Economics and Salmon Habitat Conservation: Welcome to the Data-Poor Real World

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The views expressed in this presentation are those of the author alone, and do not reflect the official or other views of the National Marine Fisheries Service.

Economics and the Endangered Species Act: Like Oil and Water?

- Economics prohibited: Listing (and delisting) decisions.

  "Economic considerations have no relevance to determinations regarding the status of species."

- Economic data required: Recovery planning (but silent on economic analysis)

  "Estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal."

- Economic analysis required (!): Critical habitat designation

Designating Critical Habitat under the ESA

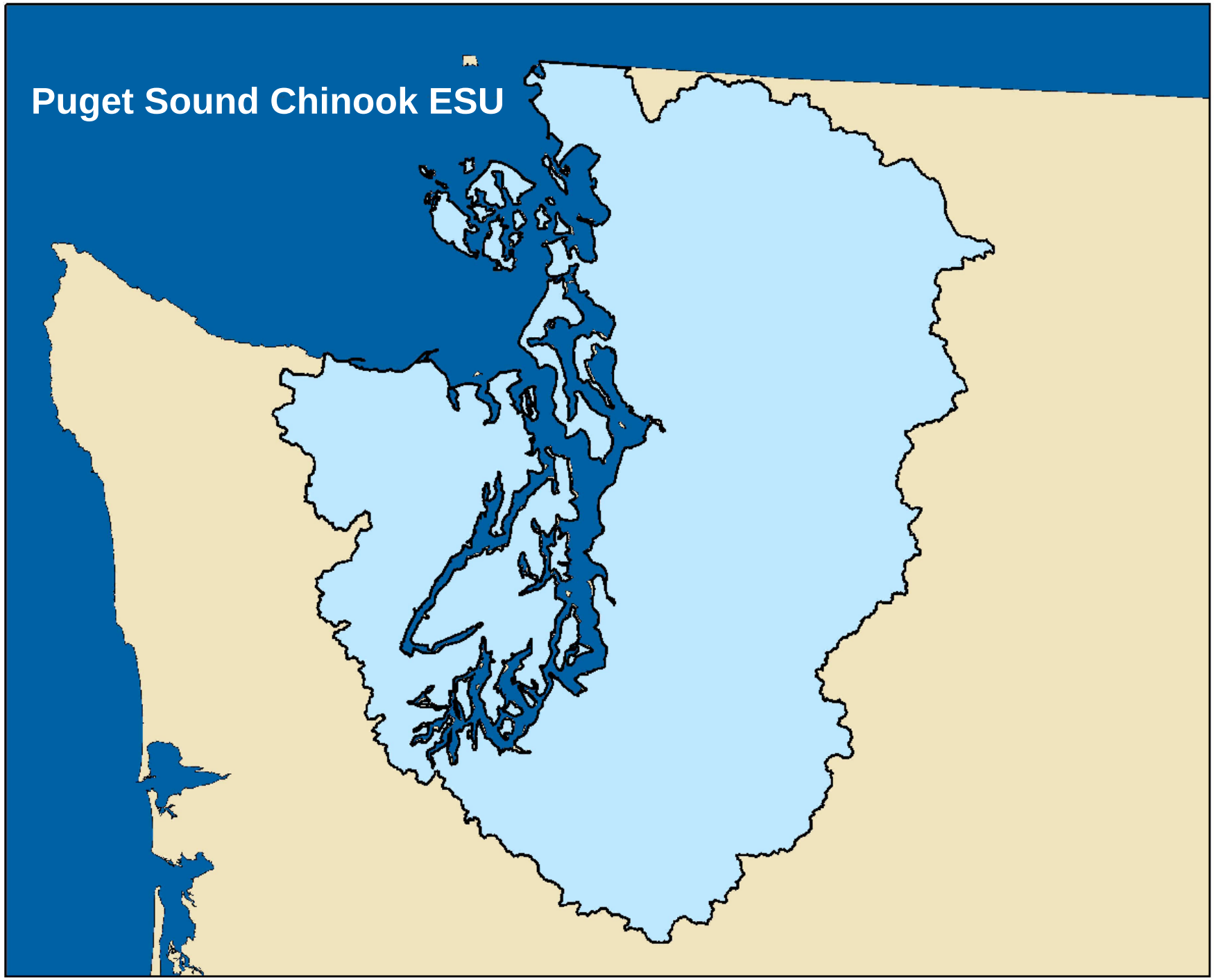
- Section 3(5)(A): Identify areas that qualify as potential critical habitat
- Section 4(b)(2): Designate "particular areas" from among those that qualify:
  - Mandatory: Secretary **shall** take into consideration "the economic impact, the impact on national security and any other relevant impact, of specifying any particular area as critical habitat"
  - Discretionary: Secretary **may** exclude any area if "the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat."

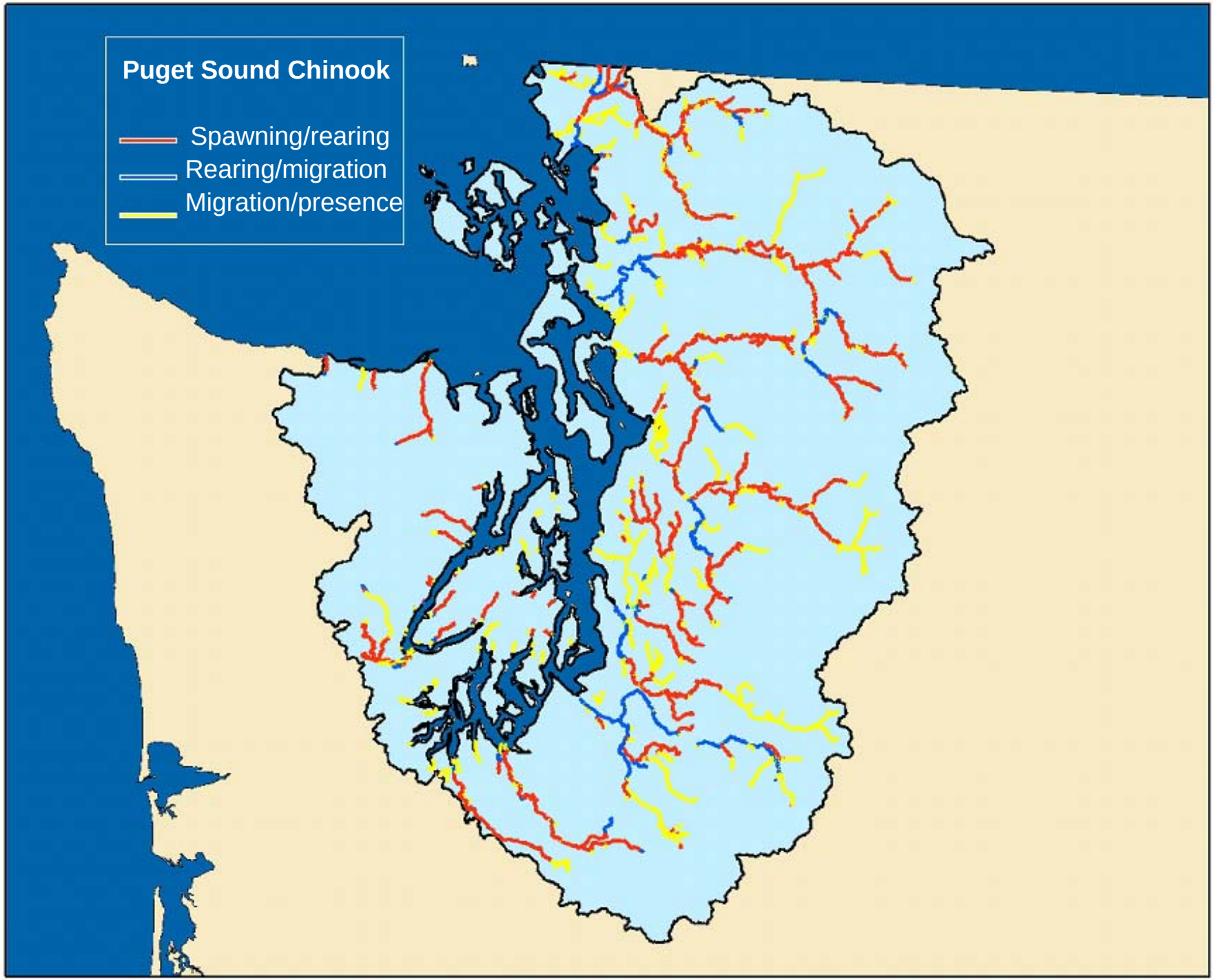
Designation of Critical Habitat: West Coast Salmon and Steelhead

