UWR Chinook salmon and UWR steelhead Harvest Management

Presenter: Tucker Jones

Corresponding Summary Page(s): 8-11

UWR Chinook salmon and UWR steelhead Harvest Management

20 August 2018

Oregon Department of Fish and Wildlife

Outline for Today

- State/federal authorities outlining freshwater fishery management of UWR steelhead/Chinook
- Implementation of federal and state authorities
- How fisheries are monitored
- Fisheries impacting UWR steelhead and Chinook
- Performance of fisheries as they pertain to ESA impact limits

State/Federal Authorities

- Fisheries Management and Evaluation Plans (FMEPs)
  - Upper Willamette River Winter Steelhead in Sport Fisheries of the Upper Willamette Basin
  - Upper Willamette River Spring Chinook in Freshwater Fisheries of the Willamette Basin and Lower Columbia River Mainstem.
- OFWC has statutory authority to adopt rules regulating fisheries (ORS 496.138, 506.119 and 506.129).

Authority Implementation
(Federal and State)

- Federal:
  - Fisheries actively managed by states
  - Agency submits annual reports to NOAA Fisheries pursuant to Steelhead and Chinook FMEP requirements.
- State:
  - Commission adopts fishing regulations
  - Annually for permanent rules via the Sport Fishing Regulation Book, and
  - As needed via temporary rules for in-season actions
  - Commission established management objectives and rules specific to Willamette River subbasins in OARs, Division 500

Authority Implementation
(Federal and State)

- State (cont):
  - Objectives relate to wild fish and harvest, escapement goals for hatchery fish, and allocation of harvestable surplus hatchery fish.
  - Commercial regs adopted via temp rule.
  - Recreational fisheries typically operate under permanent regulations (Mods, when necessary, via temp rule).
    - E.G., 2017 recreational fisheries below Willamette Falls were restricted (open days per week and bag limit) late in the season when abundance expectations were in question.

Fisheries Monitoring - Sport

- Long history of recreational fisheries monitoring (1968 for CR and 1974 for WR)
- 3 main components of estimating sport harvest: Effort, catch rates and stock composition.
  - Effort determined by aerial surveys, boat, trailer and rod counts
  - Catch and stock composition is determined by creel surveys, angler interviews and fish interrogations
- Creel conducted 7d/week March - June
- All harvested fish examined for CWT and fin marks

Fisheries Monitoring - Commercial

- Also a long history of commercial fisheries monitoring dating back to 1967
- 3 main components of estimating commercial harvest: Total landings, average weight and stock composition.
  - Total landings in pounds from fish tickets
  - Average weight and stock composition is determined by sampling fish at commercial fish buyers/processors
  - Composition of released catch determined by onboard observers
- Sampling occurs during open fisheries and targets 20-30% of the landed catch

Fisheries in Question

- 5 primary fisheries with potential to impact UWR winter steelhead and spring Chinook
  - LCR mainstem sport
  - LCR mainstem commercial
  - Off-Channel commercial
  - LWR and Clackamas sport, and
  - UWR sport
- We will focus on 1st four.

LCR Mainstem Sport Fisheries

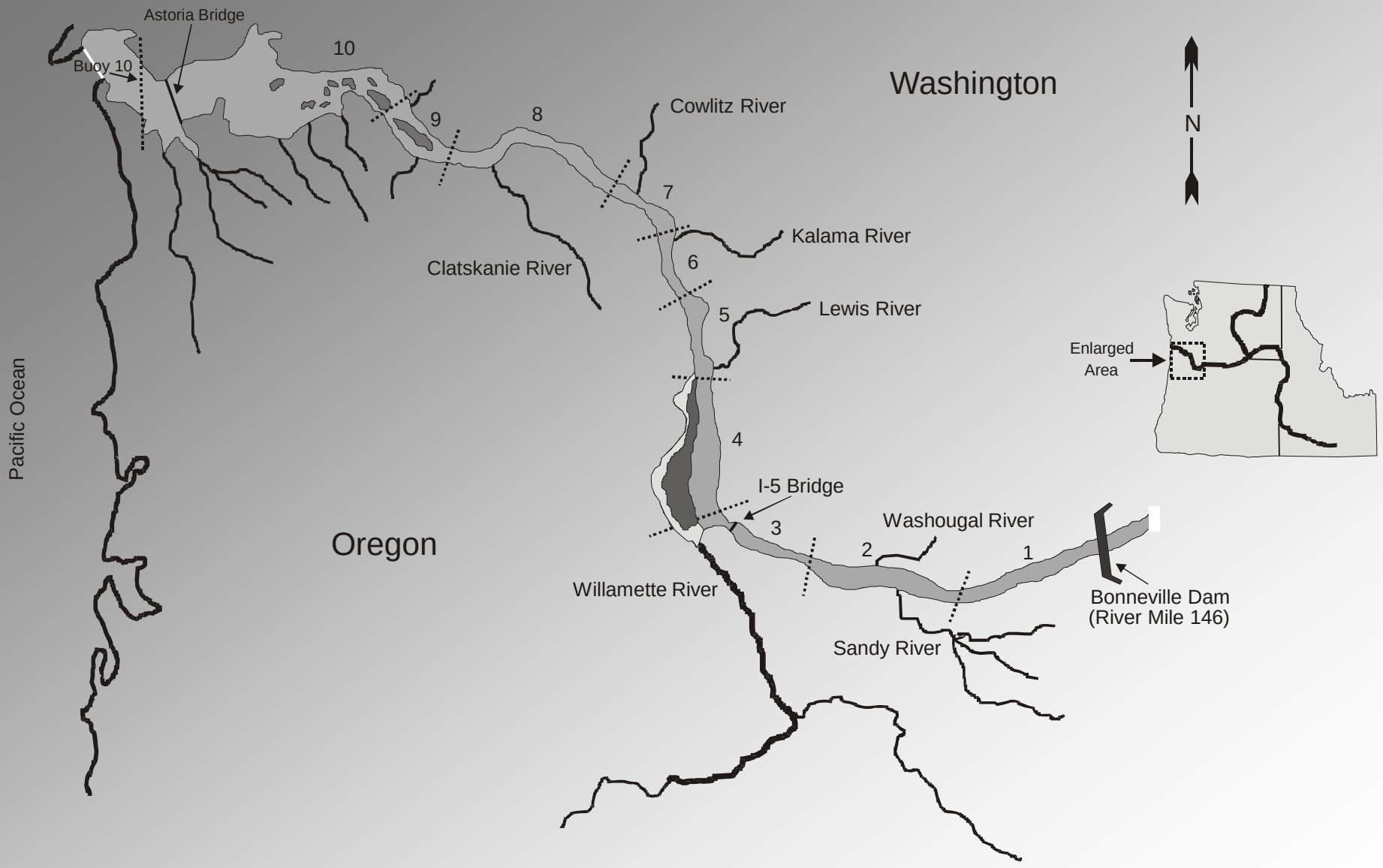
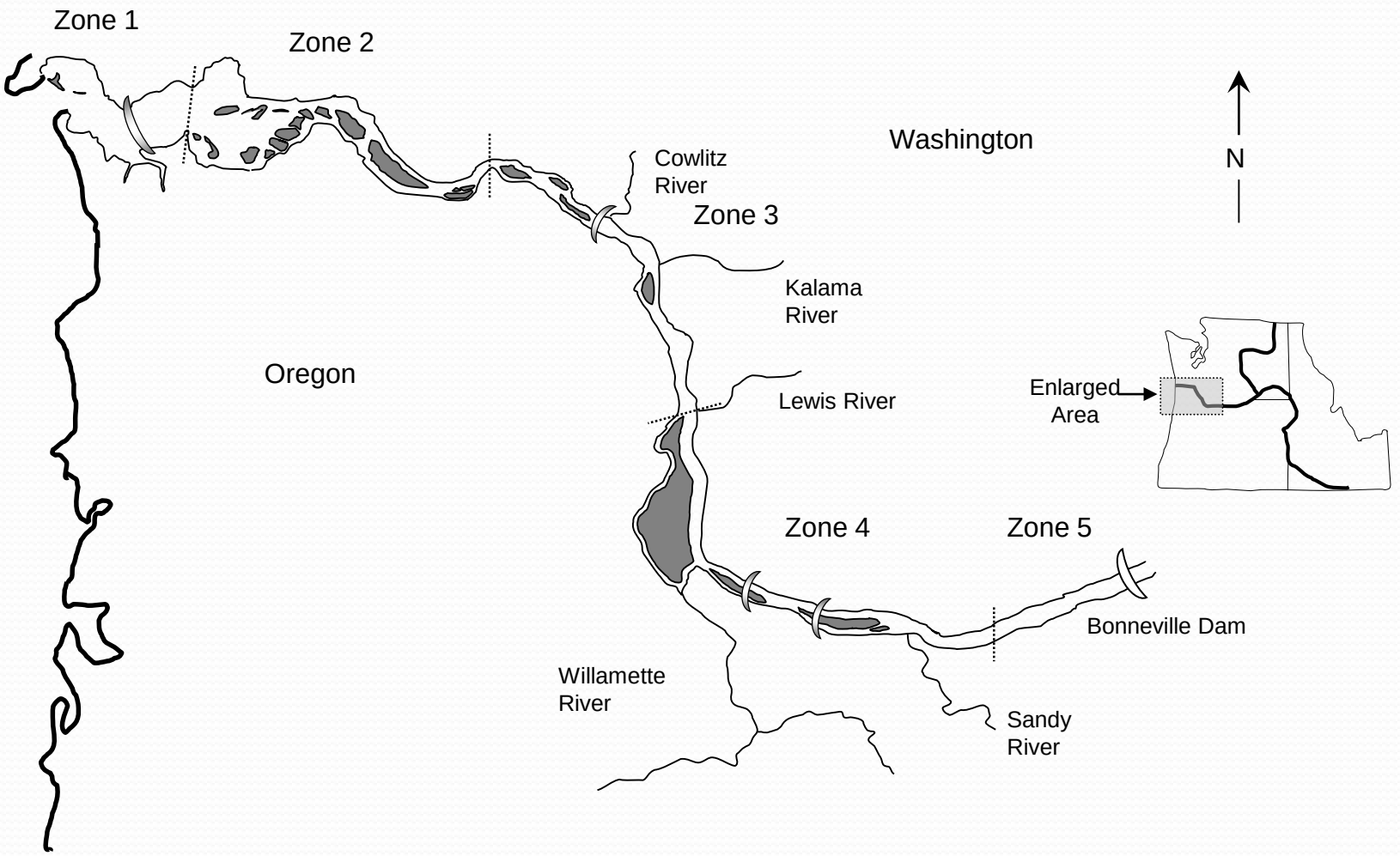


Figure 1. Recreational Sampling Sections on the Columbia River Below Bonneville Dam

LCR Mainstem Sport

- LCR mainstem sport – Permanent Regs
  - Hatchery steelhead: Tongue Point to Bonneville 1/1 – 3/31
  - Hatchery Chinook: Buoy 10 to I-5 bridge, 1/1 – 3/31
  - Time (STW and CHS) and area (CHS) expansions when run size allows
  - 10-year avg angler trips = 105,000 (majority ~58,000 in April)
  - Hatchery steelhead kept catch avg = 820
    - ~ 45 unclipped steelhead mortalities (aggregate)
  - Hatchery Chinook kept catch (Willamette) ~ 2,300

