

**Summary of Options for Central & South Puget Sound Portfolio**  
Draft November 15, 2017

Population or Watershed	Run Timing	Option	Designation	Fishery		Purpose	Integrated Hatchery		Segregated Hatchery		Comments
				Early Timed (angler days)	Native-Timed (angler days)		PHI Limit (Proposed)	Proposed Program Size	DGF Limit (Proposed)	Proposed Program Size	
North Lake Washington	Winter	A	Stabilizing	440 <sup>4/</sup>							Likely few natural-origin spawners currently based upon lock counts and spawner surveys conducted in 1990s. Catch of 53 hatchery fish.
		B	Contributing								
Cedar River	Winter	A	Stabilizing								Initiate conservation program with 20-45 adults from Green River population when population is consistently exceeding spawner objective (2,000). Projected initial return of 250-500 adults. Transition to C&R, C&K fishery after population re-established.
		B	Contributing			Conservation	Reintroduction	25,000-50,000			
Green River	Winter	A	Primary	C&K (3,100 angler days) <sup>2/</sup> Mark Selective (3,100 angler days)	Conservation /Harvest	Conservation /Harvest	0.67 (0.83)	55,000 (winter)			Discontinue program when spawner objective consistently achieved. Initiate C&R fishery when 75% of spawner objective achieved (1,500). Mark-selective fishery when 75% of spawner objective achieved (1,500). Catch of 138 hatchery fish. Initiate C&K fishery when spawner objective achieved (2,000). Catch of 50 natural and 14 hatchery fish.
		B					0.67 (0.83)	55,000 (winter)			
		C					0.67 (0.67)	110,000 (winter)			
		D					0.67 (0.67)	110,000 (winter)			
		E					0.67 (0.67)	110,000 (winter)			
		F					C&K Summer (3,500 angler days) <sup>4/</sup>	Harvest			
White River	Winter	A	Primary	C&R (1,500 angler days) <sup>5/</sup> Mark Selective (1,500 angler days)	Conservation /Harvest	Conservation /Harvest	0.67 (0.94)	60,000 (winter)			Discontinue program when spawner objective consistently achieved. Initiate C&R fishery when 75% of spawner objective achieved (730). Mark-selective fishery when 75% of spawner objective achieved (730). Catch of 15 hatchery fish. Initiate C&K fishery when spawner objective achieved (974). Catch of 24 natural and 15 hatchery fish.
		B					0.67 (0.94)	60,000 (winter)			
		C					0.67 (0.83)	120,000 (winter)			
		D					0.67 (0.83)	120,000 (winter)			
Puyallup/ Carbon River	Winter	A	Primary	C&K (200 angler days) <sup>6/</sup>	Conservation /Harvest	Conservation /Harvest	0.67 (0.83)	120,000 (winter)			
Nisqually River	Winter	A	Primary	C&R (> 3,100 angler days) <sup>7/</sup>							Initiate C&R fishery when 75% of spawner objective achieved (1,500). Initiate C&K fishery when spawner objective achieved (2,000). Catch of 50 natural fish.
		B	Primary	C&K (420 angler days)							

South Puget Sound	Winter	A		Primary Contributing	C&K (500 angler days) <sup>8/</sup>							Initiate program in Deschutes River when hatchery upgrade completed. Catch of 60 hatchery fish.
		B	C									
		Contributing										
East Kitsap	Winter	A		Contributing								
		B										

1/ Assumes an average SAR of 0.50% (Green average for outmigration years 2000-2012), a 35% recreational harvest rate, and an average catch of 0.12 steelhead per angler trip.

2/ Assumes runsize of 1,500 natural-origin fish, 5% allowable exploitation rate, 10% release mortality rate, and an average encounter of 0.12 steelhead per angler trip.

3/ Assumes runsize of 2,000 natural-origin fish, 50 hatchery-origin fish, 5% allowable exploitation rate, 10% release mortality rate, and an average encounter rate of 0.12 steelhead per angler trip.

4/ Assumes 2001-2012 average catch of 417 and an average encounter rate of 0.12 steelhead per angler trip.

5/ Assumes runsize of 730 natural-origin fish, 5% allowable exploitation rate, 10% release mortality rate, and an average encounter of 0.12 steelhead per angler trip.

6/ Assumes runsize of 974 natural-origin fish, 600 hatchery-origin fish, 5% allowable exploitation rate, 10% release mortality rate, and an average encounter of 0.12 steelhead per angler trip.

7/ Assumes runsize of 1,500 natural-origin fish, > 5% allowable exploitation rate, 10% release mortality rate, and an average encounter of 0.12 steelhead per angler trip.

8/ Assumes an average SAR of 0.12% and an average catch of 0.12 steelhead per angler trip.

Acronyms:

DGF. Demographic gene flow.

C&K. Recreational catch and keep fishery.

C&R. Recreational catch and release fishery.

