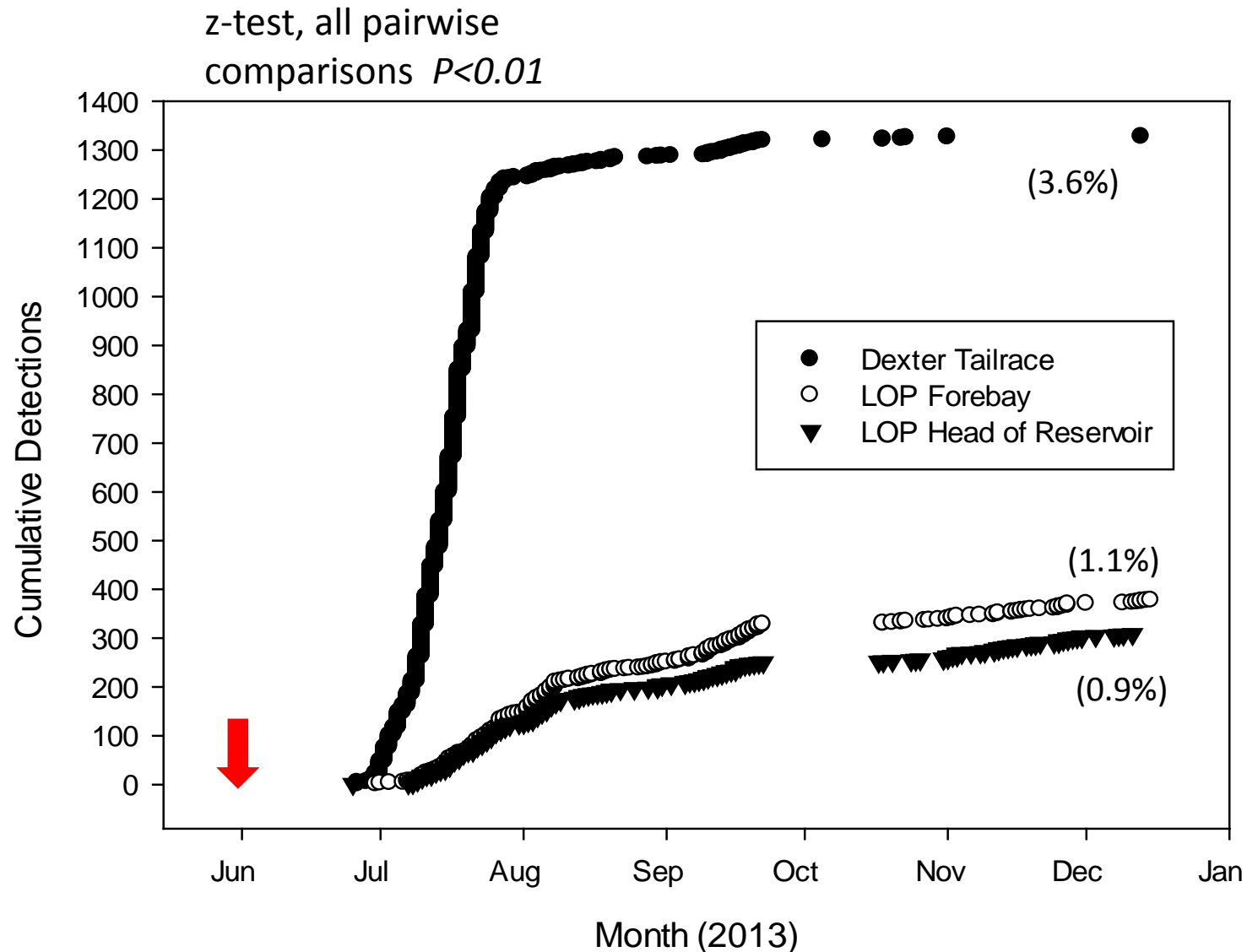
Outmigration Success – MFW 2011



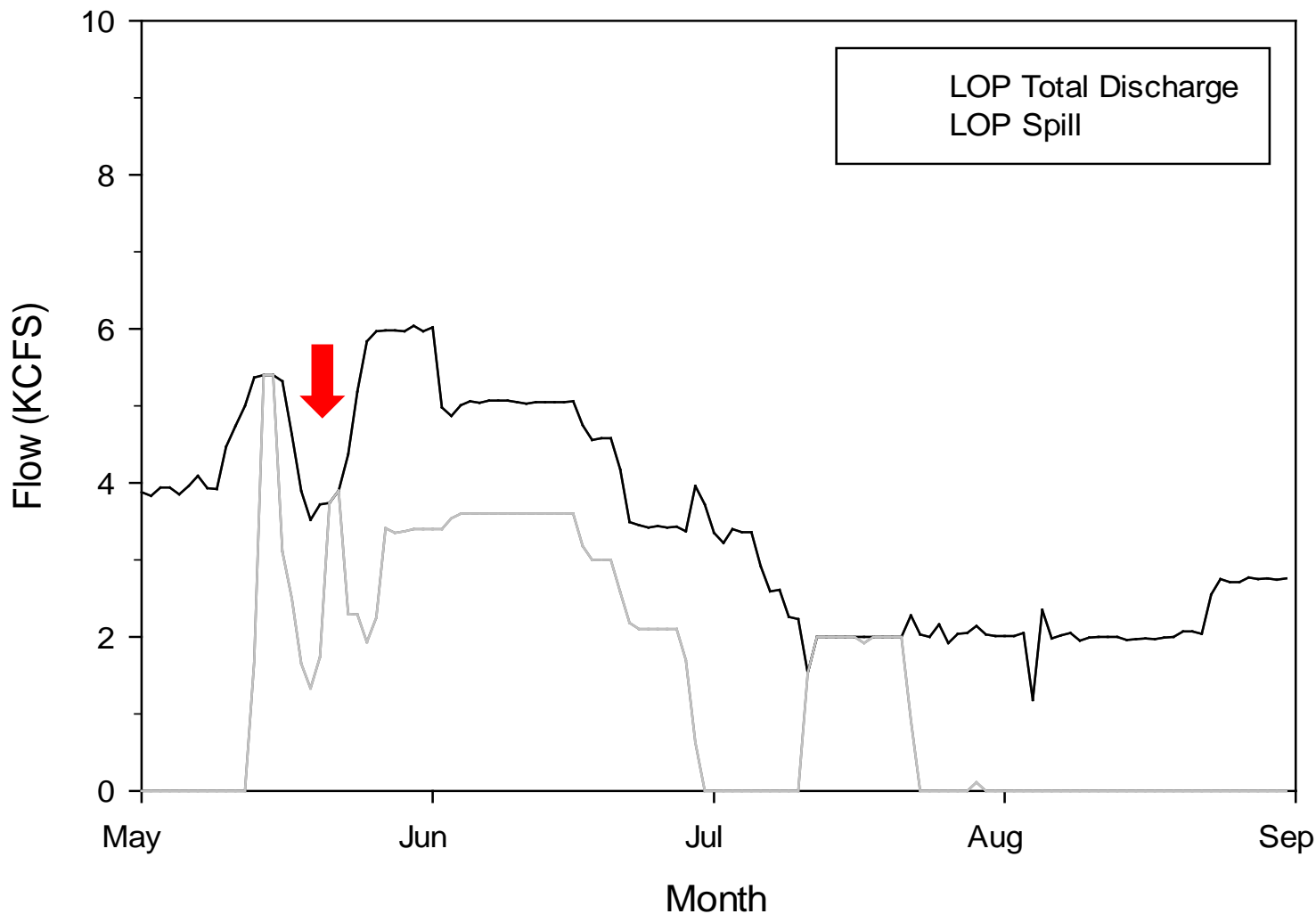
Outmigration Success – MFW 2012



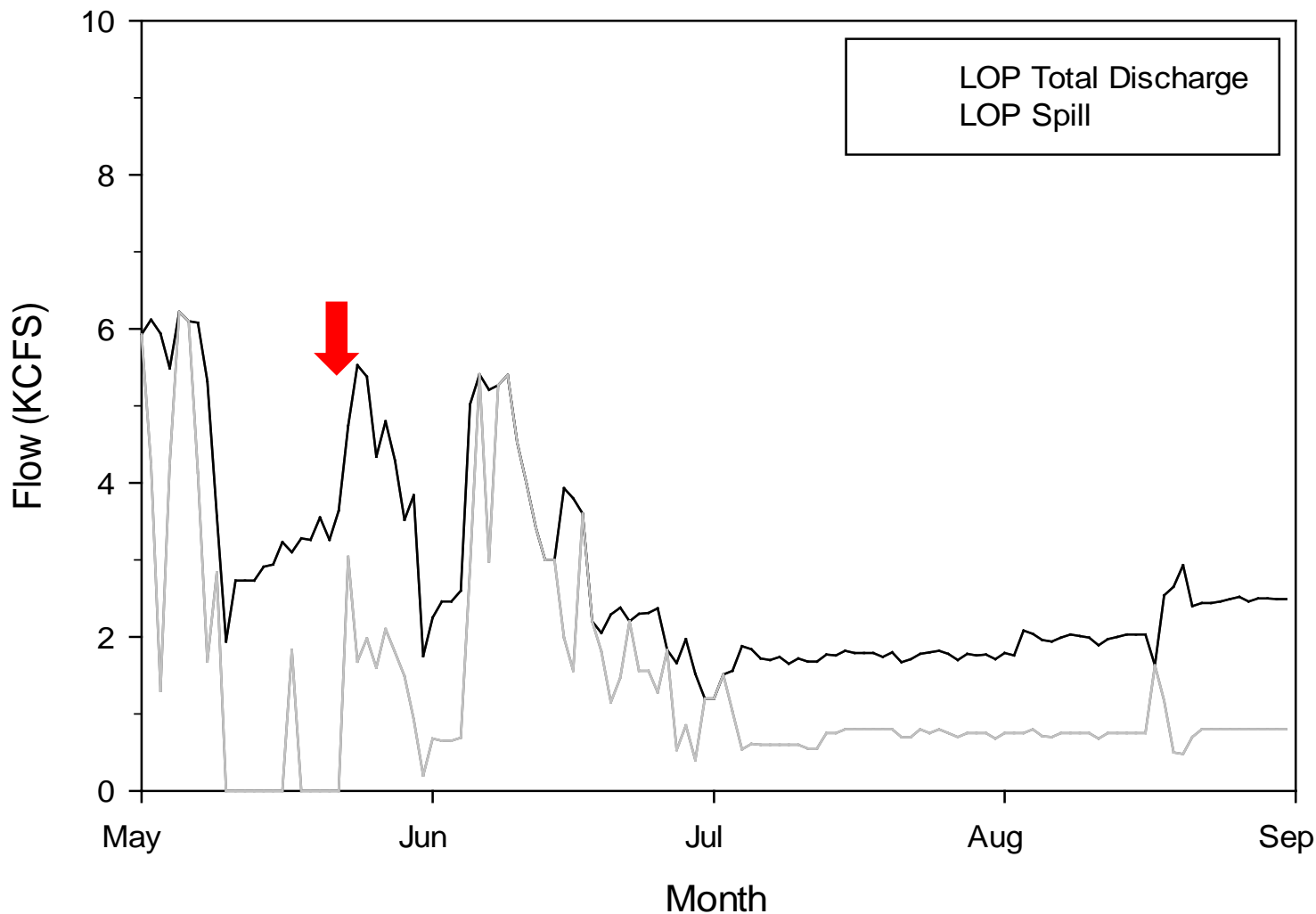
Outmigration Success – MFW 2013



