Spawning success of spring Chinook salmon in Fall Creek, the North Fork Middle Fork Willamette and South Santiam, 2008-2015

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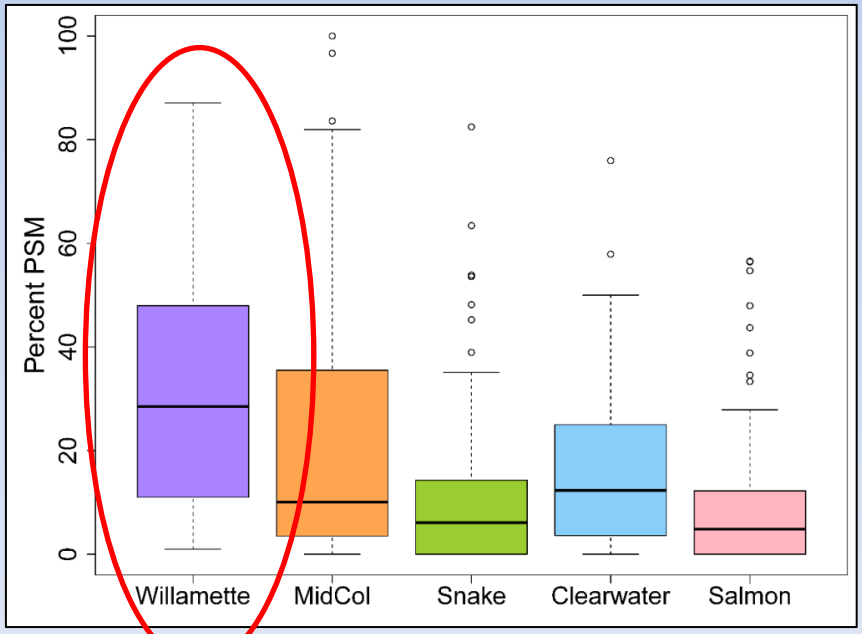
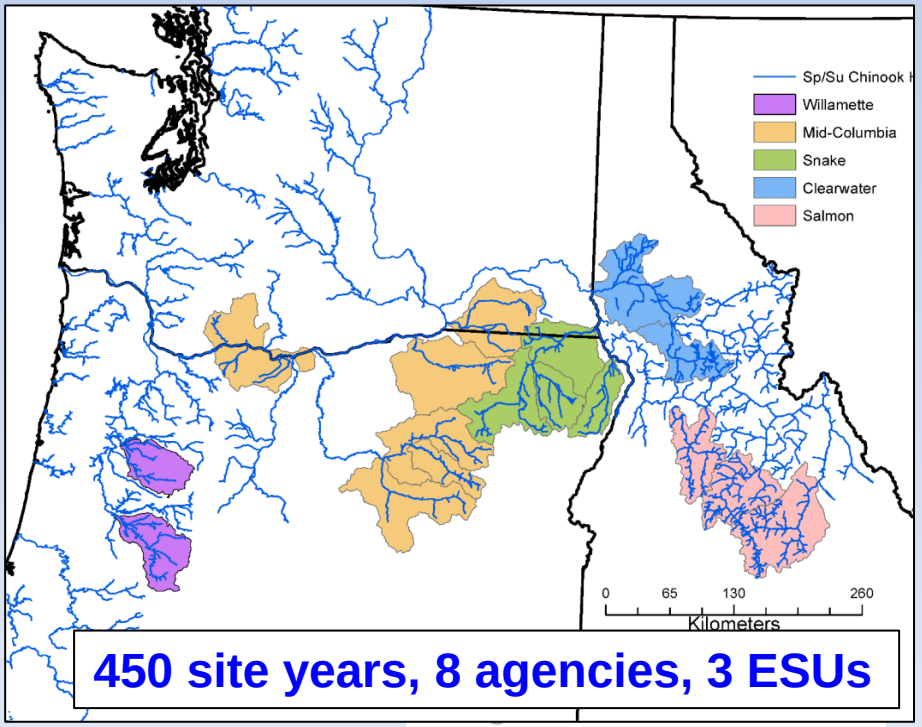
Background: Prespawn mortality

- Adult Chinook PSM is a regional issue
  - Temperature-mediated mortality
  - Disease, density-dependent effects
- WIL spring Chinook have relatively high PSM



Bowerman, Caudill, & Keefer *in prep*



450 site years, 8 agencies, 3 ESUs

2008-2015 WIL tributary objectives

- Monitor prespawn mortality
  - Radiotelemetry, PIT tags
  - Spawning ground surveys