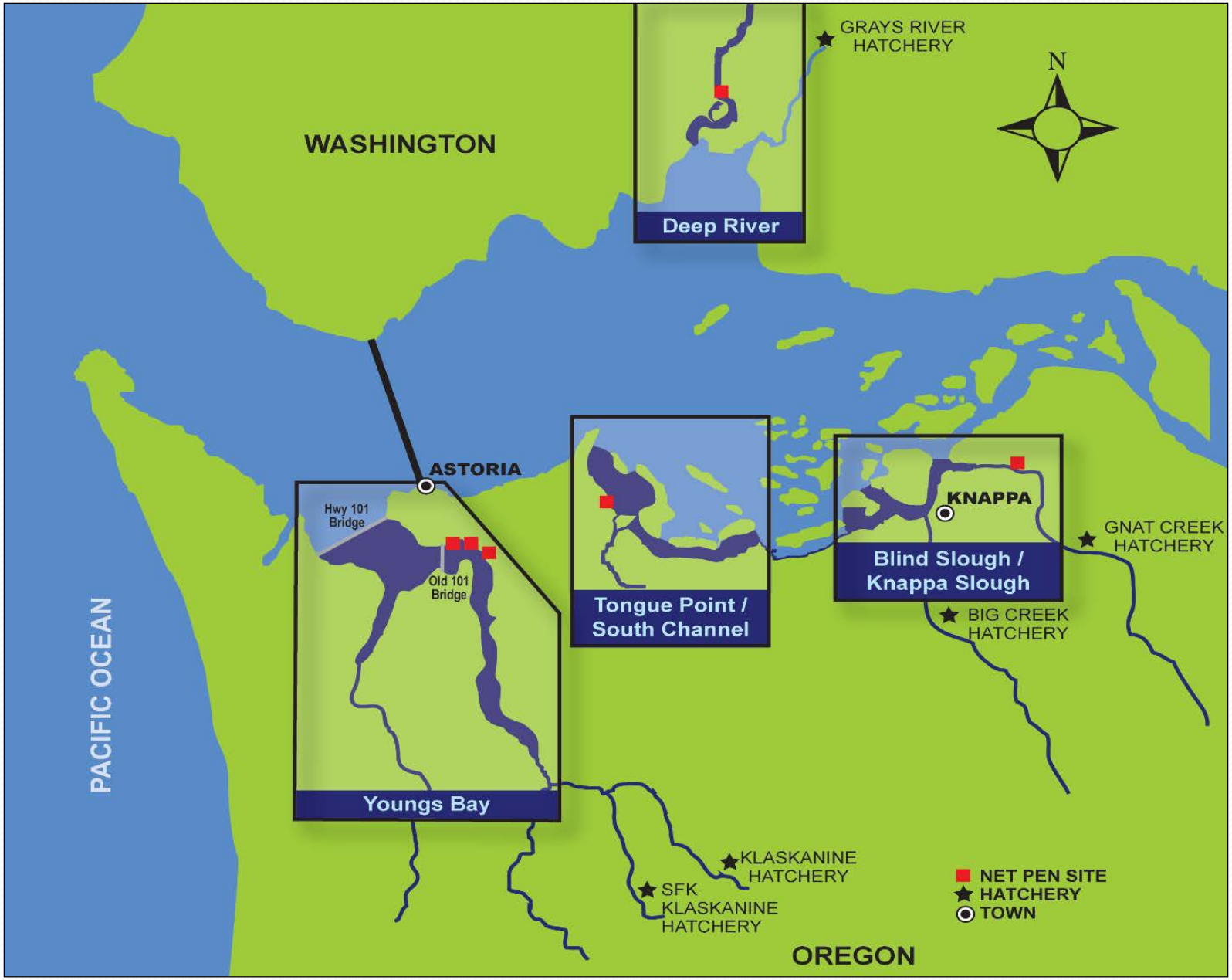
LCR Commercial Fisheries



LCR Mainstem Commercial

- LCR mainstem commercial – via temp rules
  - Steelhead: retention not allowed
  - Hatchery Chinook: Zones 1-5, late Feb thru mid-June
    - No mainstem commercial fisheries in 2017 or 2018
    - Outlook for future is unknown
  - Natural origin Steelhead mortalities avg = 42
    - Aggregate estimate (UWR unknown)
  - 2008-2016 average Hatchery Chinook landings = 5,150
  - Expected participation 40 – 180 fishers

Off-Channel Commercial Fisheries



Off-Channel Commercial

- Select Area commercial
  - Terminal locations in the lower Columbia River
  - Steelhead: retention not allowed
    - Steelhead handle expected to be de minimis
    - Any STW handle expected to be SW WA DPS
  - Chinook: Target local origin hatchery CHS
    - 10-year avg. = 880 Willamette-origin CHS
    - 10-year total harvest avg. = 10,900

LWR Sport Fisheries

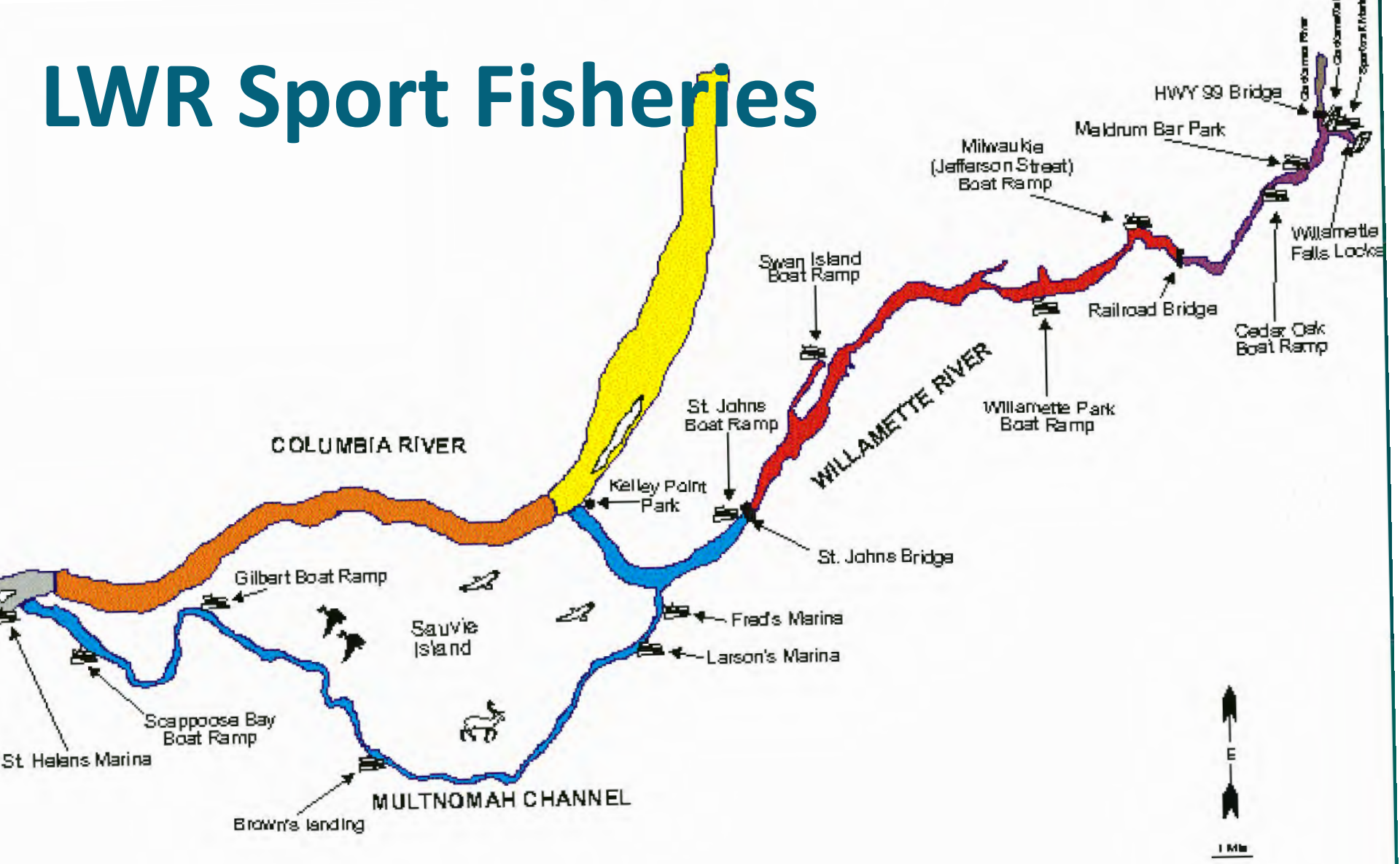


Figure 1. Sampling Stations and River Sections on the Willamette and Clackamas Rivers and River Sections on the Columbia River.

LWR and Clackamas Sport

- Lower Willamette and Clackamas rivers – Perm regs
  - Hatchery steelhead and Chinook retention allowed Jan-Dec
    - Bulk of effort occurs March – June (Chinook focus)
  - 10-year avg angler trips = 81,000 (Willamette) and 5,500 (Clackamas)
  - Hatchery steelhead kept catch avg = 650 (Willamette) and 520 (Clackamas)
    - ~ 45 unclipped steelhead mortalities (aggregate)
  - Hatchery Chinook kept catch = 11,000 (Willamette) and 380 (Clackamas)

ESA Impacts – Winter Steelhead

- ESA impact limits outlined in FMEPs for wild winter steelhead (20%/10%)
- Steelhead impacts downstream of the Falls estimated at 0-3% annually, upper WR fisheries avg 1.2%

ESA Impacts – Spring Chinook

- ESA impact limit outlined in FMEP for wild spring Chinook is 15%
- Recent year averages have ranged 8-12%

Combined CR/WR annual mortality rate

Period	’02-06	‘07-11	’12-16	2017
AMR	11.2%	10.4%	8.5%	4.9%

ESA Impacts – Spring Chinook

- Switch in 2001 to M/S Fisheries greatly reduced fishery impacts to UWR spring Chinook
- Pre/Post ~ 75% reduction (~25% vs ~5%) in annual harvest rate as measured in Willamette fisheries

Willamette River Annual Mortality Rates by decade

Period	1950s	1960s	1970s	1980s	1990s	2000s	2010s
AMR	25.1%	27.0%	29.7%	24.2%	19.3%	5.0%	3.6%

Conclusions

- States have delegated and self-derived authority to manage fisheries
- Fisheries are actively managed to stay within federally set impact limits
- Hatchery spring Chinook fishery is robust, with minimal impacts to wild spring Chinook
- Minimal to non-existent winter steelhead fisheries in much of the range
- Fisheries impacts to both stocks are well below limits, are not impeding recovery, and are not contributing to further declines

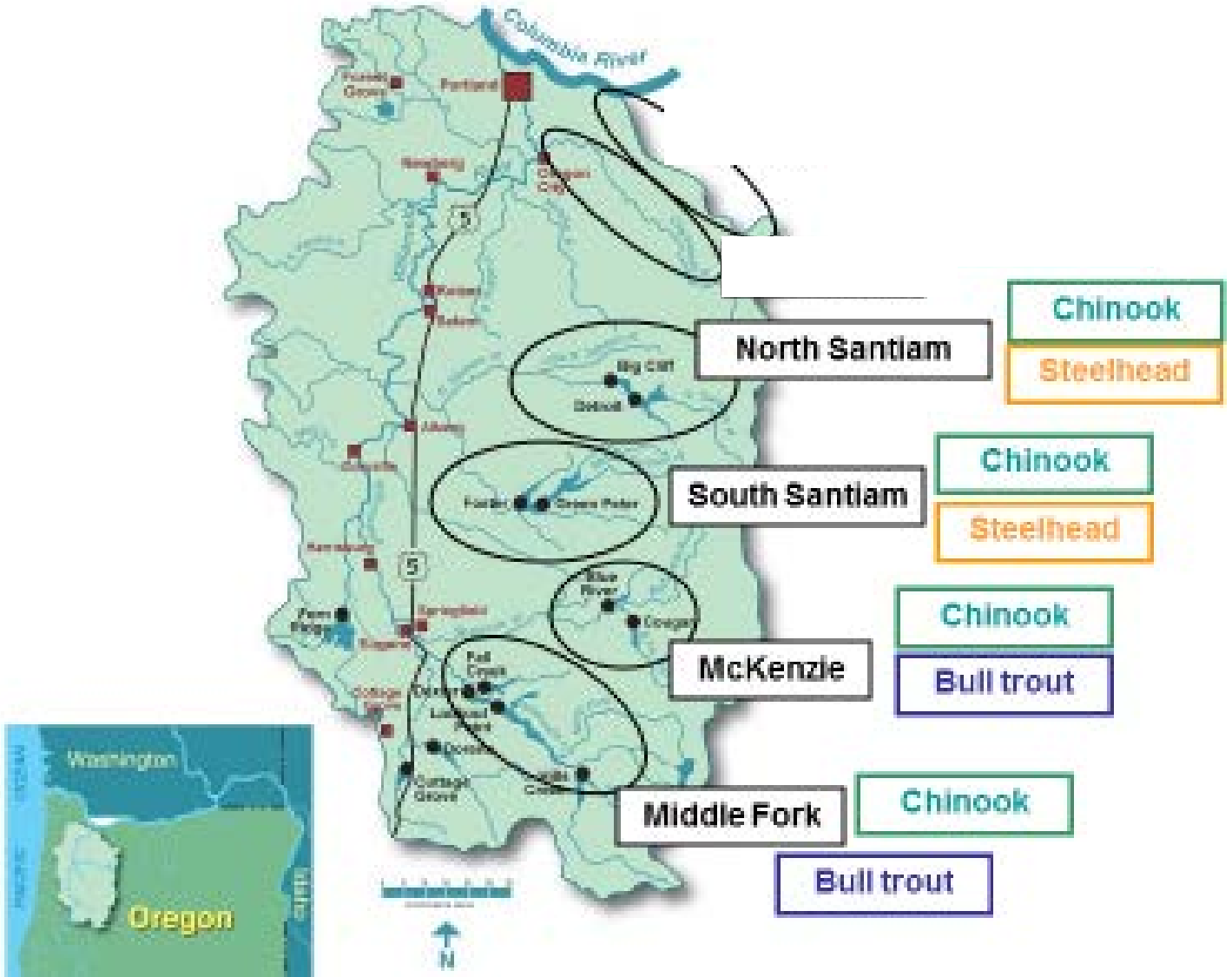
QUESTIONS?

