EFFECTIVENESS OF HATCHERIES
SNAKE RIVER BASIN DATA QUALITY OBJECTIVES

Richard W. Carmichael
Oregon Department of Fish and Wildlife
Fisheries Research and Development

Contributors: Chris Beasley, Marc Porter, Dave Fast, Bill Bosch, and Kathryn Kostow

What is the Problem?

- Artificial propagation is used extensively as a management tool for salmonids in the Snake River Basin.
- There remains substantial uncertainty of the benefits and risks, particularly related to the unintended impacts on natural populations of harvest augmentation hatcheries and the effectiveness of supplementation hatcheries.

Why Do We Have the Problem?

- Uncertainty remains primarily as a result of two factors: Lack of clearly articulated hatchery program objectives and lack of past scientifically rigorous research, monitoring, and evaluation of hatchery programs at all spatial scales.

Cobb (U.S. Bureau of Fisheries) in 1930 worried that there was an:

"almost idolatrous faith in the efficacy of artificial culture of fish for replenishing the ravages of man and animals."

He believed that hatcheries did substantial good but:

"the very fact that this cannot be conclusively proved ought to be a warning to all concerned not to put blind faith in hatcheries alone."

The Decision (What are the Questions)

Based on management intent and different questions we characterized hatchery programs into three types

- Harvest Augmentation: To provide fish for fishing opportunity while keeping impacts to natural populations within acceptable limits .
- Supplementation: Use of hatchery fish to enhance the viability of natural populations while keeping impacts to non-target populations within acceptable limits.
- Genetic Conservation: Maintaining genetic resources of imperiled populations (zoo-like)

Decision Statements

- Under what set of ecological conditions and hatchery operational practices can harvest augmentation hatcheries achieve harvest objectives with acceptable impacts to natural populations?
- Under what set of ecological conditions and hatchery operational practices can supplementation hatcheries enhance viability of natural populations?
- Under what conditions and hatchery operational practices can genetic conservation hatcheries preserve the genetic legacy of imperiled populations?

The Questions

We rated each Question as high, moderate, or low priority

- Harvest Augmentation: Eleven Questions
- Supplementation: Twenty-two Questions
- Conservation: Four Questions

The Inputs (Performance Measures)

We rated each measure as high, moderate or low priority

- Harvest Augmentation: Thirty-seven measures
- Supplementation: Seventy-Measures
- Conservation: Eighteen measures

Decision Inputs - Supplementation Hatcheries

Question: What is the productivity of hatchery and natural fish and how do they compare?

Performance Measures

- Progeny- to-parent ratios
- Adult escapement
- Hatchery fraction
- Age-structure
- Number harvested
- Prespawn mortality
- Sex ratio
- Spawner abundance
- Redd counts
- Fish-per-redd

Decision Inputs - Supplementation Hatcheries

Question: What are the adult life history characteristics of hatchery and natural fish and how do they compare?

Performance Measures

Age-at-return
Size-at-age
Sex ratio
Run timing
Fecundity

Decision Inputs - Harvest Augmentation Hatcheries

Question: What is the magnitude and distribution of strays into natural populations and what is the impact on viability of natural populations?

Performance Measures

Number of strays
Distribution of strays
Stray rates
Hatchery fraction

Reproductive success of strays
Abundance of natural fish
Natural progeny-to-parent ratios
Genetic characteristics

