Chehalis Basin Aquatic Species Restoration Plan

Evaluation of Aquatic Species Restoration Plan Scenarios for Anadromous Salmonids

April 4, 2019

Models are:

1. Interpretations of reality

2. Useful indicators of paths forward

Model Caveats

There is uncertainty:

- Climate change
- Land use degradation
- Dated/incomplete habitat data
- Effectiveness of restoration

Model Caveats

Not included in modeling exercise:

- Predation from exotic species
- Estuary and ocean conditions
- Harvest

Model Outcomes

Do: Focus on patterns of change predicted by models

Do not: Fixate on actual numbers

Outline

- Key takeaways
- Analytical methods
  - Evaluation metrics
  - Baseline—No Action Alternative
  - Description of Aquatic Species Restoration Plan (ASRP) scenarios
- Results
  - Abundance by Ecological Region
  - Basin-level results for Coho and Spring Chinook Salmon
    - Abundance
    - Spatial structure
- Summary and conclusions

Key Takeaways

- The Chehalis Basin is expected to change appreciably in the future and will affect native aquatic species and ecosystems.
  - Climate change
  - Increase in human population
- Without significant restoration actions (No Action), these changes will have strong negative impacts on native species and ecosystems
- ASRP restoration scenarios have the potential to counter these changes to the aquatic environment
  - By late century, abundance of salmonids increased relative to abundance if we do no restoration (No Action)
  - By late century, abundance of most salmonids increased with ASRP restoration relative to current abundance
- These changes expected to be similar for other native species and their environments

Analytical Methods

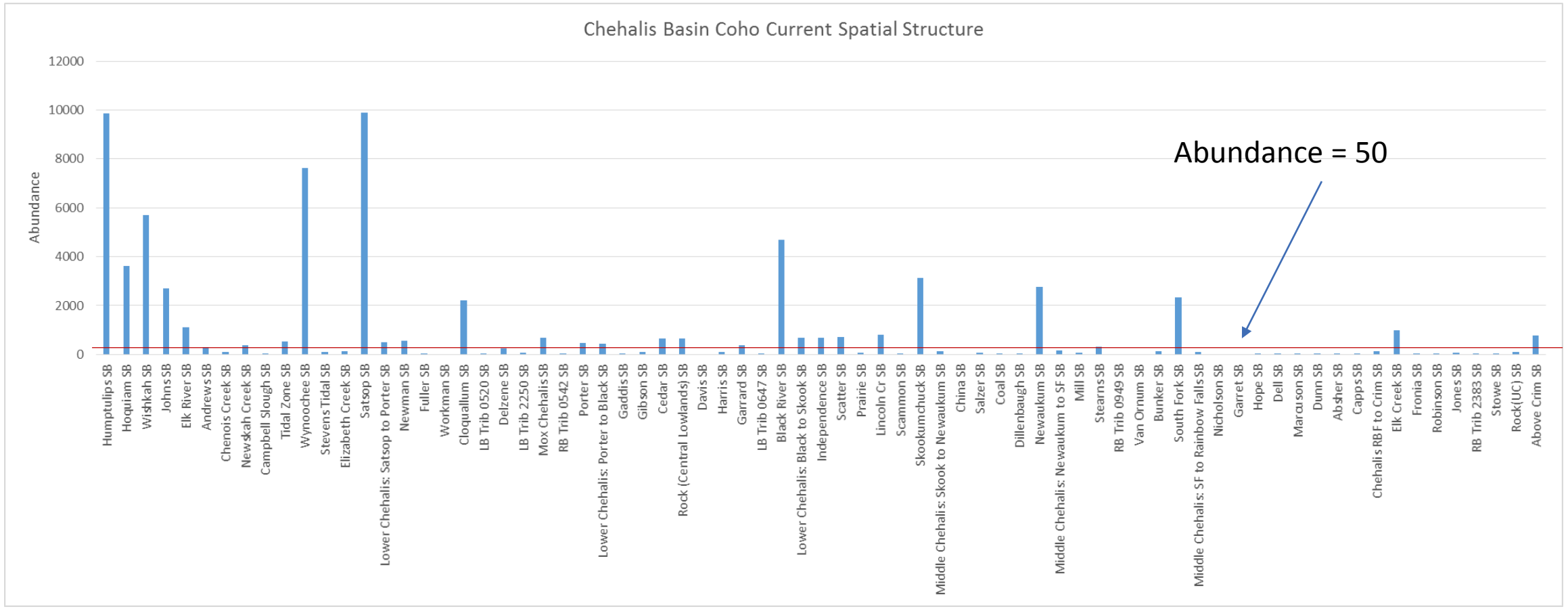
Evaluation of ASRP Scenarios

- Biological Model
  - Chehalis EDT Habitat Model
  - Computed potential of habitat to support naturally spawning salmon species
    - Adult fish returning to the Chehalis Basin
    - Doesn't include hatchery fish
    - Harvest removed

Evaluation of ASRP Scenarios

- Evaluation Metrics
  - Viable Salmonid Population (VSP)
    - **Abundance:** Number of adult fish returning to Chehalis Basin without harvest
    - Productivity: Returning fish/Parental spawners
    - Biological Diversity: Physical, behavioral, and life history variation within populations
    - **Spatial Structure:** Distribution of production across the landscape
      - Proportion of sub-basins with habitat producing more than 50 adult fish returns

Spatial Structure: Portfolio of Sub-Populations Across the Chehalis Basin for Coho Salmon

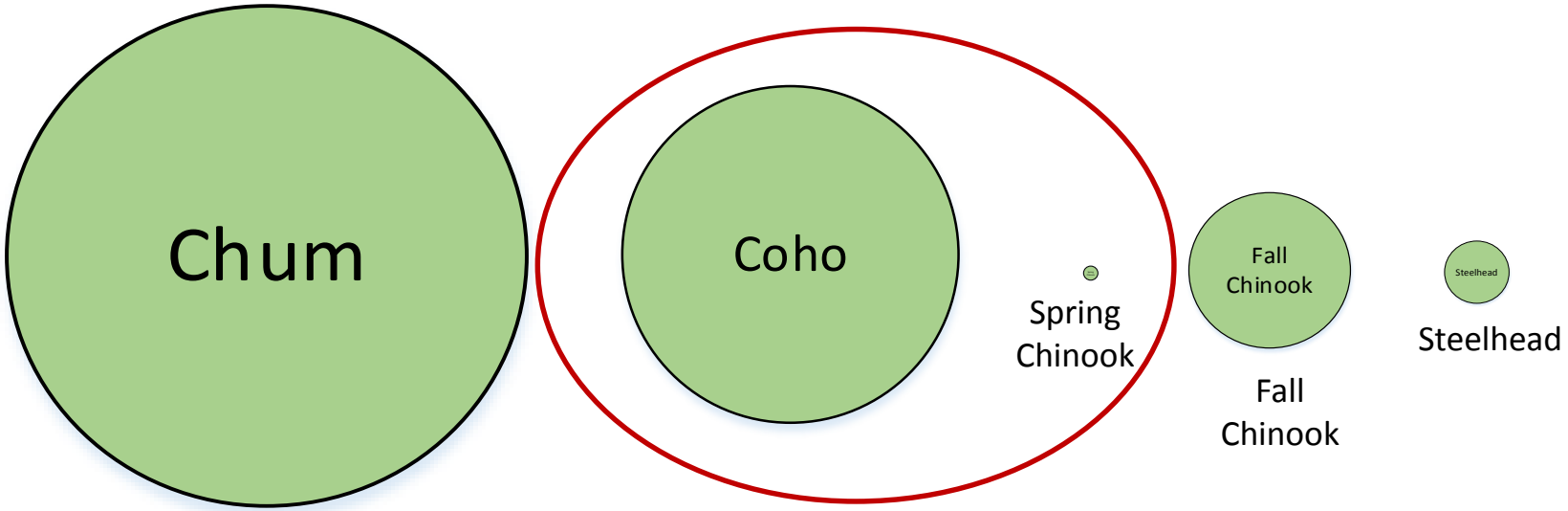


ASRP Scenario Evaluation

SPECIES EVALUATED	
• **Coho Salmon** • **Spring-run Chinook Salmon**	• Fall-run Chinook Salmon • Chum Salmon • Steelhead