UWR Chinook salmon and UWR steelhead Hatchery Management

Presenter: Shaun Clements

Corresponding Summary
Page(s): 11-13

WILLAMETTE BASIN | HATCHERY PROGRAM

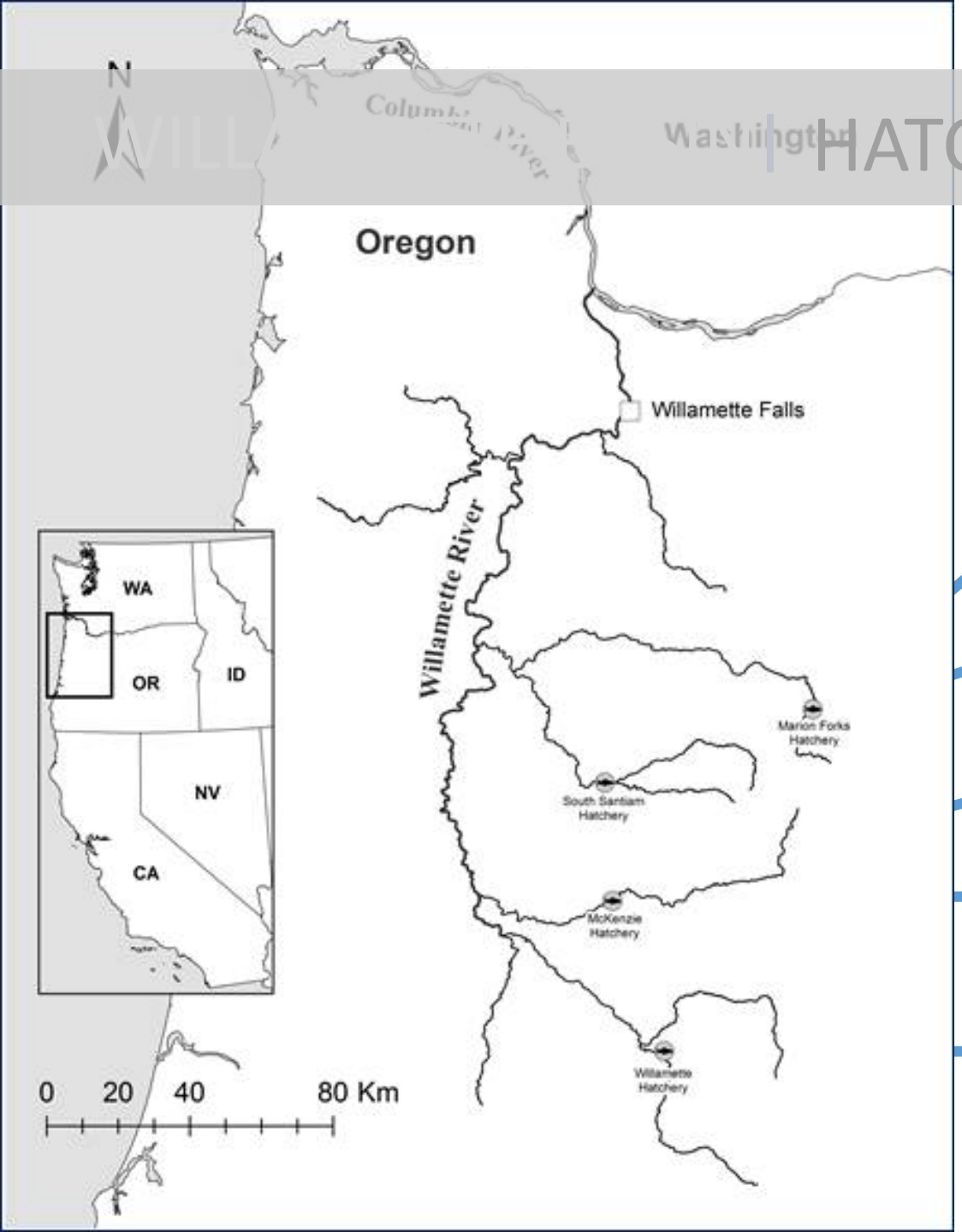


- Mitigation for dam construction
- Programs approved under HGMP

WILLAMETTE BASIN | HGMPs

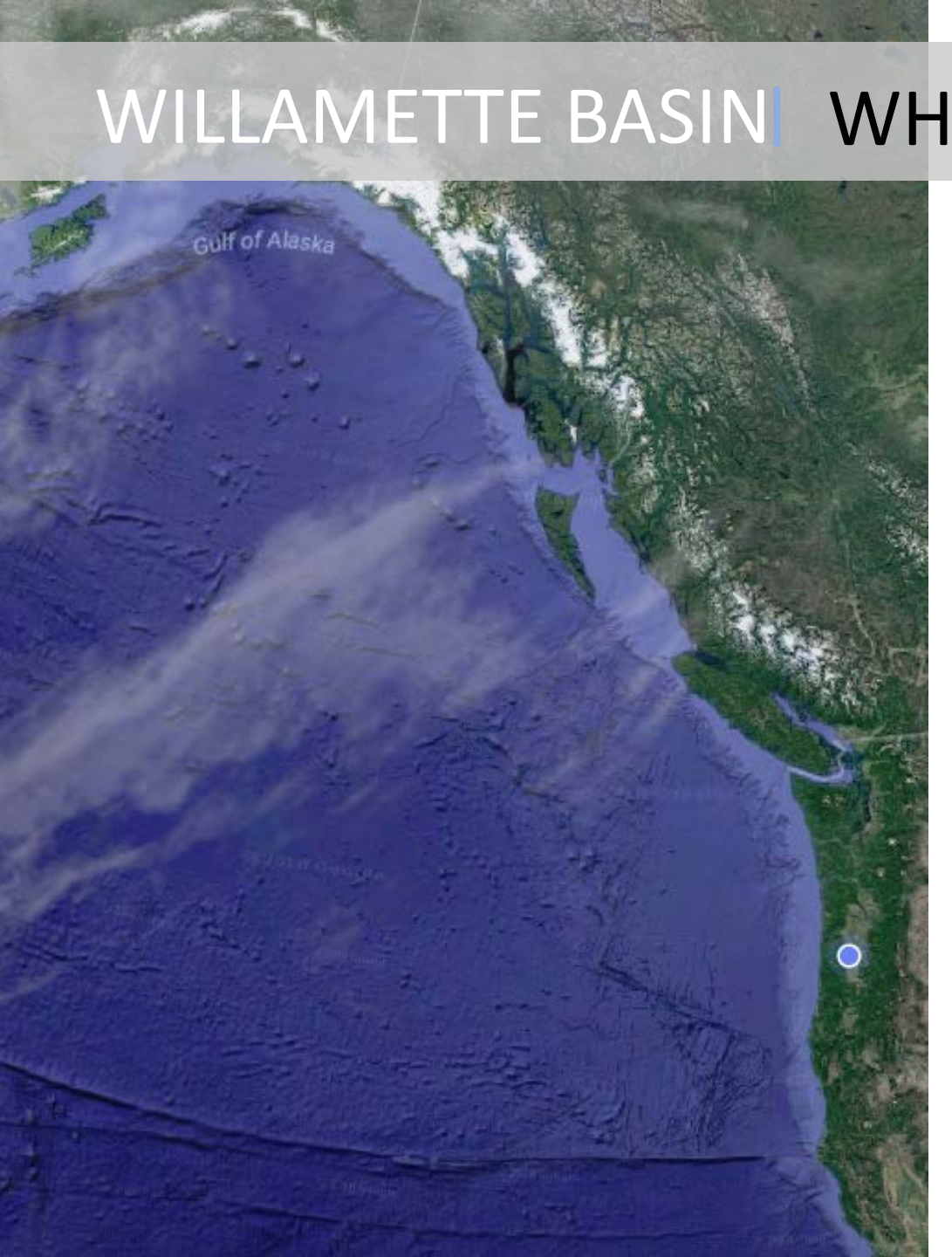
- Describe the composition and operation of each program
- Reviewed by NMFS to ensure consistency with recovery of ESA listed stocks
- https://www.dfw.state.or.us/fish/HGMP/final.asp

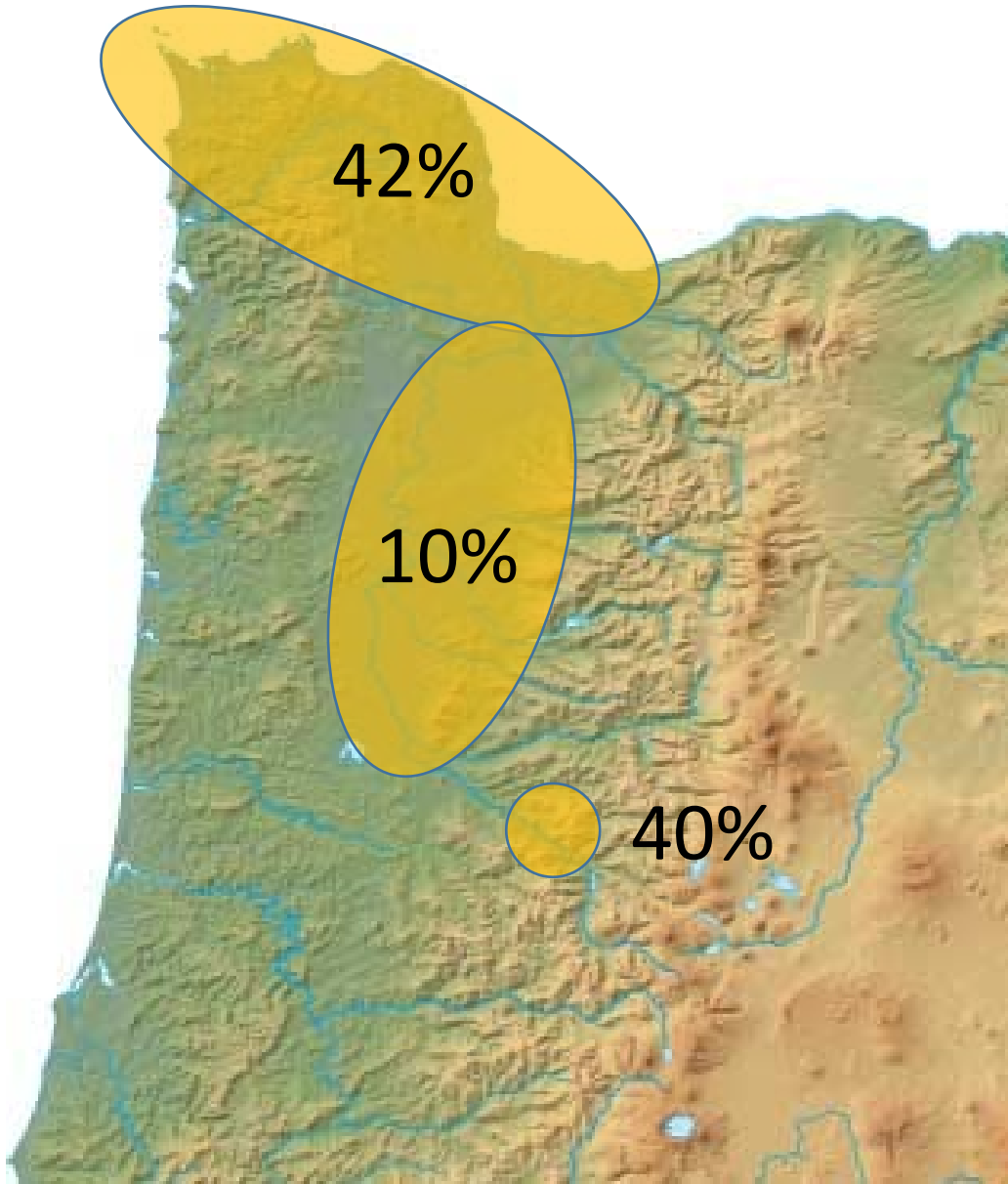
HATCHERY RELEASES



	Spring Chinook	Summer Steelhead
Willamette Falls	704,000	121,000 → 90,000
Willamette River	1,021,000	161,500 → 120,000
Marion Forks Hatchery		108,000
South Santiam Hatchery	605,000	
McKenzie Hatchery		
Willamette Hatchery	1,939,000	157,000

WILLAMETTE BASIN | WHERE DO THE FISH GO?





Comprehensive recovery strategy for UWR Chinook salmon and UWR steelhead

Presenter: Bernadette Graham-Hudson

Corresponding Summary
Page(s): 13-15

Comprehensive Recovery Strategy

Threats, Limiting Factors, and Actions

- Flood Control/Hydro
- Habitat
- Hatchery
- Harvest
- Other species

Limiting Factors

Identified as key and secondary limiting factors for each life stage and subbasin

- Flood Control/Hydropower Management
- Land Management – estuary, freshwater
- Harvest Management
- Hatchery Management
- Other species – estuary, above Willamette Falls

Table 5-7. Key and secondary LFTs to the recovery of all populations in the UWR Chinook ESU. Bolded codes are key concerns and non-bolded codes are secondary concerns. Codes are in Table 5-9. The codes for Clackamas Chinook are subordinate to the codes used for this population in the OrLCR Plan; the code usage here is for tracking purposes of the LFTs. Black cells indicate where life stage is not present. Abbreviations

Table 5-8. Key and secondary limiting factors to the recovery of all populations in the UWR Steelhead DPS. Bolded codes are key concerns and non-bolded codes are secondary concerns. Codes are in Table 5-9. Abbreviations for populations are: Molalla=MO, North Santiam=NS, South Santiam=SSA, Calapooia=CA.

