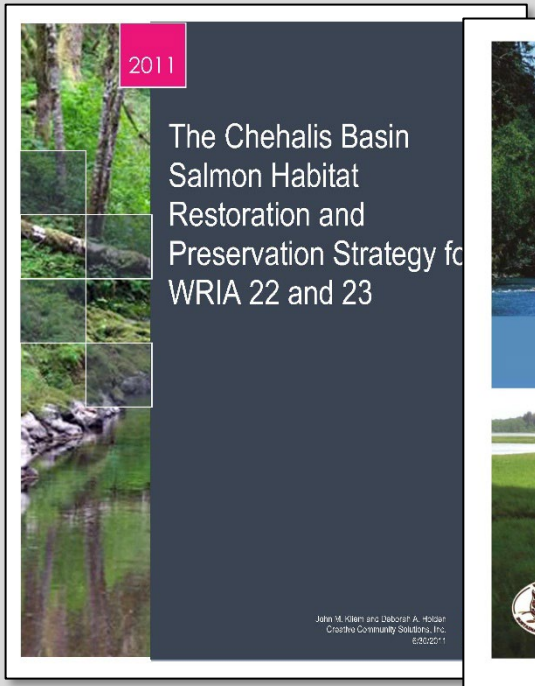
Integrated Analysis

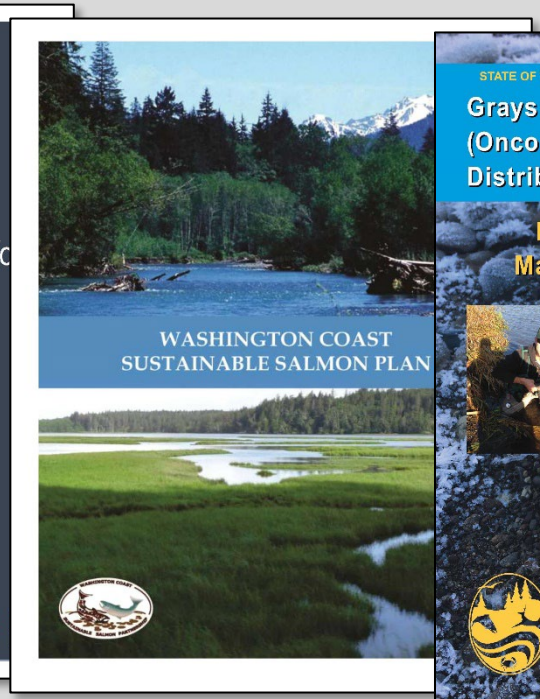
Limiting Factors & Opportunities for Improvement

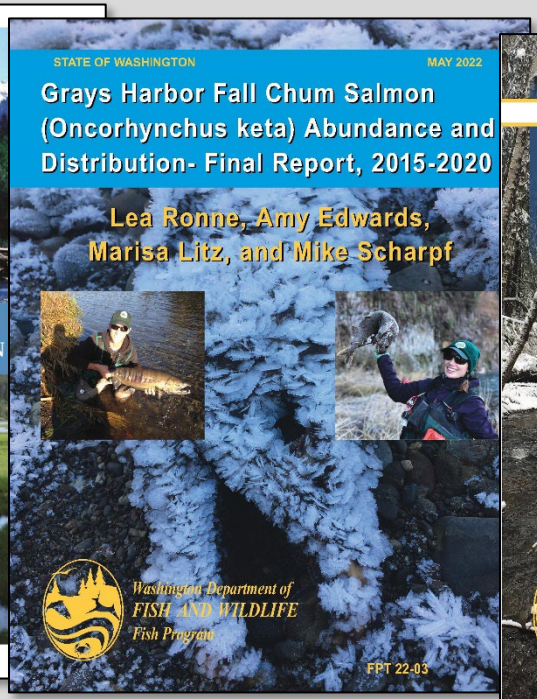
of Chehalis Salmon & Steelhead

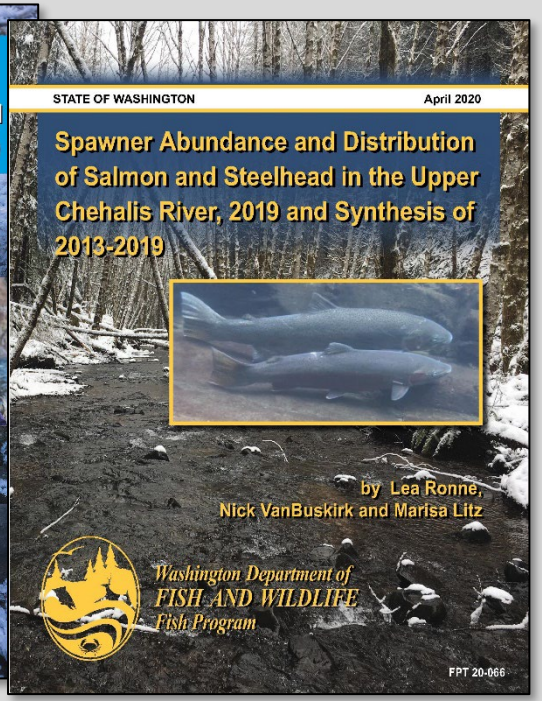
Prepared for:
Chehalis Basin Board,
WRCO, WDOE & WDFW

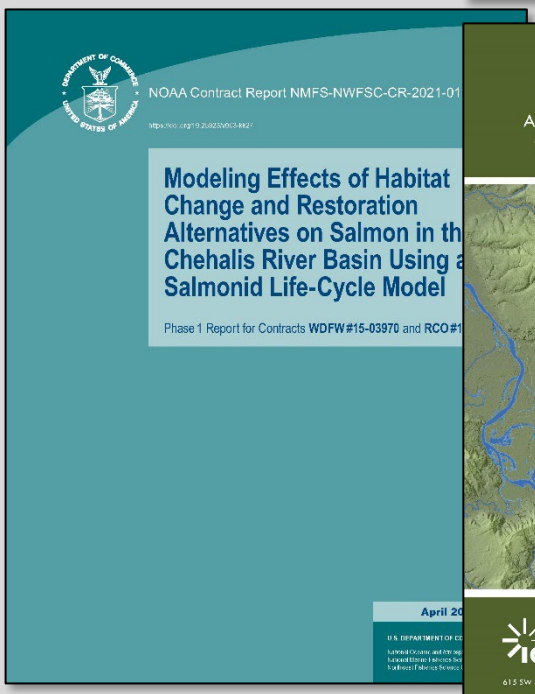
By:
Ray Beamesderfer
Fish Science Solutions, Inc.

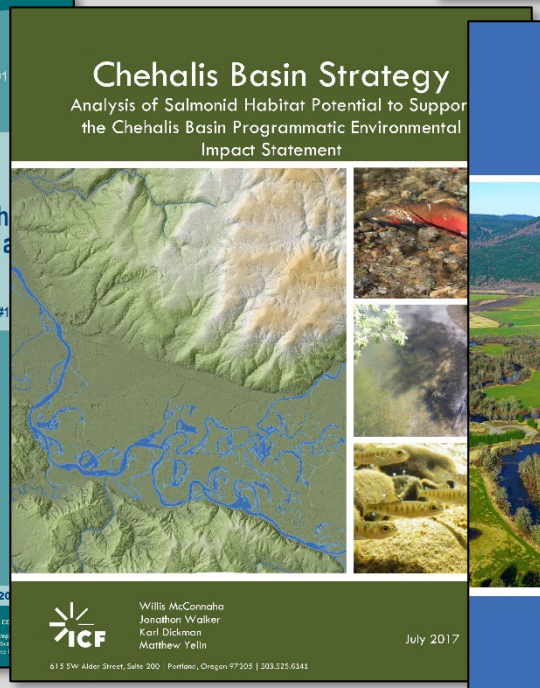

2011
The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy fo WRIA 22 and 23
John M. Kliem and Deborah A. Holtan
Creative Community Solutions, Inc.

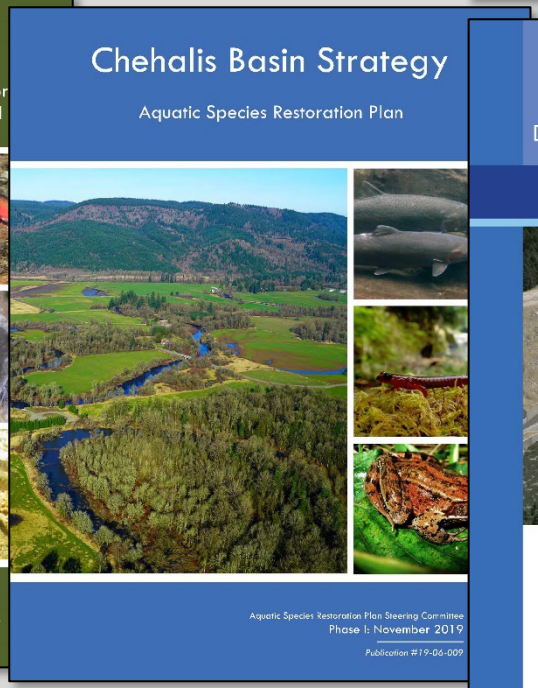

WASHINGTON COAST SUSTAINABLE SALMON PLAN

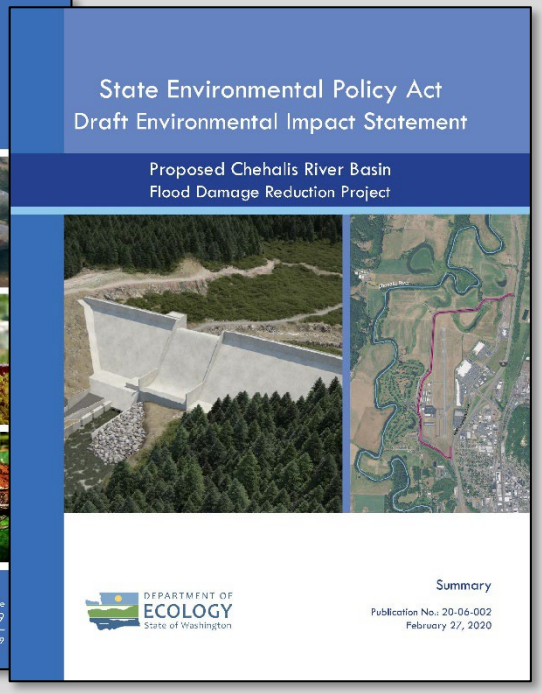

STATE OF WASHINGTON
MAY 2022
Grays Harbor Fall Chum Salmon (Oncorhynchus keta) Abundance and Distribution- Final Report, 2015-2020
Lea Ronne, Amy Edwards, Marisa Litz, and Mike Scharpf
Washington Department of FISH AND WILDLIFE Fish Program
FPT 22-03


STATE OF WASHINGTON
April 2020
Spawner Abundance and Distribution of Salmon and Steelhead in the Upper Chehalis River, 2019 and Synthesis of 2013-2019
by Lea Ronne, Nick VanBuskirk and Marisa Litz
Washington Department of FISH AND WILDLIFE Fish Program
FPT 20-066


NOAA Contract Report NMFS-NWFSC-CR-2021-01
Modeling Effects of Habitat Change and Restoration Alternatives on Salmon in th Chehalis River Basin Using a Salmonid Life-Cycle Model
Phase 1 Report for Contracts WDFW#15-03970 and RCO#1


Chehalis Basin Strategy
Analysis of Salmonid Habitat Potential to Suppor the Chehalis Basin Programmatic Environmental Impact Statement
Willis McConnaha
Jonathon Walker
Karl Dickman
Matthew Yelin
ICF
July 2017


Chehalis Basin Strategy
Aquatic Species Restoration Plan
Aquatic Species Restoration Plan Steering Committee
Phase I: November 2019


State Environmental Policy Act
Draft Environmental Impact Statement
Proposed Chehalis River Basin Flood Damage Reduction Project
DEPARTMENT OF ECOLOGY State of Washington
Summary

REMAINING QUESTIONS

Is the recovery burden being shared "equitably" among all the contributing parties?

