

Iteration #2 Results

Fish Passage Modeling – EbF Anadromous Fish Sub Group

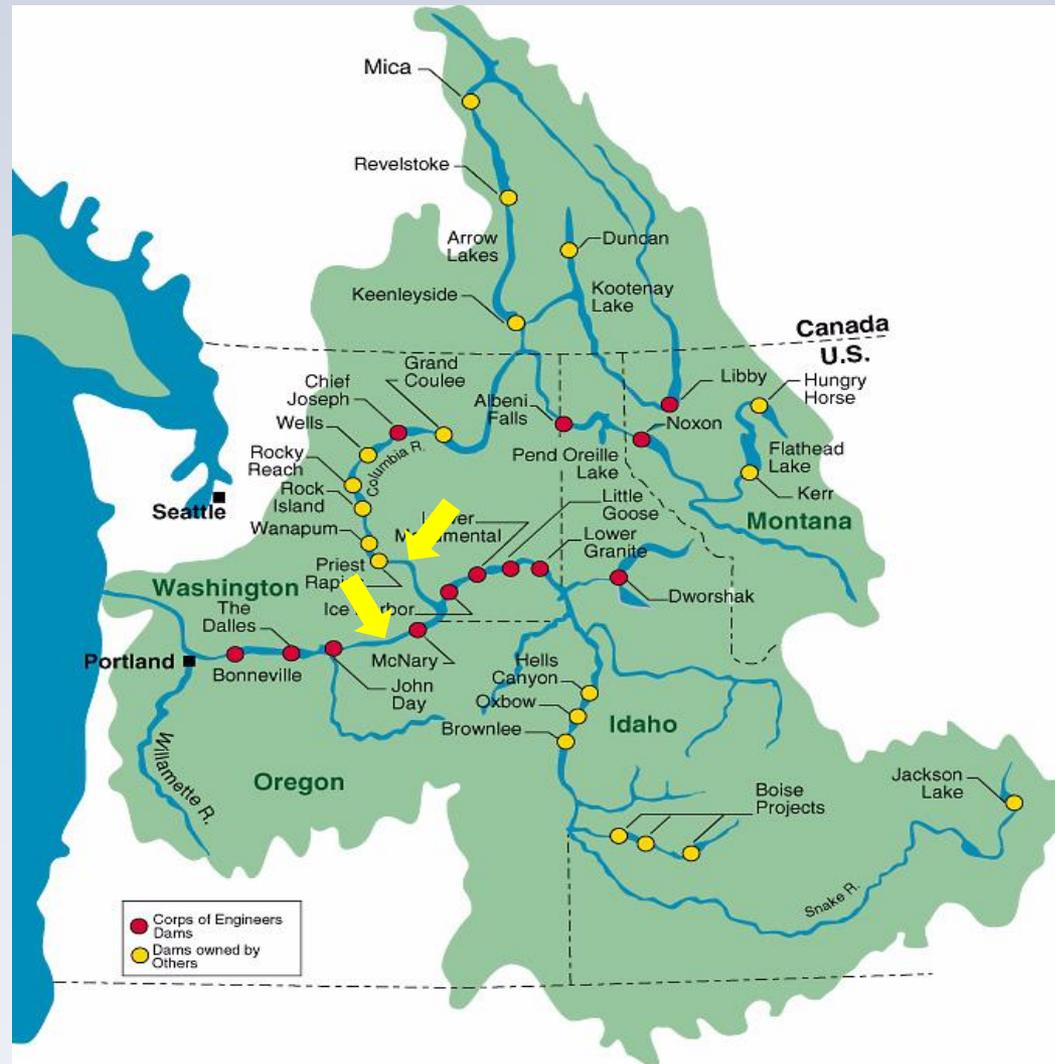
Fish Habitat Modeling Results

STT Meeting – March 14, 2013
Jim Hatten and Mike Parsley
USGS Western Fisheries Research Center