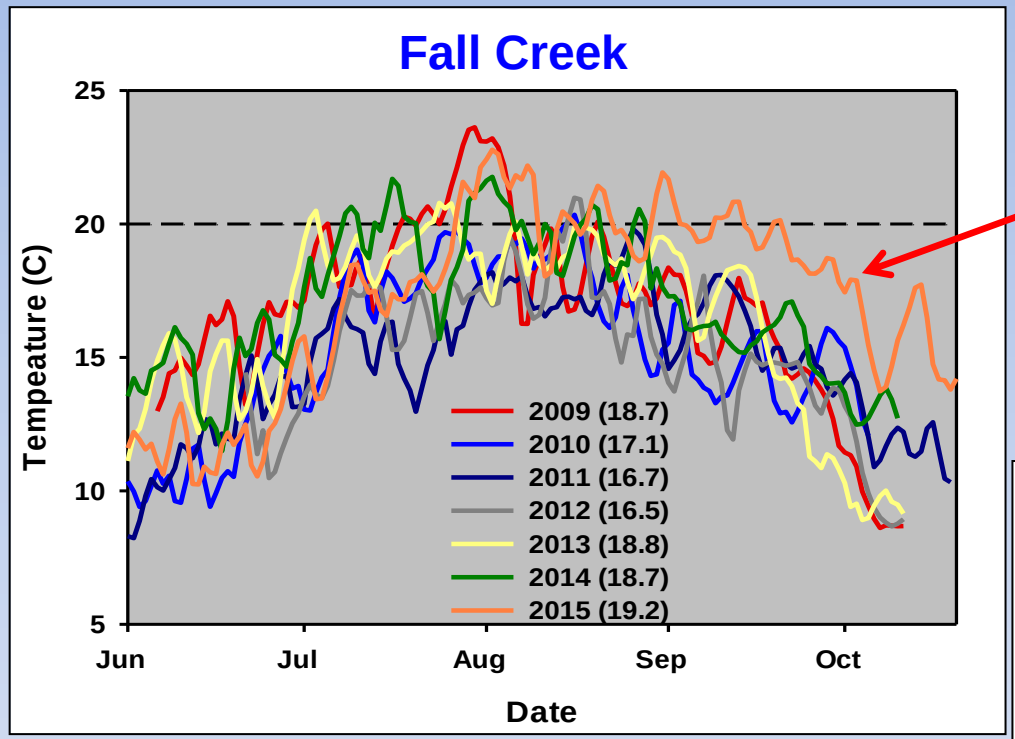
- Assess covariates
  - Fish traits: size, sex, condition, migration timing, energetics
  - Temperature exposure
  - Toxin loads
  - *Disease, pathogens, etc (Schreck, Kent et al.)*

No disease objectives in 2015, Summary reports available

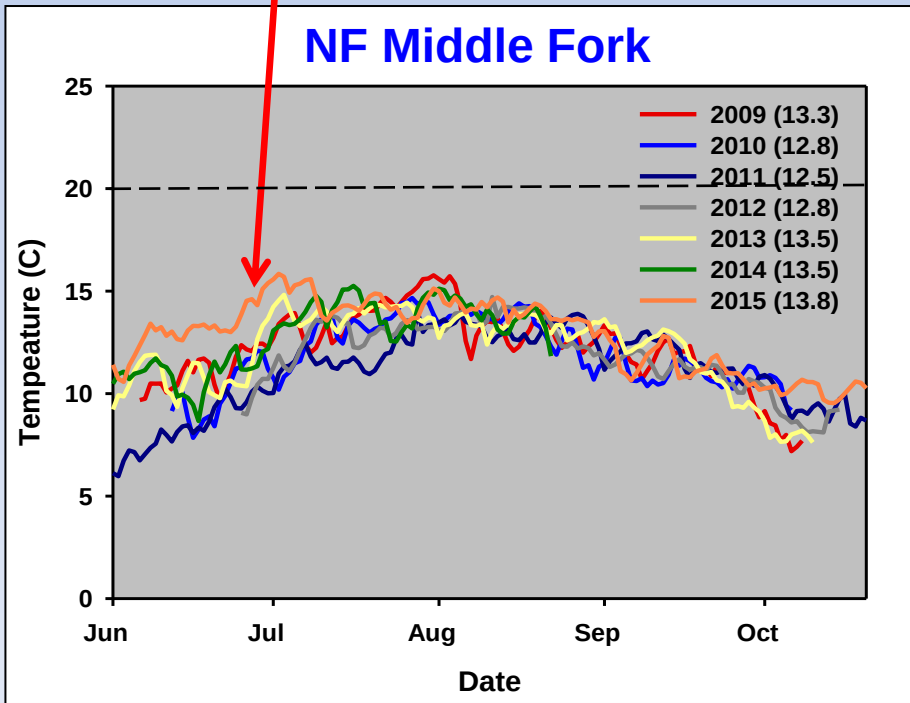
2015-specific objectives

- Fall Creek, NF Middle Fork, S Santiam, N Santiam
  - PSM estimates
  - Inter-annual PSM patterns
  - Temperature monitoring
- Foster Reservoir releases
  - Thermal refuge?
- *Toxins analysis*
- *Minto radio-tagging*
  - *Fallback behavior*
  - *Movement to Big Cliff*

