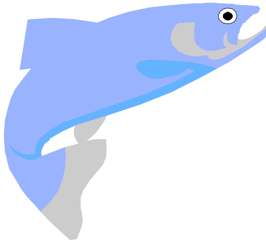
Update

NWFSC effort – Habitat and Population Evaluation for Biological Opinion Remand

March 16, 2004

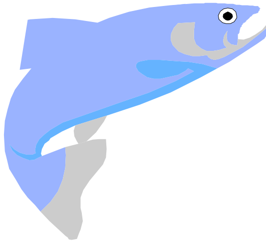
PRELIMINARY RESULTS



Our analysis comes logically after:

- Determination of hydrosystem impact
- Determination of potential hydrosystem mitigation or contribution
- Determination of any additional needed improvements

PRELIMINARY RESULTS



Main Question

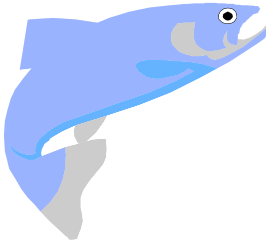
Is there potential for improvements to tributary or estuarine habitats to affect anadromous salmonid population status positively?

PRELIMINARY RESULTS

Basic logic and process

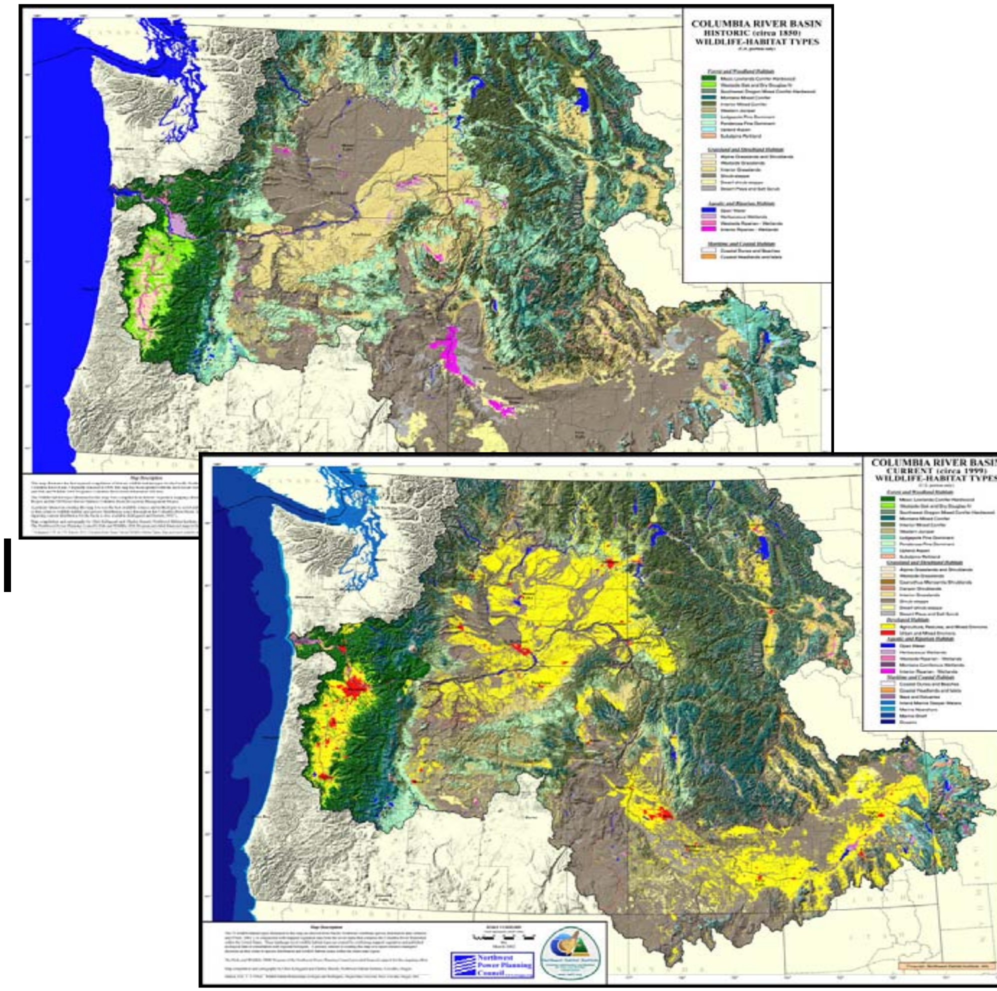
- Evaluate habitat status for each of several factors (based on habitat condition alone)
- Evaluate fish population status
- Categorize populations
- Life-cycle modeling for context

PRELIMINARY RESULTS



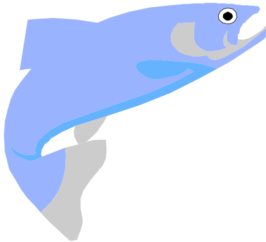
Approach to habitat analyses

- Focuses on causes of habitat change
  - Landscape processes
  - Land use impacts
- Compares current rate or condition to historical rate or condition
  - Accounts for natural variation in processes



Candidate habitat factor	Analysis priority
Landscape processes that form and sustain aquatic habitats	
Barriers to passage	1
Irrigation diversions	1
Flows and water withdrawals	1
Sediment	1
Riparian condition	1
Floodplain interactions (e.g. channelization, off-channel habitat)	1
Fire regime	3
Habitat conditions influenced by landscape processes	
Physical habitat (e.g., pool spacing)	2
Water quality	2
Stream temperature	3
Trophic interactions (e.g., nutrient cycling)	3
Exotic species	3
Predator/competitor interactions	3

PRELIMINARY RESULTS

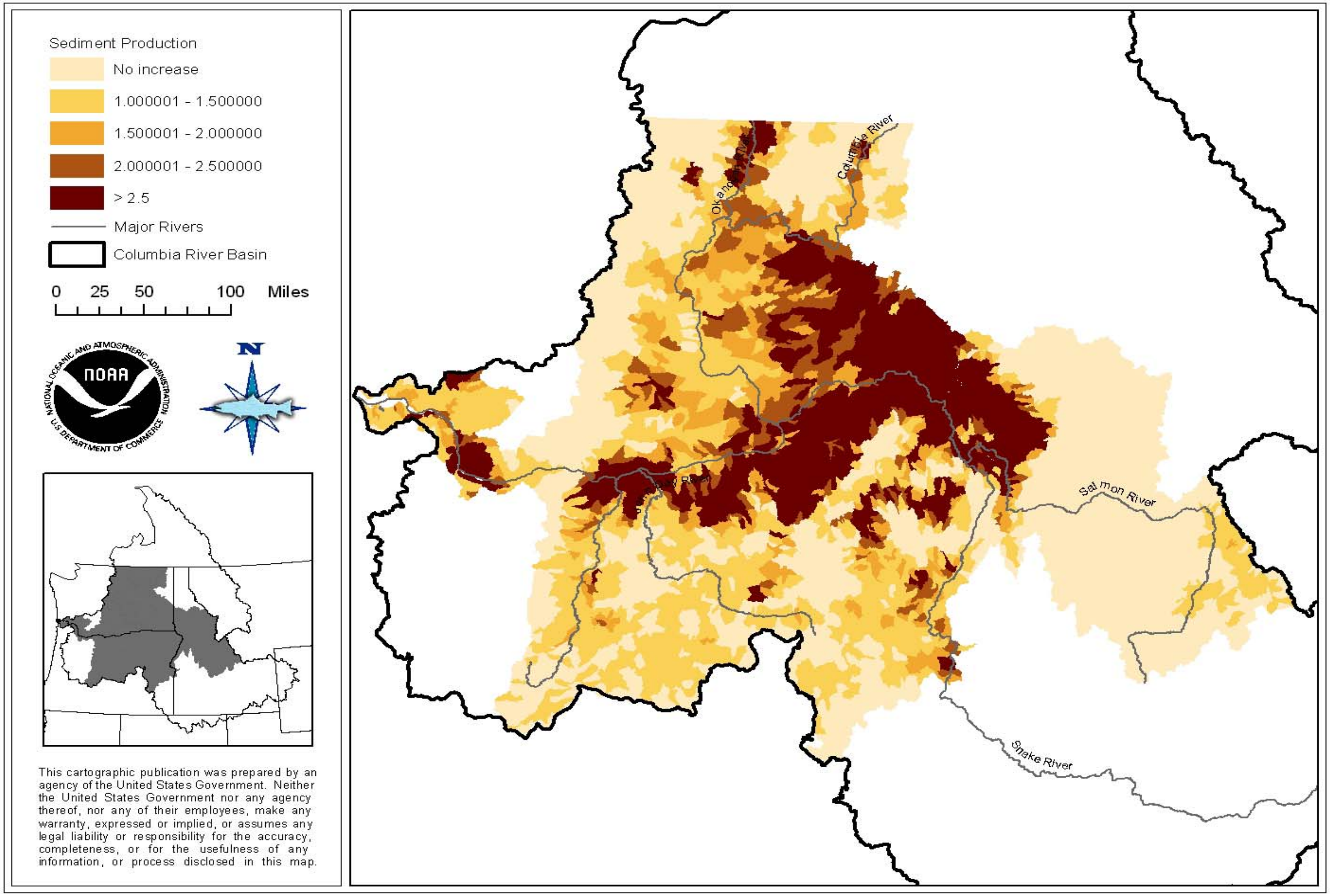


Sediment supply – non-forest

- Changes from historical condition based on RUSLE:
  - A = RKLSCP
- Simplified to use only:
  - Hillslope angle (S)
  - Soil type (K)
  - Land cover (C)
- Considered constant or unknown
  - Rainfall erosivity factor (R)
  - Slope length (L)
  - Erosion control practice (P)

Cover type	Erosion factor
Historically grasses	1
Historically shrub	4
Agriculture – historically grasses or forest	10
Agriculture – historically shrub	12
Rock, water, alpine, and all forest types	0