- Focus today will be on results for Coho and Spring Chinook Salmon
  - Coho Salmon—most widespread, occurs throughout the Basin, abundant
  - Spring Chinook Salmon—most restricted distribution; only in Cascades, Middle Chehalis, and Willapa Hills; least abundant

Relative Habitat Potential of Chehalis Basin Salmonids



Circles indicate relative abundance

Evaluation of ASRP Scenarios

- Time
  - Current
  - Mid-Century (2040)
  - Late Century (2080)

Evaluation of ASRP Scenarios

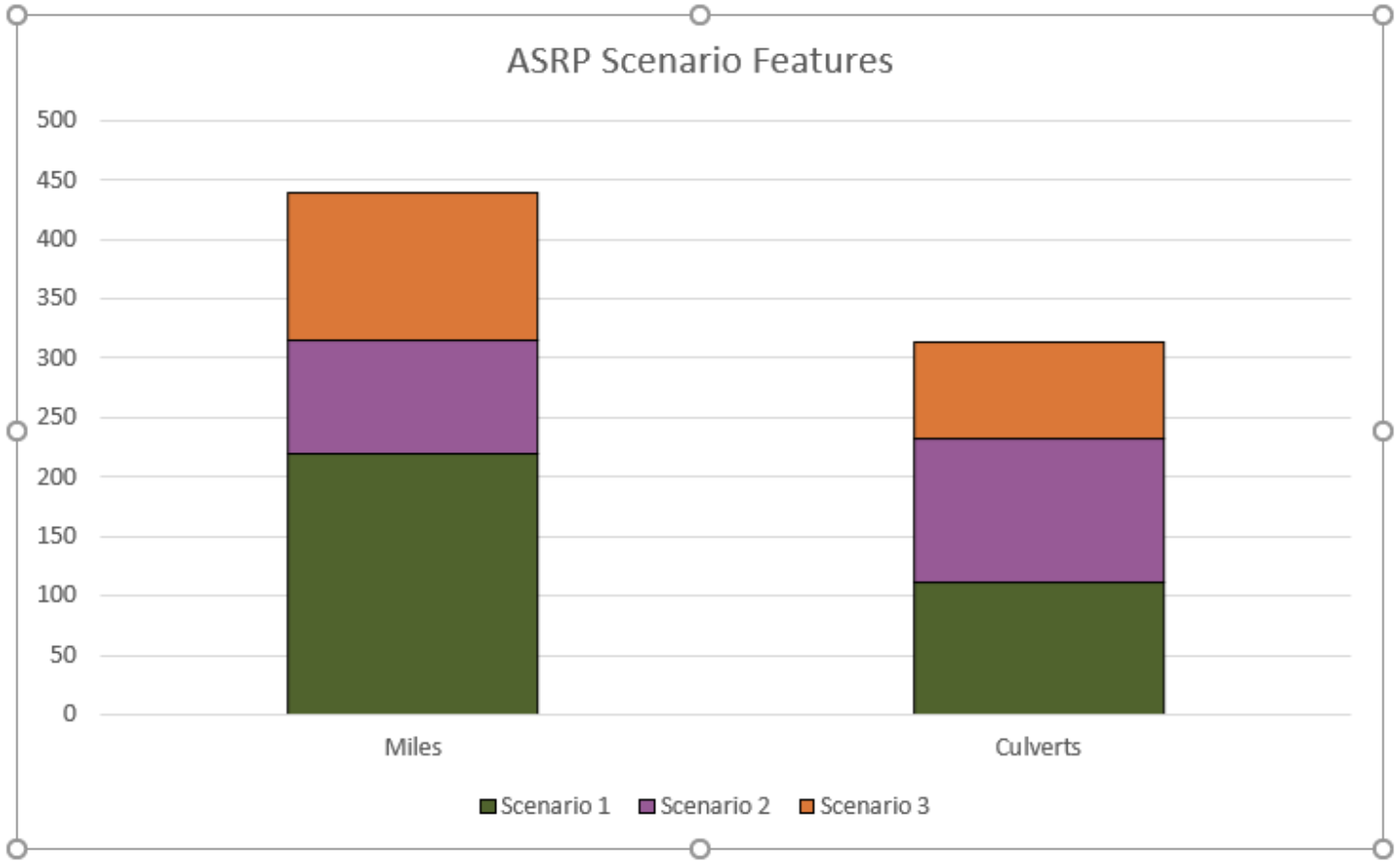
- Space
  - Entire Chehalis Basin
    - Grays Harbor
    - Chehalis River
  - Scenarios applied to geographical areas within sub-basins (e.g., South Fork Newaukum River, Upper East Fork Satsop River)

ASRP No-Action Baseline

- How would species perform in the absence of the ASRP?
- Changing baseline over time
- Components
  - Tree growth inside **managed** forest (positive change)
    - Increase shade ➔Reduce temperature
    - Recruitment of large wood to streams
  - Removal of culverts under the tribal injunction in **managed** and **non-managed** forest areas (positive change)
    - 24 Washington Department of Transportation prioritized culverts intersect with EDT stream network
      - Top 50% removed in 2040
      - Remainder removed in 2080
  - Future climate (negative change)
  - Habitat degradation due to future development (negative change)

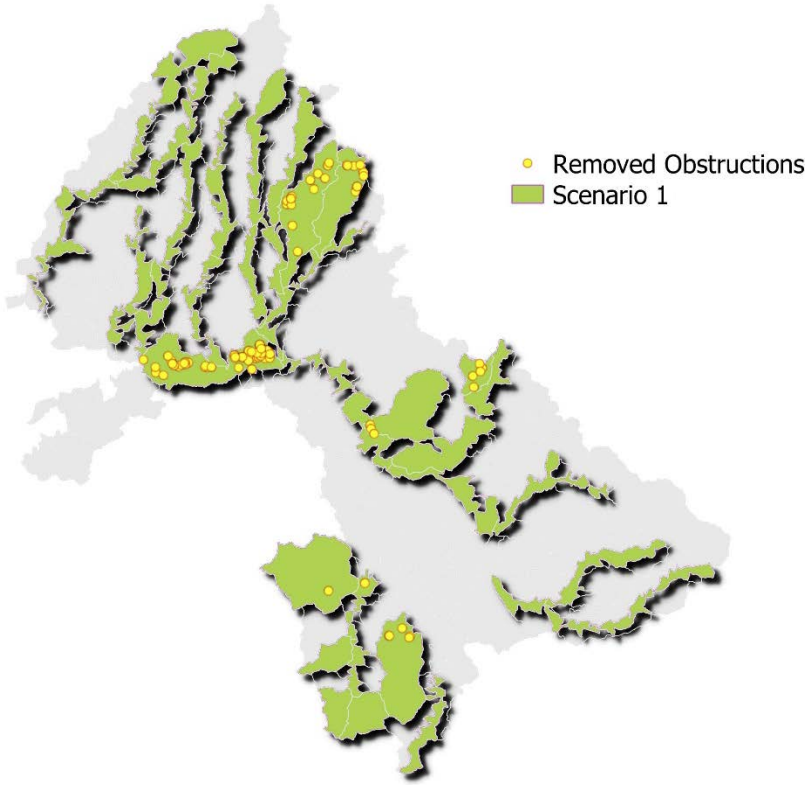
ASRP Scenarios

- Scenarios are cumulative—not alternatives
- Treatments differ within and outside Managed Forest
- Restoration applied geographic areas within sub-basins
  - Focused on mainstem reaches
  - Averaged across the geographic areas
- All culverts within selected areas removed (set to 100% passage)
  - Mainstem and tributaries

