

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

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Study Area



Historic production of spring Chinook salmon in the Middle Fork
“*was comparable to, and possibly exceeded, runs of the nearby
McKenzie River*” (Hutchison et al. 1966)

Objectives

- Estimate the effect that passage through dams and reservoirs in the Middle Fork Willamette River has on outmigration success (relative survival) of juvenile hatchery Chinook salmon
- Estimate the effect that passage through dams and reservoirs has on survivorship to adulthood for hatchery Chinook salmon
- Useful ancillary data: migration rate, growth and fate of juvenile hatchery Chinook salmon released above and below dams

Tagging & Release

2011

- ~6,000 PIT @ head of Lookout Point Res. (LOP), May 19
- ~6,000 PIT @ Dexter tailrace, May 25
- ~200,000 AD-CWT, reservoir only, May 19 and June 10

2012

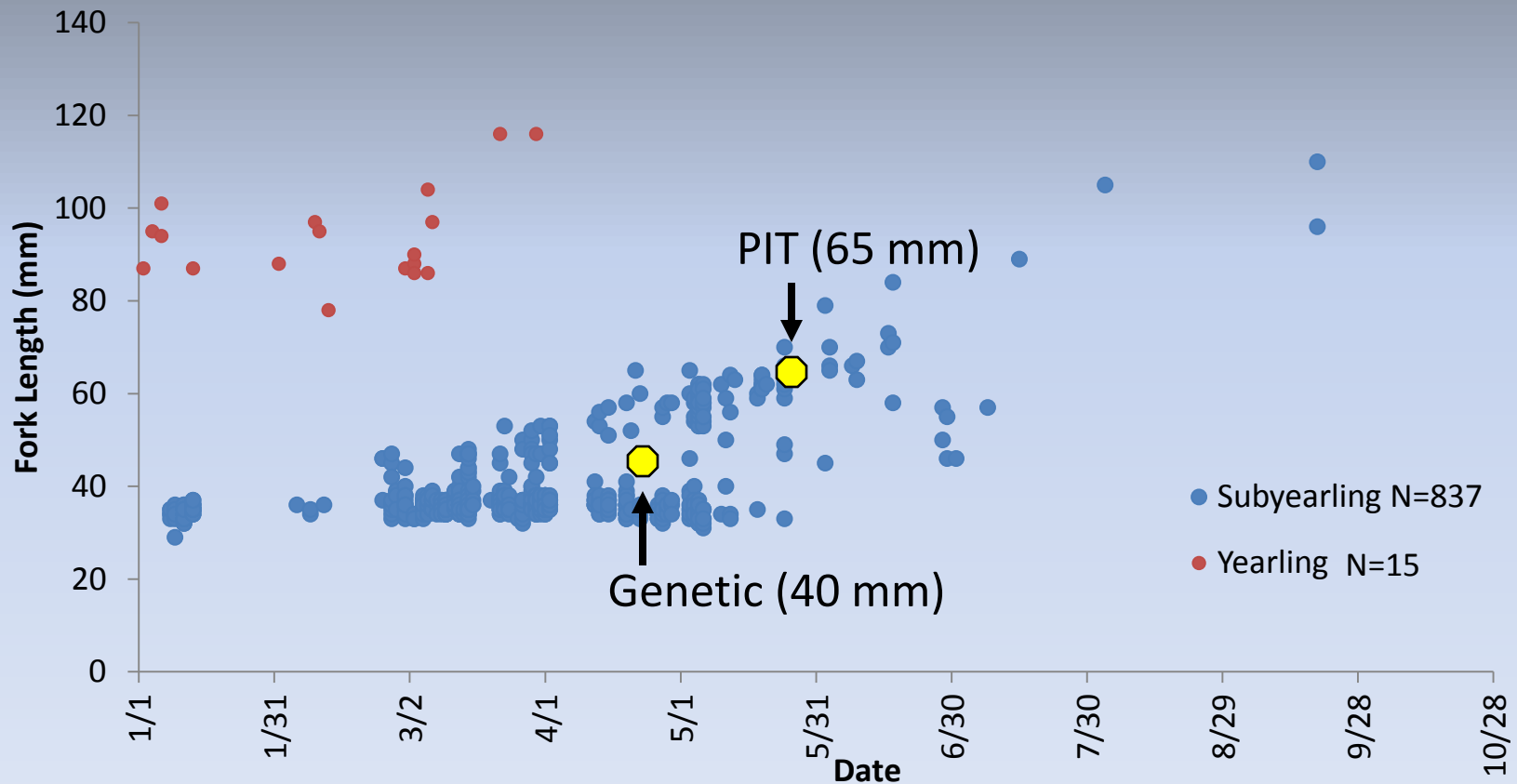
- ~50,000 PIT @ head of LOP, May 23
- ~49,000 PIT @ Dexter tailrace, May 23
- ~49,000 PIT @ Hills Cr. Reservoir, May 23
- ~46,000 genetic mark @ head of LOP, April 20
- ~46,000 genetic mark @ Dexter tailrace, April 20

