Conservation concerns related to recovering pinniped populations: Willamette Falls

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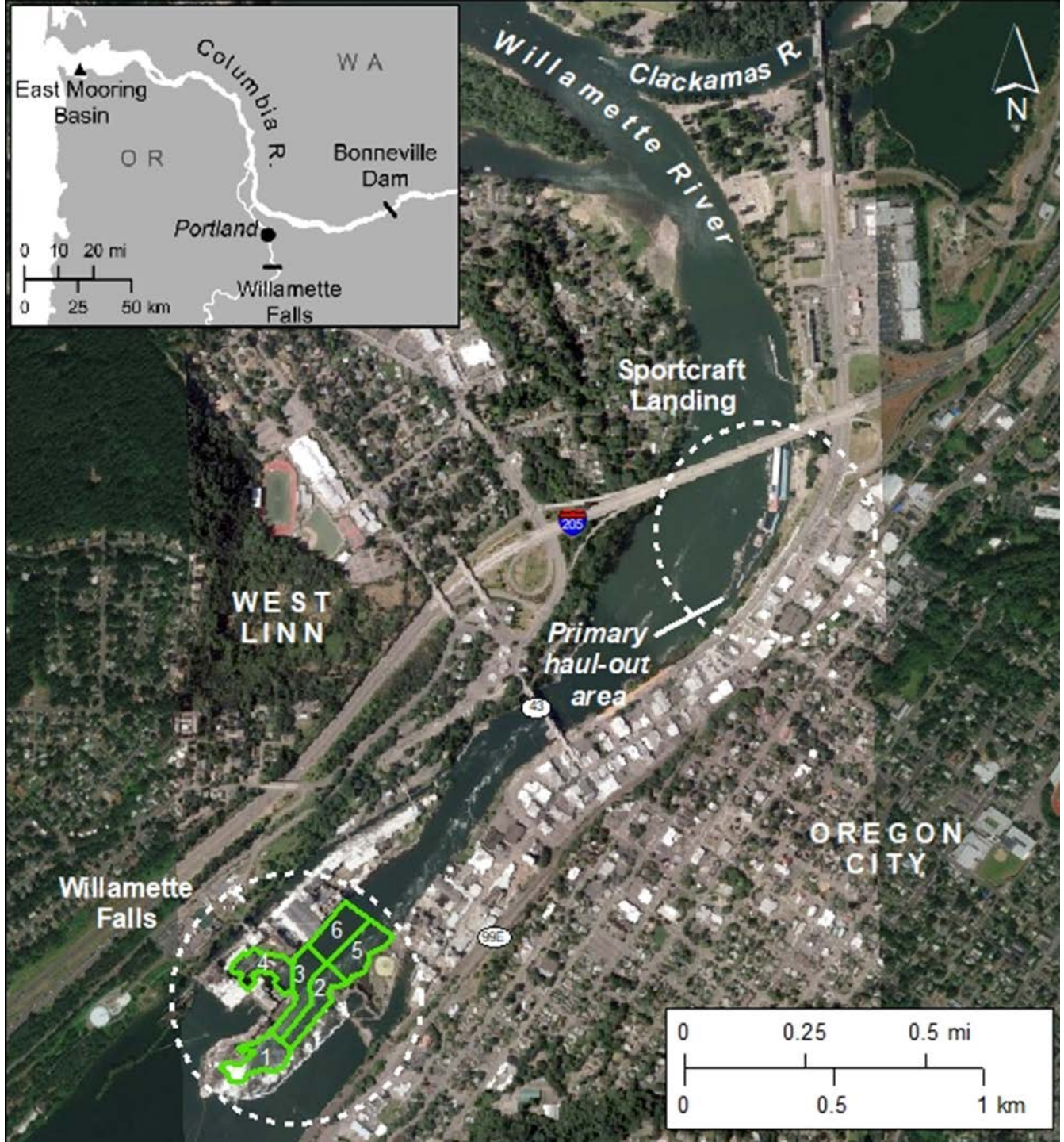


Willamette Falls

- 128 river miles (RM) from ocean
- 72 RM from Bonneville Dam
- Combination hydroelectric dam and natural falls
- Two ESA-listed native salmonid runs
- Hatchery runs, lamprey, white sturgeon
- Mostly CSLs but increasing SSLs
- Mostly artificial haul-out substrates