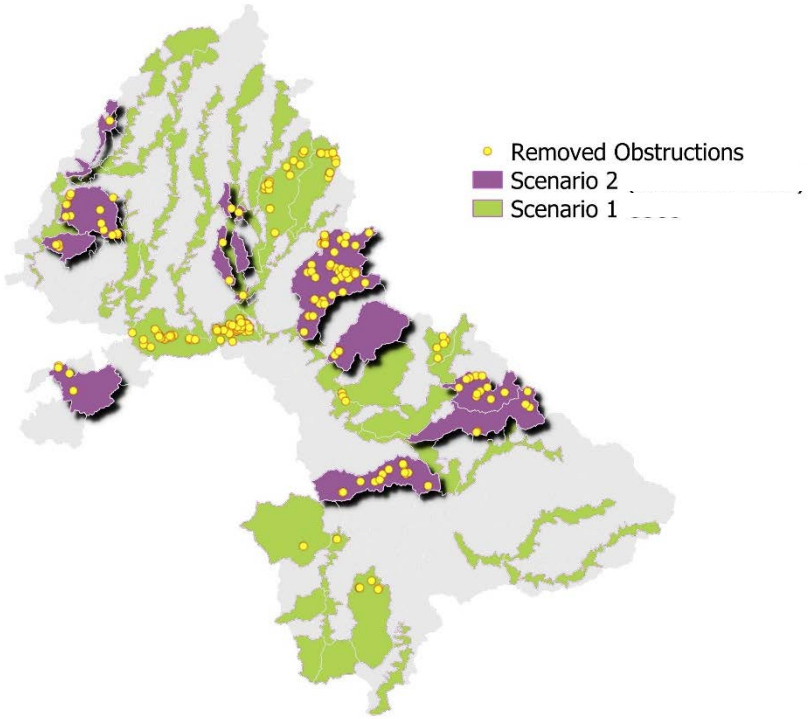


ASRP Scenarios

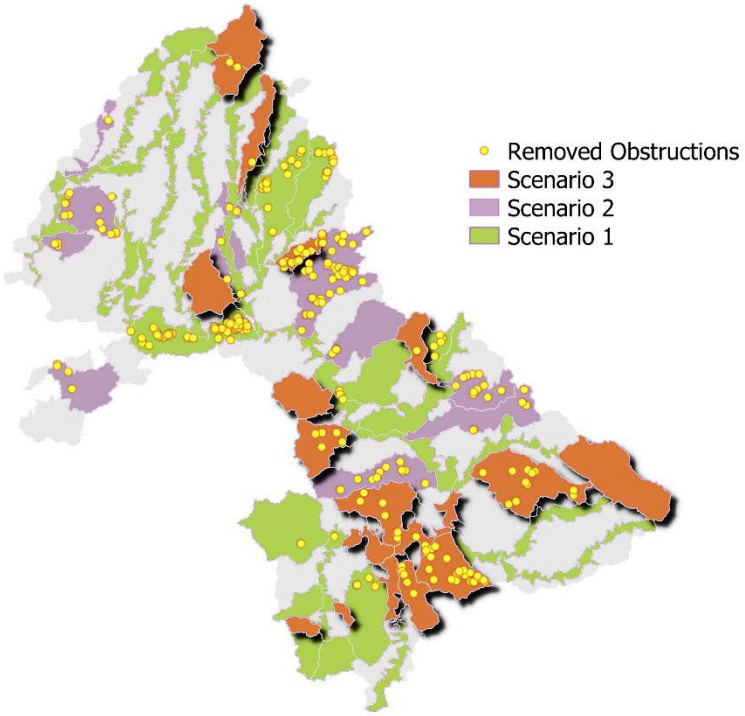
Scenario 1: Protect and Restore Core Habitats



Scenario 2: Protect and Expand Restoration

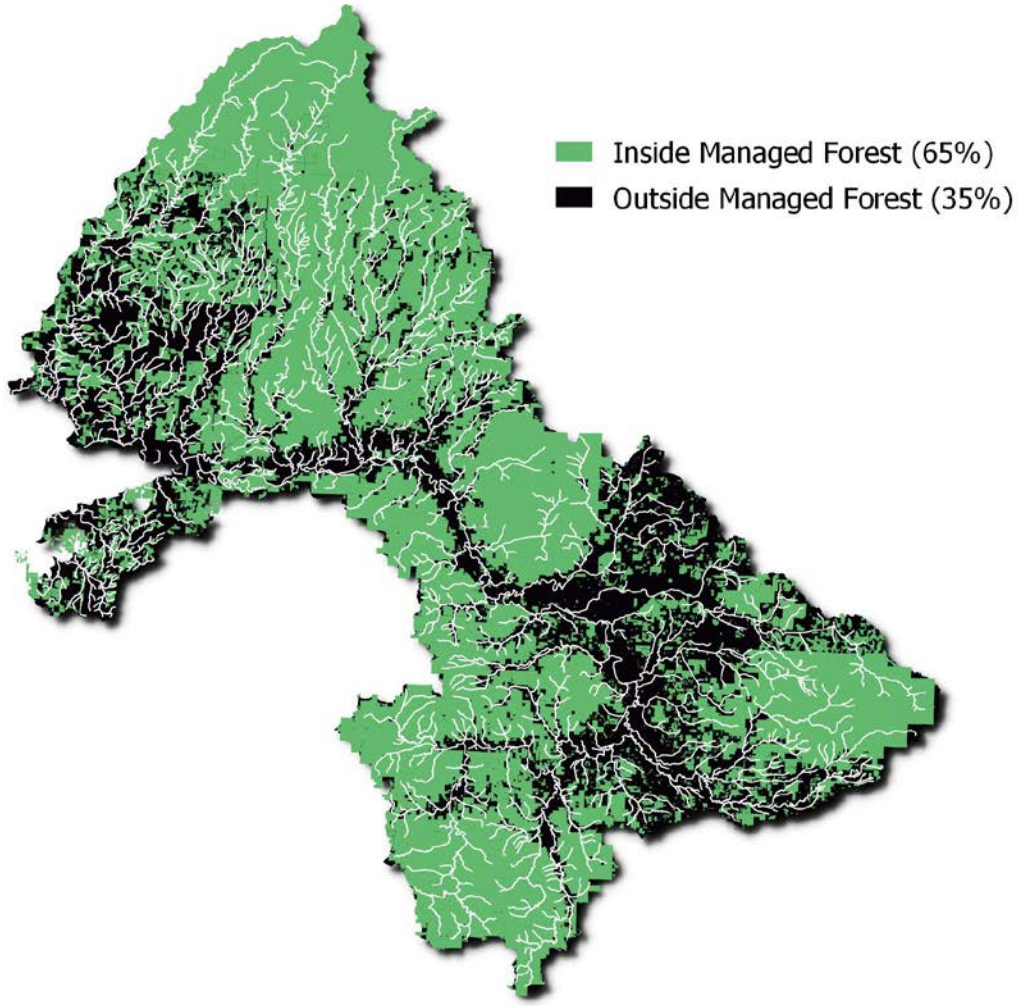


Scenario 3: Protect Core Habitats Restore Spatial Diversity



Colored polygons = Geographic areas where treatment was applied; dots = Culverts removed