# Mid-South Sound hatchery steelhead evaluation

HATCHERY EVALUATION AND ASSESSMENT TEAM  
WASHINGTON DEPARTMENT OF FISH AND WILDLIFE



# Background and approach

- ▶ Used three approaches to assess the programs.
  1. Smolt to adult return (SAR%)
    - a. North Lake Washington Tribs. segregated early-winter steelhead
    - b. Cedar River Winter-Late steelhead reintroduction
    - c. Deschutes River segregated early-winter steelhead
  2. Demographic Geneflow Model (DGM)
    - a. Green River segregated summer steelhead
  3. All-H-Analyzer Model (AHA)
    - a. Green River Winter-Late steelhead
    - b. White River Winter-Late steelhead



# AHA Model

- ▶ Data intensive model developed by the HSRG, that uses habitat, hatchery and harvest data to predict impact on natural origin populations.
- ▶ The AHA Model was used to estimate potential program sizes, pHOS and PNI and population recovery.
- ▶ Model primary needs:
  - ▶ Goals for transitioning between recovery phases
  - ▶ Requires smolt capacity and productivity and SAR% data.
  - ▶ Harvest rates
  - ▶ Release data, broodstock data (pNOB and pHOB), Spawning Ground data ( NOS and HOS).
- ▶ Has a built in life cycle model that incorporates the Pacific Ocean Decadal Oscillation (PDO).

**Step 1. ISIT SET-UP**

What do we want to achieve?

Open Data File

Species: **Steelhead Yearling**

Region/Basin	Green River
Population Name	Late Winter Steelhead
Current Designation	Primary
Current Recovery Phase	Recolonization

Hatchery Program 1	
Purpose	Both
Broodstock Policy	Integrated

Hatchery Program 2	
Purpose	NA
Broodstock Policy	NA

Fishery Labels	Ocean
	Puget Sound
	Terminal

Click here to set Biological Targets by Recovery Phase:  
 1. Natural Production  
 2. Harvest

**Step 2. AHA**

What's our working hypothesis?

Click here to enter Key Assumptions for:  
 1. Natural Production  
 2. Fish passage and SAR  
 3. Harvest  
 4. Hatchery Production

RETURN TO PREVIOUS SCREEN

**Step 3. Status and Trends**

How are we doing?

Click here to enter Annual Data:  
 1. Catch  
 2. Escapement  
 3. Hatchery

Save Data File

**Step 4. Life Cycle Model**

What's our long-term strategy?

A. Set Random and Systematic Variability for:  
 1. Early Marine Survival  
 2. Exploitation Rate  
 3. Habitat Potential  
 4. Fitness Effect  
 5. Freshwater Survival  
 6. Ocean Survival

B. Set Harvest Policy

C. Refine Hatchery Reform Strategy  
 1. Phase triggers  
 2. Management Constraints

D. Scenario Analysis

**Step 5. Management Targets**

What's the plan for this year?