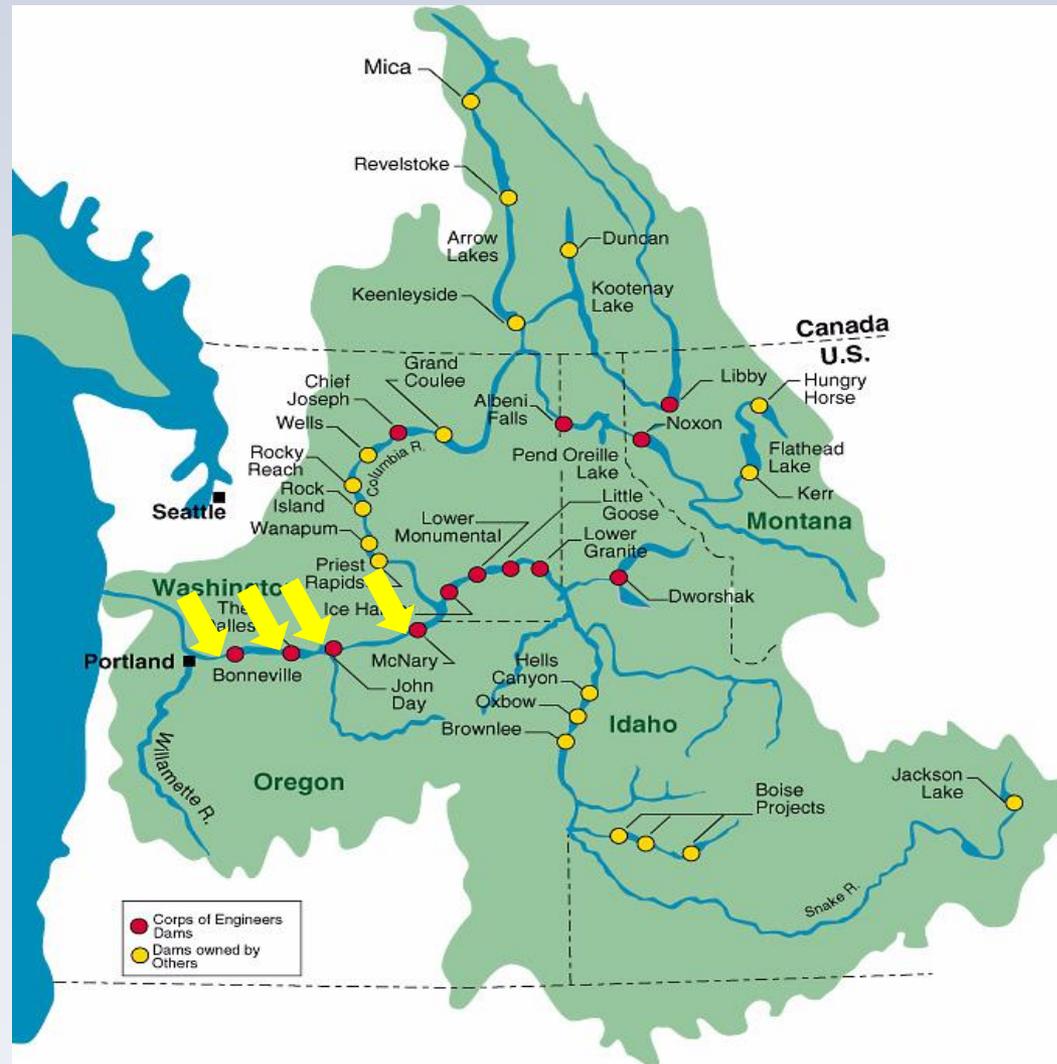
Metrics/Evaluation Criteria

- Two published models used to assess potential effects of discharge scenarios on habitat for fall Chinook and white sturgeon.
- Metrics evaluated:
 - Fall Chinook rearing habitat
 - White sturgeon spawning habitat
- Fall Chinook habitat applies to John Day Reservoir and Priest Rapids Dam to McNary Dam
- White sturgeon habitat applies to spawning areas downstream from BON, TDA, JDA, and MCN

Fall Chinook Rearing Habitat



Sturgeon Spawning Habitat



Modeling Methods

- Fish Habitat Models
 - Purpose: Provide a set of predicted daily habitat estimates given a set of measured or simulated river discharges
 - Estimates of surface area on a daily time step (time series)
 - Data and models developed & published by USGS
 - Compilation of physical models to describe environment and biological habitat selection

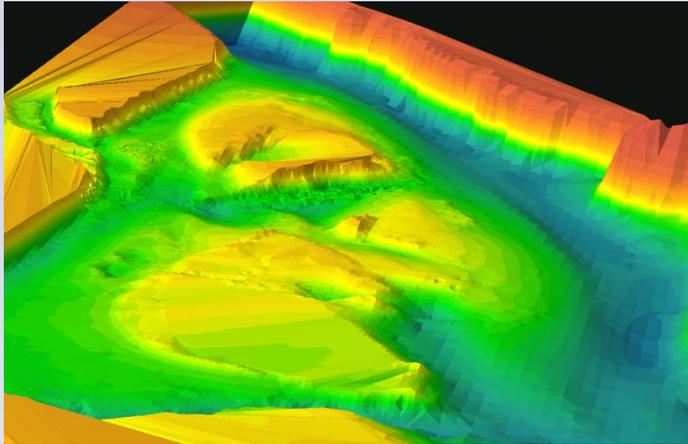
Modeling Methods

- Physical Models of River Reaches
 - Flow – taken as input at dams
 - Velocity – calculated from flow and river geometry
 - Depth – calculated from flow and river geometry
 - Riverbed substrate – mapped
 - Lateral slope – derived from river geometry