Restoration Treatments Differ with Land Use

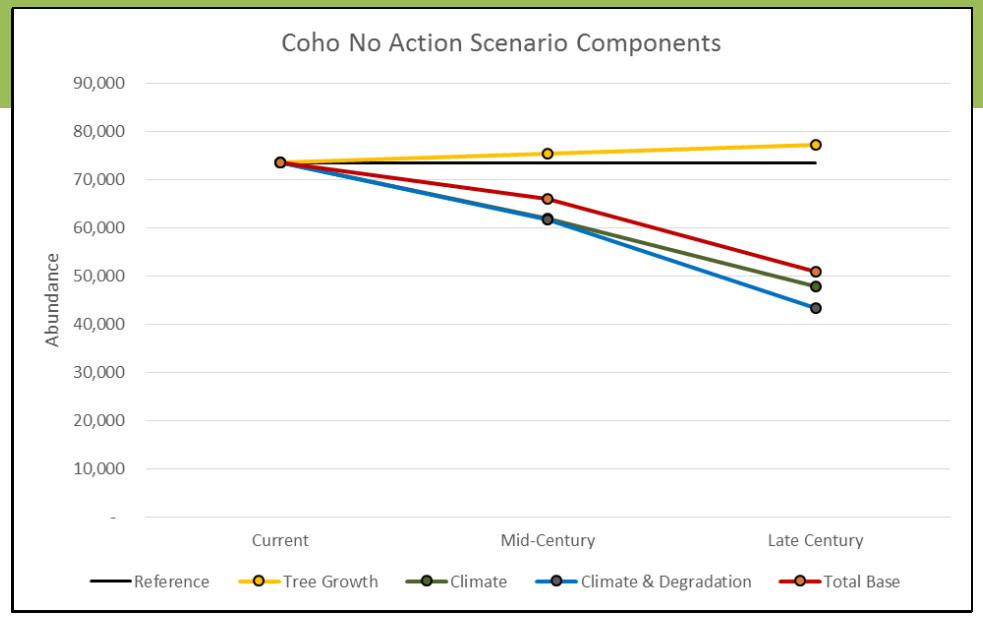


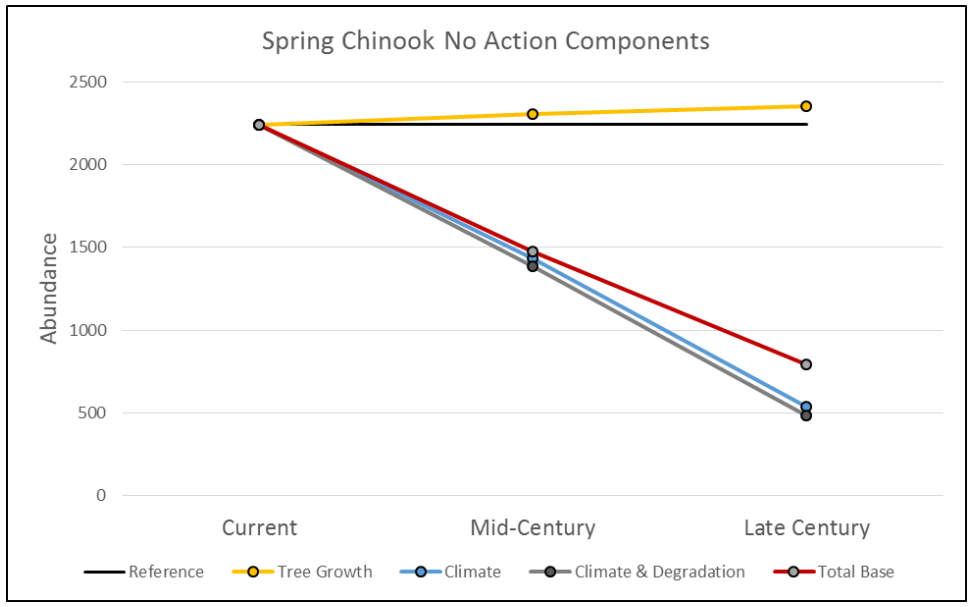
- Inside Managed Forest
  - State and federal forests
  - Private managed forests
  - Mid-Century: Large wood added
  - Late Century: Tree maturation
- Outside Managed Forest
  - Cities, agriculture, residential, major roads
  - Mid-Century: Large wood added, riparian trees planted, floodplains reconnected
  - Late Century: Riparian forests matured, connected floodplains continue