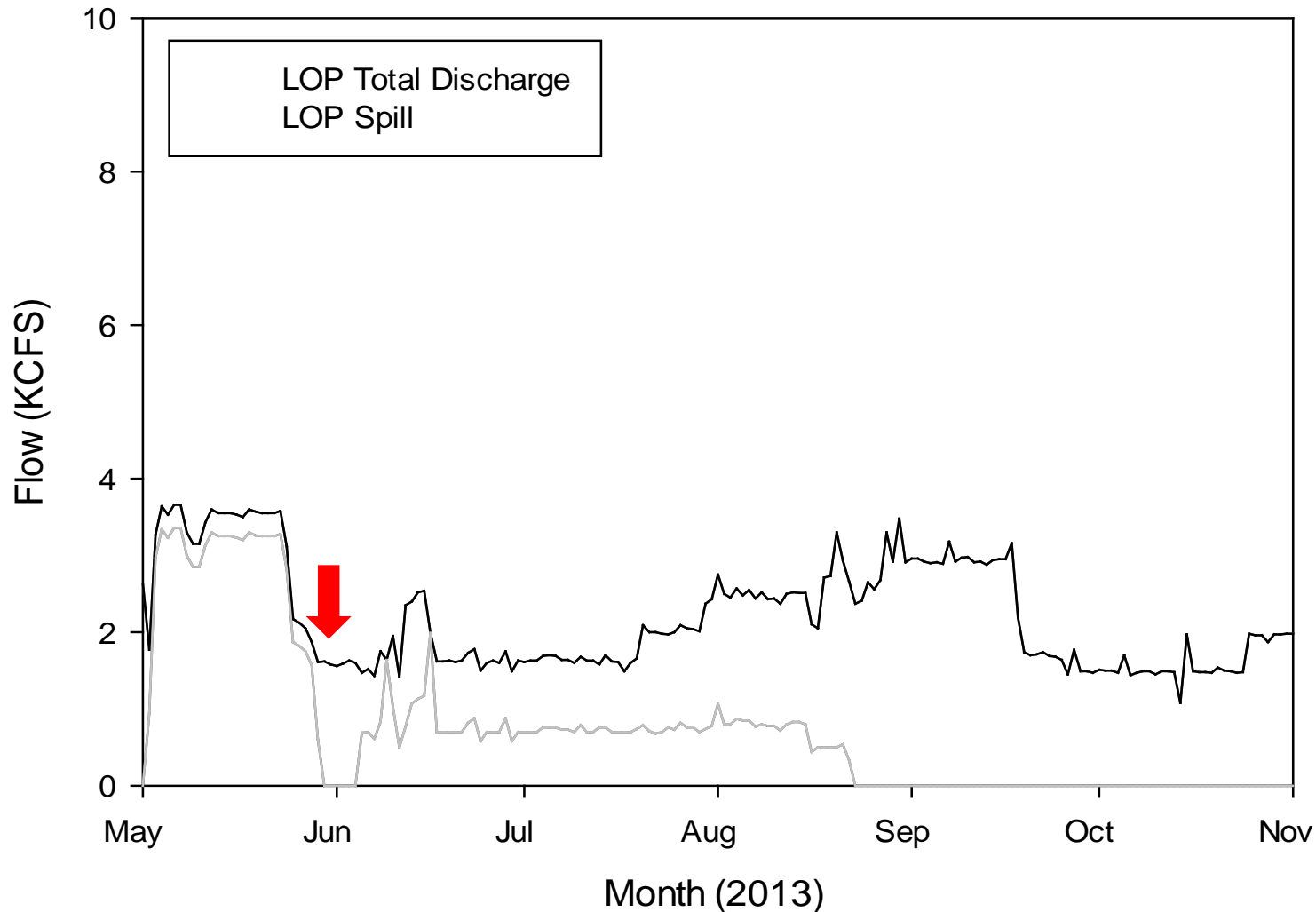
Lookout Point Dam Operations 2011



Lookout Point Dam Operations 2012



Lookout Point Dam Operations 2013



Migration Rate - MFW

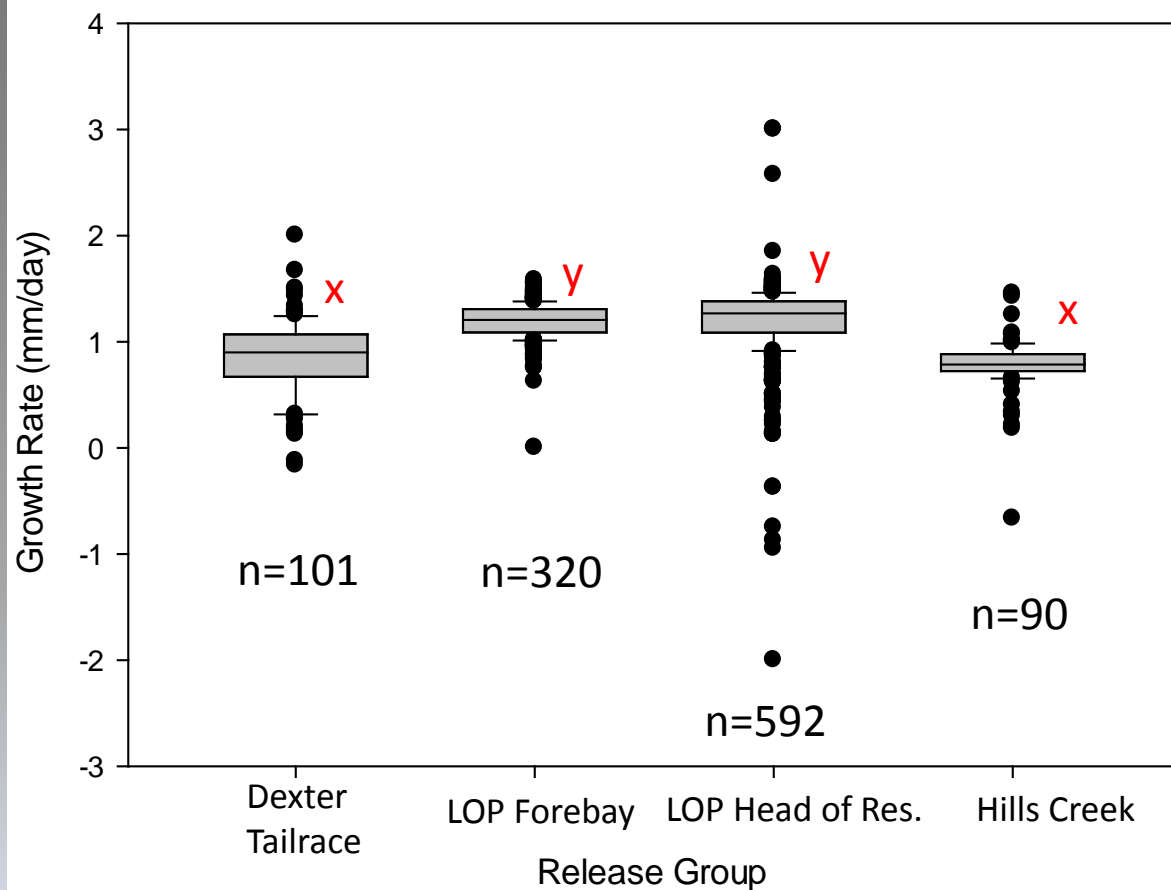
Rate = km/day

Kruskal-Wallis, ANOVA $P < 0.01$

