EPA-910-R-21-001
January 2021

Columbia River Cold Water Refuges Plan

Prepared by:
U.S. Environmental Protection Agency
Region 10


COLD WATER REFUGE


21C(70F)
14C
(57F)

Plan Focused on Lower Columbia River

Regulatory Background

- Oregon numeric temperature water quality standard for the Lower Columbia River is 20°C, plus
  - Must have sufficiently distributed CWR to aid migrating salmon and steelhead
  - CWR are areas that are at least 2°C cooler than the main channel

- EPA issued the Plan to meet the Reasonable and Prudent Alternative in National Marine Fishery Service's 2015 Biological Opinion on EPA's approval of Oregon's temperature water quality standards

- Plan also is the basis for the CWR targets in EPA's Columbia/Snake River Temperature TMDL & can be used by the States in their associated TMDL implementation plans

EPA Columbia River CWR Plan

1. Describes the CWR areas in the Lower Columbia River

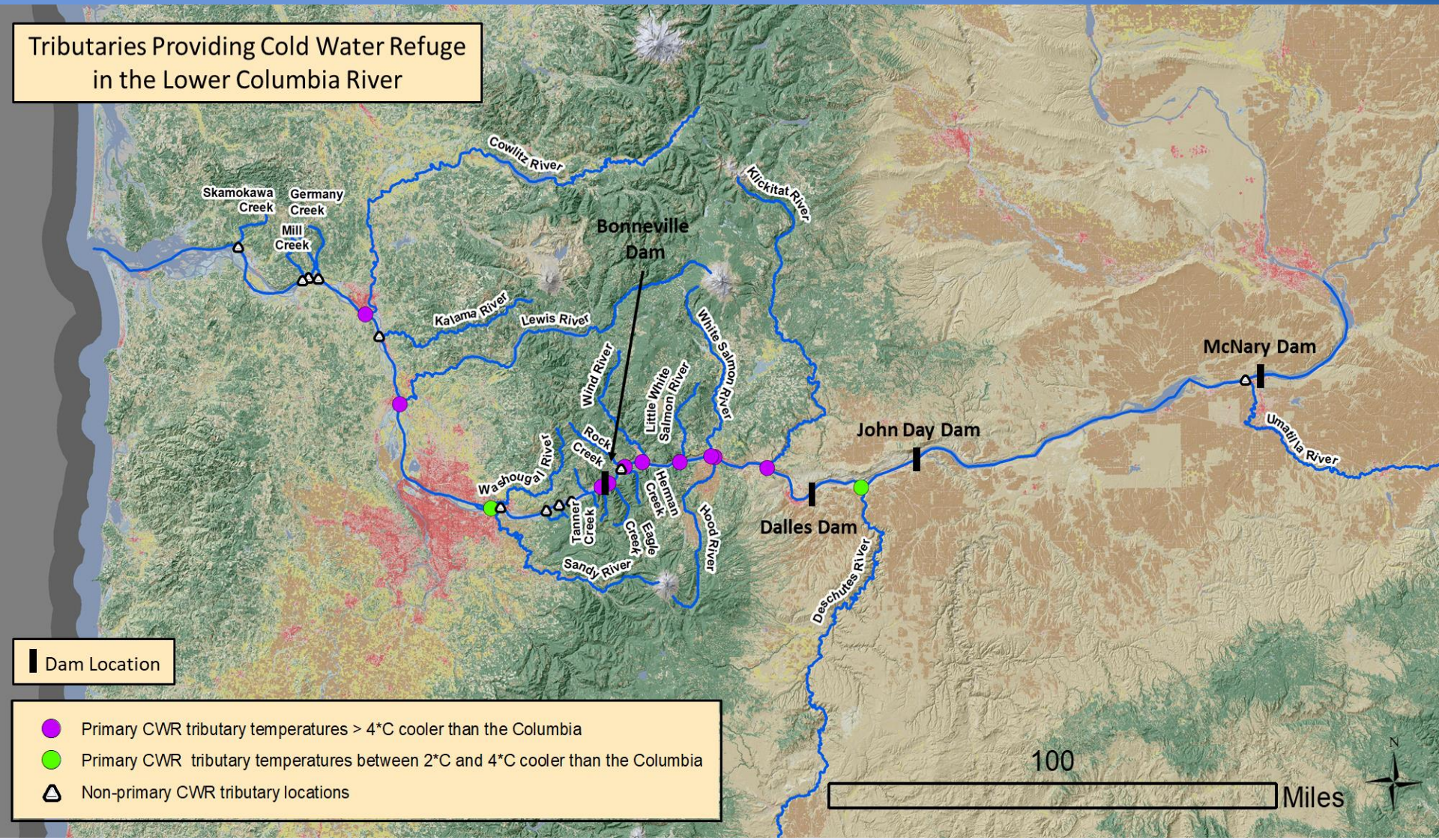
2. Characterizes how salmon and steelhead use CWR

3. Assesses the amount of CWR needed to meet Oregon's CWR narrative standard

4. Identifies actions to protect, restore, or enhance CWR

5. Recommends future CWR studies and monitoring

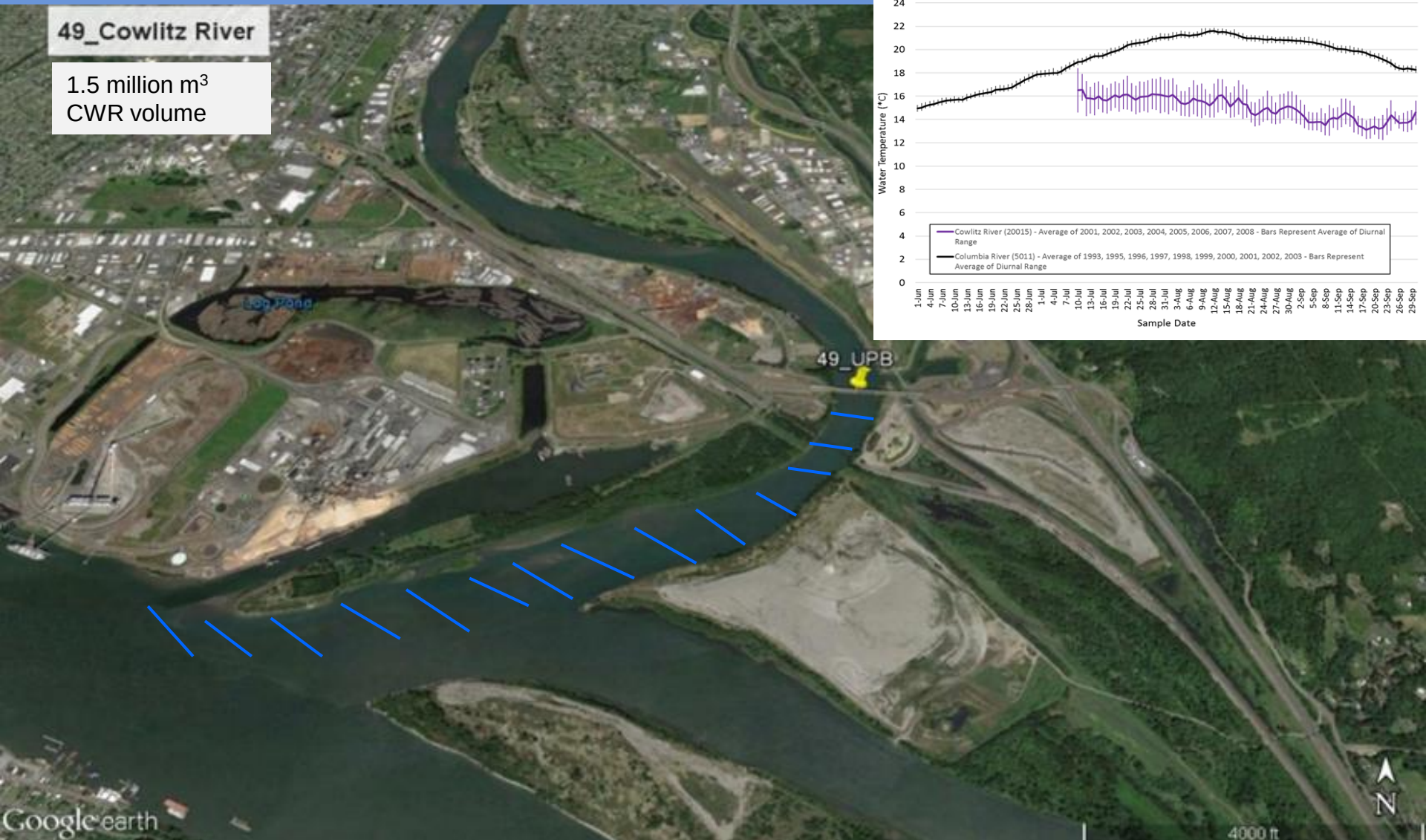
12 Primary CWR in Lower Columbia River (23 Total CWR)