Timeline

1990s

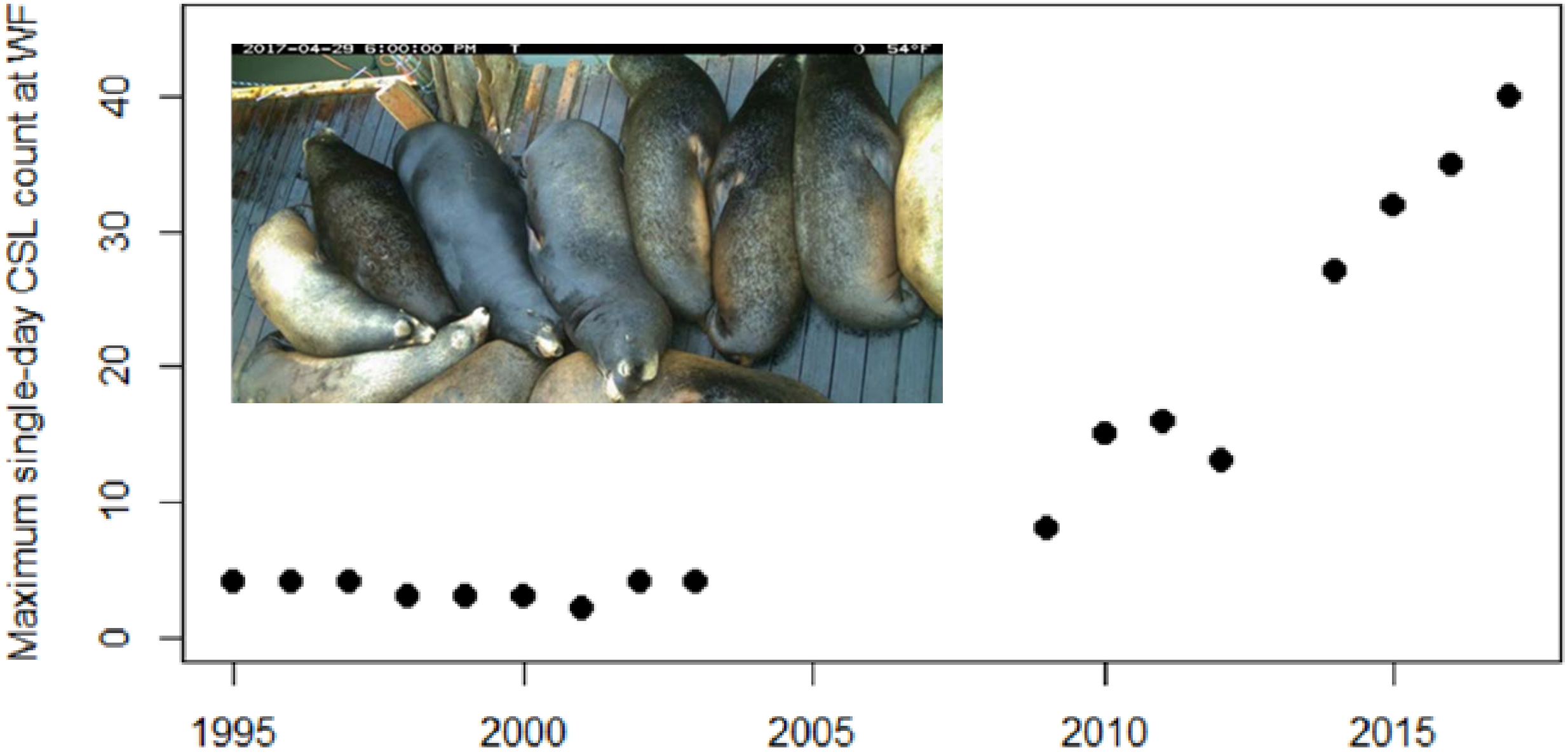
- Several California sea lions each winter/spring mid-1990s
- Limited monitoring late-1990s
- SLEDs added to fishway entrances

