

Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species

Aquatic Species Enhancement Plan

Policy Work Group Meeting

Chehalis, Washington

May 22, 2014



ASEP – Talk Outline

- Background information and biological context
- Habitat
 - Limiting factors
 - Enhancement actions
- Climate change

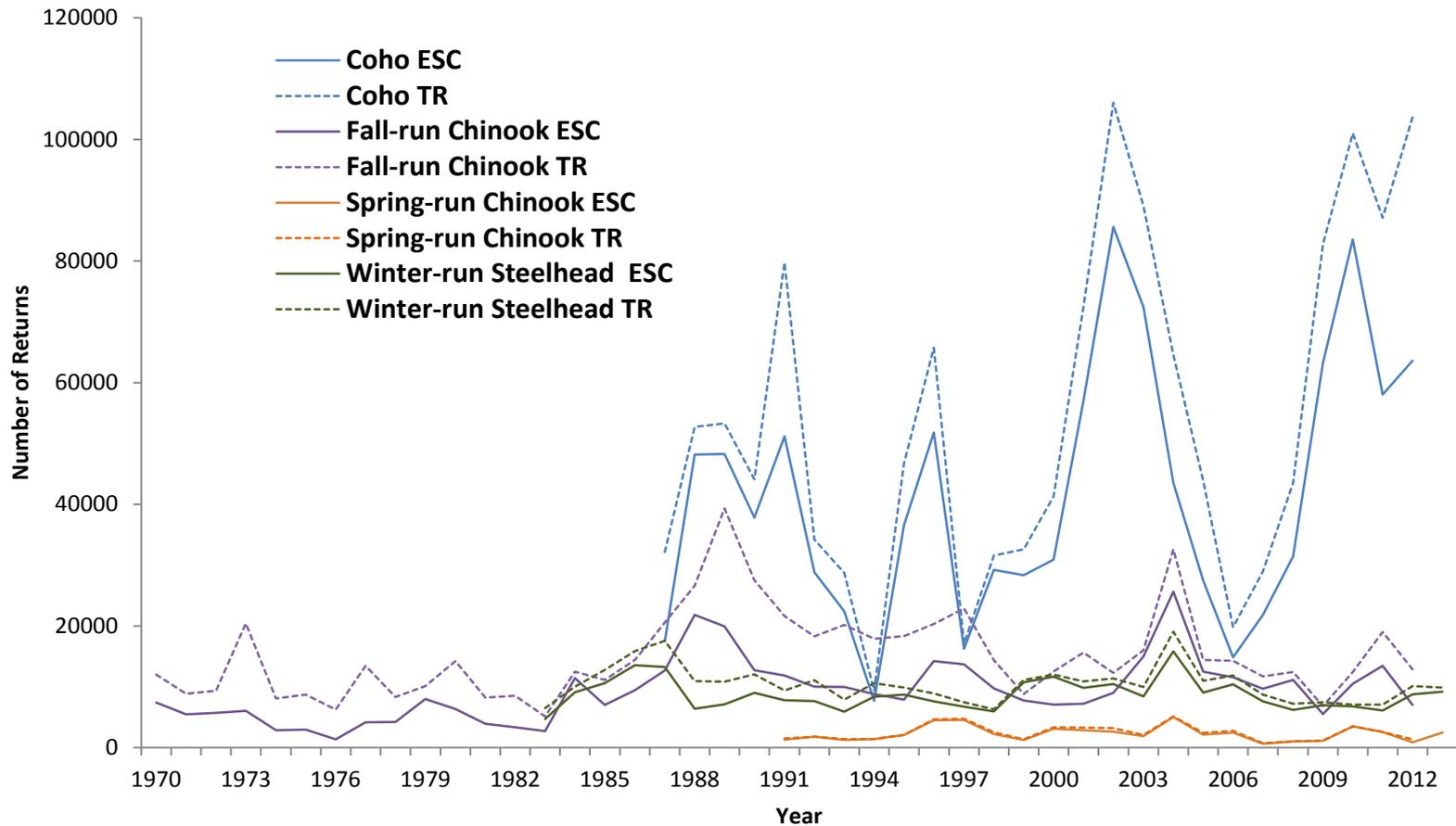
Background Information and Biological Context



Species

- 22 key species evaluated using variety of models in 3 categories
 - Salmon (EDT and Shiraz)
 - Spring Chinook, Fall Chinook, Coho and Winter Steelhead
 - Other fish (11)
 - Non-fish (7)

Salmon – Current



Salmon – Habitat Potential (EDT)

Species	Current	Intrinsic	Habitat Impairment
Spring Chinook Salmon	3,349	15,287	78%
Fall Chinook Salmon	25,459	46,052	45%
Coho Salmon	24,144	78,986	69%
Winter-run Steelhead	4,557	8,102	44%

Other Fish and Non Fish



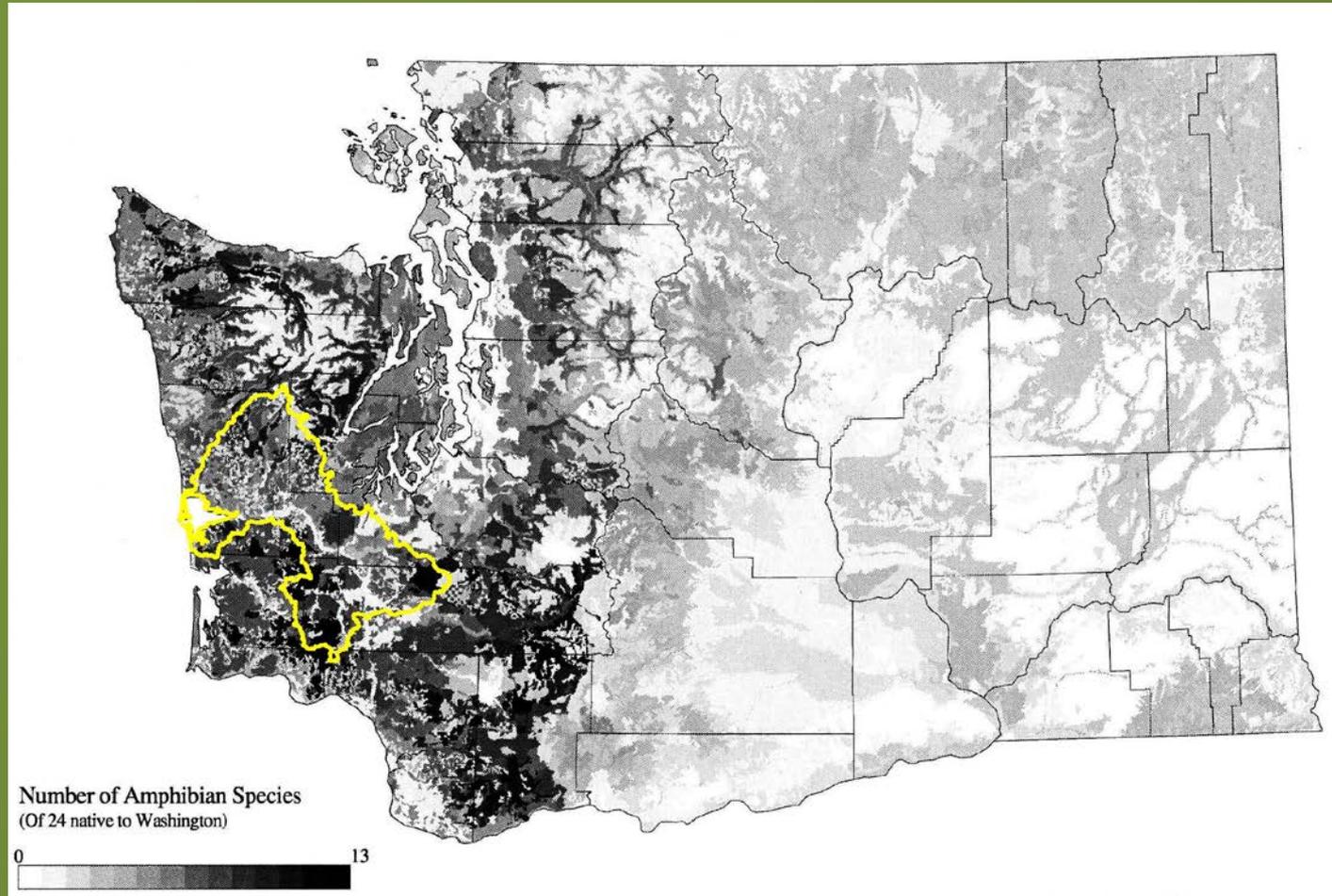
Background Information – Other Fish Species

- Historical and current population information very limited in Basin
- Olympic mudminnow unique; center of distribution is Chehalis Basin
- Chum salmon the exception; geo mean of total run size since 2003 = 25,116 fish (no clear trend)