- Significance of non-habitat factors?
- Actions fully integrated across factors?
- Habitat actions canceled by other factors?
- How can concerted efforts work together to produce success?

Abundance

Stream Habitat

Estuary Habitat

Dams

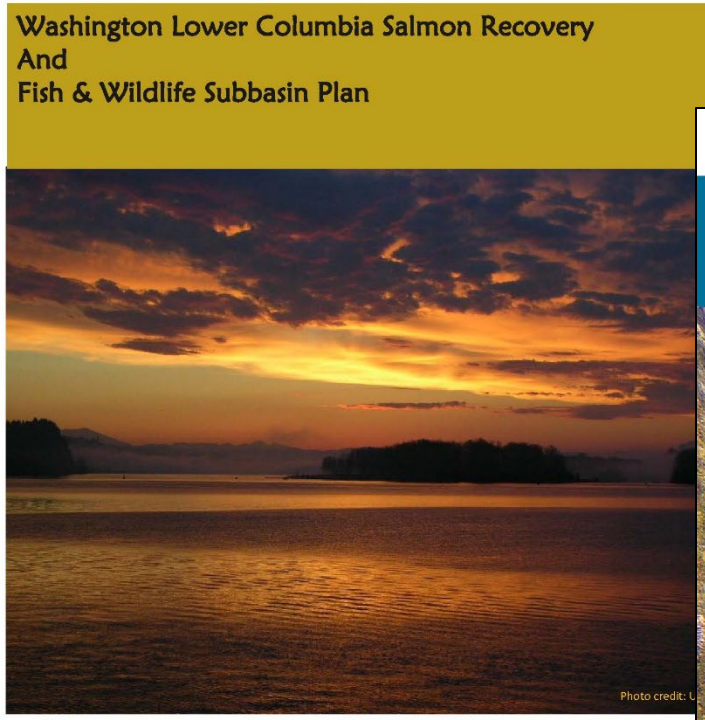
Fishery

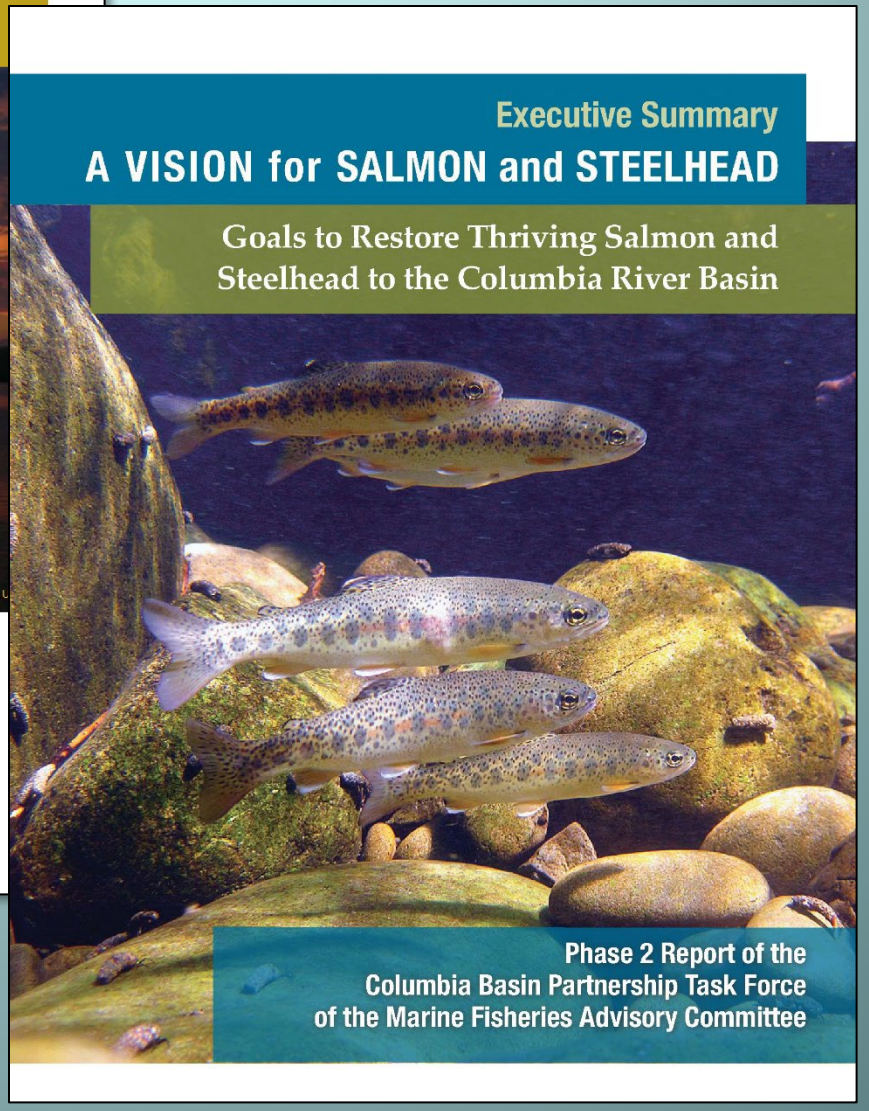
Hatchery

Predation

Climate

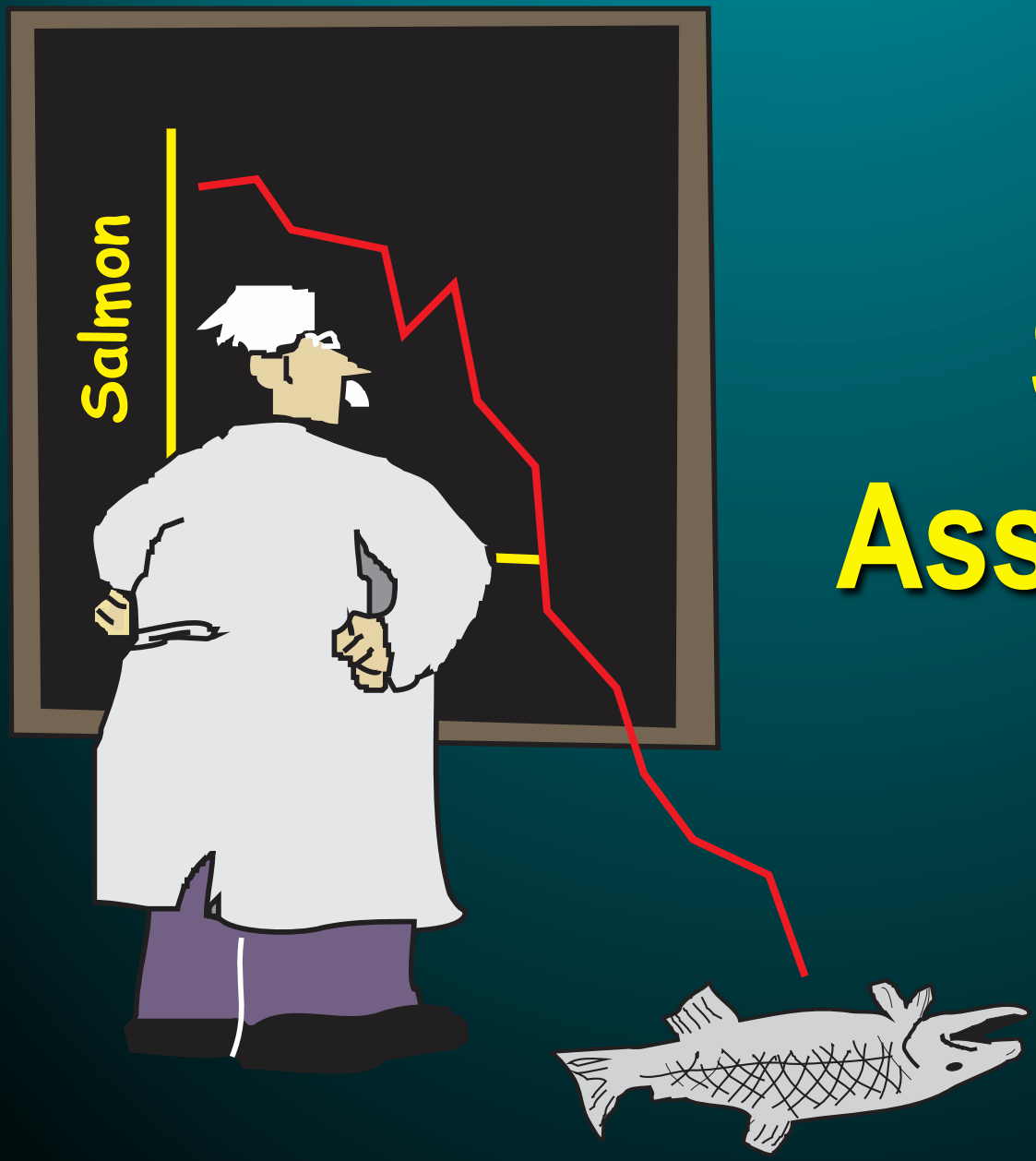
APPROACH DEVELOPMENT





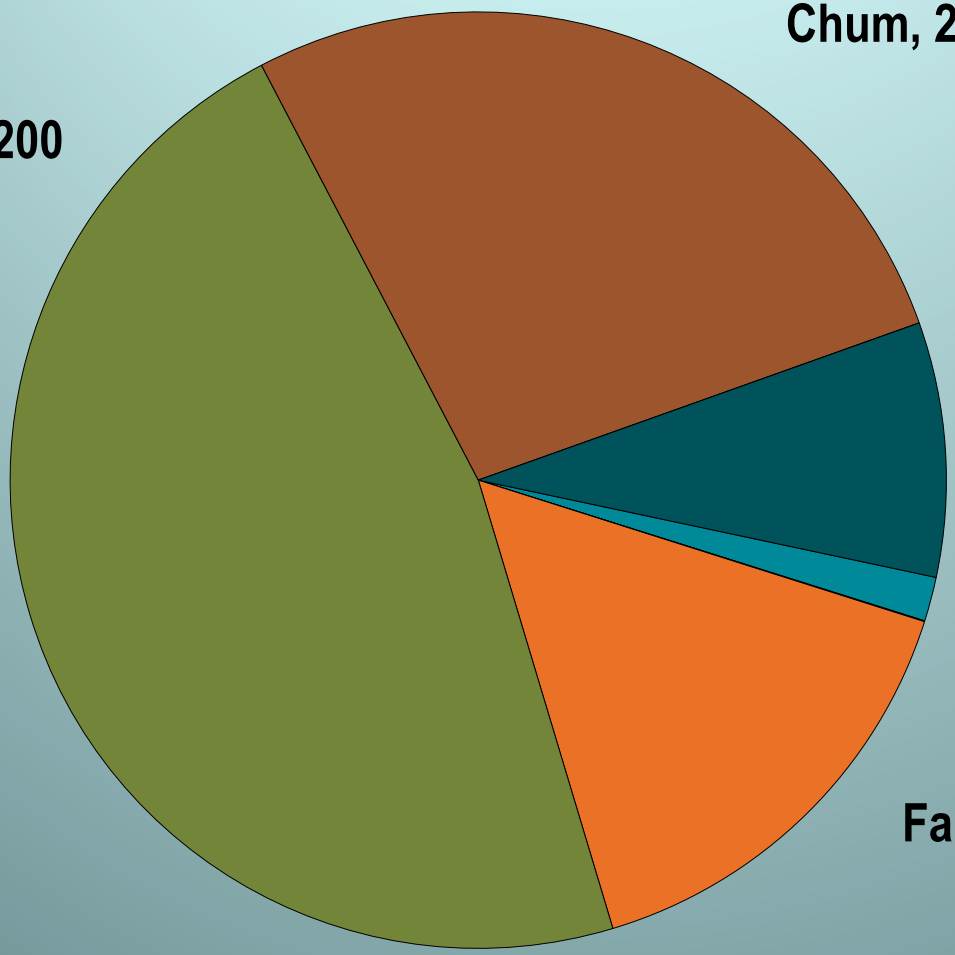
Integrated Analysis

- Stock Assessment
- Limiting Factor Analysis
- Life Cycle Analysis



