



NORTH AMERICAN

Salmon Stronghold
PARTNERSHIP

**Pacific Northwest Salmon and Steelhead Stronghold Population
Identification and Network Options**

October 24, 2008

R. W. Charmichael

Topics

- Background – Network Principles and Report
- Geographic area of coverage
- Species, races and population delineation
- Metrics and criteria, uncertainty ratings
- Data acquisition, workshops, follow up data quality improvement
- One approach for identification of stronghold populations and network options
- Example network options - Pacific Northwest single and multi species/race at different geographic scales
- Refinement and improvement considerations

Network Principles

- **Population Strongholds:** The salmon and steelhead network will include populations characterized as strongholds thus providing the network with the greatest chance of achieving the Stronghold Partnership goals.
- **Single and Multi-Species Value:** Not all strongholds are of equal importance to all species of salmon and steelhead. Those which rate highly for a single species may be critical to the long term persistence of that species. Others may serve as strategic core production or re-colonization sources for multiple species.
- **Protected Status Value:** Some stronghold watersheds have more habitat in protected status than do others. The inclusion of strongholds with high levels of existing habitat protection is desirable.
- **Distance:** The distance between strongholds within single species networks should not be greater than the dispersal potential of the species.

Network Principles

- **Variation in Species Needs:** The shape and size of strongholds as well as intensity of protection and restoration may vary according to species needs. For some species it may be strategic to provide fewer but larger strongholds.
- **Connectivity:** Connectivity within and between strongholds across the entire life cycle is essential. This connectivity supports within and between population diversity as well as natural rates of genetic exchange.
- **Resilience:** Long term resilience of strongholds is important to consider when identifying a network. Some strongholds may have greater vulnerability to threats such as population growth, land use changes, and climate change. Stronghold populations that have lower levels of present and future threats and the greatest capacity for adaptation to future threats have the greatest potential for persistence.

Geographic Coverage

- Geographic Areas:
 - California
 - Oregon
 - Washington
 - Idaho
- Ecoregions (not used in the analyses):
 - Baja California
 - California Coast
 - Columbia River
 - Oregon and Washington Coasts
 - Puget Sound

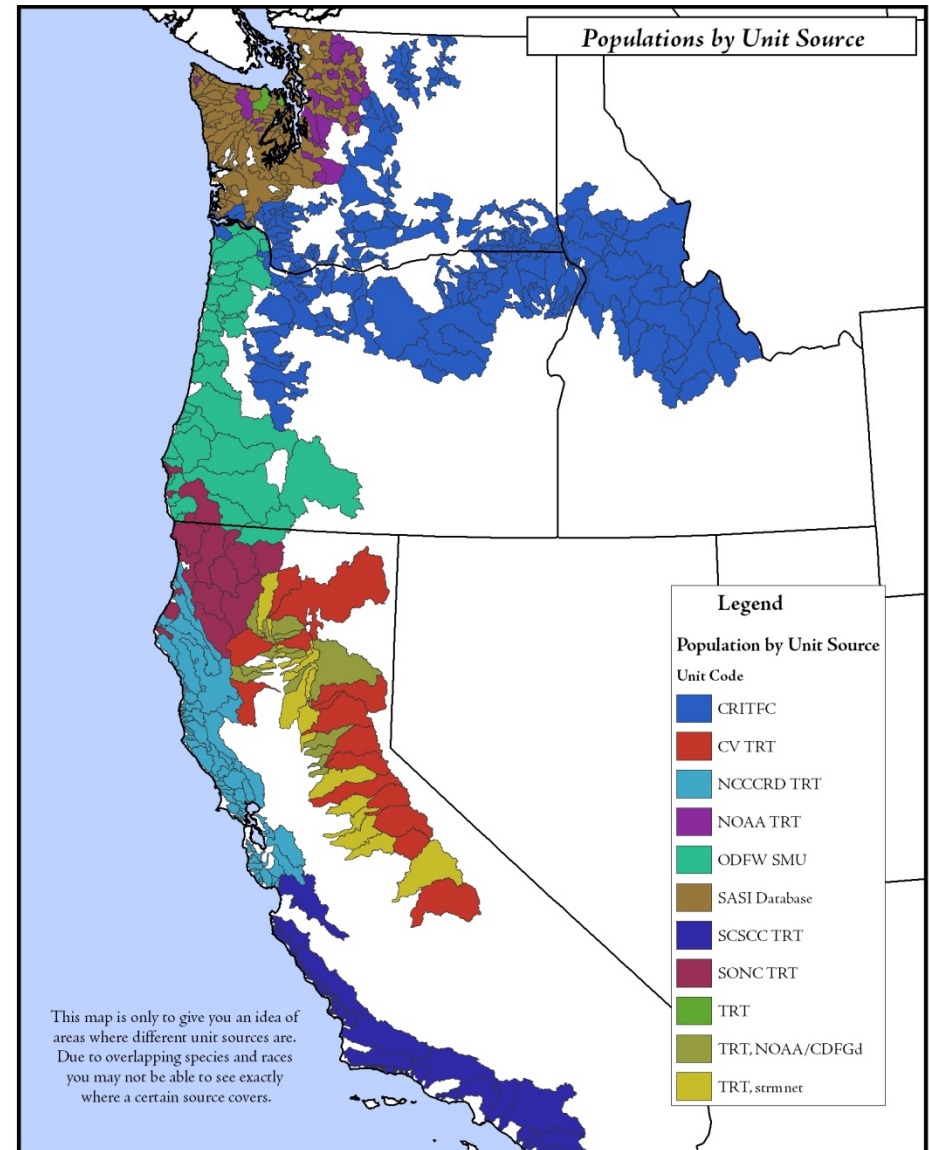
Species/Life Histories Types

- Steelhead
 - Winter
 - Summer
- Chinook Salmon
 - Spring/Summer
 - Fall (early and late)
 - Winter
- Coho Salmon
- Pink Salmon
- Chum Salmon
- Sockeye Salmon

Populations Delineations

- California
 - Technical Recovery Teams
- Coastal Oregon
 - ODFW Native Fish Conservation Policy populations
- Columbia River Basin
 - ICTRT
 - CRITFC FishPops database (from subbasin plans)
- Washington (excluding listed pops in the Columbia basin)
 - WDFW Salmon and Steelhead Stock Inventory (SaSSI)
- Idaho
 - ICTRT
 - CRITFC FishPops

Populations Delineations Sources



This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Metrics and Criteria

- **Percent Natural Origin Spawners (Genetic Stronghold):** Percent of adult fish on the spawning grounds in recent generations that are natural origin fish
- **Viability (Persistence Stronghold):** Recent generations productivity as natural origin recruits-per-spawner and natural origin spawner abundance (from VSP)
- **Life History Diversity (Diversity Stronghold):** Diversity of life history strategies relative to historic diversity and to diversity expressed within the species/race. Considers unique expressions across all life stages as well as environmental diversity experienced throughout the life cycle (elevation, habitat types, ecoregions)

Future potential also assessed based on change expected from ongoing and future management actions

Criteria

- Percent Natural Origin Spawners (Genetic Stronghold):
 - 5 = 100% (formerly 6)
 - 4 = 75 - 99% (formerly 5)
 - 3 = 50 - 74% (formerly 4)
 - 2 = 25 - 49% (formerly 3)
 - 1 = 0 - 25% (formerly 2)
 - 0 = No Data (formerly 1 and 0)

- Viability (Persistence and Source Stronghold):
 - 5 = High productivity and high abundance
 - 4 = High productivity and moderate abundance(or visa versa)
 - 3 = Moderate productivity and moderate abundance
 - 2 = Low productivity or low abundance
 - 1 = Critically low productivity or abundance
 - 0 = no data

Criteria

- Life History Diversity (Diversity and Resilience Stronghold):
 - 5 = Multiple life history types and/or rare unique types
 - 4 = Majority of historic and species life history types
 - 3 = Few life history types
 - 2 = Single life history reduced diversity from historic
 - 1 = No data
- Expert Certainty:
 - 5 = Excellent - Highly certain
 - 4 = Good - Fairly certain
 - 3 = Moderate - moderately certain
 - 2 = Poor – Little knowledge or information
 - 1 = Unknown – No data or knowledge exists
 - 0 = Expert has no knowledge

Data Gathering

- **Workshops:**
 - Columbia Basin – Portland
 - Western Washington and Oregon – Portland
 - California and S W Oregon - Medford
- **Individual meetings and consultations:**
 - Numerous individual consultations to fill California and Washington data gaps
 - Numerous individual consultations to error check and standardize data
- Over 40 experts contributed to the data base

Approach

- Calculated individual population stronghold index as the sum of the three metric ratings with the viability weighted at two-times the others. Metric ratings from multiple experts were averaged.
- Selected the highest rated populations within each species/life history across the entire distribution.
- Multi-species/life history network constructed by combining individual species/life history networks.
- The total multi-species/life history network was screened to represent two-plus, three-plus and four-plus population locations.
- Created one network that combined the two-plus with the addition of the top single-species not otherwise included.

Stronghold Identification and Network Refinements

First approach used the 6 point max for percent natural
Weighted each metric equally
Added populations to cover the range and for connectivity

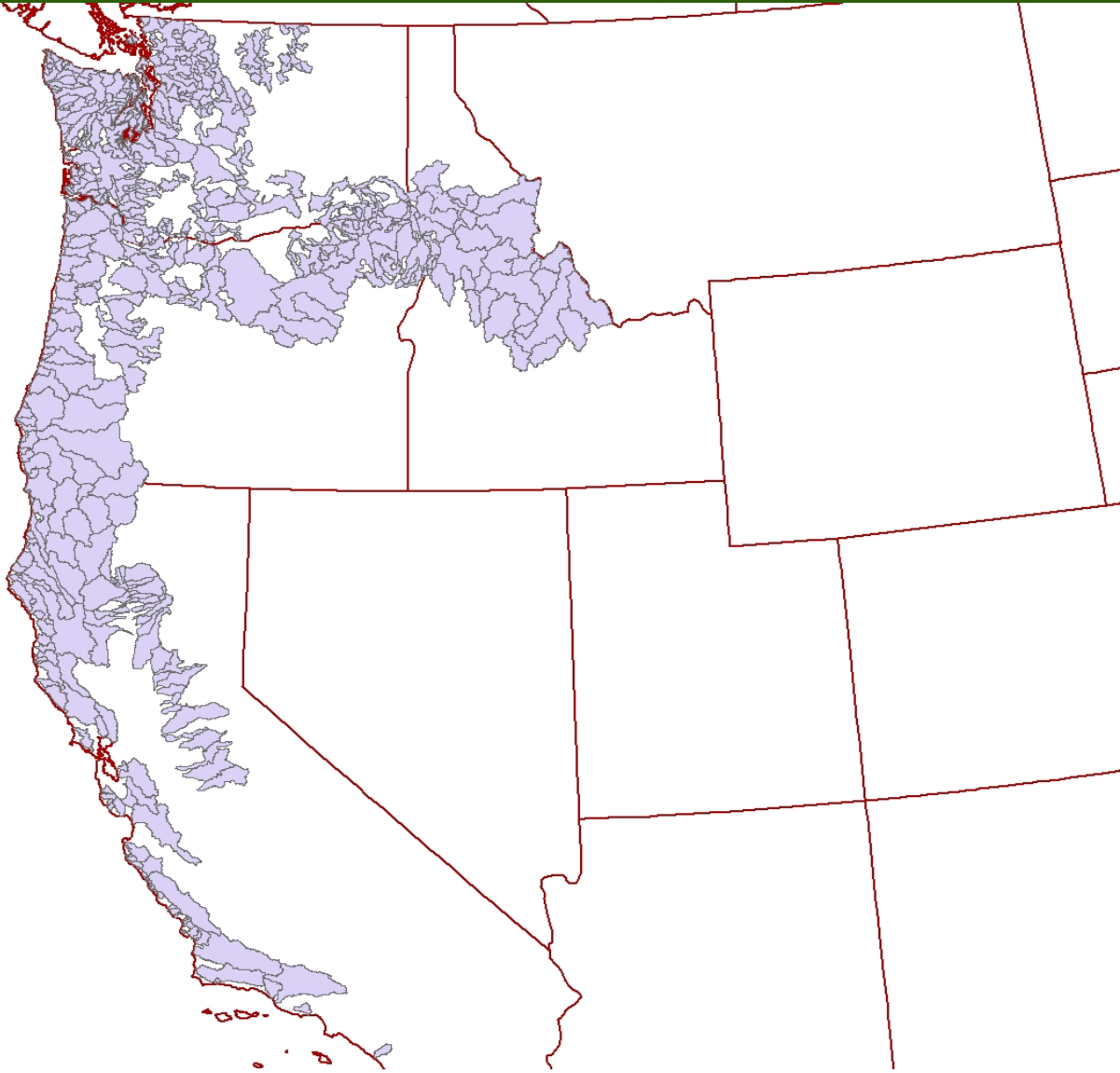
Modifications

- Scale the percent natural metric equal to the others (5 points max)
- Weight the viability metric as two times the others
- Do not add range and connectivity populations that are below the selection score