Background Information – Non-fish Species

- Historical and current population information very limited in Basin
- Highest species richness of amphibians in Washington State; also highest at risk in the state
- Potential Oregon spotted frog ESA listing
- Most extensive floodplain off-channel habitats in Washington State; occupied by seven species of stillwater-breeding amphibians

Native Amphibian Species Richness



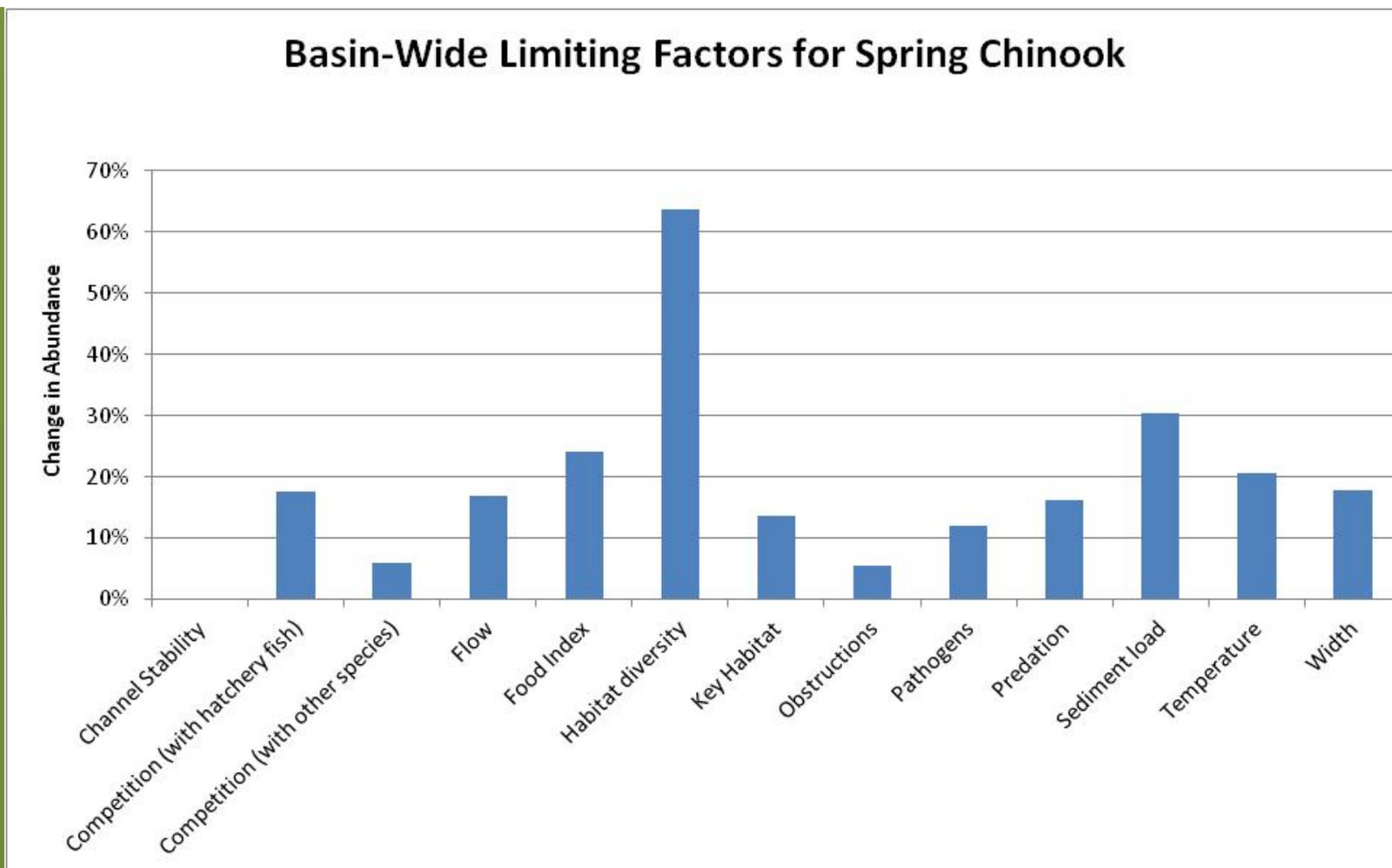
Habitat Limiting Factors



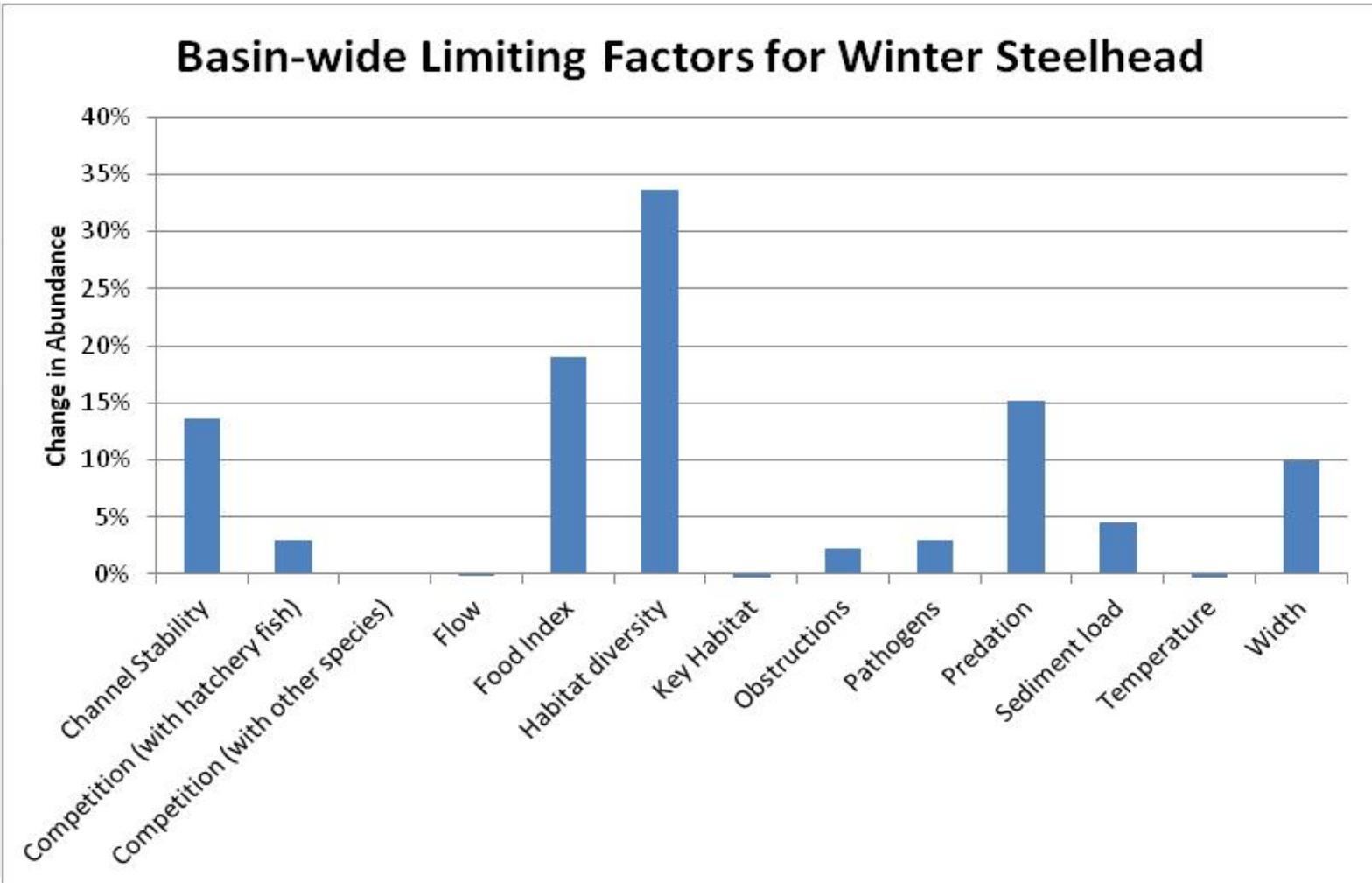
Methods - Salmon

- Ecosystem Diagnosis & Treatment Model (2014)
 - Modeled the habitat used by salmonids within the Chehalis Basin (current condition compared to intrinsic condition)
- Smith and Wenger (2001)
 - Habitat factors limiting salmonid abundance and production within the Chehalis Basin
- Input and reviews by technical team member experts and local experts