Tagging

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



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



Detection & Recovery

PIT tags (2011-2018):

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

CWTs (2013-2018):

- Fisheries, hatcheries, spawner surveys

Genetic “tags” (2013-2018?):

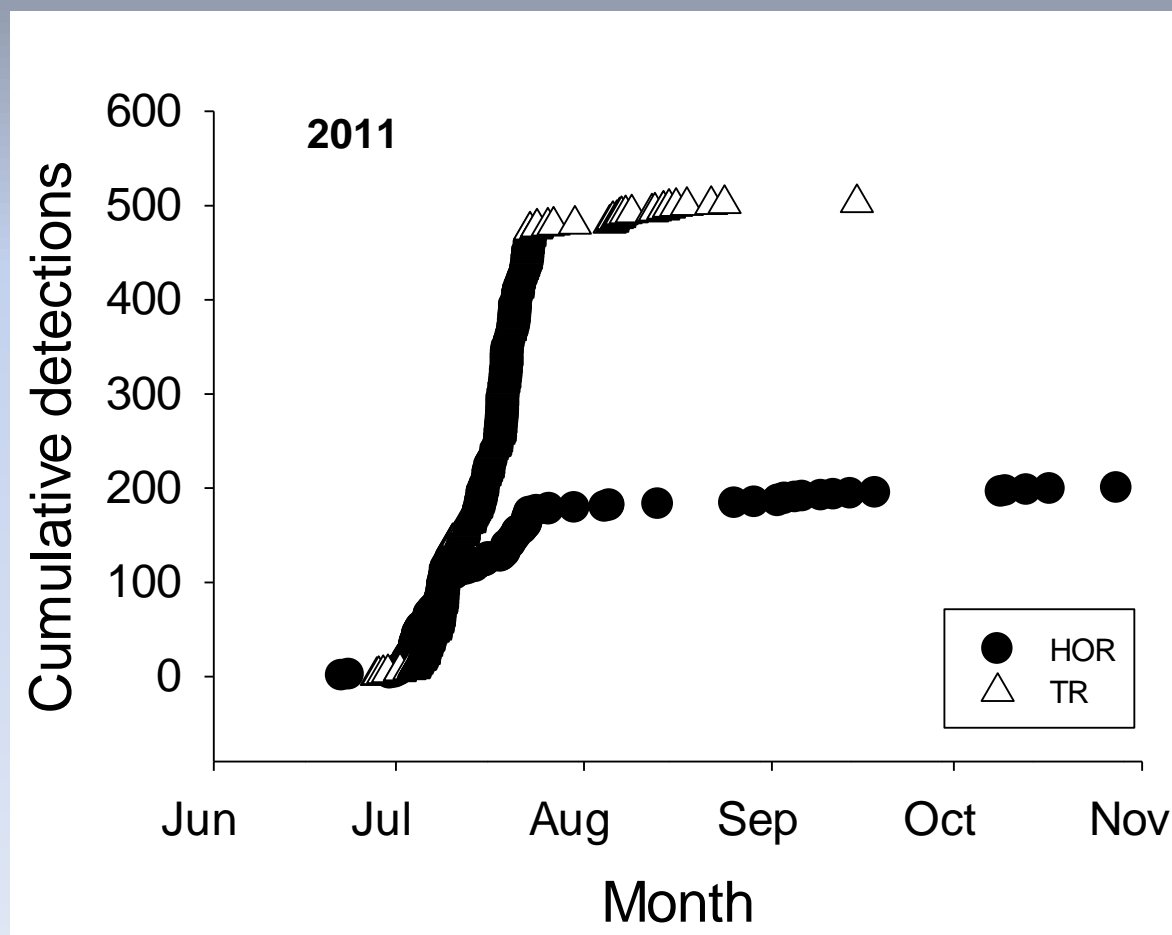
- Collection facilities, hatcheries, surveys



Relative Survival

Lookout Point to Willamette Falls, 2011:

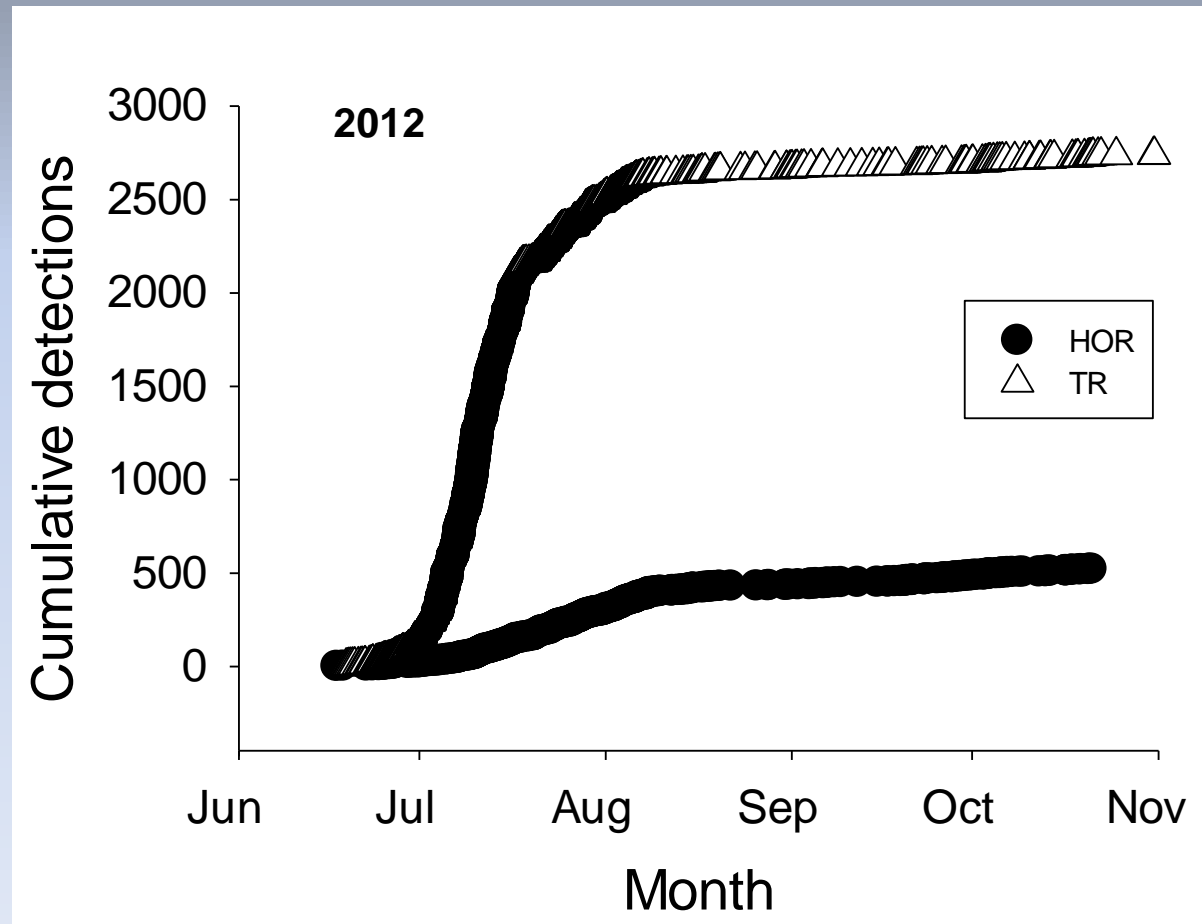
- 8.5% of tailrace group detected (n = 503)
- 3.4% of reservoir group detected (n = 200)
- 6.0% overall detection
- Significantly different; $Z=11.74$; $P<0.001$
- 2.5 tailrace fish for every reservoir fish
- No subsequent detections (!)



Relative Survival

Lookout Point to Willamette Falls, 2012:

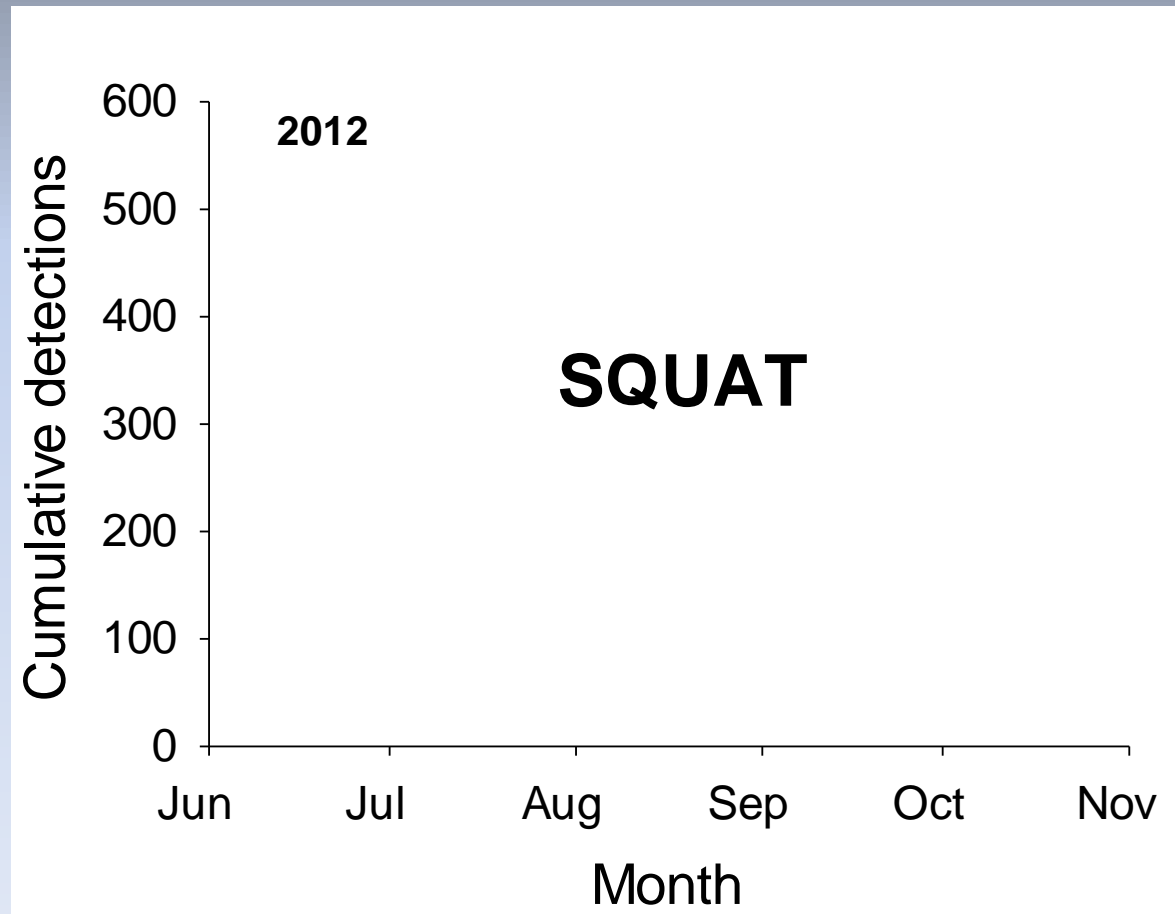
- 5.9% of tailrace group detected (n = 2,740)
- 1.3% of reservoir group detected (n = 521)
- 3.6% overall detection
- Significantly different; $Z=40.89$; $P<0.001$
- 5.3 tailrace fish for every reservoir fish
- A few subsequent detections



Relative Survival