Enter Run Forecast and Calculate Annual Management Targets

FUTURE OPTIONS

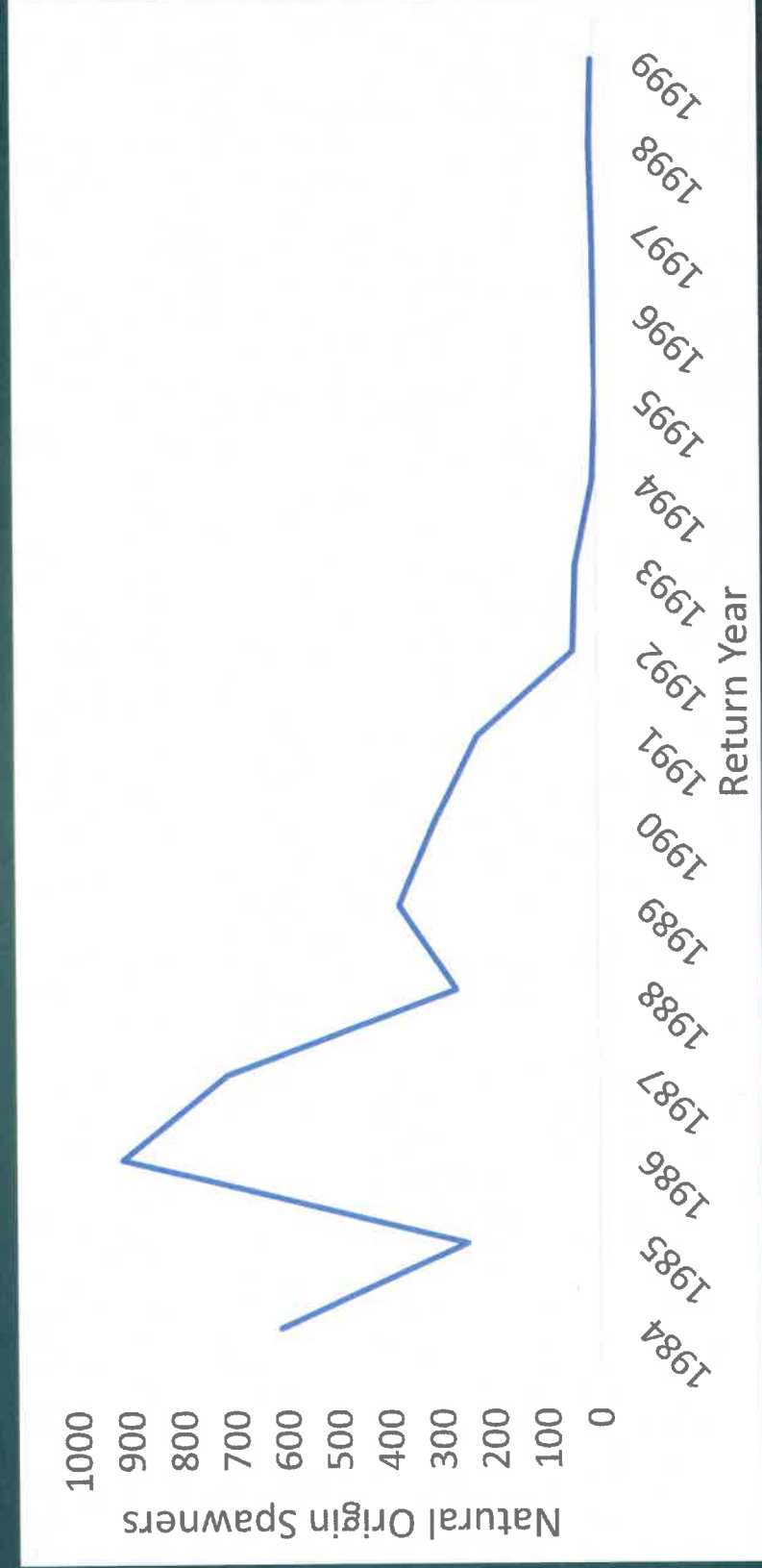
Viability Analysis

Run Forecast

# North Lake Washington

- ▶ Assessed a segregated early-winter steelhead program with a 30,000 smolt release.
- ▶ Potentially a stabilizing or contributing population.
- ▶ Assumptions:
  - ▶ Used a range of SAR% from 0.25% to 1%