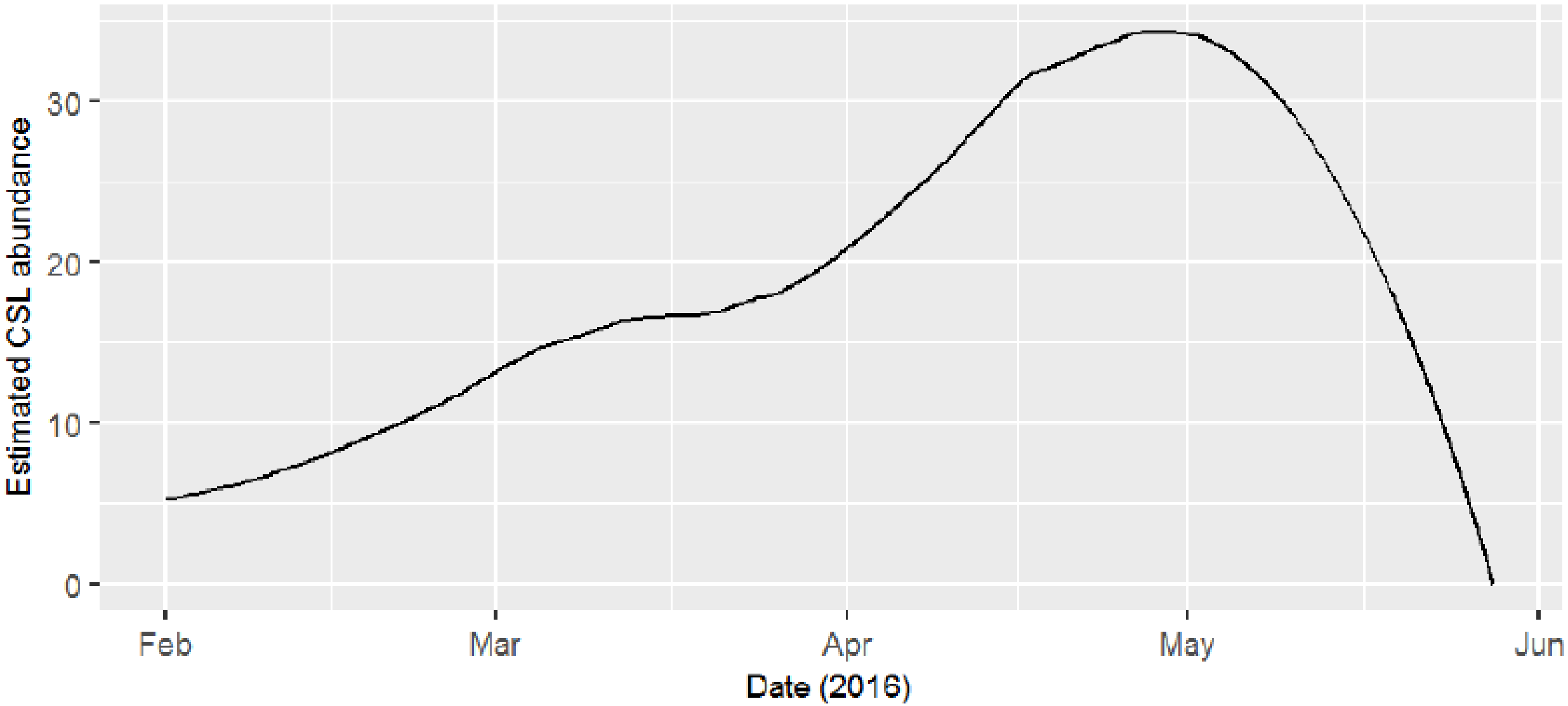
2000s

- Shifted resources to Bonneville Dam mid-2000s
- Increase in CSLs observed late-2000s
- Low winter steelhead runs late-2000s