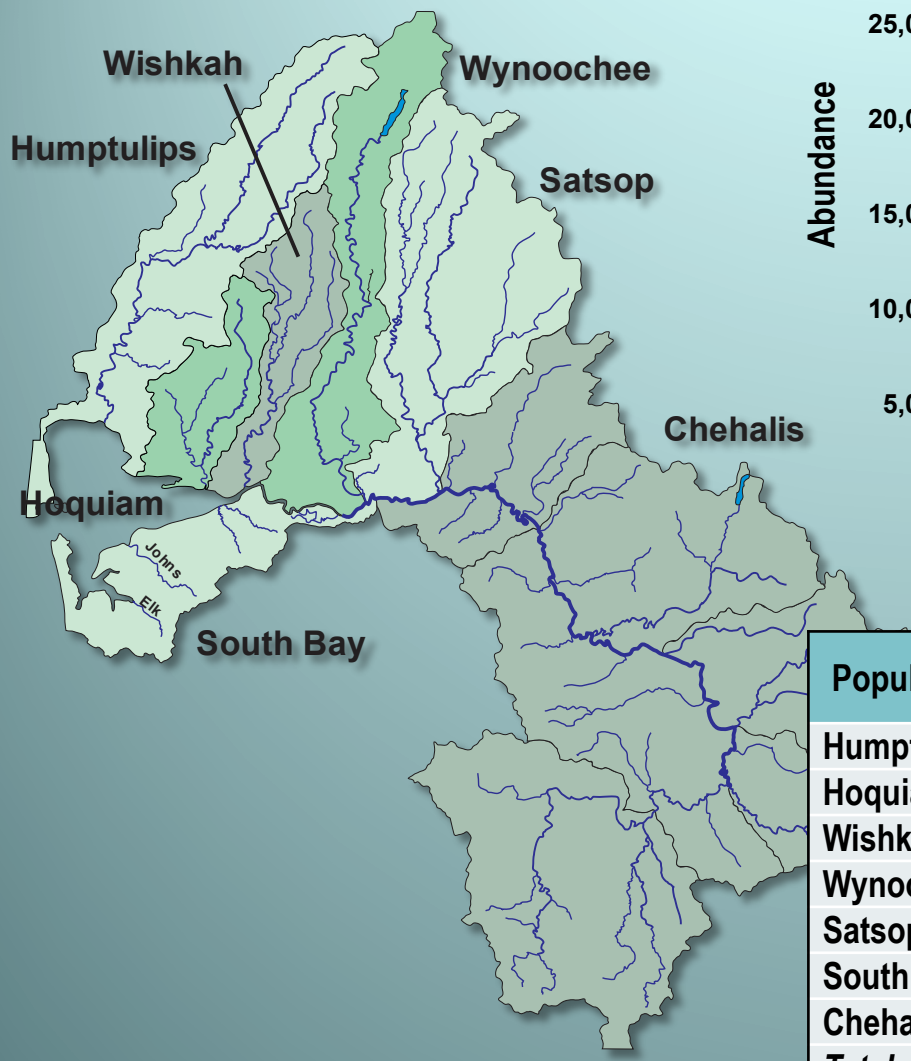
Stock Assessment

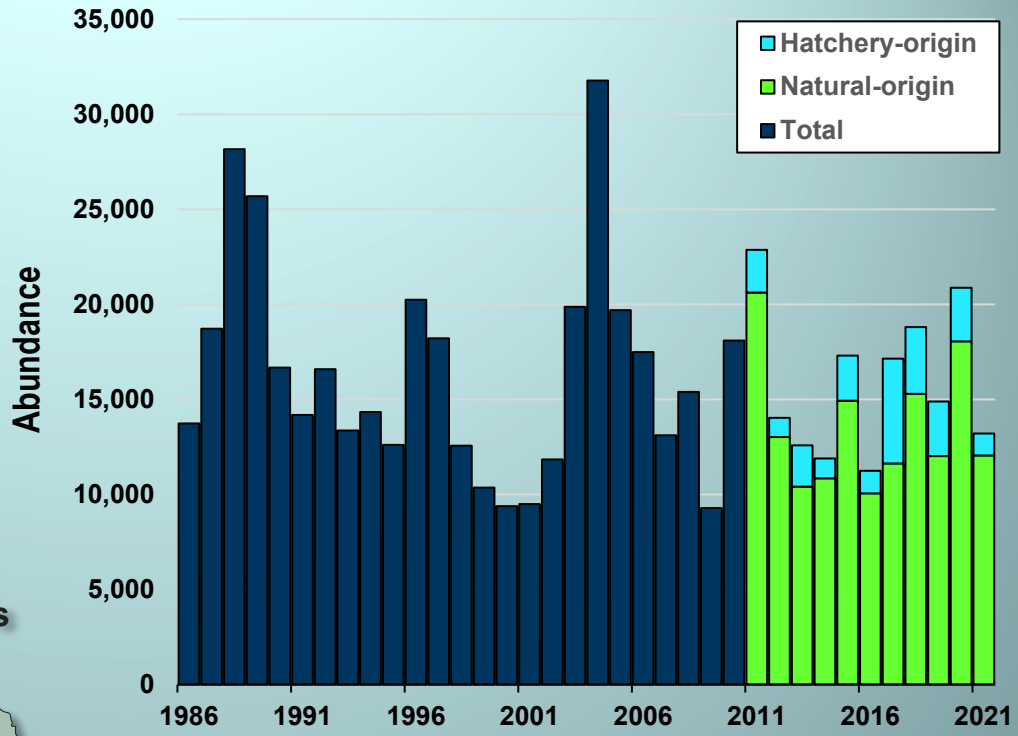
Spawner Abundance (2011-2020)*



** Natural-origin*

Fall Chinook



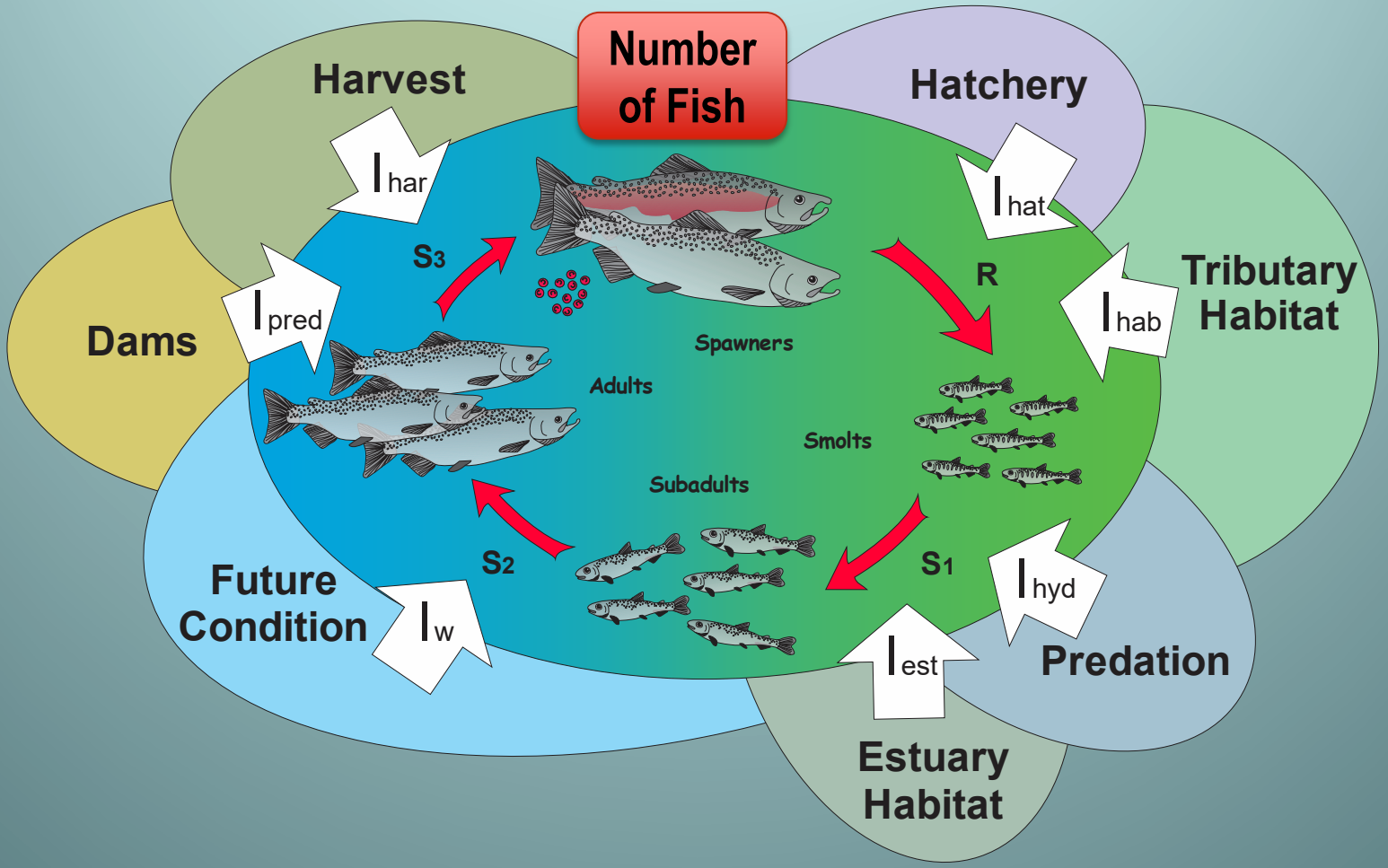


Population	Type	Spawners (2011-2020 avg.)			
		Natl.	Hat.	Total	% Hat.
Humptulips	Hatchery-Wild	3,207	1,555	4,761	31%
Hoquiam	Wild	363	0	363	0%
Wishkah	Wild	433	59	491	12%
Wynoochee	Wild	1,455	81	1,537	5%
Satsop	Hatchery-Wild	2,690	739	3,429	22%
South Bay	Hatchery-Wild	--	--	--	--
Chehalis	Wild	5,542	40	5,582	1%
Total		*13,689*	*2,474*	*16,163*	*15%*