Number of Populations in the Database

- **Steelhead**
 - Winter **234**
 - Summer **94**
- **Chinook Salmon**
 - Spring/Summer **114**
 - Fall **156**
 - Winter **2**
- **Coho Salmon** **154**
- **Pink Salmon** **14**
- **Chum Salmon** **72**
- **Sockeye Salmon** **7**

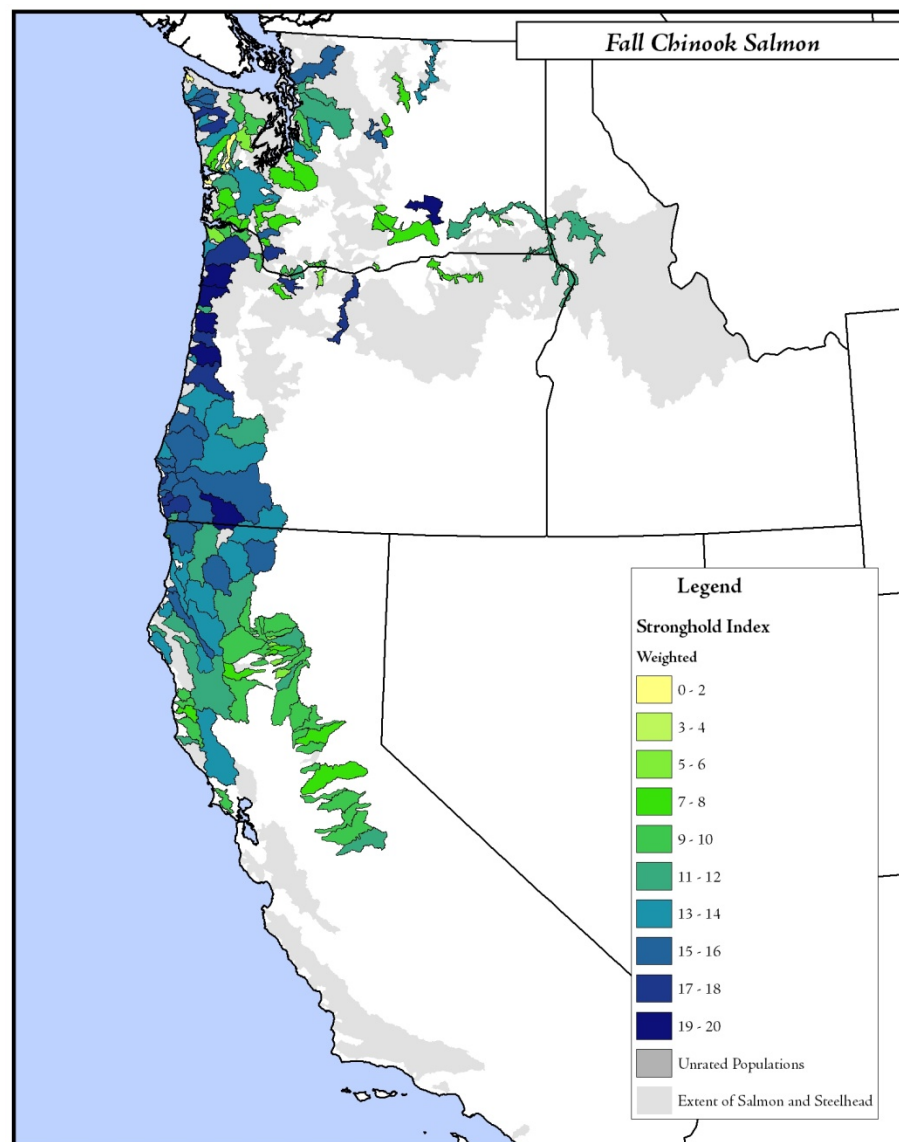
Distributions of Populations with Sufficient Data



A scenic landscape photograph of a river flowing through a forest. The river is the central focus, with a person fishing in the middle ground. The banks are lined with trees showing vibrant autumn colors in shades of yellow, orange, and red. In the background, a road and more trees are visible under a clear sky. A dark green rectangular box is overlaid on the upper part of the image, containing the text 'Stronghold Index Results' in white serif font.

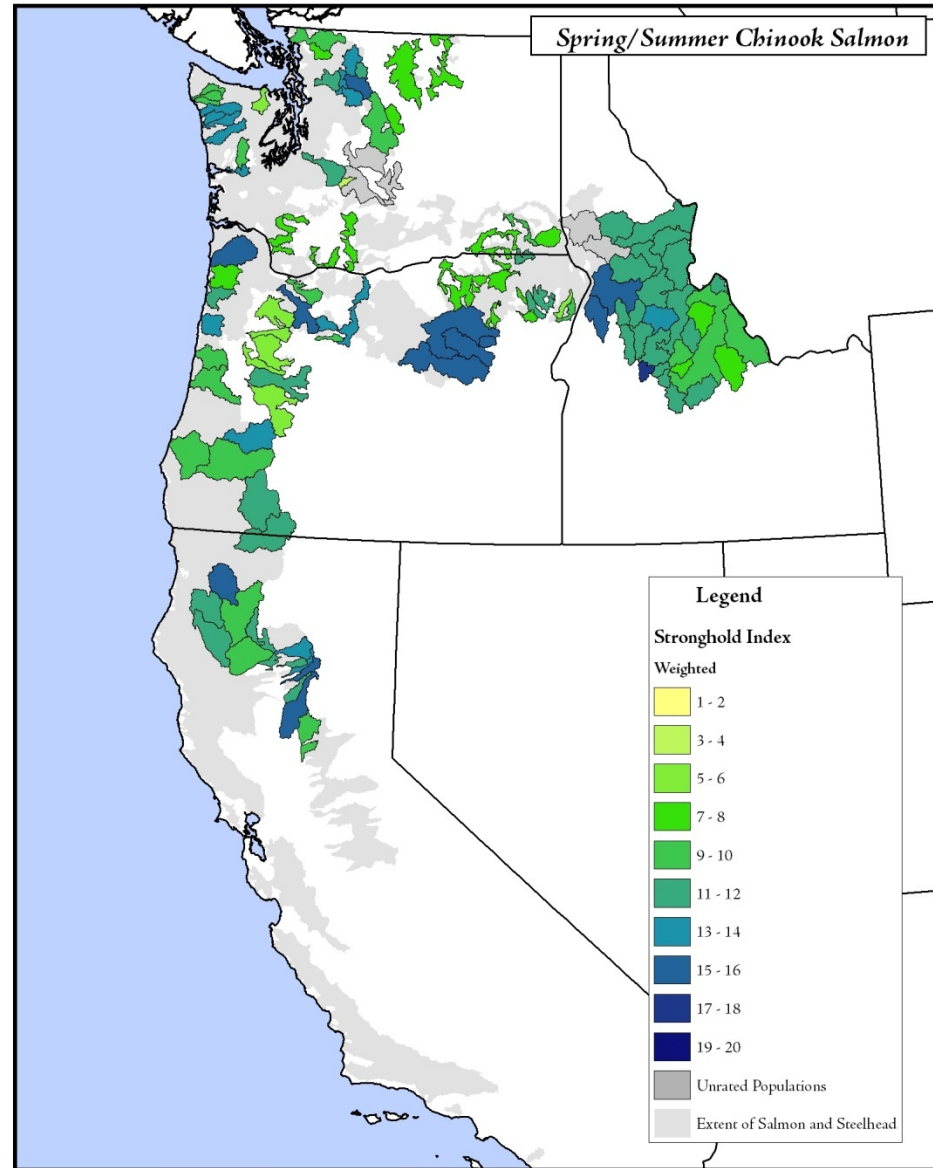
Stronghold Index Results

Stronghold Index Fall Chinook



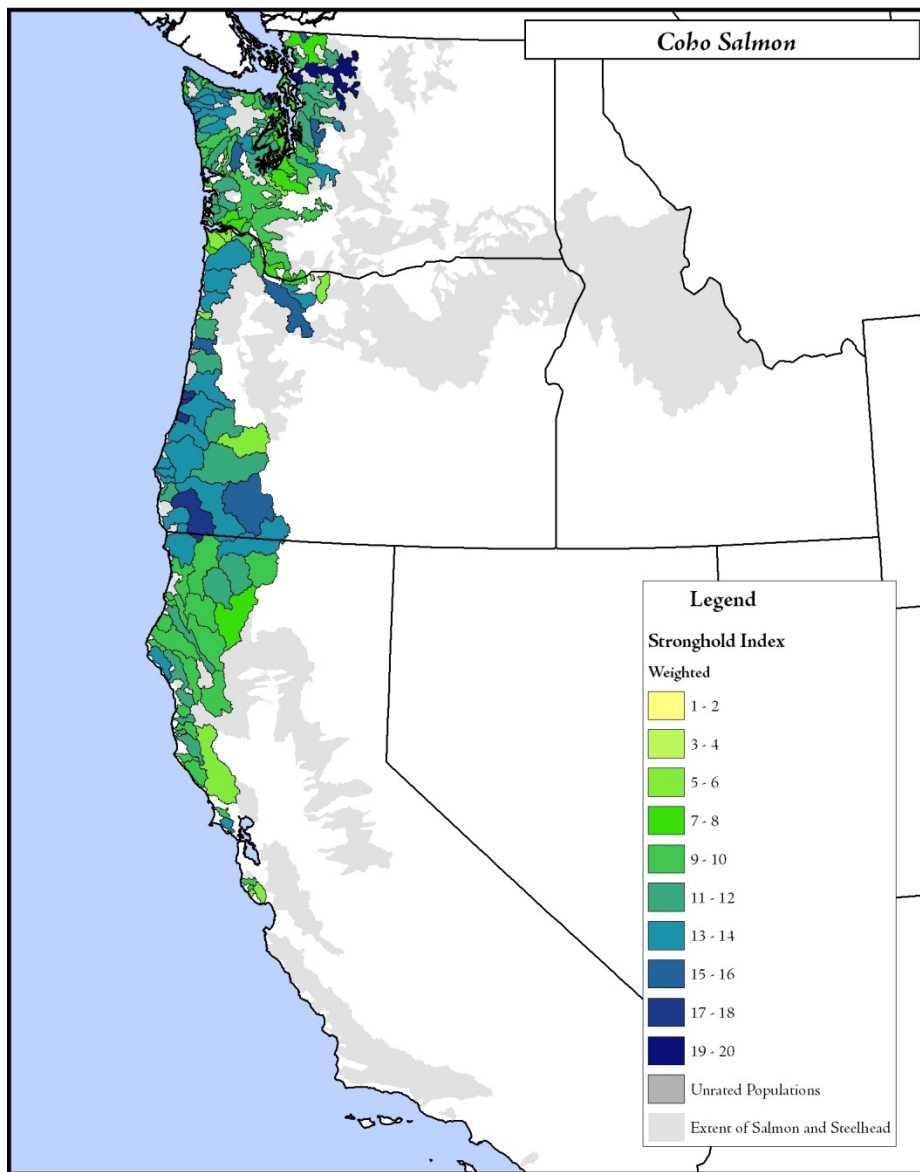
This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Stronghold Index Spring/Summer Chinook