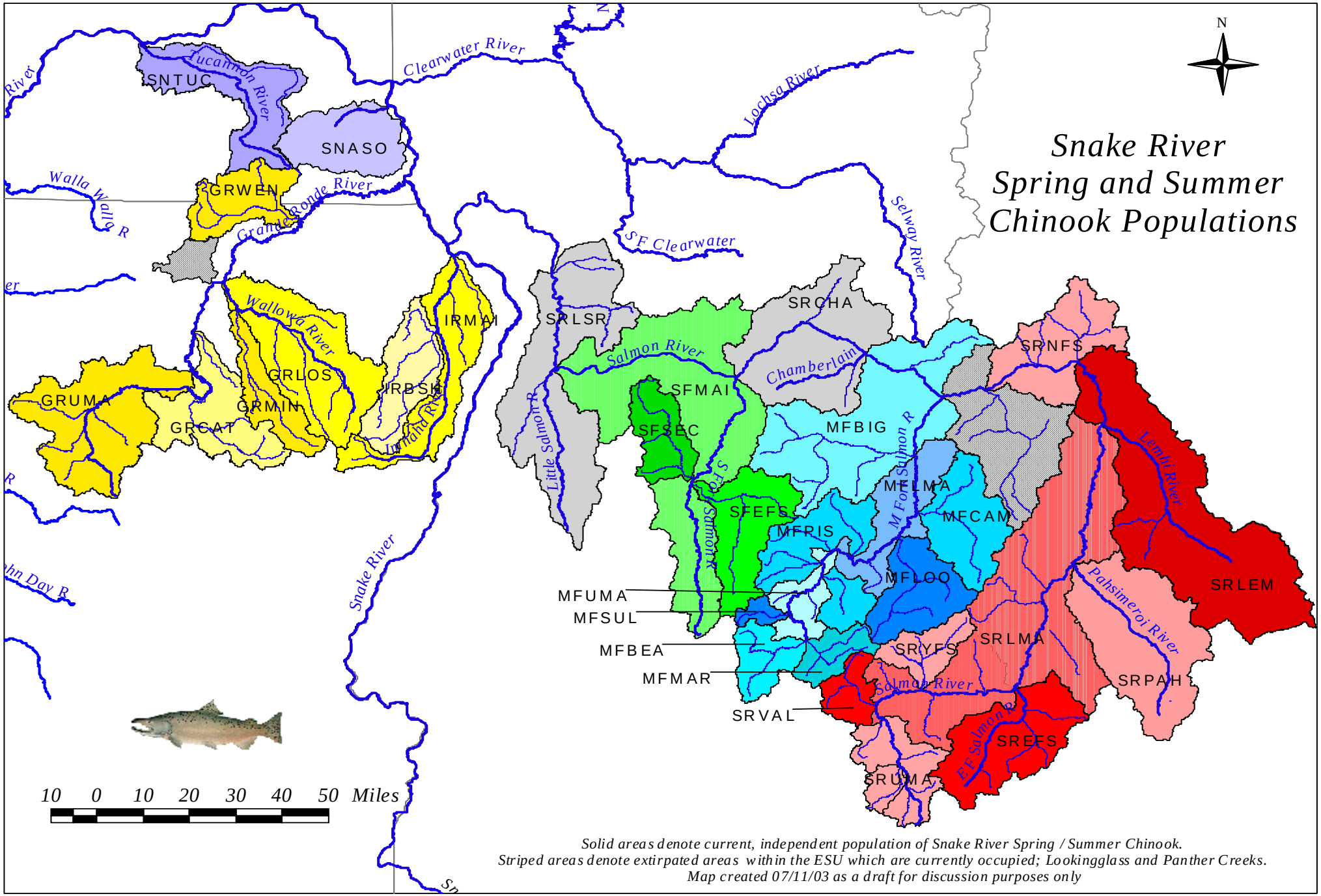
Design and Analytical Methods

- Pre-Post comparisons
- Control-Treatment comparisons
- Relative performance of hatchery and wild fish
- Time series analyses
- Stock recruitment analyses
- Genetic analyses
- EMAP sampling protocols
- Standard parametric and non-parametric analyses

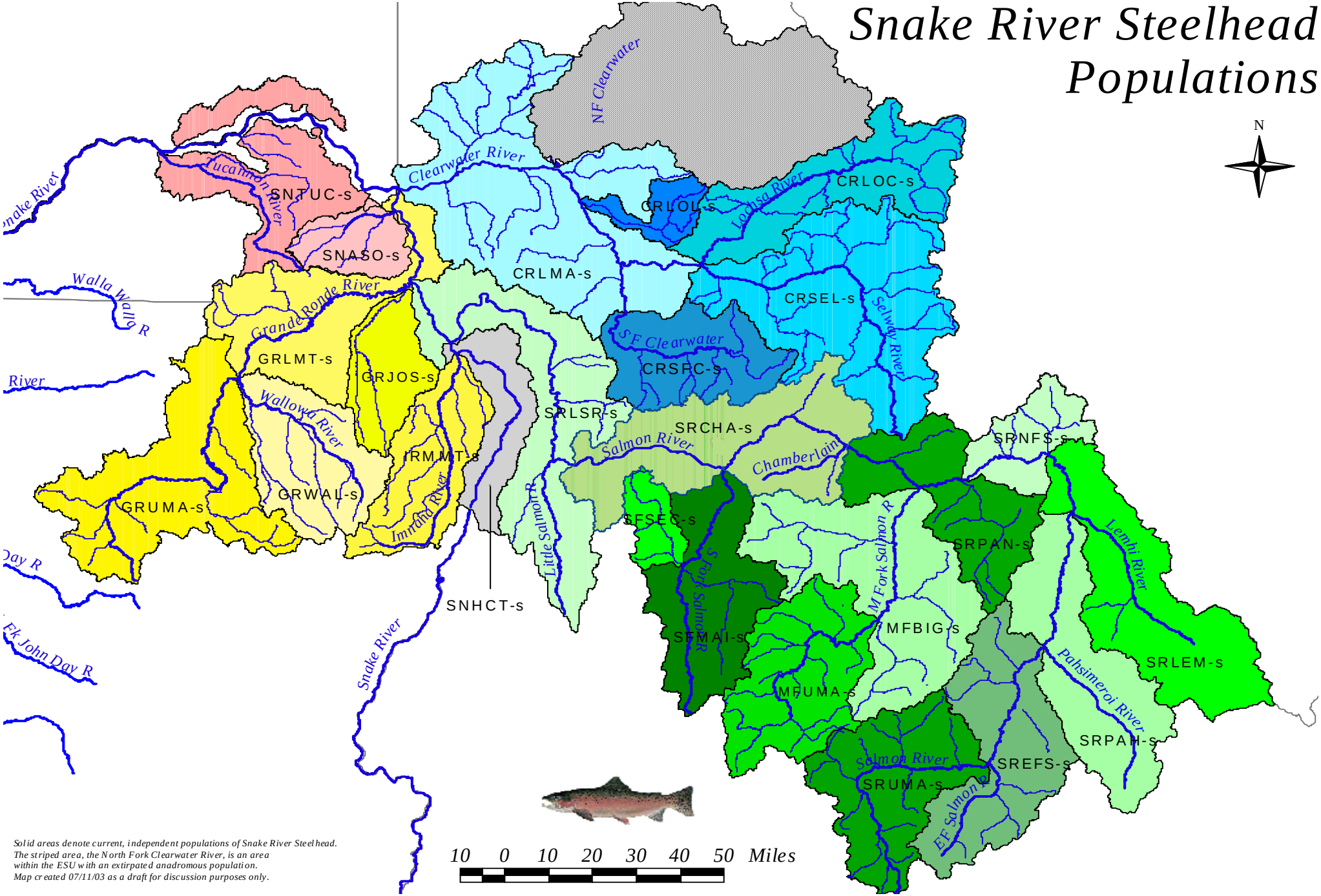
The Boundaries (Target Populations)