Sediment supply – non-forest



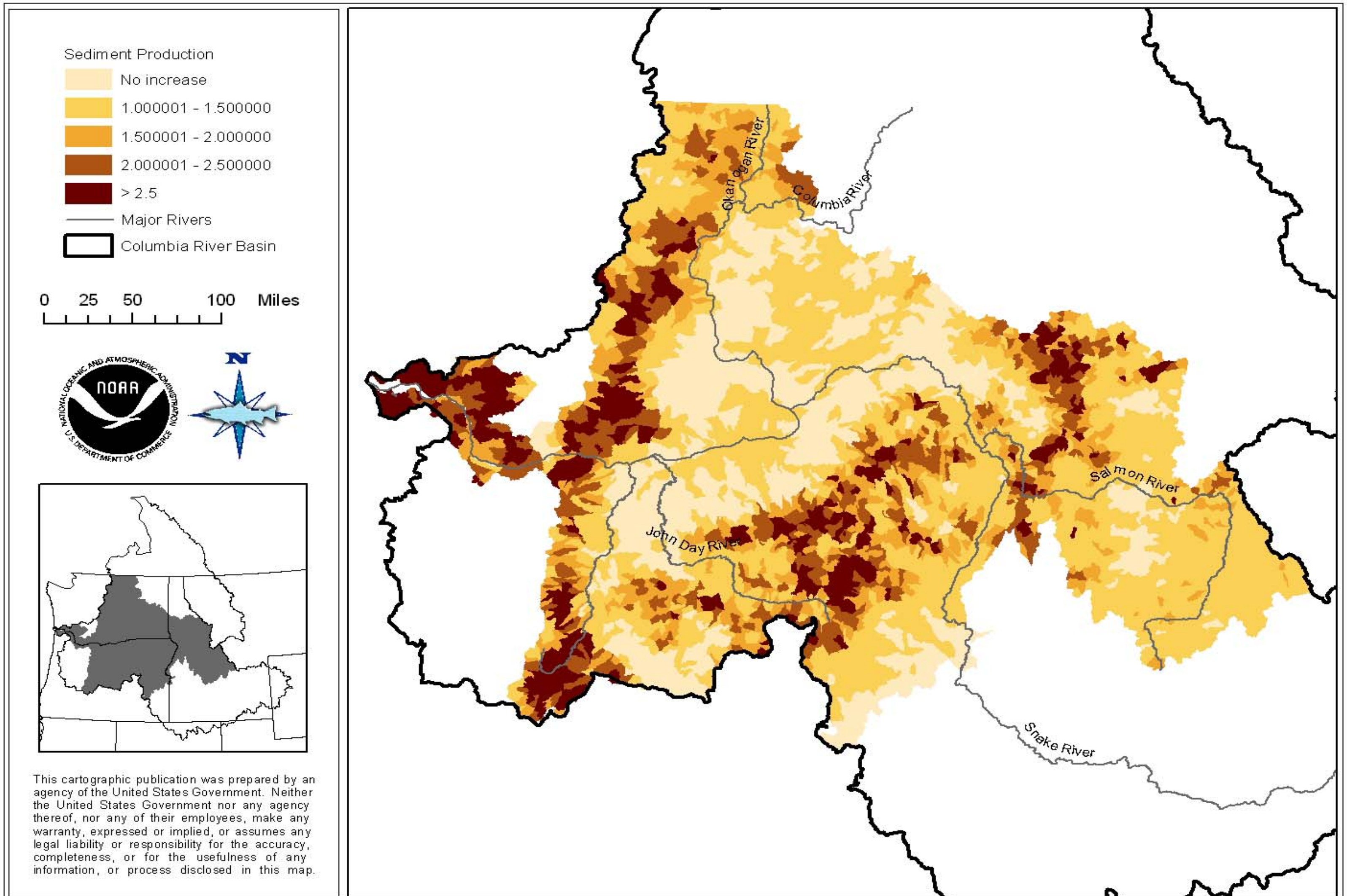
Sediment supply - forests

- Mass wasting
  - Model applies to slopes >50%
  - Percent of forest <20 years old based on average harvest rate by ownership class
- Road surface erosion
  - Applied to all forest land roads

	Eastside	Westside
Mature forest	1	3
Forest <20 yrs	10	10
Road	100	100

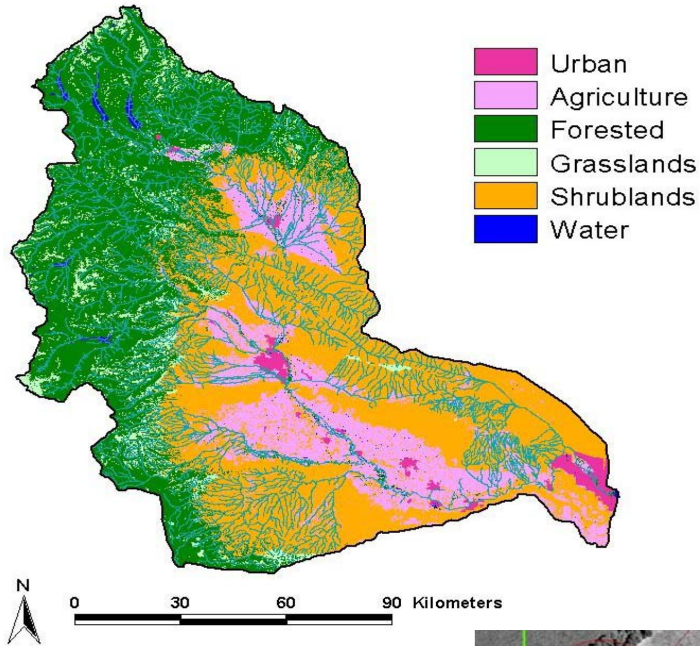
PRELIMINARY RESULTS

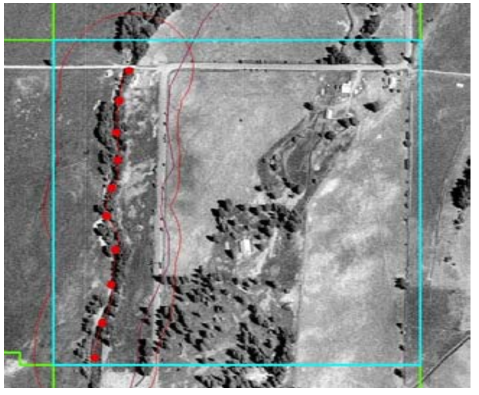
Sediment supply - forests



Riparian condition

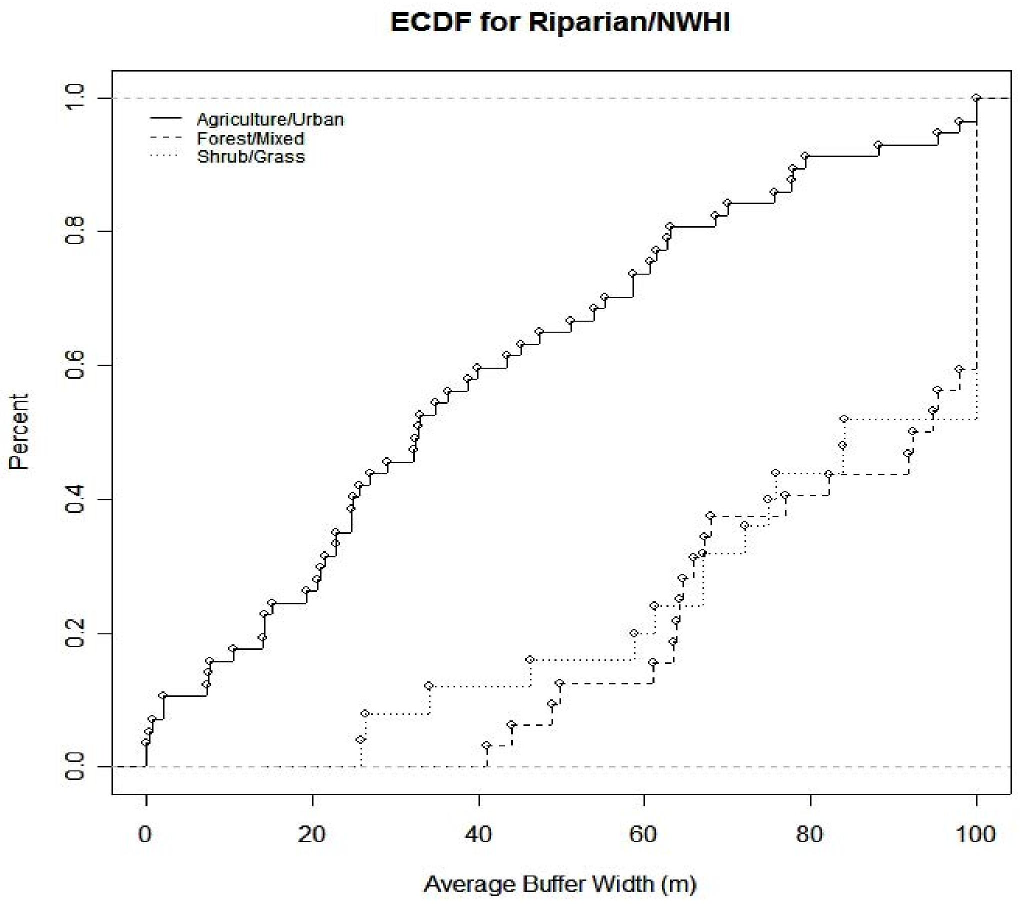
- GIS-based analysis
  - Map percent of riparia length converted to no natural land cover
- Aerial photograph analysis
  - Characterize riparian conditions within each three land cover categories (agriculture, grass or shrub, forest)





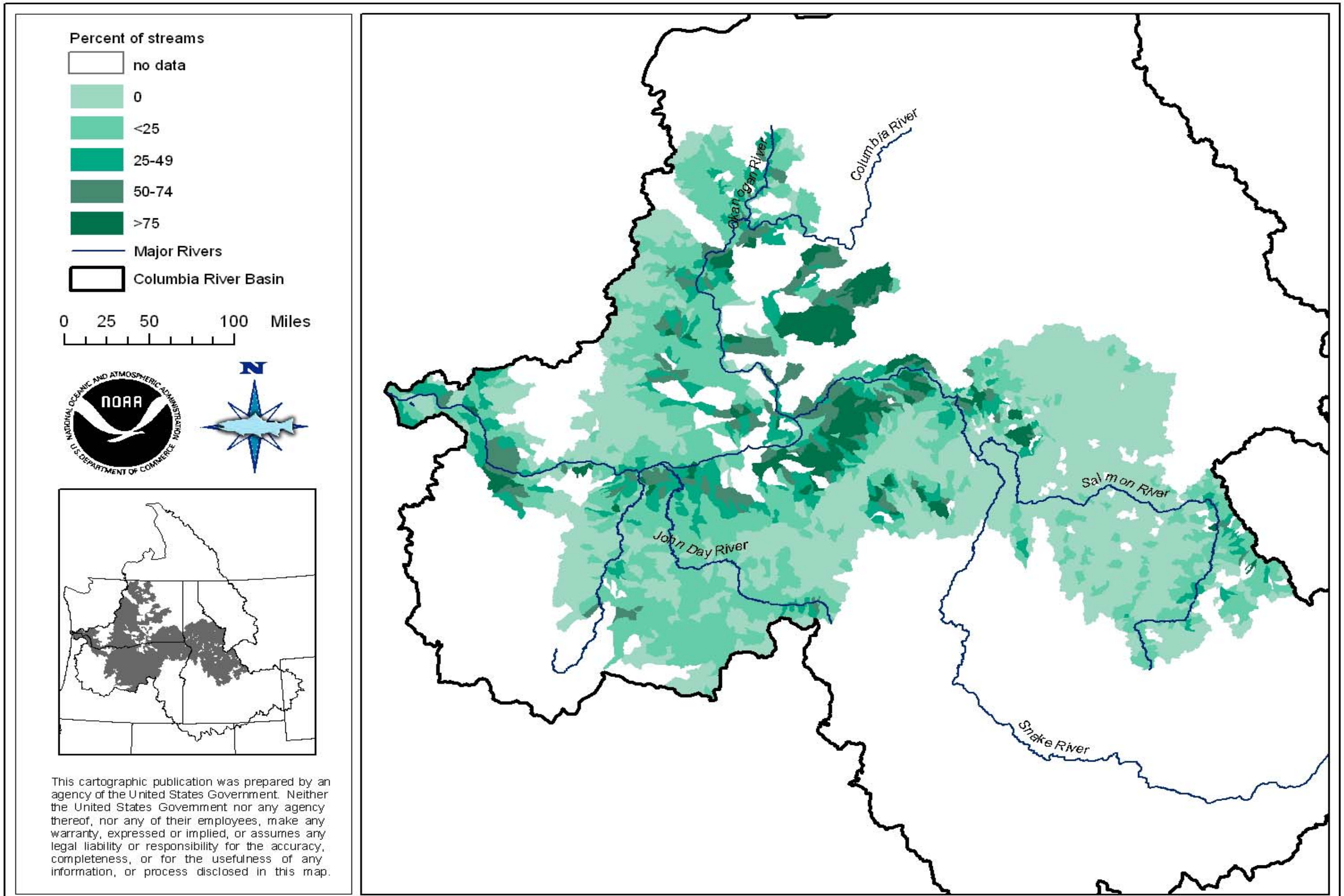
Riparian condition

- Aerial photograph analysis
  - Narrowest buffers in agricultural lands
  - Relatively little conversion of either shrub/grass or forested lands