Limiting Factors Based on EDT – Spring Chinook

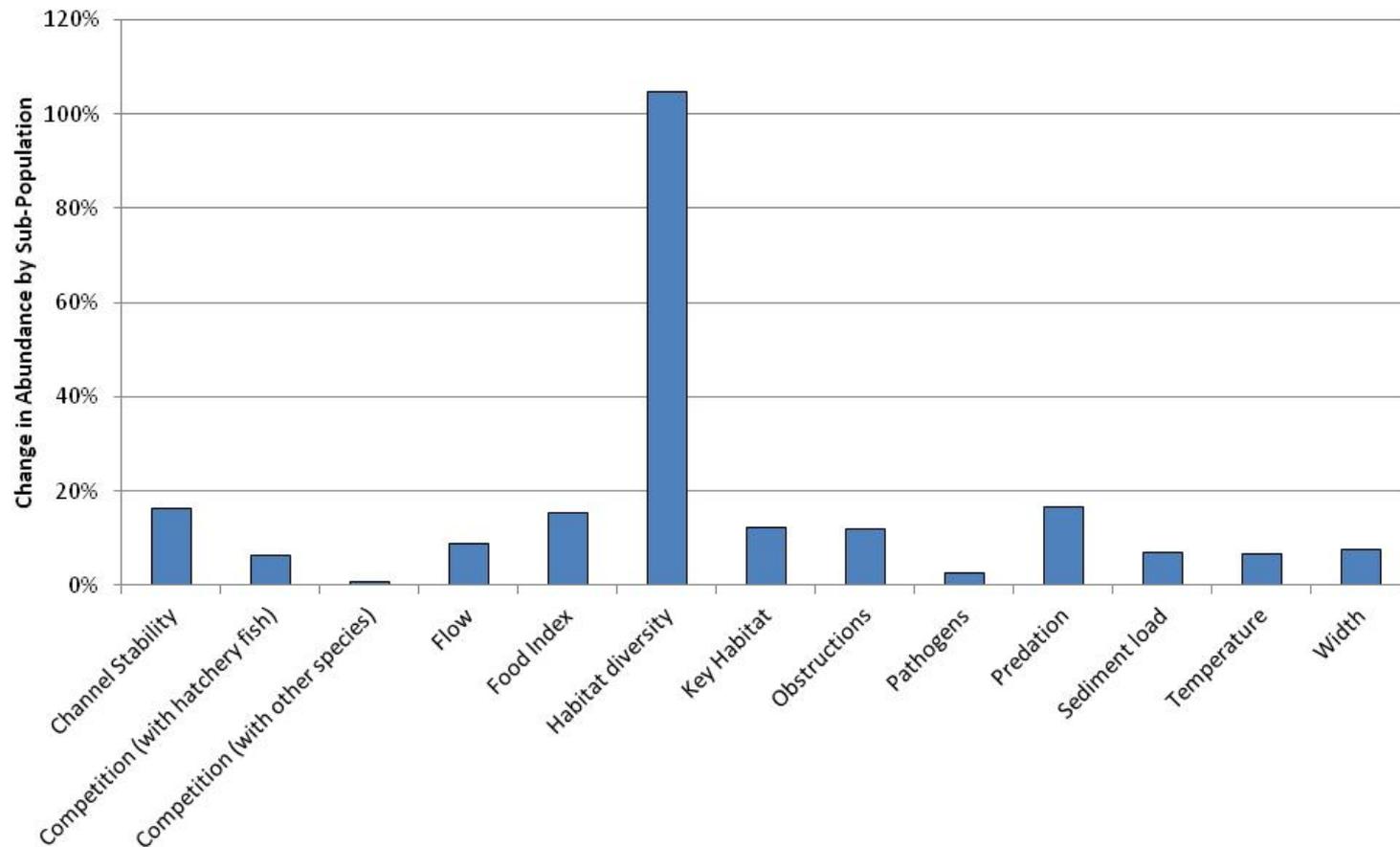


Limiting Factors Based on EDT – Winter Steelhead

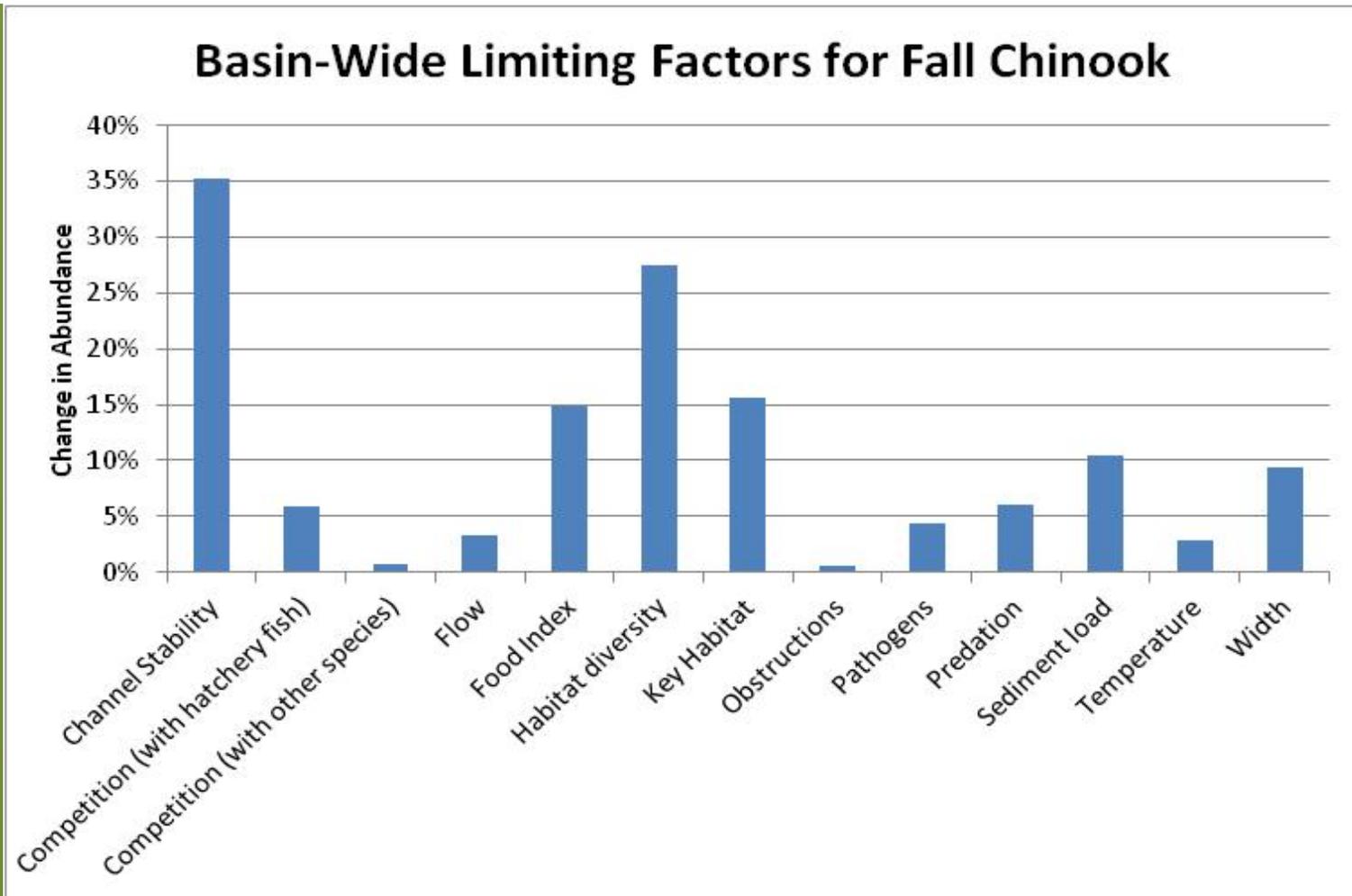


Limiting Factors Based on EDT - Coho

Basin-Wide Limiting Factors for Coho



Limiting Factors Based on EDT – Fall Chinook



Limiting Factors

- Most prevalent are
 - Barriers
 - Riparian degradation
 - Water quantity and quality (flows and temperature)
 - Sedimentation
 - Channel complexity and stability (lack of wood)
 - Loss of floodplain habitat/connectivity

Limiting Factors - Other Fish

- Limited available information for these species in the Chehalis Basin
- Limiting factors are based on known limiting factors for species, but not specifically known to be limiting in the basin
- Available information and best professional judgment was used

Limiting Factors Other Fish - Summary

- Silt free substrate is important to many of these species
- Non-native predators are likely negatively impacting many of these species
- Floodplain connectivity is important to many of these species
- During summer:
 - Flows are more limiting in the upper basin than the lower basin for many species
 - Low flows during summer months appears to be a limiting factor for many species

Limiting Factors - Non-fish

- Similar to Other Fish, very limited information on limiting factors in the Chehalis Basin
- Many limiting factors are based on known limiting factors for species and not known to be limiting in the basin
- Available information and best professional judgment was used

Limiting Factors Non-fish - Summary

- Presence of exotic aquatic predators is probably limiting to all key amphibian species and the turtle
- Suitable combination of aquatic and riparian habitats are likely limiting for
 - Northern red-legged frog, western toad and the turtle
 - The type of riparian habitat and width required varies with species
- Later stage coniferous forest that produce large wood may be limiting for
 - Coastal tail frog and Van Dyke's salamander
- Information on distribution and abundance of all non-fish taxa remains a major gap that needs to be addressed to better direct options