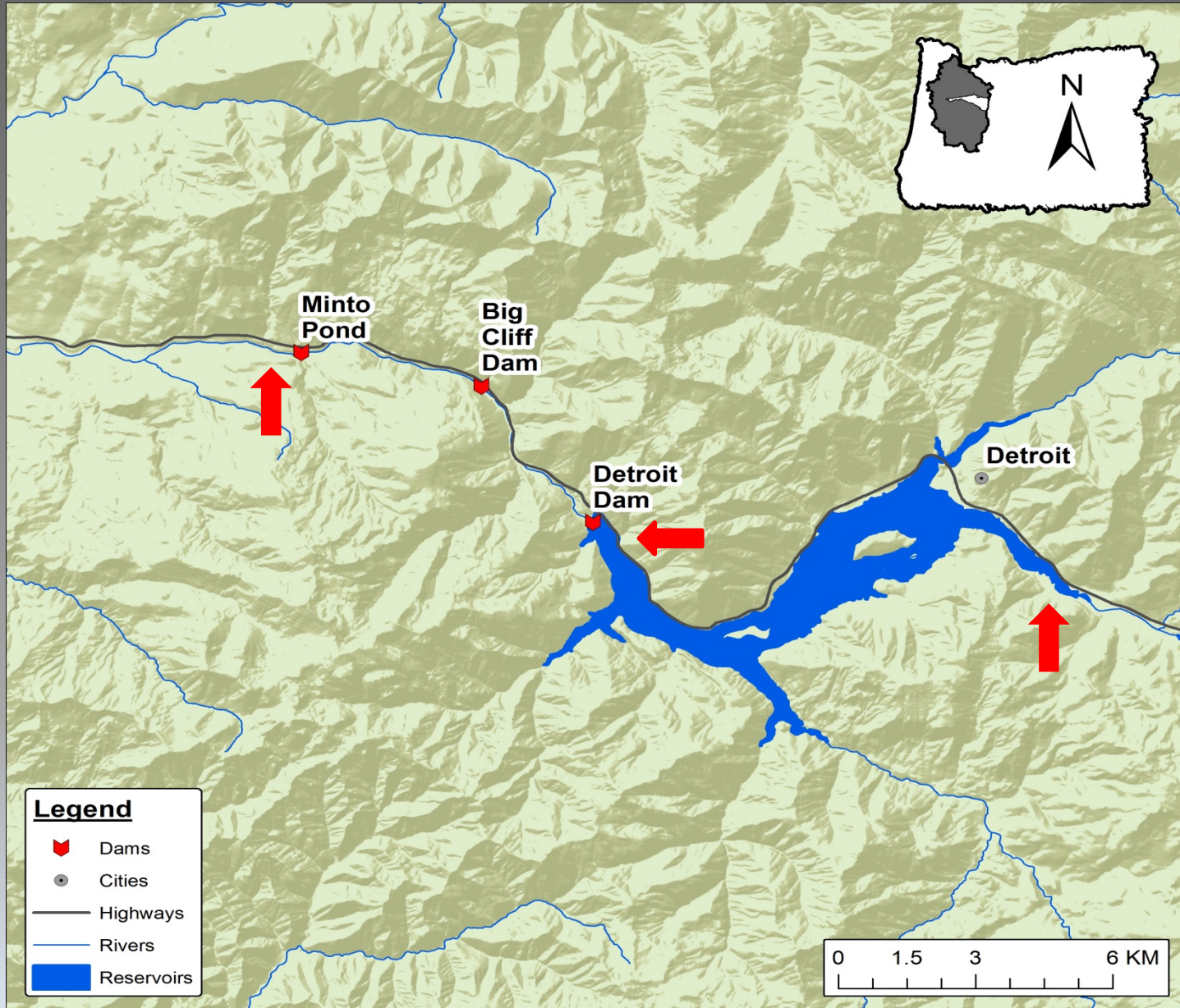
Release Year	Release Group			
	Dexter Tailrace	Lookout Point Forebay	Lookout Point HOR	Hills Creek
2011	6.085 ^X	n/a	5.353 ^X	n/a
2012	5.845 ^X	n/a	4.705 ^Y	0.988 ^Z
2013	6.196 ^X	4.328 ^Y	4.597 ^Z	n/a