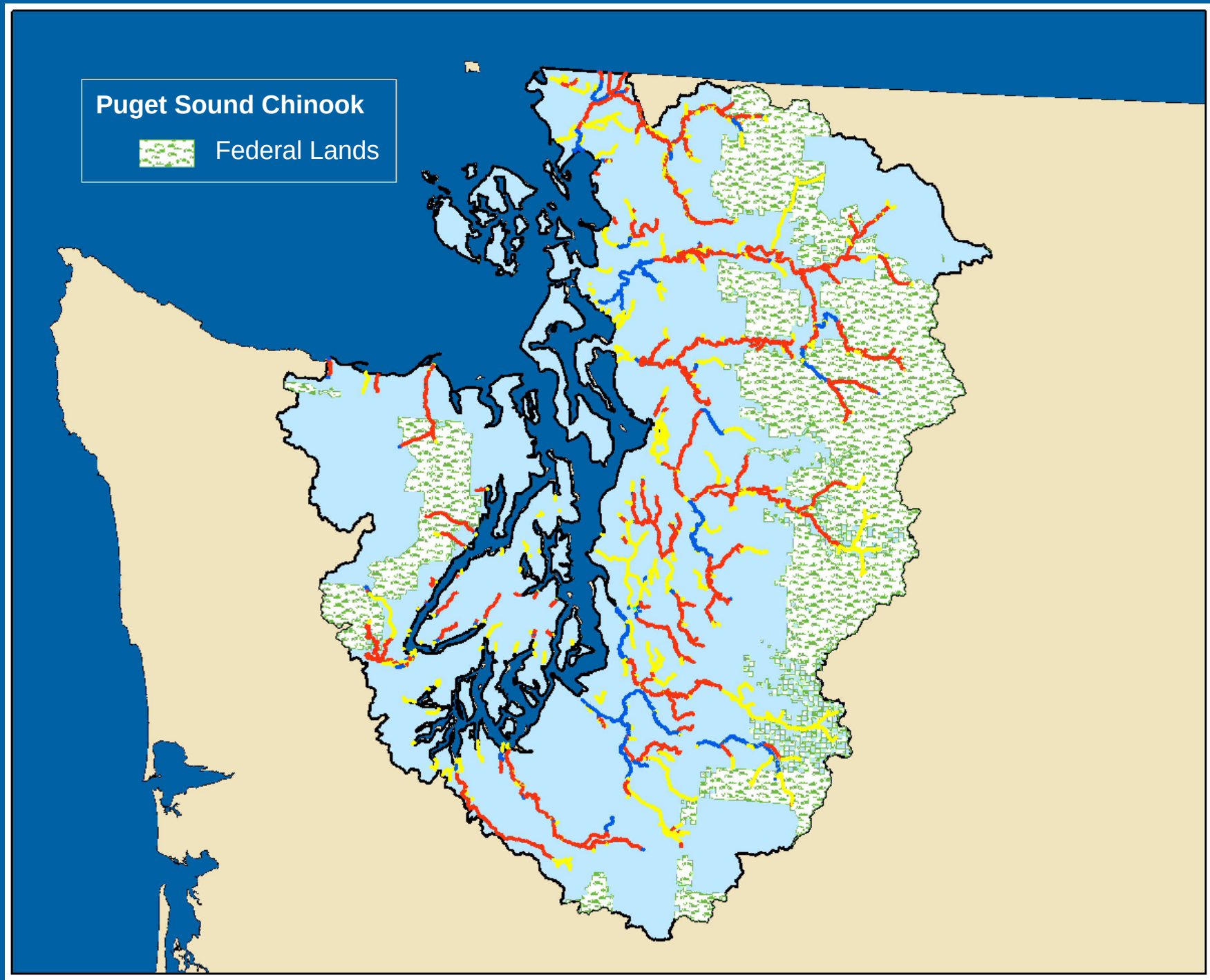
- Under the ESA, salmon and steelhead are listed as "evolutionarily significant units", or ESUs
- 52 West Coast ESUs of salmon and steelhead, 26 of which are listed under the ESA as threatened or endangered.
- In 2000, National Marine Fisheries Service (NMFS) designated critical habitat for 19 ESUs, was sued, and lost. Critical habitat designations were rescinded.
- In 2002, NMFS set out to re-designate critical habitat for 20 (later reduced back to 19) ESUs.

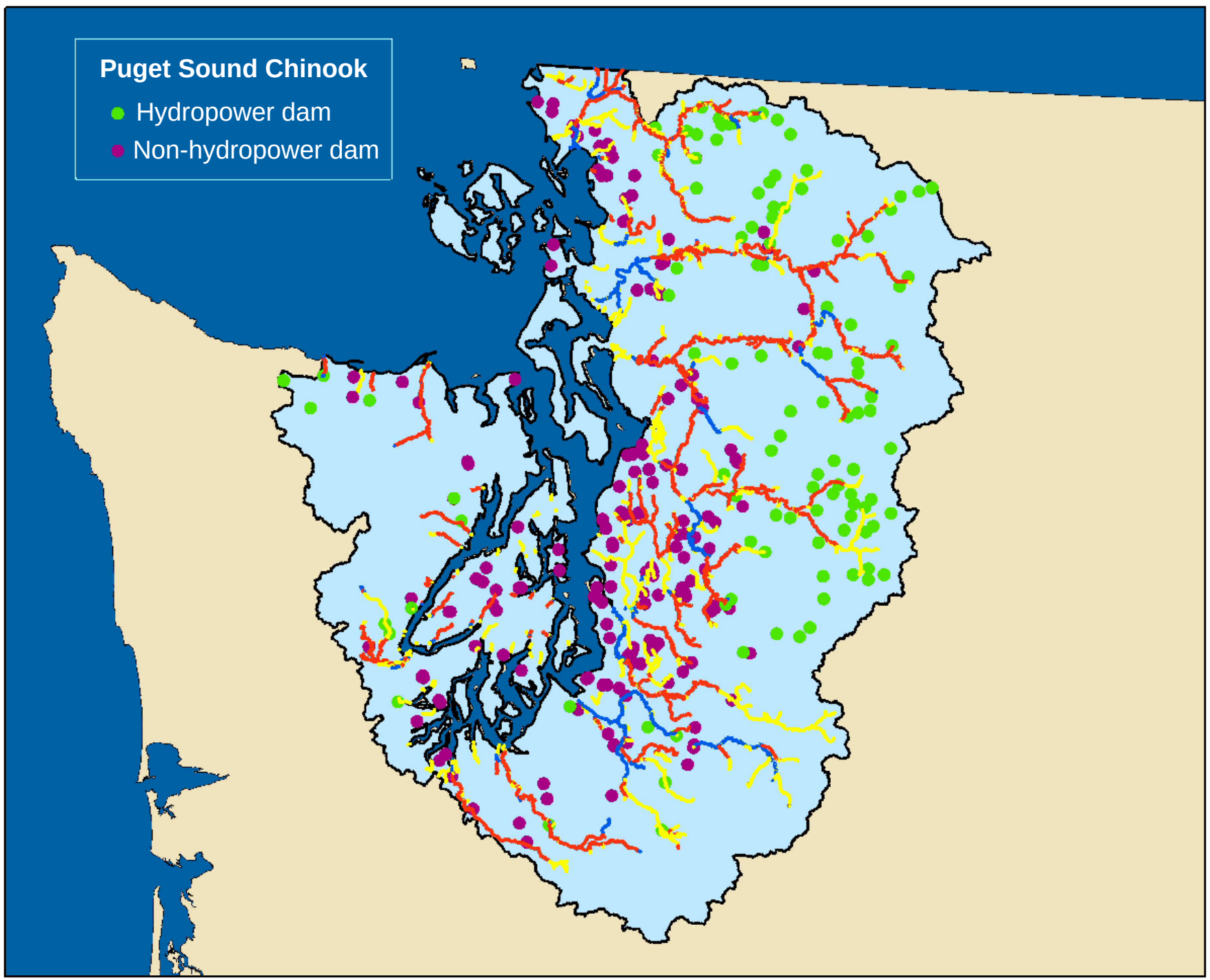
Designating Critical Habitat under the ESA: Effects of Critical Habitat Designation