Threats	Population	Natal Subbasin (Tributaries and lakes within population area)								West-side tributaries	Mainstem Willamette (Above falls)			Estuary (Below Bonneville Dam and Willamette Falls)			Ocean
		Egg / Alevin	Fry	Summer parr	Winter parr	Smolt	Adult	Spawner	Kelt	Parr	Parr	Smolt	Adult	Parr	Smolt	Adult	Adult
Flood control/ hydropower Management	MO																
	NS	**10a,** 7bc, 9d		**10d**		**1d**	**2b**		2i				**10c**		**5ab 7h, 8a, 10f,** 9j		
													10d				
	SSA	**10e,** 7d, 9e				**1e**	**2c**		2j				**10c**				
													10d				
	CA												**10c**				
													10d				
Land Management	MO	7a	9ah, 10b		**8a,** 9hi	9hi					9hi				**5a,** 8a, 9ahi		
			2a														
	NS		9ah 10b		**8a,** 9hi	9hi					**9hi,** 8a		9hi				
			2a														
	SSA		9ah, 10b		**8a,** 9hi	9hi											
			2a														
	CA		9ah, 10b		**8a,** 9hi	9hi		2h									
			2a														
Other Species	MO														6e		
	NS																
	SSA		**6b**														
	CA																
Harvest Management	MO																
	NS																
	SSA																
	CA																
Hatchery Management	MO																
	NS		**4c**					3a							4a		
				4d													
	SSA		**4c**														
				4d													
	CA																
Hatch Manage	SSA							3a							4a		
	CA																
	MK			6cd													
	MF																

Major Strategies and Actions –Flood Control/Hydropower

- Willamette Project BiOp actions, FERC agreements
  - upstream and downstream passage
  - temperature control and flow modification
  - revetments and other physical habitat (mainstem projects)

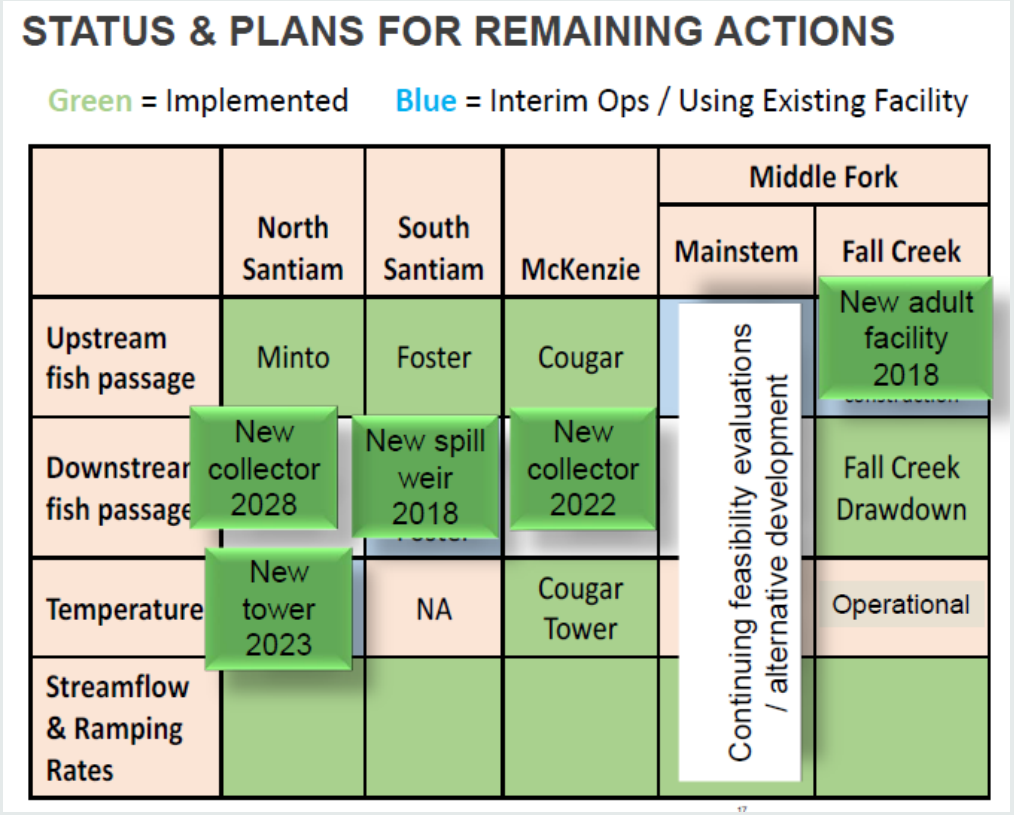
- FCRPS BiOp actions for estuary impacts

Flood Control/Hydropower Accomplishments

- **Clackamas**
  - PGE designed and implemented downstream fish passage structures at River Mill (2012) and North Fork (2015) dams
  - PGE designed and implemented the North Fork Adult Trapping and Sorting Facility (2013)
- **North Santiam**
  - Minto Adult Fish Facility completed in 2013
  - Operational temperature control to reduce PSM
- **South Santiam**
  - Foster Adult Fish Facility completed in 2014
  - Foster Fish Weir completed 2018
- **McKenzie**
  - Temperature control tower at Cougar Dam completed in 2005
  - Cougar Adult Fish Facility completed in 2010
- **Middle Fork Willamette**
  - Annual winter drawdown operation at Fall Creek Dam
  - Fall Creek Adult Fish Facility completed 2018
- Outplanting site improvements
- RME to inform passage actions, reintroduction efforts, etc.

Flood Control/Hydropower Remaining Actions

- **North Santiam**
  - Downstream passage at Detroit/Big Cliff dams (RPA deadline 2023)
  - Temperature control at Detroit/Big Cliff dams (RPA deadline 2018)
- **South Santiam**
  - Fish passage RME to inform improvements at Green Peter dams
- **McKenzie**
  - Downstream fish passage improvements at Cougar Dam (RPA deadline 2014)
- **Middle Fork Willamette**
  - Dexter Adult Fish Facility (RPA deadline 2014)
  - Downstream fish passage improvements at Lookout Point and Dexter dams (RPA deadline 2021)
- **RME to inform passage actions, reintroduction efforts, etc.**



Major Strategies and Actions - Habitat

Freshwater Habitat Actions

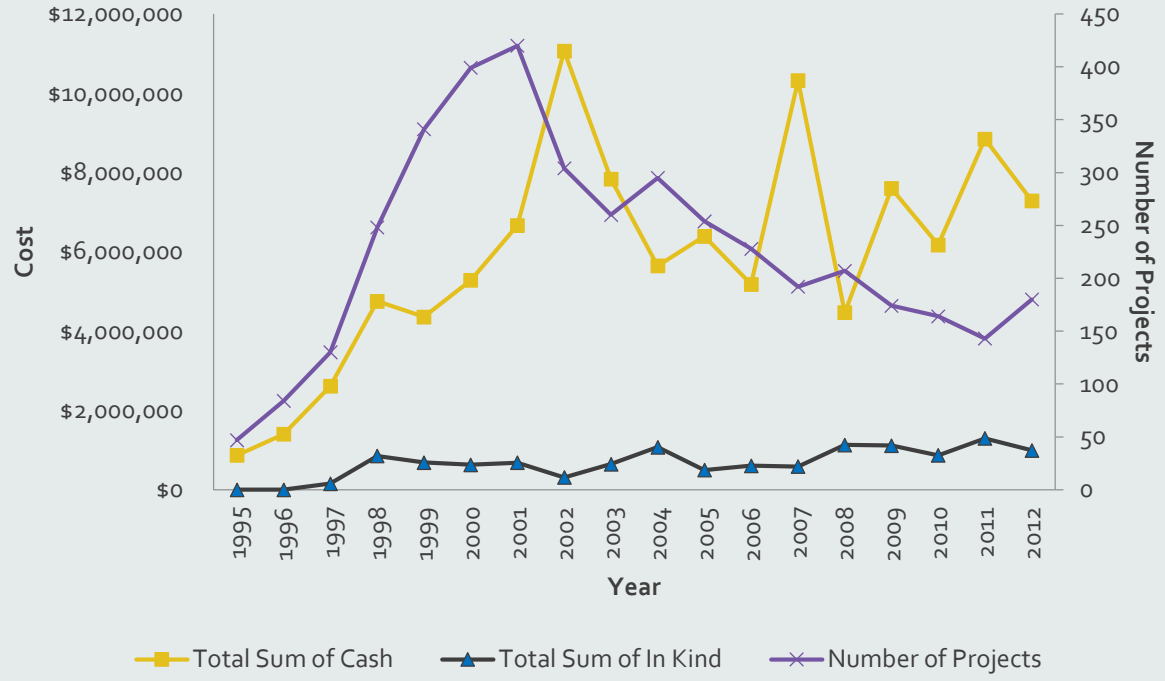
- ODEQ TMDL Water Quality actions
- Best Management Practices, State/Federal guidelines
- Voluntary protective and restoration actions

Estuarine Habitat Actions

- NMFS Lower Columbia Estuary Recovery Plan

Habitat Accomplishments – Basin-wide

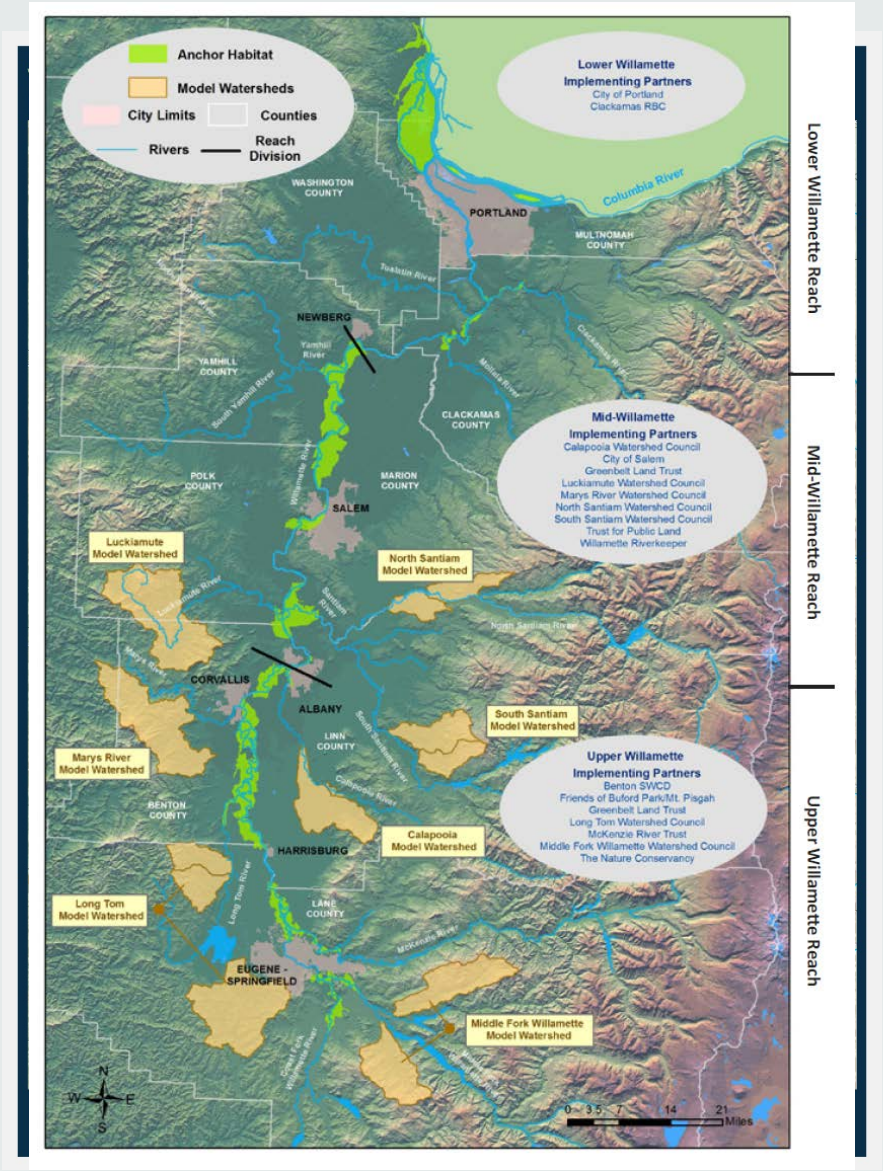
- $135,849,518 spent on habitat restoration since 1999
- 3,890 restoration projects completed
- 161 miles of instream habitat restored
- 885 miles of riparian habitat restored
- Over 1,100 miles of habitat made accessible



Number and cost of Willamette Basin habitat restoration and protection projects reported to the OWRI between 1995 and 2012.