Release site temperatures

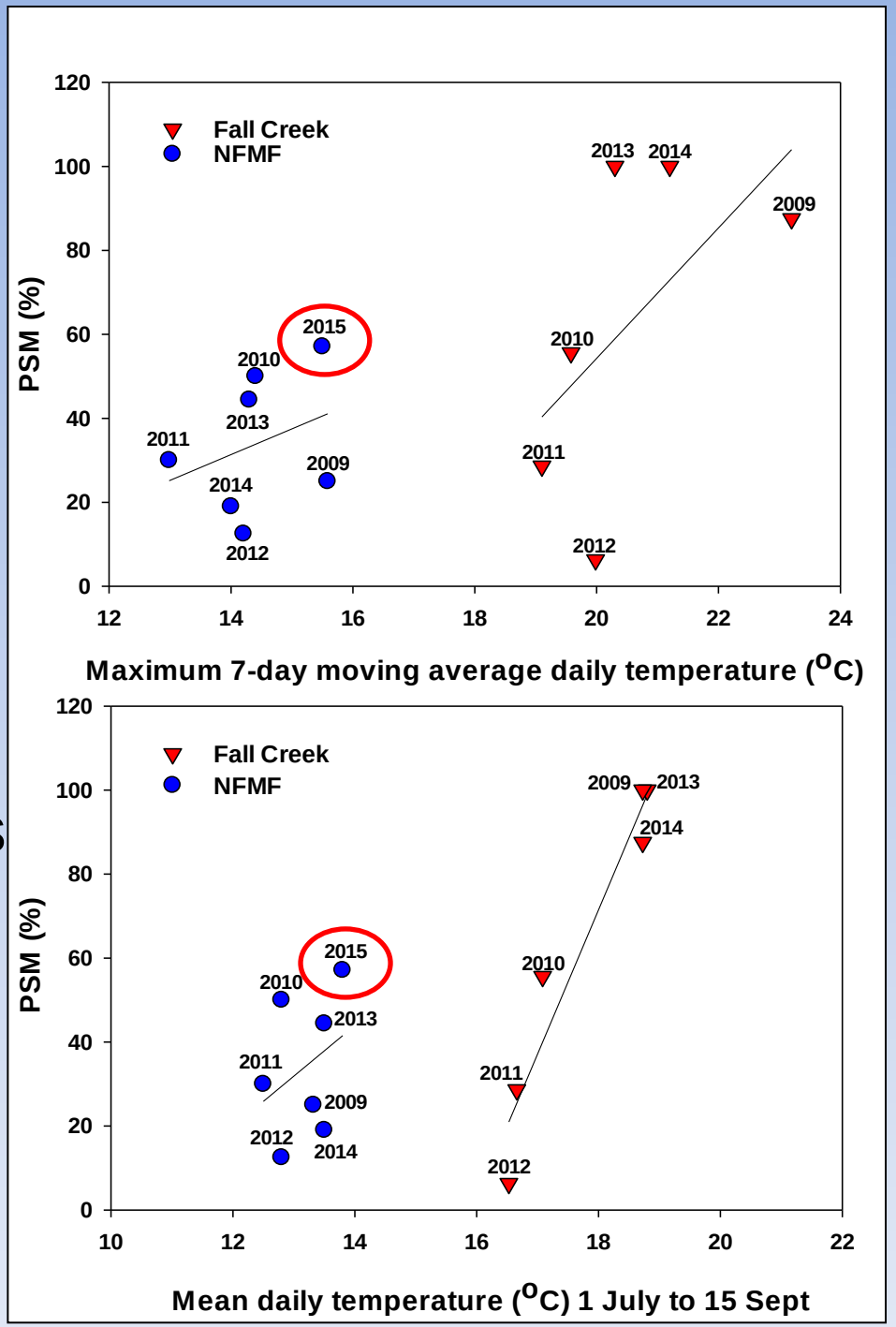


NFMF much cooler than Fall Creek



Multi-year analyses

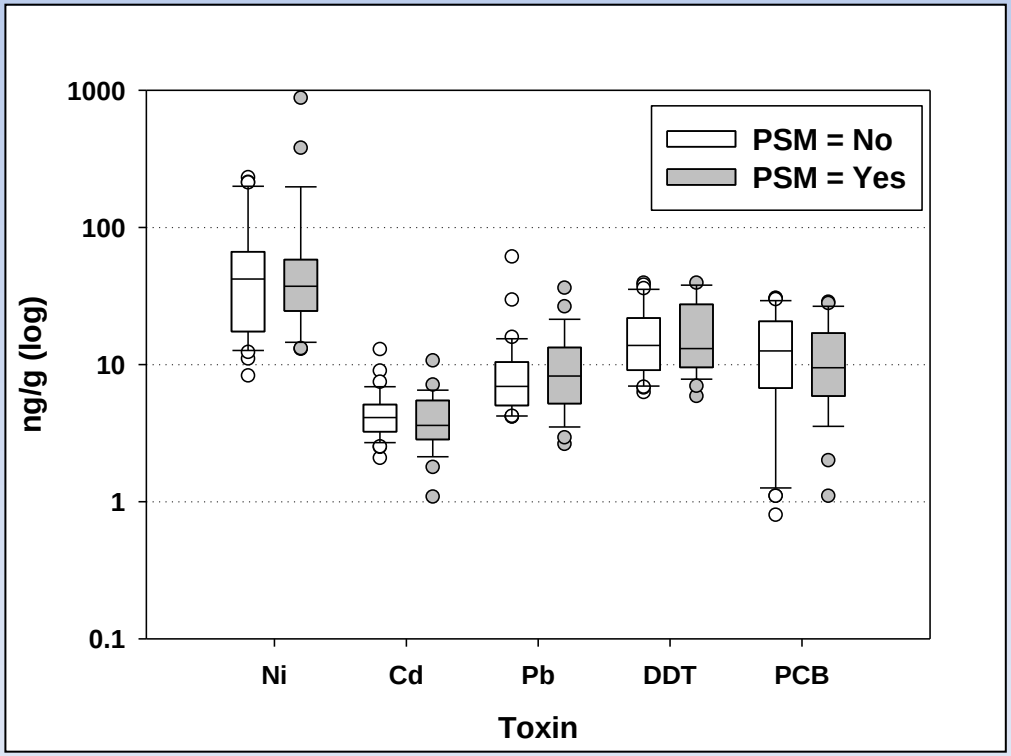
- NFMF vs Fall Creek
  - Stream temperature appears to be a primary driver
- Fall Creek models
  - PSM ▲ for late migrants
  - PSM ▲ with fish size
- NFMF models
  - Few statistically significant covariates