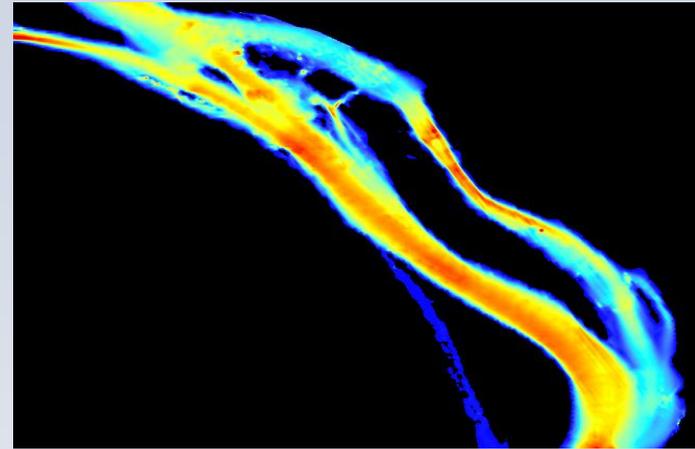
Modeling Methods

- Biological Habitat Selection
 - Fall Chinook – Logistic regression function derived from locations where species observed and not observed
 - White sturgeon spawning – Habitat suitability criteria derived from locations where newly-spawned eggs found.

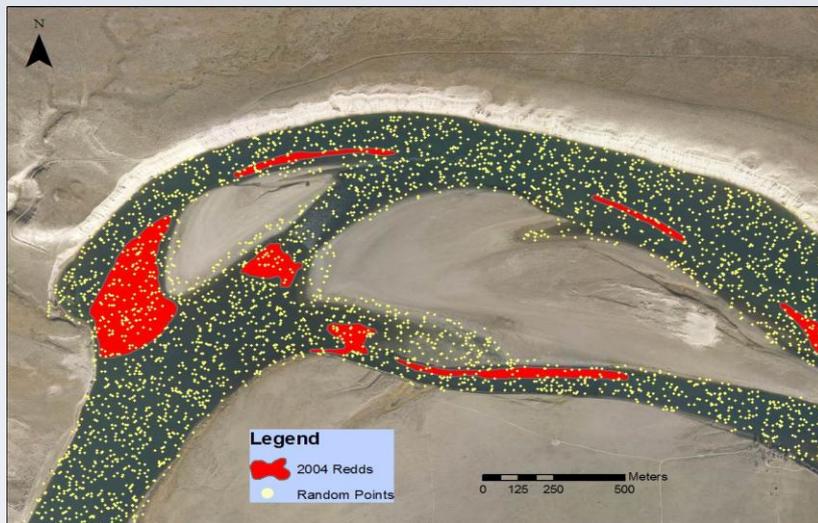
Modeling Methods



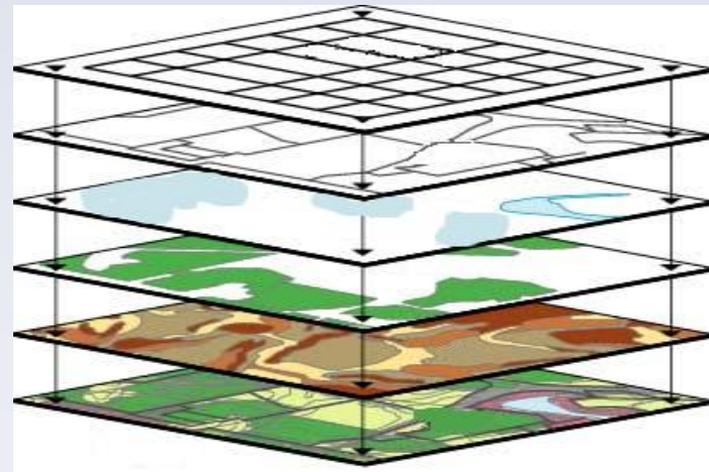
Bathymetry



Hydraulic Model Output



Presence/absence



GIS: cell-based modeling

Modeling Methods

- Modeling approach
 - For each area, derive the relation between habitat and flow
 - Apply habitat/flow model to Treaty alternatives for prediction
- Summarizing Model output – Compare RC-CC against each alternative using 70 years of daily habitat
 - Time series plots show differences among years
 - Bar graphs compare differences for 70-yr period