Growth - MFW

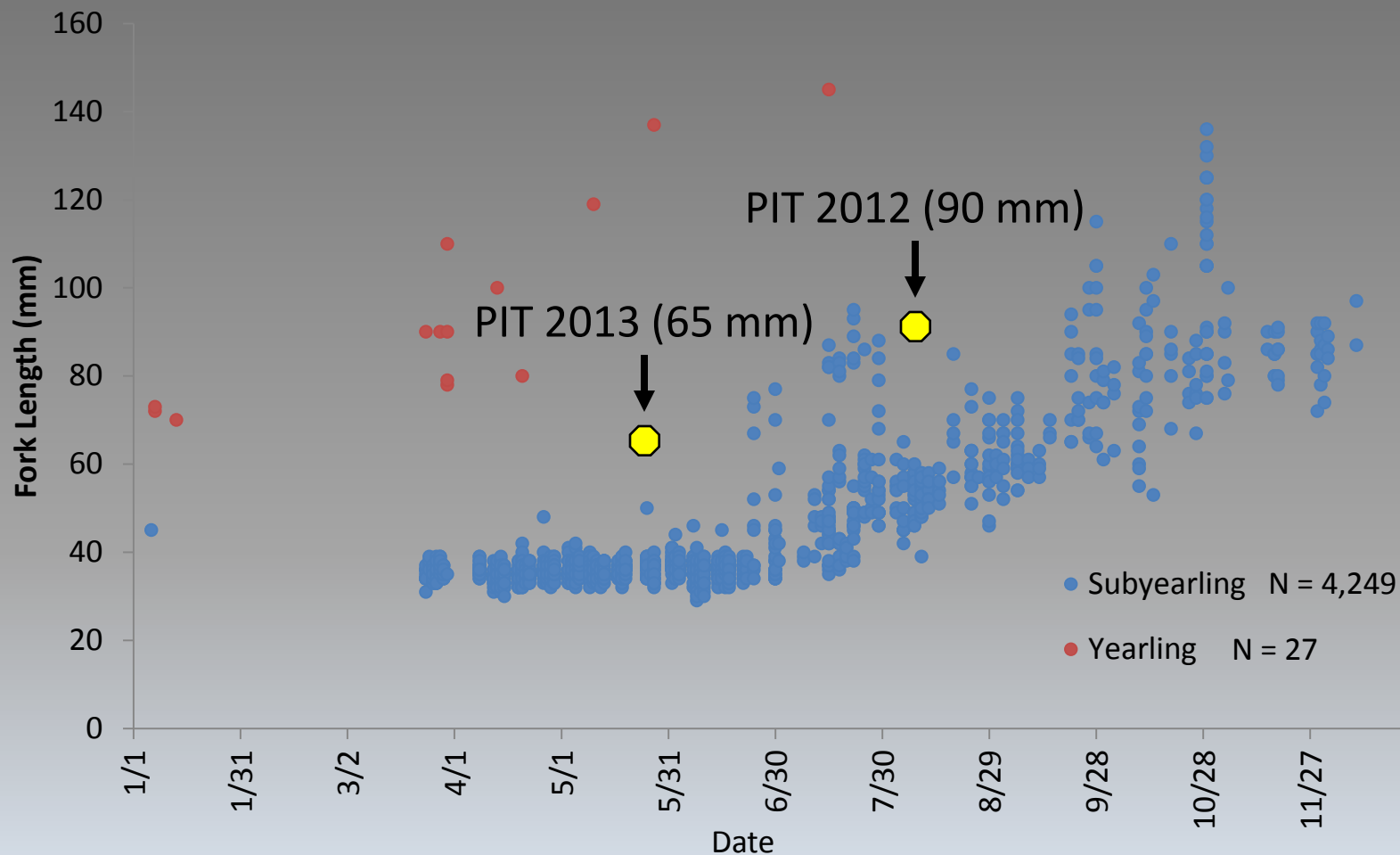
Kruskal-Wallis, ANOVA $P < 0.01$



North Santiam Release Sites



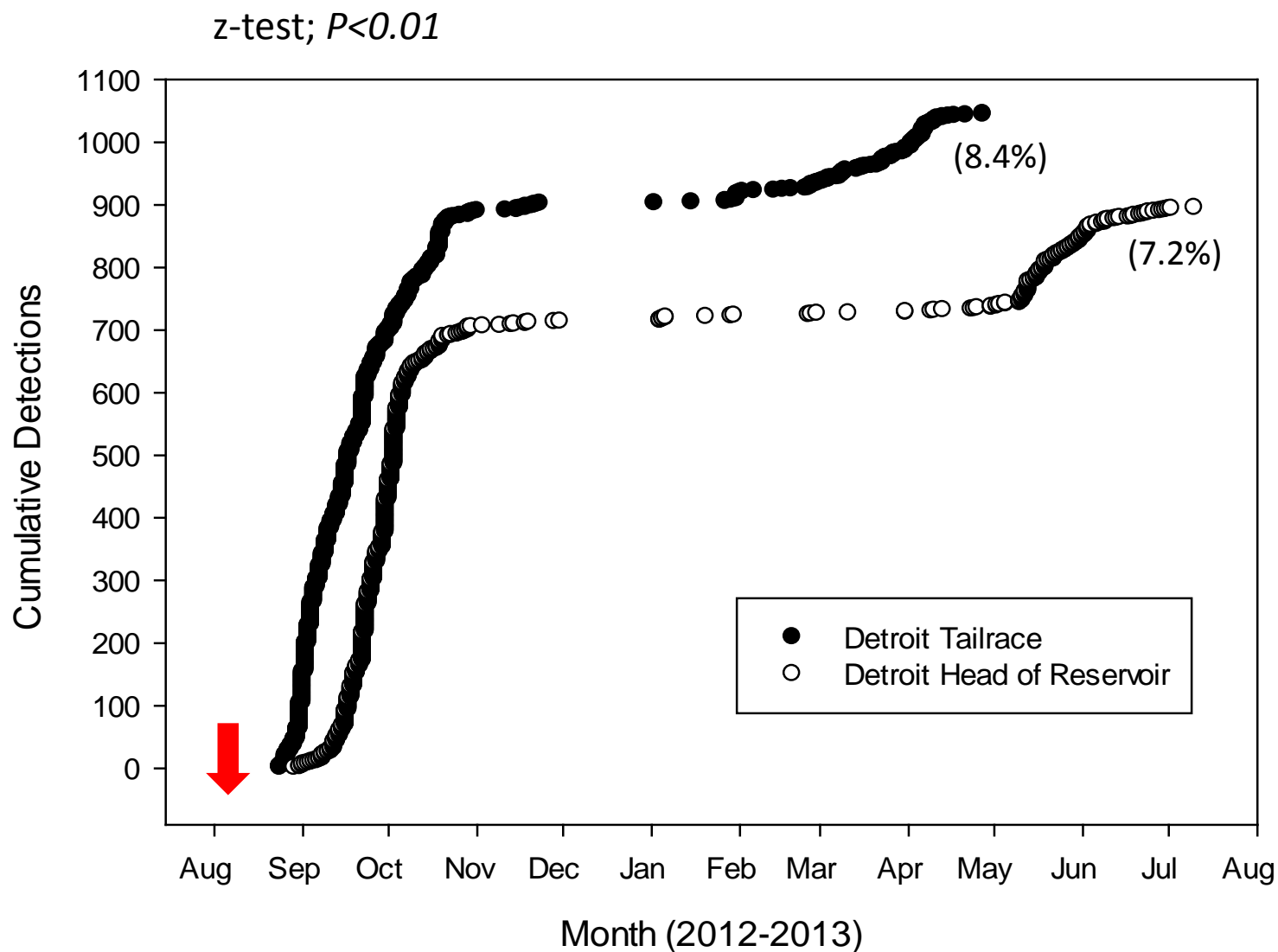
Detroit Reservoir entry, naturally-produced Chinook (Romer et al. 2012)