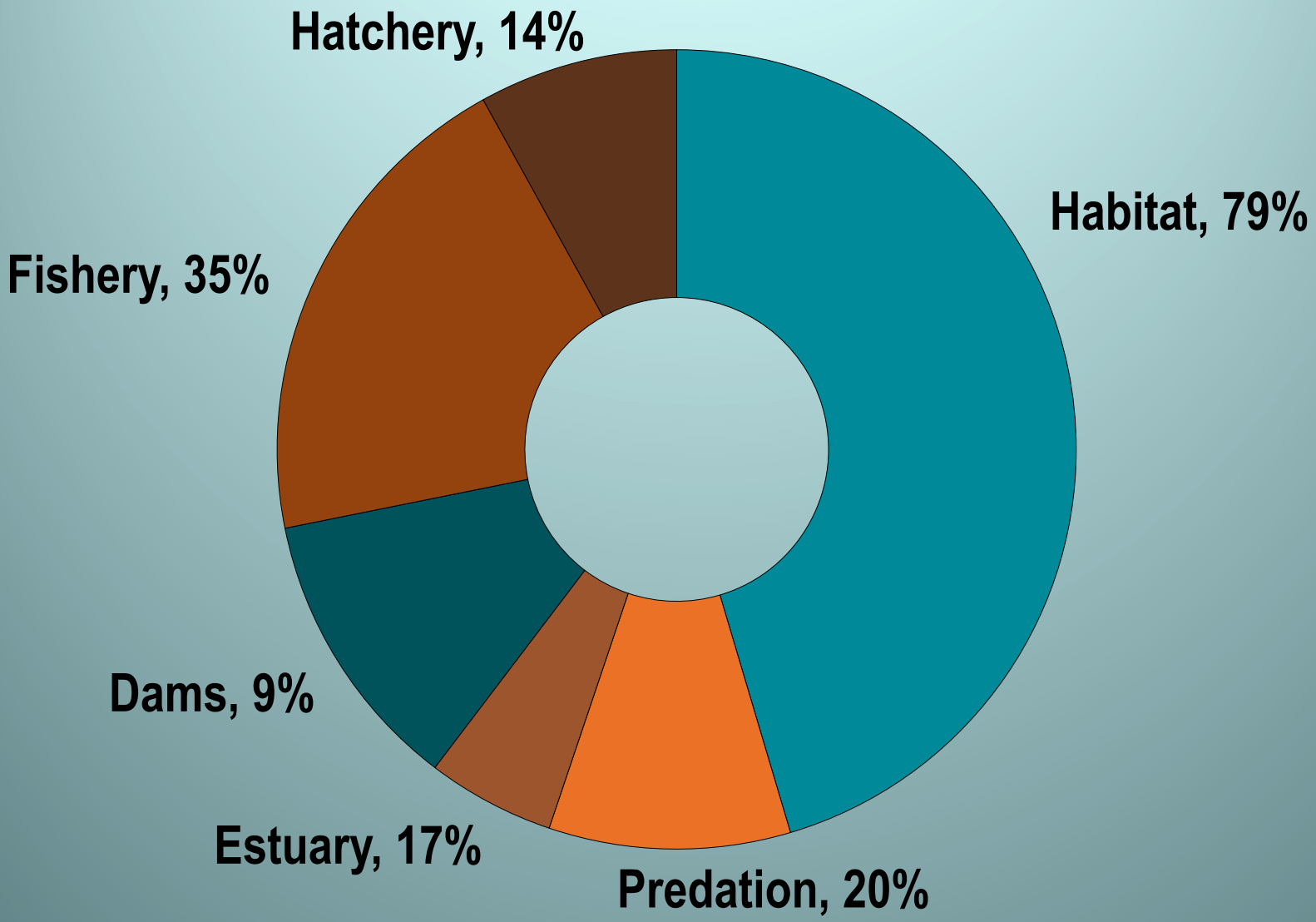
Limiting Factor Analysis

A Common Currency: Impacts

% reduction in recruitment or survival rate affecting abundance

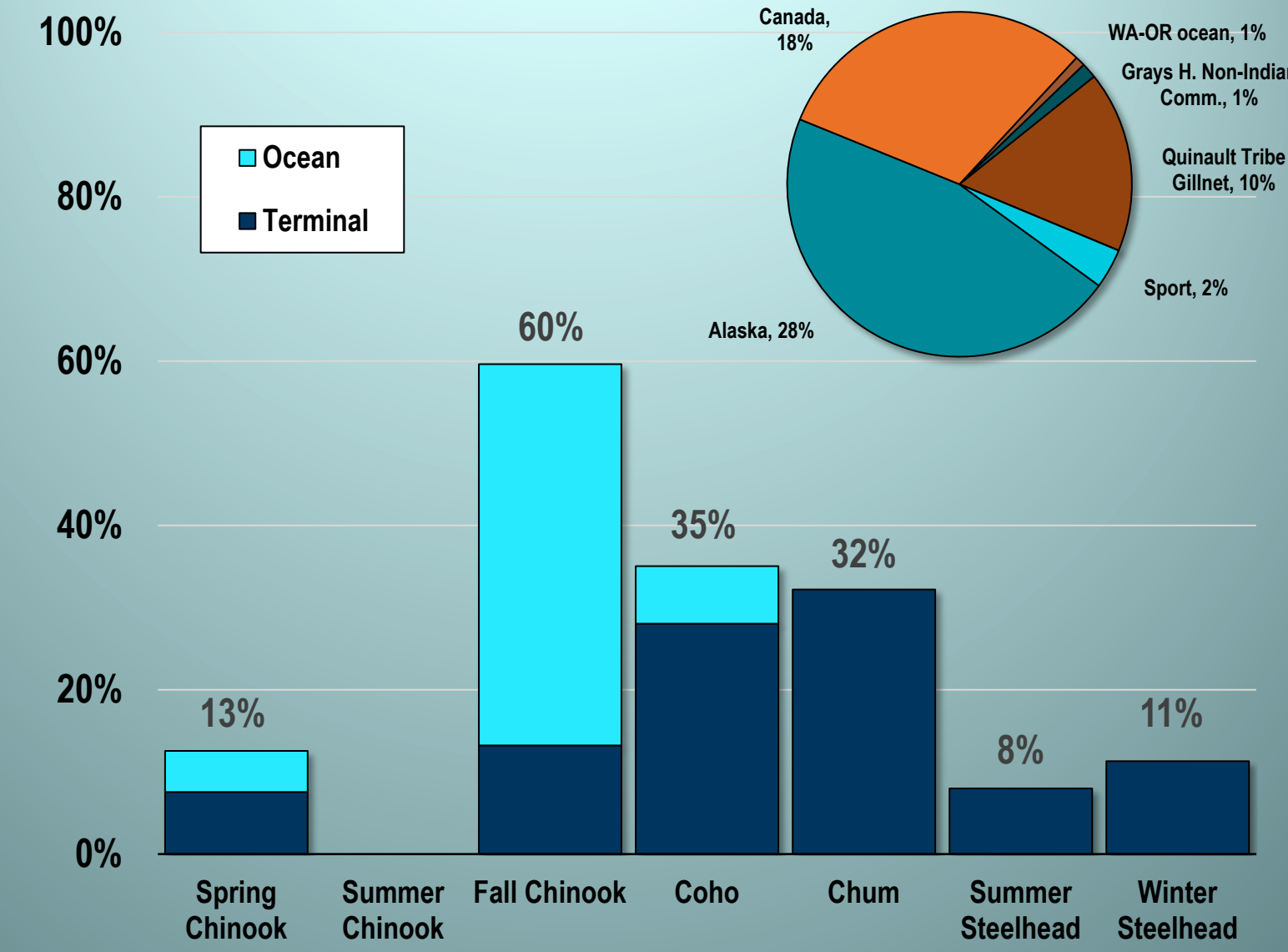


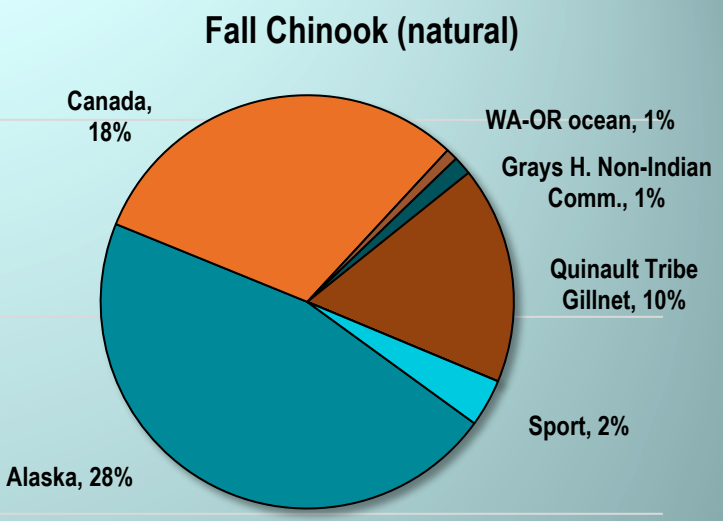
Chehalis Coho



Harvest

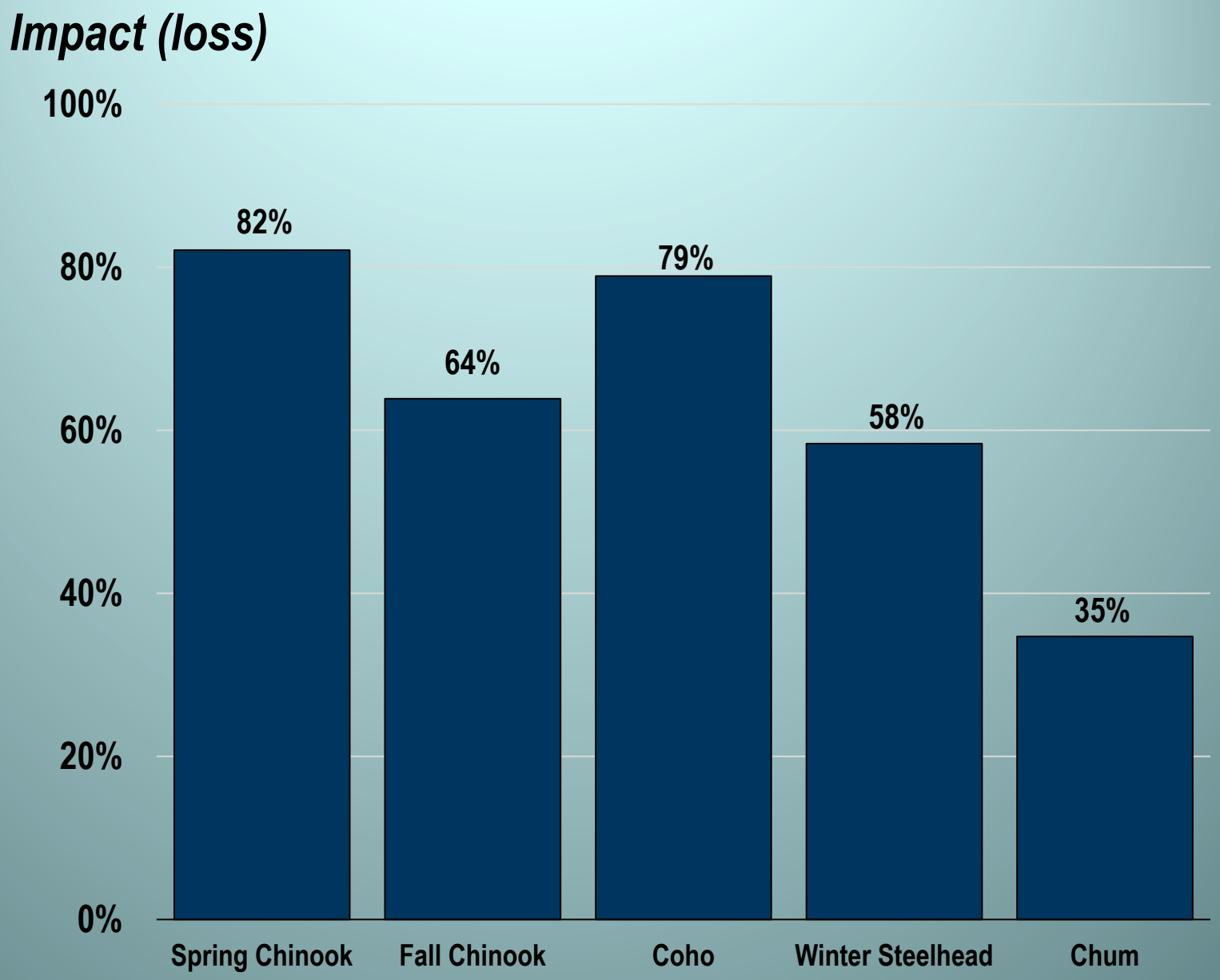
Impact