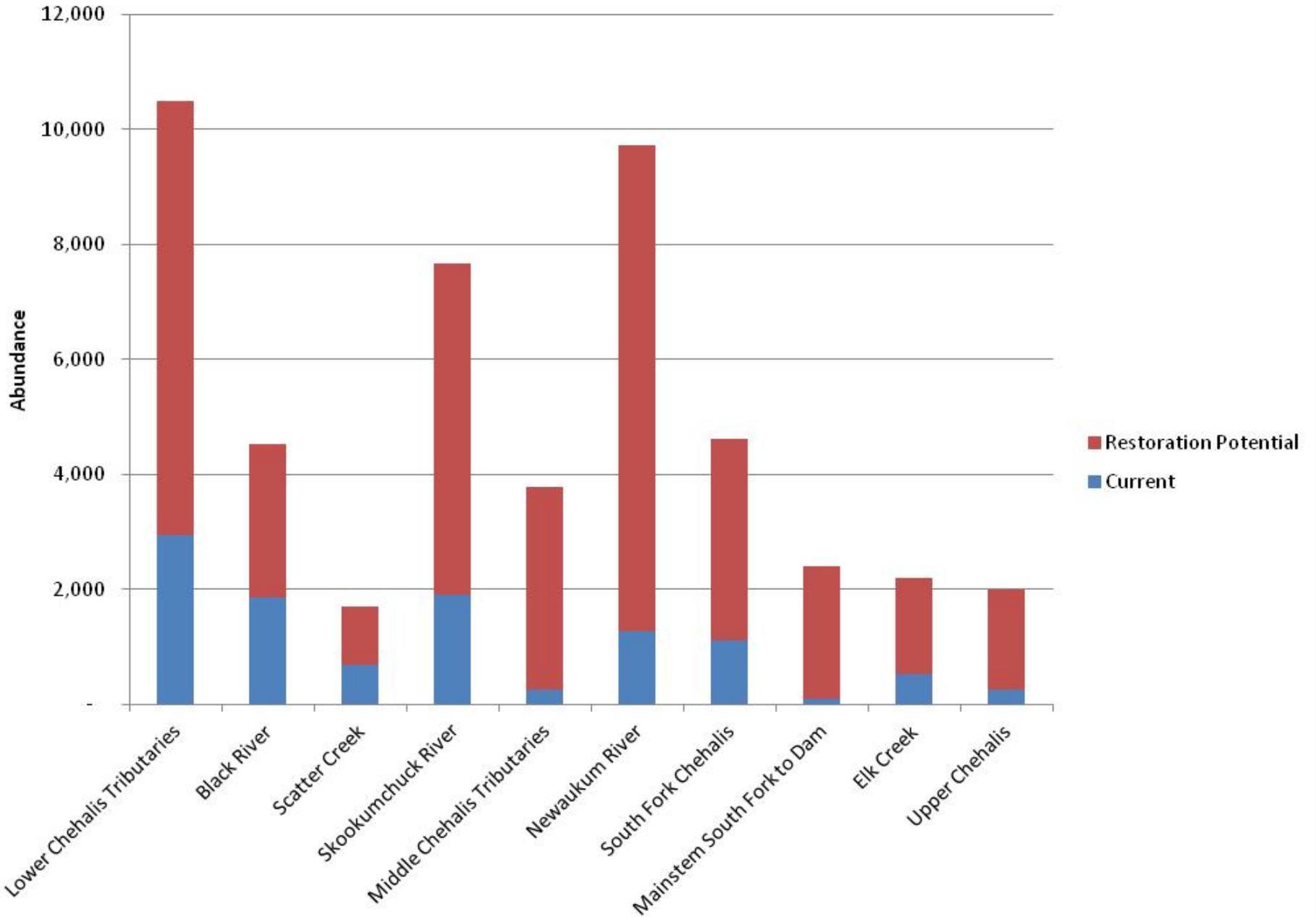
Habitat Enhancement



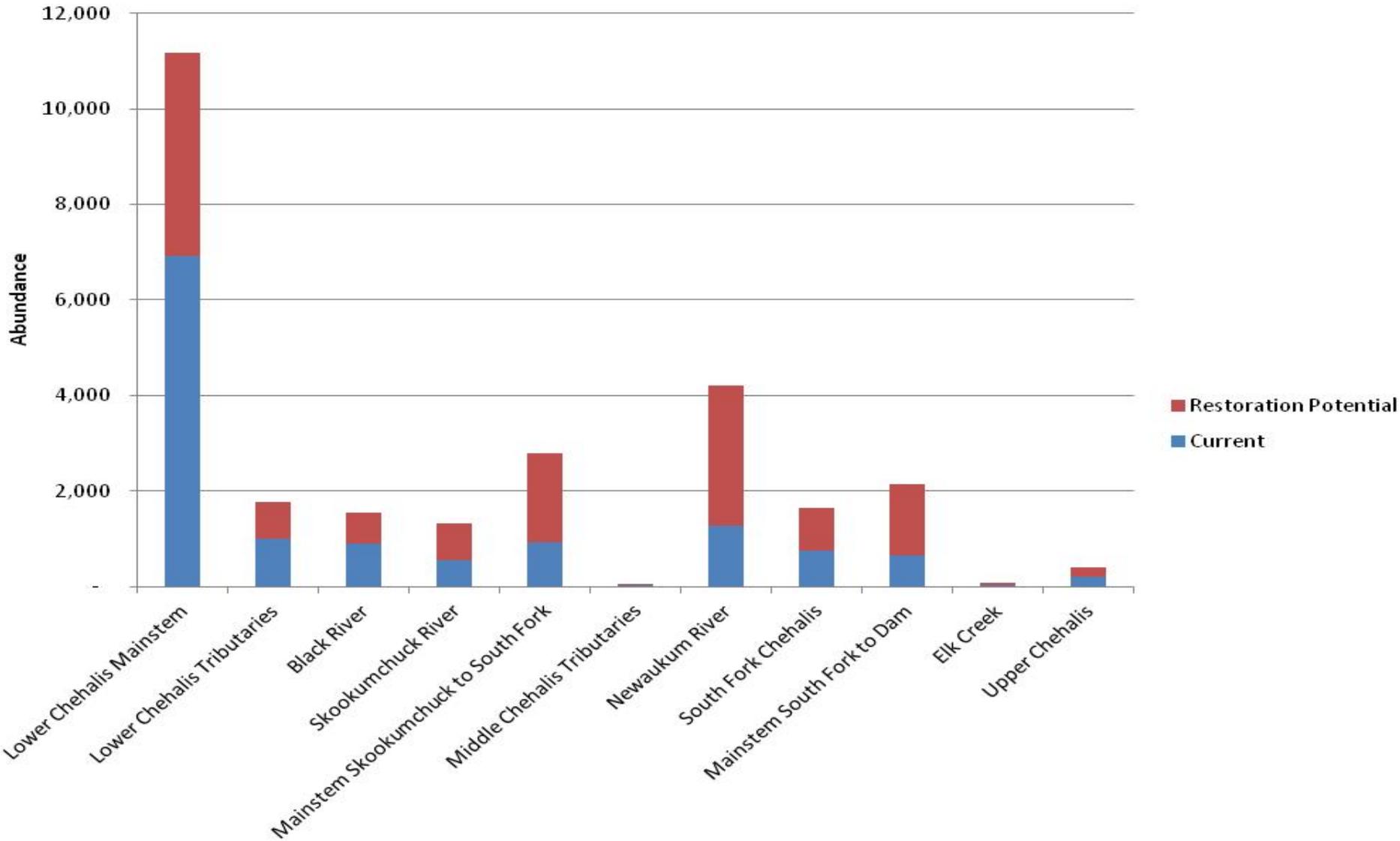
Actions to Address Limiting Factors

- Focus was on salmon due to lack of information for other species
- Actions identified in 3-day workshop and follow up 2-day workshop with WDFW
- Effects of enhancement is on all species, with a focus on spring Chinook due to low abundance
- Identified 3 scenarios that were modeled using EDT
- Qualitatively assessed effects of salmon actions on Other Fish and Non-Fish