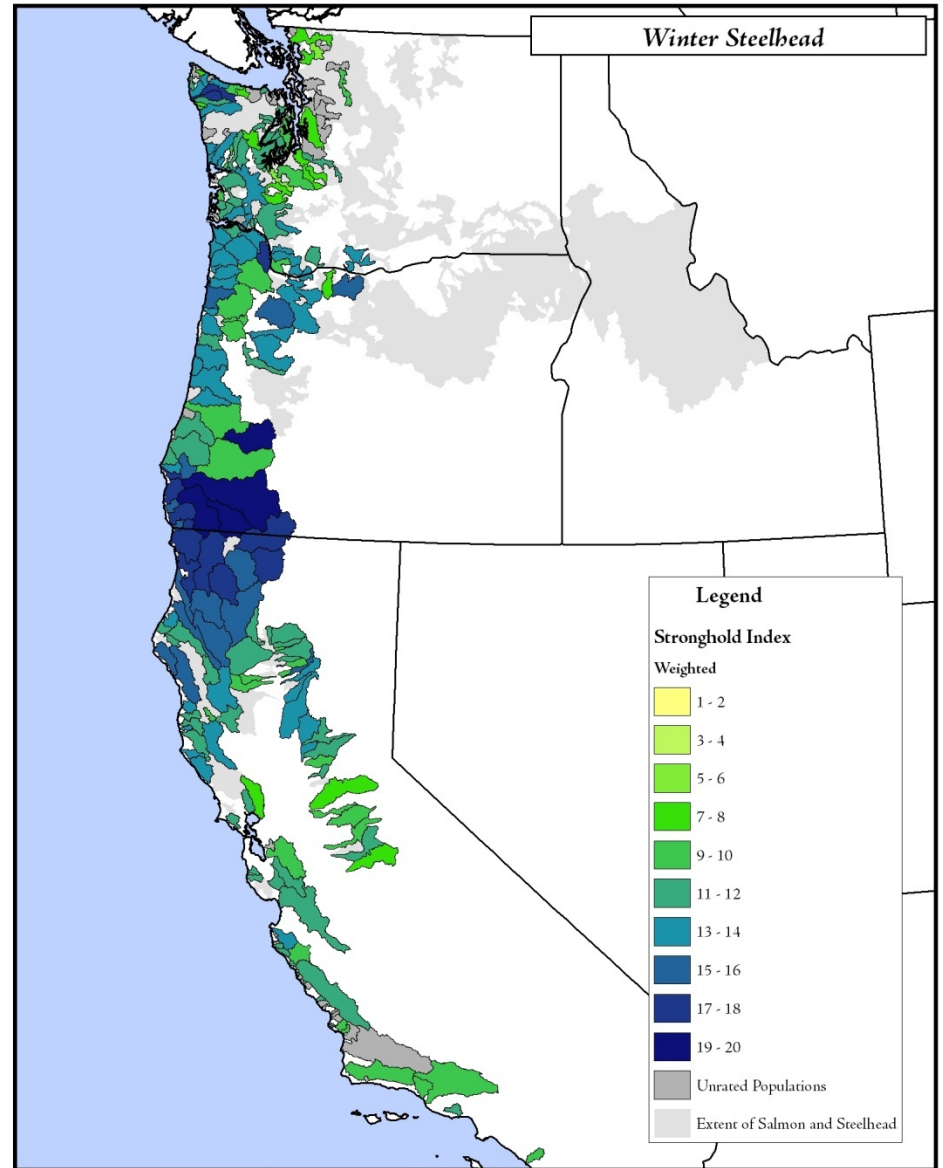
This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Stronghold Index Coho



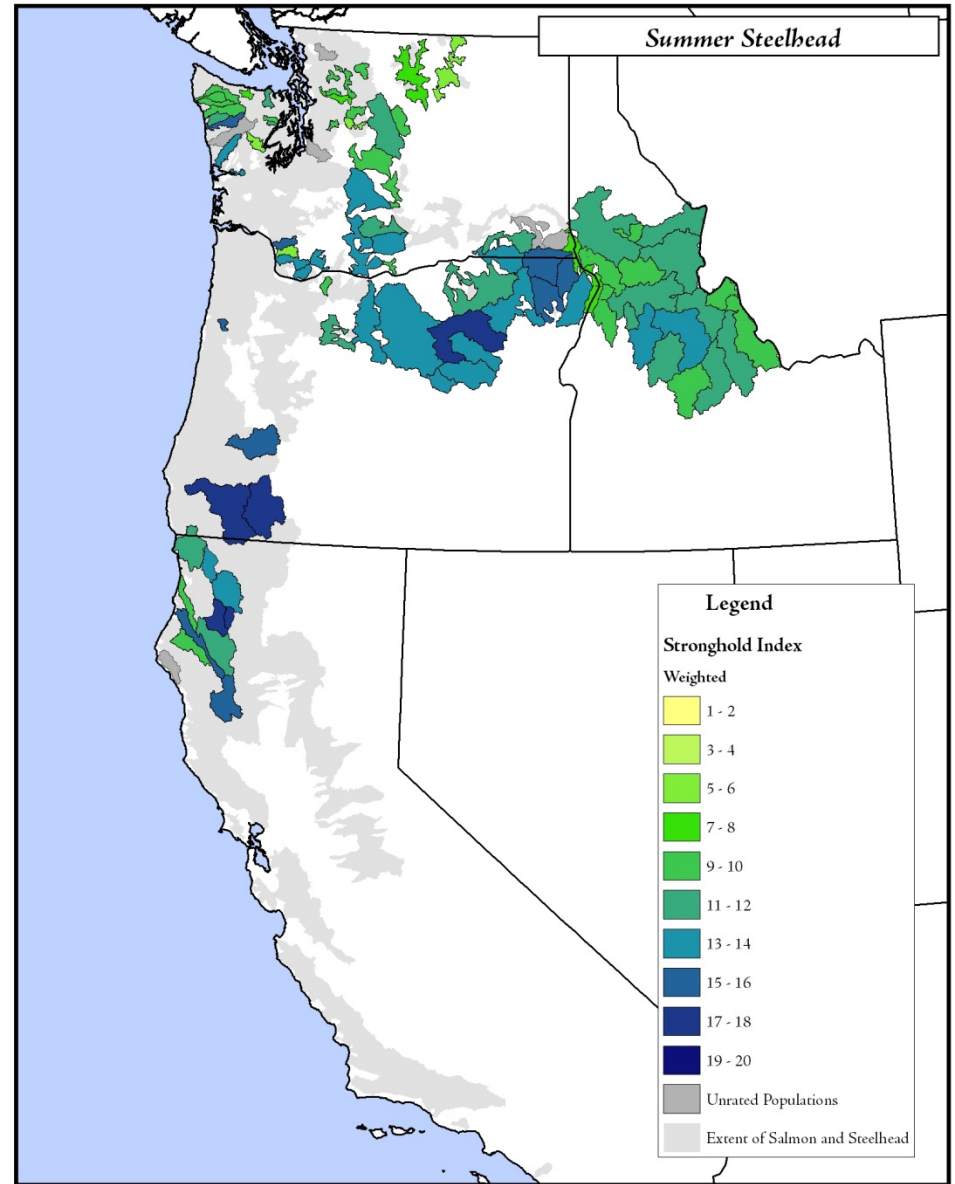
This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Stronghold Index Winter Steelhead



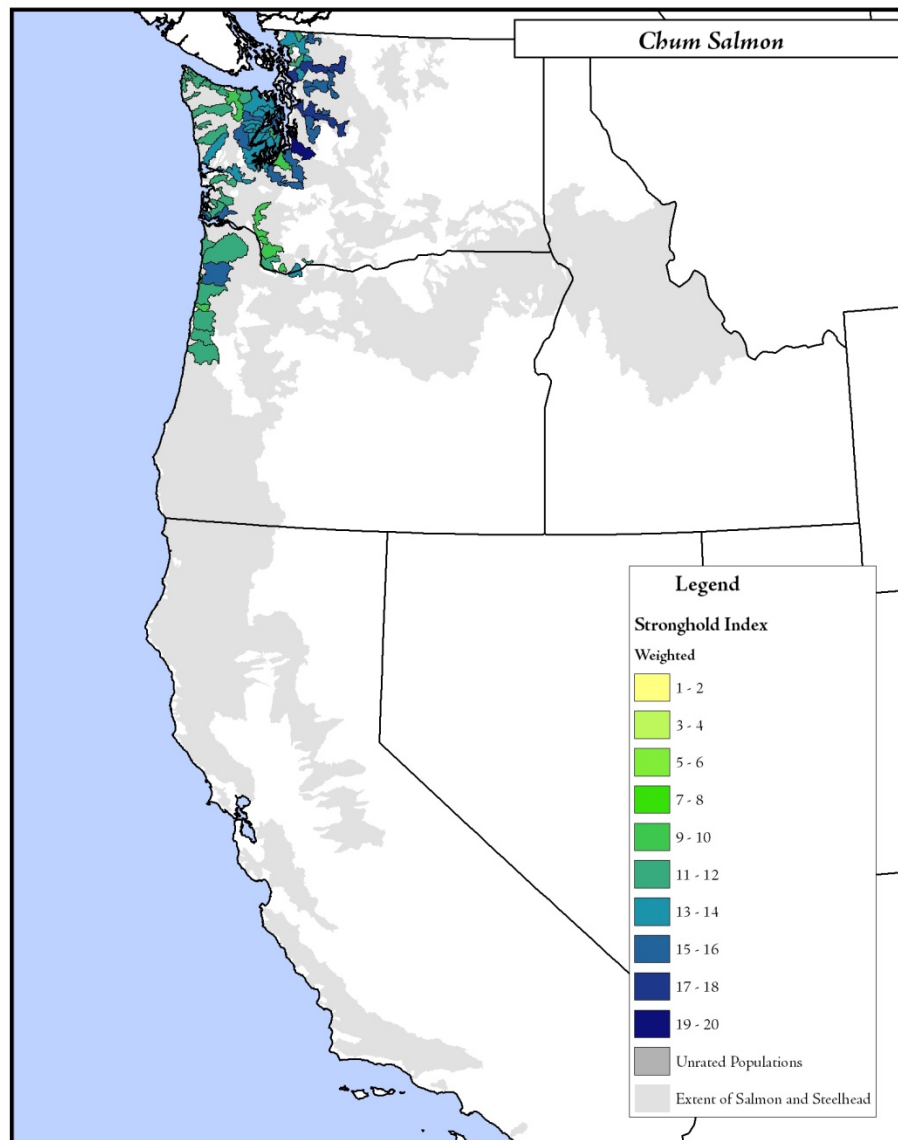
This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Stronghold Index Summer Steelhead