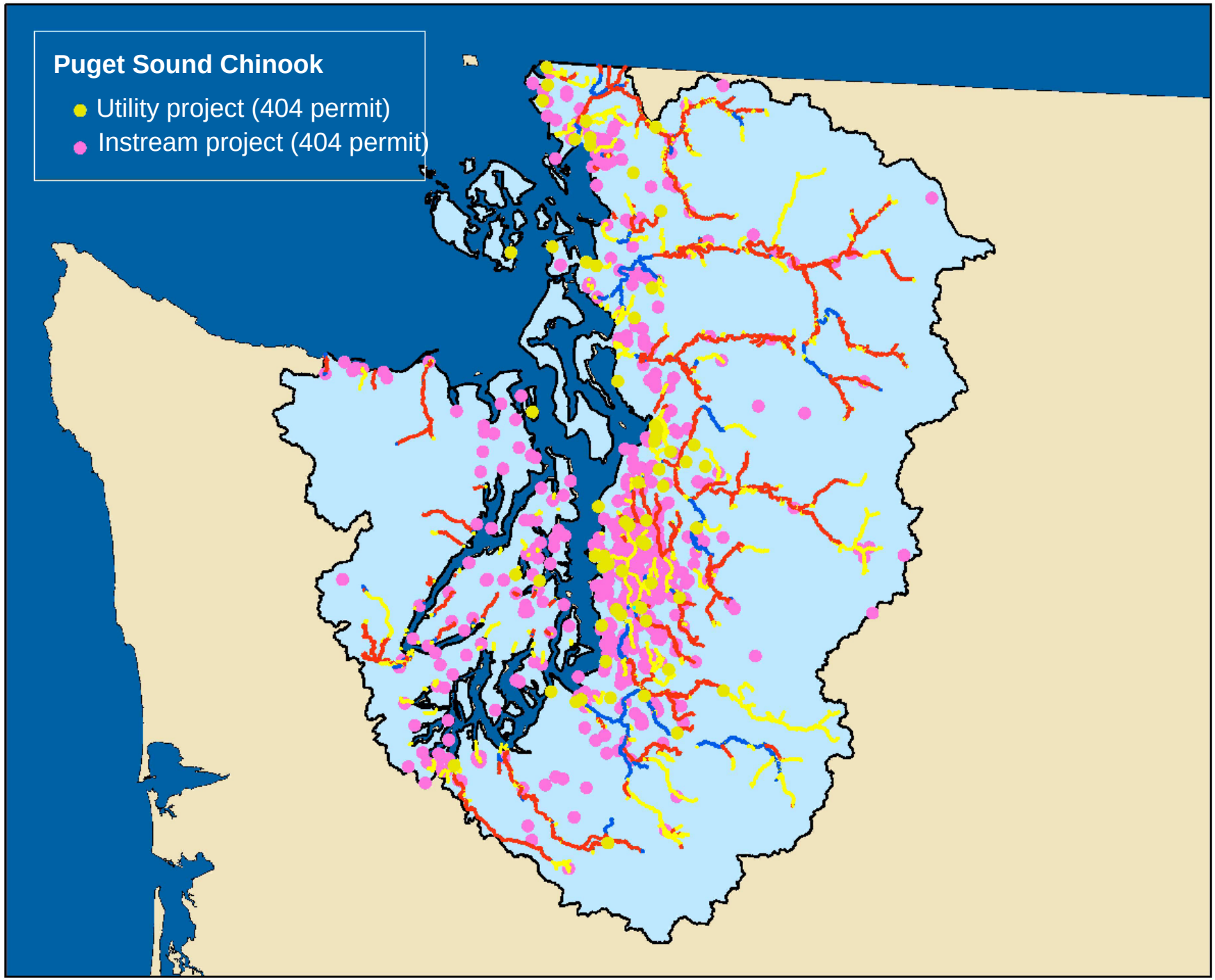
- Section 7(a)(2): Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. Covers federal agencies' own actions and private actions permitted/funded by federal agency


Puget Sound Chinook ESU


Puget Sound Chinook
Spawning/rearing
Rearing/migration
Migration/presence


Puget Sound Chinook
Federal Lands

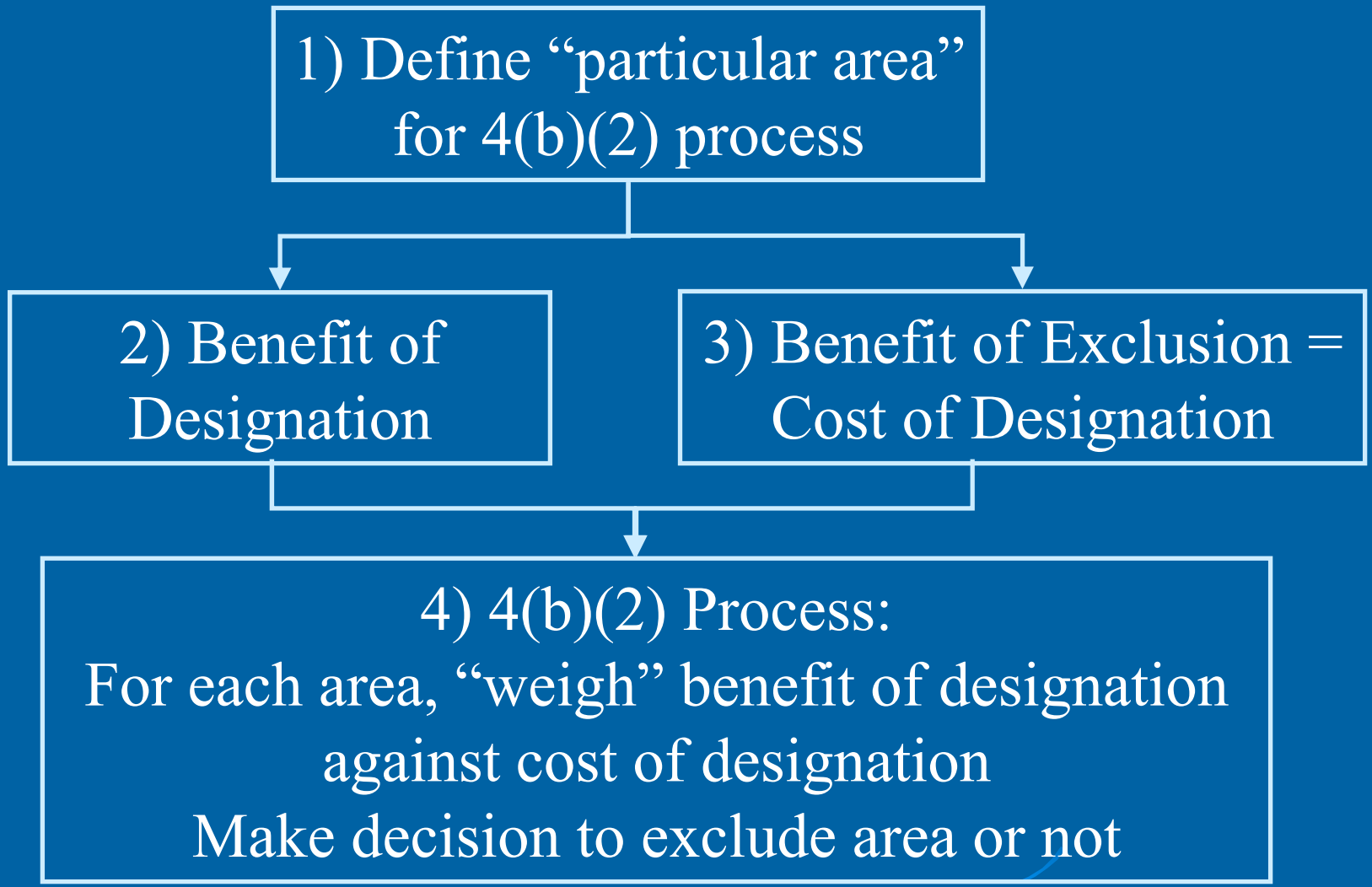

Puget Sound Chinook
Hydropower dam
Non-hydropower dam


Puget Sound Chinook
Utility project (404 permit)
Instream project (404 permit)

Implementing Section 4(b)(2): Decision-support Framework

- Goal: Create a decision-support framework that
  - Integrates biological and economic on the "benefits of inclusion" and the "benefits of exclusion"
  - Establishes and respects the dividing line between scientific analysis and policy decision-making
  - Produces a critical habitat designation that could withstand legal challenge