Lower Columbia River CWR
(12 Primary - color highlighted/23 Total)

Tributary Name	River Mile	August Mean Mainstem Temperature (DART)	August Mean Tributary Temperature (NorWeST)	August Mean Temperature Difference	August Mean Tributary Flow (NHD & USGS*)	Plume CWR Volume (> 2°C Δ)	Stream CWR Volume (> 2°C Δ)	Total CWR Volume (> 2°C Δ)
		°C	°C	°C	cfs	m^3	m^3	m^3
Skamokawa Creek (WA)	30.9	21.3	16.2	-5.1	23	450	1,033	1,483
Mill Creek (WA)	51.3	21.3	14.5	-6.8	10	110	446	556
Abernethy Creek (WA)	51.7	21.3	15.7	-5.6	10	81	806	887
Germany Creek (WA)	53.6	21.3	15.4	-5.9	8	72	446	518
Cowlitz River (WA)	65.2	21.3	16.0	-5.4	3634	870,000	684,230	1,554,230
Kalama River[2] (WA)	70.5	21.3	16.3	-5.0	314*	14,000	27,820	41,820
Lewis River (WA)	84.4	21.3	16.6	-4.8	1291*	120,000	493,455	613,455
Sandy River (OR)	117.1	21.3	18.8	-2.5	469	9,900	22,015	31,915
Washougal River[1] (WA)	117.6	21.3	19.2	-2.1	107*	740	32,563	33,303
Bridal Veil Creek (WA)	128.9	21.3	11.7	-9.6	7	120	0	120
Wahkeena Creek (WA)	131.7	21.3	13.6	-7.7	15	220	0	220
Oneonta Creek (OR)	134.3	21.3	13.1	-8.2	29	820	54	874
Tanner Creek (OR)	140.9	21.3	11.7	-9.6	38	1,300	413	1,713
Eagle Creek (OR)	142.7	21.2	15.1	-6.1	72	2,100	888	2,988
Rock Creek[1] (WA)	146.6	21.2	17.4	-3.8	47	530	1,178	1,708
Herman Creek (OR)	147.5	21.2	12.0	-9.2	45	168,000	1,698	169,698
Wind River (WA)	151.1	21.2	14.5	-6.7	293	60,800	44,420	105,220
Little White Salmon (WA)	158.7	21.2	13.3	-7.9	248*	1,097,000	11,661	1,108,661
White Salmon River (WA)	164.9	21.2	15.7	-5.5	715*	72,000	81,529	153,529
Hood River (OR)	165.7	21.4	15.5	-5.9	374	28,000	0	28,000
Klickitat River (WA)	176.8	21.4	16.4	-5.0	851*	73,000	149,029	222,029
Deschutes River (OR)	200.8	21.4	19.2	-2.2	4772*	300,000	580,124	880,124
Umatilla River[1] (OR)	284.7	20.9	20.8	-0.1	87*	0	10,473	10,473

Cowlitz River CWR



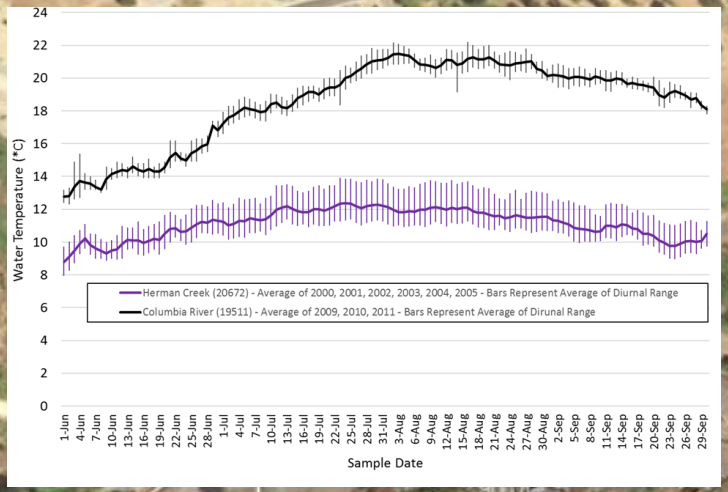
Herman Creek/Cove CWR

96_Herman Creek

170,000 m^3 CWR volume

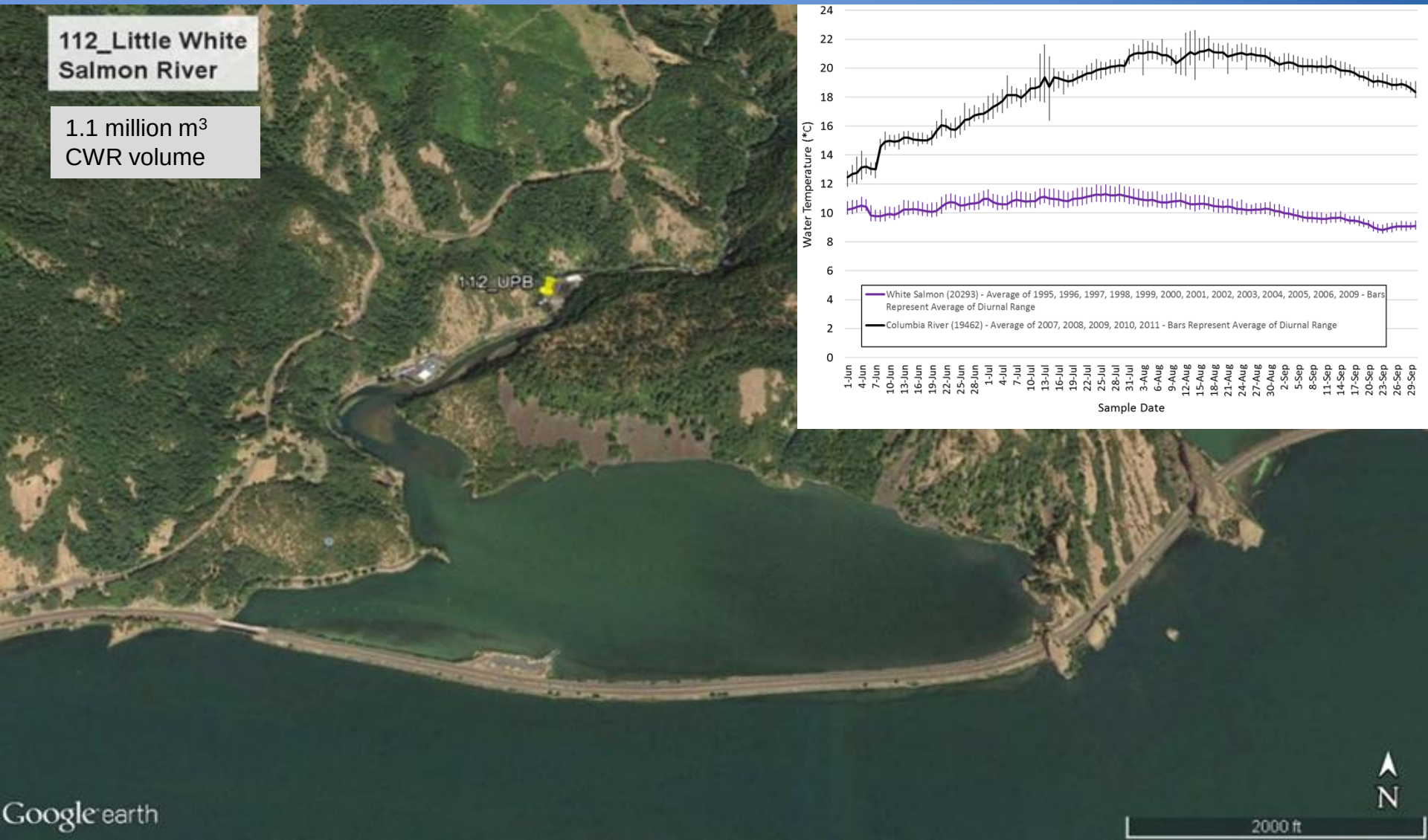
96_UPB_B

96_UPB_A



Google earth

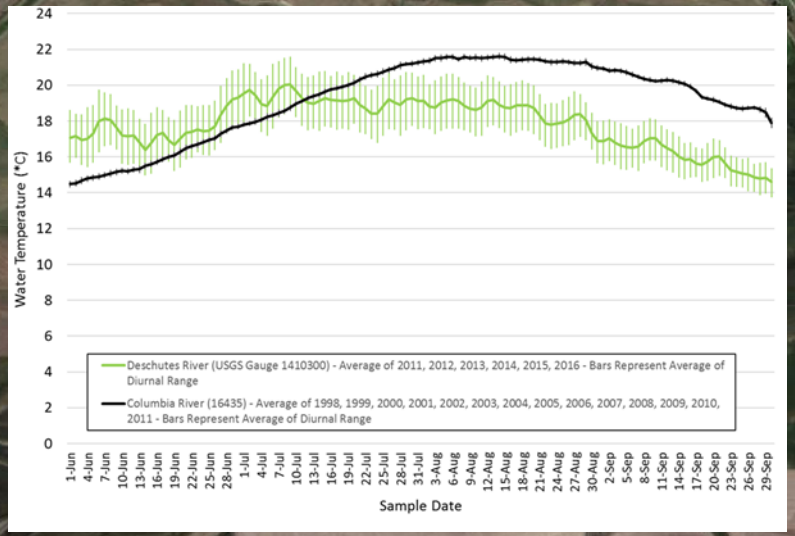
Little White Salmon River/Drano Lake CWR