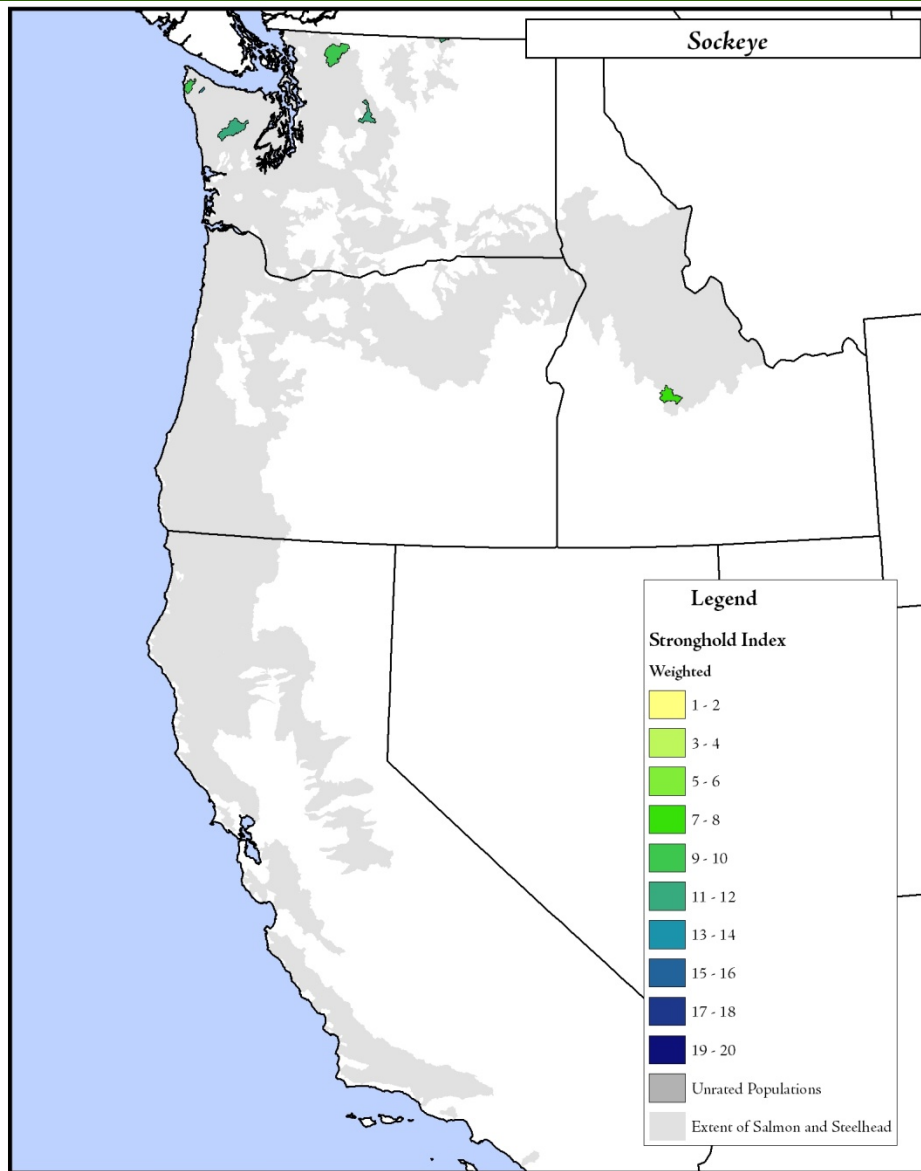
This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Stronghold Index Chum



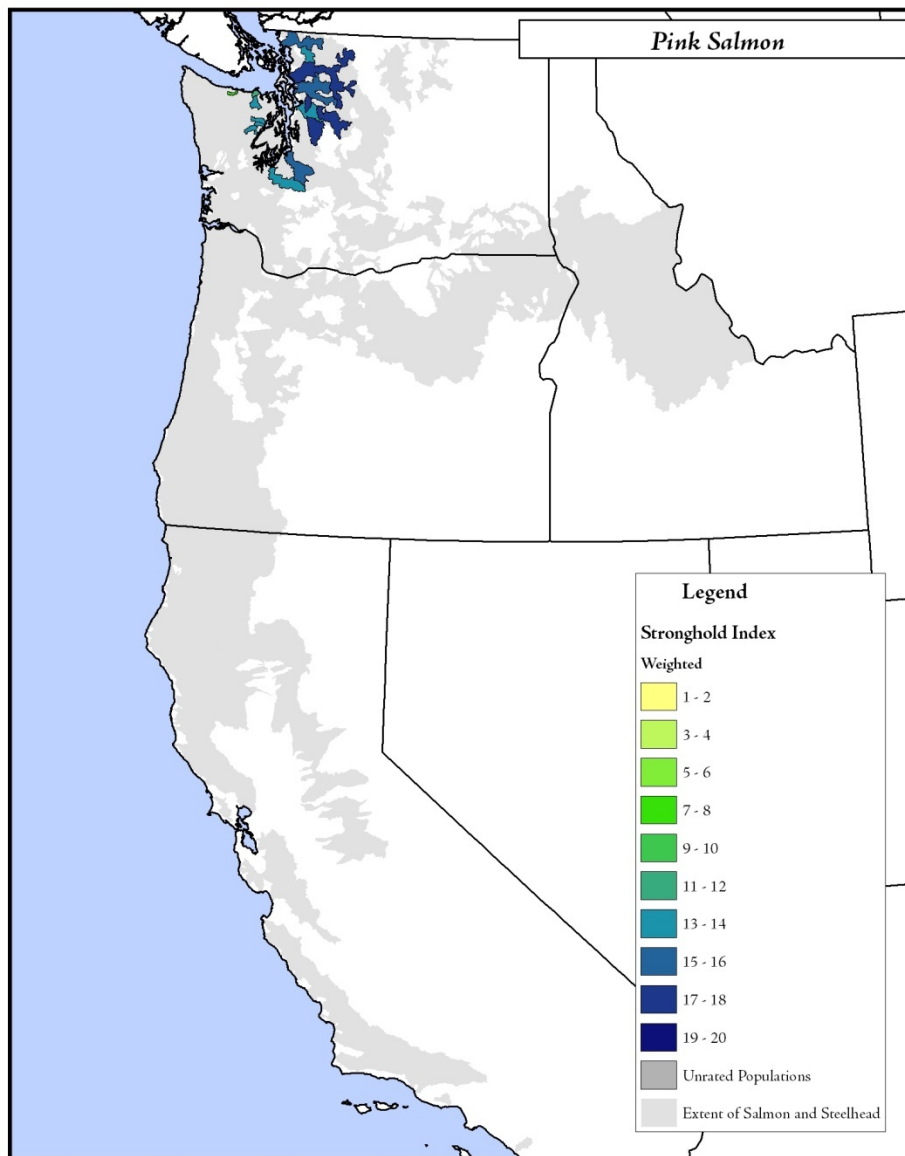
This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Stronghold Index Sockeye



This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

Stronghold Index Pink



This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 08.10.2008

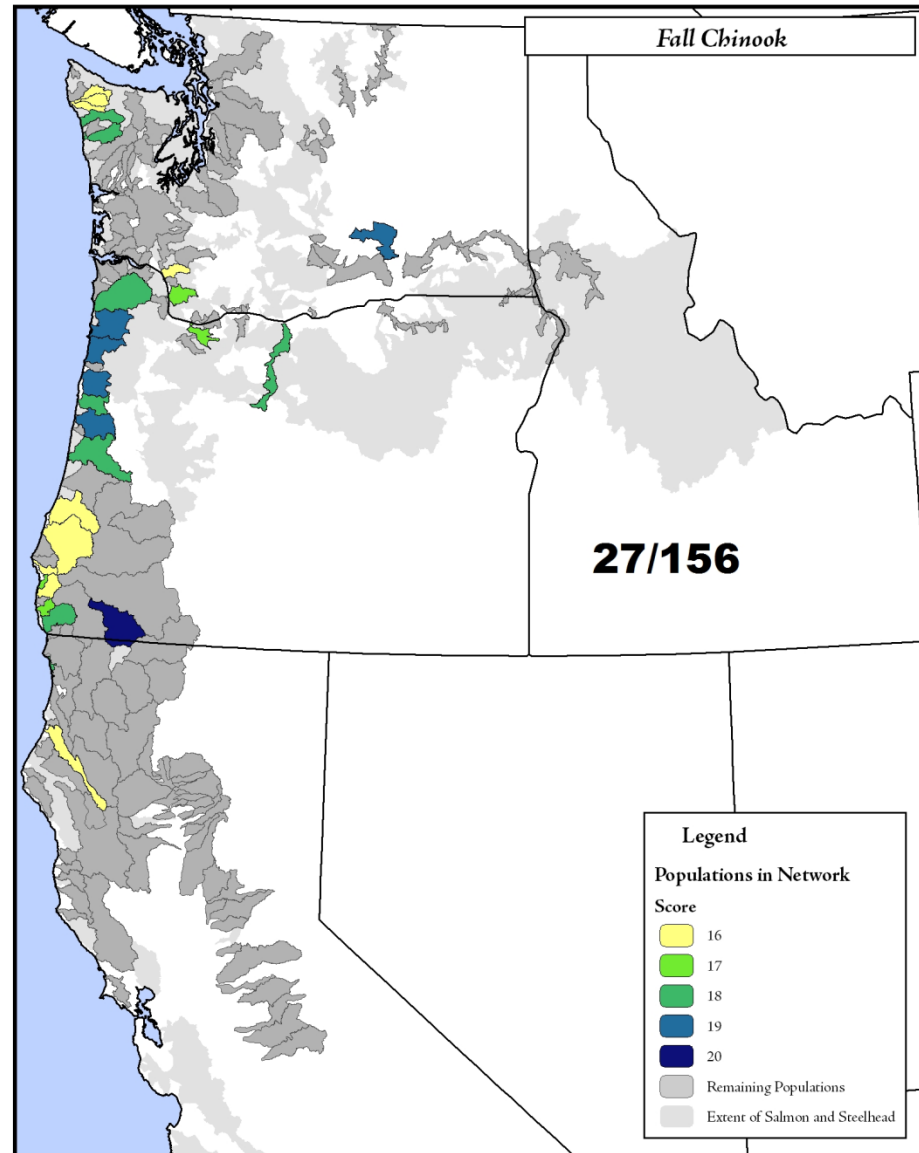
A scenic landscape photograph of a river flowing through a forest. The river is the central focus, with a person wading in the middle ground. The banks are lined with trees showing vibrant autumn colors in shades of yellow, orange, and red. In the background, a dense forest of evergreen trees is visible under a slightly hazy sky. A dark green rectangular box is overlaid on the upper part of the image, containing white text.