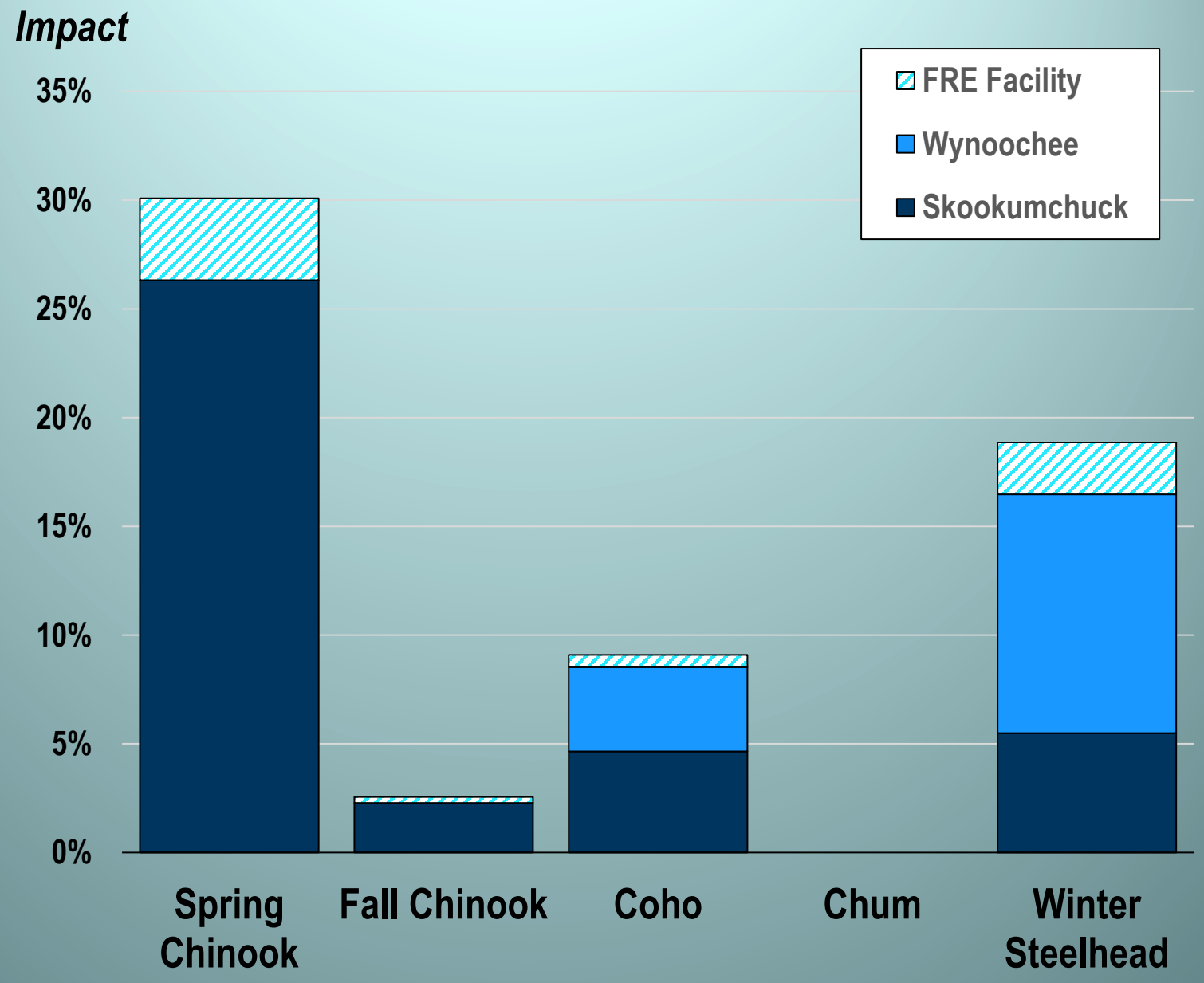
Source: PSC, PFMC, WDFW

Habitat



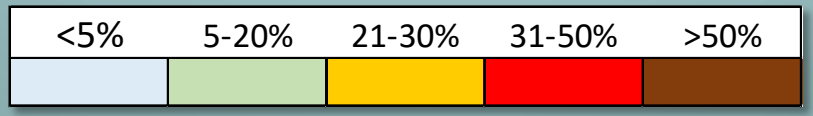
Source: EDT & NOAA habitat models

Dams

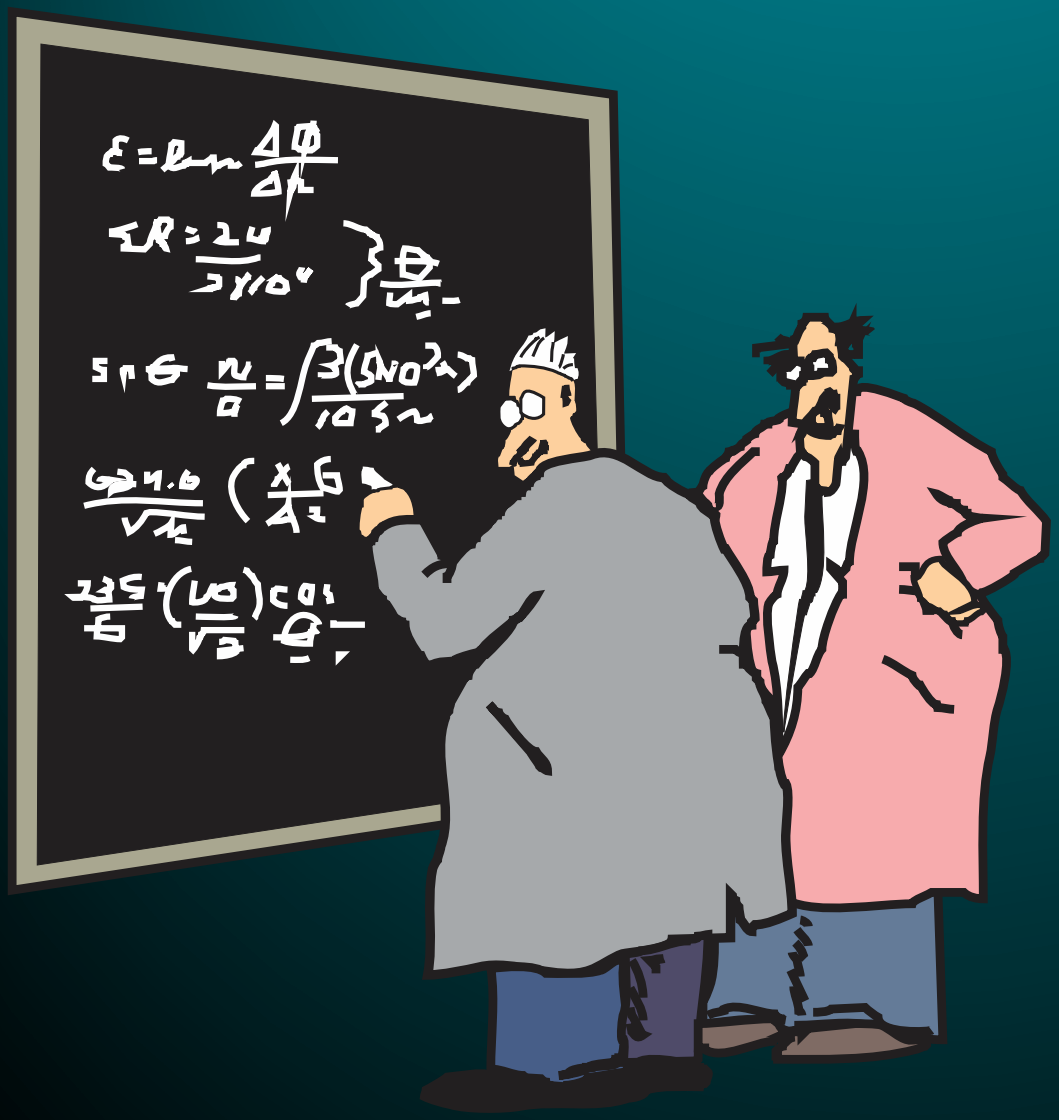

Impact
35%
30%
25%
20%
15%
10%
5%
0%
FRE Facility
Wynoochee
Skookumchuck
Spring Chinook
Fall Chinook
Coho
Chum
Winter Steelhead