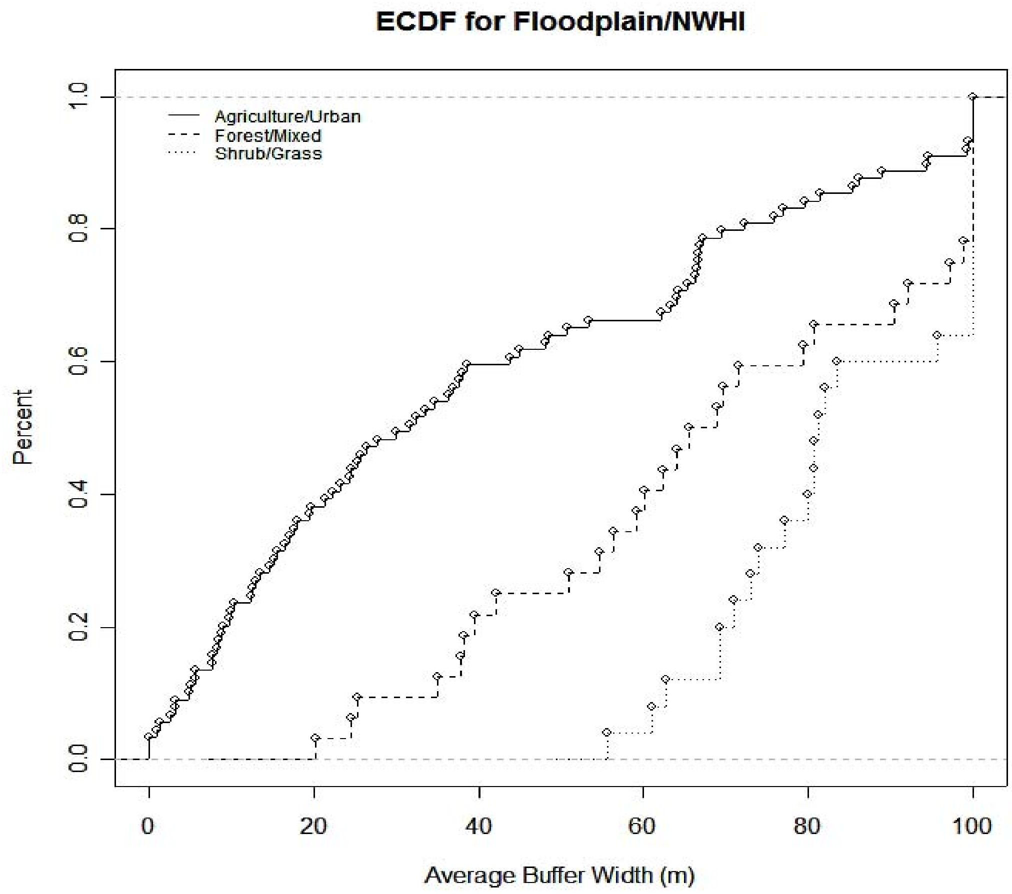
PRELIMINARY RESULTS

Riparian condition



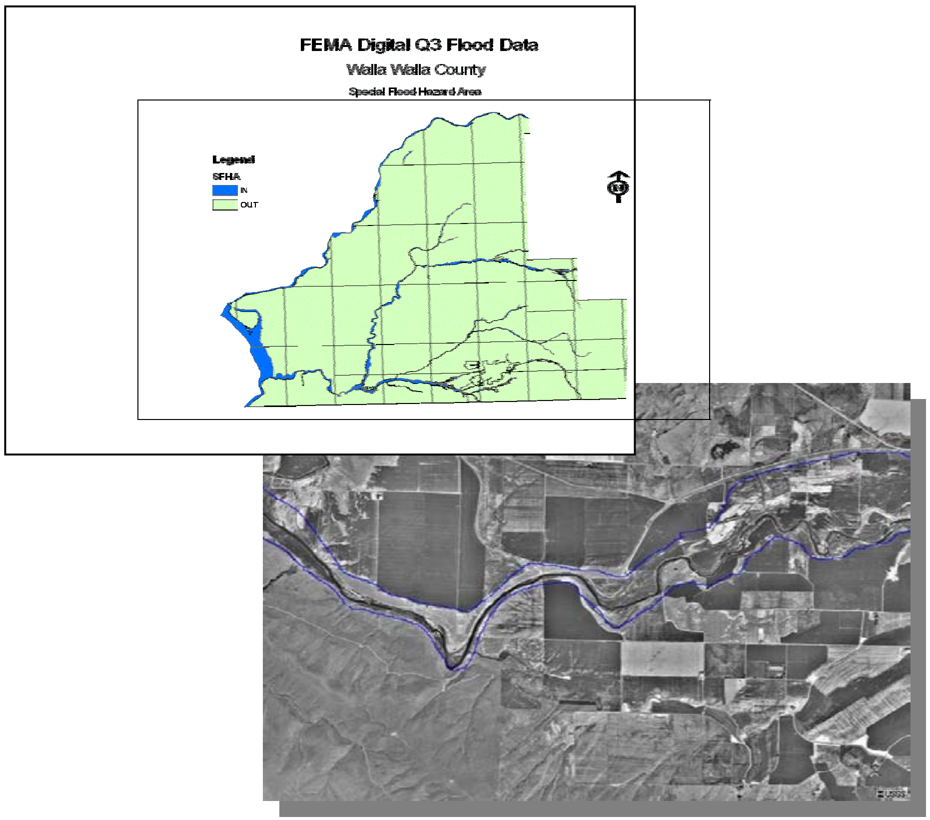
Floodplain condition

- Aerial photograph analysis
  - Narrowest buffers in agricultural lands
  - Significant conversion of forested floodplains



PRELIMINARY RESULTS

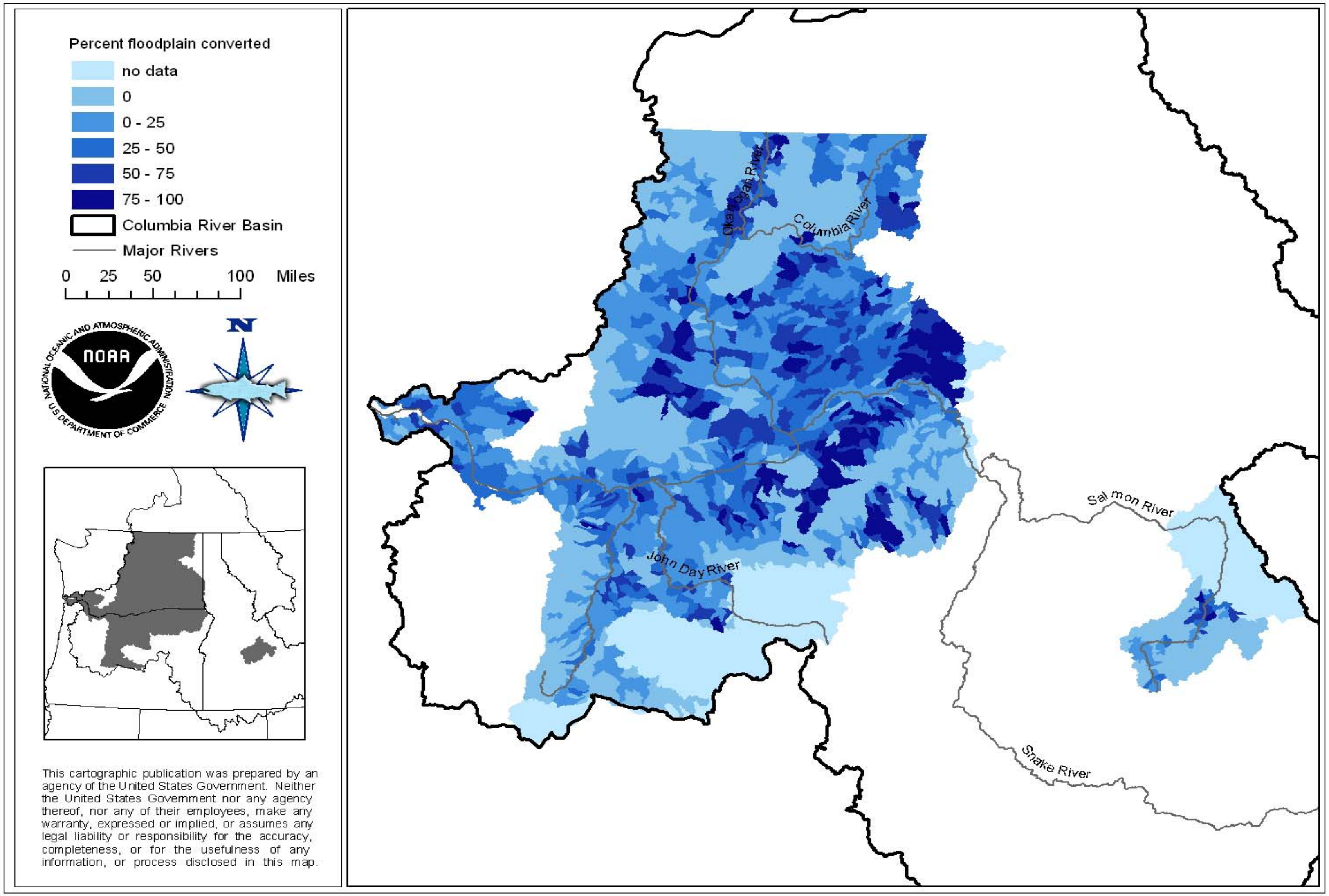
Floodplain condition



- GIS-based identification of floodplains
  - Based on FEMA maps where possible
  - Based on modeled floodplain width where necessary (valley width at 3 m above the stream 'bed')