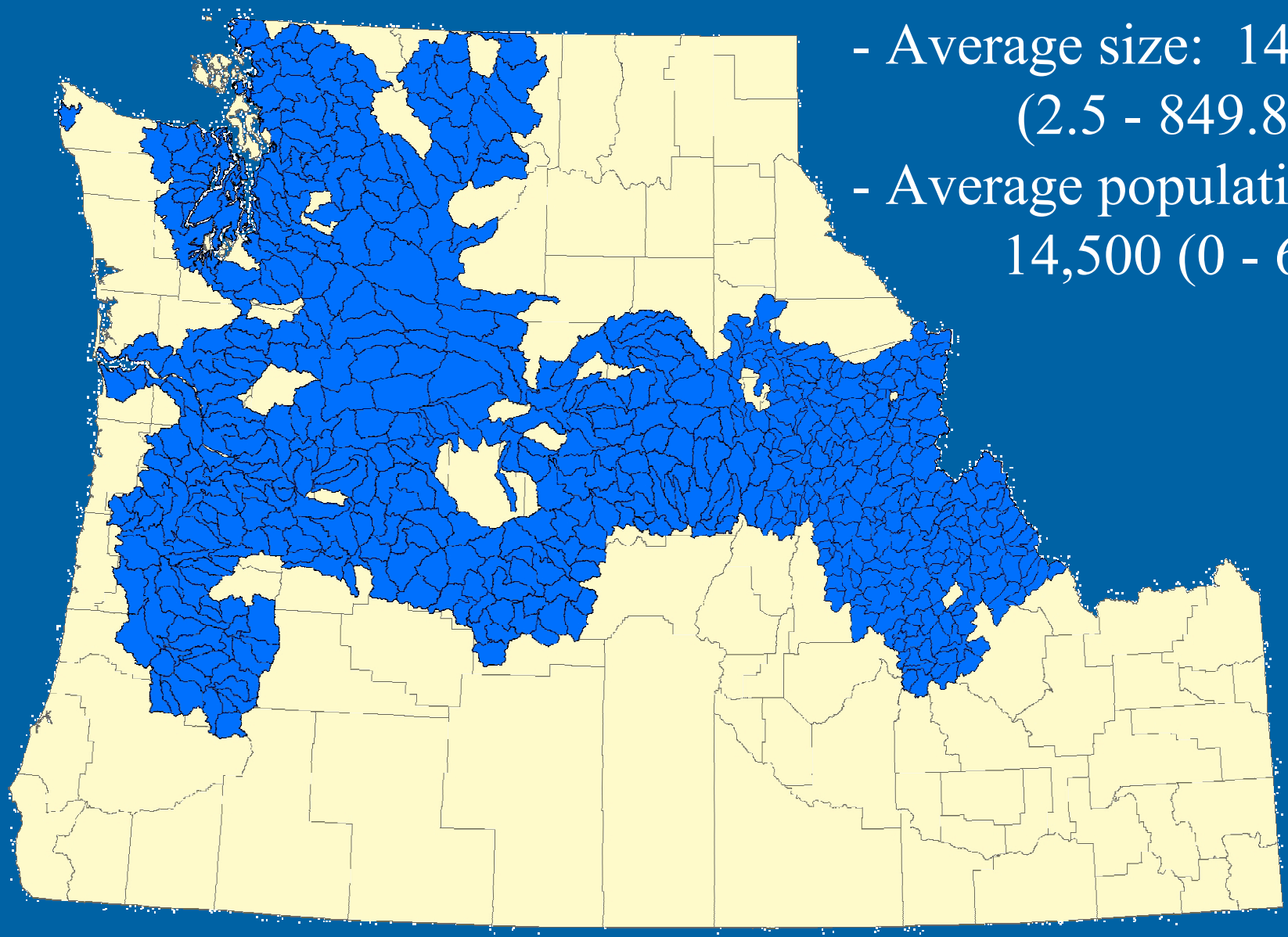
Decision Framework for West Coast Salmon and Steelhead CH



1) Particular Area

- 4(b)(2) process operates at the level of a particular area, not at the level of the designation as a whole
- For West Coast salmon and steelhead, "particular area" defined as a HUC5 watershed
  - Complication: ecological boundaries ≠ economic/legal boundaries
  - Sheer number of watersheds adds to difficulty

NW Salmon and Steelhead watersheds



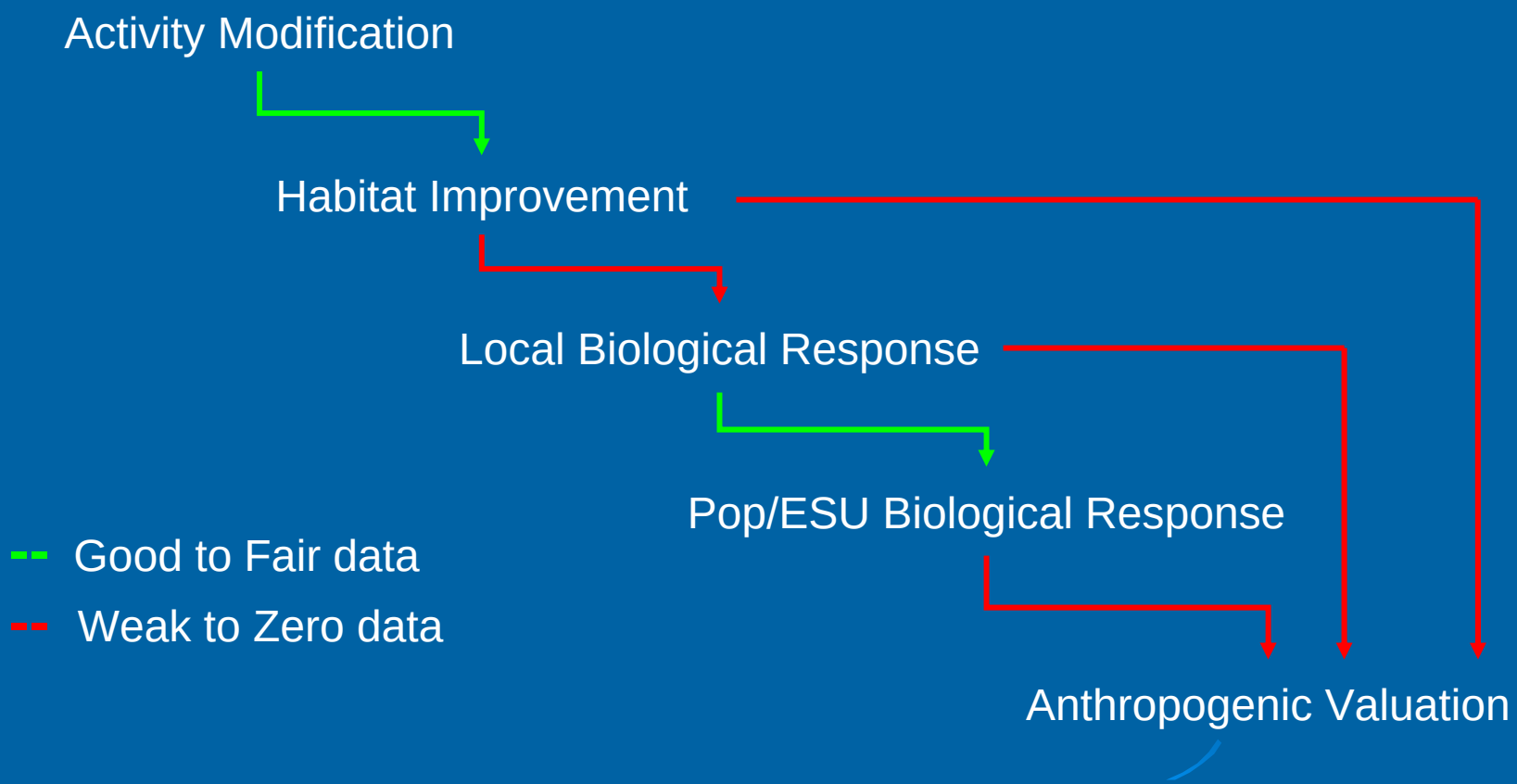
- 685 watersheds
- Average size: 145.9 mi^2 (2.5 - 849.8 mi^2)
- Average population: 14,500 (0 - 642,240)

2) Benefit of Designation: Theoretical Approach (Economics)

- Benefit ($) of designation:
  1. Quantify biological response
     - Salmon and steelhead
     - Other natural systems
  2. Quantify anthropogenic response linked to biological response
     - Commercial and recreational fishing
     - Happiness (reduced extinction risk)
     - Other (non-salmon) recreation, ecotourism, decreased global warming, etc.
  3. Attach $-values to anthropogenic response
     - Market values (commercial harvest, commercial water recreation)
     - Non-market use values (e.g., recreational harvest, non-market water recreation)
     - Existence and other non-use values

2) Benefit of Designation: Data Problems

- Major Problem: Lack of data



2) Benefit of Designation: Practical Approach (Biology)

- Critical Habitat Analytical Review Team (CHART)
- Three phase, rapid assessment approach

1. Assessment of available data
2. Generate watershed scores based on quantity and quality of primary constituent elements (PCEs), from section 3(5)(a) "physical or biological features"
3. Add additional considerations (e.g., migratory corridors), generate watershed rating (High, Medium, Low). Adjust rating downward in cases of "low leverage" (watersheds where federal activity is low, so little effect of designation).