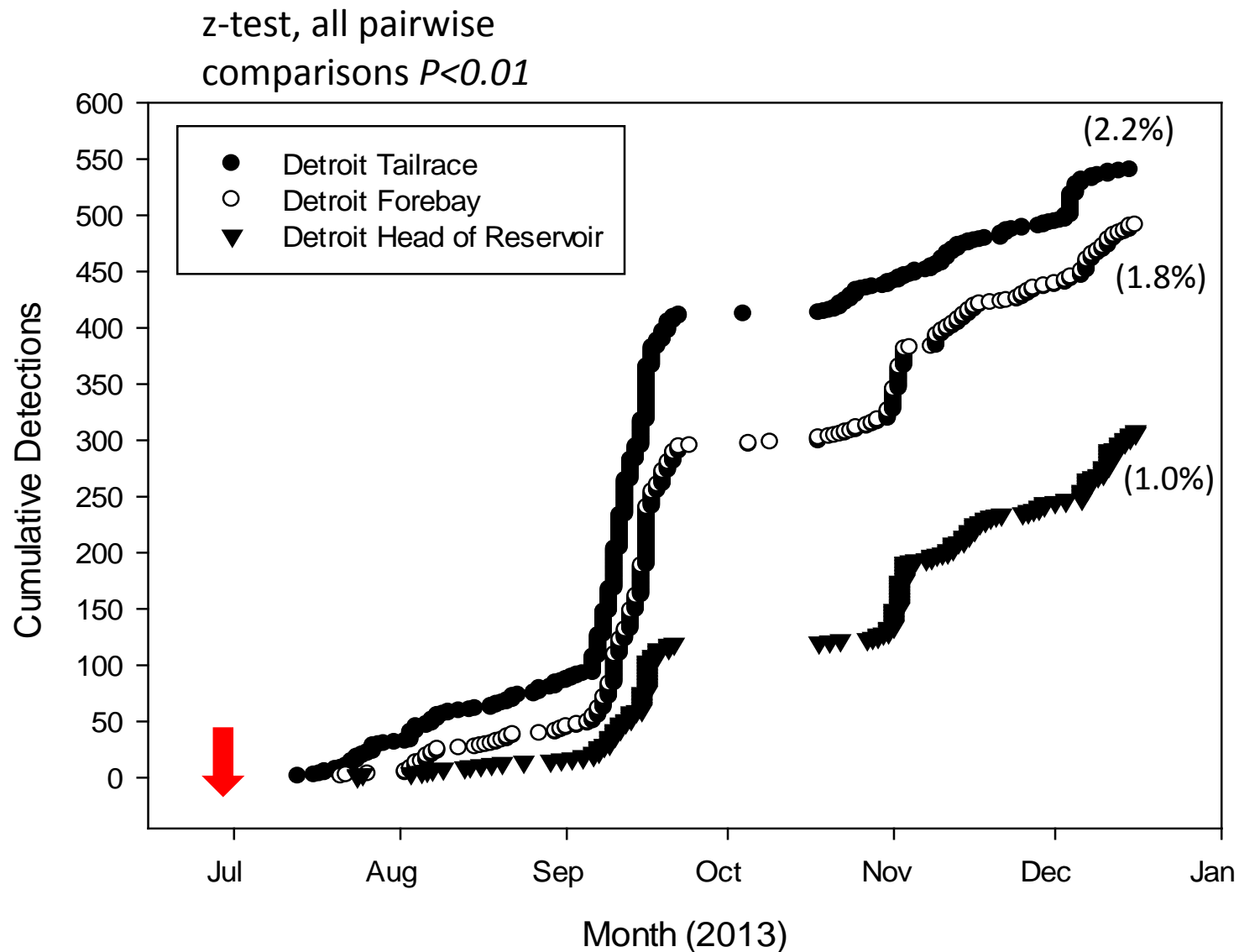
Tagging & Release – N. Santiam

Release Year	Release Location		
	Detroit Tailrace	Detroit Forebay	Detroit Head of Reservoir
2012	12,000-PIT & CWT 38,000-CWT	--	12,000-PIT & CWT 38,000-CWT
2013	33,000 PIT	33,000 PIT	33,000 PIT