PRELIMINARY RESULTS

Floodplain condition

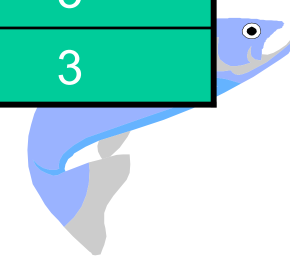


Non-point pollutants

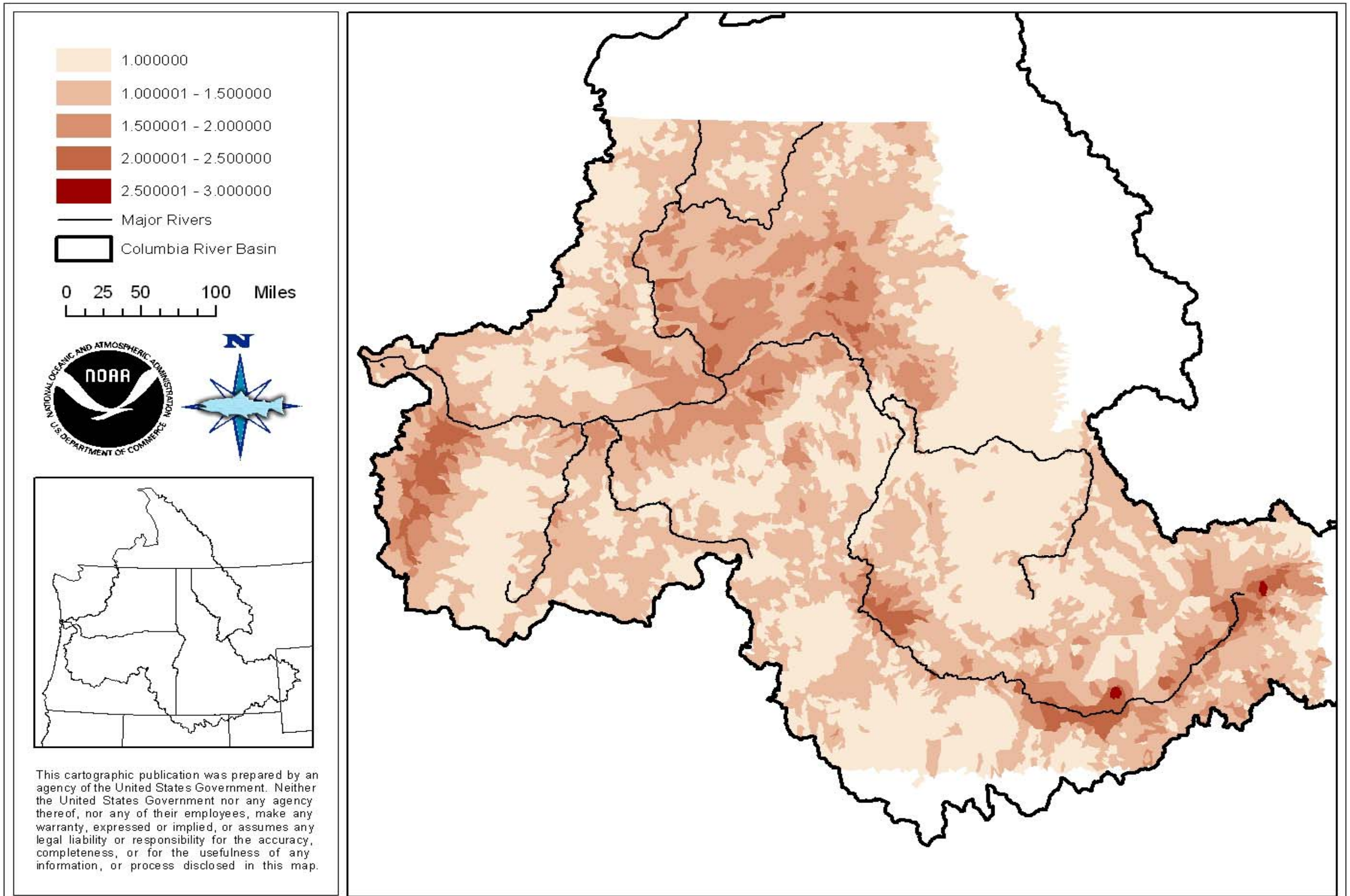
- Rates potential exposure to toxic chemicals
- Focuses on pesticides and urban runoff (neglects some mines and point sources)
- Ratings based on intensity of pesticide application or runoff of petroleum based products

Cover class	Rating
Barren	1
Forested	1
Grass/shrub	1
Wetlands, water	1
Pasture	2
Small grains	2
Fallow	2
Orchards/vineyards	3
Row crops	3
Quarries/mines	3
Urban	3