From The Interior Columbia TRT

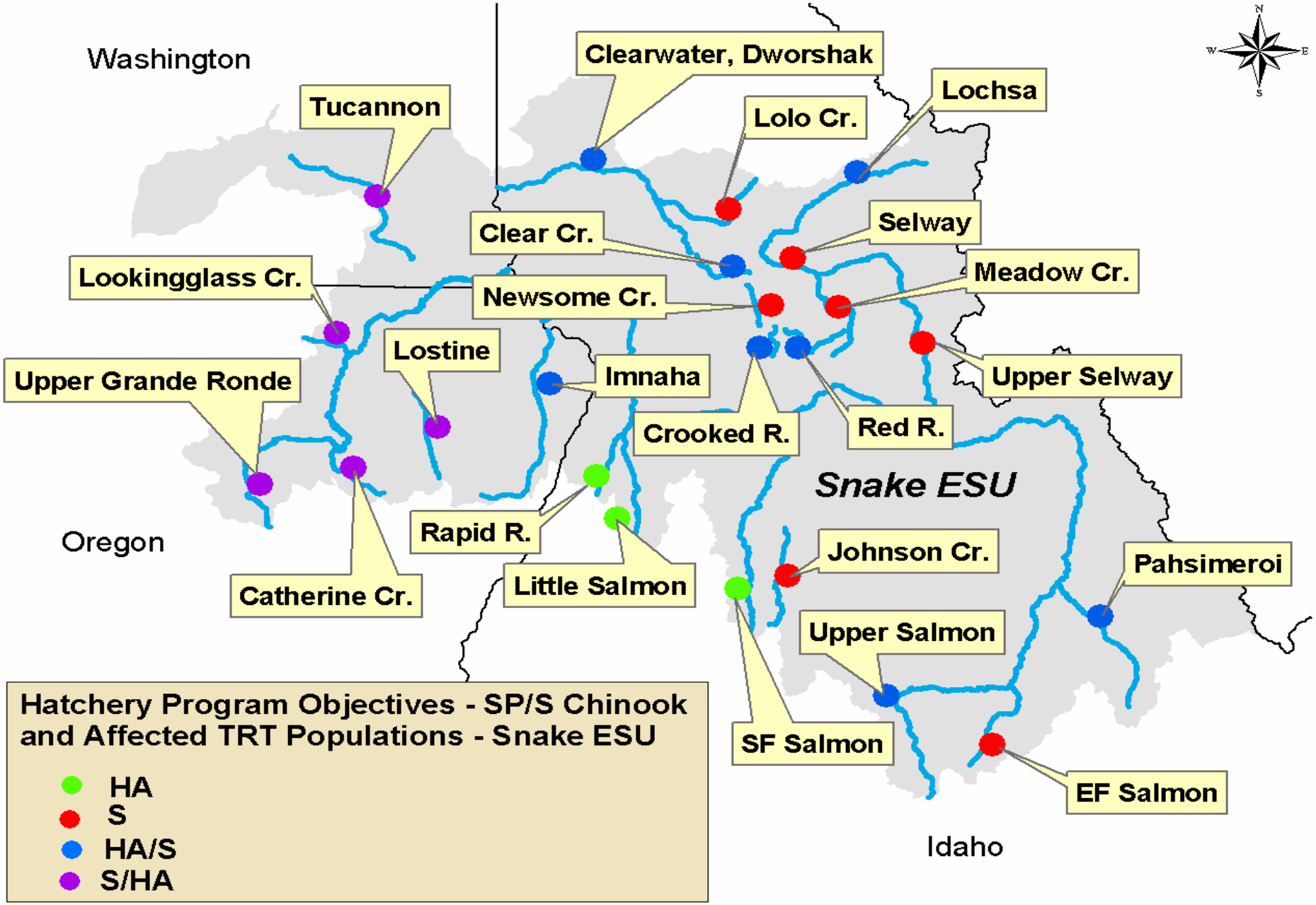
- Thirty-three natural Snake River spring/summer Chinook salmon populations
- Twenty-five natural Snake River summer steelhead populations
- One natural Snake River fall Chinook salmon population
- One natural Snake River sockeye salmon population