Hills Cr. Reservoir to Willamette Falls, 2012:

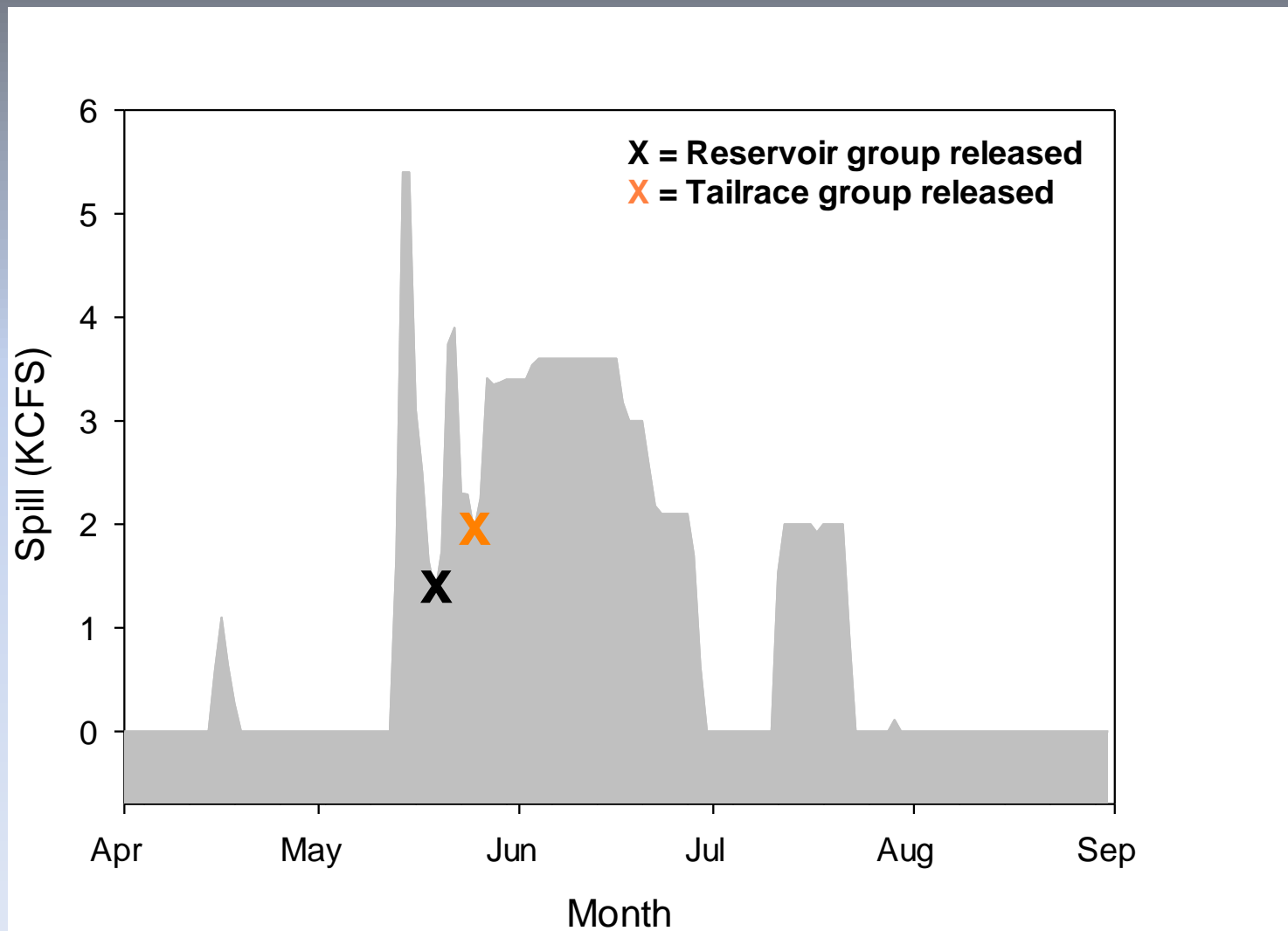
- 0.0% of tailrace group detected (n = 0)
- 0.0% of reservoir group detected (n = 0)
- 0.0% overall detection
- 14 fish recaptured in Corps tailrace screw trap; no subsequent recoveries (to date)