Deschutes River CWR

135_Deschutes River

880,000 m^3 CWR volume



135_PIT

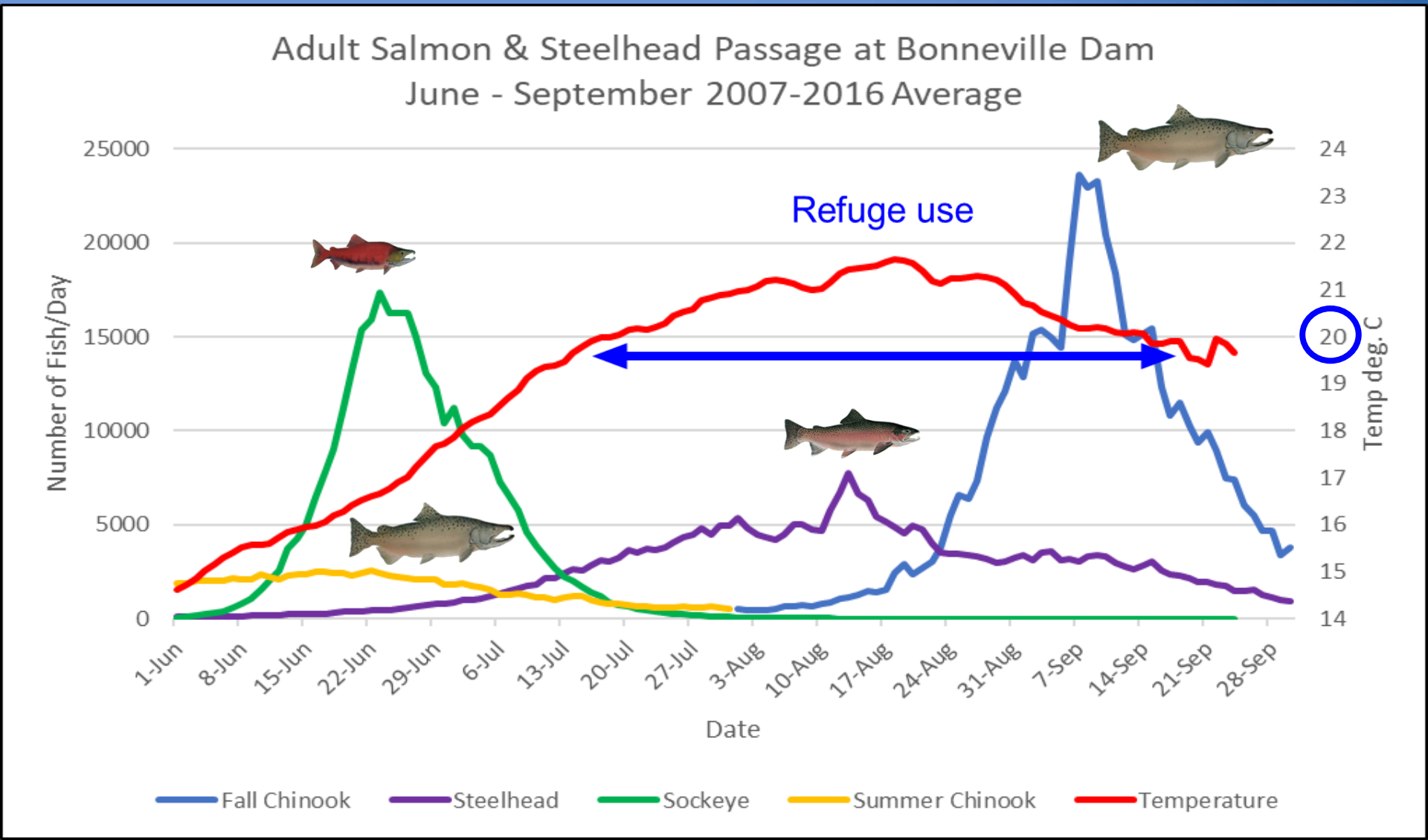
135_UPB

Google earth

N

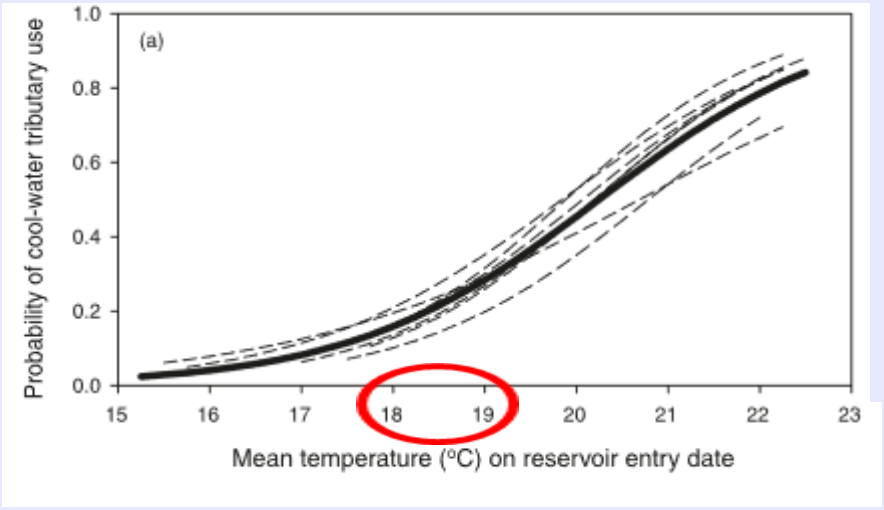
1 mi

Bonneville Dam Temperatures and Fish Passage



Fish use of CWR

Steelhead



- 18-19°C threshold for CWR use
- 70-80% steelhead use CWR when temps are 21-22°C

Source - Keefer et. al. 2009

Fall Chinook

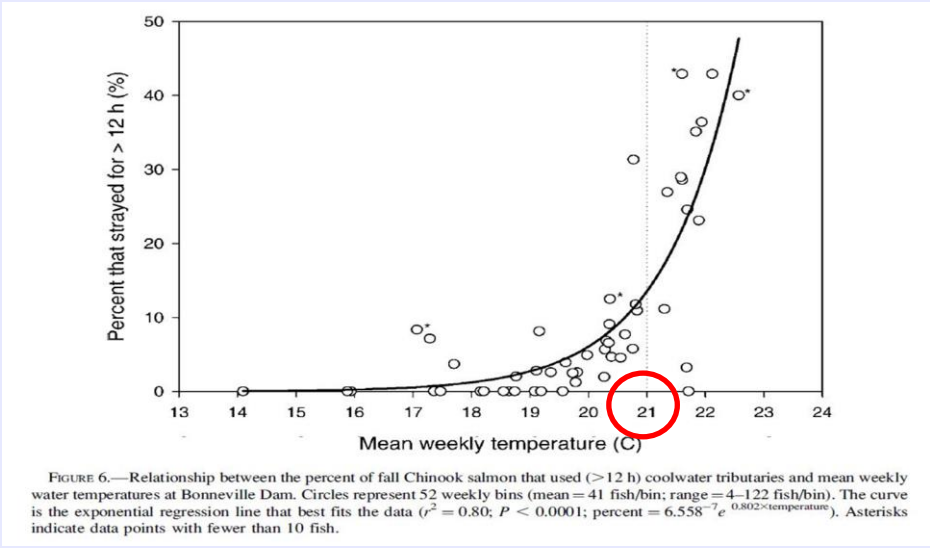


FIGURE 6.—Relationship between the percent of fall Chinook salmon that used (>12 h) coolwater tributaries and mean weekly water temperatures at Bonneville Dam. Circles represent 52 weekly bins (mean = 41 fish/bin; range = 4–122 fish/bin). The curve is the exponential regression line that best fits the data ($r^2 = 0.80$; $P < 0.0001$; percent = $6.558^{-7} e^{0.802 \times \text{temperature}}$). Asterisks indicate data points with fewer than 10 fish.