Single Species Network Options

Single Species/ Race Networks

Fall Chinook

27 of 156 total
populations 17.3%

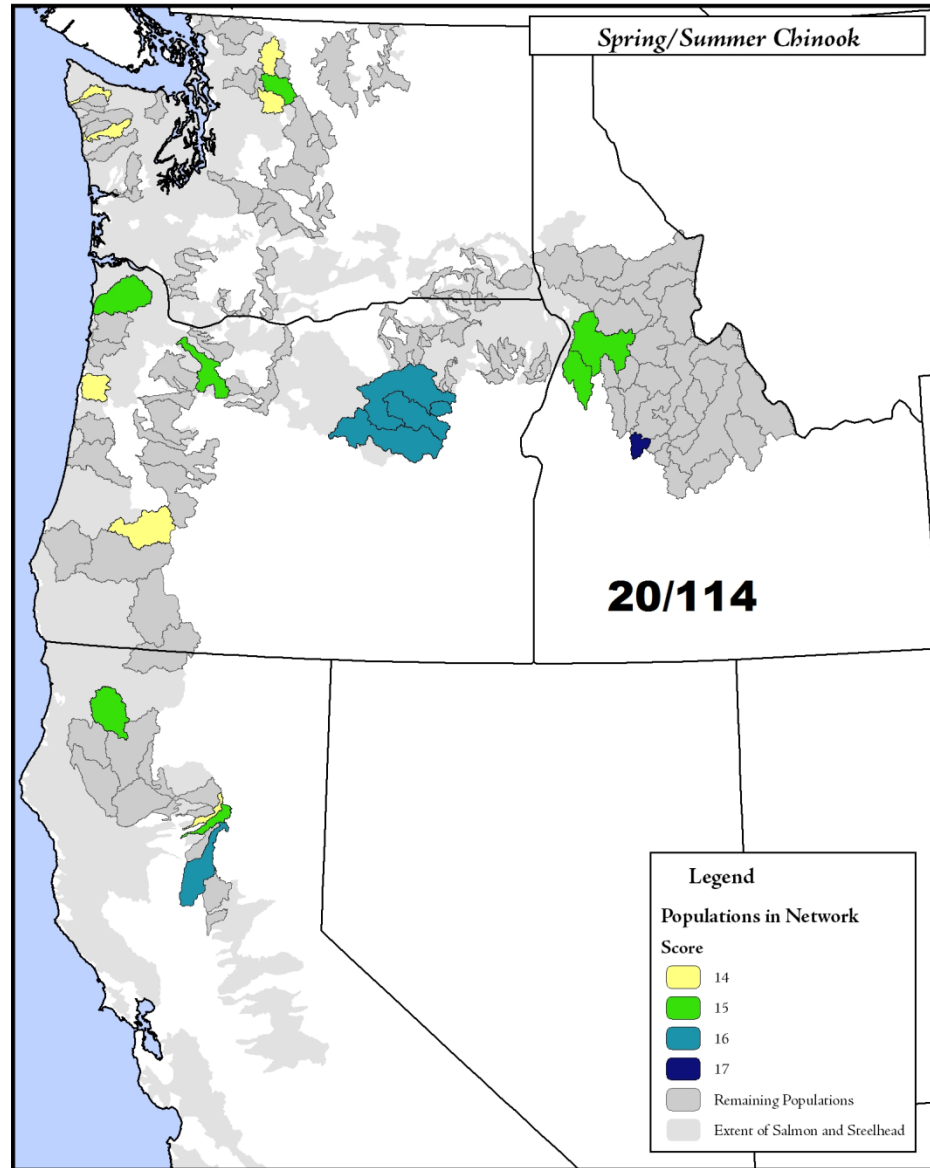


This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale though an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