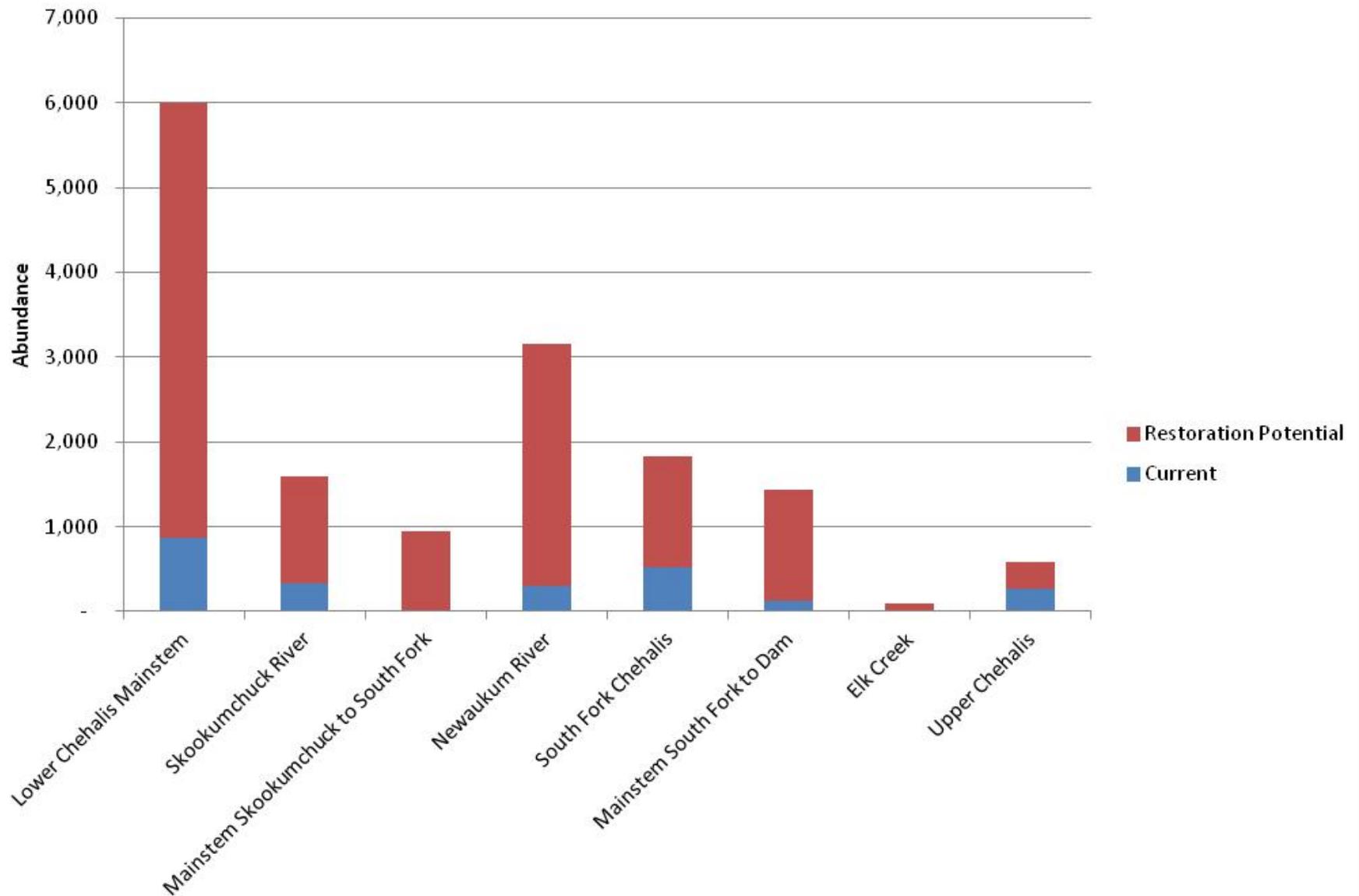
Relative Potential for restoration of Chehalis Basin Coho Salmon



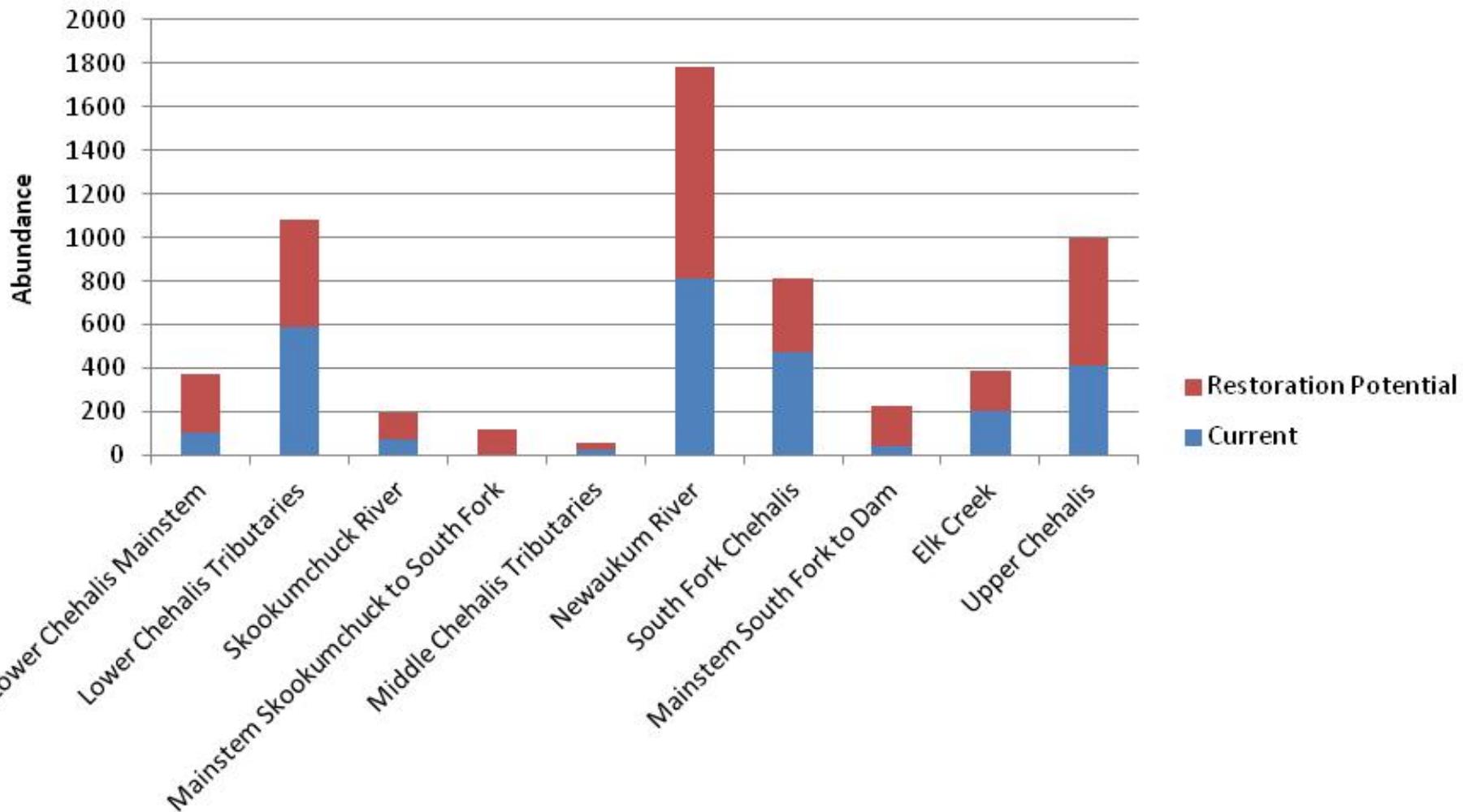
Relative Potential for restoration of Chehalis Basin Fall Chinook