- 21°C threshold for CWR use
- 15-30% use CWR with 21-22°C
- Underestimate – no plume use

Source - Goniea et. al. 2006

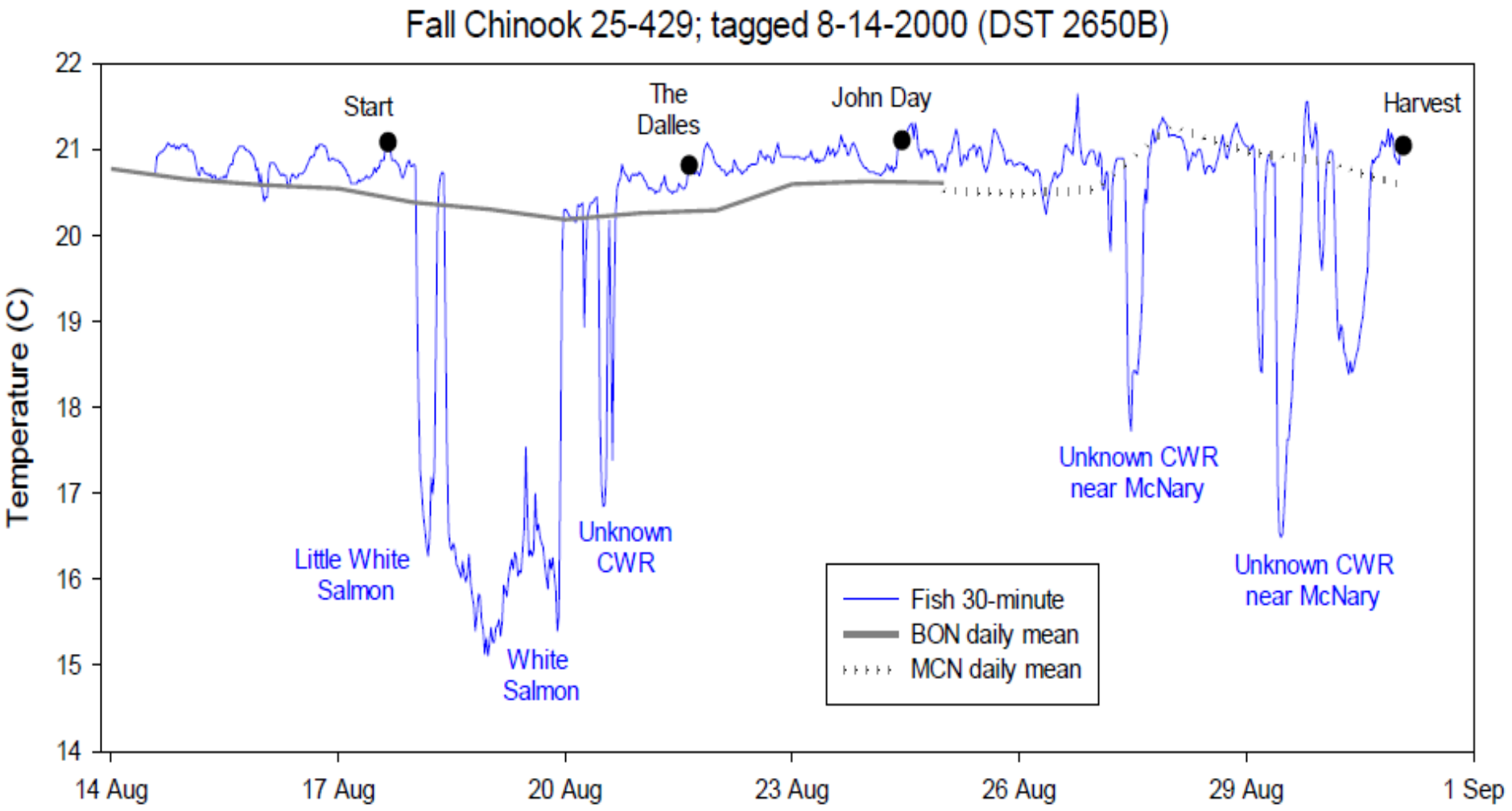
Steelhead use of CWR

Columbia River between Bonneville Dam and The Dalles Dam

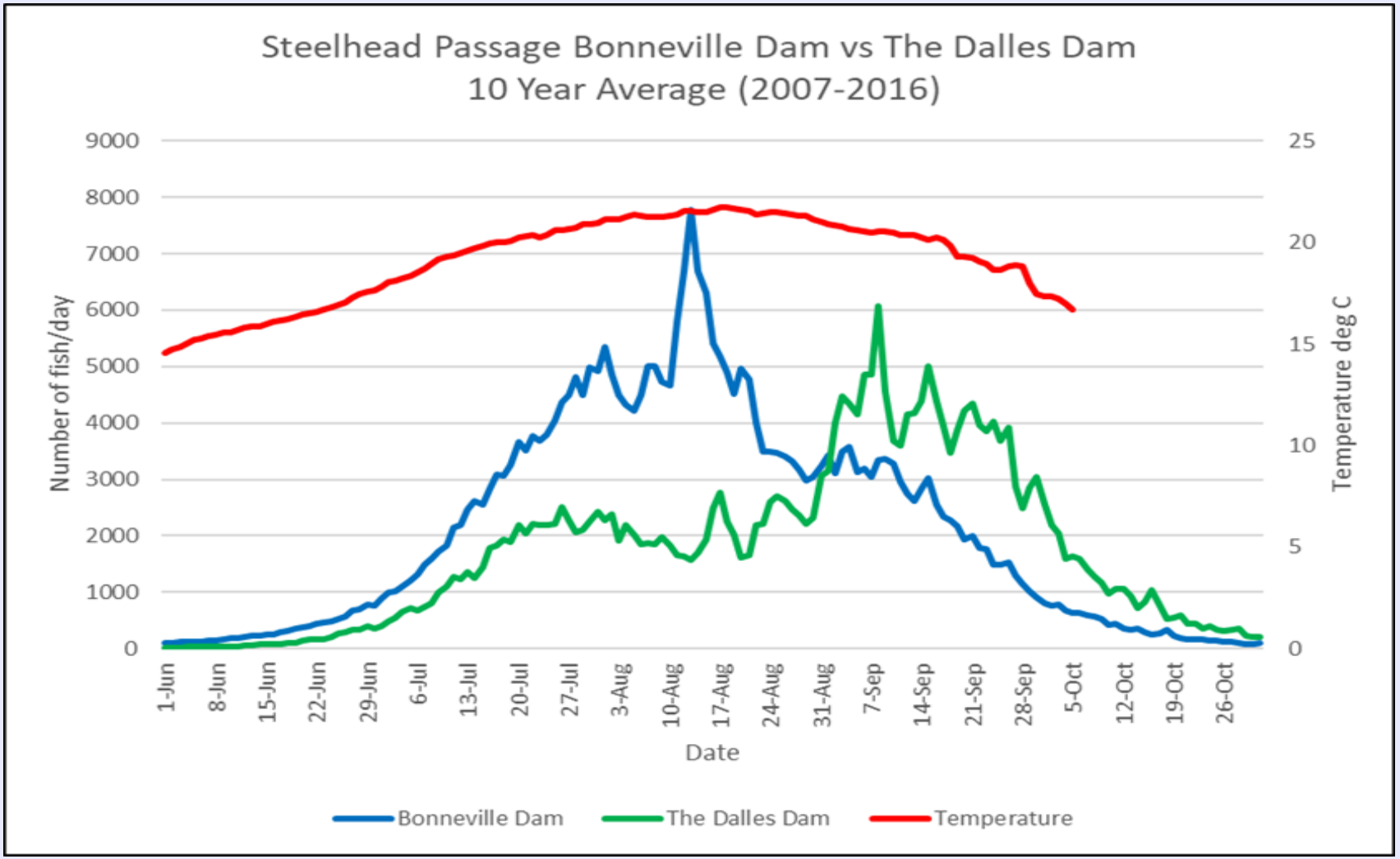
University of Idaho
College of Natural Resources