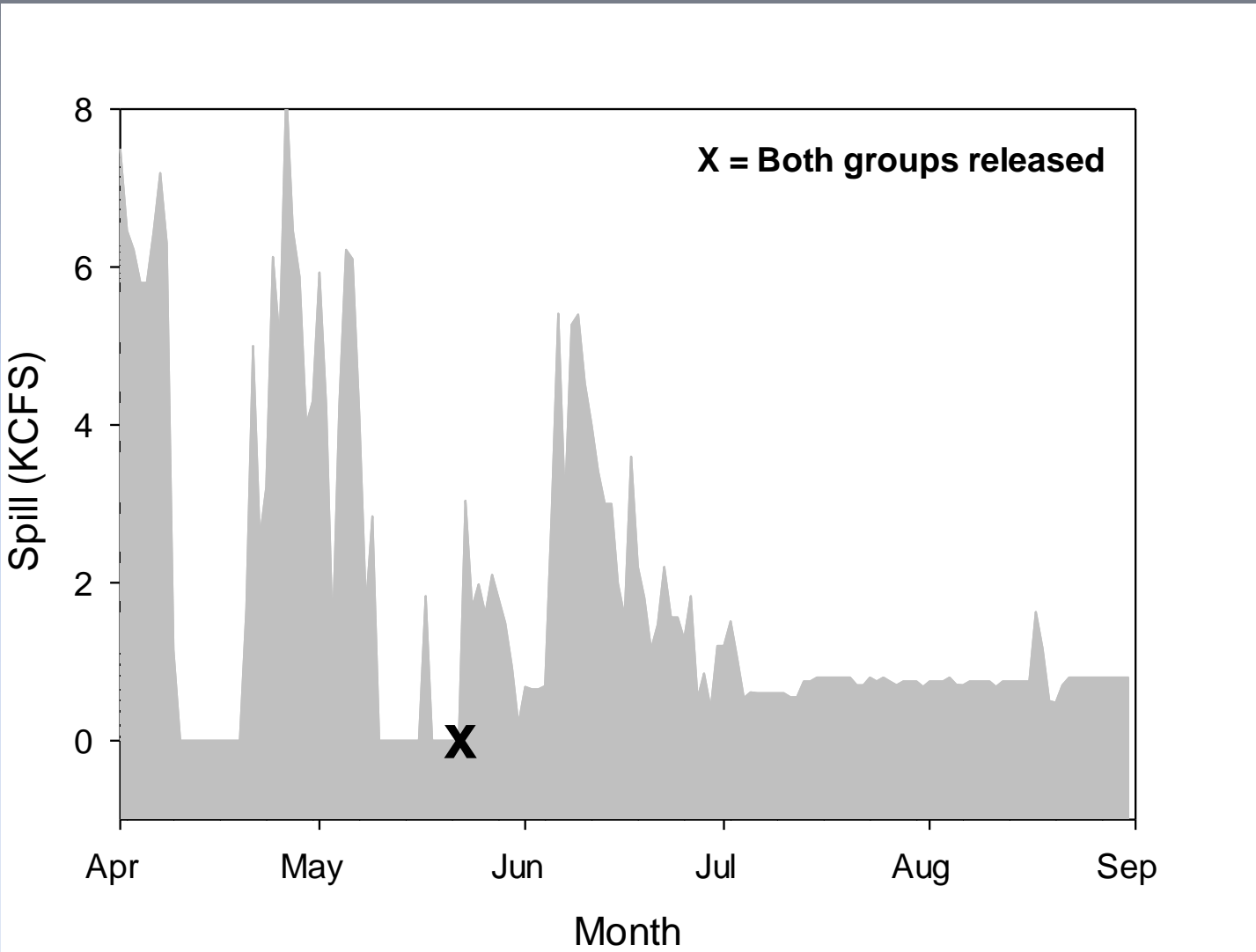
Effects of Dam Operations



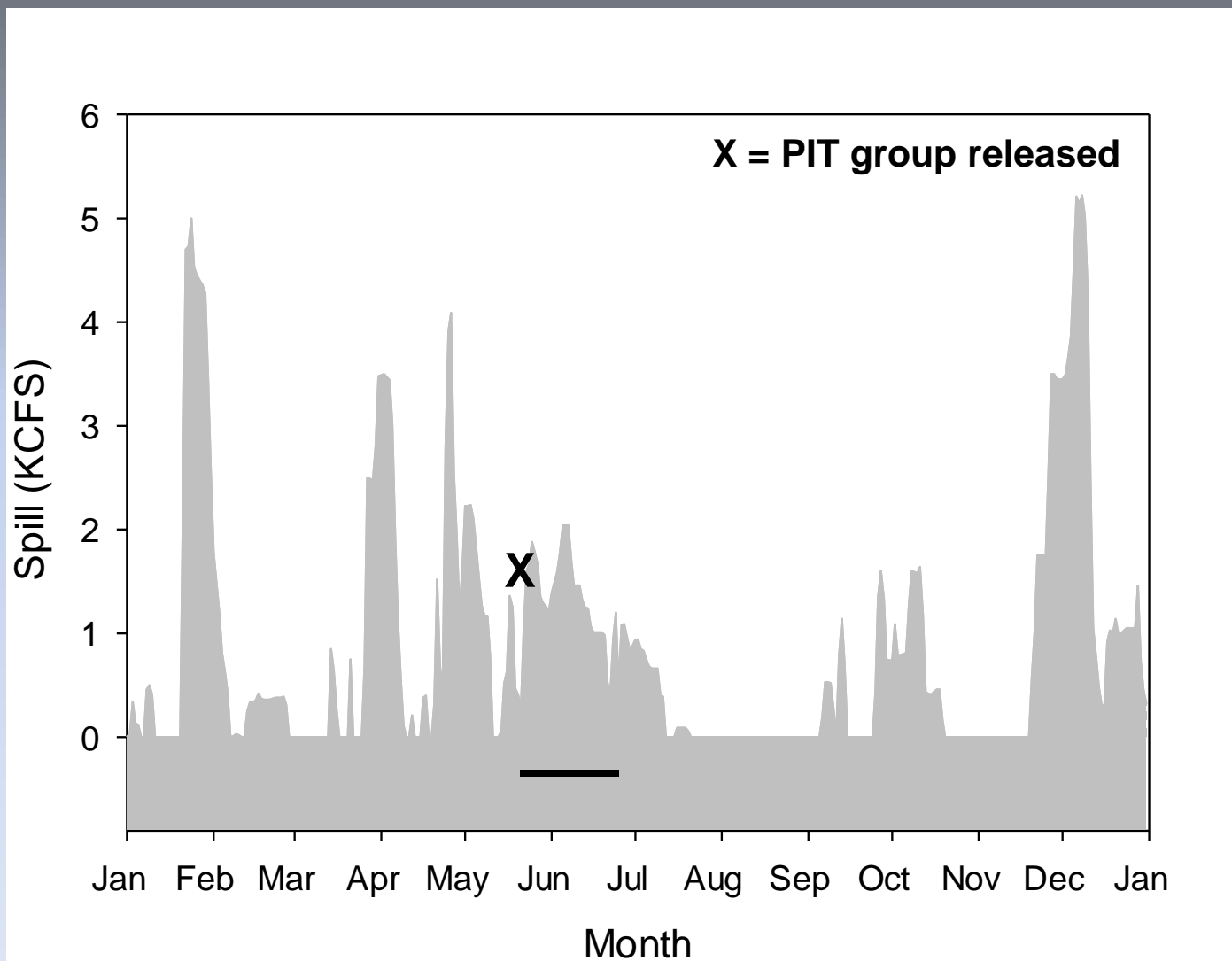
Effects of Dam Operations – LOP 2011



Effects of Dam Operations – LOP 2012



Effects of Dam Operations – HCR 2012

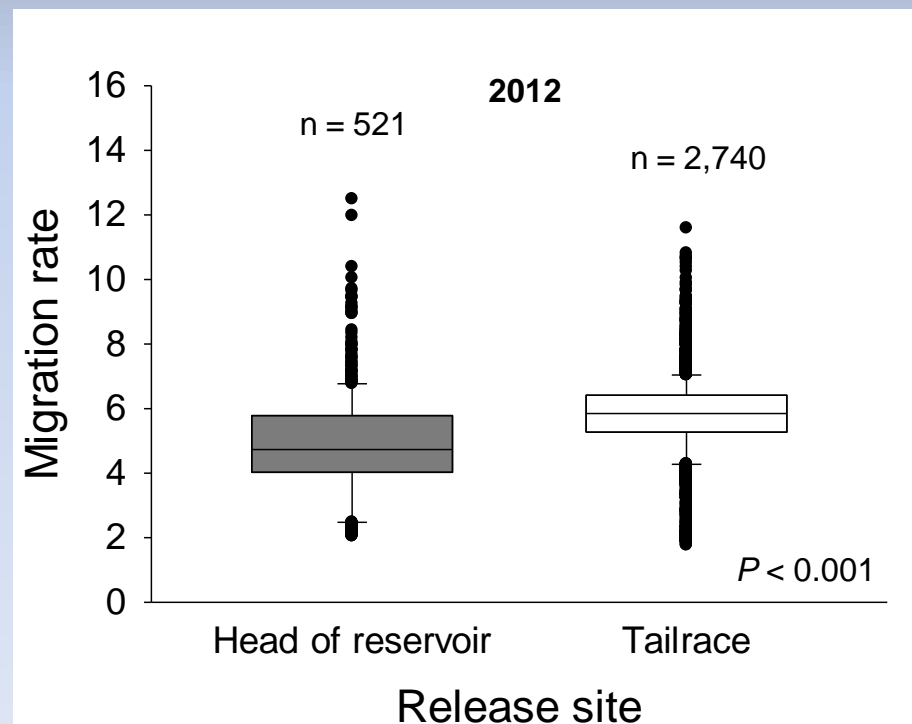