Results

March 5, 2019

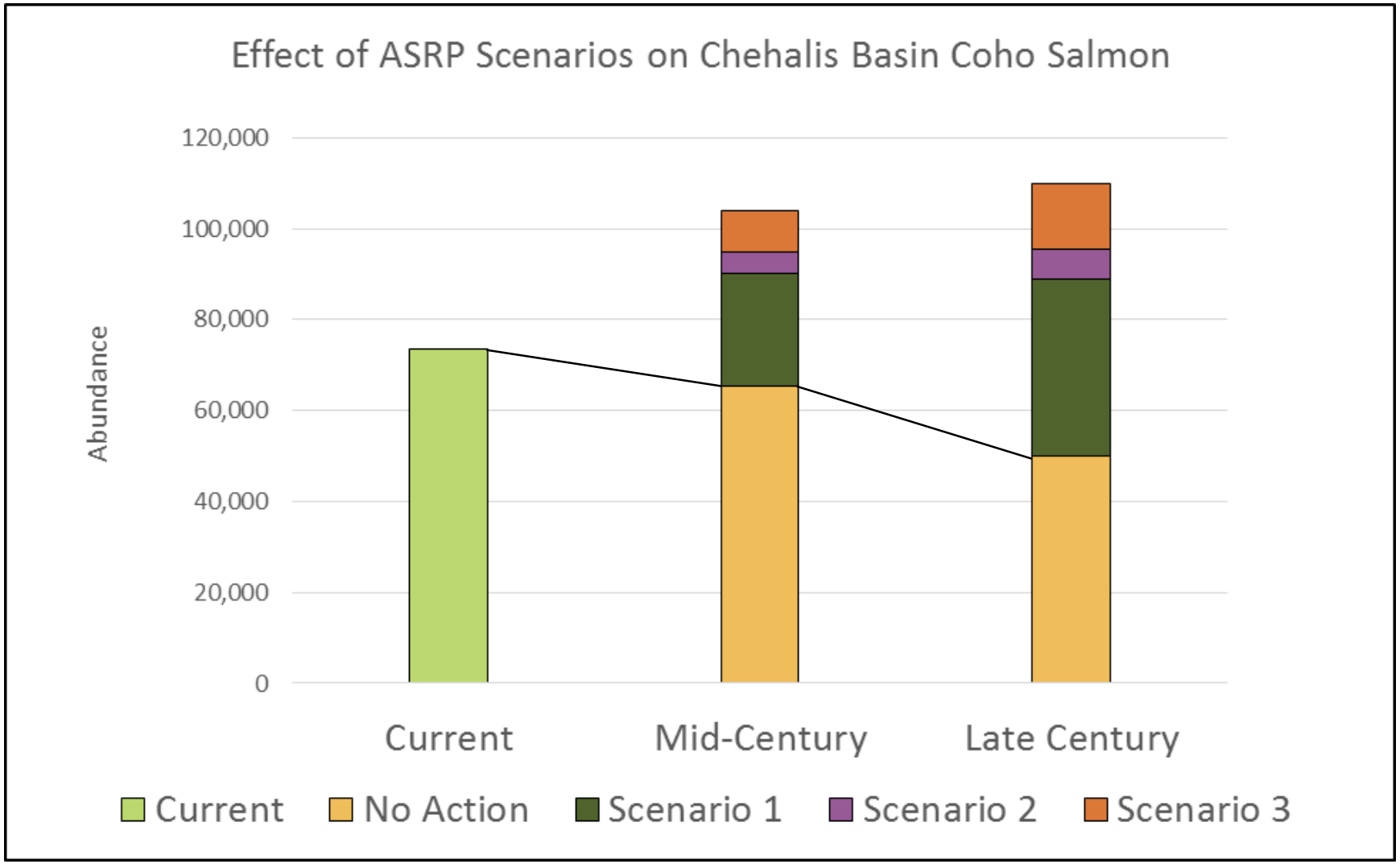
No Action Components



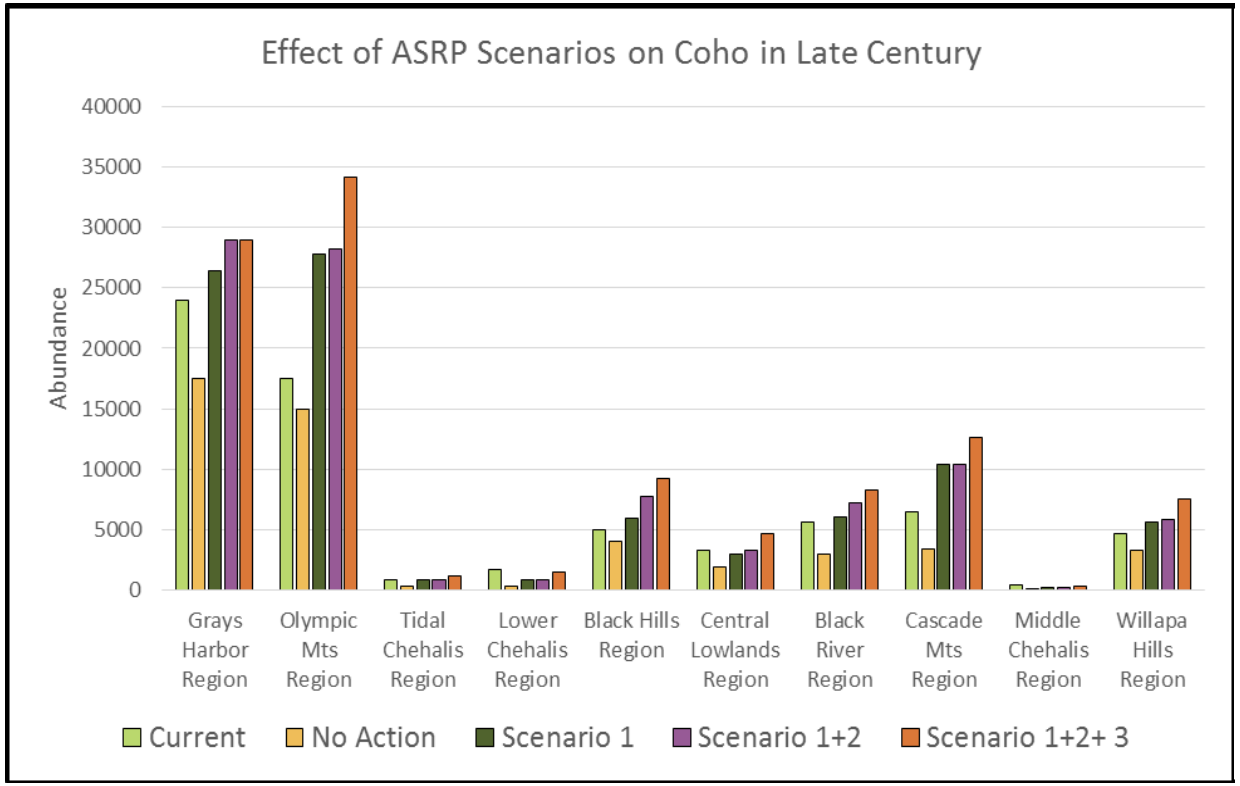


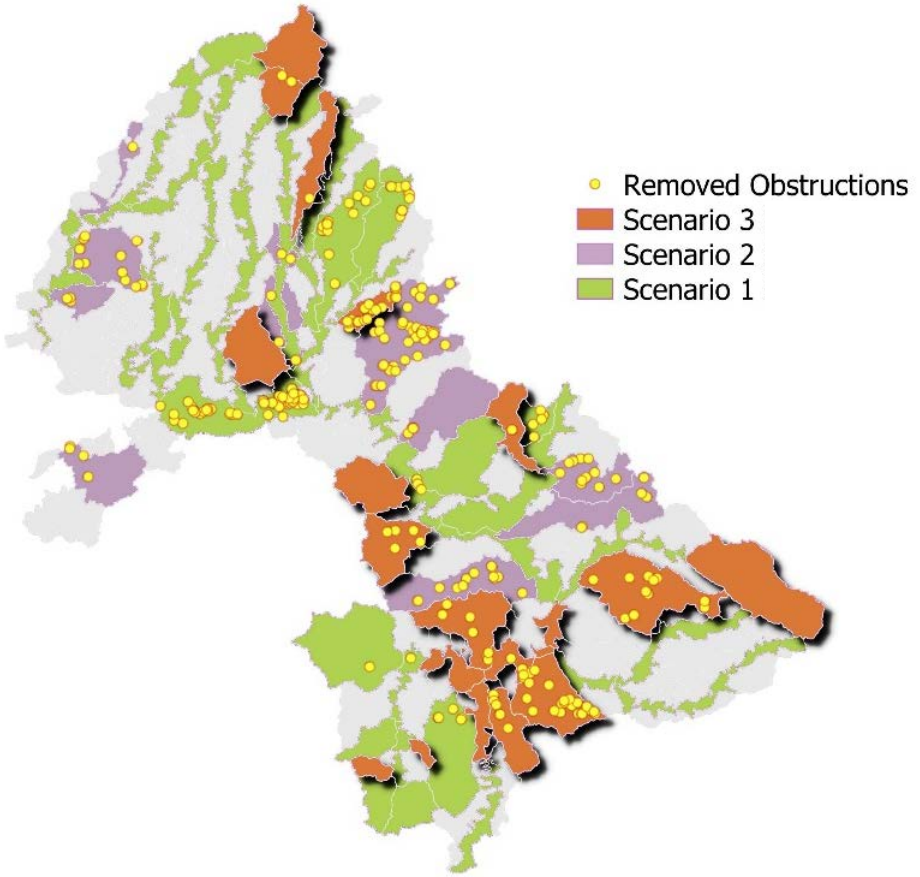
- Under No Action abundance declined markedly by Late Century
  - -30% Coho Salmon
  - -70% Spring Chinook Salmon
- Greatest decline due to climate change temperature