Relative Potential for restoration of Chehalis Basin Spring Chinook



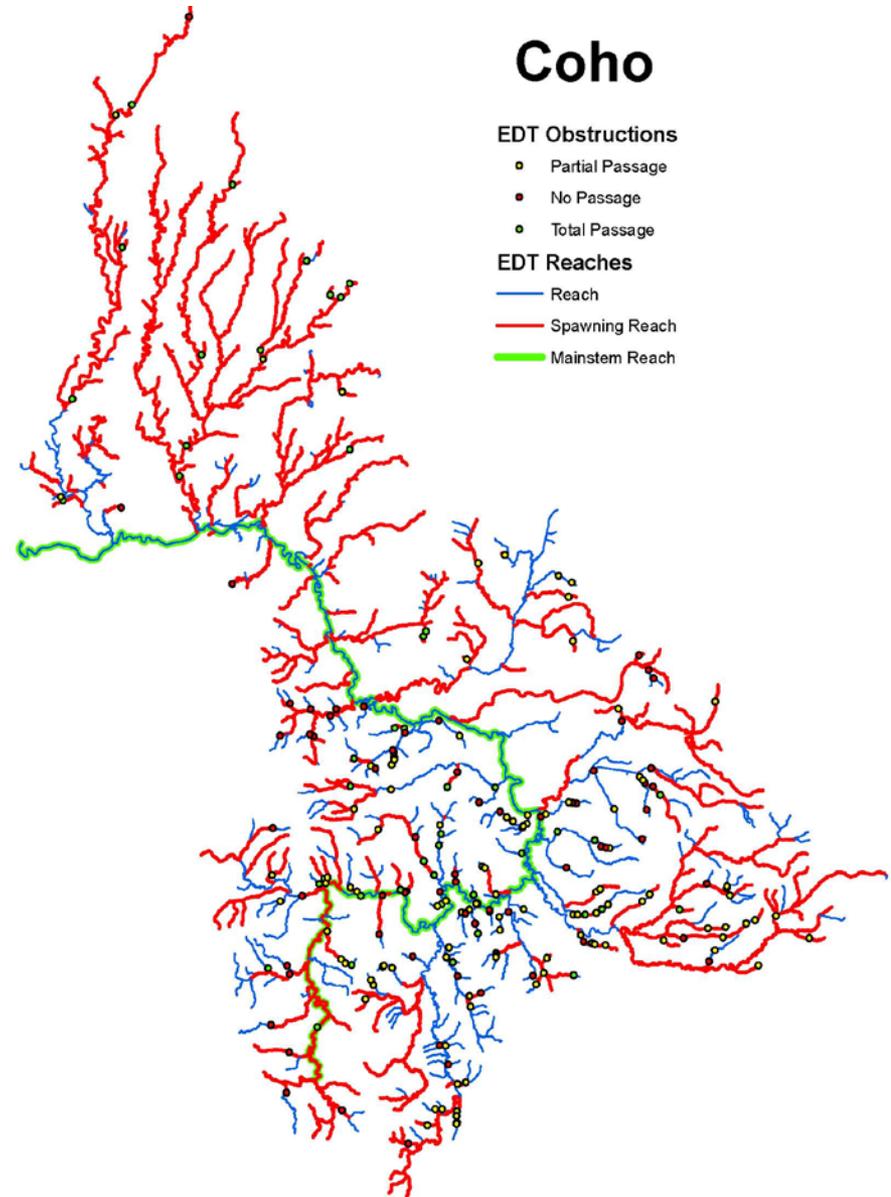
Relative potential for restoration of Chehalis Basin Winter Steelhead



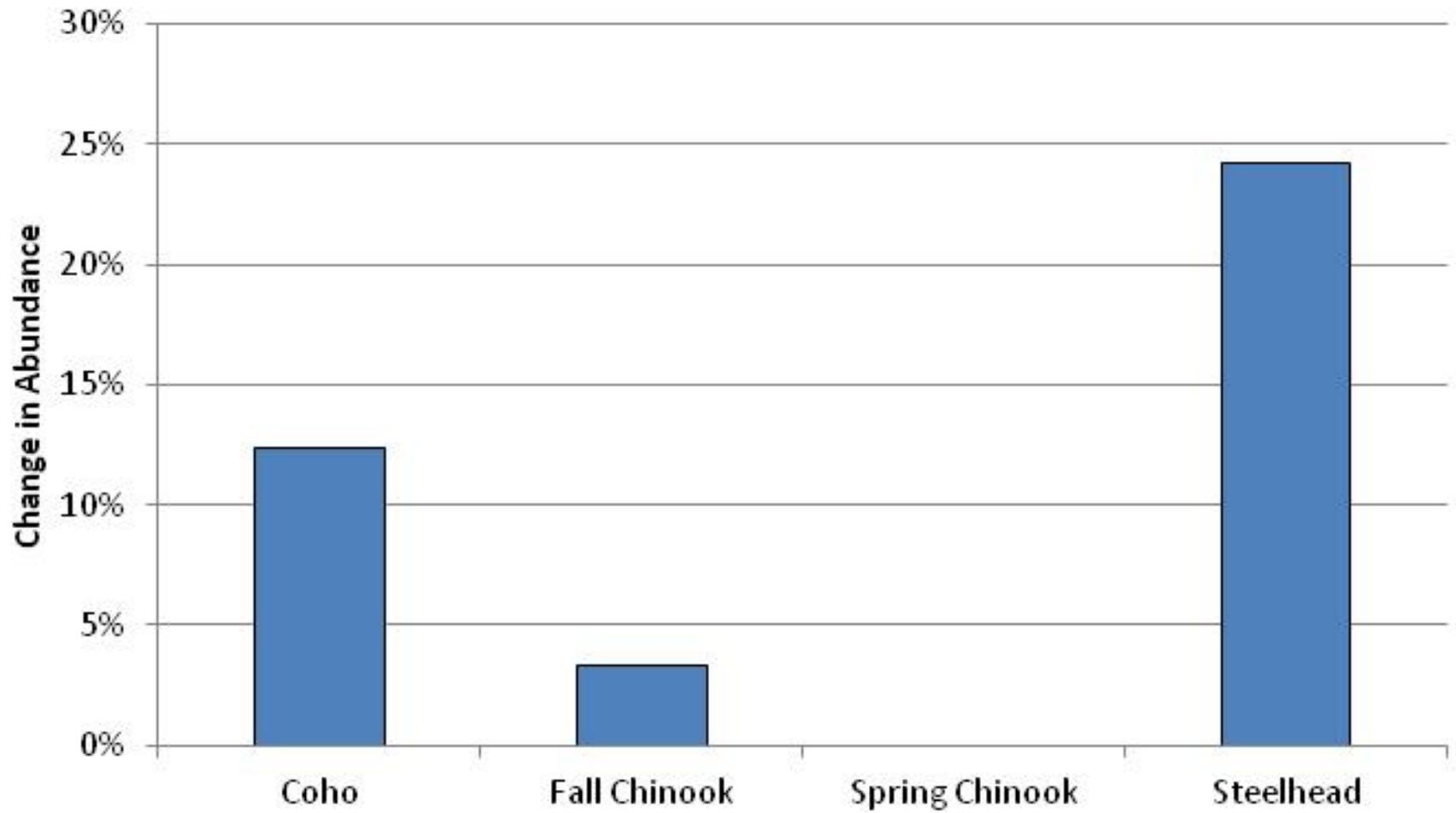
Enhancement Scenarios Modeled

1. Remove/improve barriers to fish passage (culverts) – benefit to coho, steelhead and fall Chinook (not spring Chinook)
2. Riparian enhancement in managed forests – all stocks
3. Riparian enhancement to restore 50% of Spring Chinook spawning reaches outside of managed forests, combined with restoring large wood attribute by 50% in same reaches; includes mainstem – all stocks