Single Species/ Race Networks

Spring/Summer Chinook

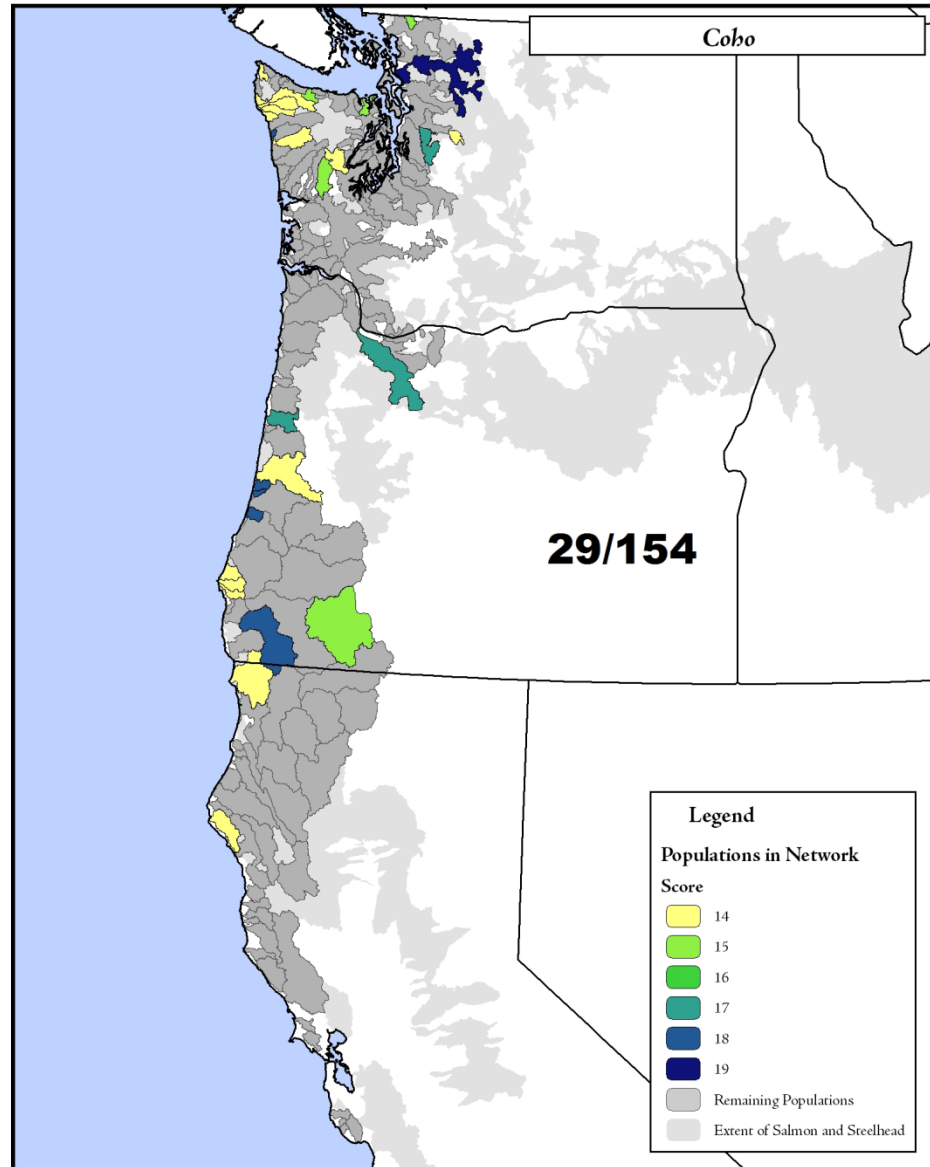
20 of 114 total
populations 17.5%



This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

Single Species/ Race Networks Coho

29 of 154 total
populations 18.8%

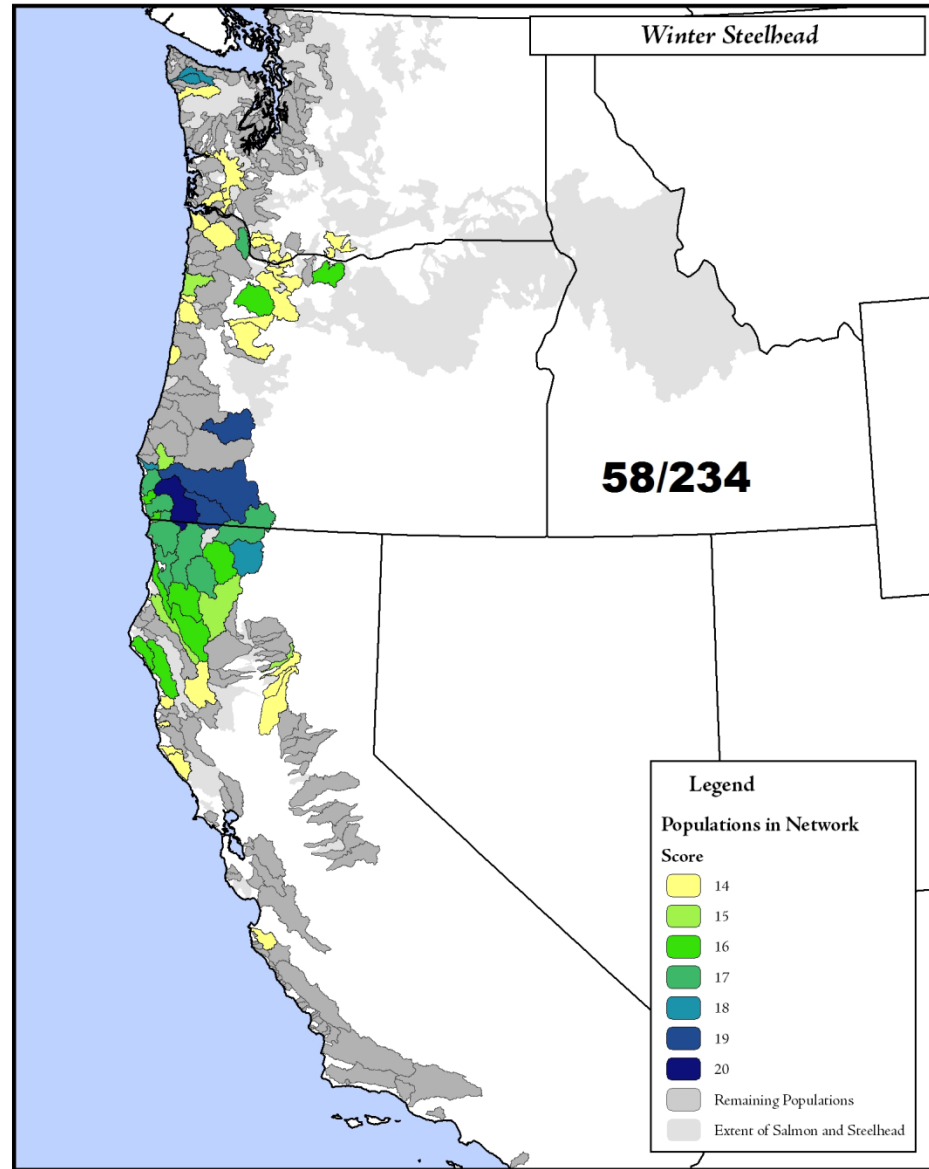


This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

Single Species/ Race Networks

Winter Steelhead

58 of 234 total
populations 24.8%

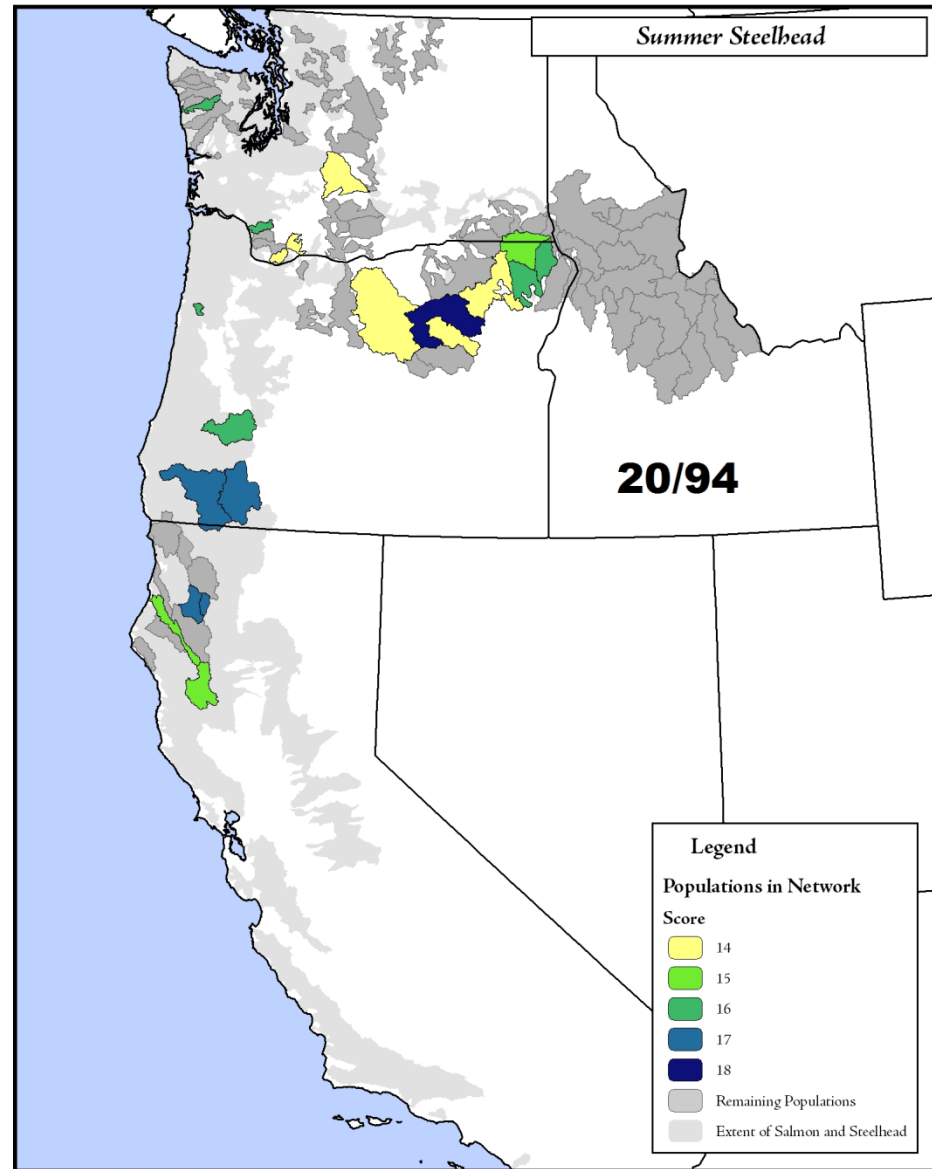


This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

Single Species/ Race Networks

Summer Steelhead

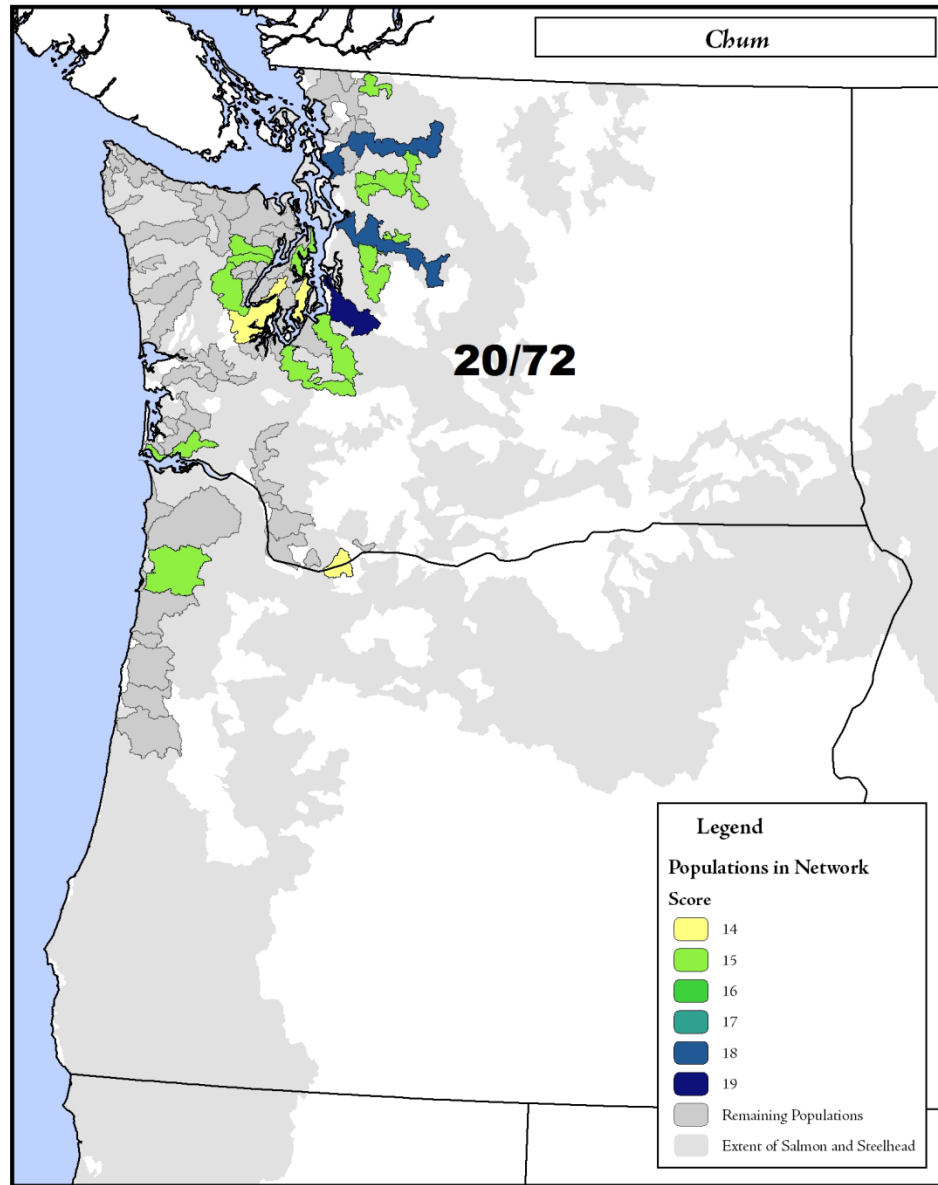
20 of 94 total
populations 21.3%



This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

Single Species/ Race Networks Chum

20 of 72 total
populations 27.8%

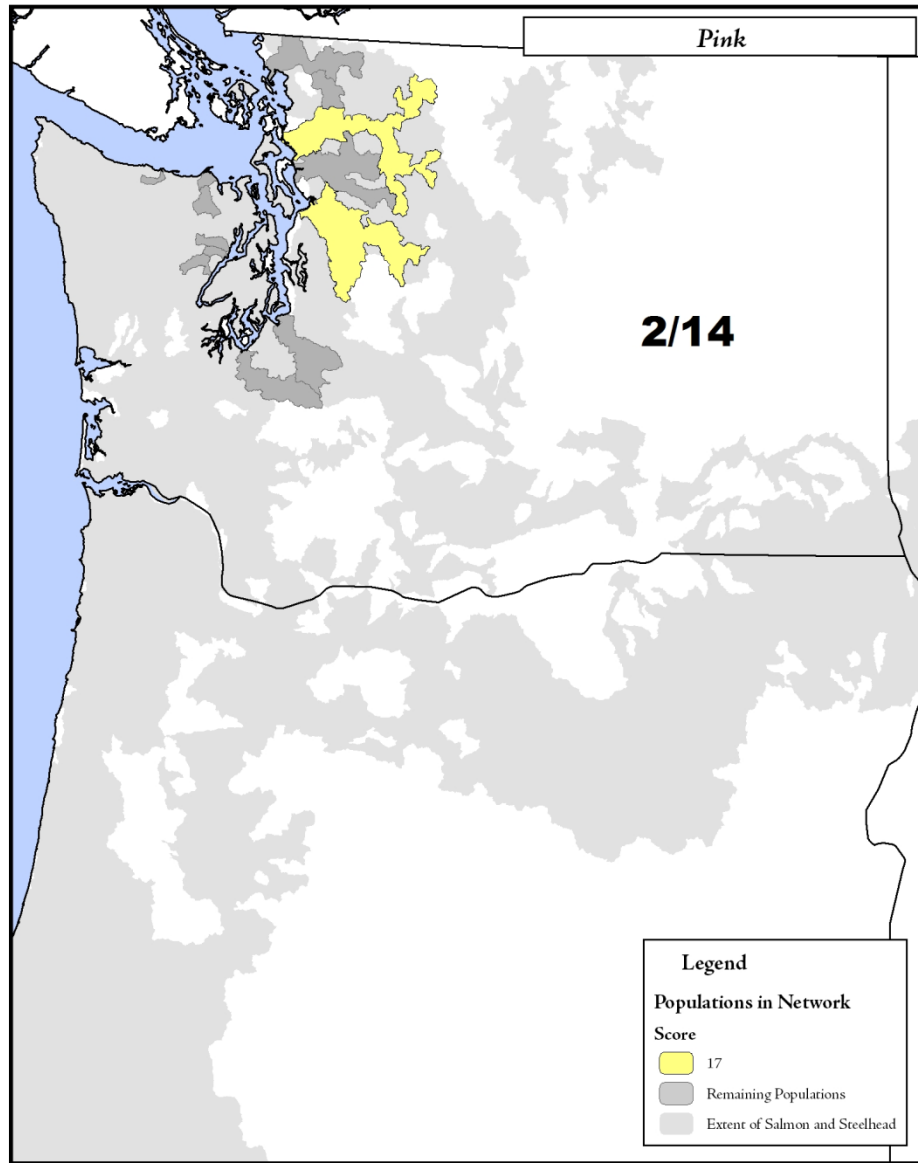


This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

Single Species/ Race Networks

Pink

2 of 14 total
populations 14.3%



This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

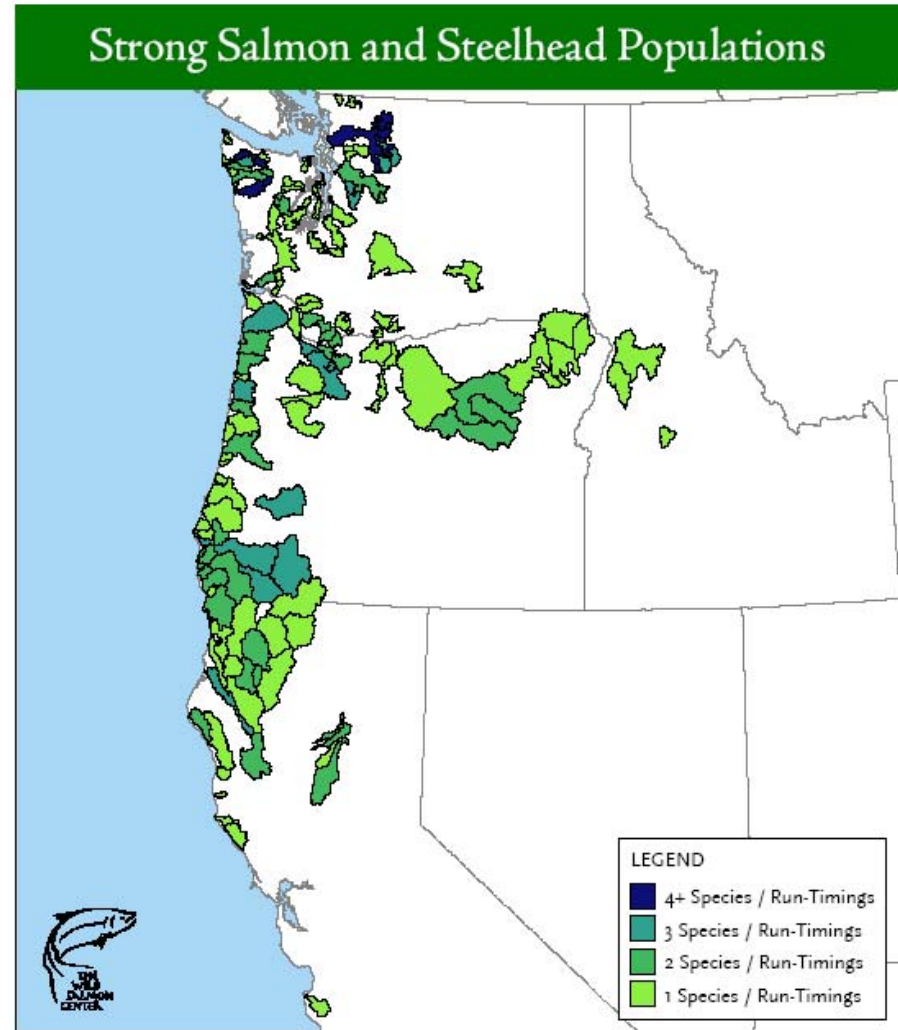
Single Species/Race Network Summary

Species/Life History	Total populations	Number of populations selected	% of total selected
Fall Chinook	156	27 (16-20)	17.3%
Spring/ Summer Chinook	114	20 (14-17)	17.5%
Coho	154	29 (14-19)	18.8%
Winter Steelhead	234	58 (15-20)	24.8%
Summer Steelhead	94	20 (14-18)	21.3%
Chum	72	20 (14-19)	27.8%
Pink	14	2 (17)	14.3%

A scenic landscape photograph of a river flowing through a forest. The river is the central focus, with a person fishing in the middle ground. The banks are lined with trees showing vibrant autumn colors in shades of yellow, orange, and red. In the background, a dense forest of evergreen trees is visible under a slightly hazy sky. A dark green rectangular box is overlaid on the image, containing the title text in white serif font.