Toxins summary: 2013-2014

- Assessed Ni, Cd, Pb, DDT, PCB

PSM	S Santiam	Fall Creek	NF Middle Fork	Total
No	13	1	23	**37**
Yes	7	5	14	**26**



Statistical tests by tributary, by year, by toxin:

No smoking gun for PSM

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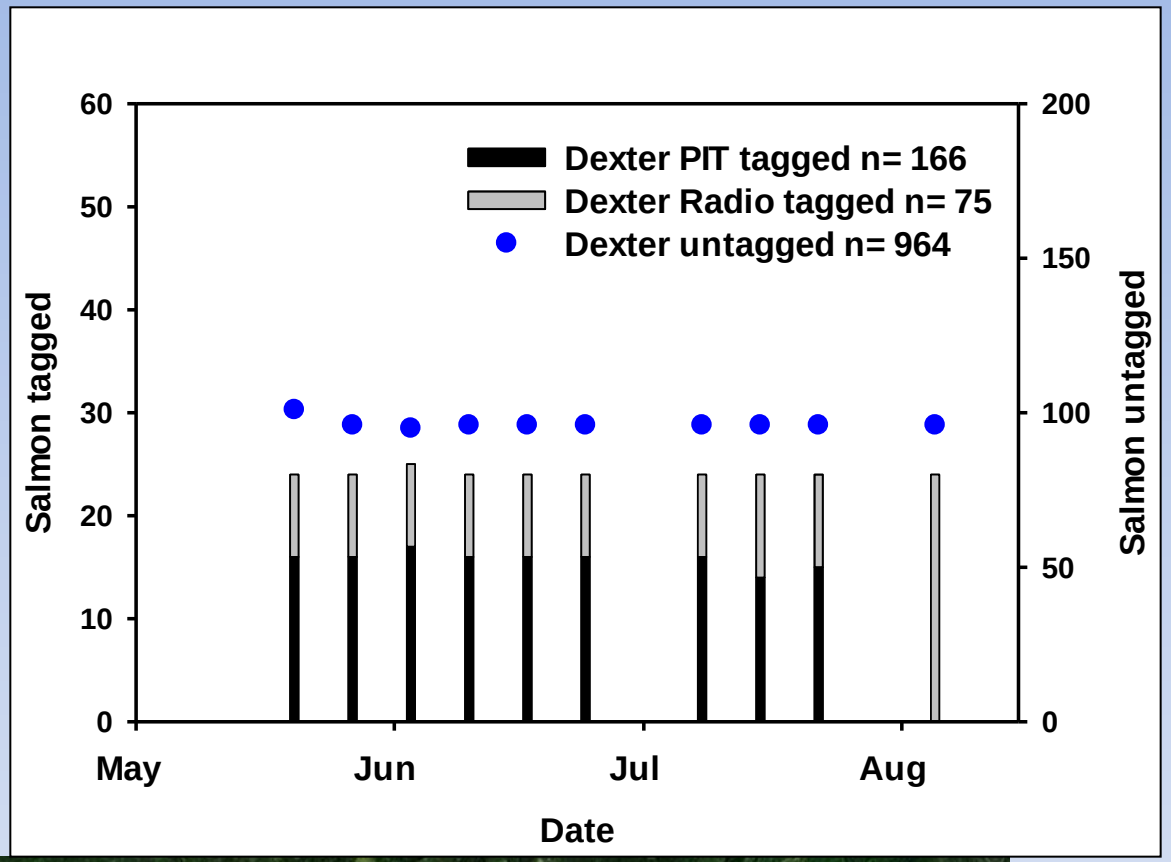
2015 Dexter radio & PIT tagging



Release site: NF Middle Fork

New in 2015: No CO_2 for PSM Samples

Year	Group	# released	# recovered	% recovered	Females #recovered	Females %PSM
2009 (DEX)	PIT	124	6	5	3	0
	Double	12	3	25	1	100
	Unmarked	N/A	66	N/A	19	47
2009 (HH)	PIT	103	1	1	1	0
2010 (DEX)	PIT	148	30	20	15	47
	Double	43	8	18	3	67
	Unmarked	N/A	266	N/A	102	64
2010 (HH)	PIT	81	8	10	7	0
	Double	18	7	39	6	33
2011 (DEX)	PIT	109	7	6	5	0
	Double	71	11	15	5	60
	Unmarked	1,366	186	14	98	38
2011 (HH)	PIT	79	8	10	5	40
2012 (DEX)	PIT	104	14	13	10	10
	Double	50	11	22	6	17
	Unmarked	2,441	387	16	192	23
2012 (HH)	PIT	71	17	24	10	10
2013	PIT	106	11	10.4	6	50
	Double	59	6	10.2	3	33
	Unmarked	2,031	336	16.5	153	29
2014	PIT	150	29	19.3	17	24
	Double	50	8	16.0	3	0
	Unmarked	865	208	24.0	74	10
2015	PIT	166	22	13.3	4	75
	Double	75	10	13.3	3	33
	Unmarked	964	182	18.9	76	36

Table 1. Final fates of PIT-tagged, double-tagged (PIT and radio), and unmarked subsets of the Chinook salmon outplanted in the NFMF Willamette River in 2009-2015. Prespawning mortality (PSM) rates were only calculated for females. DEX = fish tagged at the Dexter Dam trap and immediately outplanted into the NFMF Willamette River. HH = fish held at the Willamette Hatchery and later outplanted into the NFMF Willamette River. Prespawning mortality (PSM) rates were only calculated for females with known spawning status.