  - ▶ Other Puget Sound segregated programs have averaged around 0.5%
  - ▶ Used a harvest rate of 35%.
- ▶ Natural populations appear to be functionally extinct.

# North Lake Washington





# North Lake Washington Results

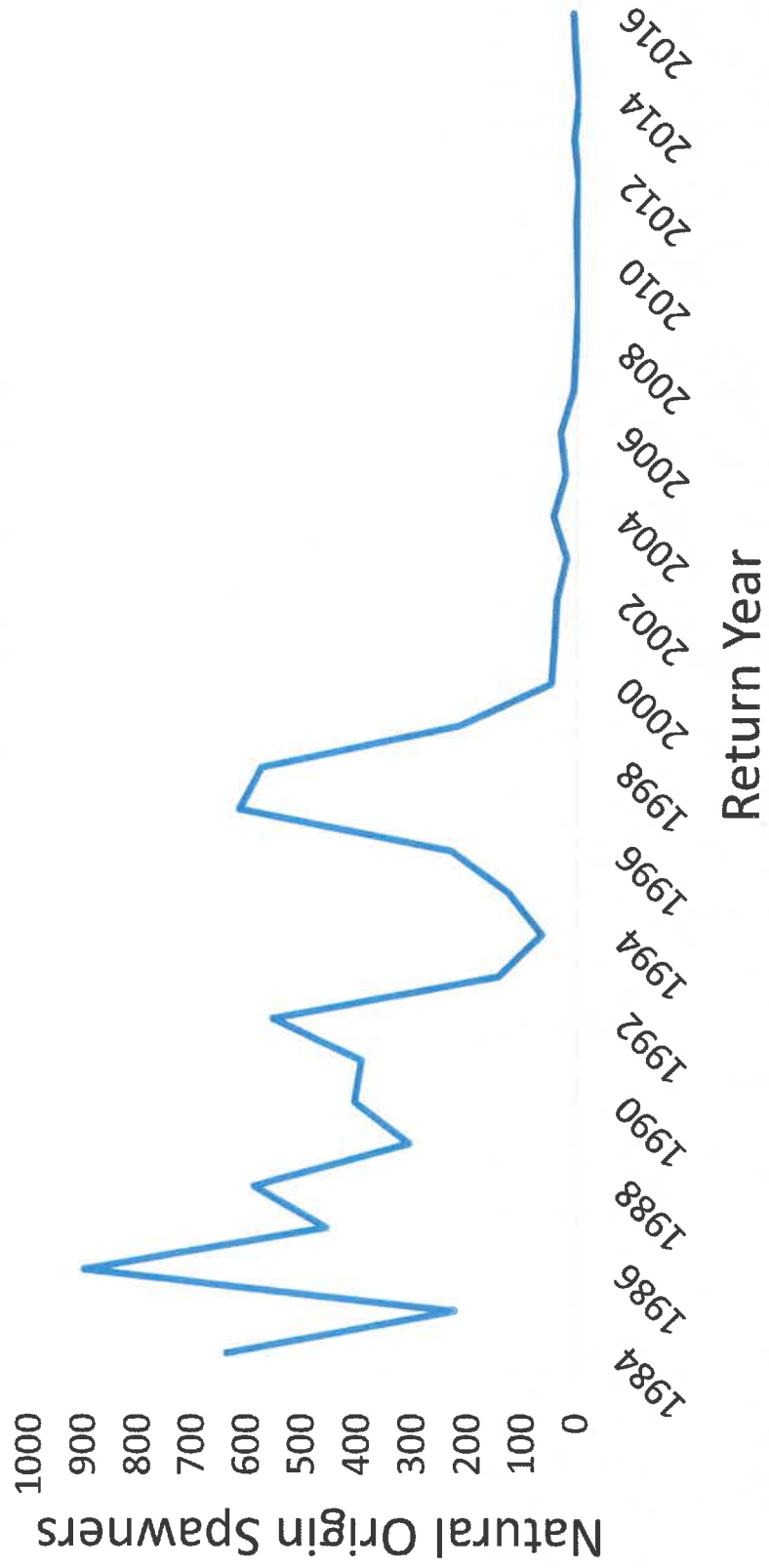
- ▶ A release of 30,000 yearling smolts with a 0.5% SAR
- ▶ Total return of 150 adults
- ▶ Harvest of 53 adults
- ▶ 440 angler days.