2) Benefit of Designation: Watershed Scores

- Watershed scores used six factors:
  1. Quantity of PCEs
  2. Quality of PCEs
     a. Current condition
     b. Potential condition
     c. Support for rare life history/genetic, important habitat type
     d. Support for abundant populations
     e. Support for spawning/rearing

2) Benefit of Designation: Watershed Score Factors

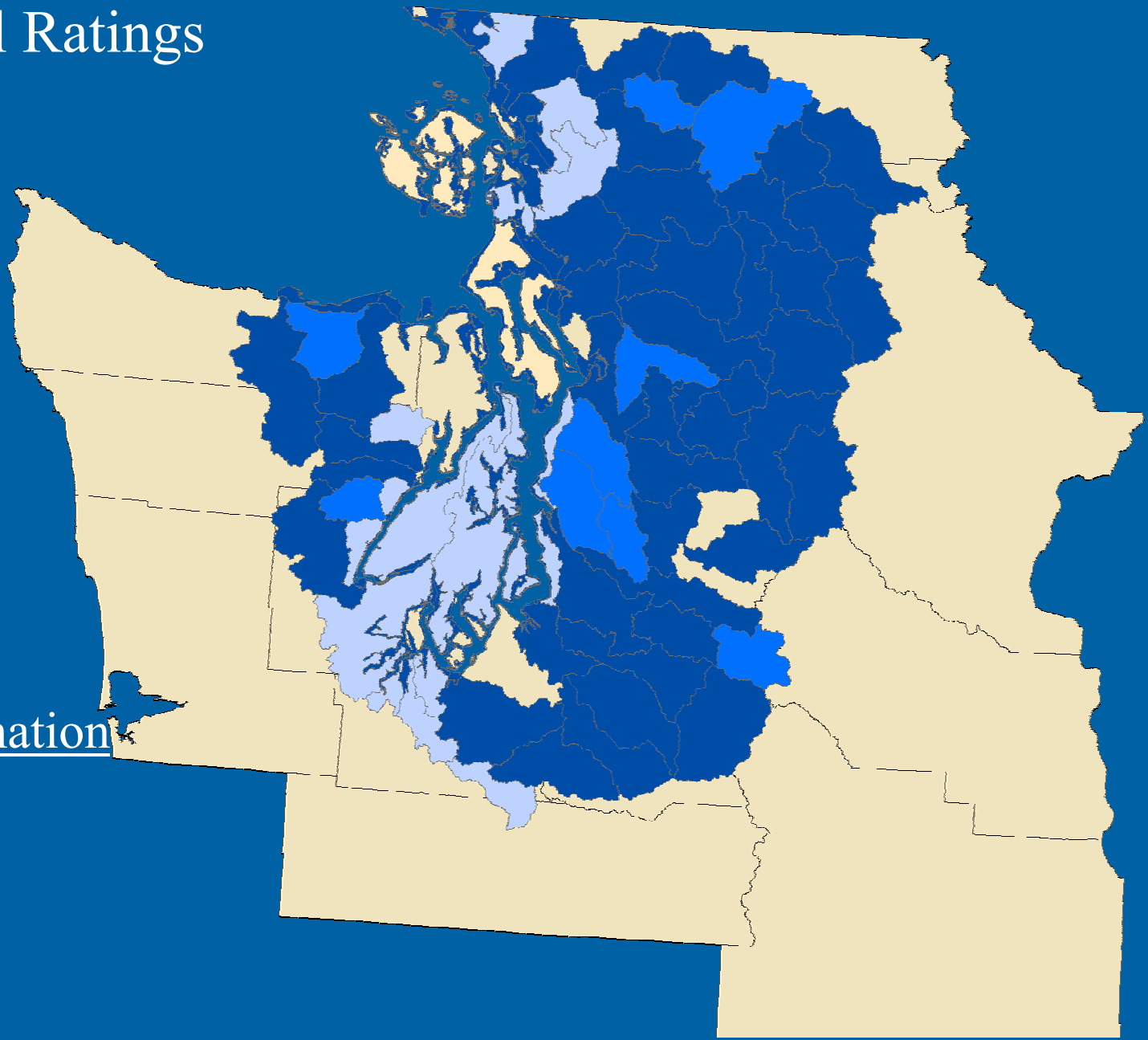
Factor 3: PCE Quality – Potential Condition	3 = PCEs in the HUC5 are highly functioning and are at their historic potential
	2 = PCEs in the HUC5 are reduced, but have high improvement potential
	1 = PCEs in the HUC5 may have some improvement potential
	0 = PCEs in the HUC5 have little or no improvement potential

2) Benefit of Designation: Biological Ratings

Puget Sound Chinook ESU Watersheds

Name	Watershed Score	Low Leverage?	Biological Rating
Bellingham Bay	4	No	Low
Samish River	7	No	Low
Birch Bay	5	No	Low
U. North Fork Nooksack River	13	No	High
M. Fork Nooksack River	9	No	Medium
S. Fork Nooksack River	14	No	High
Skagit River/Gorge Lake	16	No	High