Heat Map of Limiting Factors

Population	Freshwtr Habitat	Estuary Habitat	Dams	Predation	Fishery	Hatchery
Spring Chinook	82%	24%	26%	20%	13%	0%
Summer Chinook	64%	24%	0%	20%	na	0%
Fall Chinook	64%	17%	2%	20%	60%	14%
Coho	79%	17%	9%	20%	35%	14%
Chum	35%	17%	0%	20%	32%	3%
Summer Steelhead	58%	17%	0%	20%	8%	47%
Winter Steelhead	58%	17%	16%	20%	11%	11%

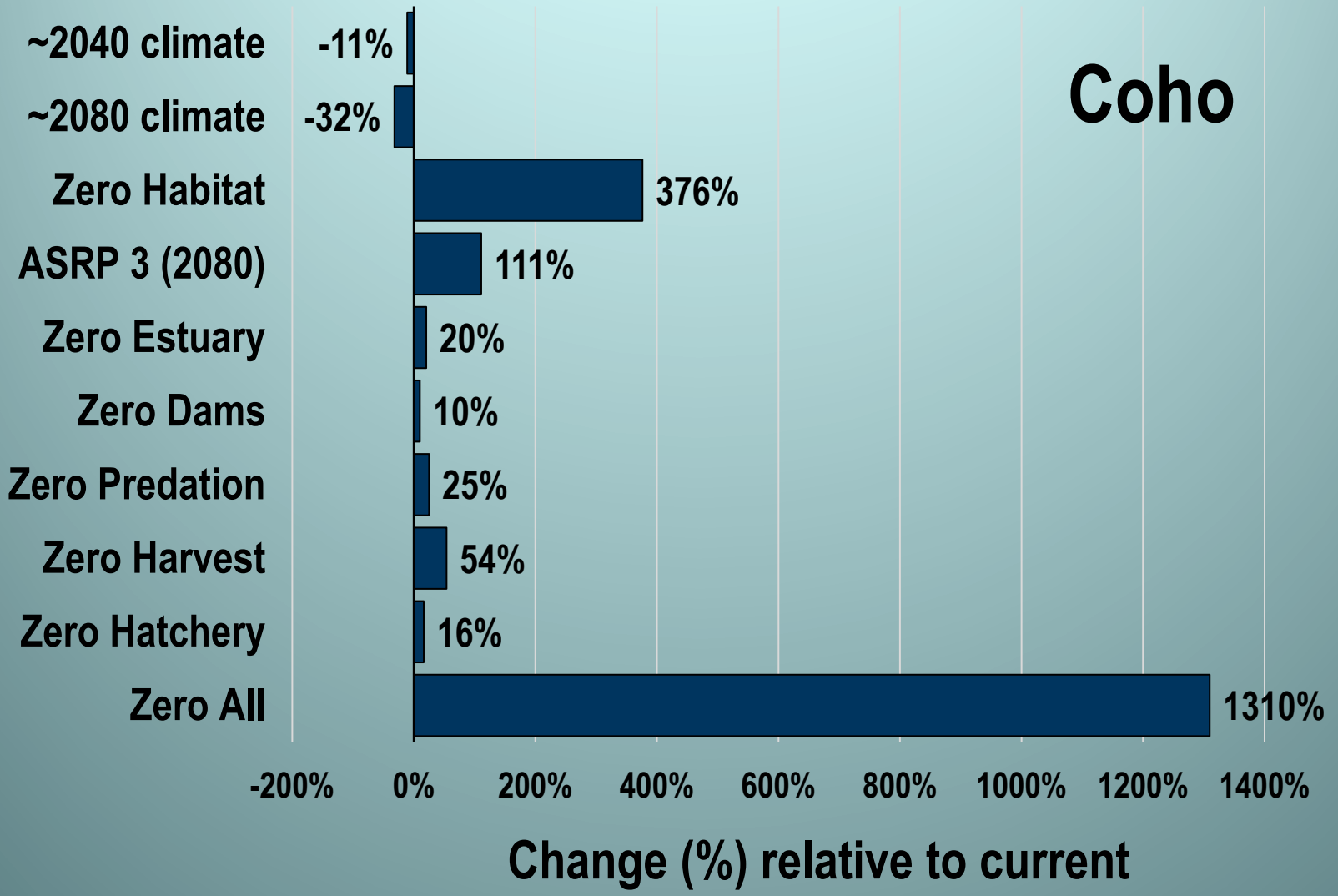


Impacts defined by associated % reduction in abundance

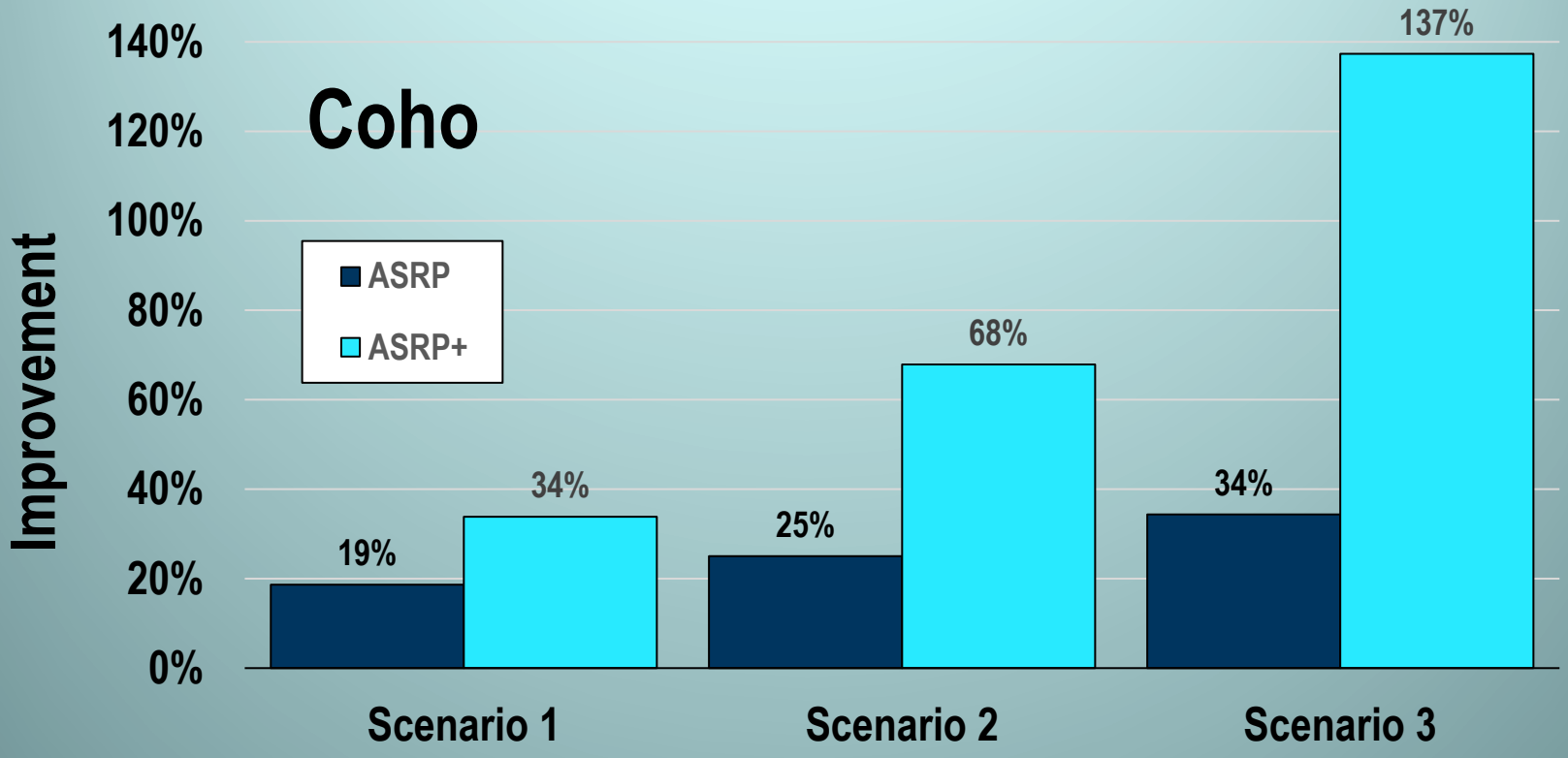


Life Cycle Analysis

Sensitivity Analysis



Scenario Analysis

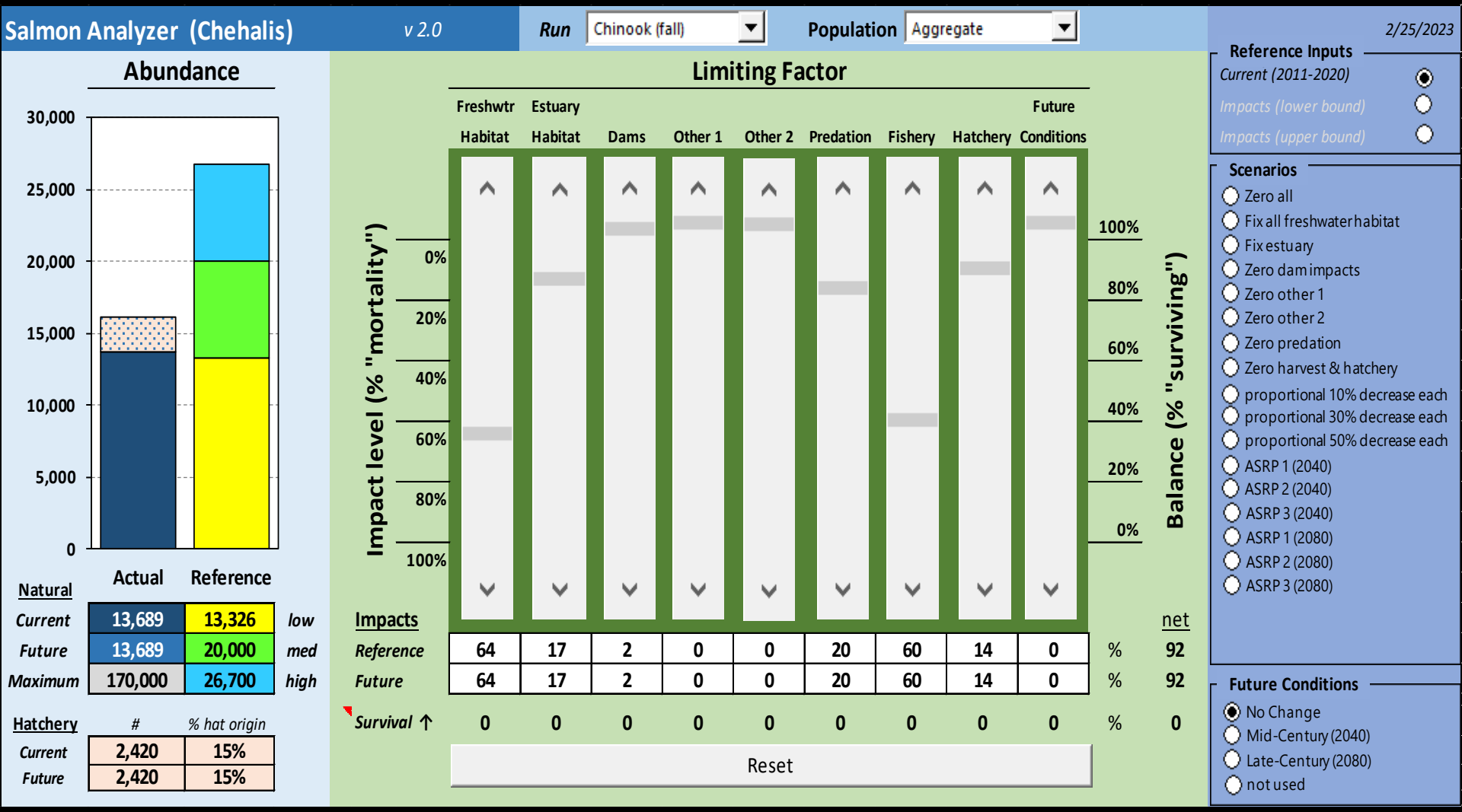


Scenario	Improvements ASRP + (mid-century)						
	Habitat	Estuary	Dams	Predation	Fishery	Hatchery	Climate
1	ASRP 1	--	small	small	small	small	decrease
2	ASRP2	small	med	med	med	med	decrease
3	ASRP3	med	high	high	high	high	decrease