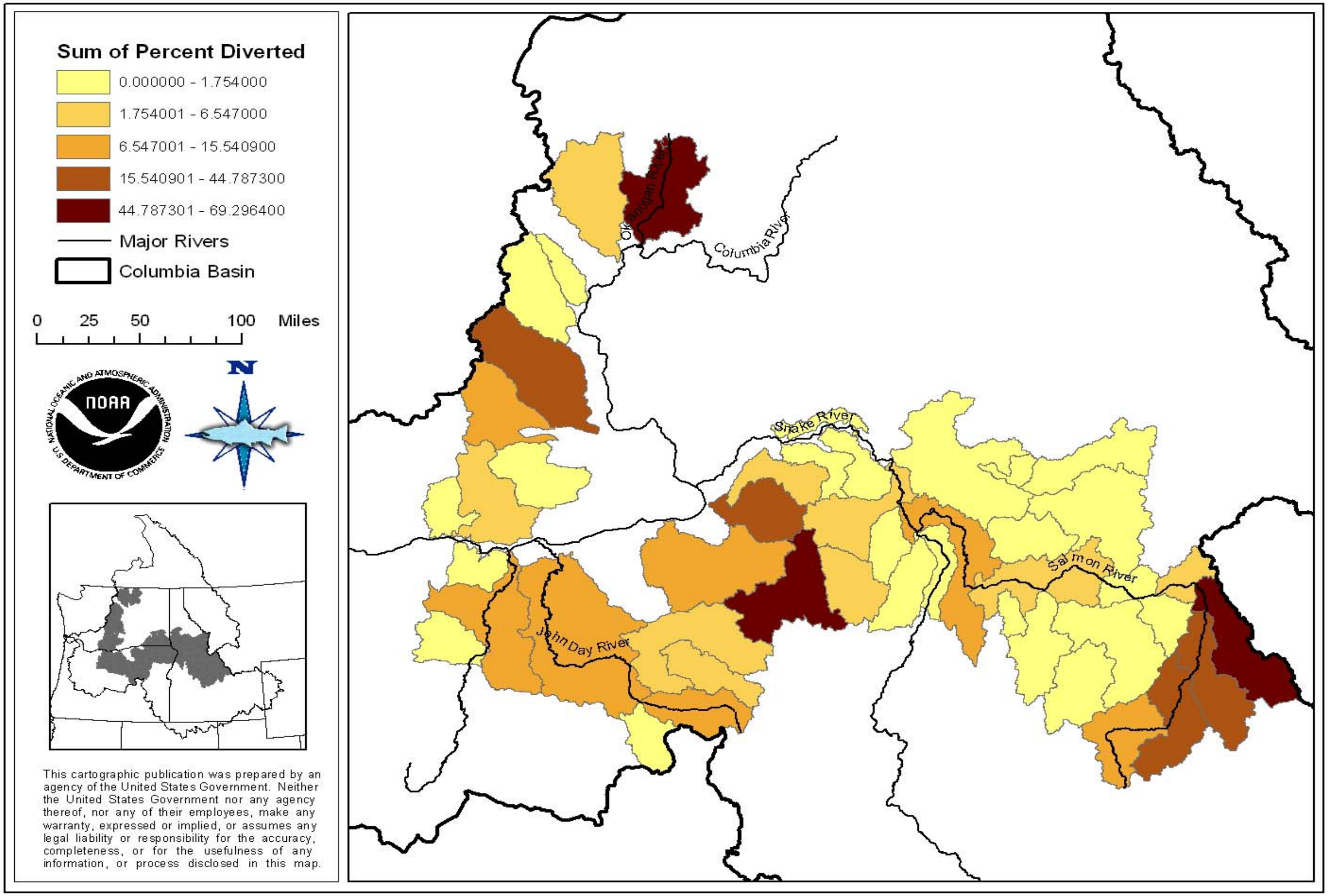
PRELIMINARY RESULTS



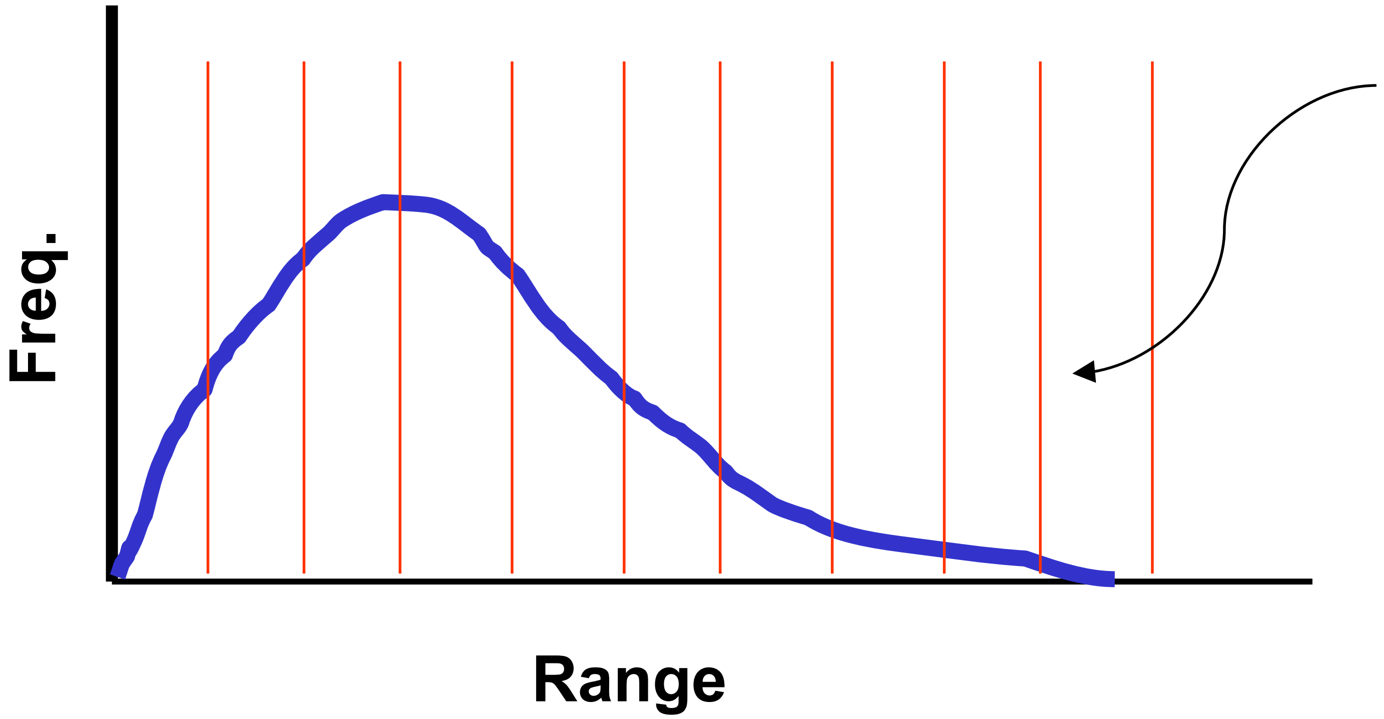
Non-point pollutants



Instream flow

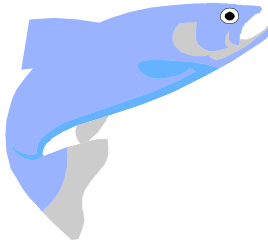


Evaluating degree of change

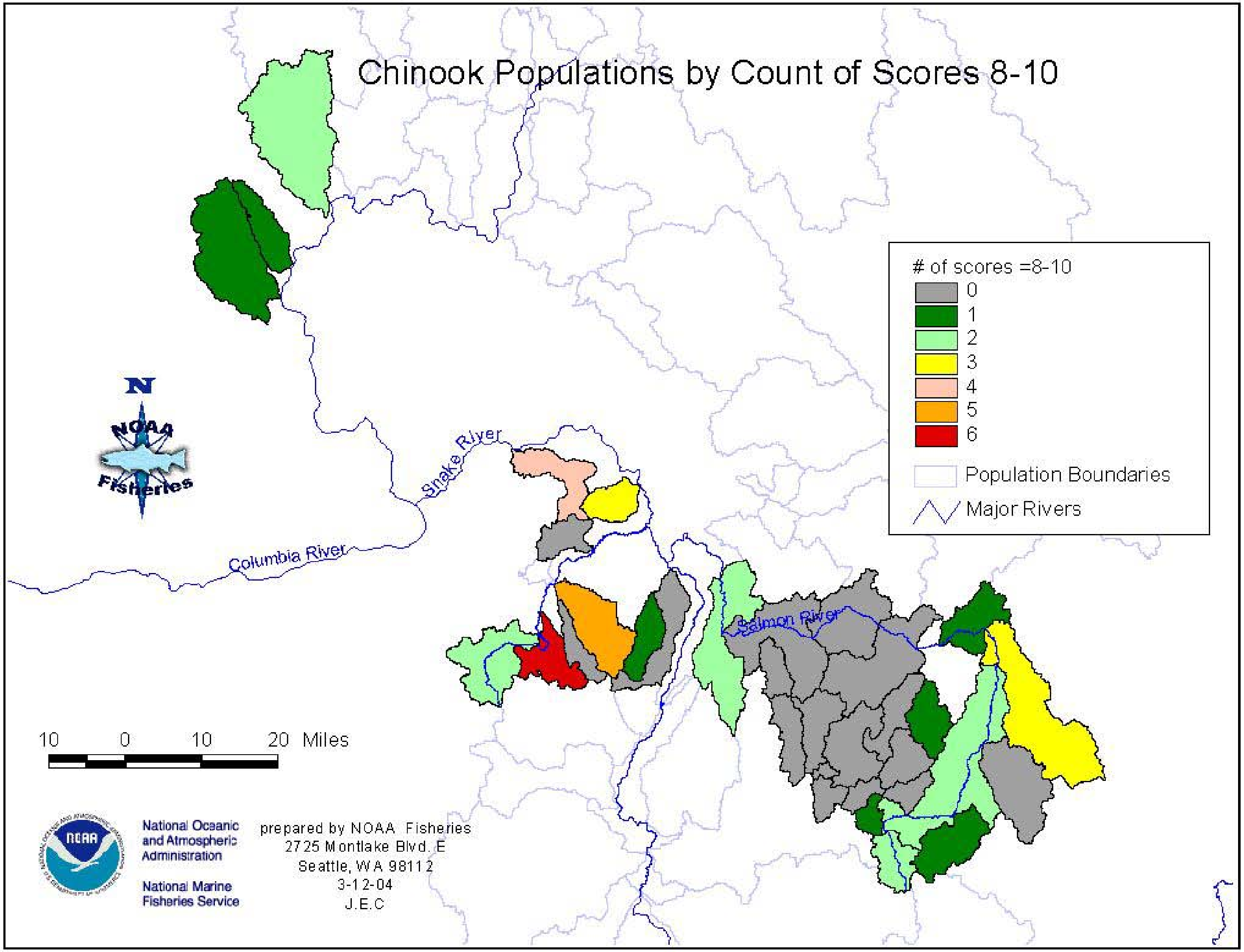


Ten bins, each containing 10% of the range

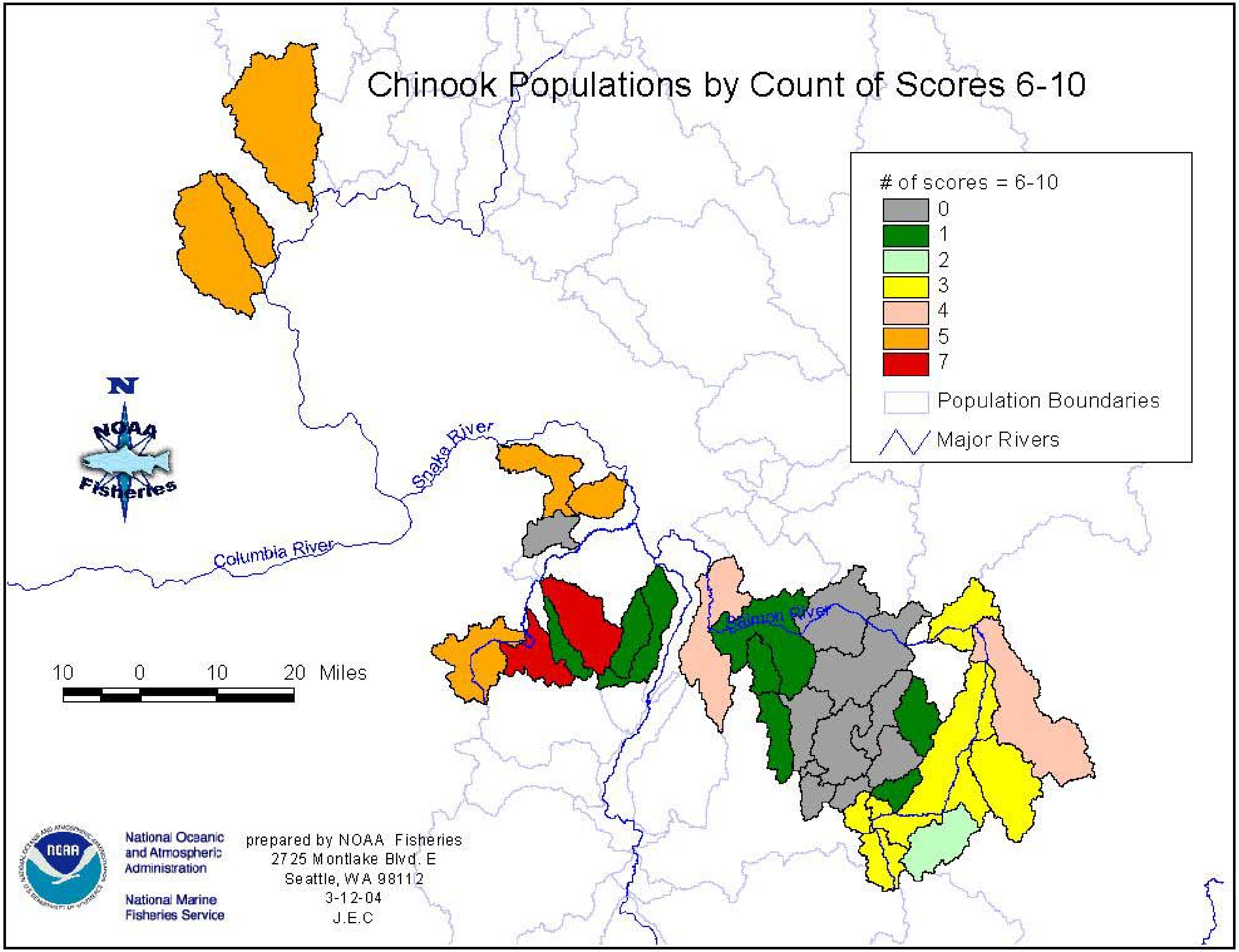
PRELIMINARY RESULTS

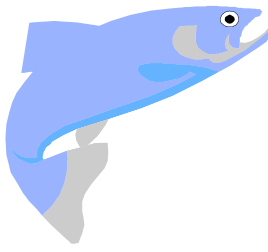


Cumulative impacts -- extreme



Cumulative impacts -- moderate and extreme

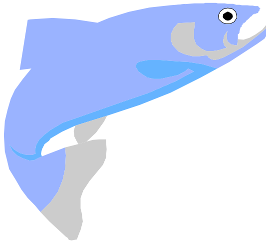




Estuary and Plume

- Flow
- Habitat loss
- Tern predation
- Toxics

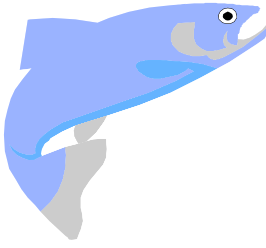
PRELIMINARY RESULTS



Approach – Estuary and Plume

- Classify ESU according to life history types and strategies.
- Assess possible changes to life history types and strategies based upon changes in estuarine habitat and use of this habitat.
- Based upon possible changes to life history types and strategies, evaluate ability of each factor to change VSP parameters as a result of impacts on the fish directly or the ability of the factor to affect estuary and plume habitat.

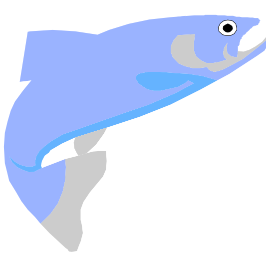
PRELIMINARY RESULTS



Estuary – some outcomes

- Operations of hydropower system directly affects some characteristics of estuarine habitat, especially amount and quality of shallow water habitat which is most important to certain life history strategies.
- Flow, toxics and habitat primarily affect fry, fingerling and subyearling strategies. Those ESUs and portions of ESUs that produce these strategies are most vulnerable to changes in these factors
- Tern predation primarily affects yearlings. Those ESUs and portions of ESUs that produces yearlings are most vulnerable to this factor.

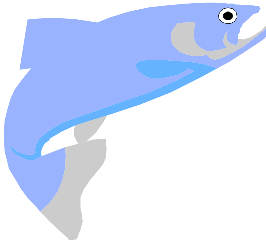
PRELIMINARY RESULTS



Fish population status

- Abundance, productivity, spatial structure, diversity
- Compare current to historical (when available) or potential status
  - estimating "intrinsic potential" fundamental to most comparisons

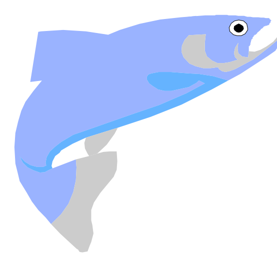
PRELIMINARY RESULTS



Estimating Intrinsic Potential

- Stream width – bankfull width (m)
- Gradient – change in elevation across 200m stream reach segments
- Valley width – based on elevation change perpendicular to reach segments
- Vegetation – Forested or other