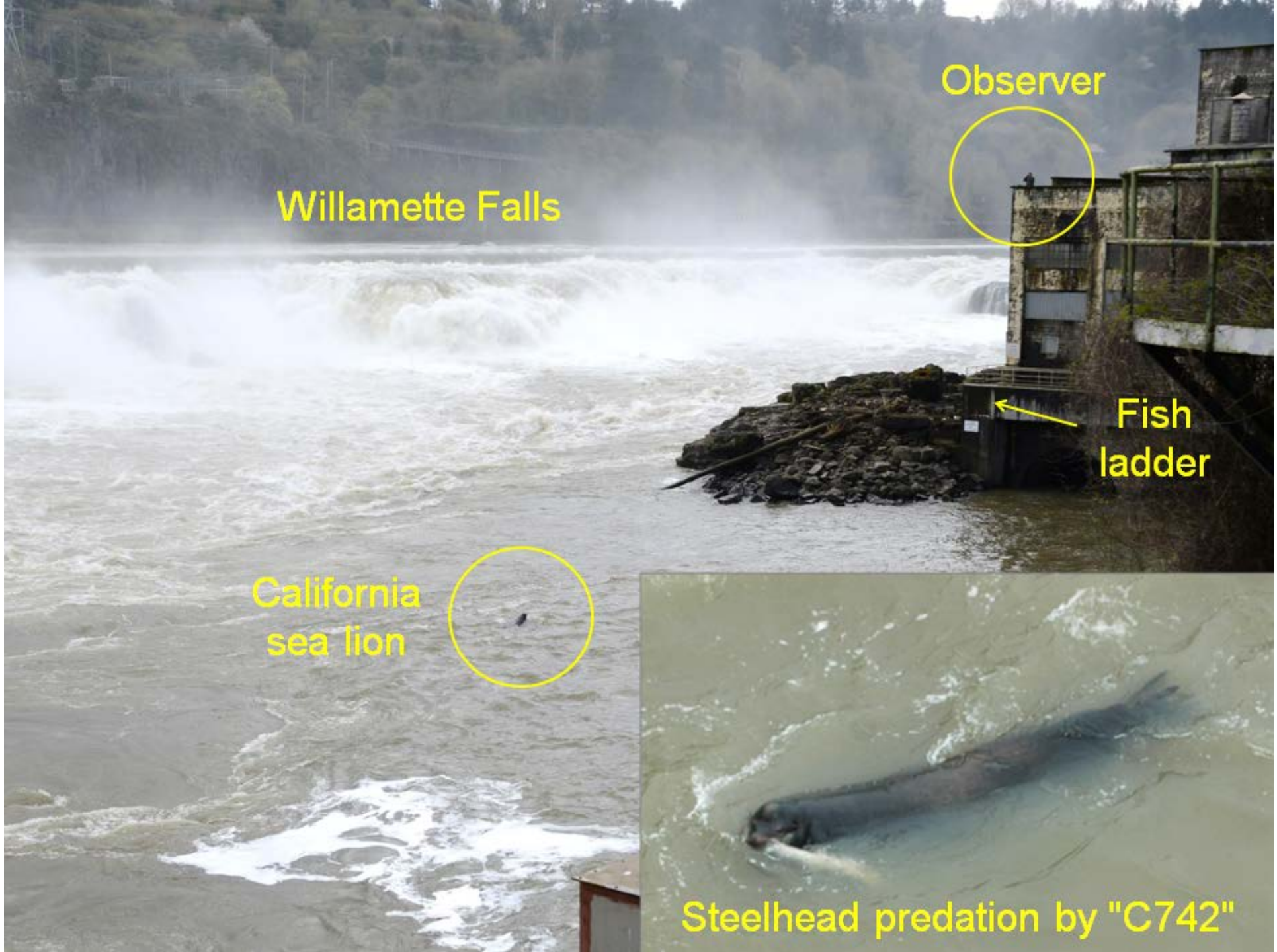
2010s

- Hazing (2010, 2011, 2013)
- Monitoring (2014-2018)
- Section 120 application (2017)
- Trapping and relocation (2018)


Maximum single-day CSL count at WF
0
10
20
30
40
1995
2000
2005
2010
2015
2017-04-29 6:00:00 PM
54°F


Estimated CSL abundance
30
20
10
0
Feb
Mar
Apr
May
Jun
Date (2016)

Winter steelhead passage
20000
10000
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015


Observer
Willamette Falls
Fish ladder
California sea lion
Steelhead predation by "C742"

Estimated salmonid predation by California sea lions

	2014	2015	2016	2017
Total salmonids	3,690	5,775	4,585	2,673
Winter steelhead (% of escapement)	780 (13%)	557 (11%)	915 (14%)	270 (25%)

**Estimates only apply to sampling frames which vary by year and have potentially substantial undercoverage of target population.*

Probabilities of extirpation (100 year PVA)

Scenario	Winter steelhead population				
Sea lion predation	N. Santiam	S. Santiam	Molalla	Calapooia	At least one extirpated*
None	2%	5%	0%	99%	6%
Low (2015)	8%	16%	0%	99%	23%
Average (2016)	27%	34%	2%	99%	53%
High (2017)	64%	60%	21%	99%	89%

* Excluding Calapooia and assuming independence

Reproducible results (data and code): www.falcy.weebly.com/pva

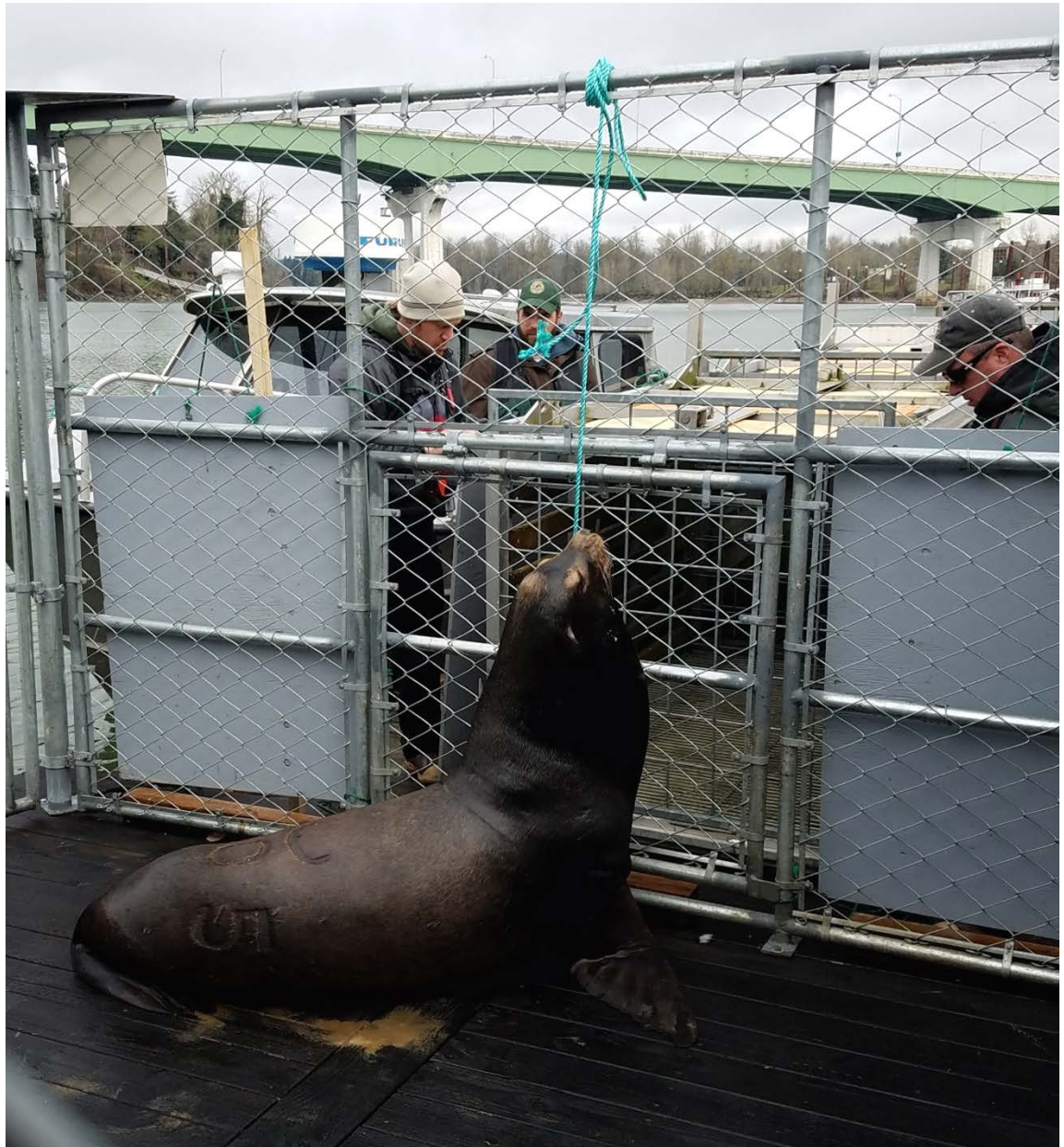
Trapping and relocation (Feb-Mar, 2018)