1. Obstructions



Effect of Culvert Removal on Salmon

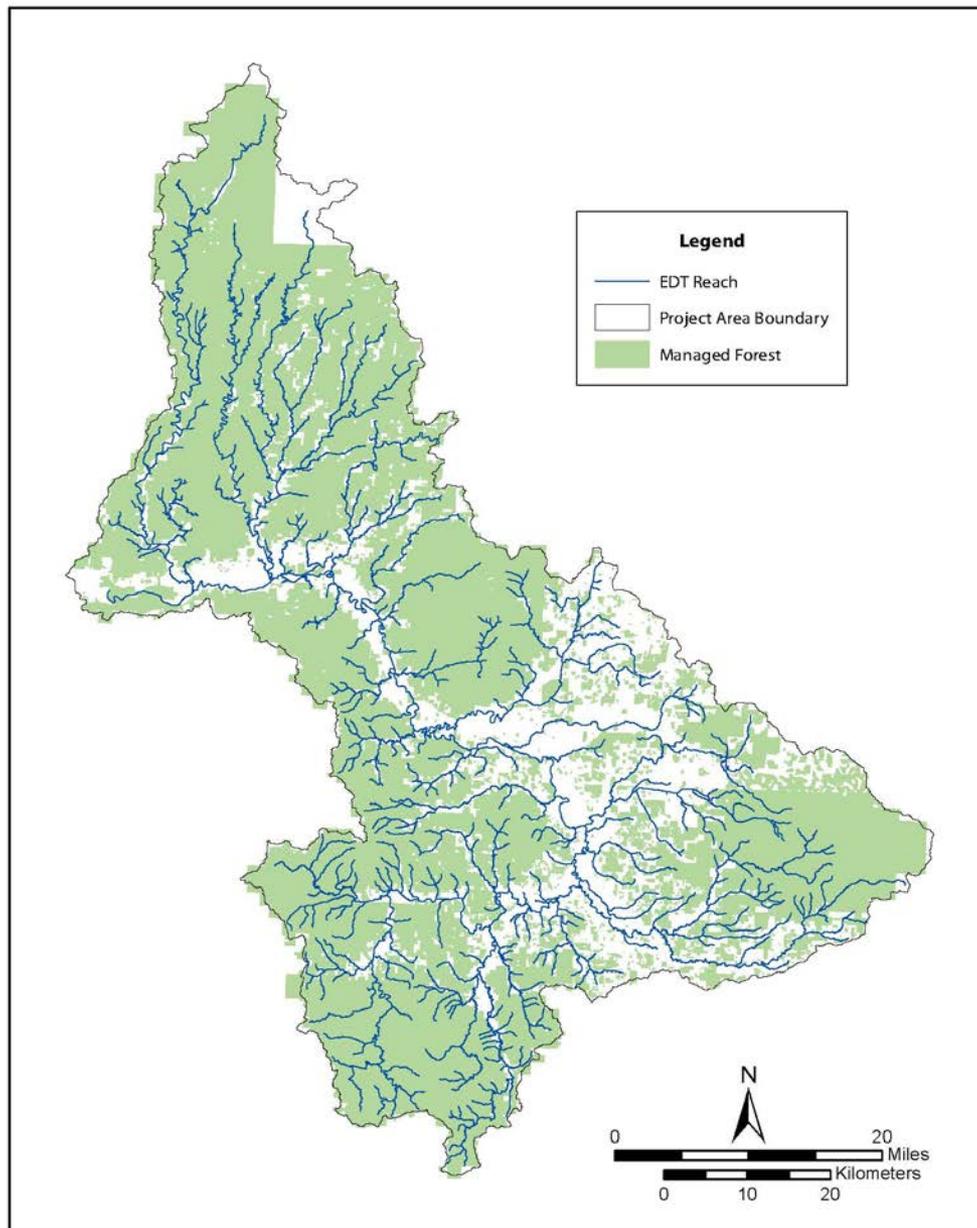


Preliminary Restoration Cost Estimates

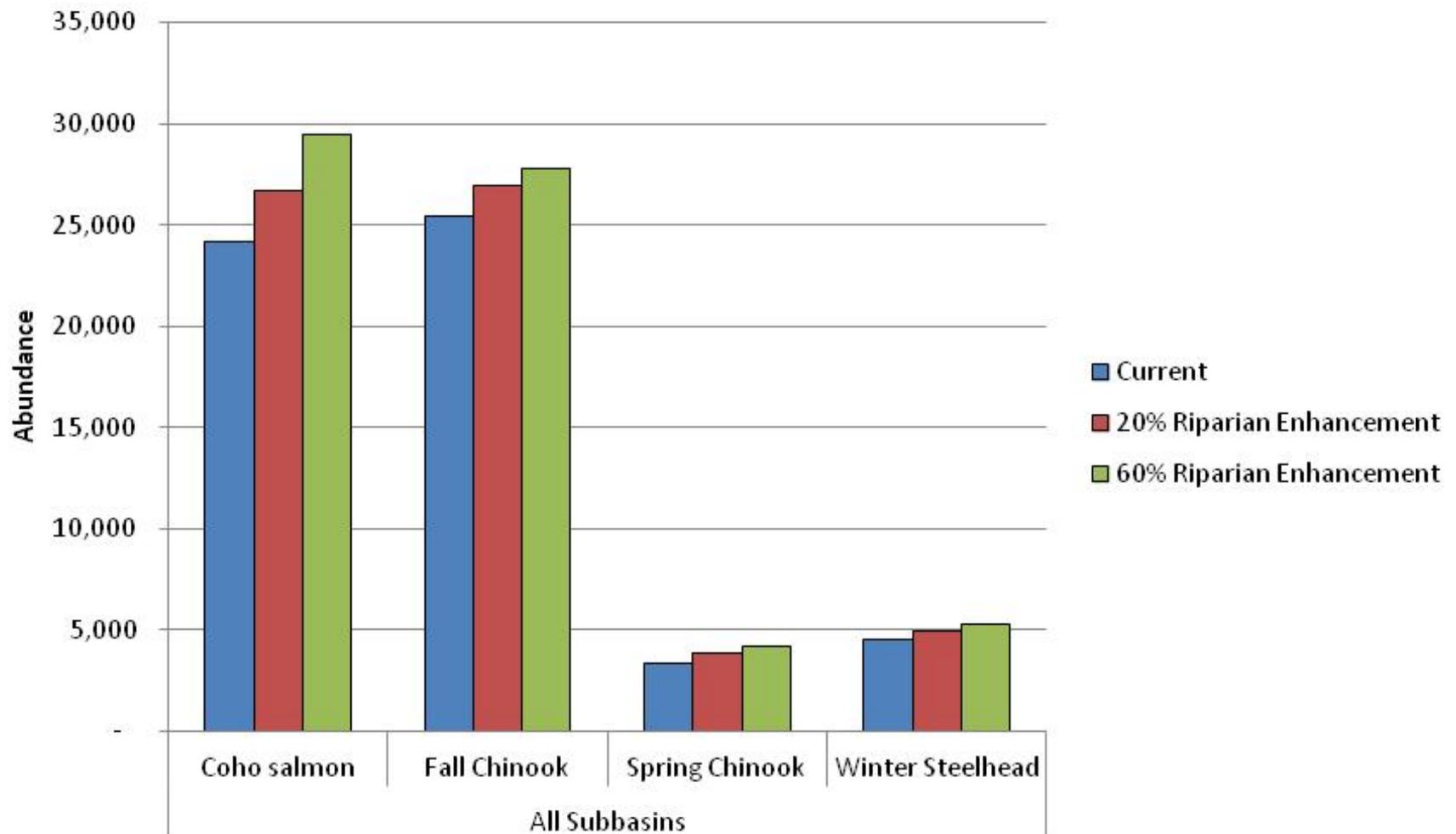
1. Barrier removal (172 culverts):
 - Range in costs from \$26M to \$50M