Puget Sound Chinook ESU
Biological Ratings



Benefit of Designation

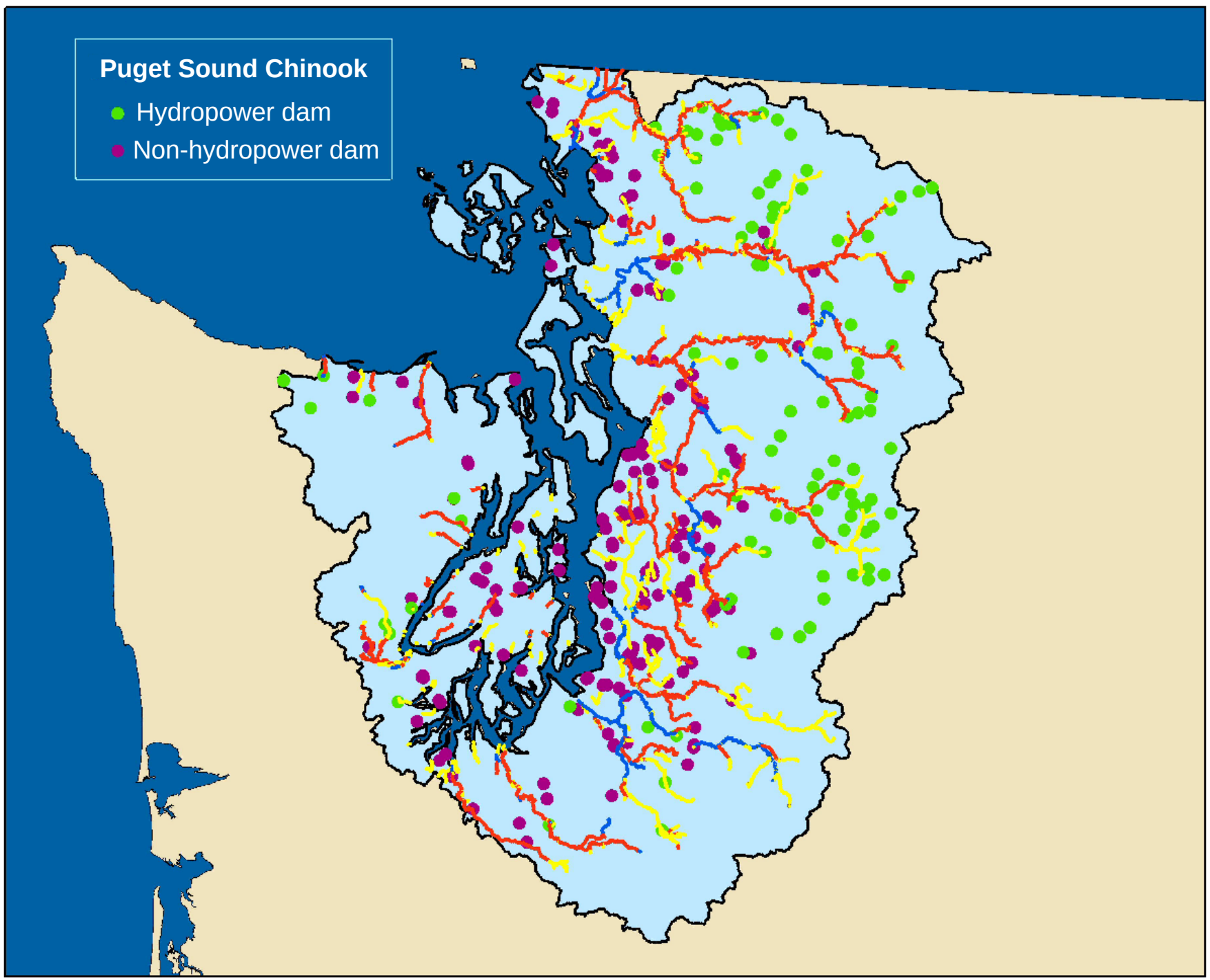
- High
- Medium
- Low

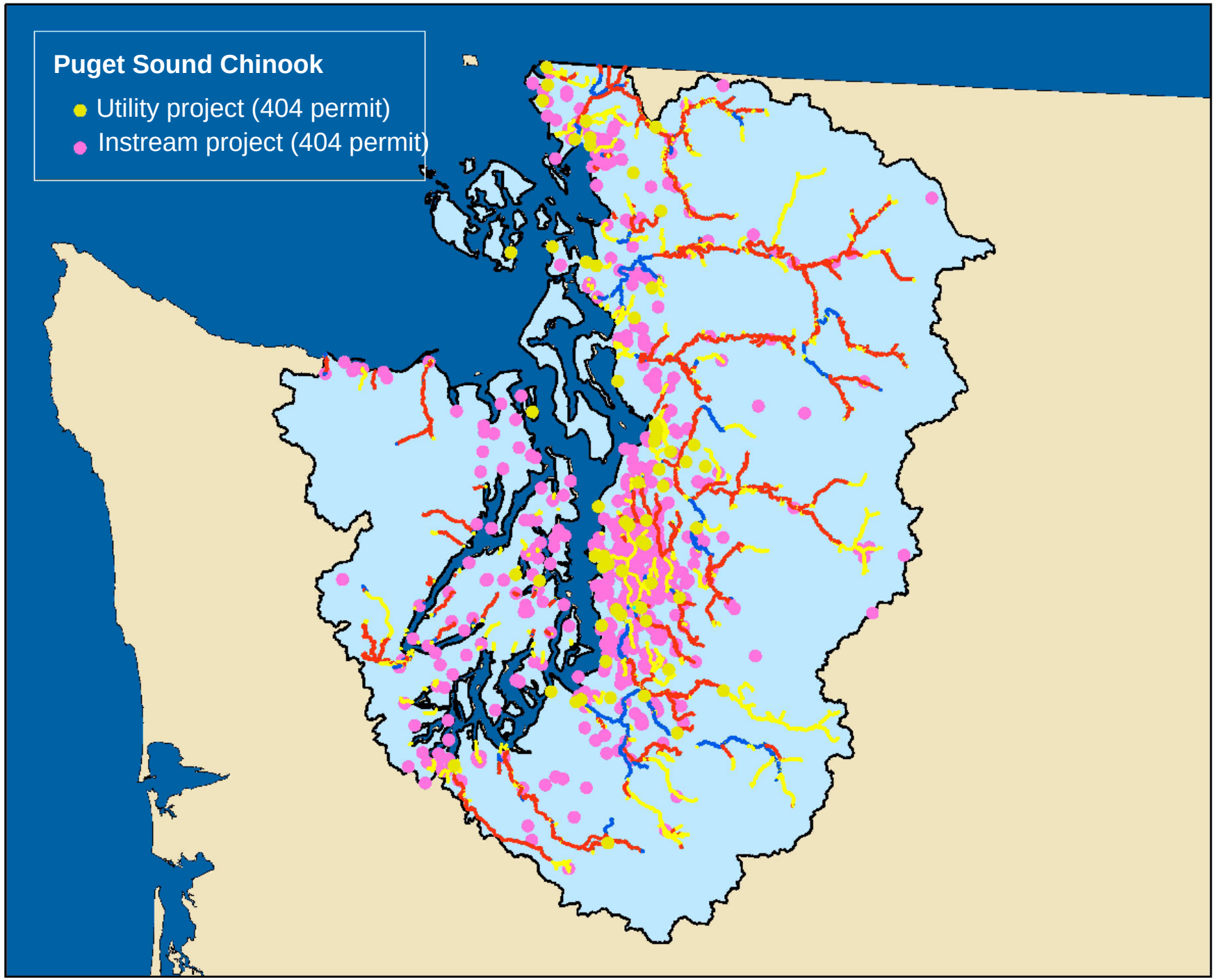
3) Cost of Designation: Theoretical Approach (Economics)

- Chain of logic
  - Impose CH restrictions for all federal activities that are located in or affect a particular area (watershed)
  - Allow adjustments to restrictions (move elsewhere, adjust scale, modify, etc.)
  - Allow adjustments by other activities to adjustments, etc.
  - Account for all changes at a national scale
- Tools: Computable General Equilibrium models, etc.

3) Cost of Designation: Practical Difficulties

- Designation imposes costs by requiring federal agencies to modify activities
- Activities are
  - Diffuse
  - Rarely have direct impact on market inputs or outputs (hydropower and irrigation water exceptions, but horrible data problems)
- Result: Lots of little (and sometimes not-so-little) costs spread across the landscape for which little project-specific data exist


Puget Sound Chinook
Hydropower dam
Non-hydropower dam


Puget Sound Chinook
Utility project (404 permit)
Instream project (404 permit)

3) Cost of Designation: Practical Approach (Economics)

- Identify types of federal activities covered by ESA and critical habitat designation
- Determine typical type and extent of impacts on these activities
  - Modifications necessary to comply with ESA
  - Cost of modifications
- Determine location and volume of activities
- Aggregate impacts up to watershed level

3) Cost of Designation: Types of Activities

- Hydropower dams (FERC)
- Non-hydropower dams (ACOE)
- Federal lands management, including grazing (Fed land agency)
- Transportation projects (FHA)
- Utility line projects (ACOE)
- Instream activities, including dredging (ACOE)
- EPA NPDES-permitted activities (EPA)
- Sand & gravel mining (ACOE)
- Residential and commercial development (EPA)

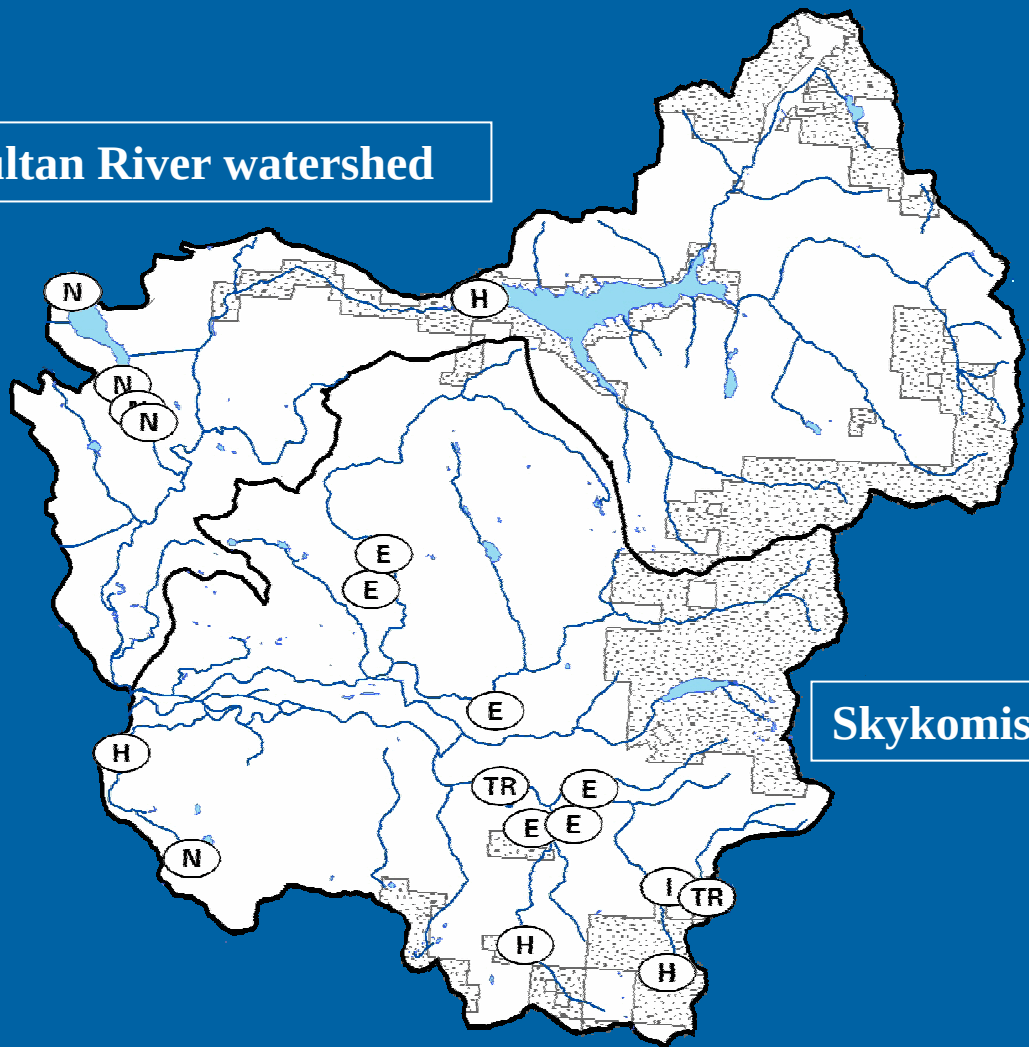
3) Cost of Designation: Estimating Costs of Impacts

- Costs of modifications estimated with a "unit-cost" approach
- Refined approach by
  - estimating per-unit cost by *type of activity* affected (*e.g.*, hydropower v. utility lines), *scale of activity* (big dams v. small dams), and *region* (WA, OR, ID)
  - accounting for *timing & probability* of impacts (*e.g.*, date of hydropower dam FERC licensing, probability of minor NPDES-permitted activity requiring modification)

Location and Volume of Activities

- Spatial data used to estimate location and volume of projects
  => Impacts associated with particular watershed

Sultan River watershed



H - Hydropower Dam
E - EPA NPDES Permit
I - Instream Project
N - Nonhydropower Dam
TR - Transportation Project
- Federal Land