Snake River
Spring and Summer
Chinook Populations
N
SNTUC
Tucannon River
SNASO
GRWEN
Grande Ronde River
Walla Walla R
Clearwater River
Lochsa River
Selway River
S F Clearwater
Wallowa River
IRMAI
GRLOS
GRMIN
GRCAT
GRUMA
IRBSH
Imnaha River
SRLSR
Little Salmon R
Salmon River
SRCHA
Chamberlain
SFMAI
SFSEC
MFBIG
S Fork Salmon R
M Fork Salmon R
SFEFS
MFRIS
MFELMA
MFCAM
MFLOO
MFUMA
MFSUL
MFBEA
MFMAR
SRVAL
SRNFS
Lemhi River
SRLEM
Pahsimeroi River
SRPAH
SRLMA
SRYFS
Salmon River
SREFS
EF Salmon R
SRUMA
Snake River
10 0 10 20 30 40 50 Miles
Solid areas denote current, independent population of Snake River Spring / Summer Chinook.
Striped areas denote extirpated areas within the ESU which are currently occupied; Lookingglass and Panther Creeks.
Map created 07/11/03 as a draft for discussion purposes only

Snake River Steelhead Populations



Solid areas denote current, independent populations of Snake River Steelhead. The striped area, the North Fork Clearwater River, is an area within the ESU with an extirpated anadromous population. Map created 07/11/03 as a draft for discussion purposes only.


Washington
Oregon
Idaho
Clearwater, Dworshak
Tucannon
Lochsa
Lolo Cr.
Selway
Clear Cr.
Meadow Cr.
Lookingglass Cr.
Newsome Cr.
Lostine
Upper Selway
Upper Grande Ronde
Imnaha
Crooked R.
Red R.
Snake ESU
Rapid R.
Johnson Cr.
Pahsimeroi
Little Salmon
Catherine Cr.
Upper Salmon
SF Salmon
EF Salmon
Hatchery Program Objectives - SP/S Chinook and Affected TRT Populations - Snake ESU
HA
S
HA/S
S/HA

The Temporal Boundaries

Variable temporal boundaries depending on the Question and the Performance Measure

- Life stage specific
- Annual
- One generation
- Multiple generations

Decision Rules-Action Levels

- No standard levels of change or broadly accepted benchmarks have been defined for most specific performance measures.
- No standards have been established for acceptable levels of uncertainty (data variability) or for consideration of uncertainty in decision process.
- Decisions will always be based on many performance measures and associated action levels. Integration across measures is required.

Decision Rules - Action Levels

- Two things must be considered in the decision:

1. How the performance measure estimate compares to the criteria, and

2. The degree of certainty (variability) in the estimated value.

Future Direction and Issues

- Characterize each performance measure in relation to all the Questions it pertains to. This will aid in prioritization.
- Identify temporal and spatial scale of assessment for each performance measure.
- Conduct an assessment of ongoing RM&E efforts to determine which performance measures are being assessed and at what level of adequacy.

Future Direction and Issues

- Given the number of measures and their complexity, as well as the need to integrate for decisions, we are uncertain how or if Decision Rules can be developed.
- Many of the well designed RM&E programs are relatively early in implementation and there will be limited datasets for specifying range of values, error levels, and error allocation.
- Utilize existing peer reviewed experimental designs (Yakima, Idaho Supplementation Studies, Northeast Oregon Hatcheries RM&E Plan, Umatilla Basin RM&E Plan) to assist in Step 7.