SAR%	Returns		Harvest			Angler Days		
	Release		15%	25%	35%	15% Harvest Rate	25% Harvest Rate	35% Harvest Rate
0.50%	30,000	150	23	38	53	188	313	440

# Cedar River Winter-Late

- ▶ Natural population went functionally extinct during the early 2000's.
- ▶ 1984 to 1999 abundance averaged 402 spawners.
- ▶ Assessed a reintroduction program using wild Green River winter-late steelhead.
- ▶ Used the SAR% approach to model potential program sizes.
- ▶ Smolt to adult survival is unknown for the Cedar River.
- ▶ Used a range of SAR% from 0.25% to 2%.

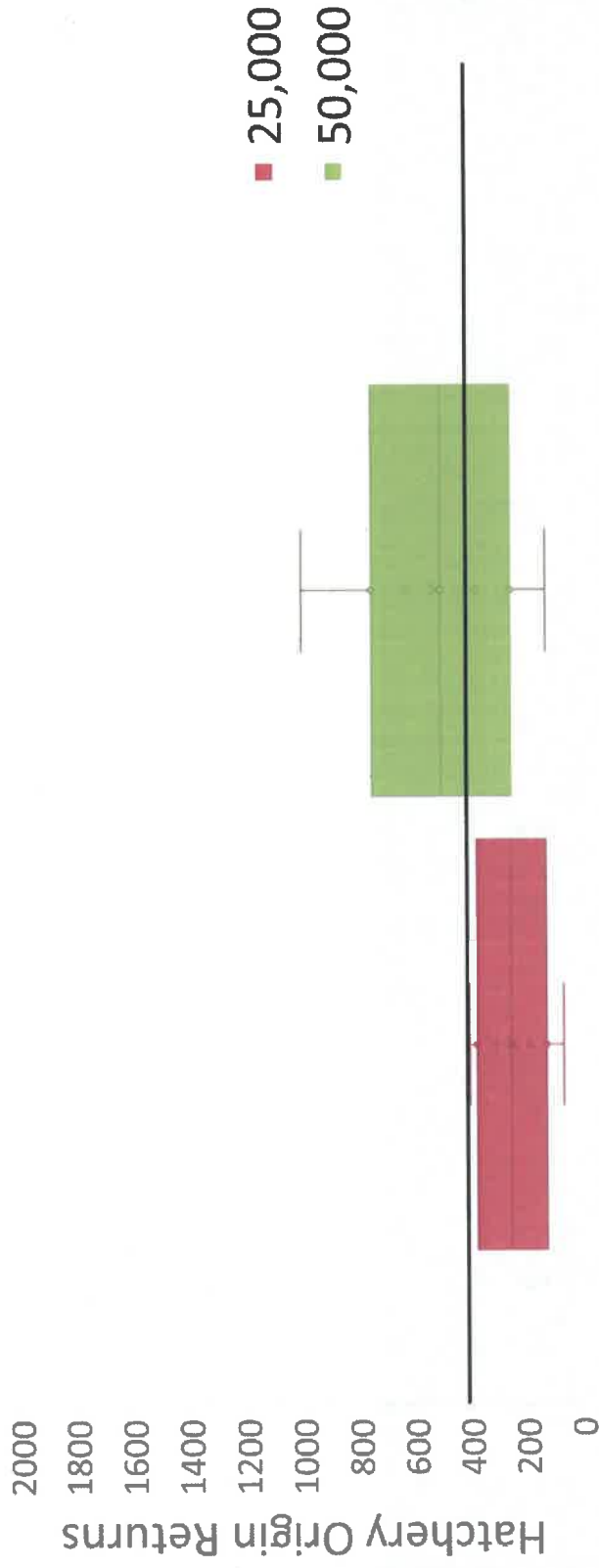
# Cedar River Winter-Late



# Results

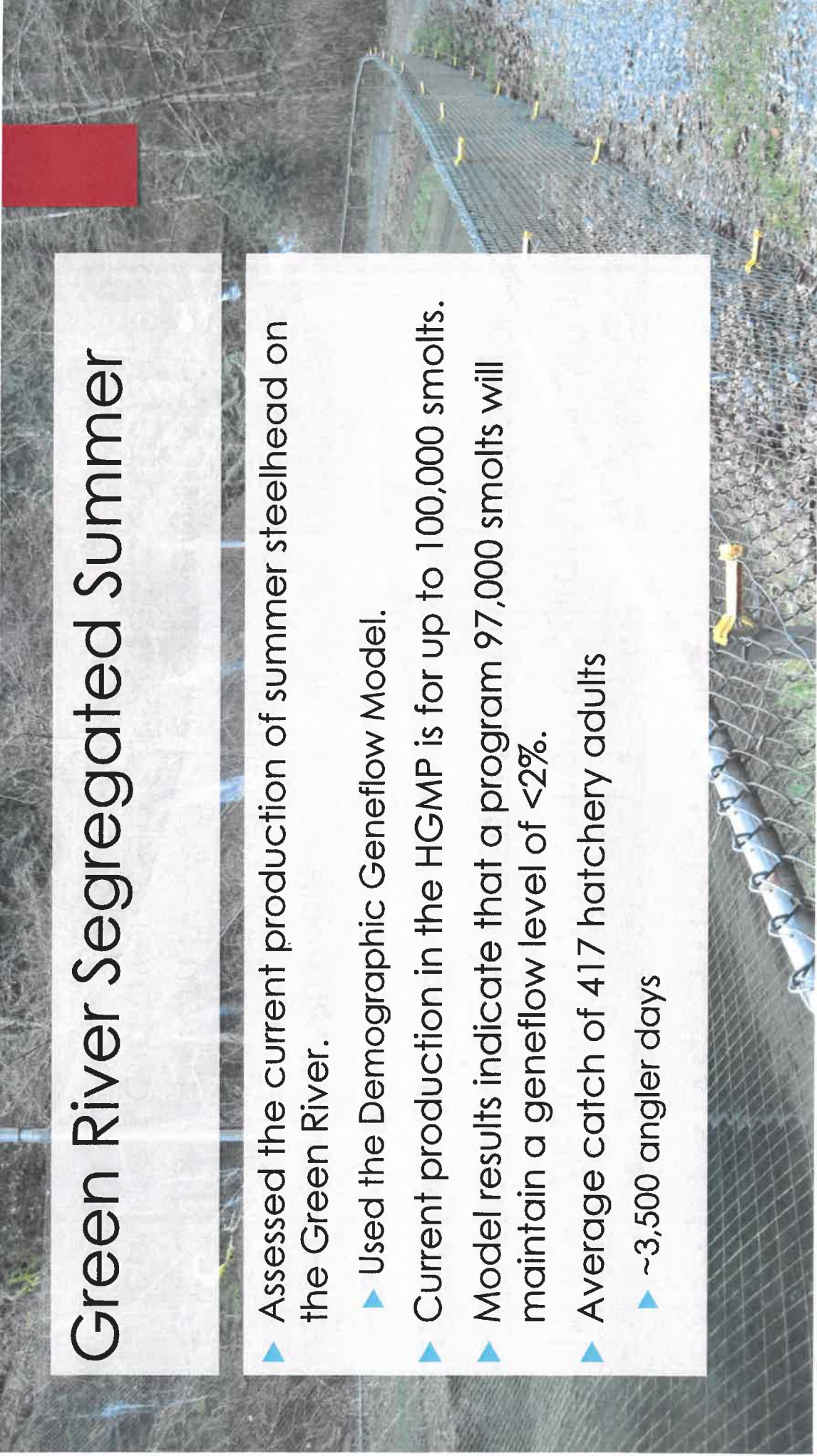
- ▶ A program size of 25,000 to 50,000 would be needed to get sufficient returns.