Habitat Accomplishments – Mainstem Willamette

- Habitat Restoration
  - $78,508,834 spent on habitat restoration since 1999
  - 1,279 restoration projects completed
  - 65.8 miles of instream habitat restored
  - 369.7 miles of riparian habitat restored
  - 882.5 miles of habitat made accessible
- Meyer Memorial Trust's Willamette River Initiative mainstem and model watershed funding
- OWEB's Willamette River Special Investment Partnership mainstem and model watershed funding (2008 – 2015)
- Habitat Technical Team (BPA funding through BiOp) restoration funding
- Slices Framework for tracking changes in the Willamette River floodplain
- Willamette Wildlife Mitigation Program habitat protection funding
- OWEB Willamette Mainstem Anchor Habitat Focused Investment Partnership (2016 – 2022)

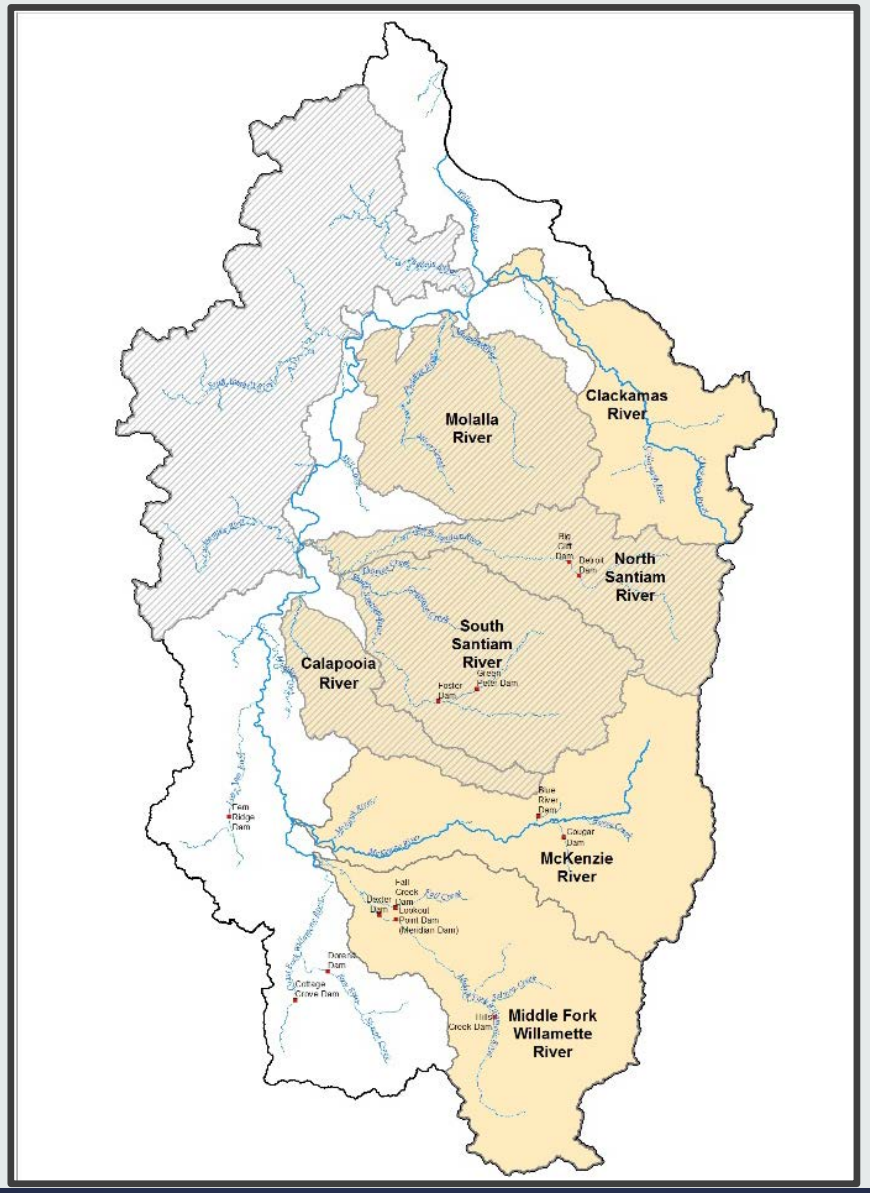


Habitat Accomplishments – Tributaries

West Side Tributaries (including Tualatin, Yamhill, and Coast Fork Willamette subbasins)
- $21,359,261 spent on habitat restoration since 1999
- 895 restoration projects completed
- 19.2 miles of instream habitat restored
- 160 miles of riparian habitat restored
- 204.1 miles of habitat made accessible

Molalla Pudding
- $7,386,591 spent on habitat restoration since 1999
- 311 restoration projects completed
- 3 miles of instream habitat restored
- 34.2 miles of riparian habitat restored
- 139.8 miles of habitat made accessible

MF Willamette
- $6,016,011 spent on habitat restoration since 1999
- 317 restoration projects completed
- 32.1 miles of instream habitat restored
- 64.3 miles of riparian habitat restored
- 43.5 miles of habitat made accessible



Clackamas
- $7,398,429 spent on habitat restoration since 1999
- 84 restoration projects completed
- 17 miles of instream habitat restored
- 33.2 miles of riparian habitat restored
- 166.2 miles of habitat made accessible

N Santiam
- $3,630,958 spent on habitat restoration since 1999
- 118 restoration projects completed
- 6.5 miles of instream habitat restored
- 18.4 miles of riparian habitat restored
- 13.4 miles of habitat made accessible

S Santiam
- $5,736,180 spent on habitat restoration since 1999
- 158 restoration projects completed
- 11.3 miles of instream habitat restored
- 55.7 miles of riparian habitat restored
- 90.7 miles of habitat made accessible

McKenzie
- $5,628,367 spent on habitat restoration since 1999
- 723 restoration projects completed
- 6.1 miles of instream habitat restored
- 149 miles of riparian habitat restored
- 53.7 miles of habitat made accessible

Major Strategies and Actions - Hatchery

Hatchery Actions

- Reduce hatchery fish on spawning grounds
- Examine/reduce predation/competition on juveniles
- As conditions improve, re-introduce above barriers
  - Manage as wild fish emphasis areas

Major Strategies and Actions - Hatchery

- All hatchery fish are marked
- Release strategies (volitional release as smolts)
- Program reductions (N Santiam StS, McKenzie ChS, additional StS reduction in HGMP)
- Rearing strategies – maximize in-basin rearing where possible
- Eliminated recycling of summer steelhead within StW DPS; no Chinook recycling
- Collection – facility upgrades, improvements
  - Minto, Foster, McKenzie ladder attraction and mixing pipe
- Separation in spawn timing (steelhead)
- RME to evaluate introgression rates between StS and StW
- Modified trout program – release timing, eliminated in some areas
- New HGMPs under consultation
- Wild fish management areas
- Use of hatchery fish to support reintroduction efforts

Major Strategies and Actions - Harvest

Harvest Actions

- Manage current regimes in existing Fishery plans

Implementation

- Manage fisheries under current Willamette Chinook and Steelhead Fisheries Management and Evaluation Plans
- Mark all hatchery fish to support harvest management goals
- No directed harvest of wild winter steelhead
- Continued monitoring of harvest exploitation rates
- Angling regulation changes in N and S Santiam to allow harvest of fin-clipped trout to reduce residual hatchery summer steelhead

Major Strategies and Actions - Other

Other Species Actions

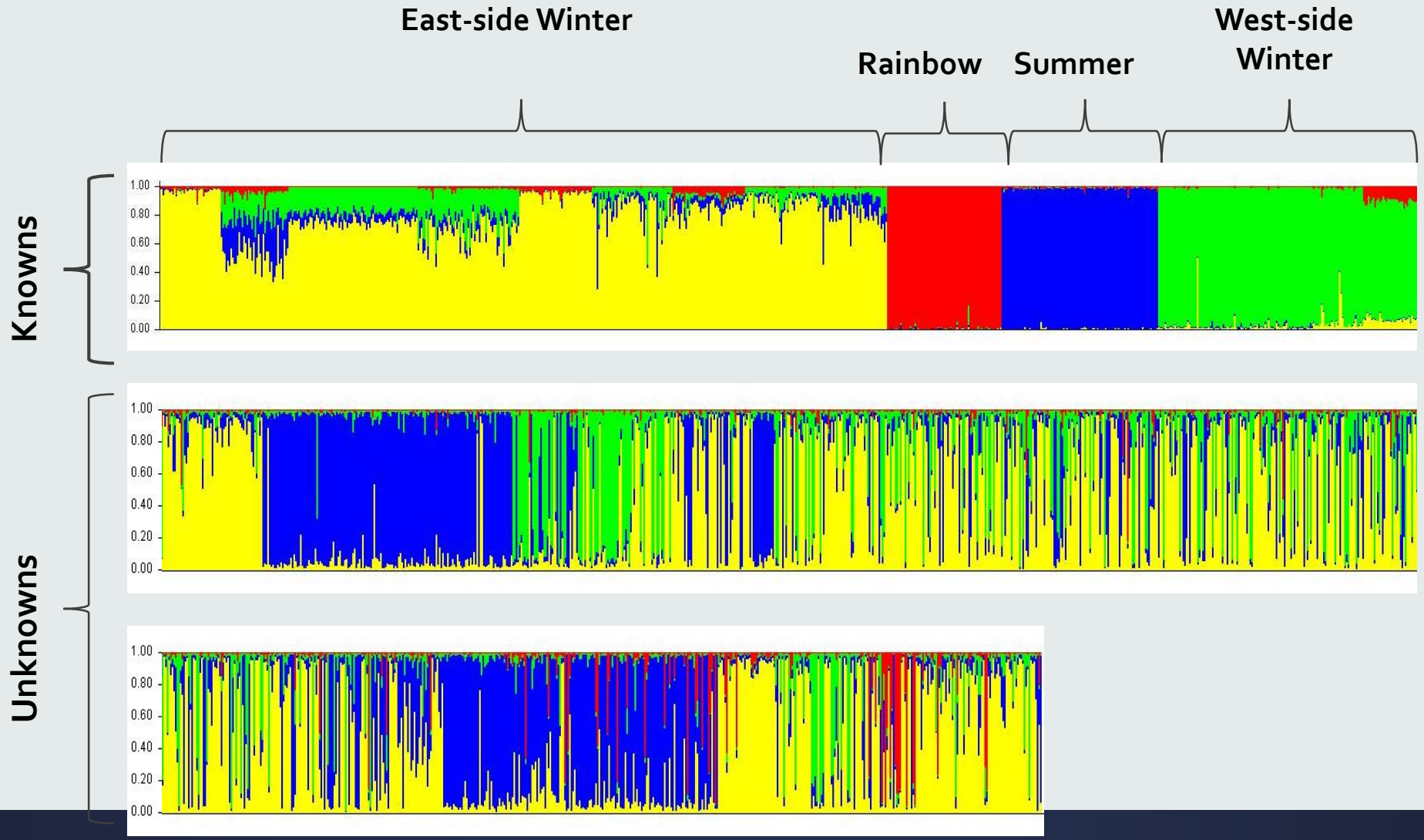
- NMFS Lower Columbia Estuary Recovery Plan
- RME for predation in Willamette and subbasins

2016 Status Review Recommended Future Actions

- Downstream passage and reservoir operations
- Implementation of habitat protection and restoration projects/programs; including Portland Harbor, levees
- Analyze and evaluate net habitat loss and restoration/protection efforts, land use regulatory mechanisms, and fisheries harvest management regulations
- Repair or replace Willamette Falls fish ladder
- FERC relicensing for Carmen-Smith on McKenzie river
- Reduce PSM
- **Seek avenues to reduce pinniped predation in the mainstem Willamette and Columbia Rivers**
- Increase outreach/public messaging about recovery salmon and steelhead in Willamette


Questions?

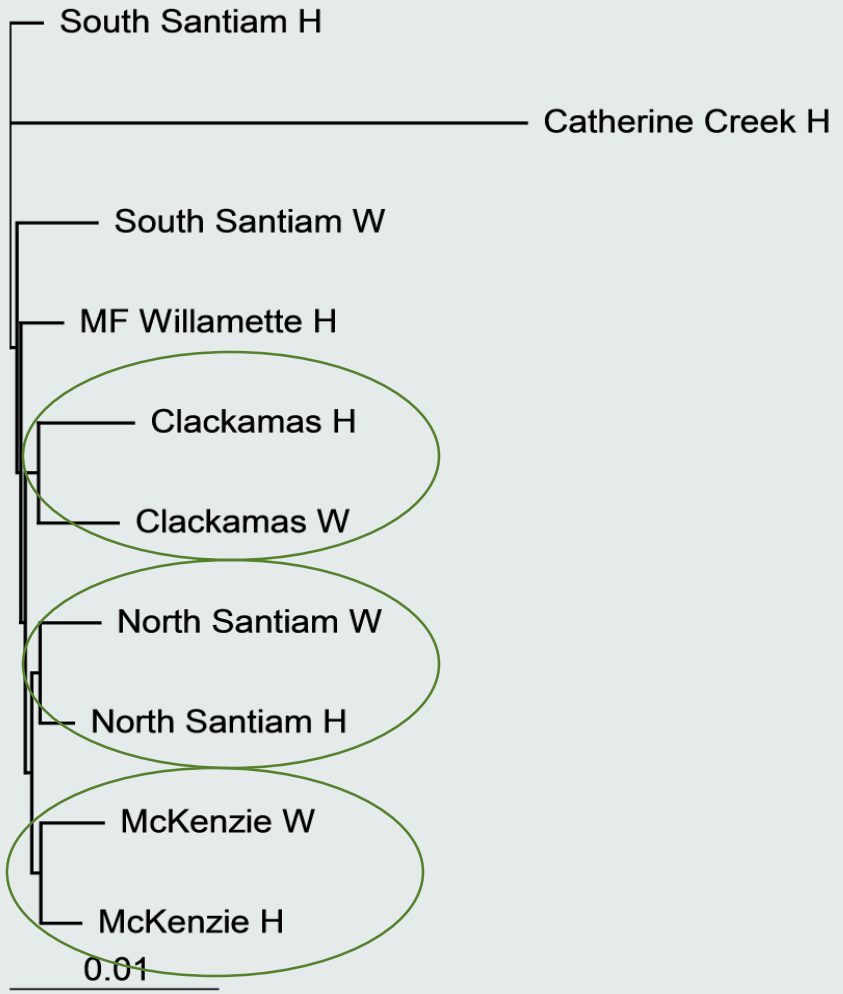
Genetic Studies – UWR Winter Steelhead



Genetic Studies – UWR Spring Chinook

Conclusions

- Weak but significant genetic structure present among sub-basins
- Most hatchery populations similar to local wild populations
- High genetic diversity (top 5 among Columbia populations)
- Genetically distinct from other spring Chinook stocks
- Does not rule out other effects of hatchery stocks (competition, fitness, etc.)