Objectives

- Short-term predation relief to winter steelhead
- Develop safe and effective trapping procedures

Results

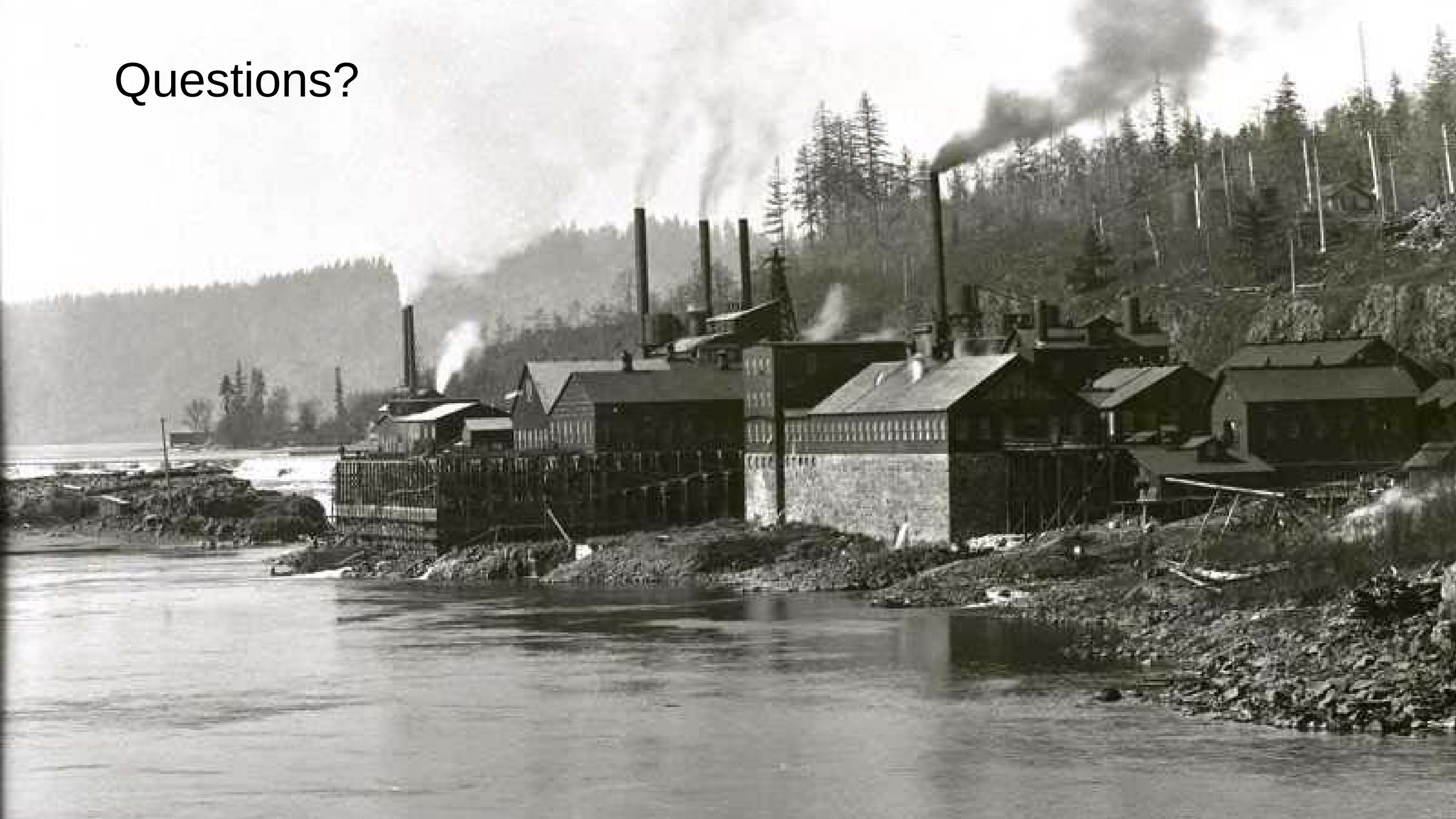
- 11 individual CSLs trapped
- 1 euthanized (Section 120)
- 10 released south of Newport (one animal twice)
- Most returned 4-6 days; maximum ~1 month