Multi Species Network Options

Single and Multi Species Networks

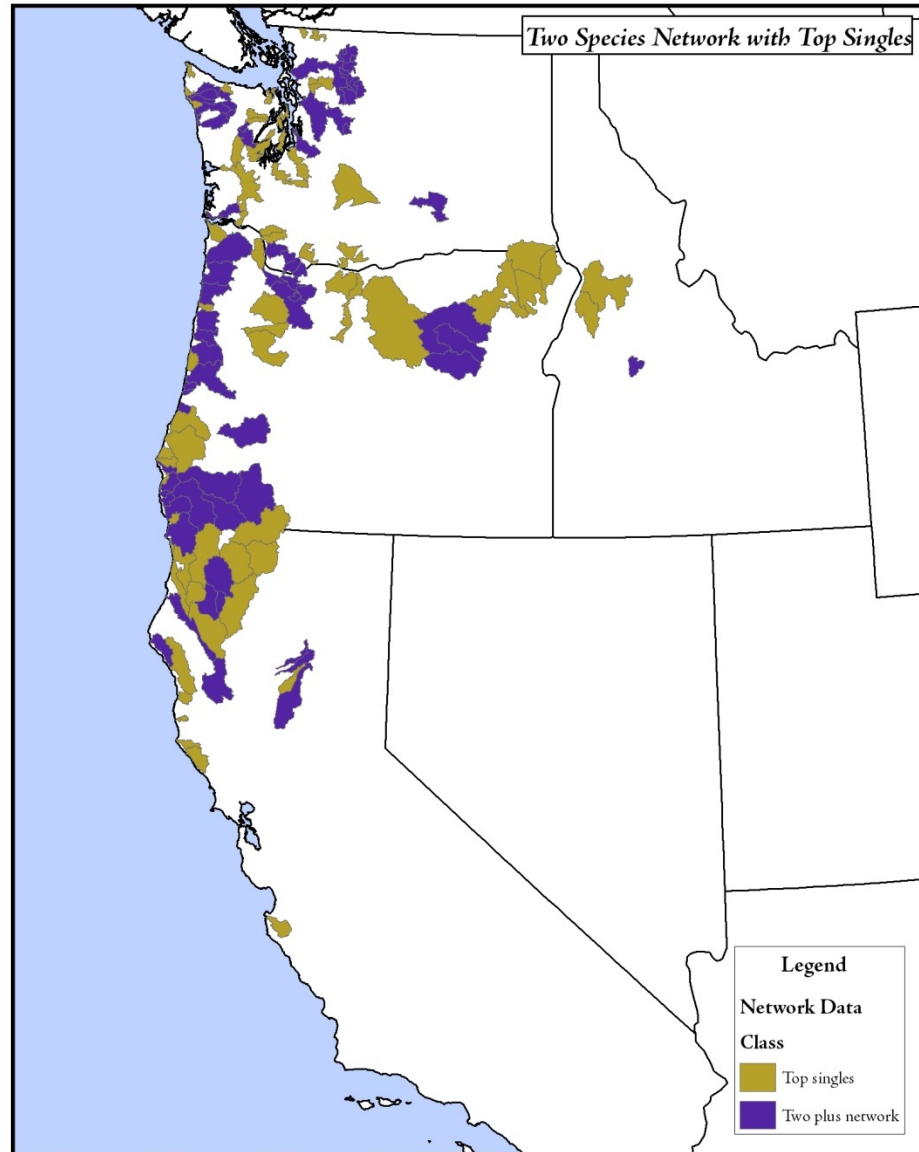


NORTH AMERICAN
Salmon Stronghold
PARTNERSHIP

The shading on this map represents places where salmon and steelhead species remain strong according to three criteria: abundance and productivity, percent natural origin spawners, and life history diversity. Abundance and productivity are weighted twice as high as the other two criteria. This map was developed using population scale data that were gathered through an expert opinion process in 2007 and 2008.

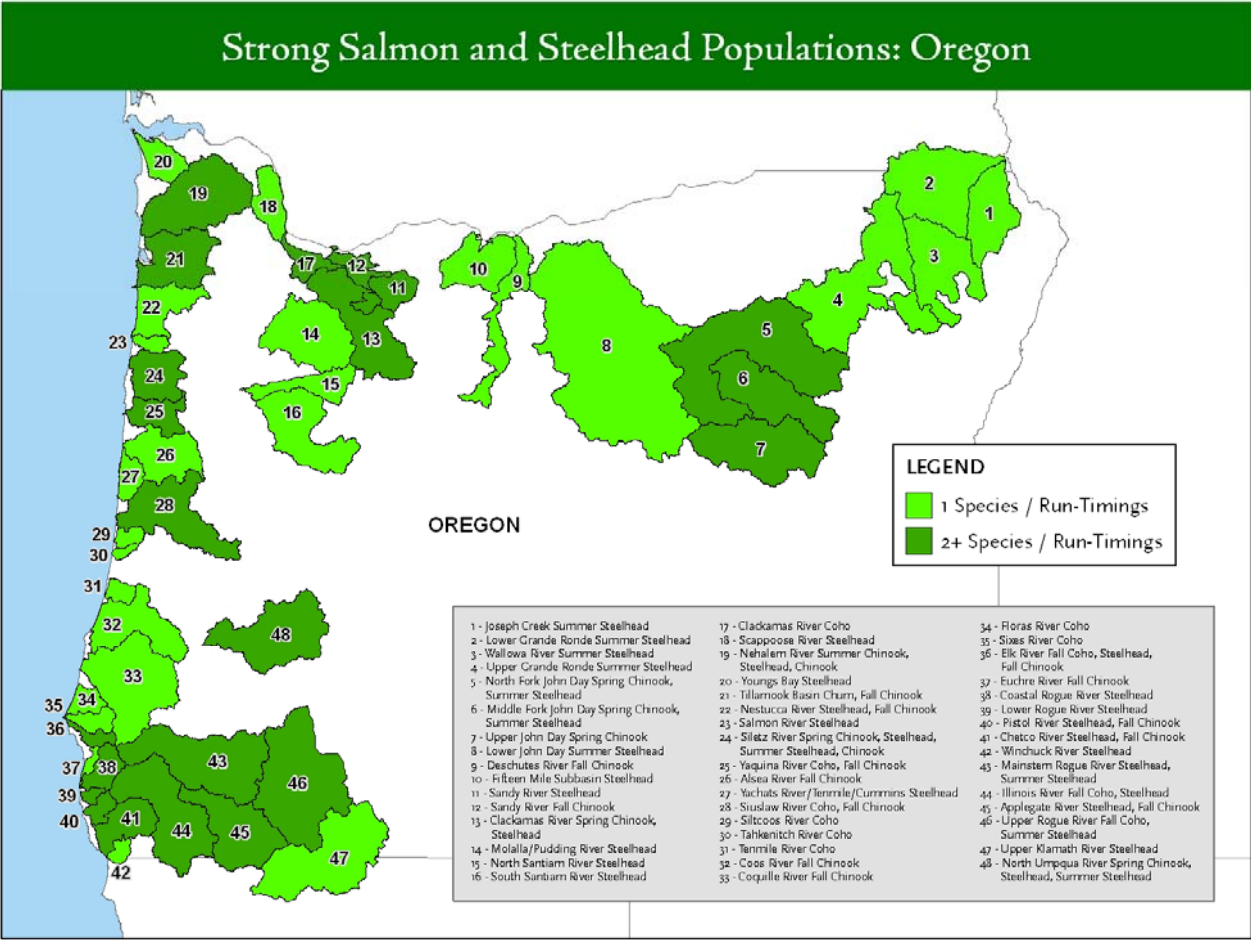
10.20.2008

Two-Plus Multi-Species with Top Single Species

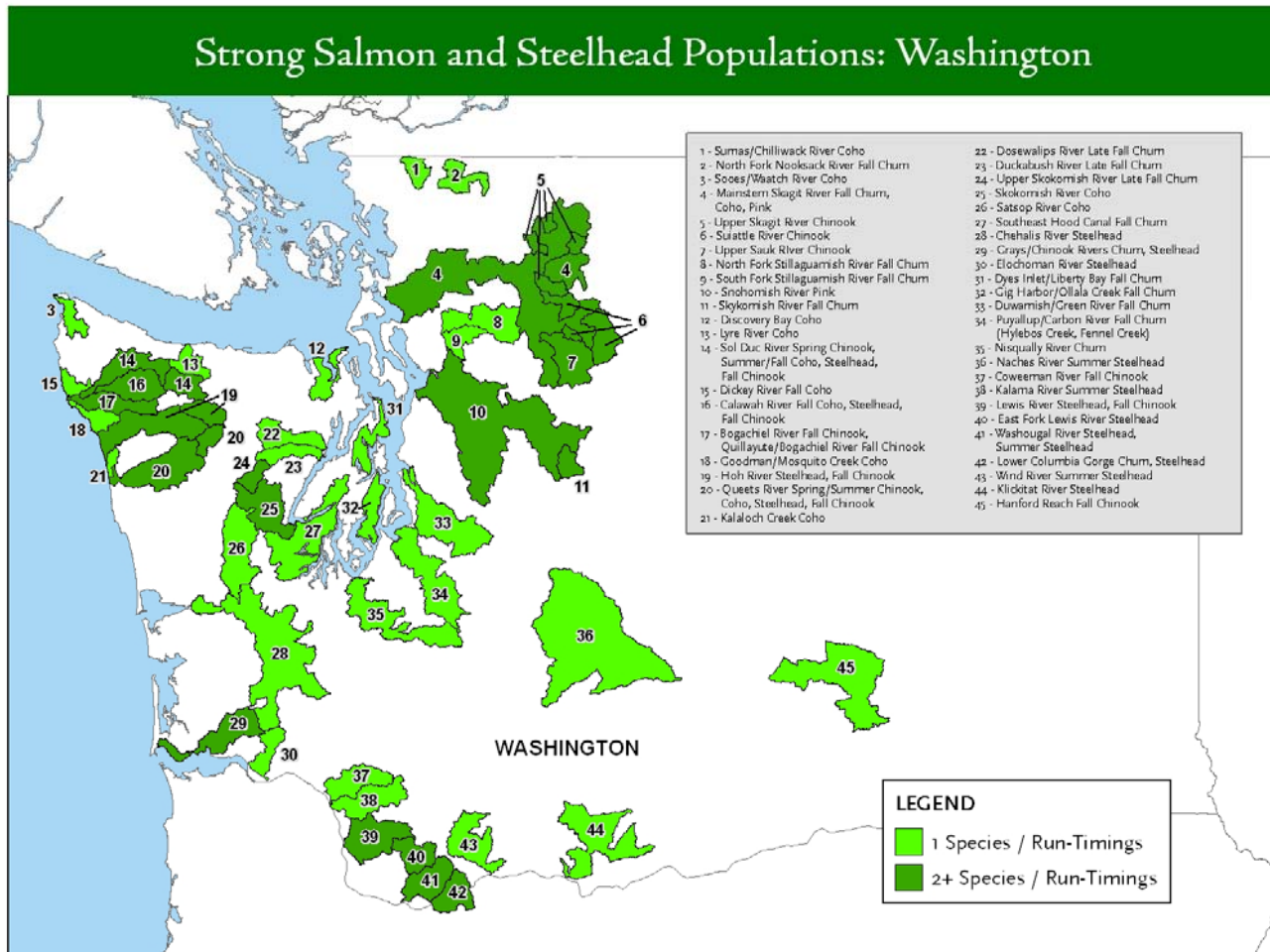


This map was generated for The Wild Salmon Center and The North American Salmon Stronghold Partnership. Data was gathered at a population scale through an expert opinion process from 2006 through 2008. No liability is assumed for the completeness or accuracy of the information contained herein. Cartography by Sasha Twelker | 09.13.2008