2. Riparian - Managed Forests

Extent of
managed forest
in Chehalis Basin



Effect of Riparian Enhancement in Managed Forests on Abundance of Salmon

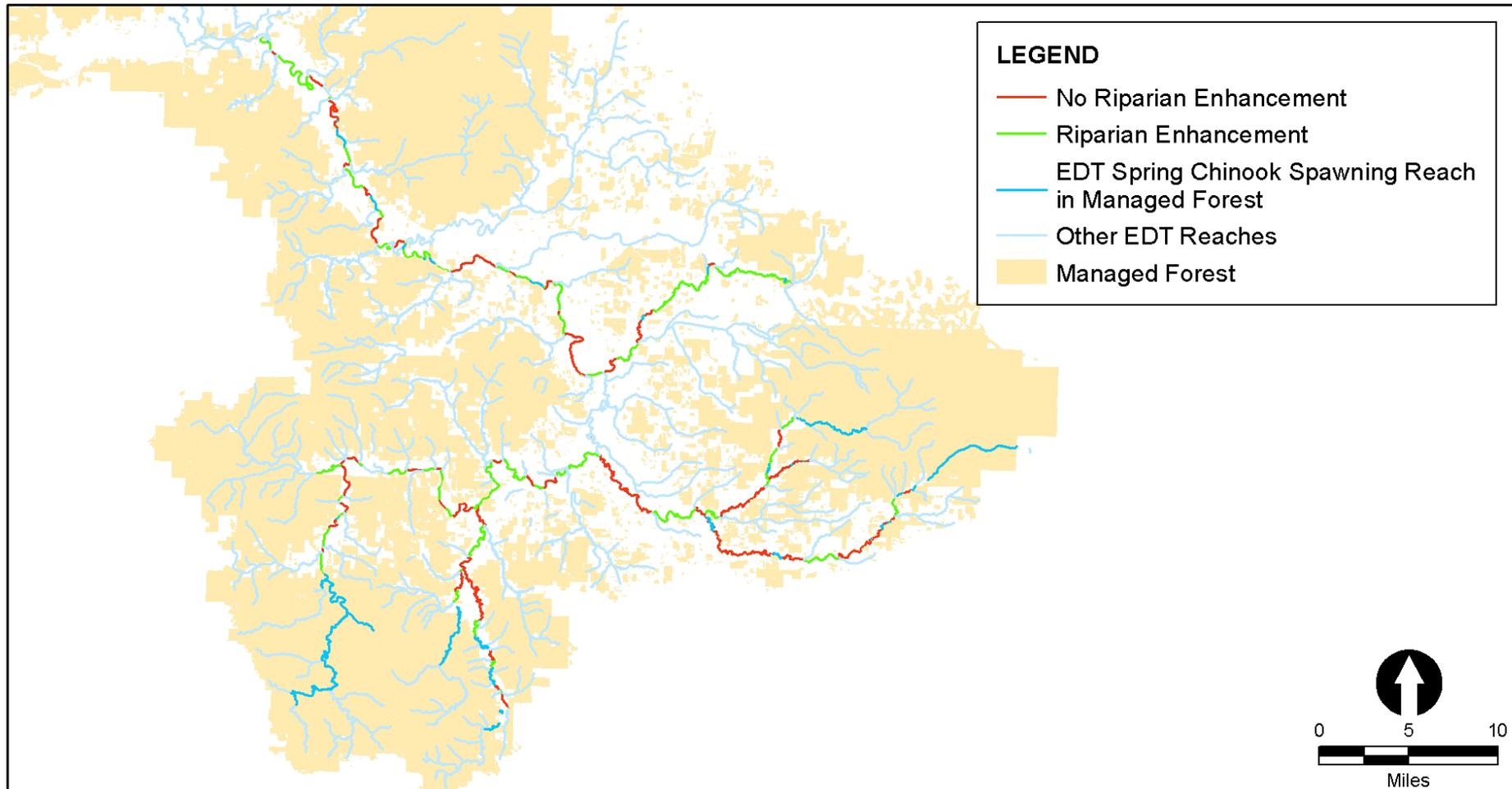


Preliminary Restoration Cost Estimates

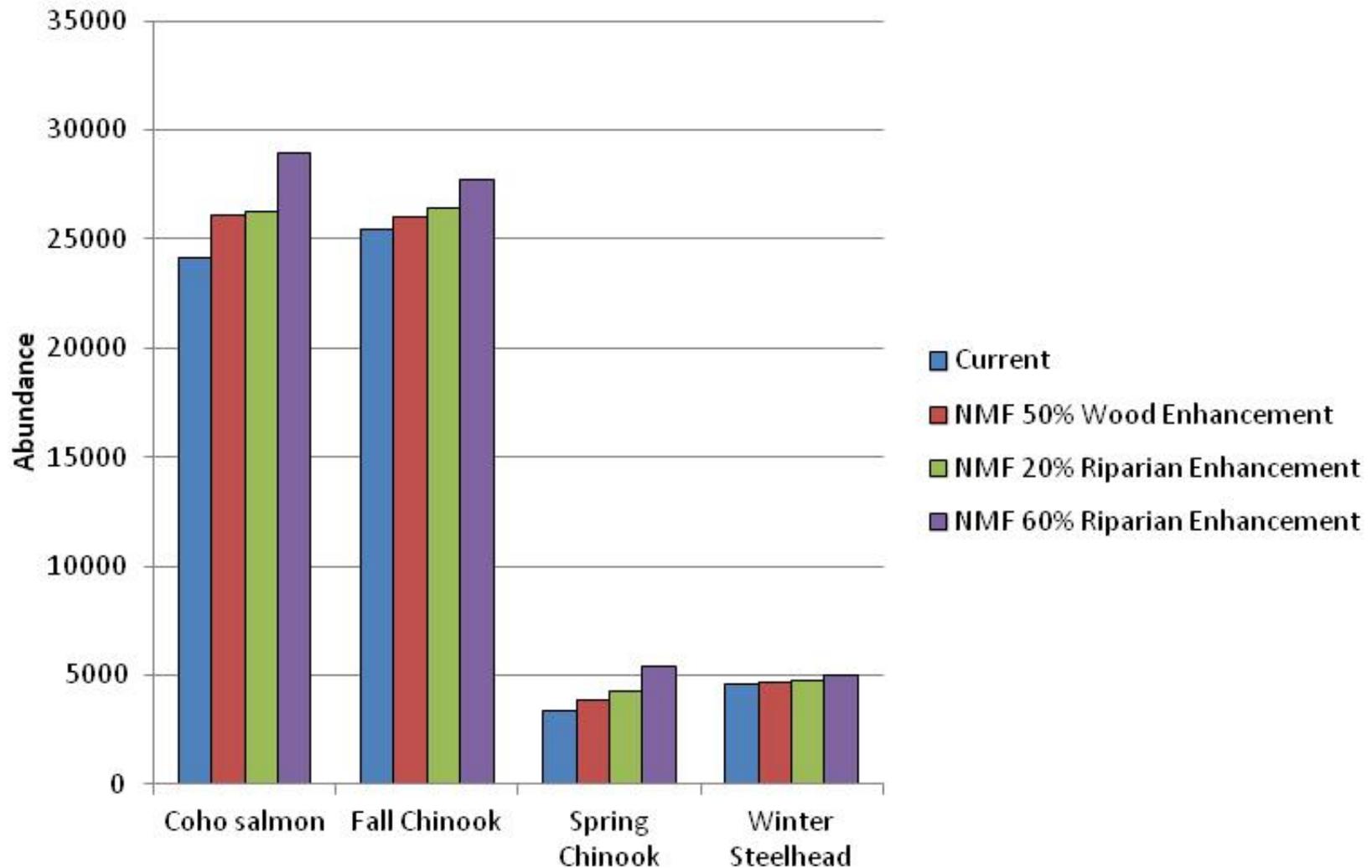
2. Riparian enhancement in managed forests

- Costs are born by public and private timber land owners

3. Riparian and Wood for 50% Spring Chinook Spawning Habitats



Effect of Riparian Enhancement in Non-Managed Forests on Abundance of Salmon



Preliminary Cost Estimates

- 3. Riparian enhancement and wood in 50% of Spring Chinook spawning reaches
- Riparian: \$24M to \$59M
- Wood treatment: \$13M to \$25M
- Total for scenario: \$37M to \$84M

Summary of Riparian Restoration

Species	Managed Forest Lands		Non-Managed Forest Lands		
	20% Riparian Enhancement	60% Riparian Enhancement	Wood Enhancement	20% Riparian Enhancement	60% Riparian Enhancement
Coho salmon	11%	22%	8%	9%	20%
Fall Chinook	6%	9%	2%	4%	9%
Spring Chinook	15%	26%	14%	26%	62%
Winter Steelhead	8%	15%	3%	4%	9%

Other Fish - Habitat Enhancement

- Salmon projects would likely be positive to neutral
 - Silt reduction
 - In channel habitat complexity
 - Habitat complexity including off-channel connection
- Removal of non-native predators would likely be beneficial
- Due to the lack of data, specifics on project designs and locations should be reviewed on a case-by-case basis to determine potential impacts by species

Non-Fish - Habitat Enhancement

- Removal of aquatic exotic predators and/or habitat modification to disfavor aquatic exotic predators can help several non-fish species
- Account for complex life stage requirements
 - Preservation of riparian areas located near and suitable to the upland needs of several species will help Western toad, Northern Red-legged Frog, and Western Pond Turtle
- Setting aside coniferous forest to generate older stage stands will help Coastal tailed Frog and Van Dyke's salamander

Climate Change



ASEP Climate Change

Addressed 2 key questions:

- How would climate change affect species compared to the continuation of existing conditions? (quantitatively)
- How should we view (select) habitat restoration scenarios when taking climate change into consideration? (qualitatively)

2014 Climate Change Estimates

- Significant uncertainty in scientific community about the magnitude of projected changes, particularly with river flows
- Used best available information from UW Climate Impacts Group
- Used 2040s model inputs based on an intermediate gas emissions scenario

ASEP Climate Change Analysis Based on Moderate Scenarios (IPCC - A1B)

- Water temperature
 - Climate Impacts Group's changes in air temperature
 - 1 to 3°C increase
- Streamflow
 - Average monthly flow (wetter winters, drier summers)
 - Higher peak flows
 - Lower low flows
- Sea level rise effects on estuary and lower river (23" increase by 2100; Wild Fish Conservancy)

Climate Change – Salmon

- To date have modeled climate change using Shiraz
 - Mainstem only
 - Spring Chinook, Winter steelhead, Coho
- Adjusted habitat capacities based on estimated changes in streamflows
- Adjusted environmental conditions (water temperature and flows)

Shiraz - Results for Climate Change (mainstem Chehalis River)

Species	Climate Change
Spring Chinook	-100%
Coho	-5%
Winter Steelhead	-62%

- Percentages are changes in medians of last 10 years in time series (2091-2100), compared to current conditions

Climate Change – Other fish and Non-fish Species

- Responses were highly variable
- Depended on species' thermal preferences (adaptations), life stage, location (reach)
- In general
 - Warm-adapted species benefit from climate change and are impacted by cold water releases from multi-purpose dam
 - Cool-adapted species impacted by climate change and benefit from releases from multi-purpose dam

Climate – Positive Habitat Restoration Actions

- Barrier removal: can aid access to cooler streams
- Floodplain reconnection: can ameliorate temperature increases by sub-surface flow
- Aggrading incised channels: restores aquifer storage, increases summer base flow, lowers summer temperatures, increases habitat diversity
- Actions that restore stream flow: ameliorate low flows and increase diversity

Climate – Positive Restoration Actions

- Restoring riparian habitat: cools streams, provides organic matter, increases wood supply and habitat diversity, and reduces fine sediments
- Reducing erosion and sediment delivery: improves habitat diversity, increases pool depth, narrows widened channels
- Instream rehabilitation: improves habitat diversity, provides cover, improves sediment storage

Summary of Key Results for Economic Analysis

- Effects of managed forest riparian buffers
- Climate change
- Species to focus on
- Level of effort and cost for benefit of enhancement

Summary

Scenario	Cost Range (\$ M)	Spring Chinook	Coho	Fall Chinook	Winter steelhead
1. Culverts	26 - 50	0%	12%	3%	24%
2. Managed forests	-	15 - 26%	11 - 22%	6 - 9%	8 - 15%
3. Non-managed forests	37 - 84	40 - 76%	17 - 28%	6 - 11%	7 - 12%
Total	63 - 134	55 - 102%	40-62%	15 - 23%	39 - 51%

Questions