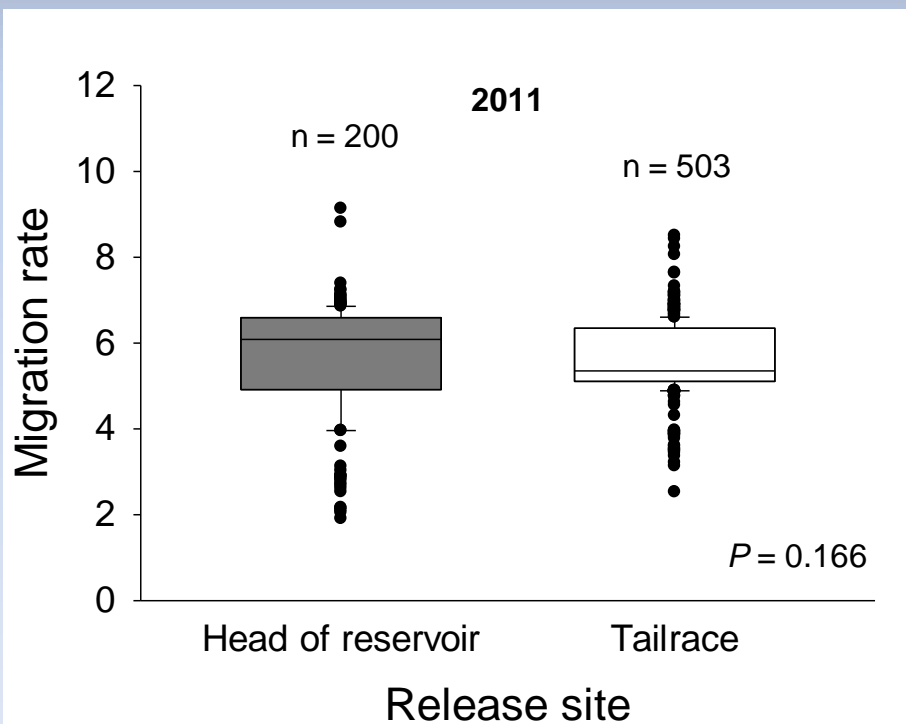


Migration Rate

Median migration rate (km/d), release to Willamette Falls:

Consistent migration rates of 4.5-6.0 km/d

2012 tailrace group migrated significantly faster (+1.2 km/d)
than reservoir group