Fall Chinook use of CWR example

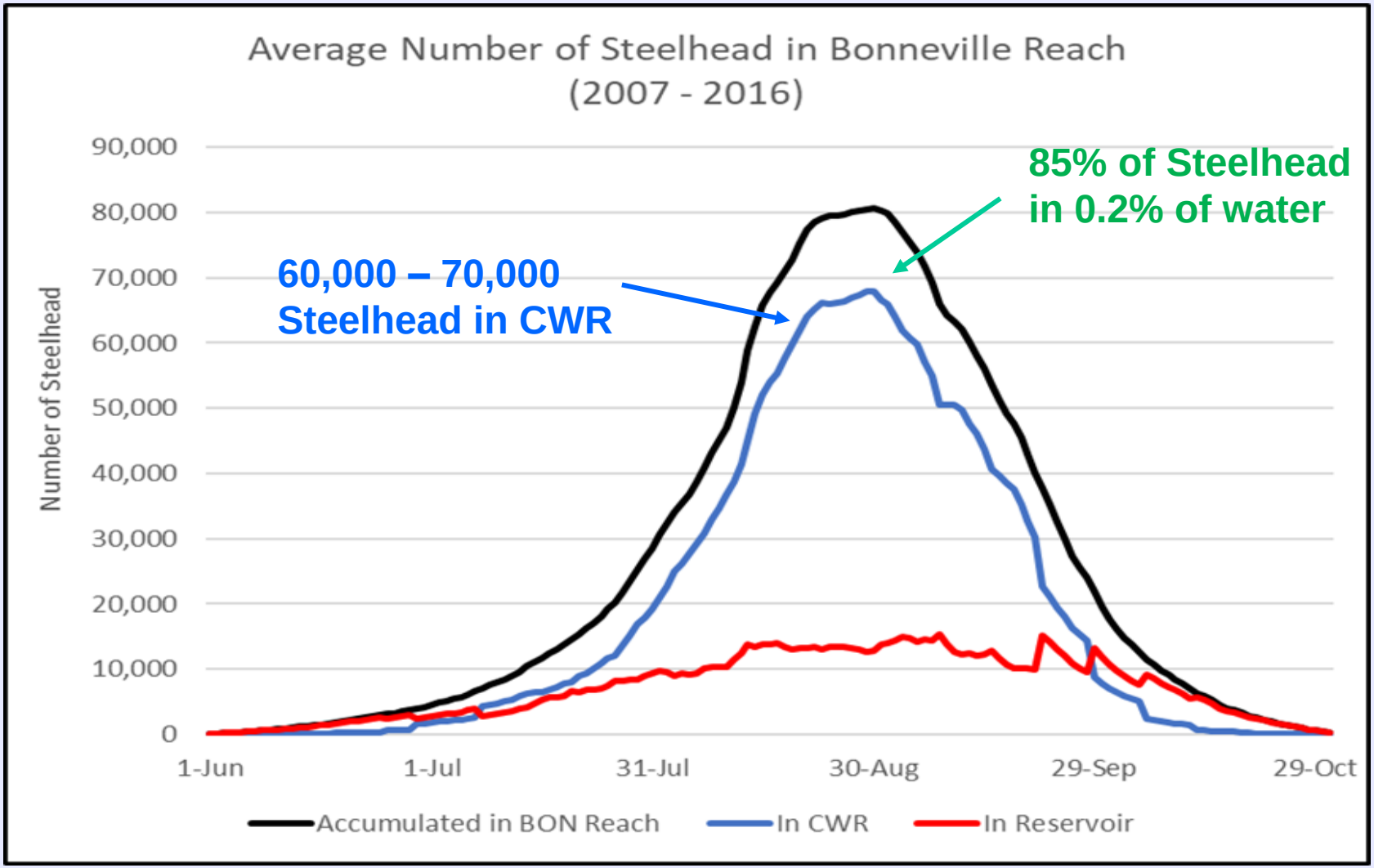
University of Idaho
College of Natural Resources



Bonneville Dam vs The Dalles Dam Steelhead Passage



Accumulation of Steelhead in Bonneville Reservoir Reach

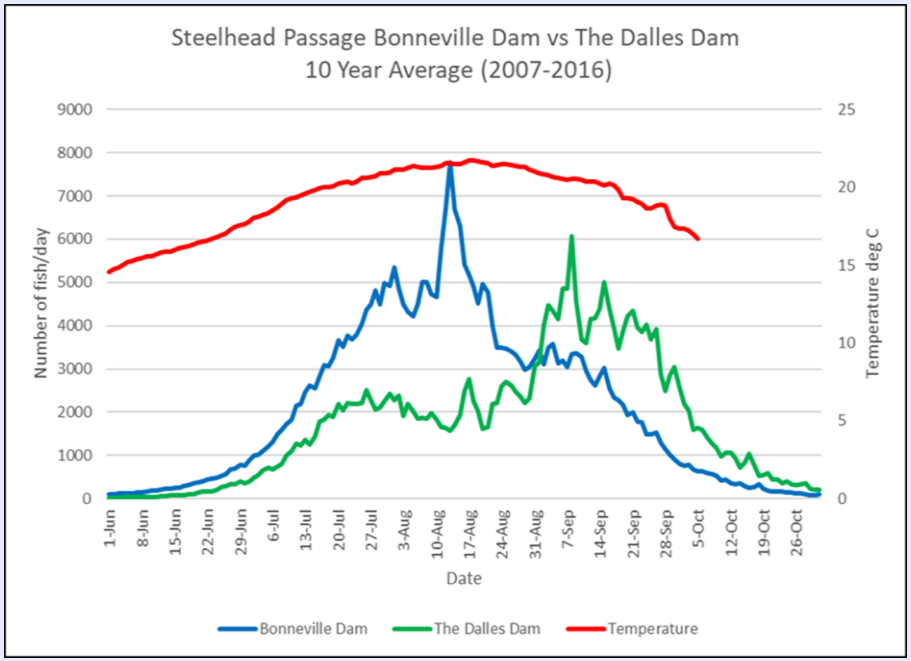


of Steelhead in Each Bonneville Reach CWR

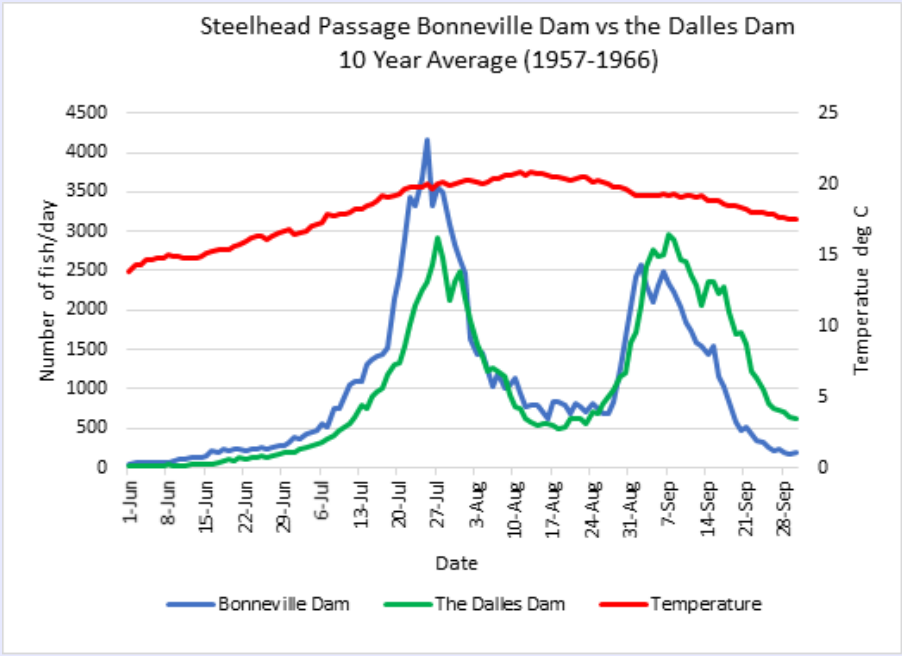
Tributary Name	Tributary Temp	Plume CWR Volume (> 2°C Δ)	Stream CWR Volume (> 2°C Δ)	Total CWR Volume (> 2°C Δ)	% of CWR in BON Reach	# Steelhead in Each CWR (1999-2016 Avg)	# Steelhead in Each CWR High Year (2009)	# Steelhead in Each CWR Low Year (2012)
	°C	m3	m3	m3				
Eagle Creek	15.1	2,100	888	2,988	0.2%	109	259	39
Rock Creek	17.4	530	1,178	1,708	0.1%	63	148	22
Herman Creek	12.0	168,000	1,698	169,698	9.5%	6,216	14,726	2,188
Wind River	14.5	60,800	44,420	105,220	5.9%	3,854	9,131	1,357
Little White Salmon River	13.3	1,097,000	11,661	1,108,661	61.9%	40,613	96,208	14,297
White Salmon River	15.7	72,000	81,529	153,529	8.6%	5,624	13,323	1,980
Hood River	15.5	28,000	0	28,000	1.6%	1,026	2,430	361
Klickitat River	16.4	73,000	149,029	222,029	12.4%	8,133	19,267	2,863
Total		1,501,430	290,403	1,791,833	100%	65,639	155,492	23,107