Preliminary Observations

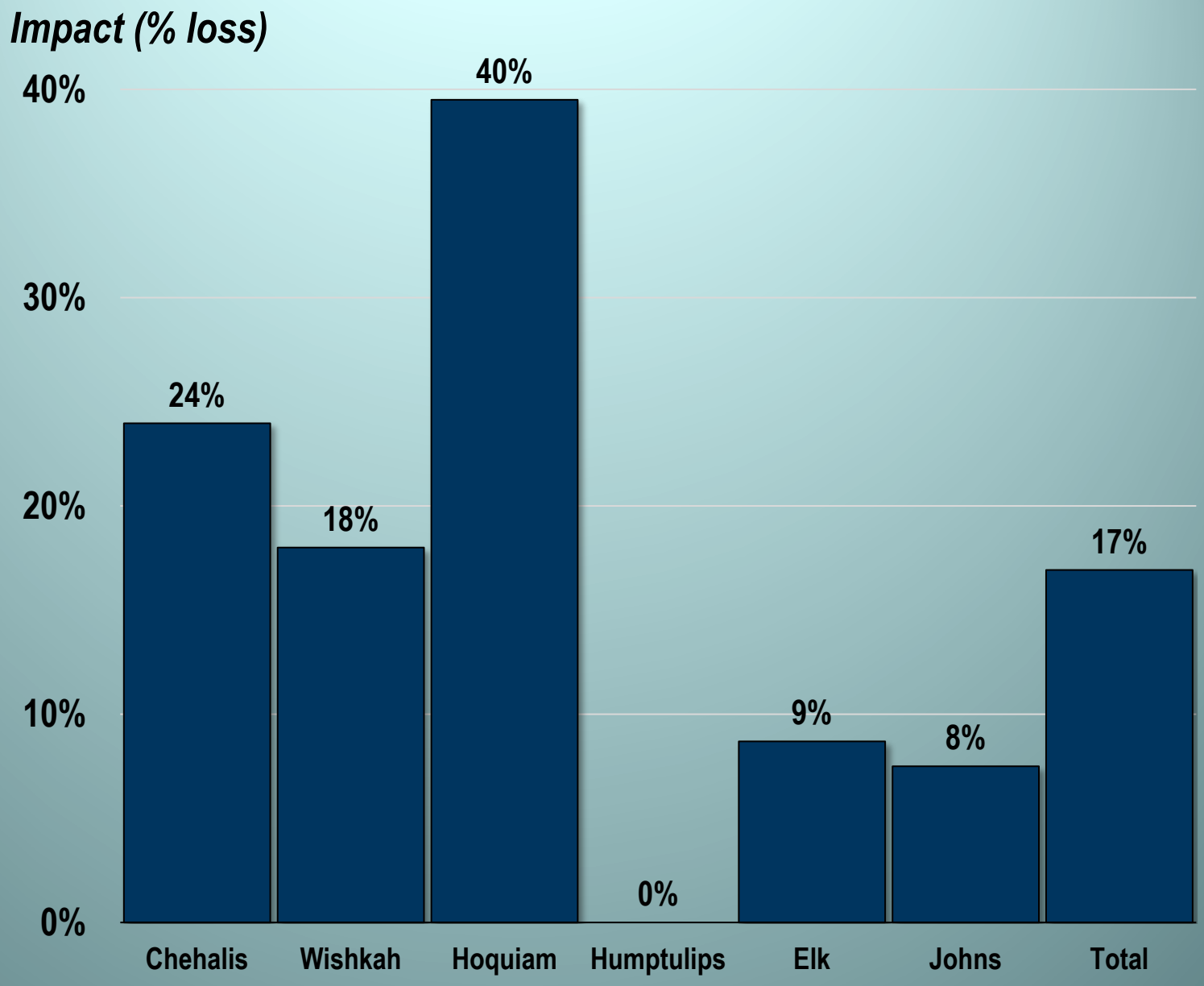
1. Relative magnitude of impacts can be identified with varying levels of uncertainty
2. Freshwater habitat impacts are very significant
3. Other impacts are individually lower but significant in combination
4. Difficult make substantial gains from other factors without significant habitat improvements
5. Compounding benefits across multiple factors can be extremely powerful
6. Climate impacts offset gains
7. Some dials harder to turn than others

THE SALMON "SLIDER"



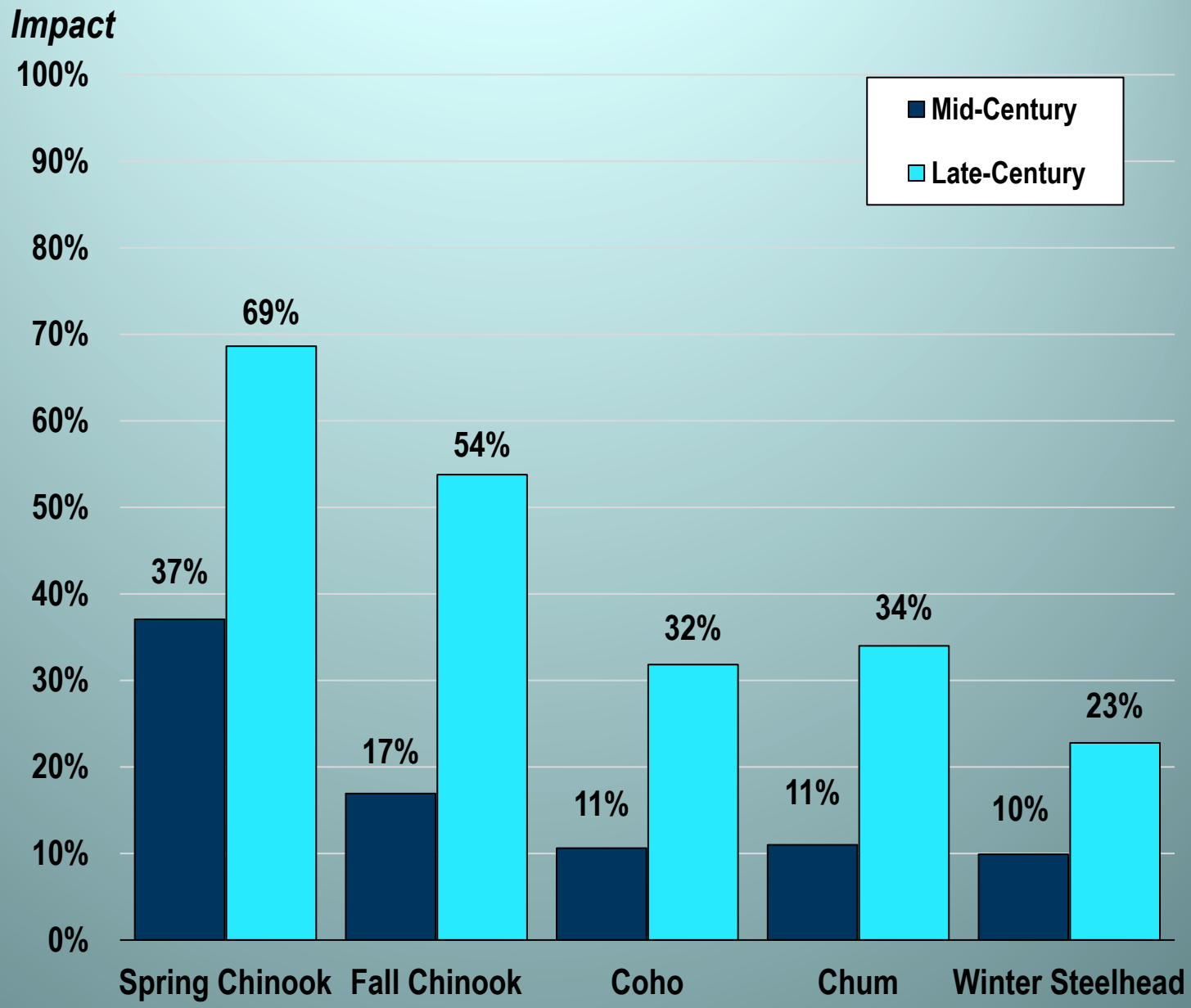
Questions?