## Cedar River Winter Late Steelhead



# Green River Segregated Summer

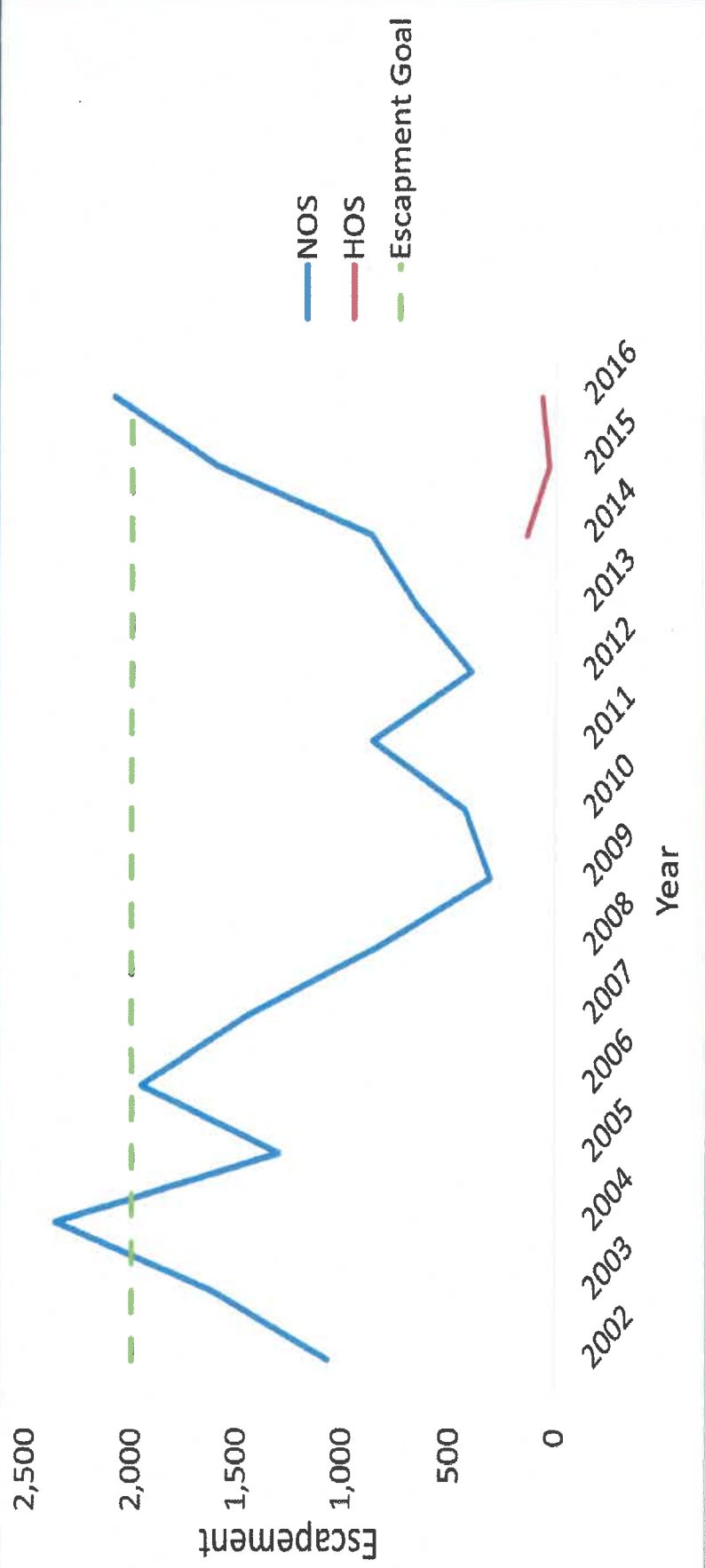
- ▶ Assessed the current production of summer steelhead on the Green River.
  - ▶ Used the Demographic Geneflow Model.
- ▶ Current production in the HGMP is for up to 100,000 smolts.
- ▶ Model results indicate that a program 97,000 smolts will maintain a geneflow level of <2%.
- ▶ Average catch of 417 hatchery adults
  - ▶ ~3,500 angler days



# Green River Winter-Late

- ▶ Primary population with current program of 55,000 smolts.
- ▶ AHA model used to assess program size and performance.
- ▶ Model inputs
  - ▶ SAR = 1.5%
  - ▶ Capacity = 40,590 smolts
  - ▶ Productivity = 110 smolts per female
- ▶ pHOS derived from hook and line broodstocking encounters and averaged 5.85% between 2014-2016.