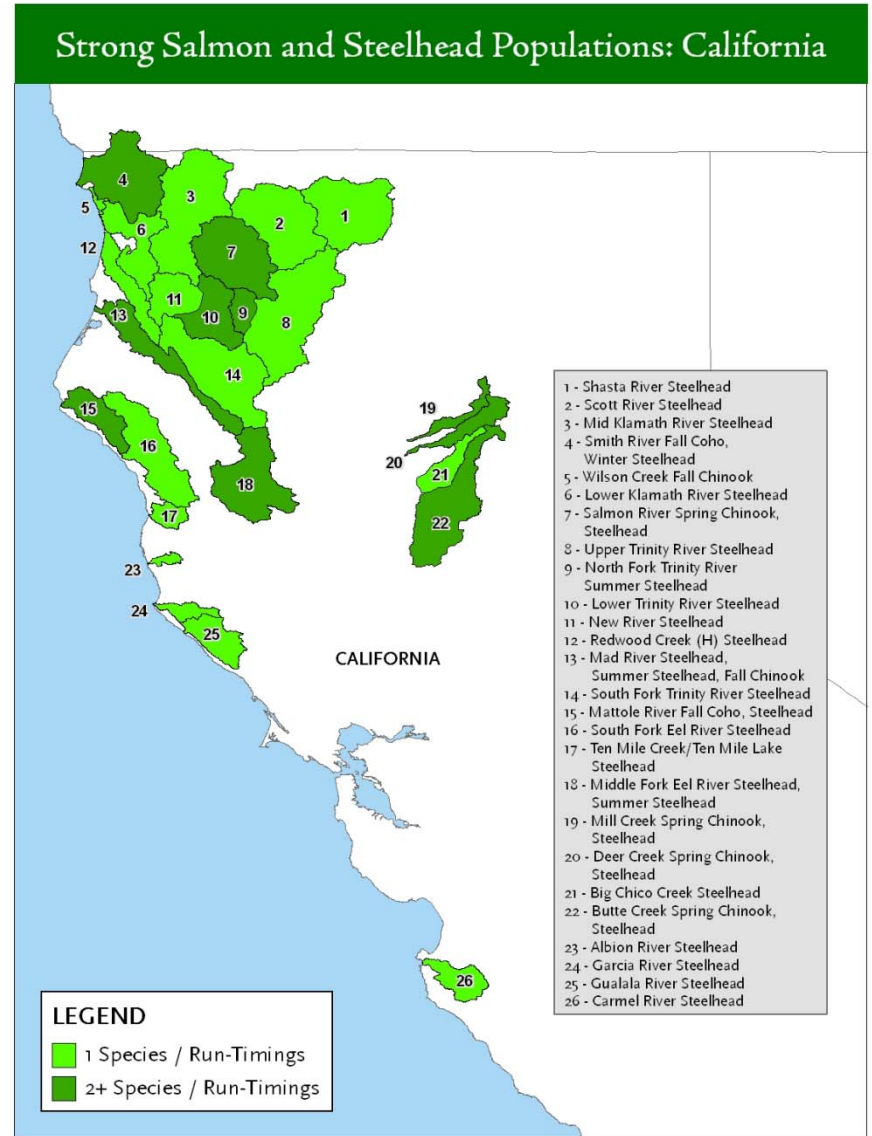
Oregon Single and Two-Plus Species Networks



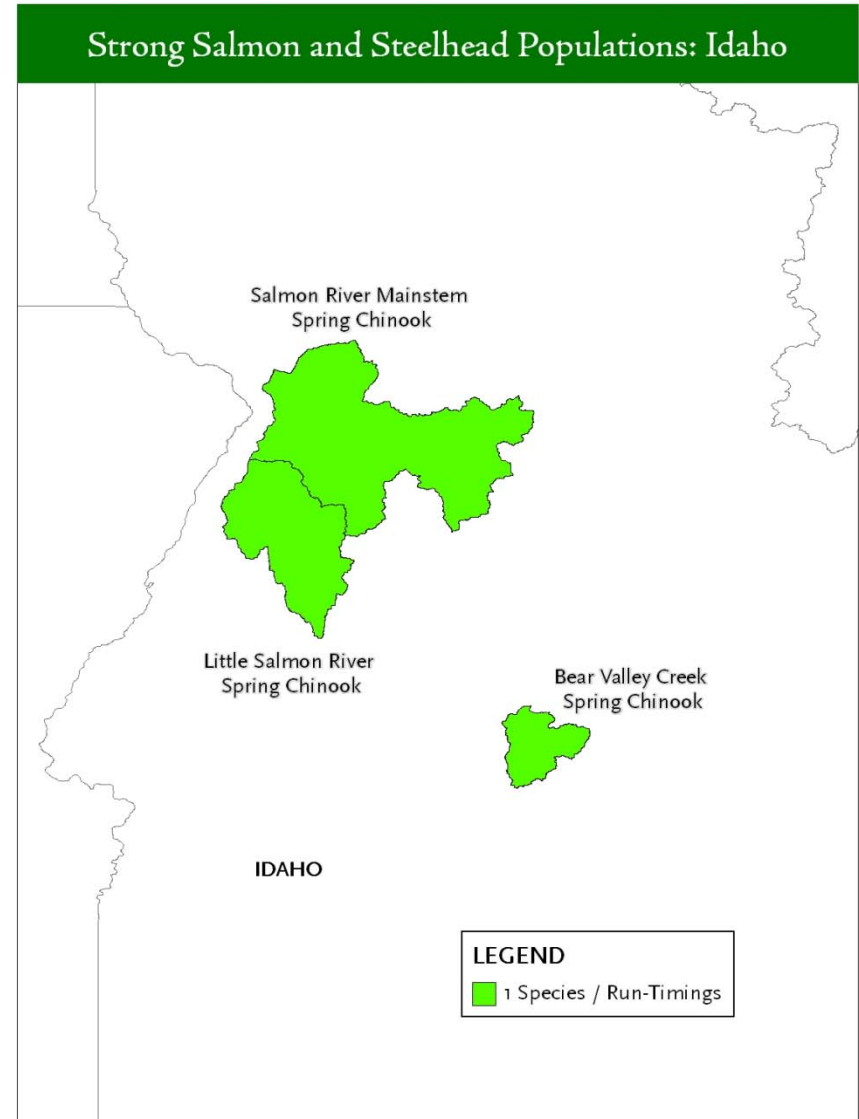
Washington Single and Two-Plus Species Networks



California Single and Two-Plus Species Networks



Idaho Single and Two-Plus Species Networks



Additional Reporting Needs

- Summarize the important comments for each population with focus on documentation of the data sources used by the experts. Put this information in an Appendix.
- Analyze uncertainty by metric, species/life history, and geographic area to assess patterns and inform future information priorities

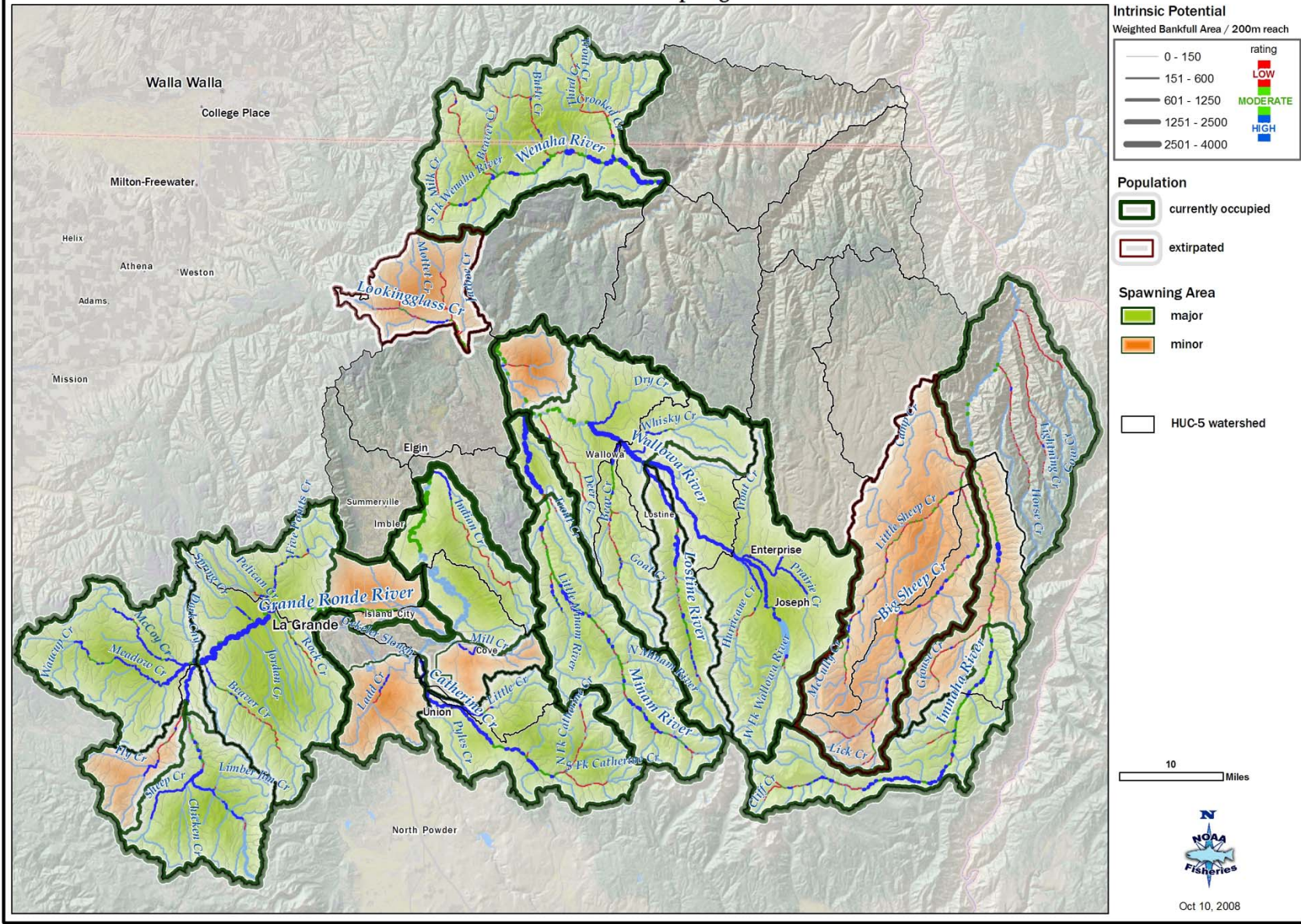
Future Refinement and Improvement

- Look at capacity (population size) to screen very small populations
- Analyze the potential future metric ratings
- Conduct additional data verification including between region consistency of ratings
- Add habitat quality and quantity information to the database and analyses
- Consider vulnerability to climate change and human population growth

Analytical Considerations

- The geographic scale of the data is at the population level. Applying the ratings at other scales (Huc 5 and 6) requires assumptions that the smaller geographic unit has the same characteristics as the population. This is often not the case.
- The data is not a habitat based dataset, it represents the fish populations status and performance.
- The original multi-species index, which was a sum of all species scores within a geographic area, was biased towards those locations that had the most species present. There was concern expressed with this index in that it did not capture the places that had the healthiest multiple populations.

Grande Ronde and Imnaha River Spring Chinook



Endorsed Strongholds

	TIER 1 Three or more species/races are strong	TIER 2 Two species/races are strong; and/or contains a top-scoring species/race	TIER 3 One species/race is strong	TIER 4 Rare/unique life history pattern and/or population has high intrinsic potential	TIER 5 All other basins	
WA	Queets/Quinault		Wenatchee			
OR		Illinois Siletz Sandy Elk MF NF John Day				
ID				Lemhi		
CA		Smith				