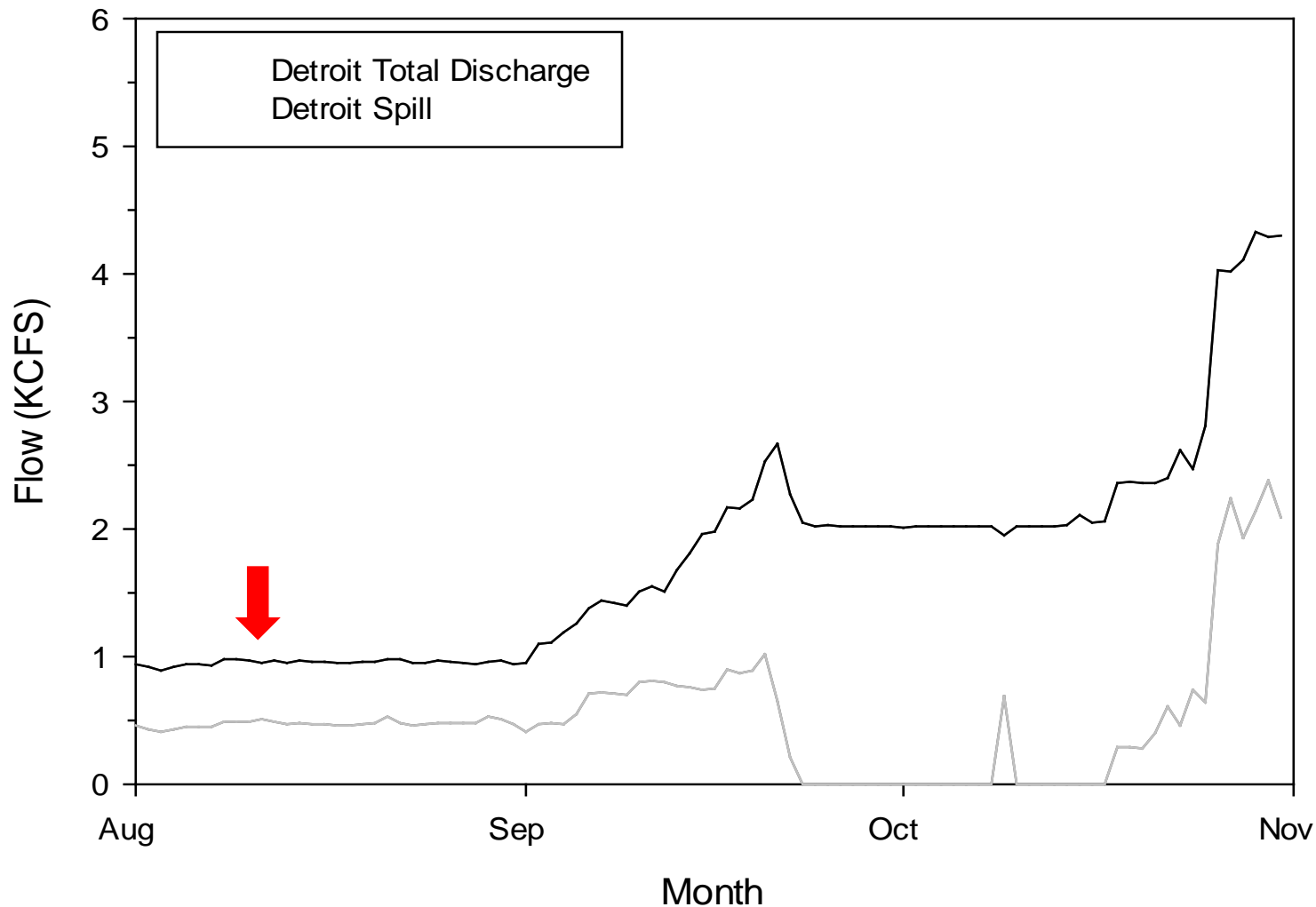
Outmigration Success – N. Santiam 2012



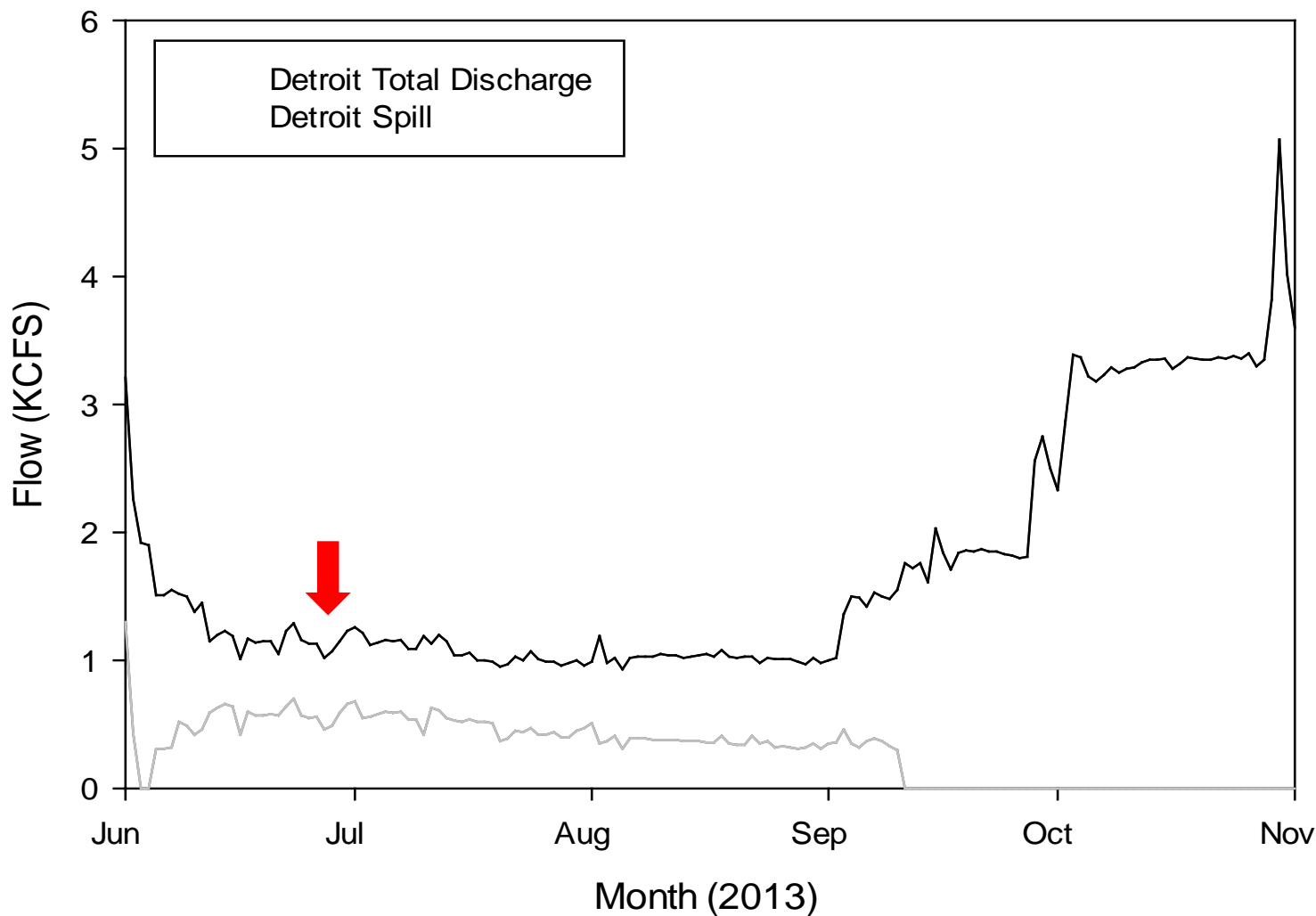
Outmigration Success – N. Santiam 2013



Detroit Dam Operations 2012



Detroit Dam Operations 2013



Migration Rate – N. Santiam

Rate = km/day

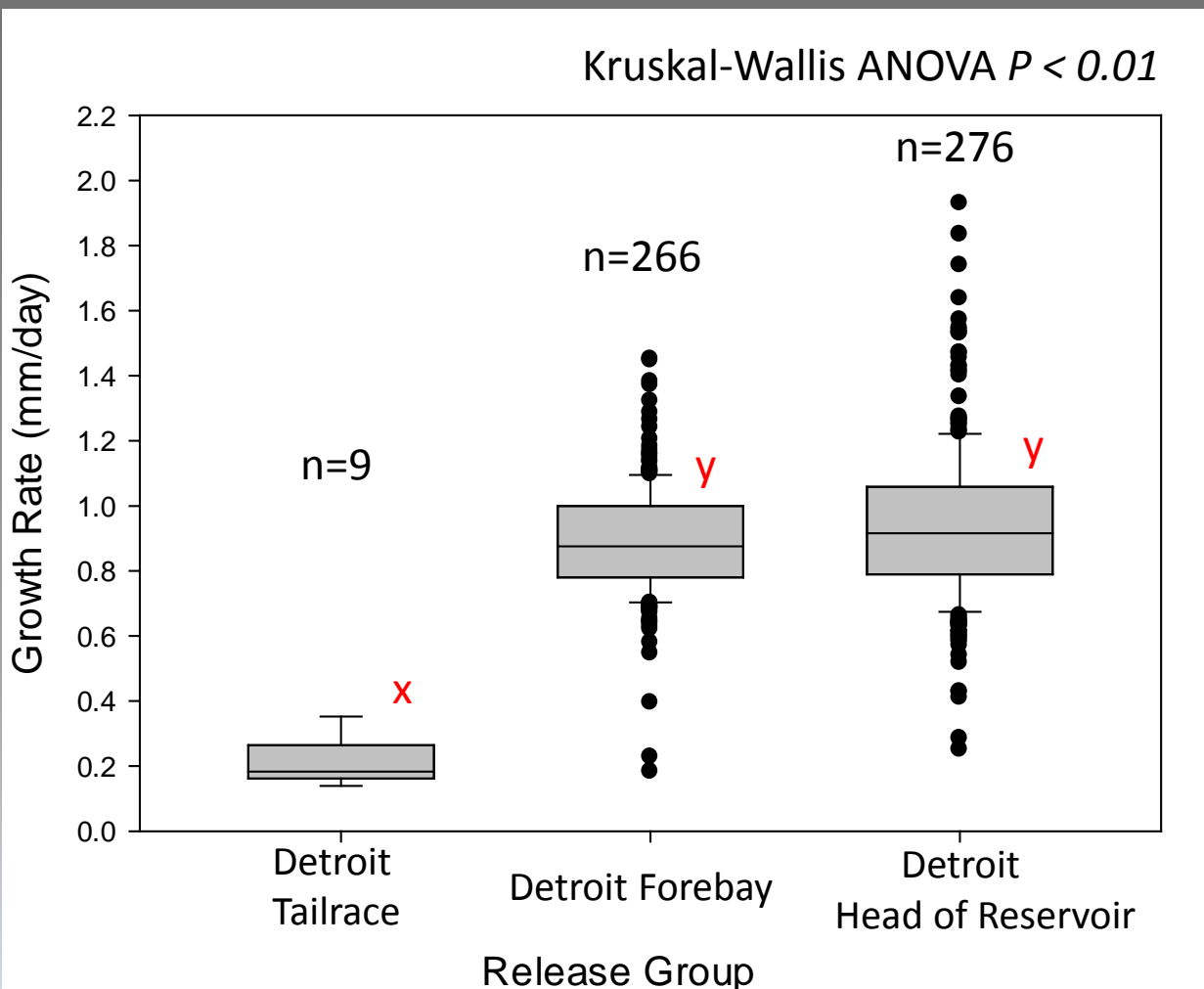
Kruskal-Wallis, ANOVA $P < 0.01$

Release Year	Release Group		
	Detroit Tailrace	Detroit Forebay	Detroit HOR
2012*	9.475 ^X	--	7.769 ^Y
2013**	2.769 ^X	2.78 ^{X,Y}	1.883 ^Y

*August 10th release, **90** mm average fork length

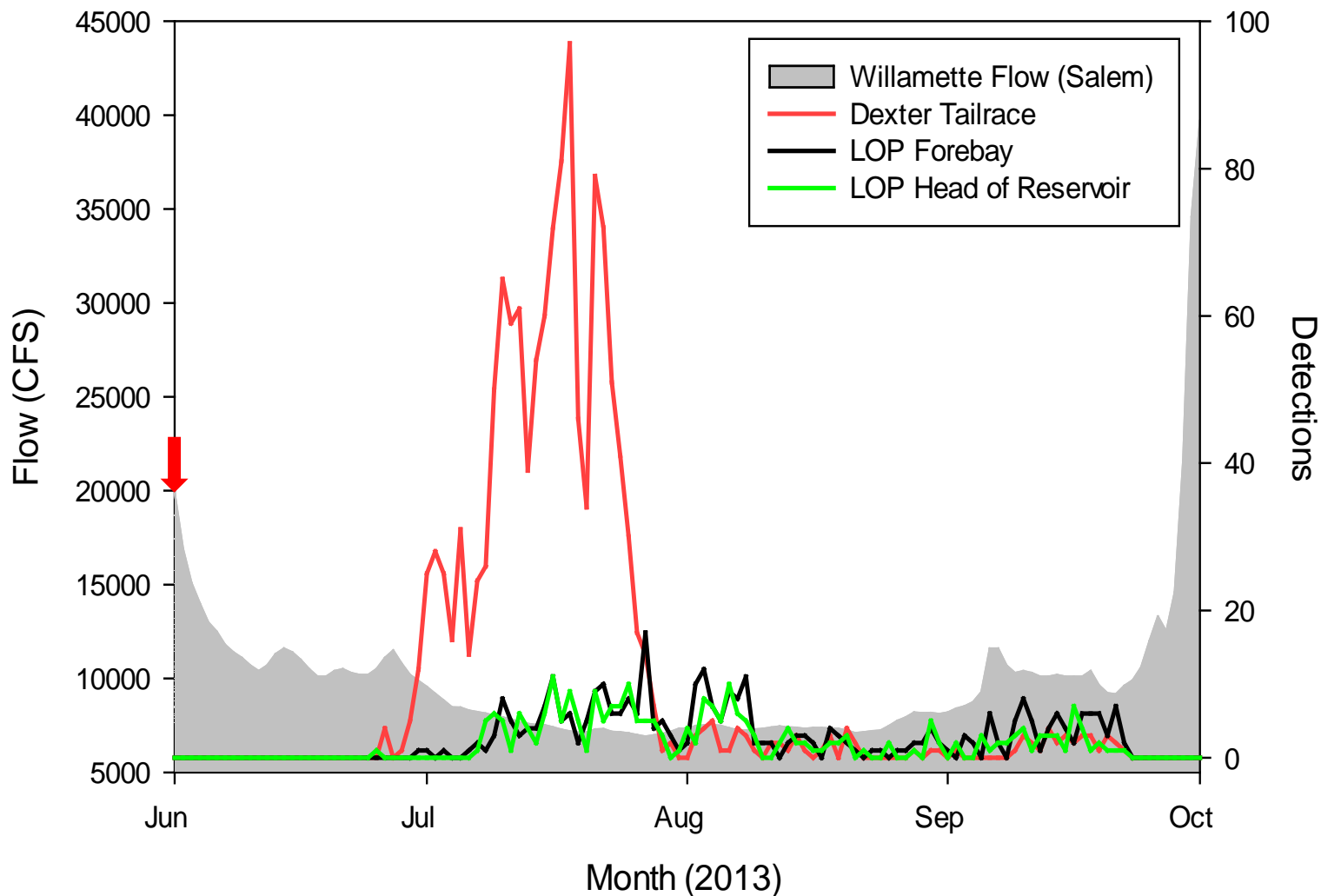
June 27th release, **65 mm average fork length

Growth – *N. Santiam*