ASRP Scenario Effects on Coho Salmon

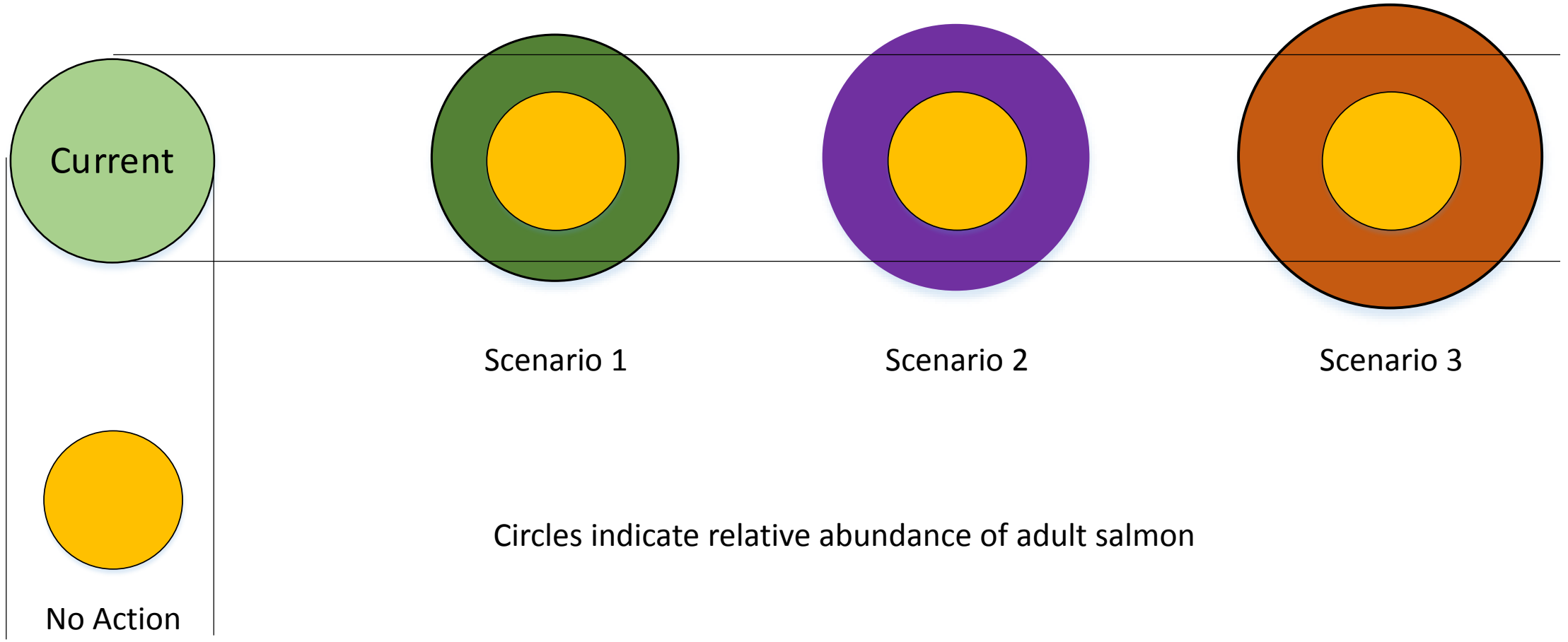


ASRP Scenario Effects on Coho by Ecological Region–Late Century

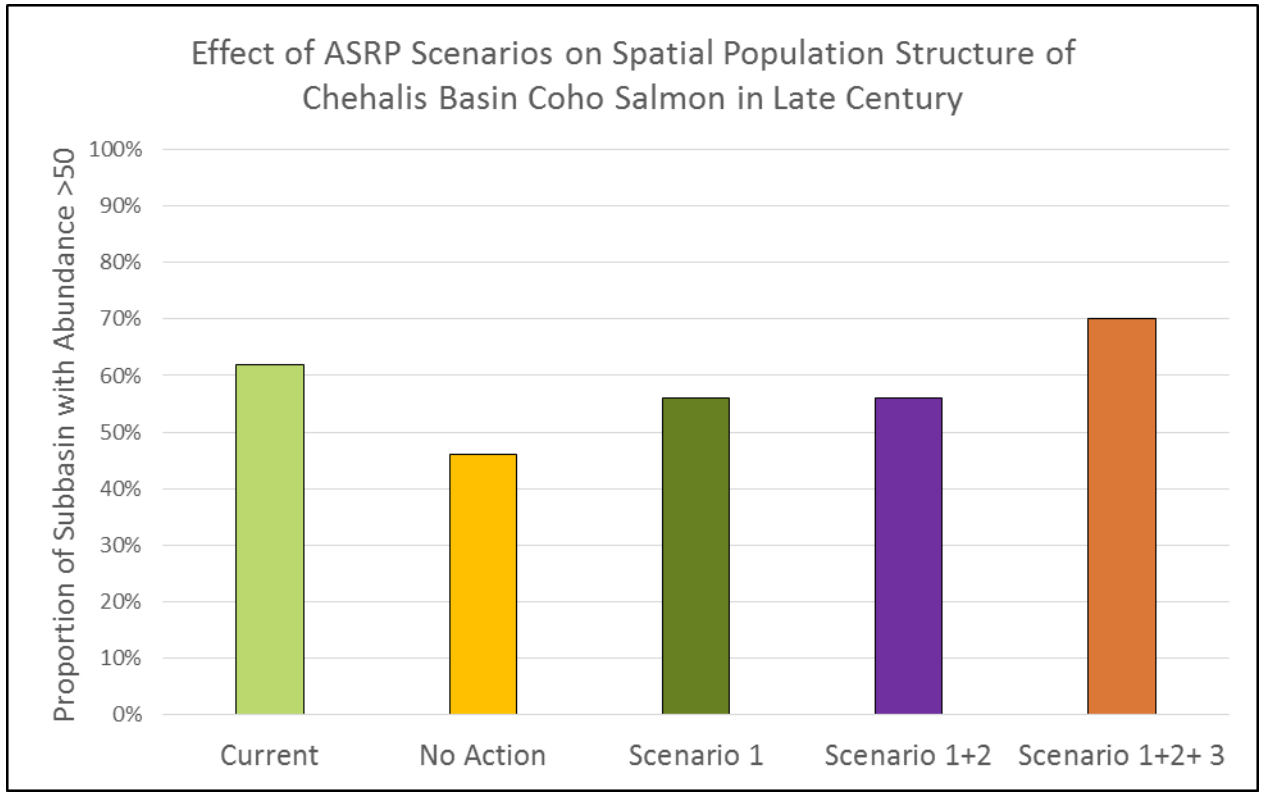




ASRP Scenario Effects on Coho Salmon–Late Century

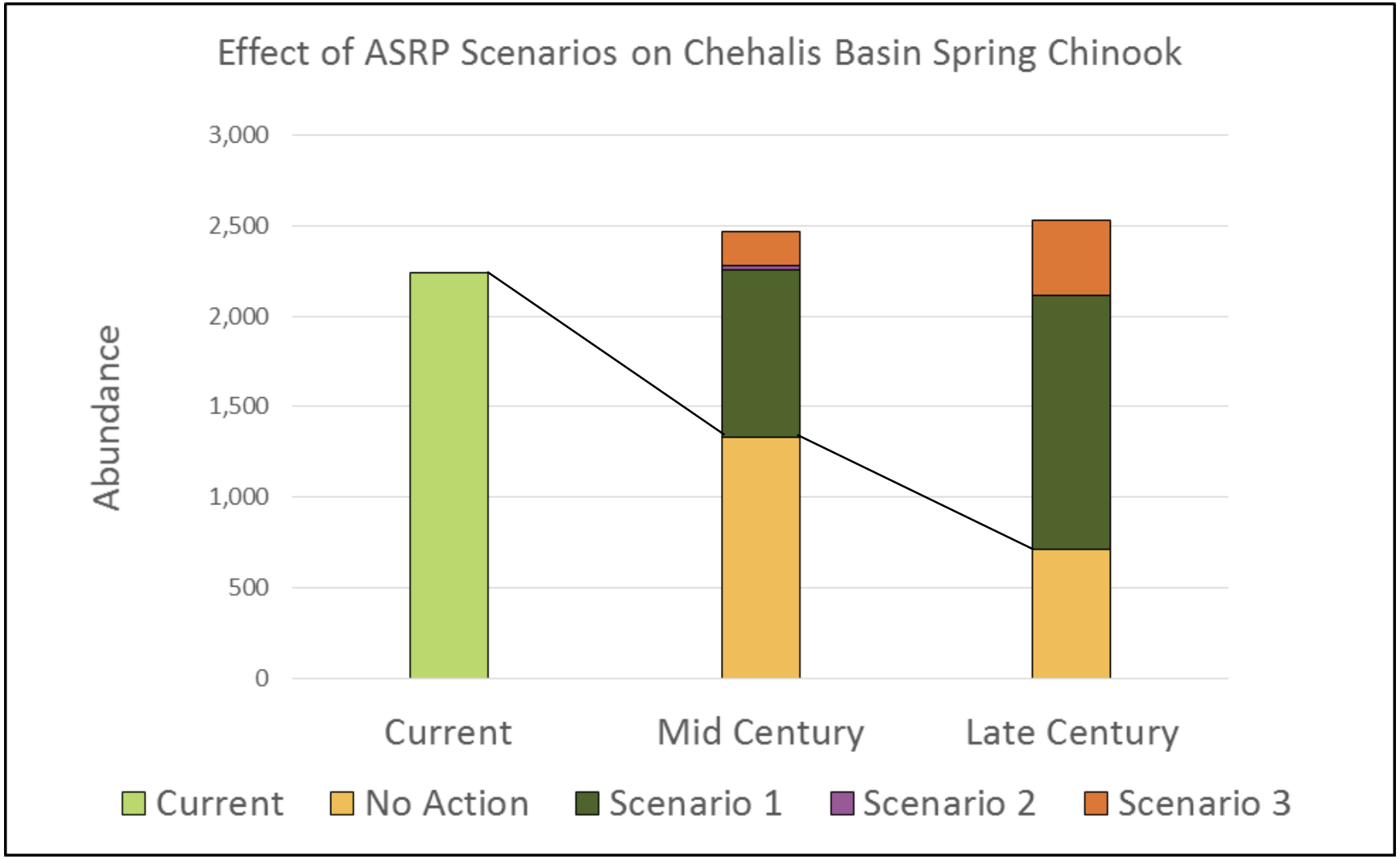


ASRP Scenario Effects on Coho Salmon Spatial Population Structure

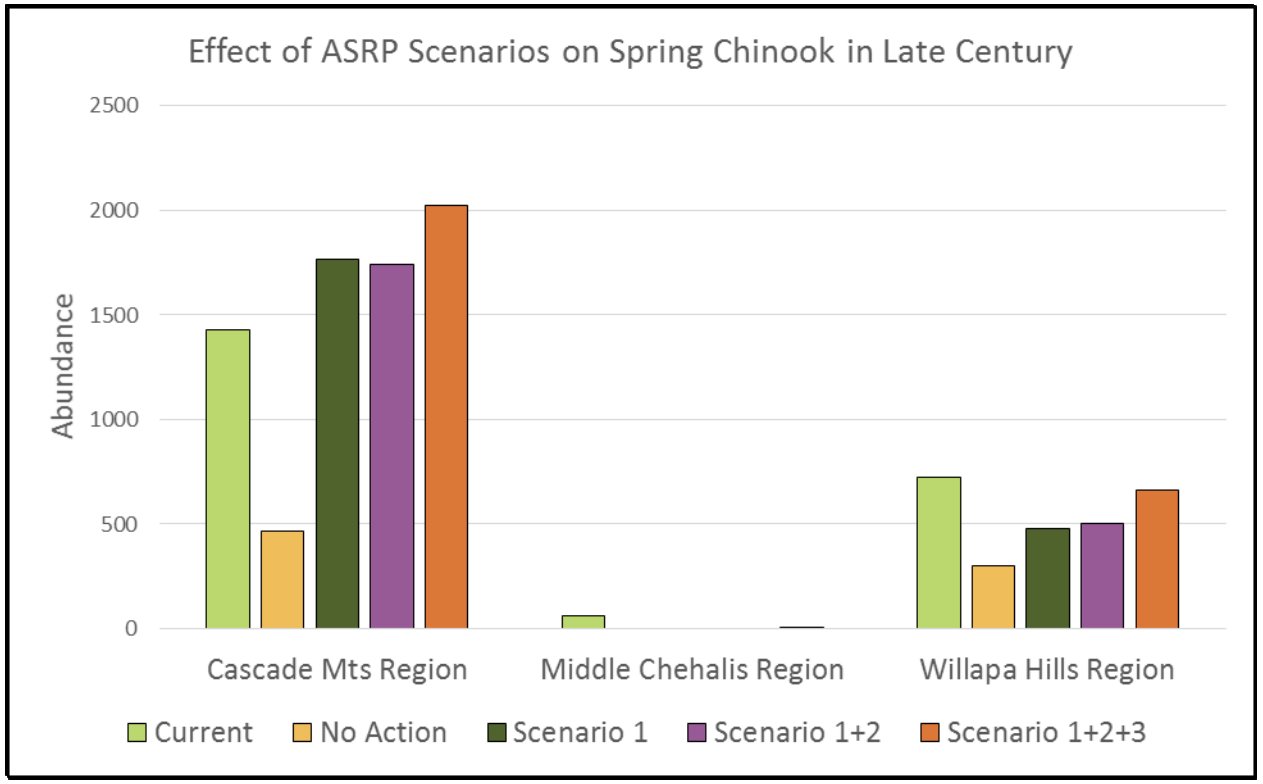