# Green River Winter-Late





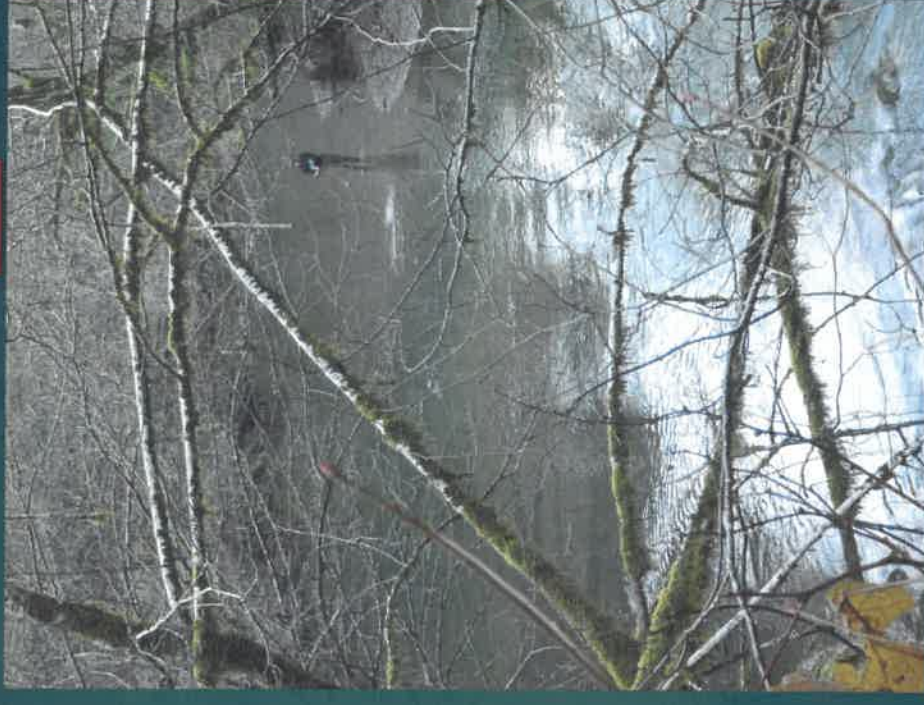
# Potential programs

- ▶ Assessed program sizes of 55,000 to 110,000
- ▶ Broodstock Needs
  - ▶ Fecundity = 4,000 eggs per female.
  - ▶ 110,000 requires 84 adults
    - ▶ 30% of the run (2002-2016 average) = 355 spawners
- ▶ Assessed hatchery programs with a SAR of 0.5%



## Results Continued

- ▶ 55,000 (current program)
  - ▶ Within HSRG standards for SAR of 0.5%.
  - ▶ pHOS (10%); PNI = (83%)
- ▶ 110,000
  - ▶ Within HSRG standards for SAR of 0.5%.
  - ▶ pHOS (25%); PNI = (67%)



# Harvest Results

- ▶ A fishery would be considered if 75% of the escapement goal (EG) is reached (1,500 fish)
- ▶ Option 1: Current program Catch and Release Fishery
  - ▶ 3,100 angler days
- ▶ Option 2: 110,000 release and mark selective fishery
  - ▶ Harvest 138 hatchery fish with 3,100 angler days
- ▶ Option 3: 110,000 release Catch and Keep Fishery when above EG of 2,000 spawners
  - ▶ Harvest 50 natural and 14 hatchery fish
  - ▶ 420 angler days