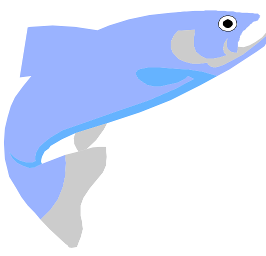
PRELIMINARY RESULTS

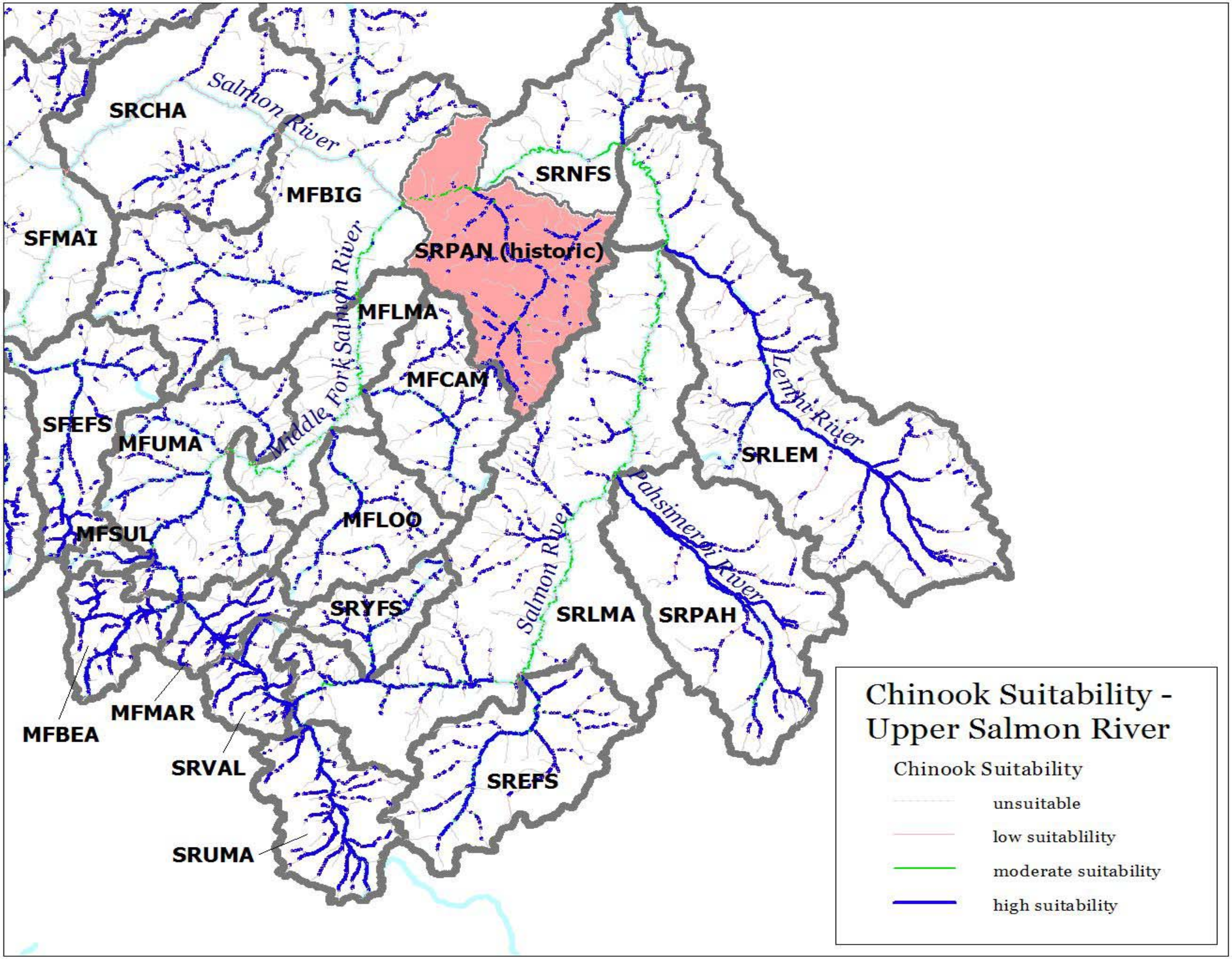


Limits

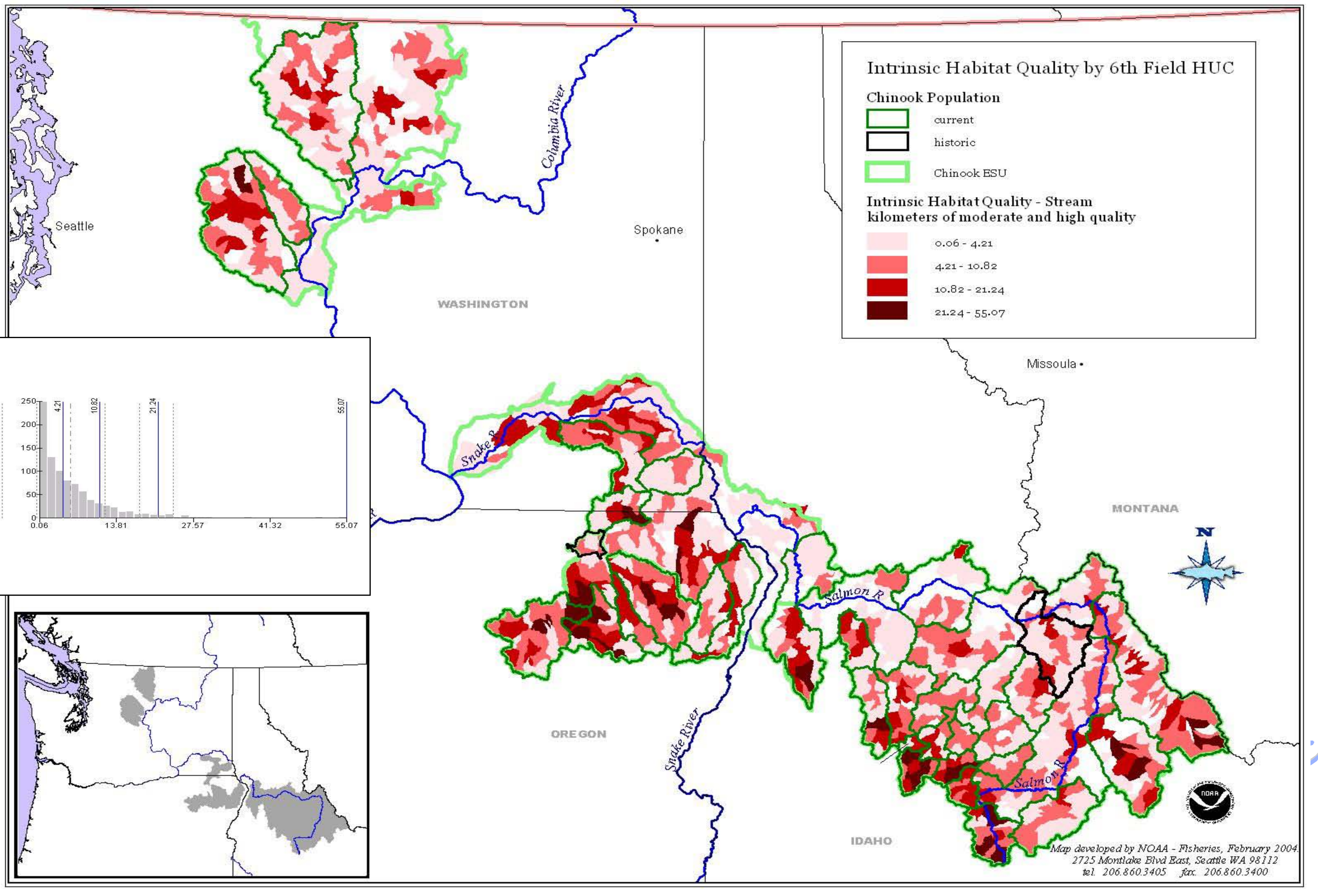
- Upper limits to spawning/rearing – Stream width, gradient breaks
  - Stream width less than 3 m
  - Gradient change greater than 20% over a 200m segment
- Temperature – Assumed that peak weekly average water temp of 22 deg C or higher prohibits rearing – Calculated water temperature based on basin wide data set, regression on elevation

PRELIMINARY RESULTS





Chinook Suitability -
Upper Salmon River
Chinook Suitability
unsuitable
low suitablility
moderate suitability
high suitability
SRCHA
MFBIG
SFMAI
SRNFS
SRPAN (historic)
MFLMA
MFCAM
SFEFS
MFUMA
MFSUL
MFLOO
SRLEM
SRYFS
SRLMA
SRPAH
MFBEA
MFMAR
SRVAL
SREFS
SRUMA
Salmon River
Middle Fork Salmon River
Lemhi River
Pahsimeroi River

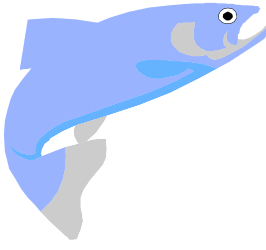


Intrinsic Habitat Quality by 6th Field HUC
Chinook Population
current
historic
Chinook ESU
Intrinsic Habitat Quality - Stream kilometers of moderate and high quality
0.06 - 4.21
4.21 - 10.82
10.82 - 21.24
21.24 - 55.07
Seattle
Spokane
Missoula
Columbia River
Snake R
Salmon R
Snake River
WASHINGTON
OREGON
IDAHO
MONTANA
N
0.06
13.81
27.57
41.32
55.07
Map developed by NOAA - Fisheries, February 2004
2725 Montlake Blvd East, Seattle WA 98112
tel. 206.860.3405 fax. 206.860.3400

Abundance/capacity

- Total spawners (geo. mean, last five yrs) < 500
- Compare “capacity rating” between current distribution and intrinsic potential (<75%)