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Treatment & collection date confounded

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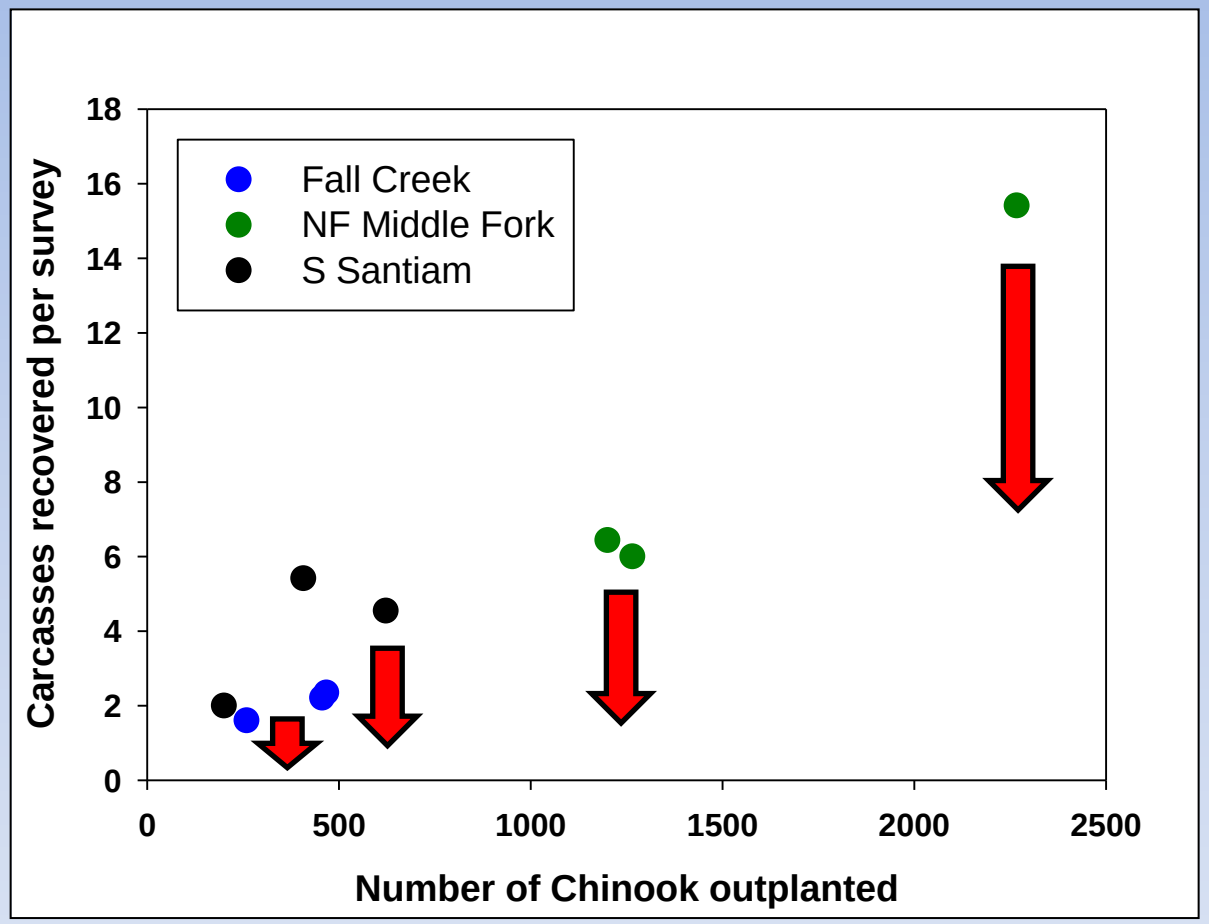
CPUE: carcass recovery (2013-2015)



All carcasses examined

~50%

Female egg retention assessed

~25%

Female subsample in acceptable condition used in PSM estimates

1: Carcass recovery proportional to outplant abundance

2: Samples for PSM estimates often small

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Methodological Considerations

Table 3. Summary of University of Idaho carcass surveys in the North Fork of the Middle Fork of the Willamette River, 2011-2015

Stream	Year	Days Surveyed	Carcasses recovered	Number outplanted	Percent recovered	Rec/ 100
NFMF	2011	8	219	1645	13.3	13
	2012	19	420	2674	15.7	16
	2013	14	370	2267	16.3	16
	2014	15	162	1265	12.8	13
	2015	11	103	1200	8.6	9

Number Outplanted	**15% Recovery**	**# Females**	**1 Treat + Control, N/treatment**
200	30	**15**	**7.5**
500	75	**37.5**	**19**
1000	150	**75**	**37**
2000	300	**150**	**75**