Estuary



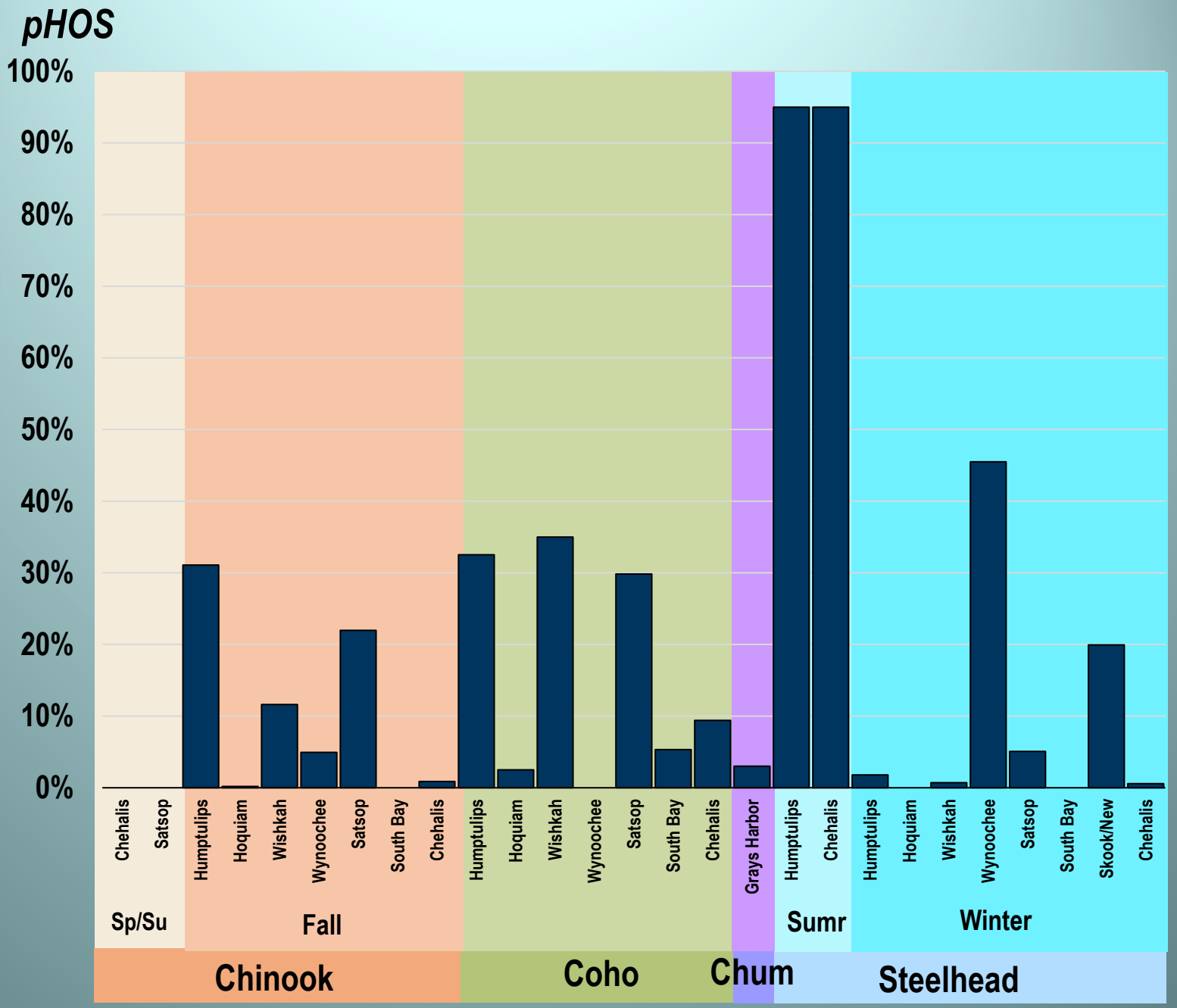
Source: Beechie et al. 2021a

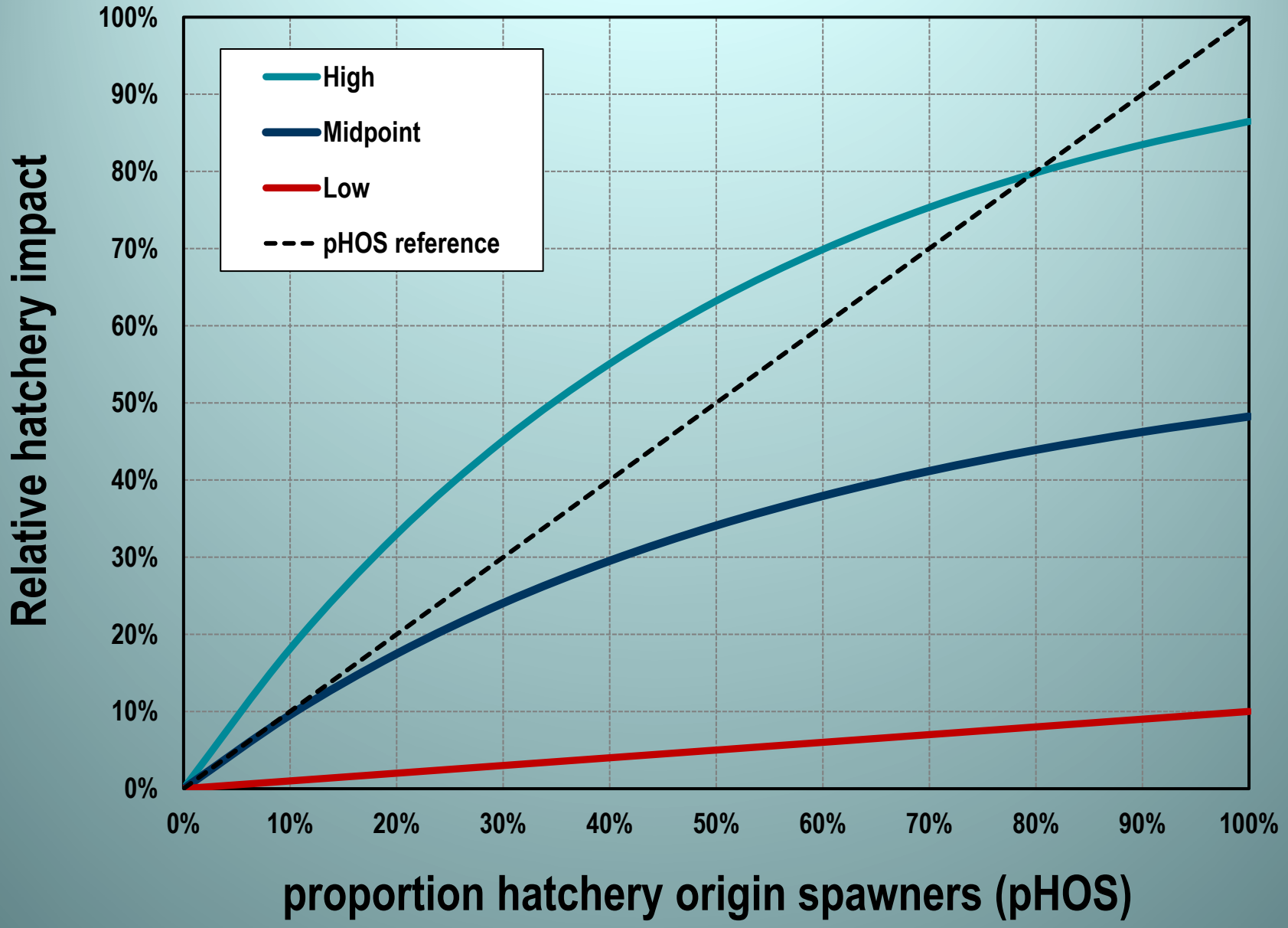
Climate



Source: Aquatic Species Restoration Plan

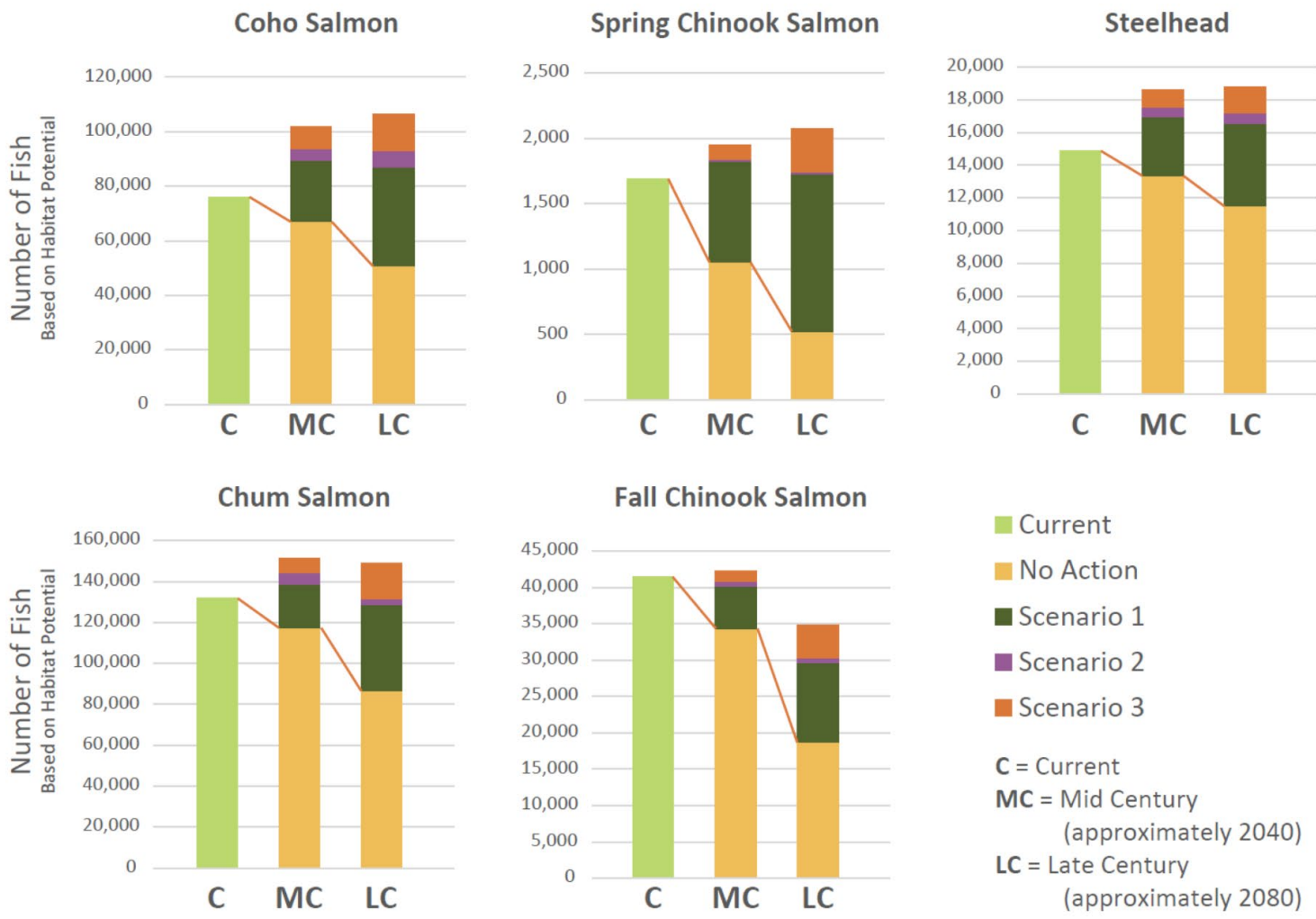
Hatchery


pHOS
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Chehalis
Satsop
Humptulips
Hoquiam
Wishkah
Wynoochee
Satsop
South Bay
Chehalis
Humptulips
Hoquiam
Wishkah
Wynoochee
Satsop
South Bay
Chehalis
Grays Harbor
Humptulips
Chehalis
Humptulips
Hoquiam
Wishkah
Wynoochee
Satsop
South Bay
Skook/New
Chehalis
Sp/Su
Fall
Sumr
Winter
Chinook
Coho
Chum
Steelhead


Relative hatchery impact
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
High
Midpoint
Low
pHOS reference
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
proportion hatchery origin spawners (pHOS)

Habitat scenarios

Figure S-3
Expected Outcomes for Salmon



Source: Aquatic Species Restoration Plan