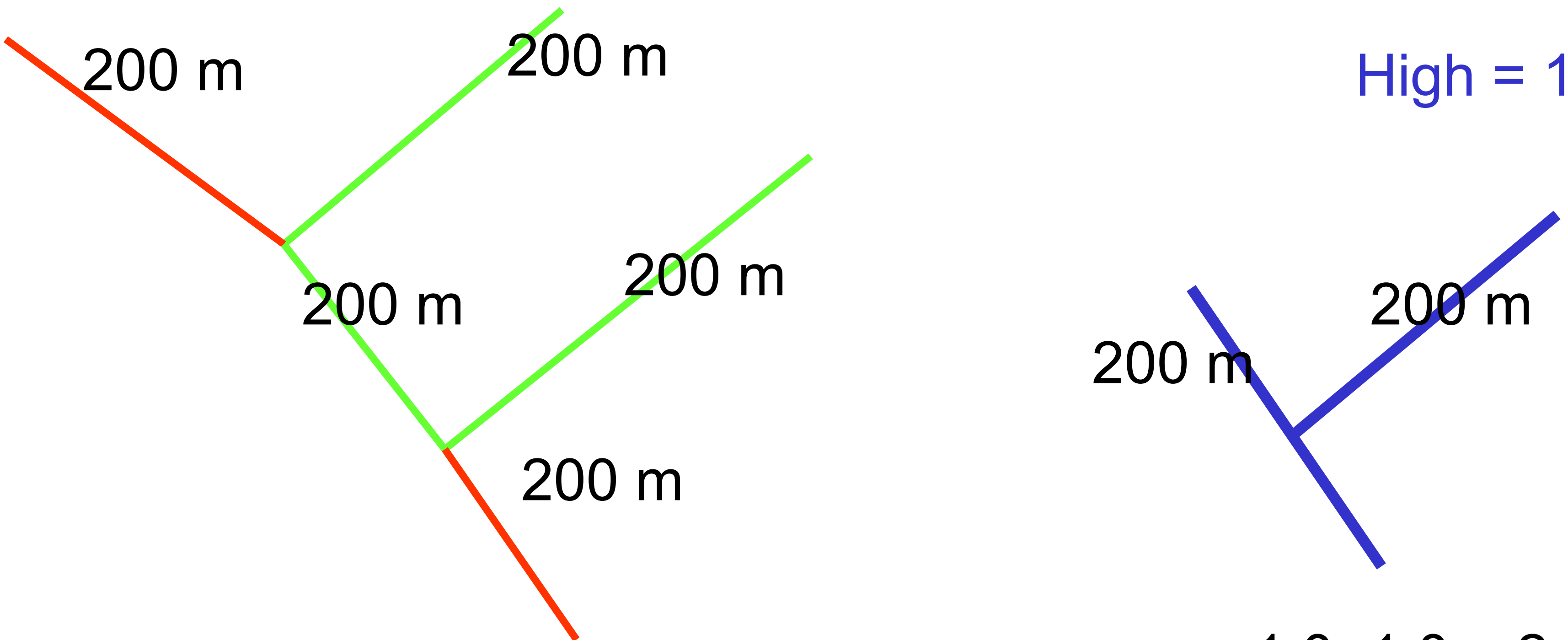
PRELIMINARY RESULTS



Low = 0.25

Medium = 0.5

High = 1.0



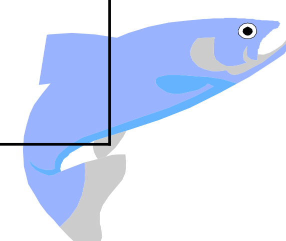
0.5+0.5+0.5+0.25+0.25 = 2.0

1.0+1.0 = 2.0

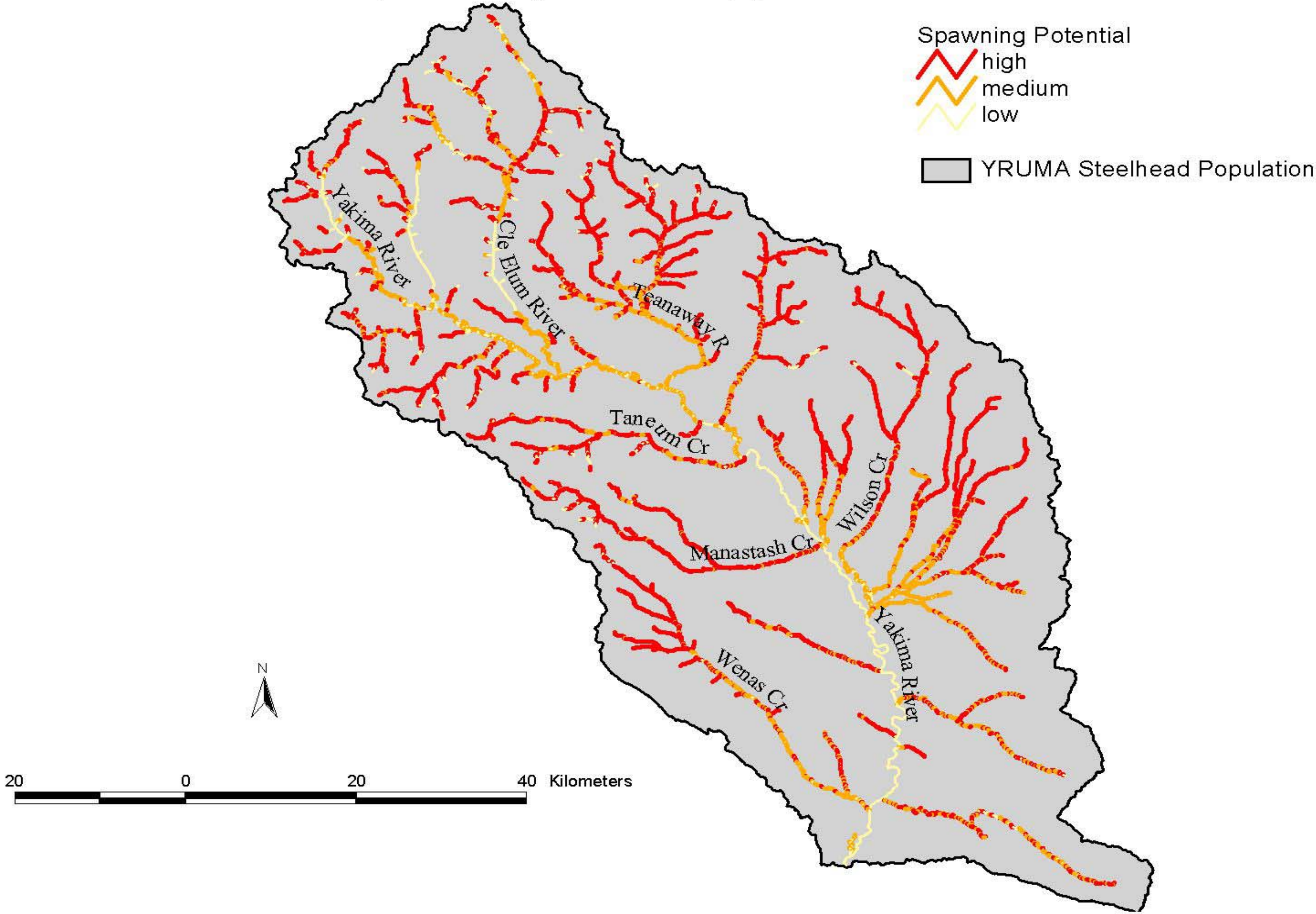
PRELIMINARY RESULTS

	Capacity Rating -- Steelhead Adults	
Population	*Intrinsic capacity rating*	*Current capacity rating*
Upper Yakima	1055	94
Naches	791	236
Satus-Toppenish	536	174

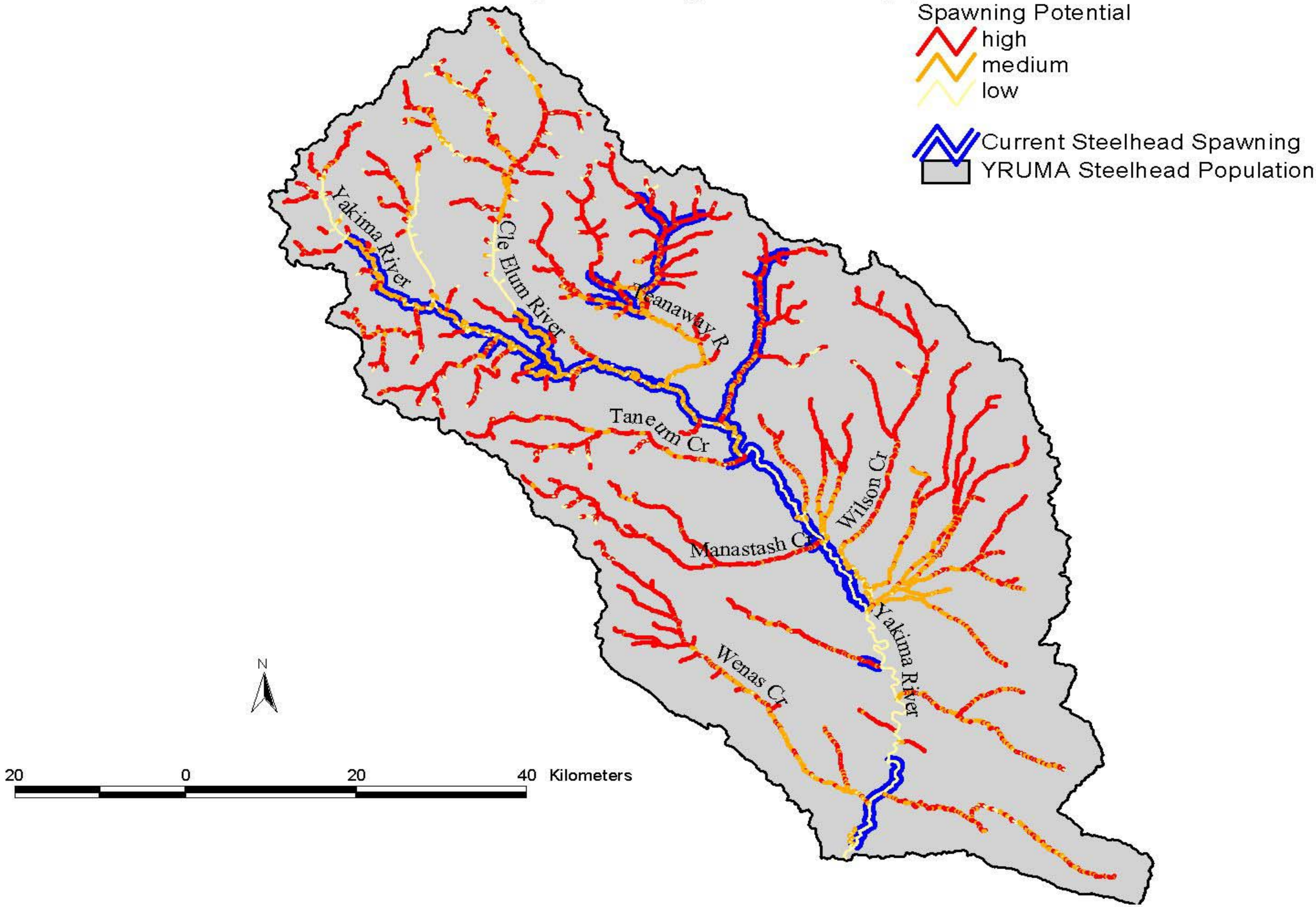
PRELIMINARY RESULTS



Potential Spawning in the Upper Yakima River



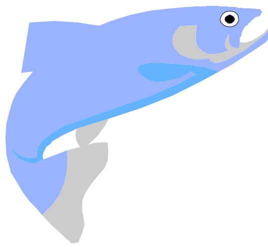
Current and Potential Spawning in the Upper Yakima River



Productivity

- Historic productivity/survival difficult (at best) to estimate
- Fallback criterion: viable populations have population growth rates >= 1.0; populations with lower growth rates need help
- Use 4 BRT metrics
  - Short-term trend, long-term trend, long-term lambda with and without hatchery fish

PRELIMINARY RESULTS



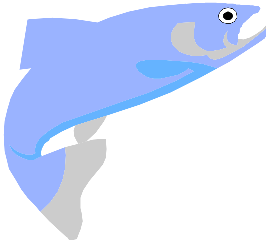
Spatial structure

- % of potential area currently occupied (<75%)

- Distribution of spawning areas (K-S test)

- Range of distances between spawning areas

PRELIMINARY RESULTS



Diversity

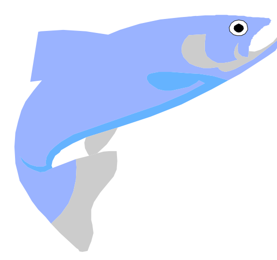
- Scoring system
  - EPA ecoregion
  - Intersection with either
    - » Current distribution (spawning)
    - » High and moderate rated reaches from intrinsic potential analysis
  - Weighting considers distribution

PRELIMINARY RESULTS

Diversity Scores -- Current

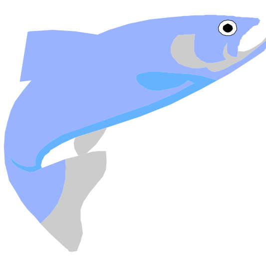
	Chiwaukum Hills and Lowlands	Grand Fir Mixed Forest	N. Cascades Highland Forest	Pleistocene Lake Basins	W. Cascades Montane Highlands	Yakima Folds	Yakima Plateau & Slopes		Diversity Score
Satus/Toppenish				5.1		66.2	28.7		5
Naches		29.6		29.6	5.9	28.5	6.3		8
Upper Yakima	54.7		7.0	24.1		10.2	4.0		8

PRELIMINARY RESULTS

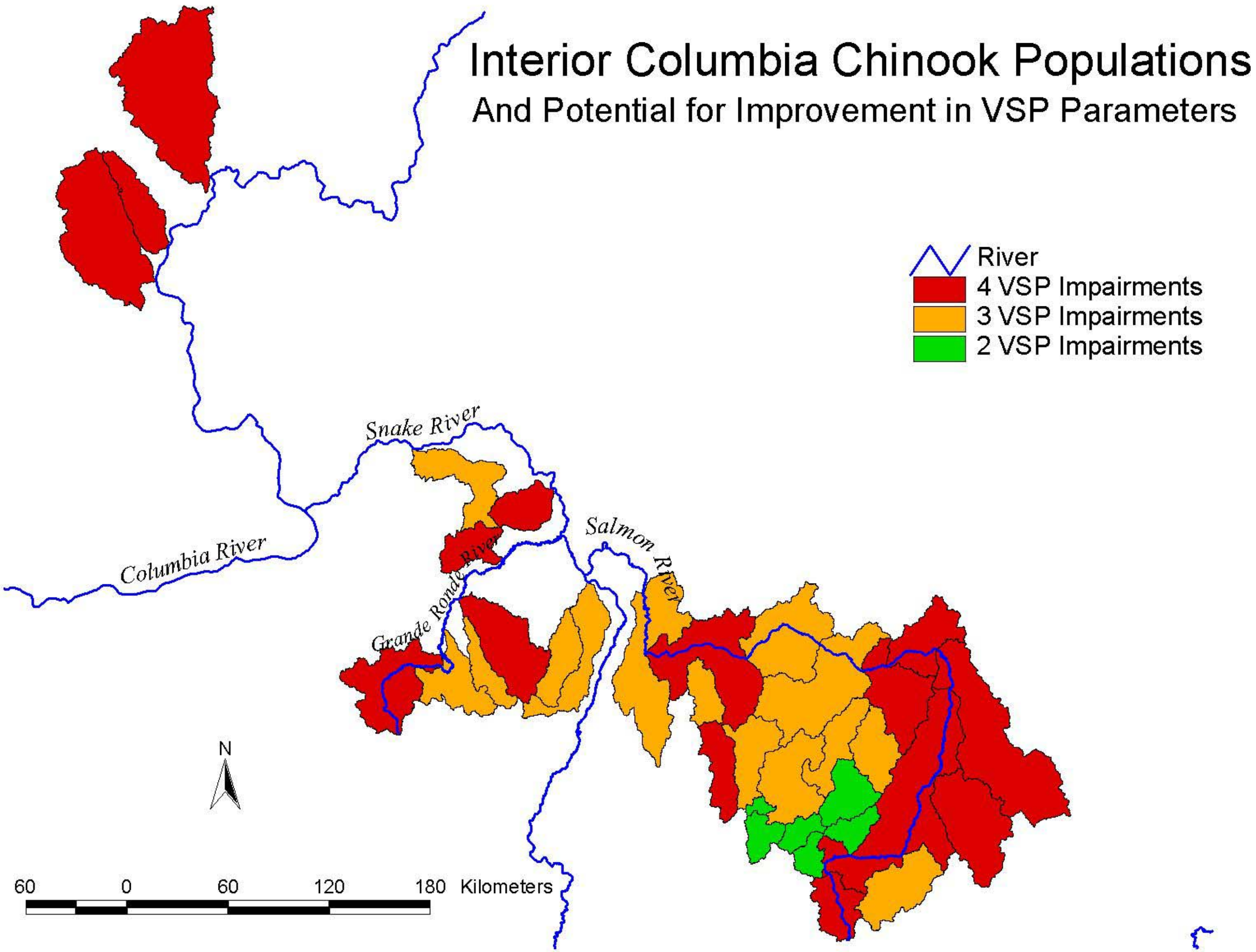


	Spatial Structure		Diversity		
Chinook Populations	*Dist'n Network Distances*	*% Area Currently Utilized*	*Historic*	*Current*	*Difference*
Satus/Toppenish		66.7	7	5	2
Naches		85.7	9	8	1
Upper Yakima		40.0	11	8	3