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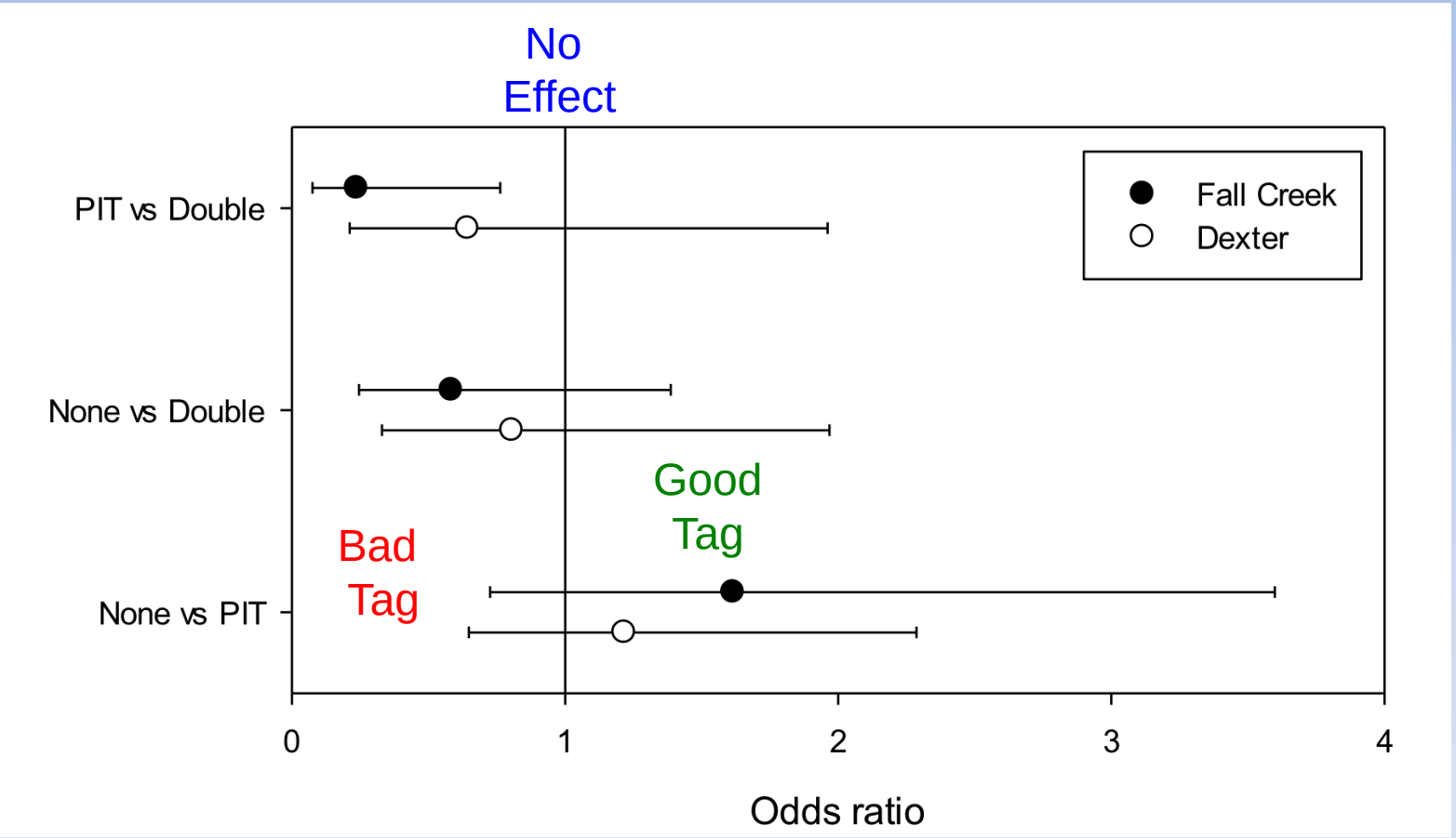
Methodological Considerations



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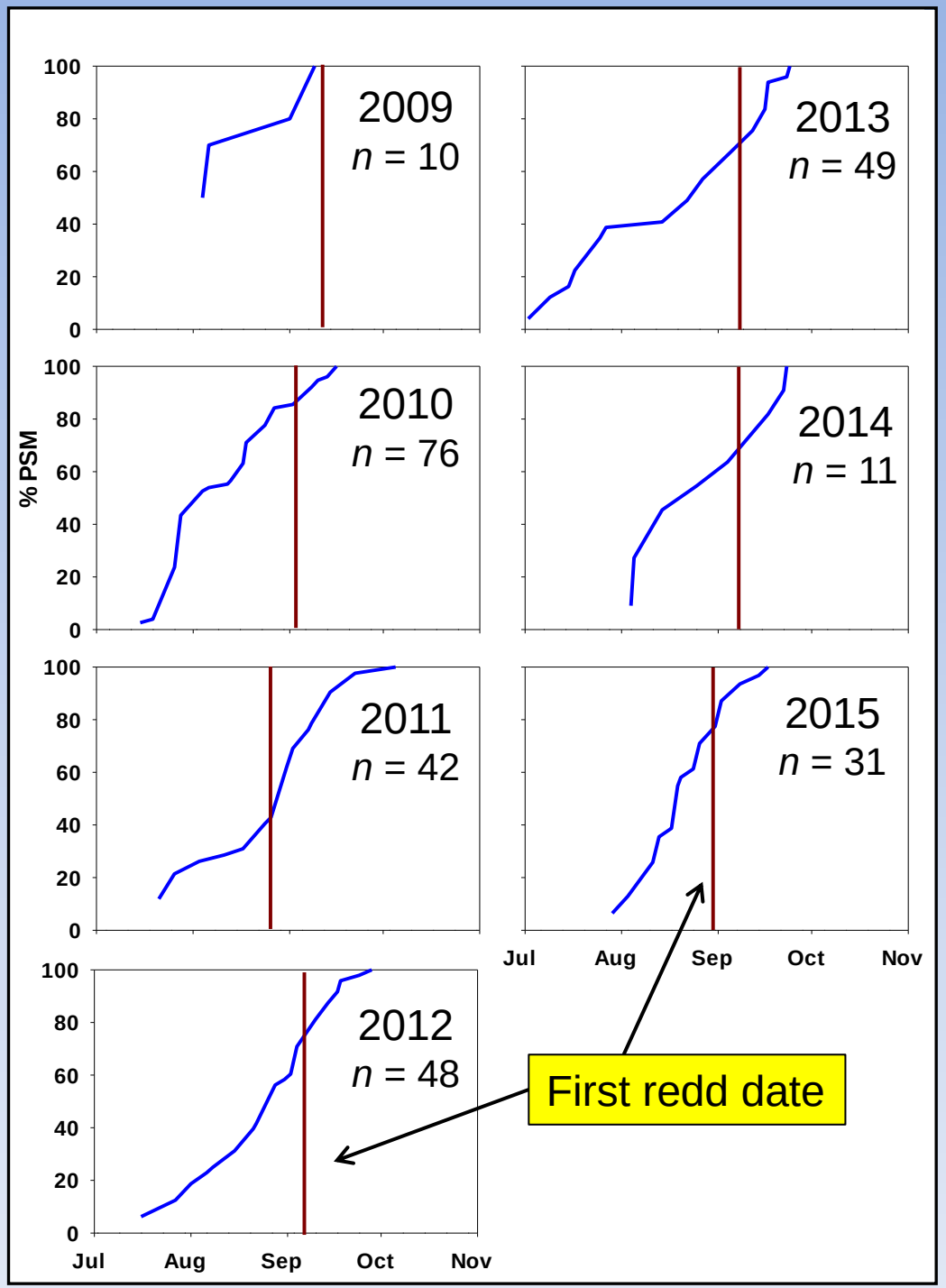
NF Middle Fork cumulative PSM%