Populations

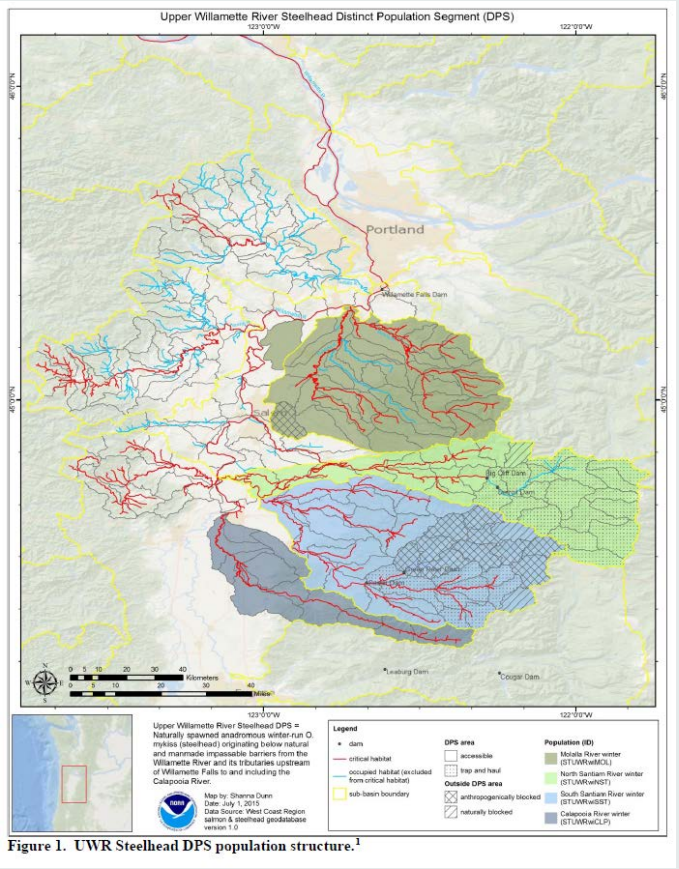


Figure 1. UWR Steelhead DPS population structure.[1]

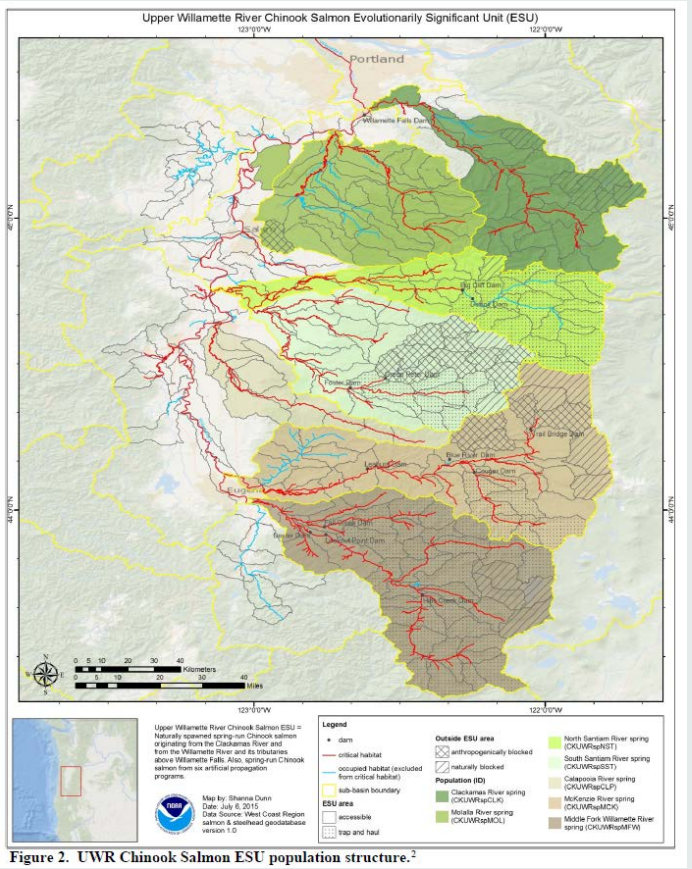


Figure 2. UWR Chinook Salmon ESU population structure.[2]

Oregon Department of Fish and Wildlife pinniped research and monitoring program, and annual sea lion/salmonid interaction at Willamette Falls

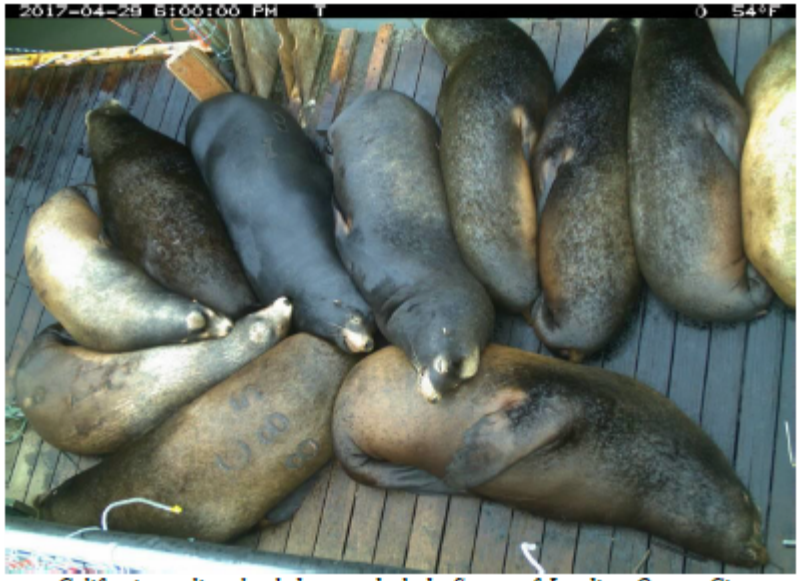
Presenter: Bryan Wright

Corresponding Summary Page(s): 15-18

Day 1

WILLAMETTE FALLS PINNIPED MONITORING PROJECT, 2017

November 7, 2017



California sea lions hauled out on docks by Sportcraft Landing, Oregon City

Oregon Department of Fish and Wildlife

Project staff: Bryan Wright, Tom Murtagh, Robin Brown, and Susan Riemer

Field crew: Clifford Owen and Theresa Tillson

REQUEST FOR MARINE MAMMAL PROTECTION ACT SECTION 120 AUTHORIZATION TO REMOVE CALIFORNIA SEA LIONS FROM THE WILLAMETTE RIVER

SUBMITTED BY

OREGON DEPARTMENT OF FISH AND WILDLIFE

OCTOBER 5, 2017


East Mooring Basin
Willamette River
Bonneville
Willamette Falls

Monitoring objectives

- Salmonid predation
- Pinniped abundance
- Pinniped brand-resights

Count statistics

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

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

Figure 1. Illustration of the spatial component of the sampling frame for 2017. Sites 1-6 ("Falls" stratum) were each approximately 0.9-ha in area.

Figure 1. Illustration of the spatial components of the sampling frame for 2015. Sites 1-6 (stratum 1) were each approximately 0.9-ha in area and Sites 7-16 (stratum 2) were each approximately 3.5-ha in area.

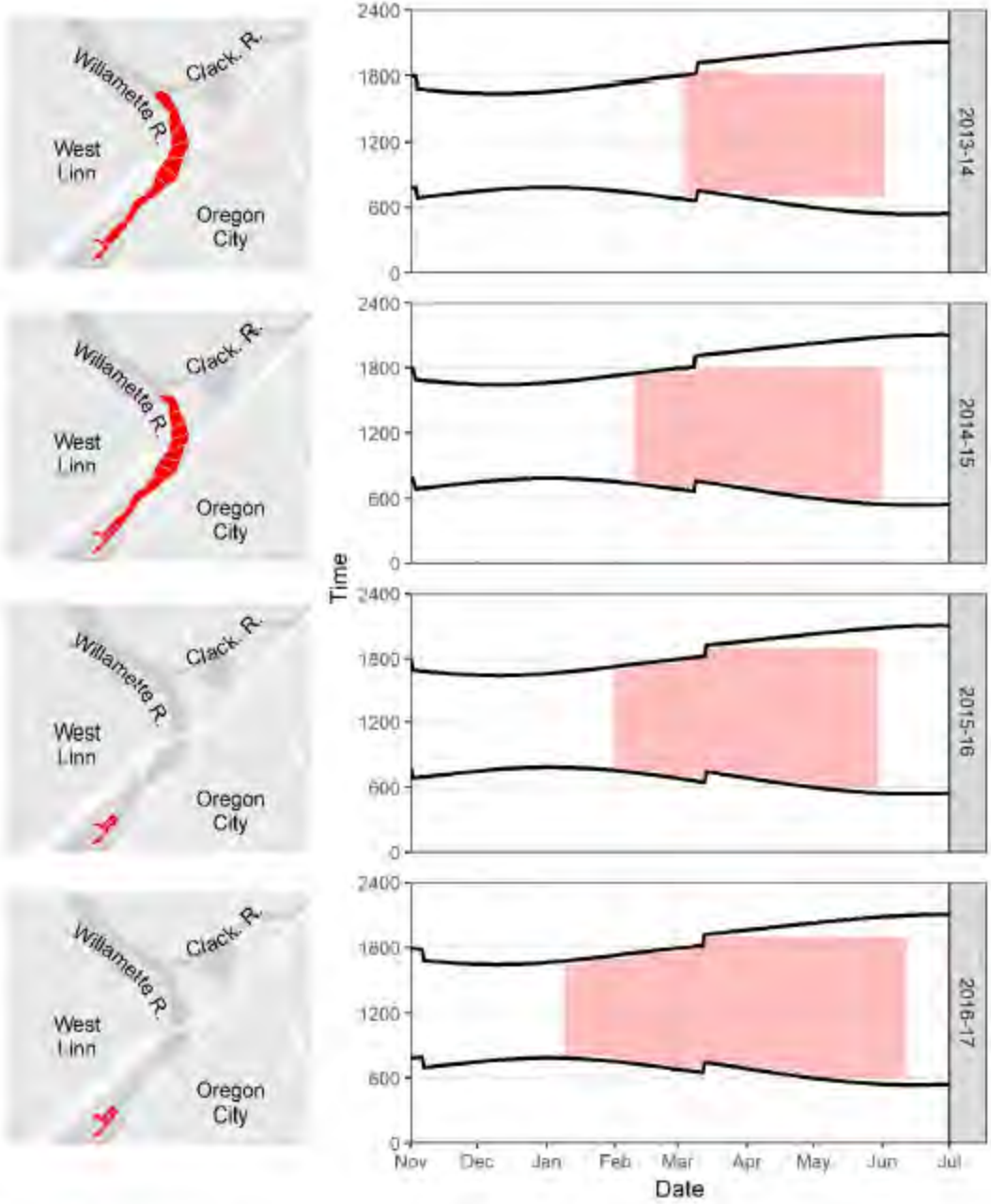


Figure 2. Illustration of spatial (left) and temporal (right) coverage of sampling frame by year. Red shaded areas depict time and area included in frame; dark black lines on the graph at right indicate sunrise and sunset, adjusted for daylight savings.