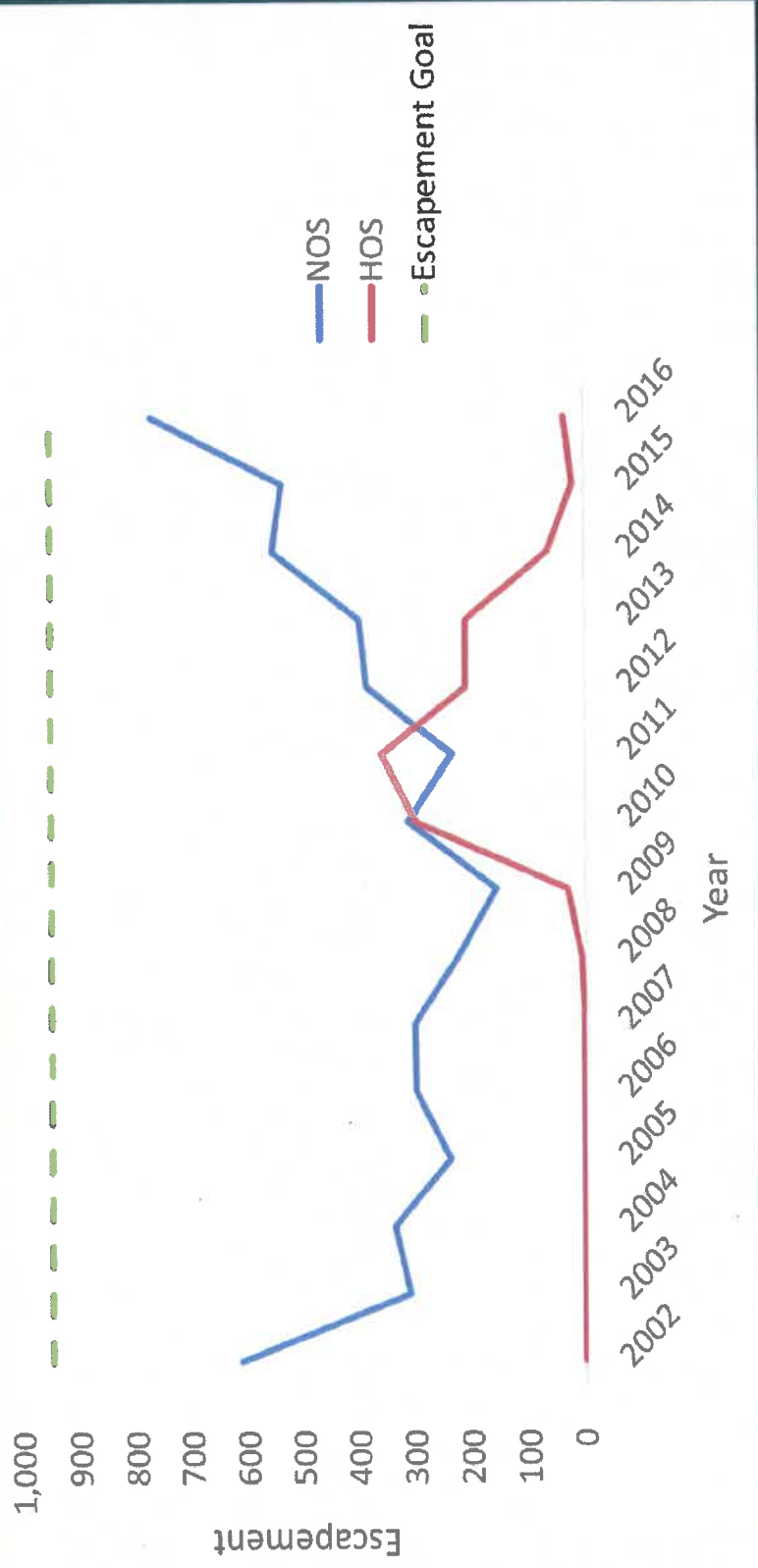


# White River Winter-Late

- ▶ Primary population, current program size up to 60,000 smolts
- ▶ AHA model used to assess program size and performance.
- ▶ Model inputs
  - ▶ SAR = 1.5%
  - ▶ Capacity = 36,899 smolts
  - ▶ Productivity = 110 smolts per female
- ▶ pHOS based on returns to the White River trap has averaged 24% since the inception of the program.




# White River Winter-Late



# Potential programs

- ▶ Assessed program sizes of 60,000 (current) to 198,000.
- ▶ Broodstock Needs
  - ▶ Fecundity = 3,209 eggs per female.
  - ▶ 198,000 requires 172 adults
  - ▶ 120,000 requires 108 adults
  - ▶ 75,000 requires 75 adults
  - ▶ 30% of the run during average (2002-2016) years = 116 spawners
- ▶ Assessed programs with a SAR of 0.5%



## Results Continued

- ▶ 60,000 (Current program)
  - ▶ Within HSRG standards for SAR of 0.5%.
  - ▶ pHOS (6.4%); PNI (94%)
- ▶ 198,000
  - ▶ Exceeds HSRG maximum broodstock limit <30% of the NORs
  - ▶ pHOS (29.5%); PNI (77%)
- ▶ 120,000
  - ▶ Within HSRG standards for SAR of 0.5%.
  - ▶ pHOS (20.2%); PNI (83%)

# Harvest Results

- ▶ A fishery would be considered if 75% of the escapement goal (EG) is reached (730 fish)
- ▶ Option 1: Current program Catch and Release Fishery
  - ▶ 1,500 angler days
- ▶ Option 2: 120,000 release and mark selective fishery
  - ▶ Harvest 15 hatchery fish with 1,500 angler days
- ▶ Option 3: 110,000 release Catch and Keep Fishery when above EG of 974 spawners
  - ▶ Harvest 24 natural and 15 hatchery fish
  - ▶ 200 angler days



# Nisqually River

- ▶ Wild Steelhead Management Zone – Primary population, No hatchery releases
- ▶ Fishery Options
  - ▶ Option 1: Current program Catch and Release Fishery if 75% of the escapement goal (EG) is reached (1,500 fish)
    - ▶ 3,100 angler days
  - ▶ Option 2: Catch and Keep Fishery when above EG of 2,000 spawners
    - ▶ Harvest 50 natural
    - ▶ 420 angler days



# Deschutes Early-winter segregated

- ▶ No natural population
- ▶ Steelhead were historically released in the Deschutes River – discontinued in 2005 due to low survival.

	SAR%	Returns			Angler Days		
		Release (Low)	Release (Med)	Release (High)	Release (Low)	Release (Med)	Release (High)
Historic Survival (BY 1995 to 2004)		25,000	50,000	100,000	25,000	50,000	100,000
High	0.12%	30	60	121	252	504	1,008

Questions?