Mainstem Flow Factor

(example – 2013 Middle Fork Willamette)



Mortality Sources

- Avian Predation (East Sand Island) – 66
- Piscene Predation (MFW Reservoirs) – 139
- Other Researchers – 1,361



Adult Returns

	R2011	R2012	R2013	R2014
Age 3	2013	2014	2015	2016
Age 4	2014	2015	2016	2017
Age 5	2015	2016	2017	2018
Age 6	2016	2017	2018	2019

R2=Release year

Key Points

Fish Released Above Projects:

- Grew Faster
- Migrated Slower
- Detected less frequently at Willamette Falls for all years and all release groups

Overall:

- Outmigration Success of HOR/FB groups much lower in MFW (relative to TR)
- Size Matters: N.Santiam size and release timing seem to affect outmigration success and migration
- Dam Operations/Flow: Difficult to evaluate without more detection infrastructure

Acknowledgments

- USACE - Task Order W9127N-10-2-0008-0009, administered by Rich Piaskowski; Greg Taylor, Todd Pierce, Doug Garletts, Chad Helms, Nathaniel Erickson et al.
- ODFW – Dan Peck & staff; Greg Grenbemer & staff; Fred Monzyk, Jeremy Romer, Ryan Emig, Kelly Reis, David Hewlett (GIS)
- NOAA – Bill Muir (original concept)
- Biomark, Inc. – PIT tagging
- PSMFC – Tag recovery database
- PGE – Interrogation facility



Questions & Discussion

<http://oregonstate.edu/dept/ODFW/willamettesalmonidrme>