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

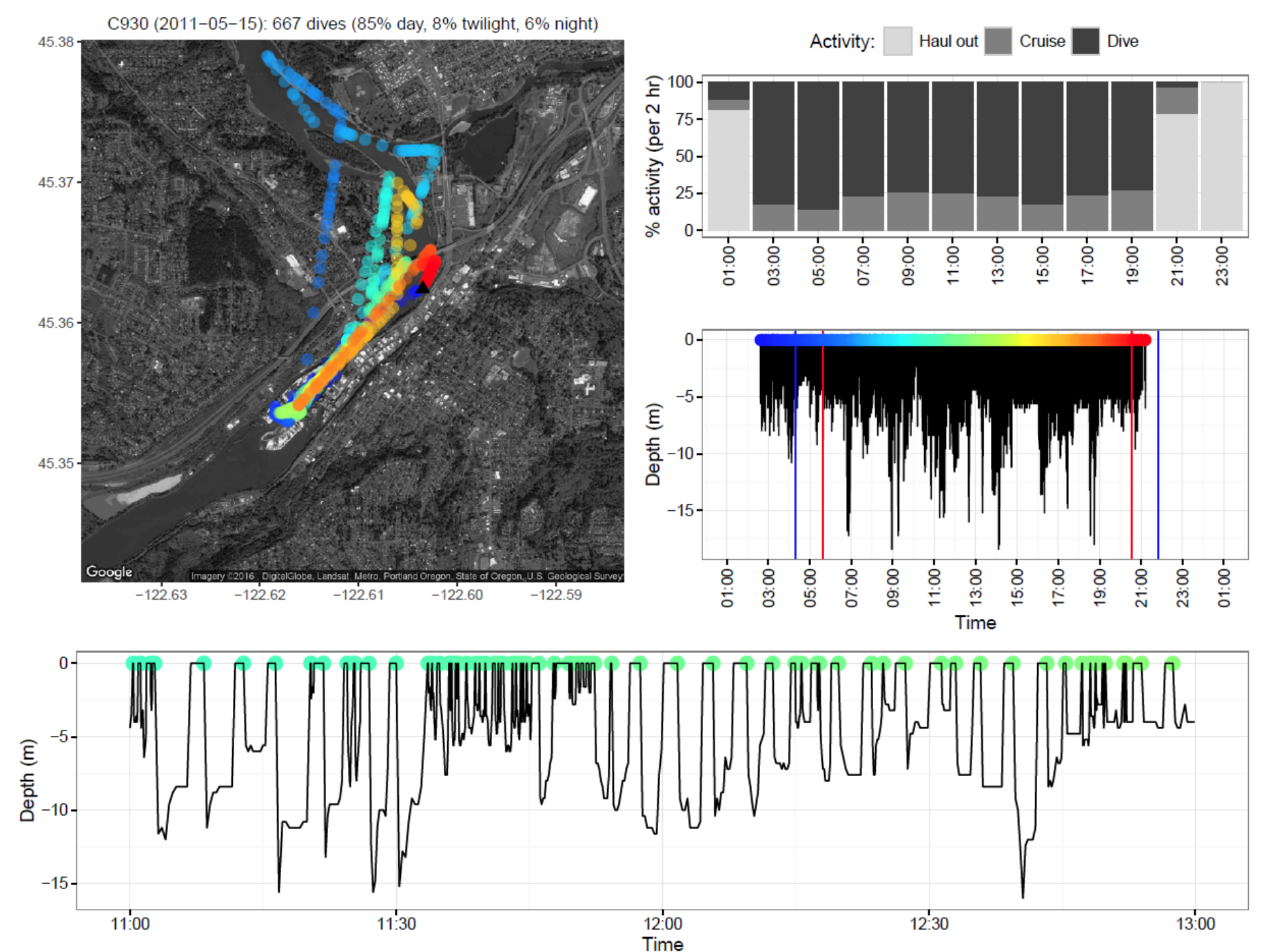

C930 (2011−05−15): 667 dives (85% day, 8% twilight, 6% night)
45.38
45.37
45.36
45.35
−122.63
−122.62
−122.61
−122.60
−122.59
Google
Imagery ©2016 , DigitalGlobe, Landsat, Metro, Portland Oregon, State of Oregon, U.S. Geological Survey
Activity:
Haul out
Cruise
Dive
% activity (per 2 hr)
100
75
50
25
0
01:00
03:00
05:00
07:00
09:00
11:00
13:00
15:00
17:00
19:00
21:00
23:00
Depth (m)
0
−5
−10
−15
Time
Depth (m)
0
−5
−10
−15
11:00
11:30
12:00
12:30
13:00
Time

Table 1. Observed predation by California sea lions at Willamette Falls, 2014-2017.

	Observed predation					% of observations				
Prey	2014	2015	2016	2017	Total	2014	2015	2016	2017	Total
Salmonids	959	1139	1001	753	3852	86.7%	85.2%	83.8%	82.7%	84.7%
Lamprey	126	175	182	145	628	11.4%	13.1%	15.2%	15.9%	13.8%
Other/unk.	18	21	11	12	62	1.6%	1.6%	0.9%	1.3%	1.4%
Sturgeon	3	2	0	0	5	0.3%	0.1%	0.0%	0.0%	0.1%
Total	1,106	1,337	1,194	910	4547	100%	100%	100%	100%	100%

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 2. Summary of estimated predation by California sea lions below Willamette Falls from January 9 to June 11, 2017 based on stratified, three-stage cluster sampling design. These estimates only apply to the sampling frame for 2017 depicted in Figure 2 and therefore are likely minimum estimates due to undercoverage of the target population.

Prey*	Observed total	Estimated total	Standard error	Coefficient of variation	95% confidence interval	
					Lower bound	Upper bound
Salmonids	179	2,673	518	0.19	1,658	3,688
Lamprey	50	747	169	0.23	415	1078

*All prey taken by California sea lions.

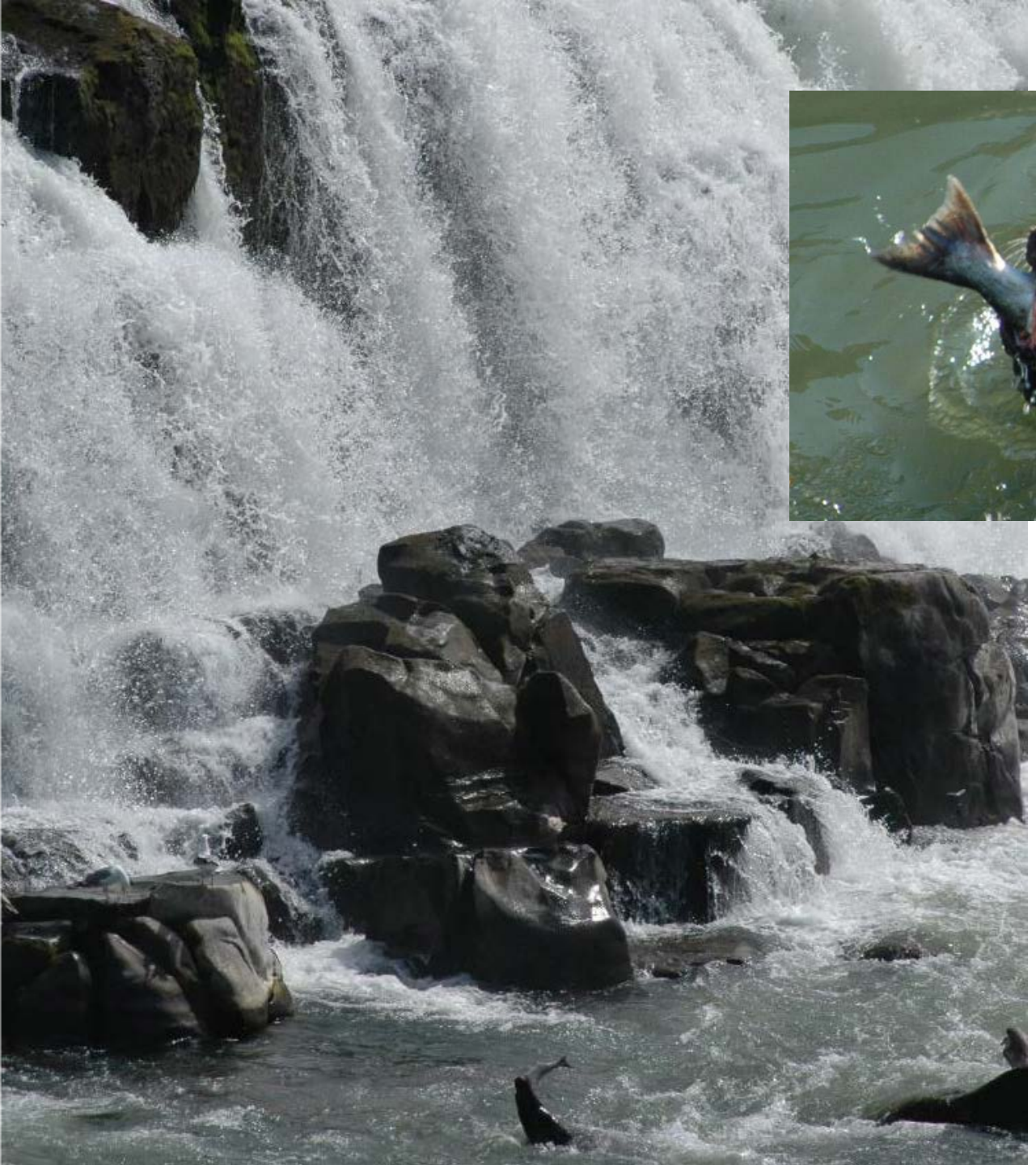


Figure 4. Daily run composition at Willamette Falls by year. Vertical dashed lines indicate study dates. (2/29/16 not shown).

Table 3. Estimated California sea lion predation on salmonids at Willamette Falls by run, 2017. These estimates only apply to the sampling frame for 2017 depicted in Figure 2 and therefore are likely minimum estimates due to undercoverage of the target population.

Escapement over falls	Run assignment model	Pooled lag-days	Estimated predation (means from 1000 simulations)					% of potential escapement**		
			Total	SE	CV	95% CI LB	95% CI UB	Total	95% CI LB	95% CI UB
Hatchery spring Chinook salmon (28,281	Window count only	1	1724	358	0.21	1022	2426	6%	3%	8%
		7	1757	360	0.20	1052	2462	6%	4%	8%
		14	1885	402	0.21	1098	2672	6%	4%	9%
	Observer ID then window count	1	1814	394	0.22	1042	2586	6%	4%	8%
		7	1870	402	0.22	1081	2658	6%	4%	9%
		14	1893	414	0.22	1082	2705	6%	4%	9%
	Mean		1824	388	0.21	1063	2585	6%	4%	8%
Wild spring Chinook salmon (5,905)	Window count only	1	402	103	0.26	200	604	6%	3%	9%
		7	381	97	0.26	190	572	6%	3%	9%
		14	385	98	0.26	193	576	6%	3%	9%
	Observer ID then window count	1	445	116	0.26	218	671	7%	4%	10%
		7	398	106	0.27	190	606	6%	3%	9%
		14	383	100	0.26	188	579	6%	3%	9%
	Mean		399	103	0.26	196	601	6%	3%	9%
Summer steelhead (2,124*)	Window count only	1	208	68	0.33	75	341	9*%	3*%	14*%
		7	243	78	0.33	89	396	10*%	4*%	16*%
		14	173	53	0.32	68	277	8*%	3*%	12*%
	Observer ID then window count	1	134	47	0.36	41	227	6*%	2*%	10*%
		7	163	48	0.30	68	257	7*%	3*%	11*%
		14	166	50	0.30	68	264	7*%	3*%	12*%
	Mean		181	57	0.32	68	294	8*%	3*%	12*%
Winter steelhead (822)	Window count only	1	339	78	0.23	186	493	29%	18%	37%
		7	293	73	0.25	150	435	26%	15%	35%
		14	231	55	0.24	122	339	22%	13%	29%
	Observer ID then window count	1	281	55	0.20	172	389	25%	17%	32%
		7	243	57	0.24	131	355	23%	14%	30%
		14	231	56	0.24	122	340	22%	13%	29%
	Mean		270	62	0.23	147	392	25%	15%	32%

*Through 9/30/2017 (run ends 10/31/2017).

** Equals estimate / (estimate + escapement)

Table 5. Estimated salmonid predation by California sea lions at Willamette Falls, 2014-2017.

	Estimated predation				% of potential escapement			
Run*	2014	2015	2016	2017	2014	2015	2016	2017
wSTH	780	557	915	270	13%	11%	14%	25%
nmCH	496	899	650	399	7%	9%	9%	6%
sSTH	712	172	768	181	3%	4%	3%	8%**
mCH	1,703	4,149	2,252	1,824	7%	9%	9%	6%

*wSTH = winter steelhead; nmCH = spring Chinook salmon (not marked); sSTH = summer steelhead; mCH = spring Chinook salmon (marked)

**As of 8/15/2017

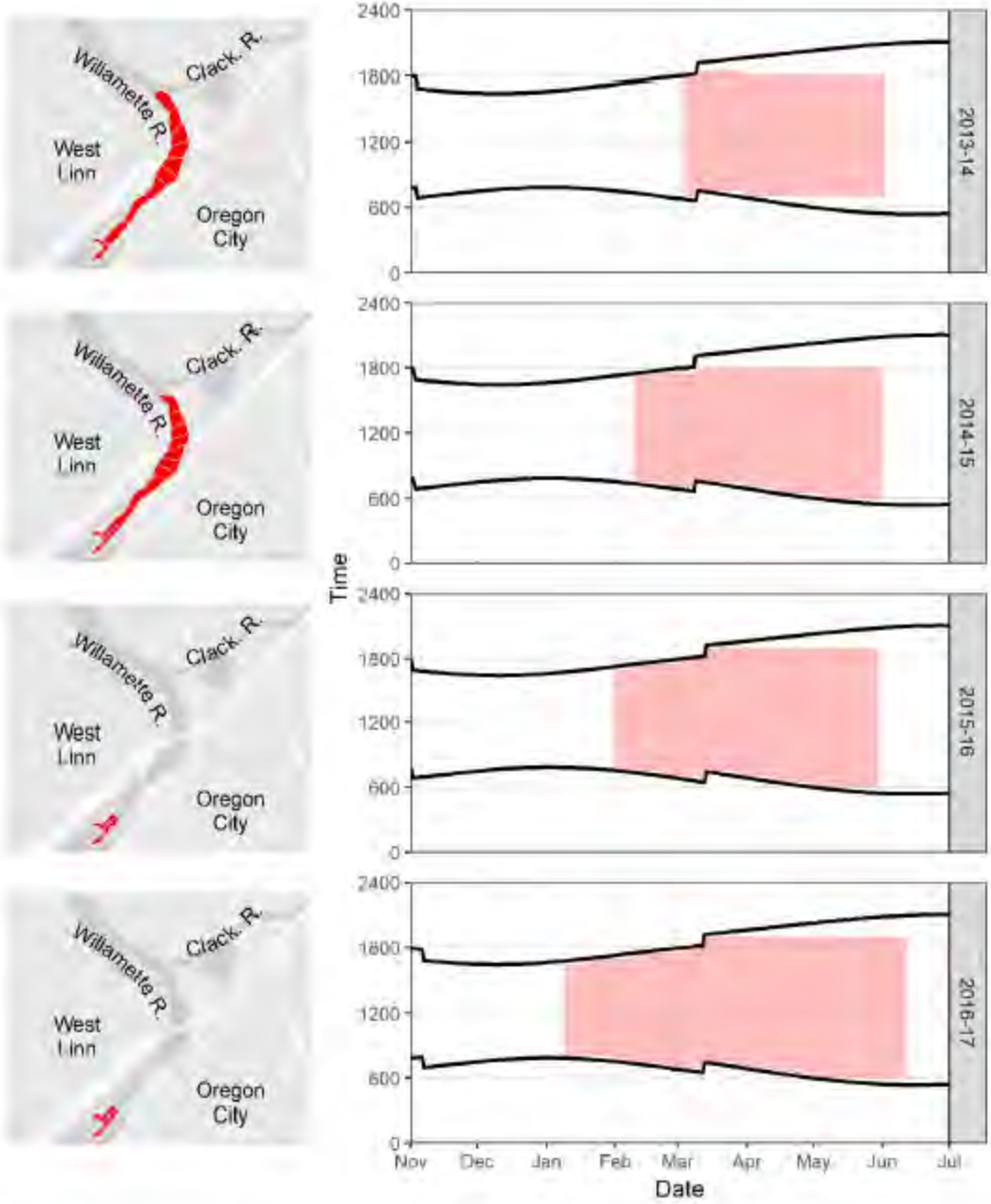


Figure 2. Illustration of spatial (left) and temporal (right) coverage of sampling frame by year. Red shaded areas depict time and area included in frame; dark black lines on the graph at right indicate sunrise and sunset, adjusted for daylight savings.