Section 120 CSL removal criteria

Criteria	Bonneville	Willamette (proposed)
Uniquely identifiable	Yes	Yes
Residency	5 days	3 days
Salmonid predation	1 fish	1 fish
“And/Or”	5 days and 1 fish	3 days or 1 fish
Exposed to hazing	Yes	No

Questions?



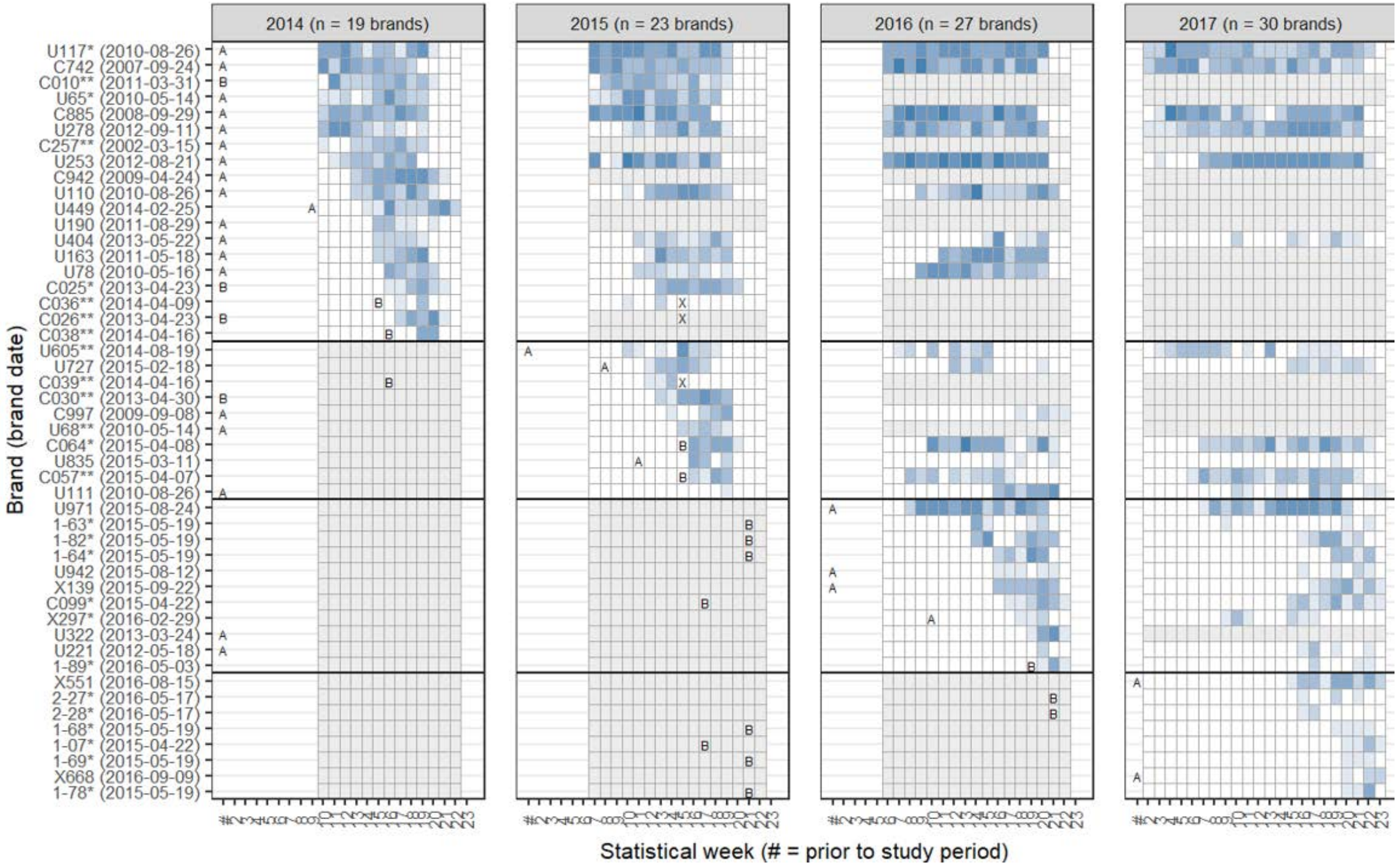

2014 (n = 19 brands)
2015 (n = 23 brands)
2016 (n = 27 brands)
2017 (n = 30 brands)
Brand (brand date)
U117* (2010-08-26)
C742 (2007-09-24)
C010** (2011-03-31)
U65* (2010-05-14)
C885 (2008-09-29)
U278 (2012-09-11)
C257** (2002-03-15)
U253 (2012-08-21)
C942 (2009-04-24)
U110 (2010-08-26)
U449 (2014-02-25)
U190 (2011-08-29)
U404 (2013-05-22)
U163 (2011-05-18)
U78 (2010-05-16)
C025* (2013-04-23)
C036** (2014-04-09)
C026** (2013-04-23)
C038** (2014-04-16)
U605** (2014-08-19)
U727 (2015-02-18)
C039** (2014-04-16)
C030** (2013-04-30)
C997 (2009-09-08)
U68** (2010-05-14)
C064* (2015-04-08)
U835 (2015-03-11)
C057** (2015-04-07)
U111 (2010-08-26)
U971 (2015-08-24)
1-63* (2015-05-19)
1-82* (2015-05-19)
1-64* (2015-05-19)
U942 (2015-08-12)