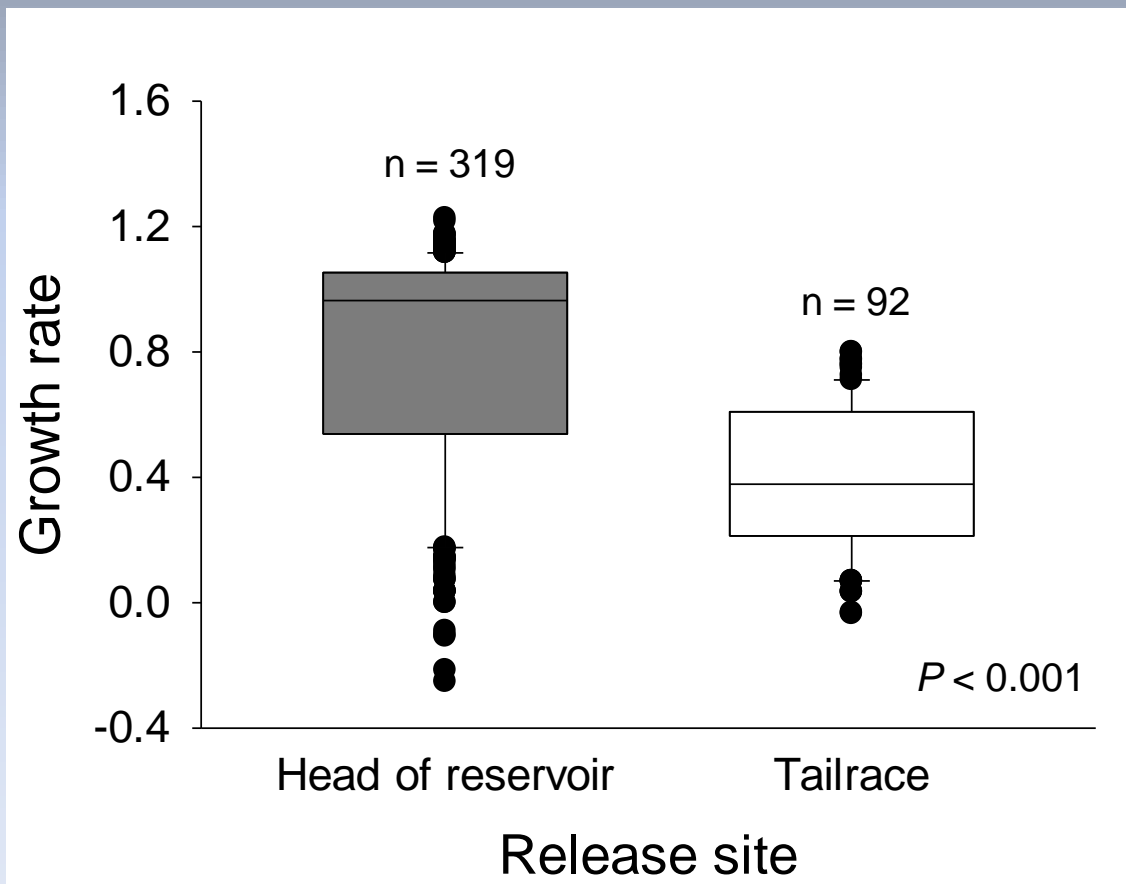


Growth

Median growth rates, 2011 and 2012 combined:

Reservoir group = 0.96 mm/d

Tailrace group = 0.38 mm/d



Fate

Anecdotal, but compelling case for substantial predation

- HCR creel – 76 crappie, 81 PIT tags
- LOP creel – 17 crappie, 27 tags
- LOP ODFW predator sampling:
 - 11 crappie, 23 tags
 - 5 bass, 7 tags
 - 2 pikeminnow, 3 tags
 - 1 walleye, 1 tag
- Dexter anglers – 2 tagged Chinook
- Cutthroat trout (mainstem) – 1
- Birds (East Sand Island) – 11

Reservoir predation perhaps exacerbated by mass releases



Fate

Other recapture / recovery:

- Corps screw trap (HCR) – 14
- Corps screw trap (LOP) - 44
- ODFW electrofishing (LOP) - 57
- ODFW gill net (LOP) - 182
- ODFW nearshore trap (LOP) - 23
- ODFW beach seine (mainstem) - 96
- NOAA estuary trawl (Columbia) - 2



Juvenile to Adult Survival

First adult returns expected in spring 2013

	BY2010	BY2011	BY2012
Age 3	2013	2014	2015
Age 4	2014	2015	2016
Age 5	2015	2016	2017
Age 6	2016	2017	2018

BY=brood year

Key Points

No surprises; fish released above projects:

- Grew faster in reservoirs than tailrace group
- Migrated slower to Willamette Falls
- Detected at a lower rate = apparent lower survival, despite increased spill
- Were exposed to high reservoir predation, perhaps magnified by en masse releases
- ❖ 2013 plans: Repeat 50K PIT groups x3 @ 65 mm FL
- ❖ Consider passage alternatives including drawdown, run-of-river operation

Acknowledgments

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- NOAA – Bill Muir (original concept)
- Biomark, Inc. – PIT tagging
- PSMFC – Tag recovery database
- PGE – Interrogation facility



Questions & Discussion

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