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.


2017-04-29 6:00:00 PM T
54°F

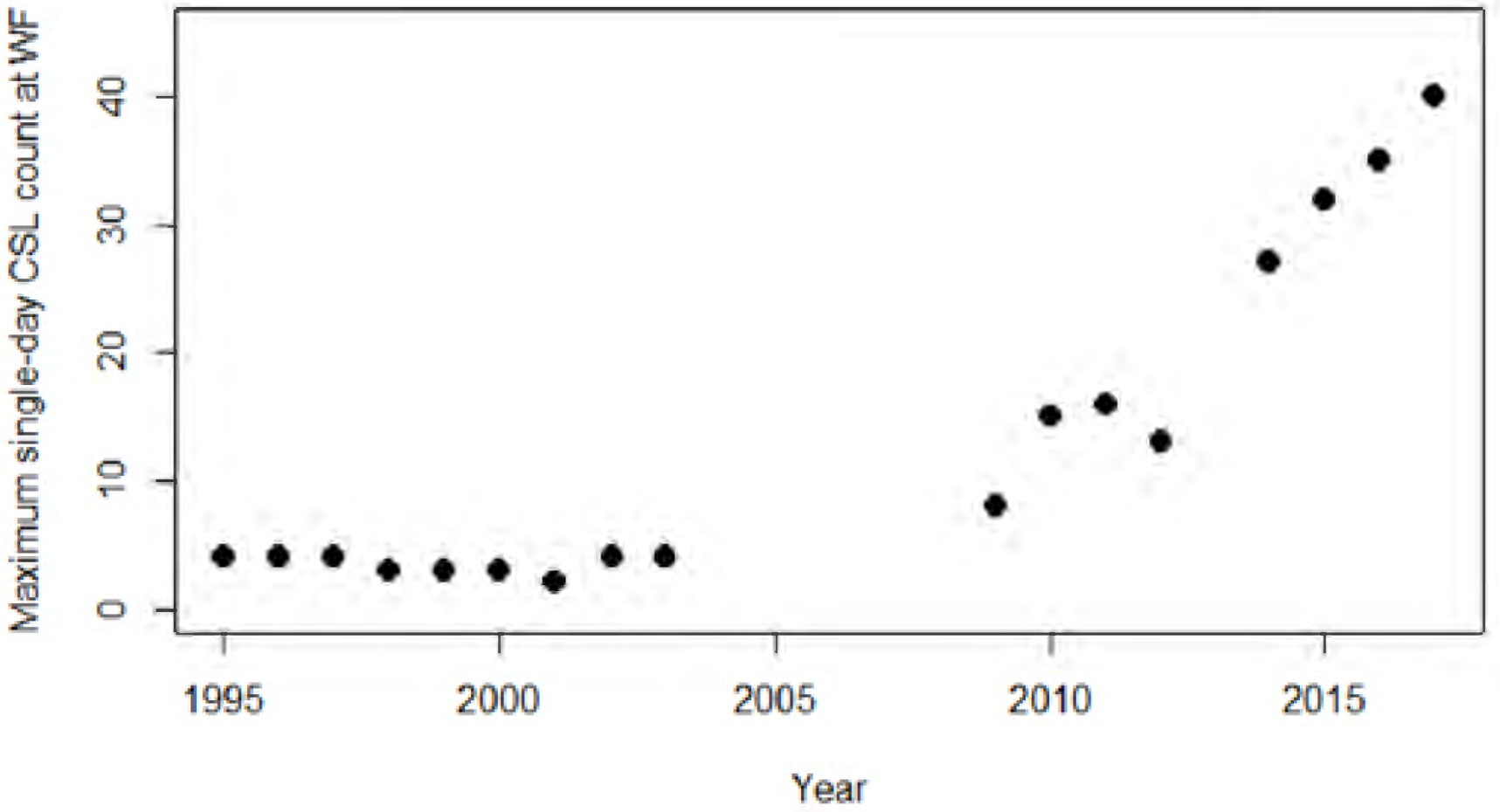


Figure 1. Maximum single-day CSL count at Willamette Falls by year. Monitoring from 1995-2003 and 2014-2017 was conducted by ODFW; monitoring from 2009-2012 was conducted by PSU.

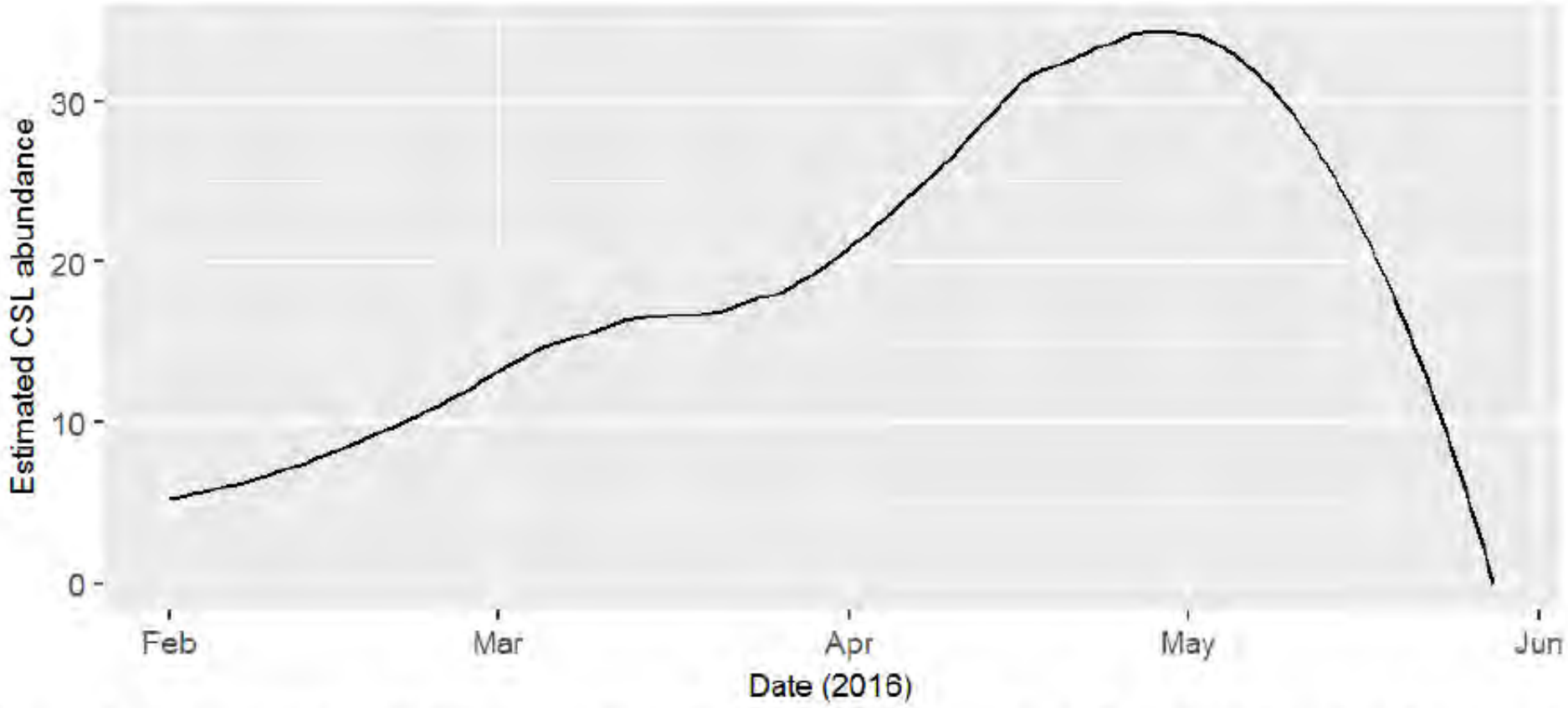


Figure 4. Estimated daily California sea lion abundance at Willamette Falls in 2016 based on loess model fit to weekly maximum count data (Wright et al. 2016).

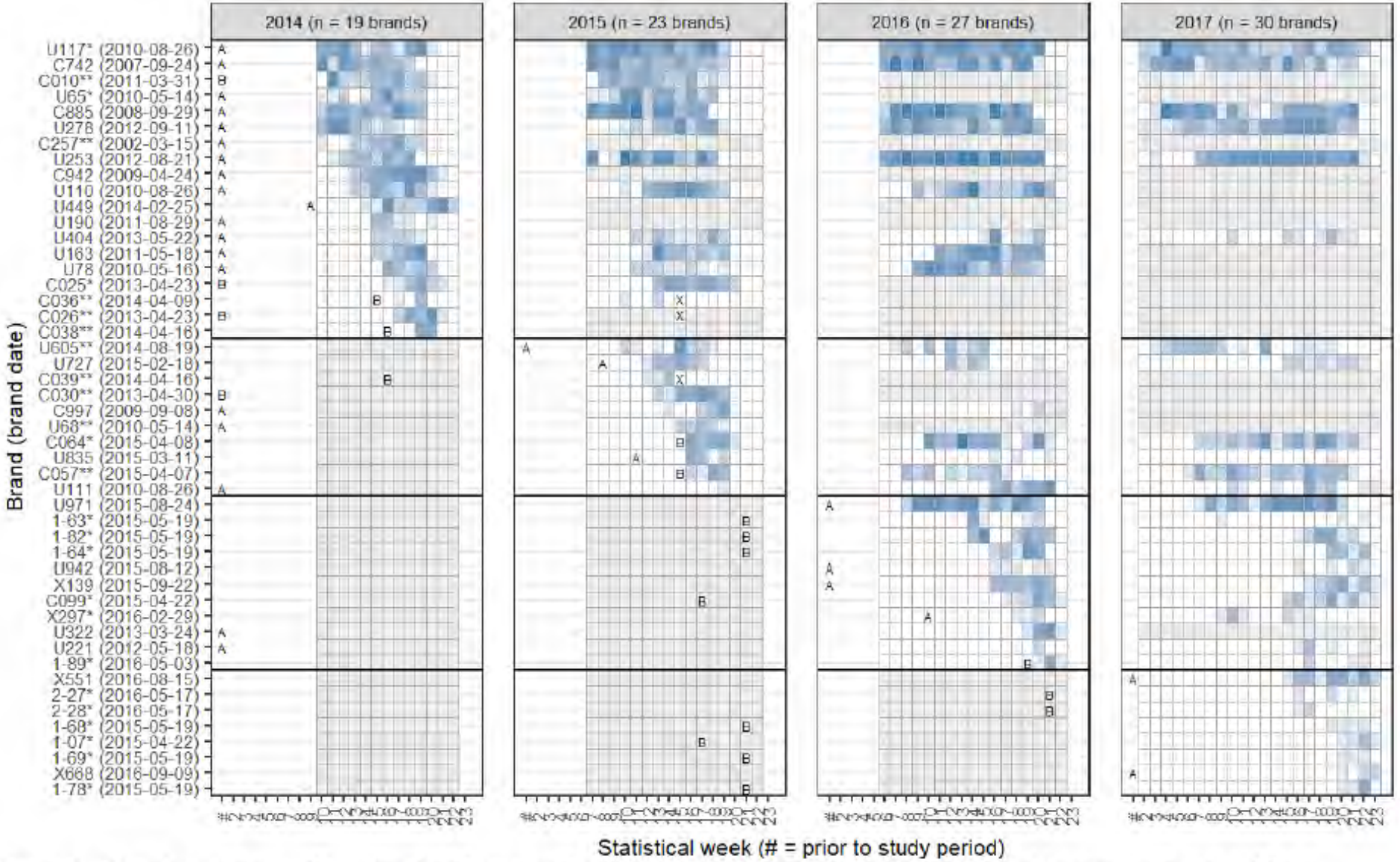


Figure 6. Weekly residency of branded California sea lions (n = 48 total) at Willamette Falls sorted by year and week of first detection (darker hue = more days detected). Capture location at branding denoted by 'A' (Astoria) or 'B' (Bonneville Dam); X denotes animal was removed under MMPA Section 120; * indicates animal documented at Bonneville Dam; ** indicates animal on MMPA Section 120 list for removal. Brands recorded less than three days per year were considered unconfirmed and are not included unless photographed. [Note that this graphic will be updated once image processing from automated cameras is competed.]

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