X139 (2015-09-22)
C099* (2015-04-22)
X297* (2016-02-29)
U322 (2013-03-24)
U221 (2012-05-18)
1-89* (2016-05-03)
X551 (2016-08-15)
2-27* (2016-05-17)
2-28* (2016-05-17)
1-68* (2015-05-19)
1-07* (2015-04-22)
1-69* (2015-05-19)
X668 (2016-09-09)
1-78* (2015-05-19)
#2 #3 #4 #5 #6 #7 #8 #9 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Statistical week (# = prior to study period)

Table 4. Scat (feces) and spew (regurgitation) analysis of 49 samples collected at Sportcraft Landing from 10/26/2016-4/24/2017.

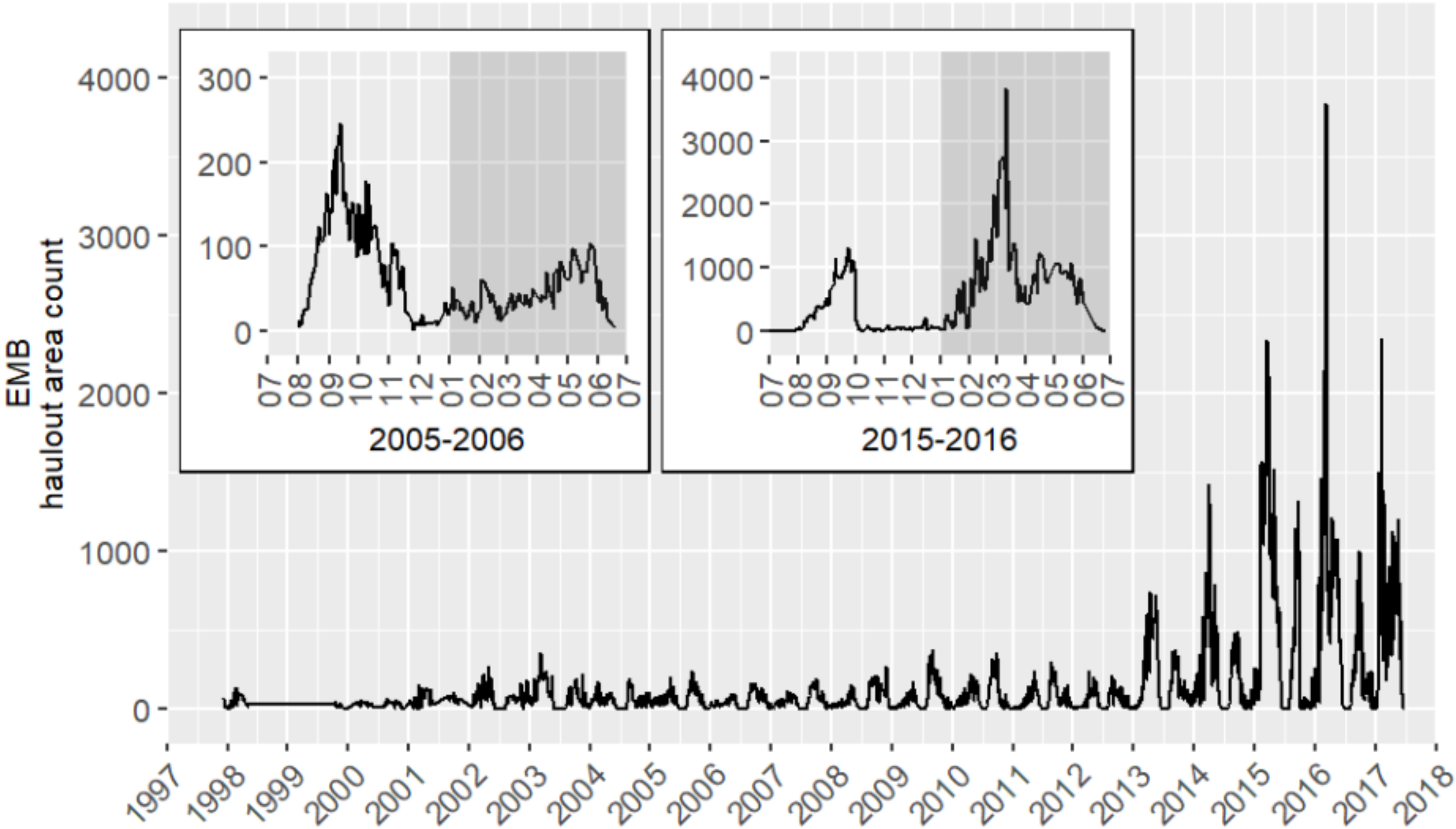
Date	Scat	Spew	Salmonid, non-juvenile	Lamprey spp.*	Salmonid, Juvenile	Unknown/ other
10/26/2016	1		1	1		
12/1/2016	1	1	2	1		
12/13/2016	1		1			
1/19/2017	2		2			1 (mackerel)
1/24/2017	2		2	1		
1/26/2017	2		2	1		
2/1/2017	7		7	3	1	
2/2/2017	4		4			
2/10/2017	2		2	2		
2/16/2017	1		1	1		
2/24/2017	1		1			
3/1/2017	2		2	2		
3/15/2017	4		4	3		1 (unknown)
3/31/2017	4	1	5	2	1	
4/4/2017	1	1	1	1		1 (rockfish)
4/14/2017		9		9		
4/24/2017		2	1	2		
Total (%)	35	14	38 (78%)	29 (59%)	2 (4%)	3 (6%)