Steelhead Dam Passage – Current vs 1950s/60s

Current 2007- 2016 average

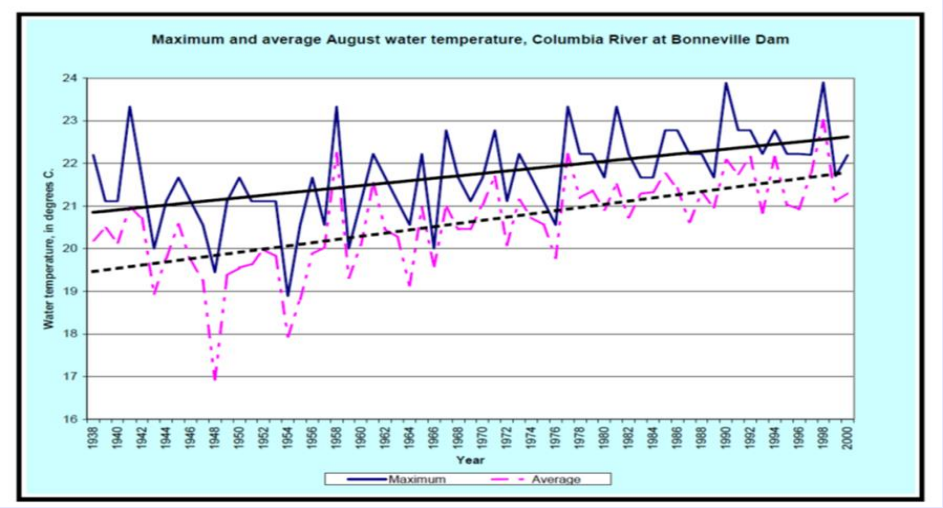


Decade after The Dalles Dam was Built 1957-1966 average

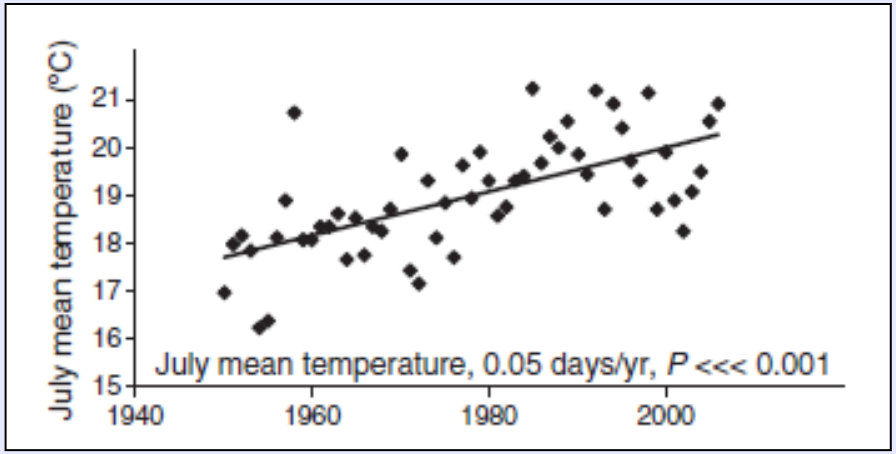


- ***Steelhead CWR use appears to be an adaptation to warmer Columbia River temperatures***
- Current temperatures are about 2°C warmer than the 1950s
  - 10 days above 20°C and 0 days above 21°C in an average year (1950s)
  - 57 days above 20°C and 27 days above 21°C in an average year (Current)

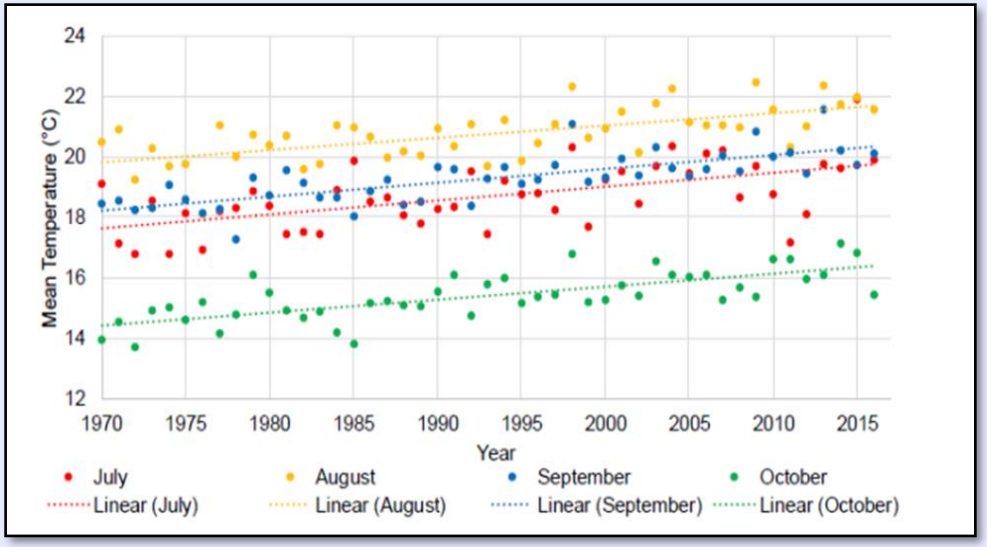
Columbia River Historical Temperature Trends



National Research Council 2004

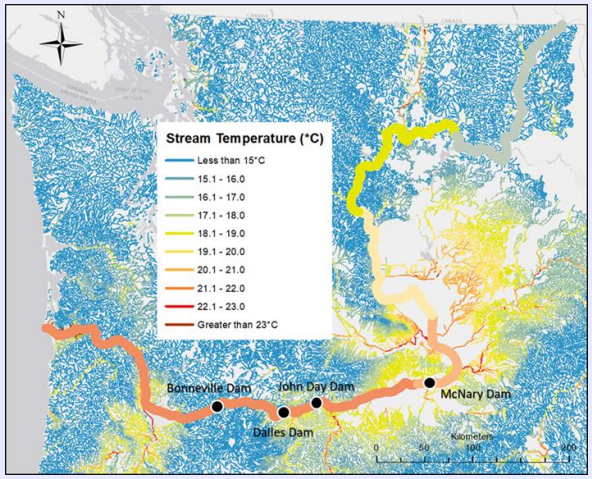


Crozier et al. (2008, Evol App)

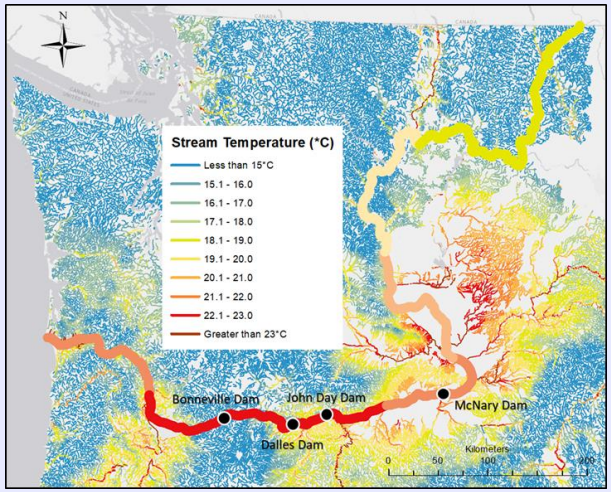


EPA 2020

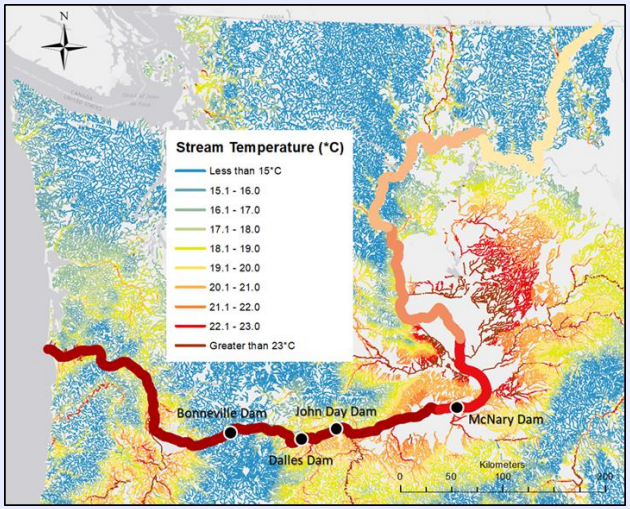
Future Lower Columbia River Temperatures (Aug mean)



Current



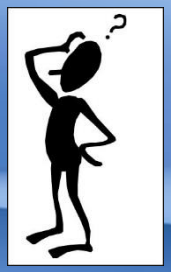
2040



2080

Assumes a continuation of the 0.3C/decade trend (since 1960)

Amount of CWR needed to attain Oregon's CWR standard



Depends on Columbia River Temperature
(Aug Mean)

20C (Historic)	21.5C (Current)	22.5C (2040)