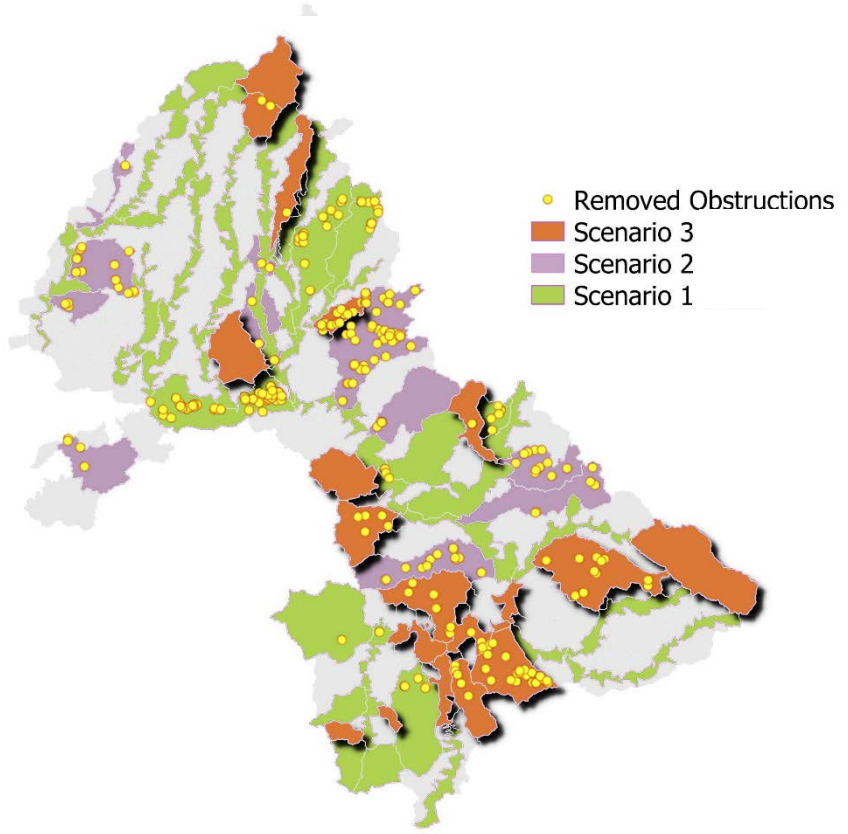
- Number of "larger" sub-populations (abundance > 50) declines in late century with No Action
  - More than 50% of sub-basins support <50 fish by late century
- Scenarios 1 and 2 help but still decrease "larger" sub-populations due to climate change
- Scenario 3 benefits smaller sub-populations and increases proportion of "larger" sub-populations