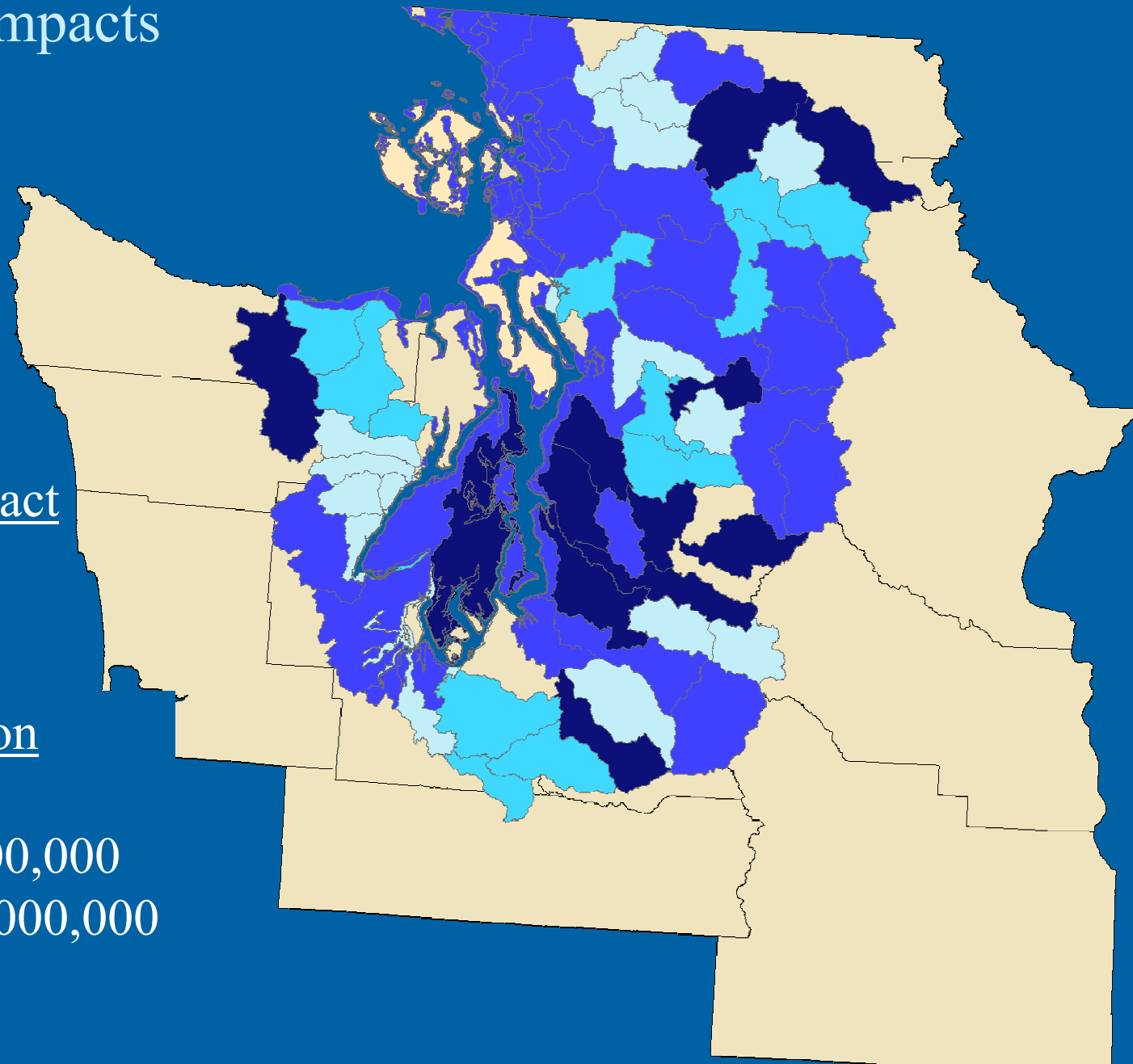
Skykomish River/Wallace River watershed

3) Cost of Designation: Annual Costs by Watershed

Puget Sound Chinook ESU Watersheds

Name	Annual Costs
Bellingham Bay	$306,869
Samish River	$382,905
Birch Bay	$261,546
U. North Fork Nooksack River	$403,583
M. Fork Nooksack River	$121,495
S. Fork Nooksack River	$129,709
Skagit River/Gorge Lake	$2,751,517

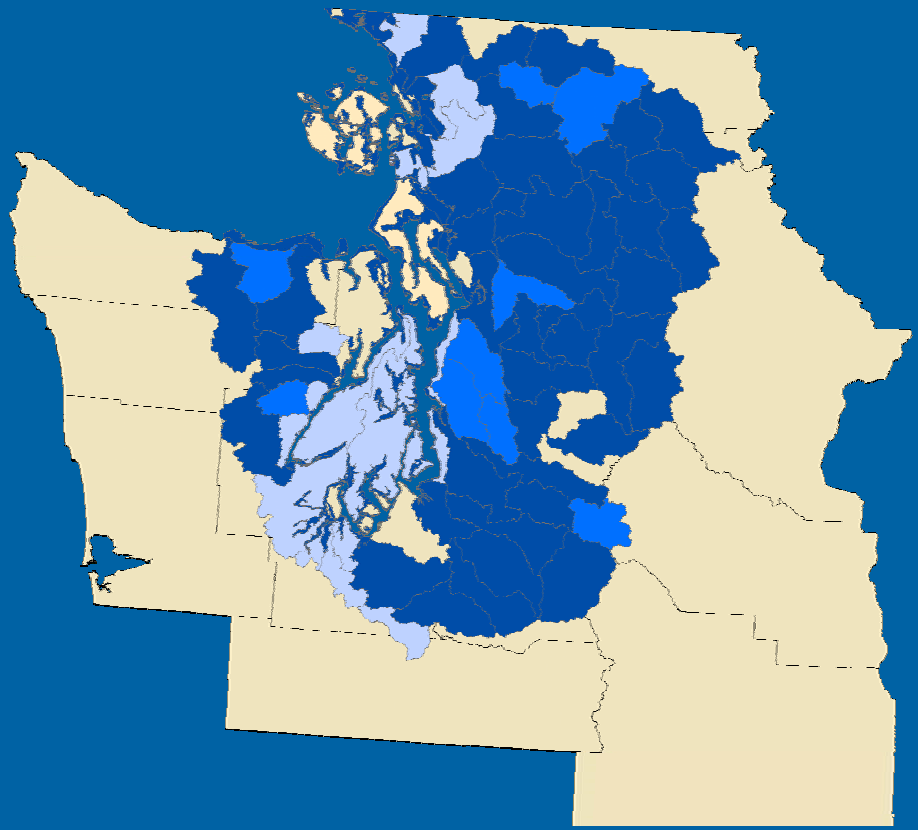
Puget Sound Chinook ESU
Economic Impacts



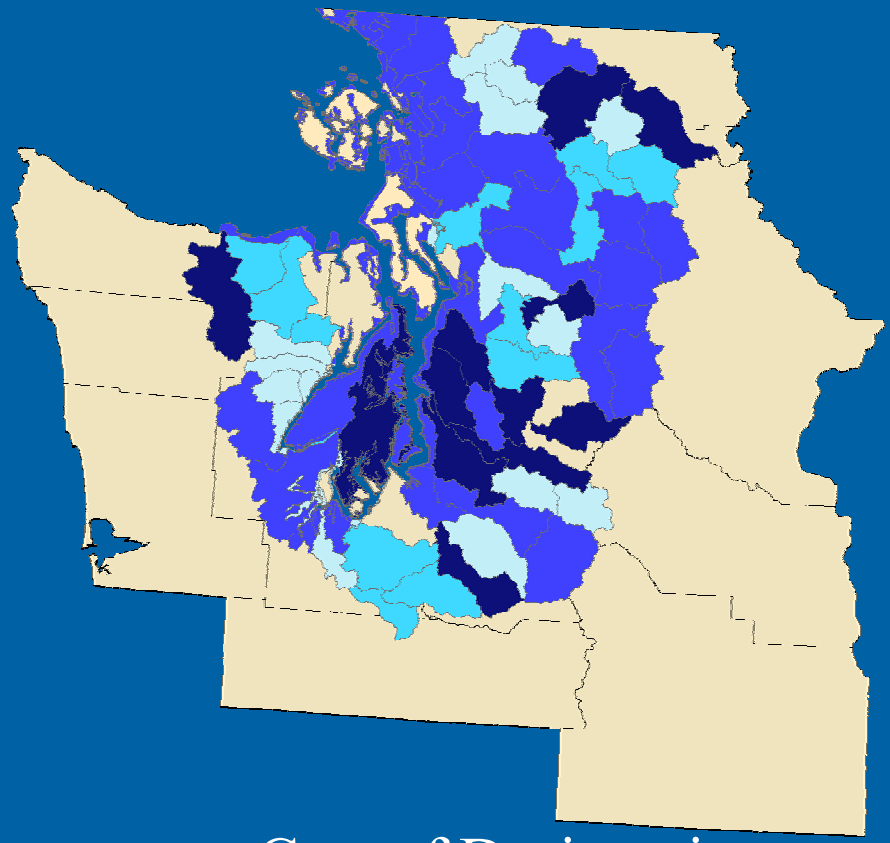
Total Annual Impact
$95.4 million

Cost of Designation
- < $250,000
- $250,000 - $500,000
- $500,000 - $2,000,000
- > $2,000,000