- Evaluated based on current conditions
- Maintain the CWR volumes in the 12 primary CWR plus provide additional CWR in the Umatilla River
  - Cool the Umatilla River consistent with the Oregon DEQ and Umatilla Tribe Umatilla River Temperature TMDLs, in part by restoring late summer flows
- Restore other tributaries to increase CWR and potentially 'create CWR' in light of predicted continued Columbia River warming is also recommended
- Important to recognize that OR CWR standard is not intended to allow for or compensate for Columbia River temperatures in excess of 20C

Actions to Protect and Restore CWRs (Chapter 7 in CWR Plan)

Tributary Assessment 'Snapshots"

Factors affecting temperature

Water Withdrawals

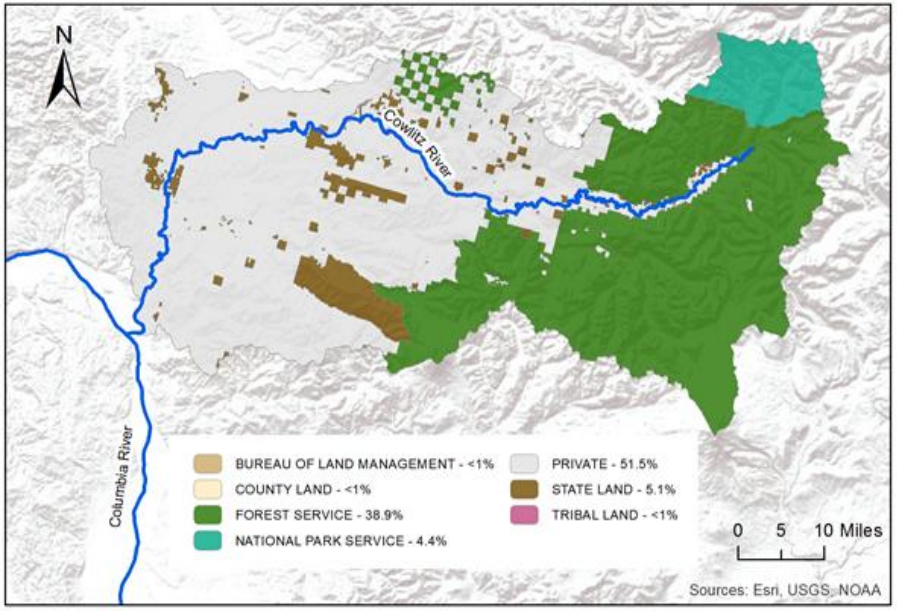
Climate Change

Riparian and Channel Conditions

Dams and Hydromodifications

1. Protect CWR Tributaries Through Existing Regulatory Programs

- Federal Forest plans
- State forest practices
- Columbia River Gorge Management Plan
- County Shoreline Master Plans/land use regulations
- Wild and Scenic River Plans
- State limits on new water withdraws/in-stream flow rules
- FERC flow requirements for Dams
- State water quality standard limits on new thermal discharges



Cowlitz Watershed

2. Restoration Actions within CWR Tributary Watersheds

- NW Power & Conservation Council Sub-basin Plans (2004)
- Salmon Recovery Plans and implementation actions
- Temperature TMDLs and Plans
- Watershed Resource Plans
- Restore stream vegetation, channel complexity, floodplain function and summer flows in target reaches
- Projects generally supported with public funds (BPA, salmon recovery, clean water, agricultural conservation)
- Counteract predicted increased temps from climate change

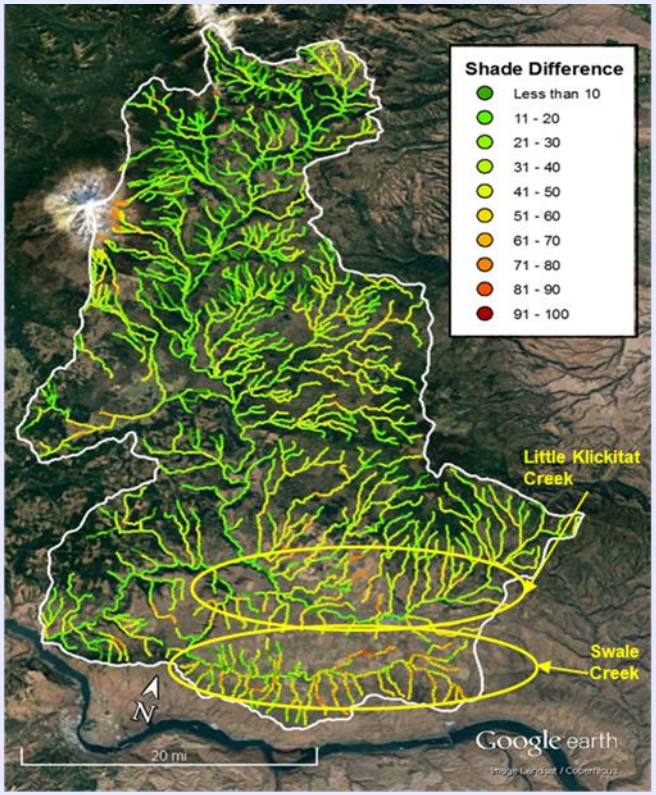
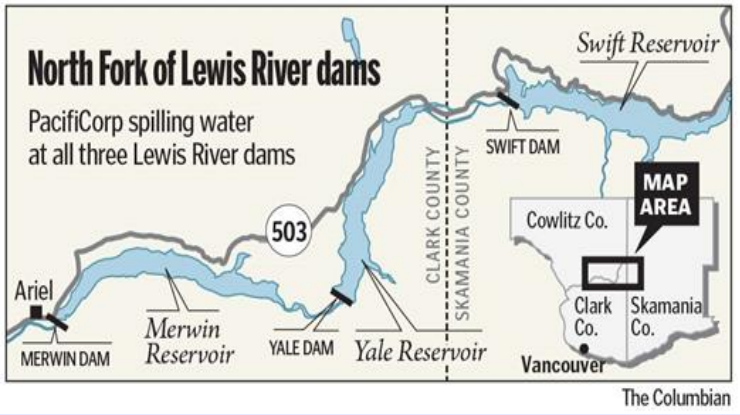
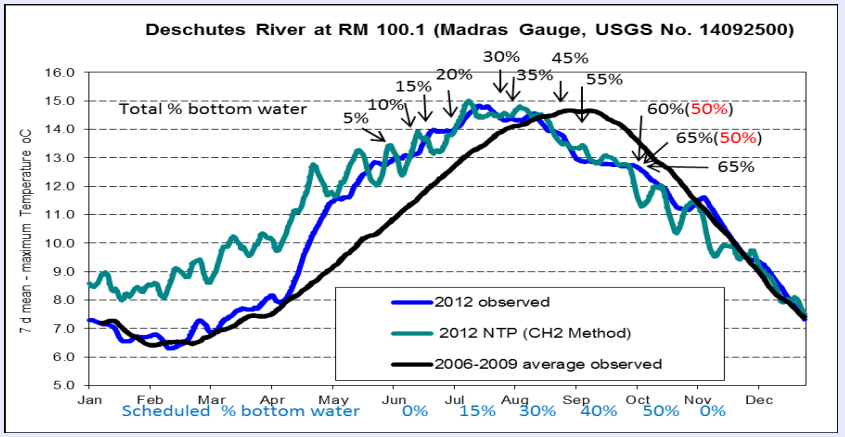


Fig. 5 Klickitat River Shade Difference between System Potential and Current Shade, Peter Leinenbach, 7/14/17

3. Manage Dams to Release Cool Summer Flows

- Cowlitz River (Mayfield Dam)
- Lewis River (Merwin Dam)
- Sandy River Basin (Bull Run Dam/Reservoir)
- Deschutes River (Pelton Round Butte Project)
- Visa-a-vis state 401 certs/FERC licenses or HCP





4. Restore Confluence Areas

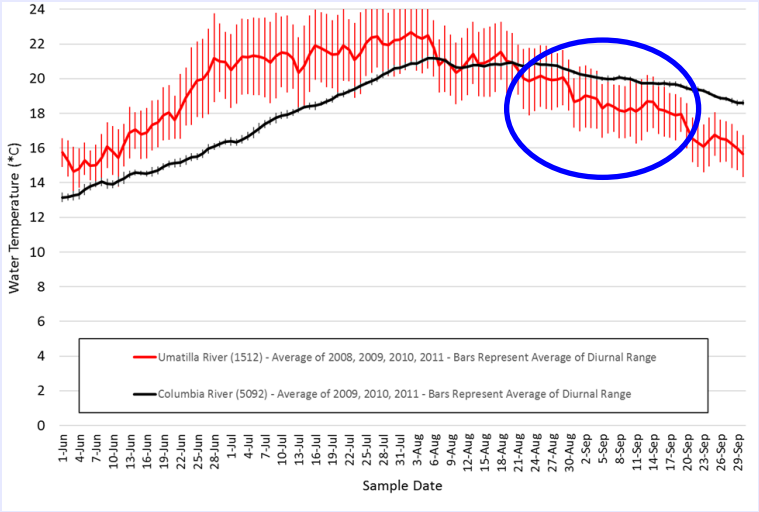
- Sediment has built up at the confluence and in the embayments of CWRs
- Potentially reducing fish access and volume of CWRs
- Recommend feasibility studies to restore confluence areas and remove sediment