*Primarily Pacific lamprey but also other lamprey remains that could not be identified to the species level.

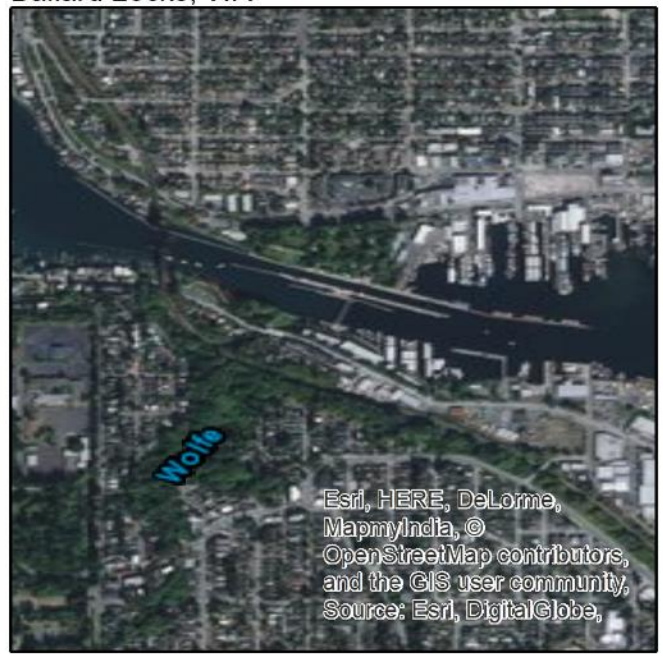
Table 5. Summary of California sea lion predation on salmonids extrapolated to river strata in 2017 based on relative amounts of predation observed between the two strata in 2014-2015. Note, however, that the 2014-2015 estimates themselves represent less temporal coverage than 2016-2017 (see Figures 1-3 and Appendix A).

Year	Stratum	Estimated California sea lion salmonid take	% California sea lion salmonid take	Site-adjusted % California sea lion salmonid take
2014	Falls	1,842	50%	60%
	River	1,848	50%	40%
		3,690	100%	100%
2015	Falls	3,620	63%	
	River	2,156	37%	
		5,775	100%	
2016	Falls	4,585		
	River	*2,870**		
		*7,455**		
2017	Falls	2,673		
	River	*1,615**		
		*4,288**		

*Extrapolations based on 2014 and 2015 estimates.


EMB
haulout area count
4000
3000
2000
1000
0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
300
200
100
0
07
08
09
10
11
12
01
02
03
04
05
06
07
2005-2006
4000
3000
2000
1000
0
07
08
09
10
11
12
01
02
03
04
05
06
07
2015-2016

Ballard Locks, WA



Willamette Falls, OR

Bonneville Dam, OR/WA

Rogue River/Gold Beach, OR

Count statistics

$$\widehat{N} = \frac{C}{\hat{\alpha}\hat{\beta}}$$

- *C* = number of sea lions or fish killed (observed)
- *N* = true number of sea lions or fish killed (estimated)
- α = sampling fraction (known or estimated)
- β = probability of detection (estimated)

Williams, Nichols, and Conroy 2002