PRELIMINARY RESULTS



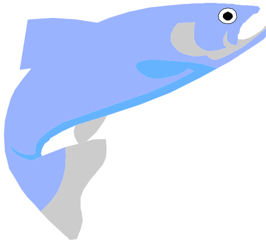
Current population status



Categorizing populations

- Habitat impacts
- Current status
- Intrinsic potential

PRELIMINARY RESULTS

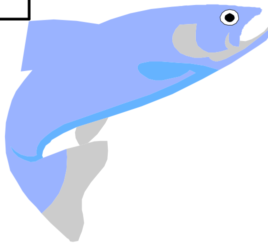


Less poor status; low habitat impact

ESU	Extreme only	Moderate and Extreme
Snake River Spring/summer chinook	Bear Valley Creek	Bear Valley Creek
	Loon Creek	Loon Creek
	Marsh Creek	Marsh Creek
	Sulphur Creek	Sulphur Creek
	Yankee Fork***	
Upper Columbia Chinook	None	None

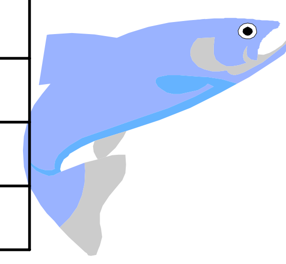
***factors not considered in our analysis affect this population

PRELIMINARY RESULTS



Low habitat impact; variable status

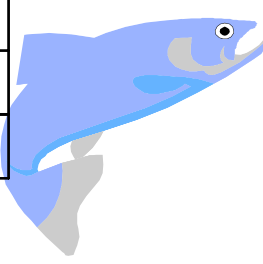
ESU	Extreme only	Moderate and Extreme
Snake River Spring/summer chinook	Minam River	Bear Valley Creek
	Wenaha River	Loon Creek
	Imnaha River	Marsh Creek
	EF South Fk Salmon R	Sulphur Creek
	SF Salmon River	Lower Mid. Fk Salmon
	Secesh River	Upper Mid. Fk Salmon
	Big Creek	Chamberlain Creek
	Bear Valley Creek	
	Loon Creek	
	Marsh Creek	
	Sulphur Creek	
	Lower Mid. Fk Salmon	
	Upper Mid. Fk Salmon	
	Chamberlain Creek	
	Pahsimeroi River	
Upper Columbia Chinook	None	None



Highly compromised habitat

ESU	Extreme only	Moderate and Extreme
Snake River Spring/summer chinook	Catherine Creek	Catherine Creek
	Wallowa-Lostine	Wallowa-Lostine
		Upper Grande Ronde
		Asotin Creek
		Tucannon River
		Lemhi River
		Upper Salmon (lower)
		Little Salmon River
		North Fork Salmon
		Upper Salmon (upper)
		Valley Creek
Upper Columbia Chinook		Entiat River
		Methow River
		Wenatchee River

PRELIMINARY RESULTS



Additional categories

- Minimally to moderately compromised, poor population status
- Compromised habitat factors restricted to instream flow and/or diversion entrainment, poor population status

PRELIMINARY RESULTS

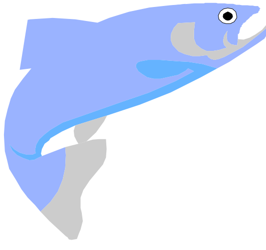
Life Cycle Modeling -- Context

1. Biological feasibility

2. Potential for trade-off between effort in freshwater habitat vs. estuarine habitat.

3. Bounds to improvement in estuary

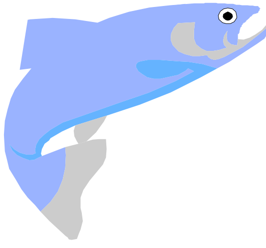
PRELIMINARY RESULTS



SRSS Chinook Model

- Density dependent
  - Beverton-Holt relationship (freshwater life stage)
- Stochastic
  - In third year = below Bonneville to 3rd birthday (ocean conditions)
  - In freshwater – based on B-H relationship
- ESU rather than population

PRELIMINARY RESULTS



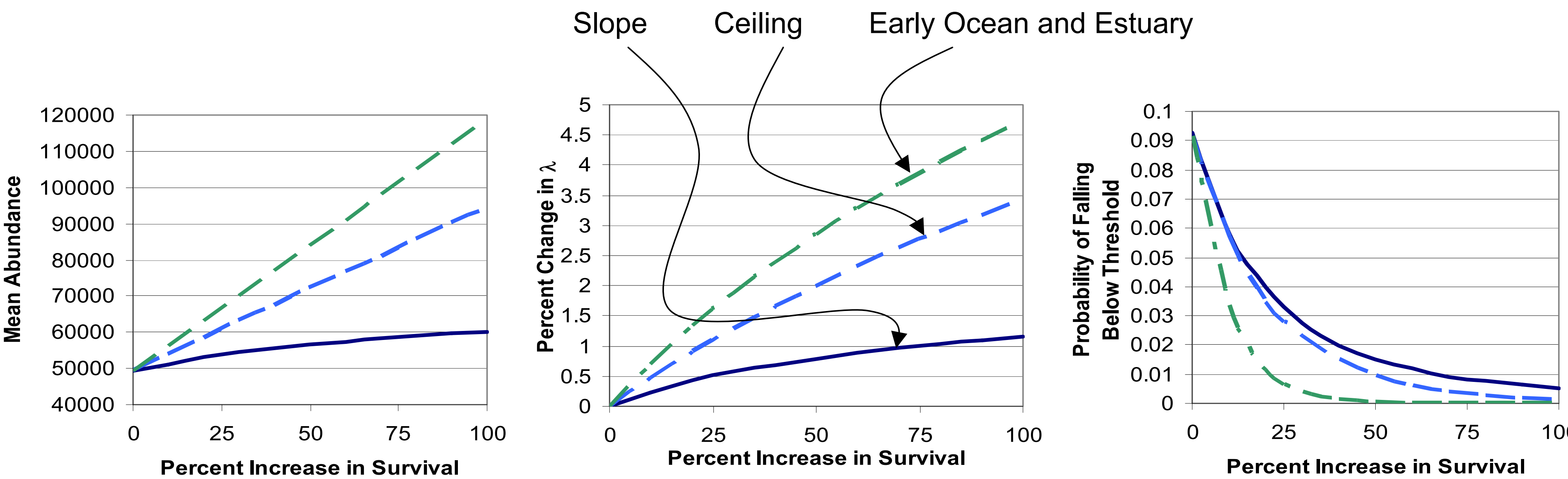
Sensitivity analysis

- Increase third-year (estuary and nearshore ocean) survival
- Increase slope of B-H relationship
- Increase ceiling

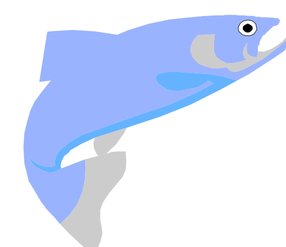
PRELIMINARY RESULTS

Trade-off – freshwater vs. estuary/early ocean

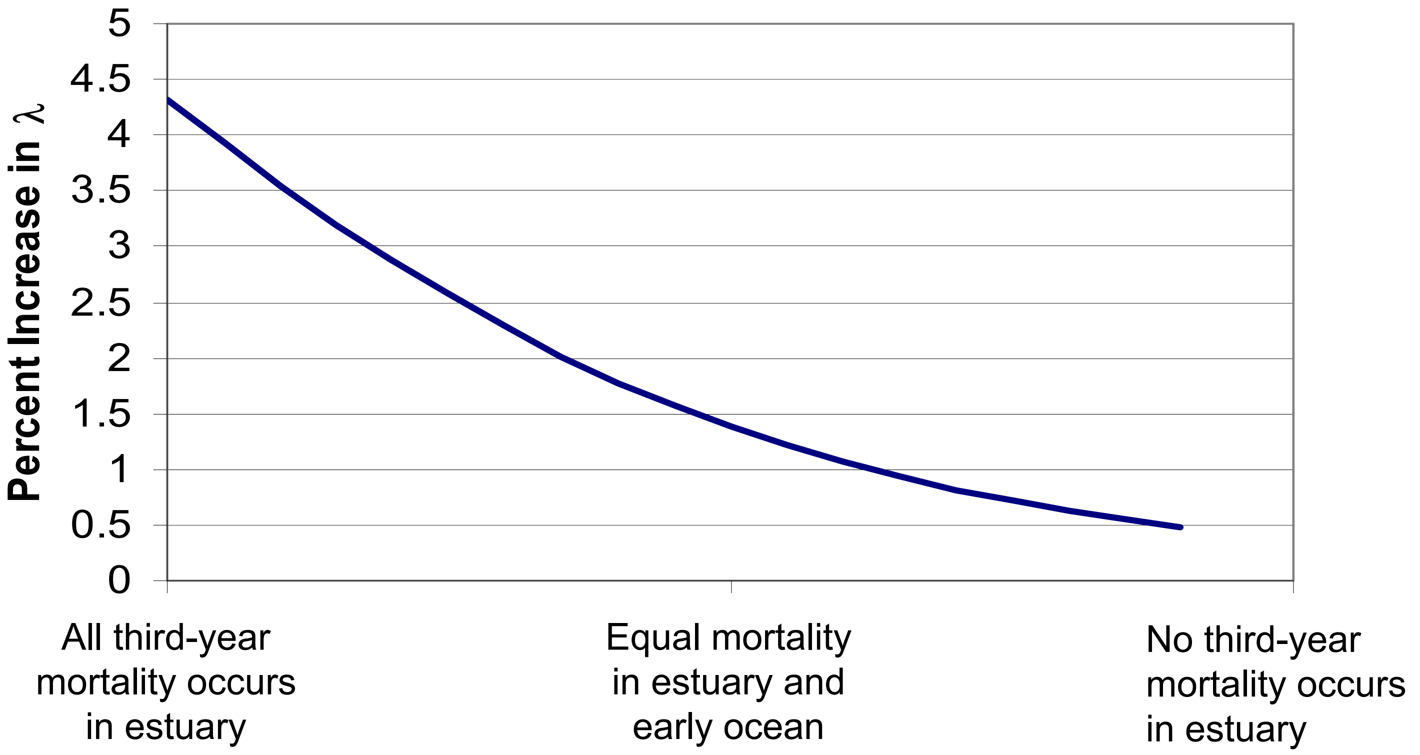
(and biological feasibility)



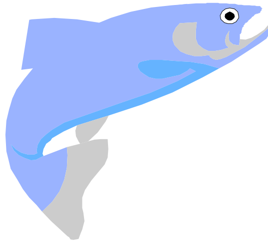
PRELIMINARY RESULTS



Bounds to improvement in estuary



PRELIMINARY RESULTS



Next steps

- Integrate estuary component
- Complete and refine life-cycle modeling
  - Additional ESUs
- Accuracy assessment for habitat work

PRELIMINARY RESULTS