ASRP Scenario Effects on Spring Chinook Salmon

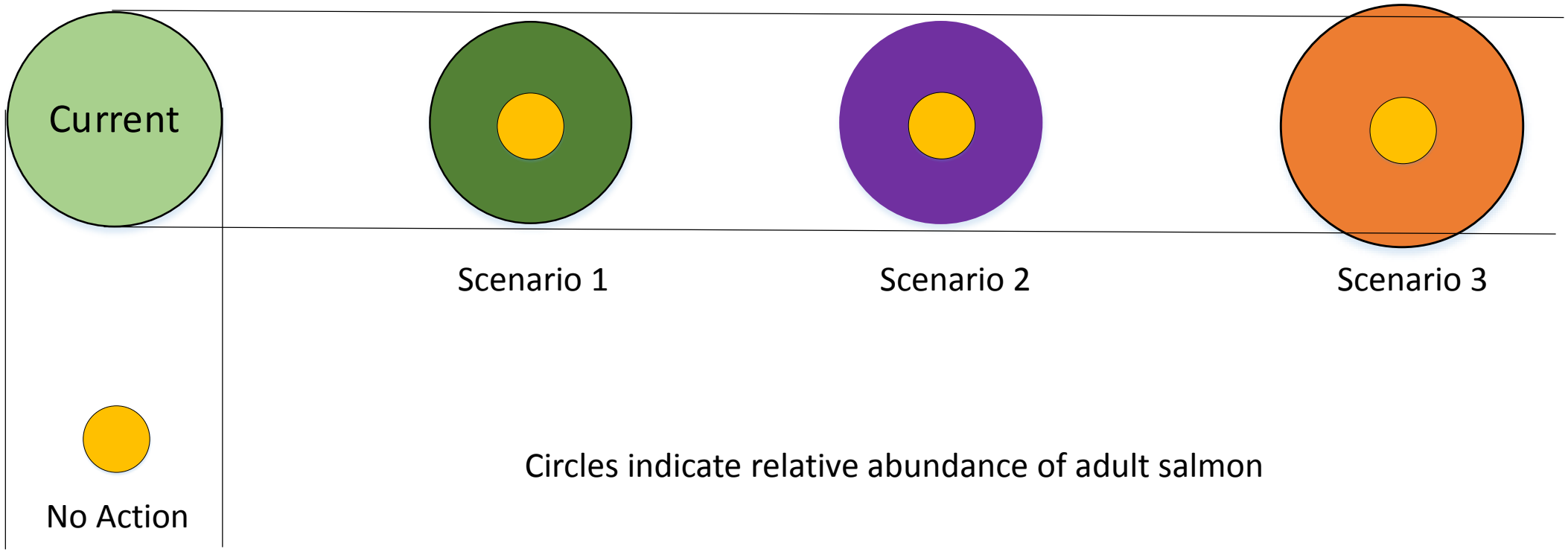


ASRP Scenario Effects on Spring Chinook Salmon by Ecological Region–Late Century

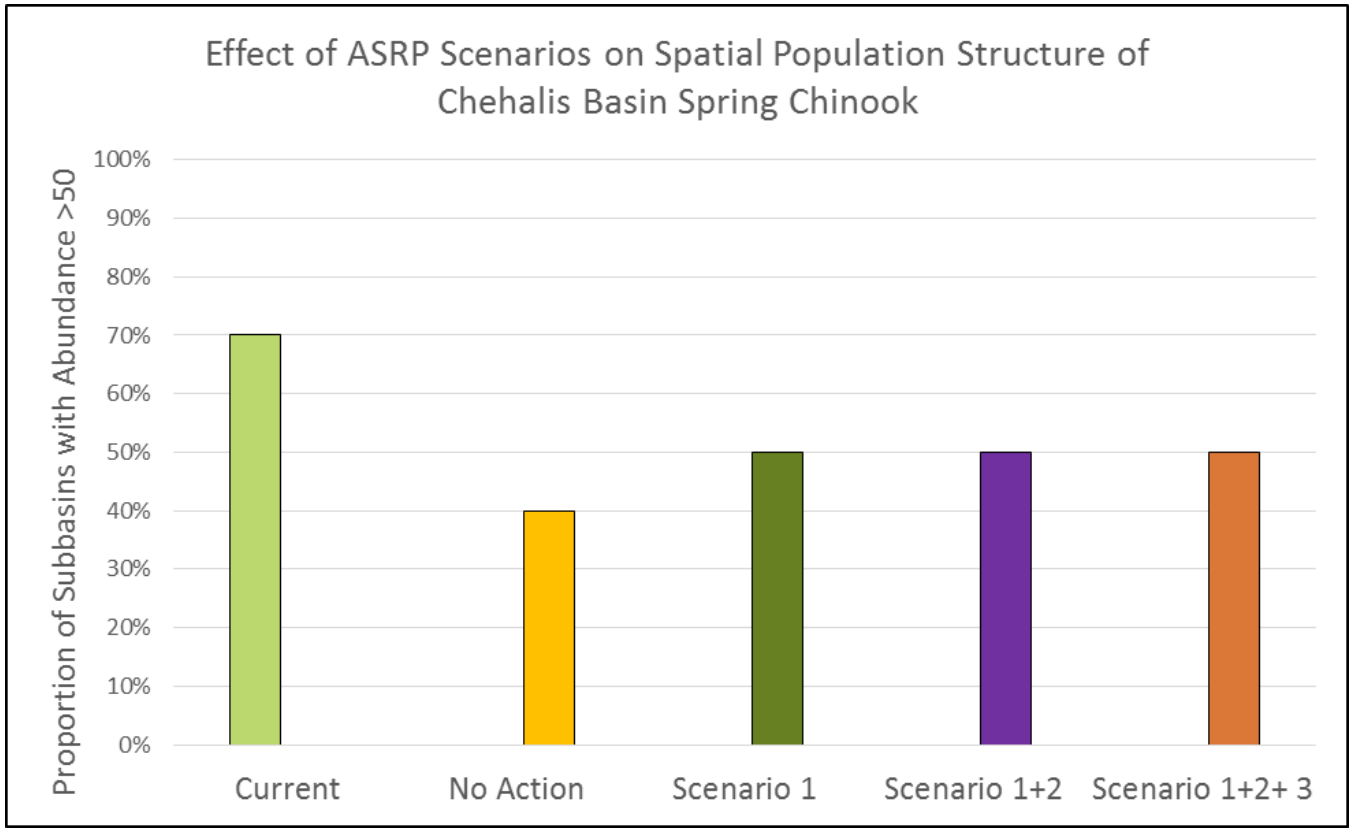




ASRP Scenario Effects on Spring Chinook Salmon–Late Century



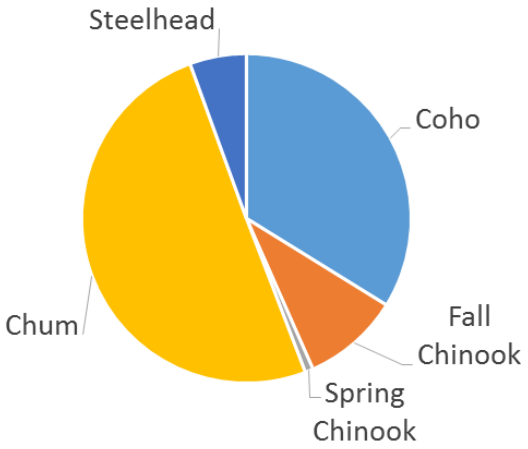
ASRP Scenario Effects on Spring Chinook Salmon Spatial Population Structure by Late Century



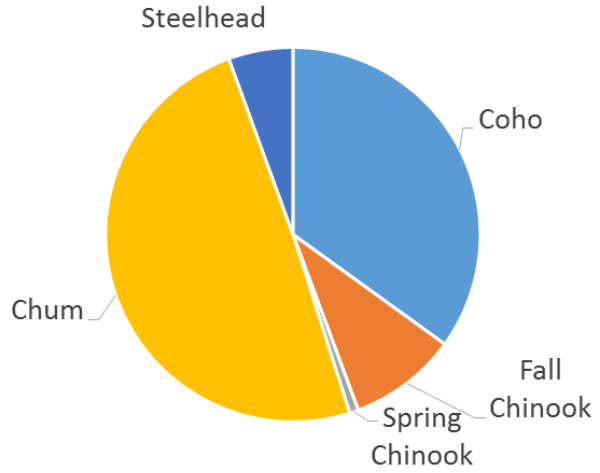
- Proportion of "larger" sub-populations (>50 abundance) declines despite ASRP restoration
- Greater proportion of production in fewer sub-basins
- Spatial Structure of Spring Chinook is reduced largely because of Climate Change

Summary and Conclusions

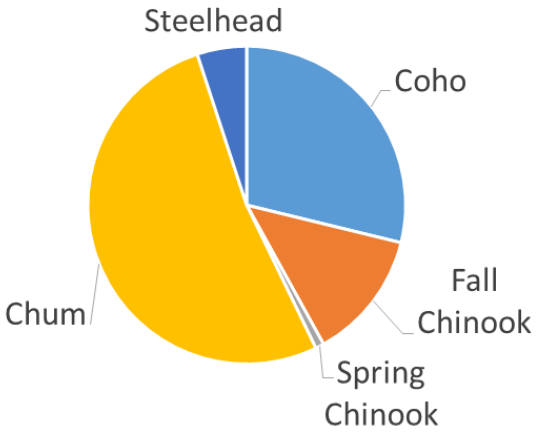
ASRP Results—Late Century



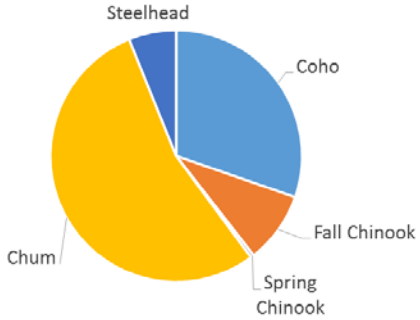
Scenario 1 = 103%



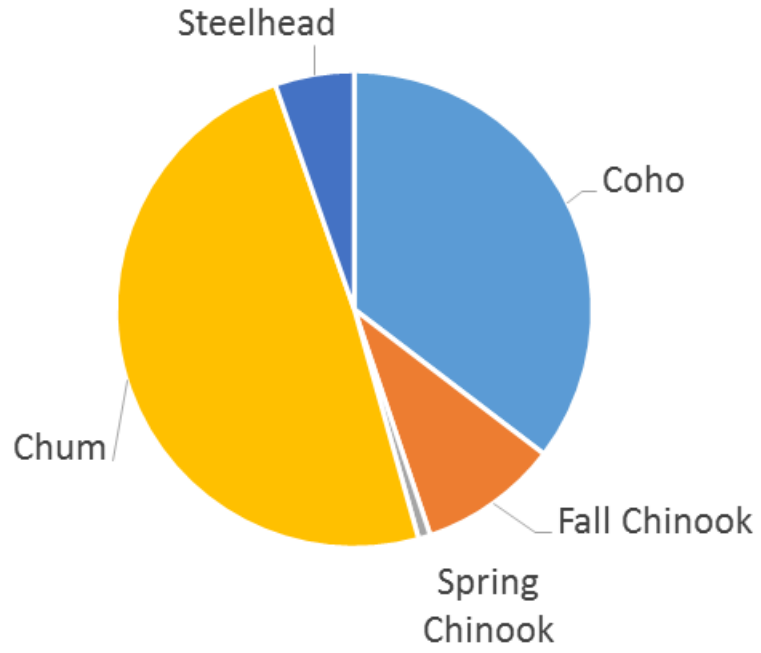
Scenario 2 = 106%



Current = 100%



No Action = 66%



Scenario 3 = 122%

LATE CENTURY	Change in Late Century Relative to
Scenario 1	**Current**
Coho	20%
Fall Chinook	-25%
Spring Chinook	-5%
Chum	-1%
Steelhead	15%

LATE CENTURY	Change in Late Century Relative to
Scenario 1 + 2	**Current**
Coho	30%
Fall Chinook	-25%
Spring Chinook	-5%
Chum	1%
Steelhead	20%

LATE CENTURY	Change in Late Century Relative to
Scenario 1 + 2 + 3	**Current**
Coho	50%
Fall Chinook	-10%
Spring Chinook	15%
Chum	26%
Steelhead	30%

Conclusions

- Baseline factors greatly affect expectations of benefits from restoration alternatives
  - Climate change in particular expected to reduce benefits
- ASRP scenarios substantially moderate baseline effects
  - Scenario 3 produced positive changes for all species except fall Chinook Salmon by Late Century relative to Current
  - Scenarios 1 and 2 result in loss of abundance for spring Chinook, fall Chinook, and Chum Salmon relative to Current
- All scenarios offer substantial benefits over No Action
  - Doing nothing greatly reduces abundance and structure
- Significant action (e.g., Scenario 3) needed for positive change in species status by Late Century relative to today's condition
- Scenarios generally directed at salmon but should benefit other native fish and amphibians as well