Same pattern: most die before spawning onset

Very important that surveys begin during the holding period



Data Gaps

- Relationship between prior experience and PSM
  - Initial condition
  - Mainstem Willamette temperature and passage time
    - PIT, RT tagging at Willamette Falls
  - DEX tailrace residence time
    - RT monitoring, alternative trap operations
- Management forecasting
  - do not outplant, outplant only early/late
  - cold-water holding, etc.

Improved adult sampling methods @ WF

- Current Willamette Falls Trap may be selective in at least two ways:
  - Denil Steeppass
  - Samples from single entrance/ladder branch
- Improved trap near top of ladder
  - Less potential for sample bias
  - Reduced potential for adverse handling
  - Selective trapping of targeted groups including hatchery and PIT groups

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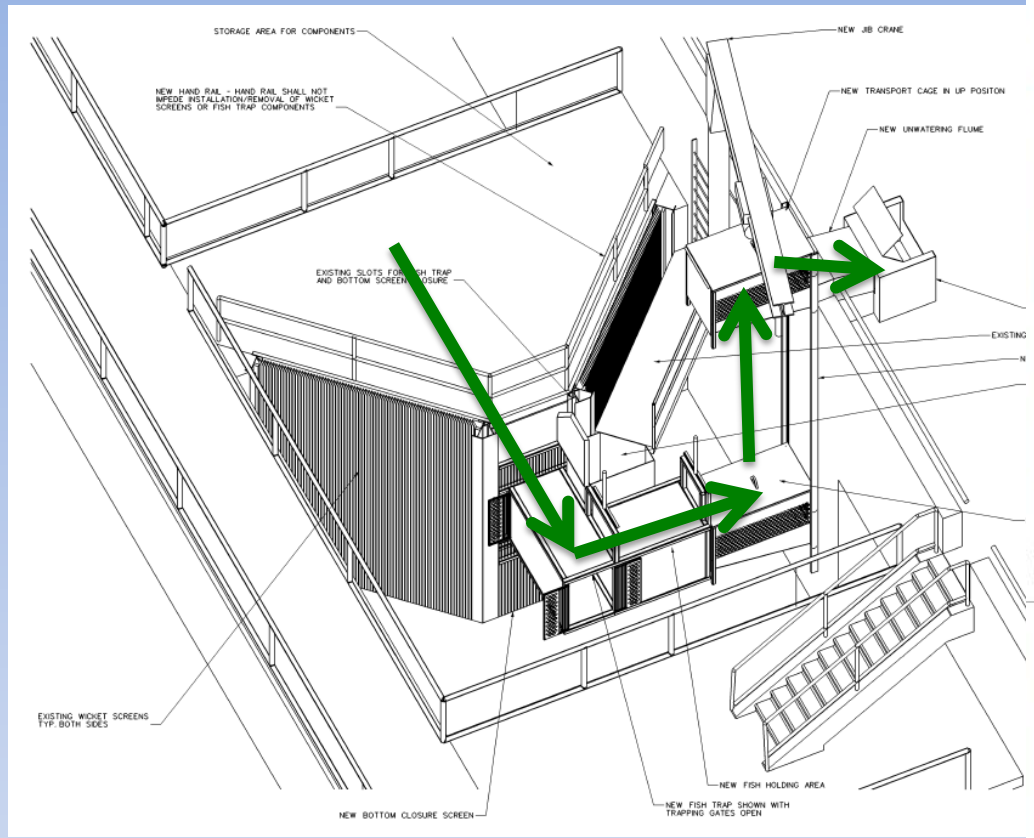