Wind River

Herman Creek Cove

Additional Umatilla Basin Water Exchange

Umatilla River



Umatilla Basin TMDL

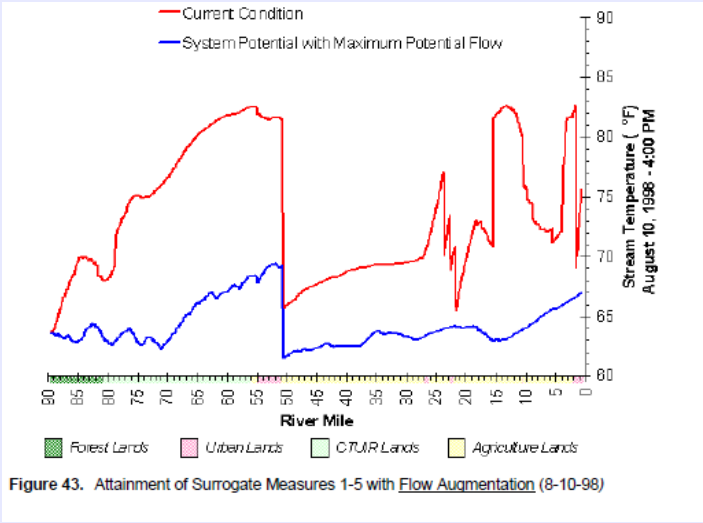
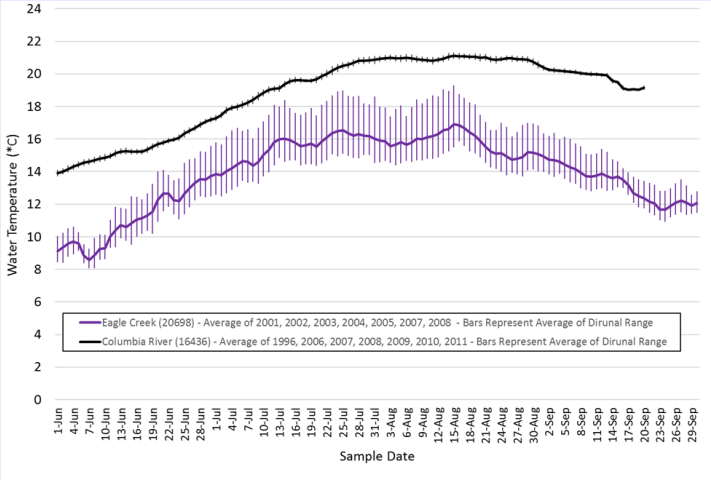


Figure 43. Attainment of Surrogate Measures 1-5 with Flow Augmentation (8-10-98)

- Pump Columbia River water for irrigation and reduce withdrawals from the Umatilla River to restore flows
- Part of Umatilla Tribe (CTUIR) water rights claim settlement negotiations
- Requires Congressional Funding

Groundwater supply at Eagle Creek Cascade Hatchery

- Creek withdrawal currently supplies hatchery
- If replaced with groundwater supply it would cool river and increase CWR Volume
- ODFW defined Eagle Creek a ‘thermal sanctuary” and owns hatchery

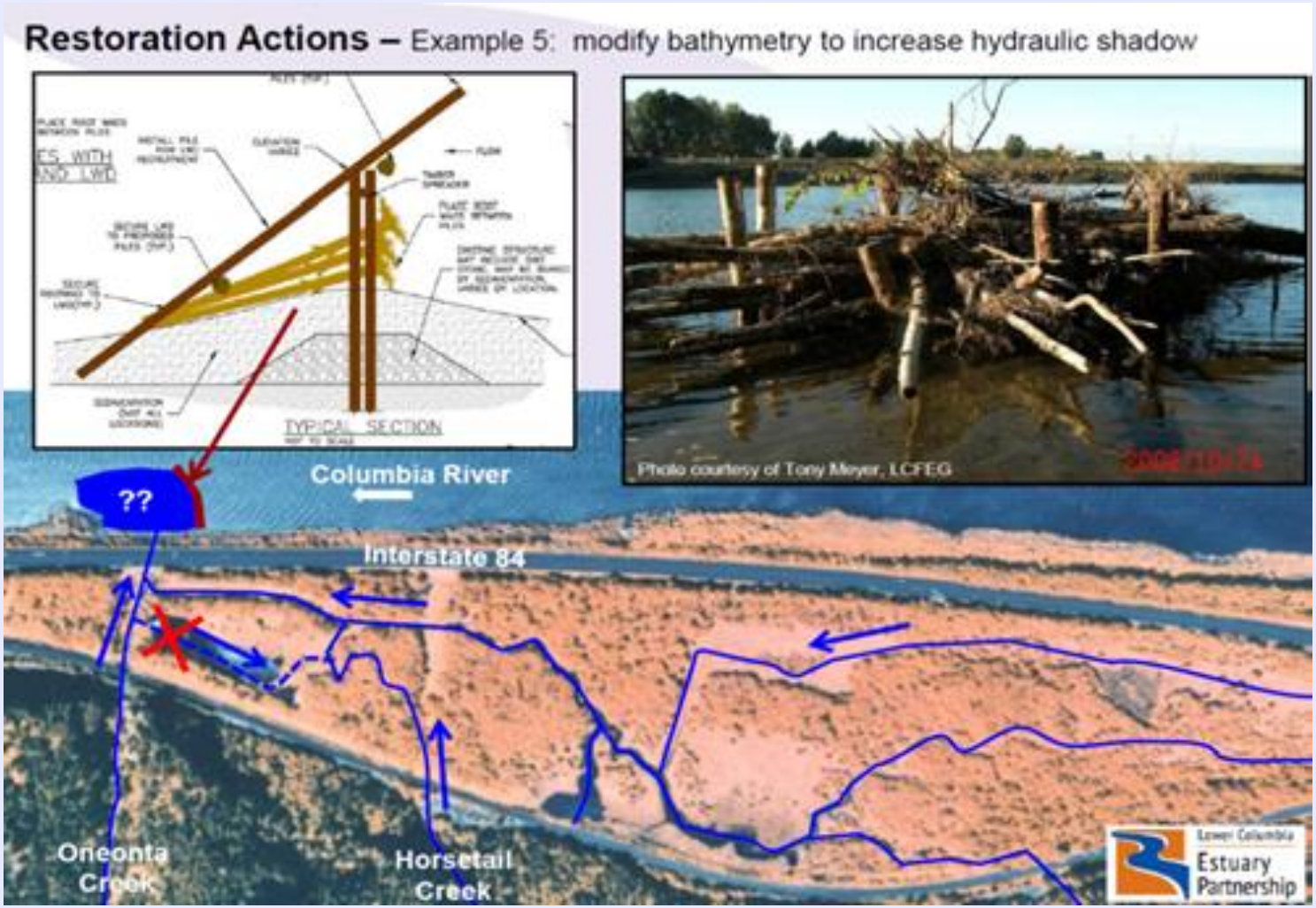


CASCADE HATCHERY

PROGRAM MANAGEMENT PLAN 2020

Enhance Oneonta Creek CWR

(Lower Columbia Estuary Partnership Design)



Columbia River Gorge Commission Doubles Riparian Protection on 7 CWR streams

Environment

Columbia River Gorge management plan updated to protect salmon, address climate change, support cideries

Updated Oct 19, 2020; Posted Oct 19, 2020

The U.S. Congress established the Columbia River Gorge National Scenic Area in 1986. This view of the Vista House is from Chanticleer Point in the Columbia River Gorge on Nov., 25 2018. Mark Graves/Staff LC- (photo courtesy of Jamie Hale)

A. **Streams and riparian areas** – protecting and enhancing aquatic and riparian systems. This includes expanding stream buffers, requiring vegetation enhancement, protecting cold water refuge habitats for fish, and other approaches.

(1) Apply a 200-foot buffer width to these EPA priority cold water refuge streams within the GMA: the Sandy River, Wind River, Little White Salmon River, White Salmon River, Hood River, Klickitat River, and

Oregon Closes Steelhead Fishing in Three Oregon CWR

(Deschutes River, Herman Creek and Eagle Creek)

New Oregon Rules Protect Migrating Columbia Wild Steelhead and Salmon Within Cold Water Refugia

OCTOBER 5, 2020 ~ LEAVE A COMMENT