4) Weighing the Benefits and Costs of Designation



Benefit of Designation:
Biological Ratings



Cost of Designation:
Economic Impacts

4) Weighing the Benefits and Costs of Designation

- Normal approach:
  - Scientists work for decades, carefully crafting studies, gathering data, conducting analyses
  - Policymaker receives studies, data, analyses
  - Policymaker issues decision
  - Black box process – unclear how science was (or wasn't used), and whether a *change* in the science would have produced a *change* in the decision

4) Weighing the Benefits and Costs of Designation: NMFS Approach

- General philosophy:
  - Set priorities based on biological ratings and economic cost estimates
  - Consider areas with low conservation value and high economic cost for exclusion first, etc.
  - Do not exclude if "conservation" would be impeded (policy choice)

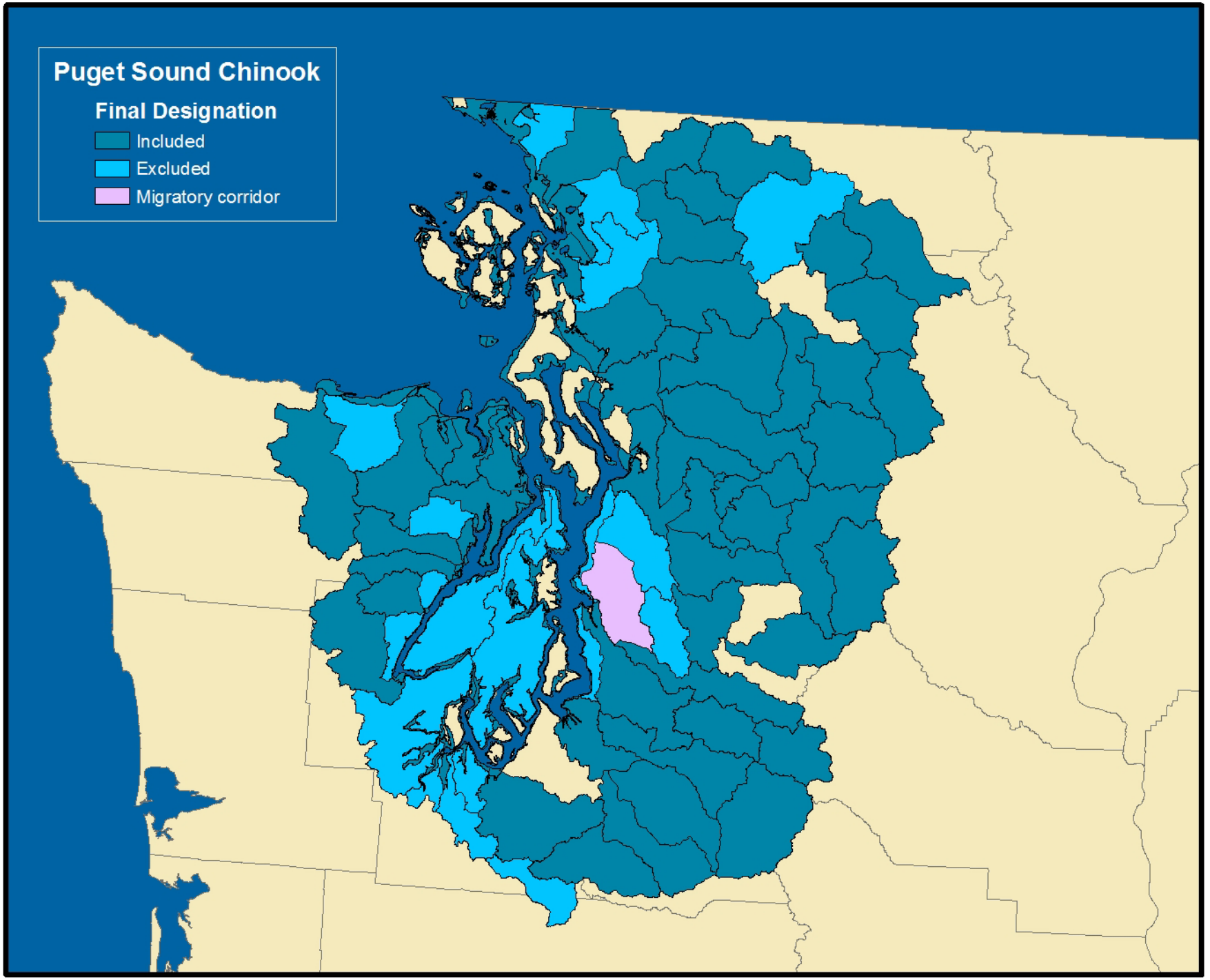
Biological Ratings and Economic Impacts

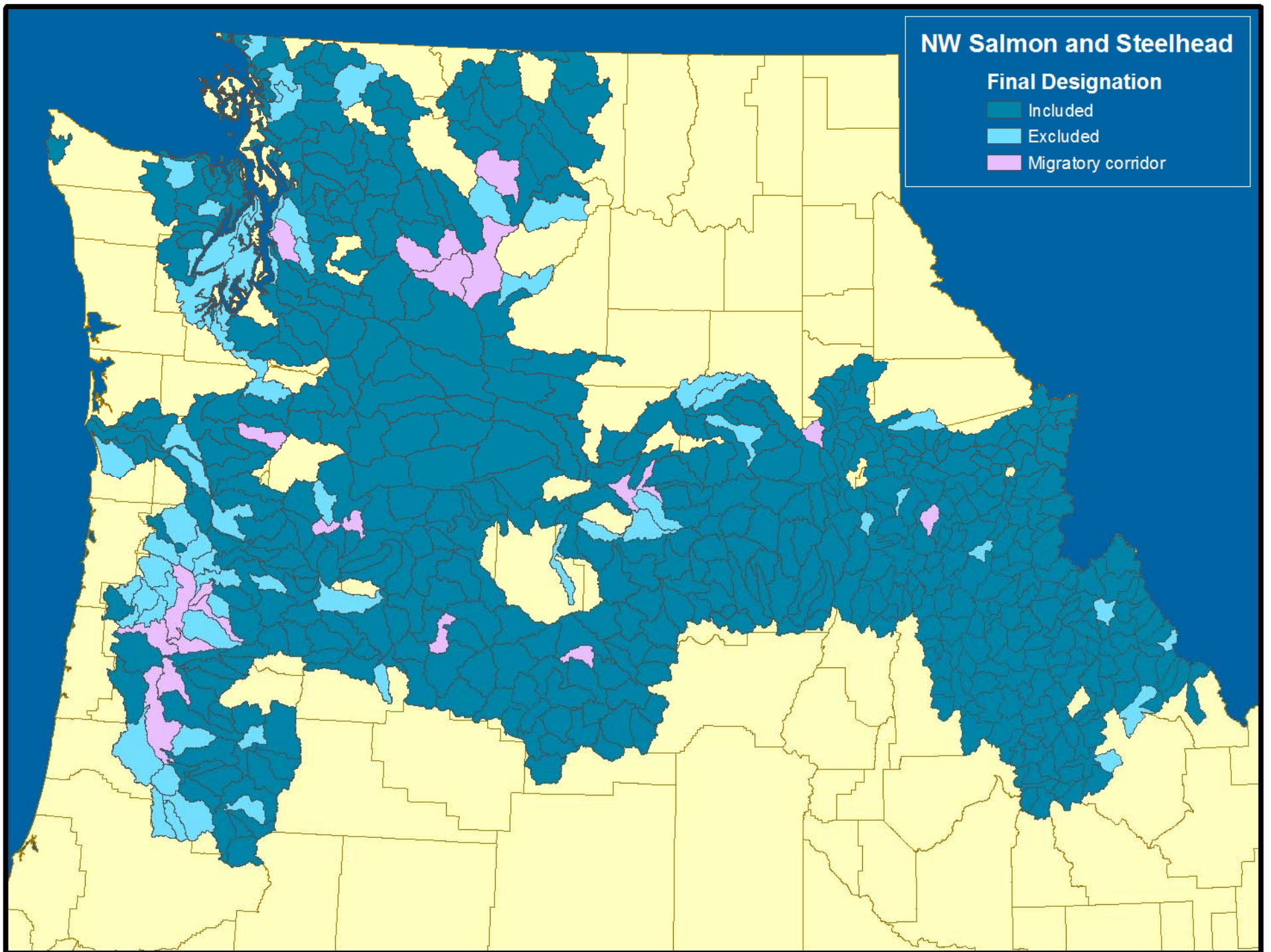
4) Weighing the Benefits and Costs of Designation: NMFS Approach

- Method for :
  - Set $-thresholds for each biological rating and apply decision rule:

    If $ impact > $ threshold => Consider for exclusion
    - Threshold represents dividing line between areas automatically designated as critical habitat and areas considered for exclusion
    - Threshold higher for higher biological ratings
    - Threshold is policy choice
  - Give biologists second chance to account for biological “synergies”

Thresholds for Exclusion Decision


Puget Sound Chinook
Final Designation
Included
Excluded
Migratory corridor


NW Salmon and Steelhead
Final Designation
Included
Excluded
Migratory corridor