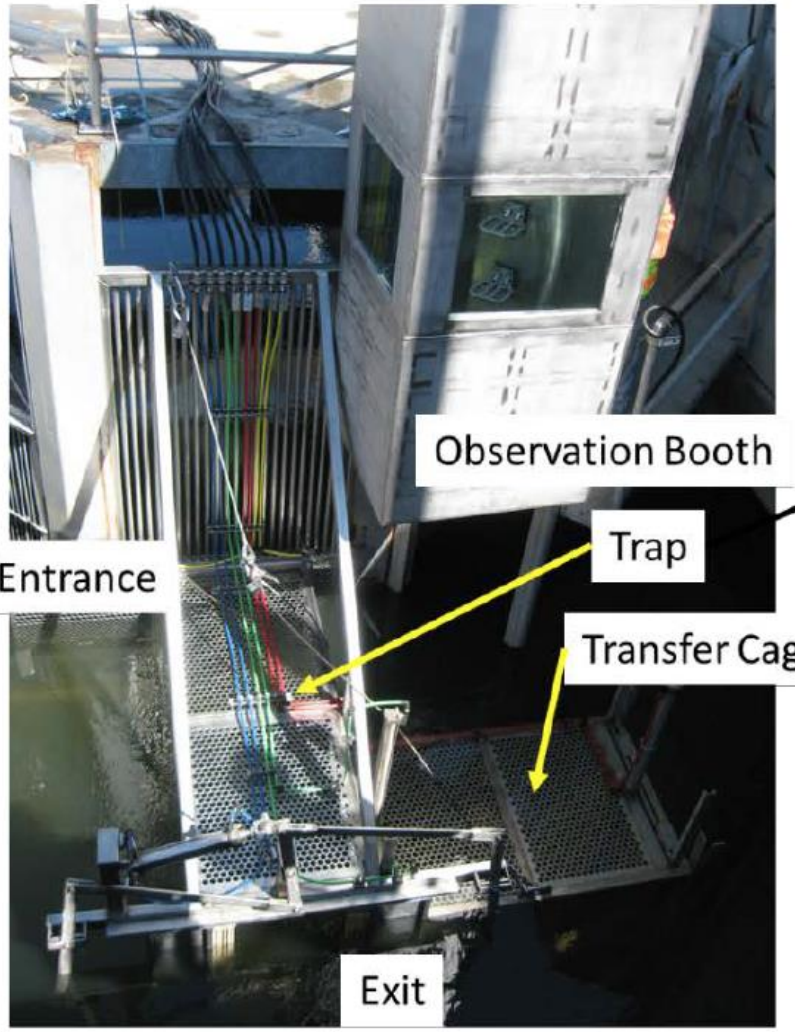

300 adult Snake River spring-summer Chinook Salmon radio-tagged in 2013 at Ice Harbor Dam

file:///Users/christophercaudill/Downloads/2014-03-Clabough-et-al-SNR-Chinook%20(1).pdf

Integrate a PIT antenna and sort-by-code system?

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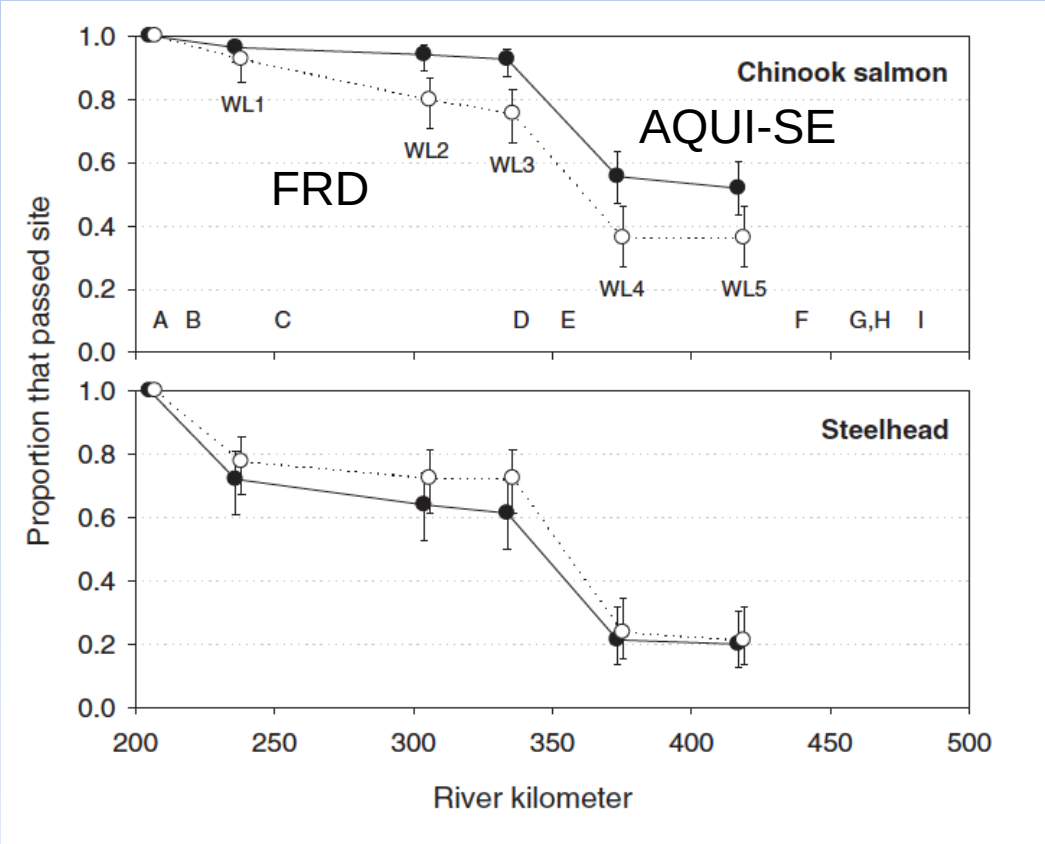
Data Gaps

- Collection, anesthetic, handling, transport effects
  - Short-term?
  - Delayed?
- Treatments
- Monitoring



Acknowledgements

ODFW

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UI

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