Modeling Methods

- Key attributes of the model/analysis
 - Habitat has direct linkages to fish
 - Input daily flow from HYDSIM model
 - Outputs used to calculate differences between RC-CC and alternatives for 70-yr period
 - Model outputs have spatial and temporal components
 - Provide practical quantification of habitat useful to decision makers

Columbia River Treaty 2014/2024 Review

Fall Chinook Rearing Habitat

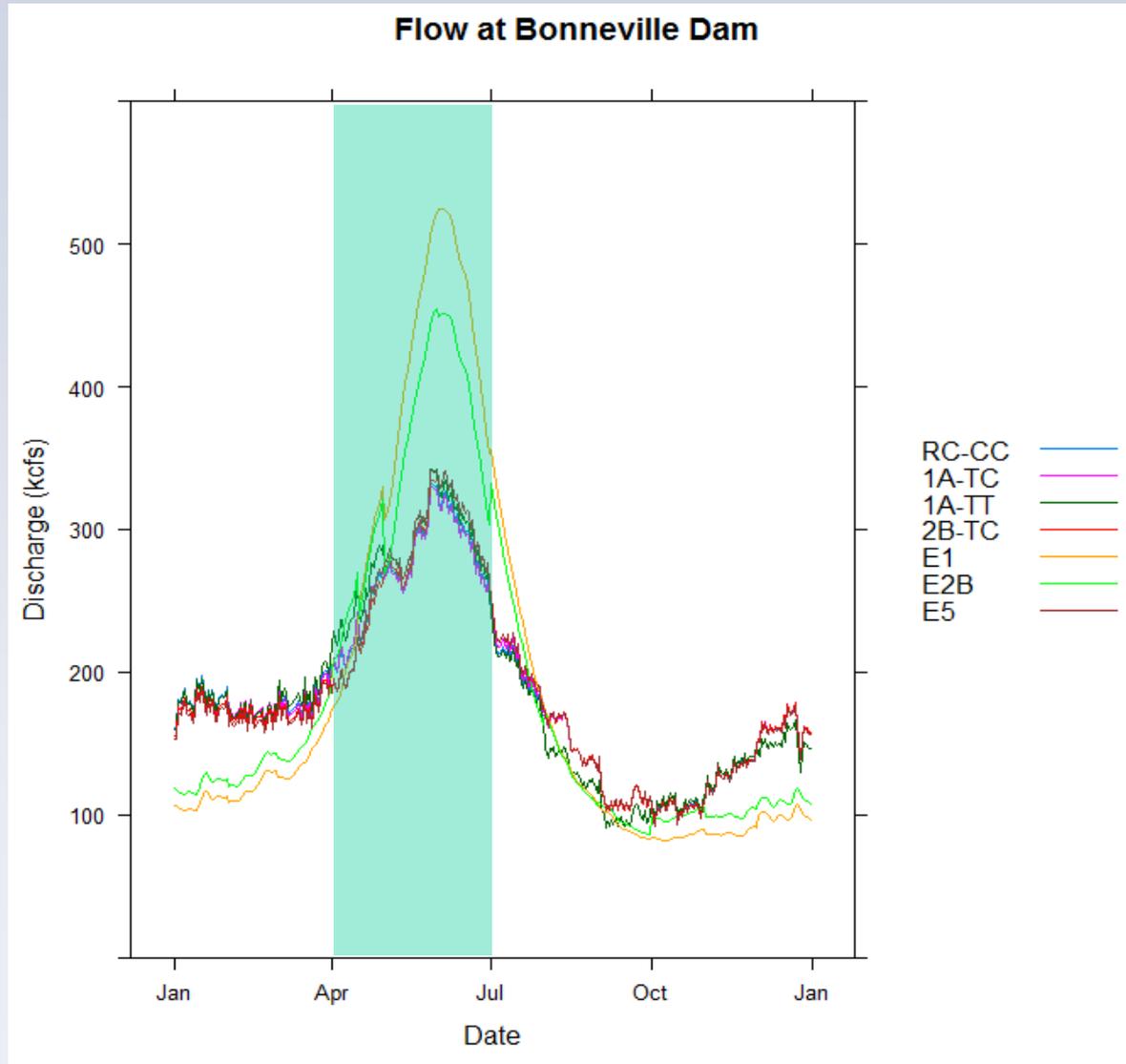


Fall Chinook outmigrate as sub-yearlings

Use shallow, low velocity habitats to feed in

Columbia River Treaty 2014/2024 Review

Fall Chinook Rearing



Sturgeon Spawning Habitat

Generally expect spawning in April – June
Spawn in fast water at various depths over
coarse substrates

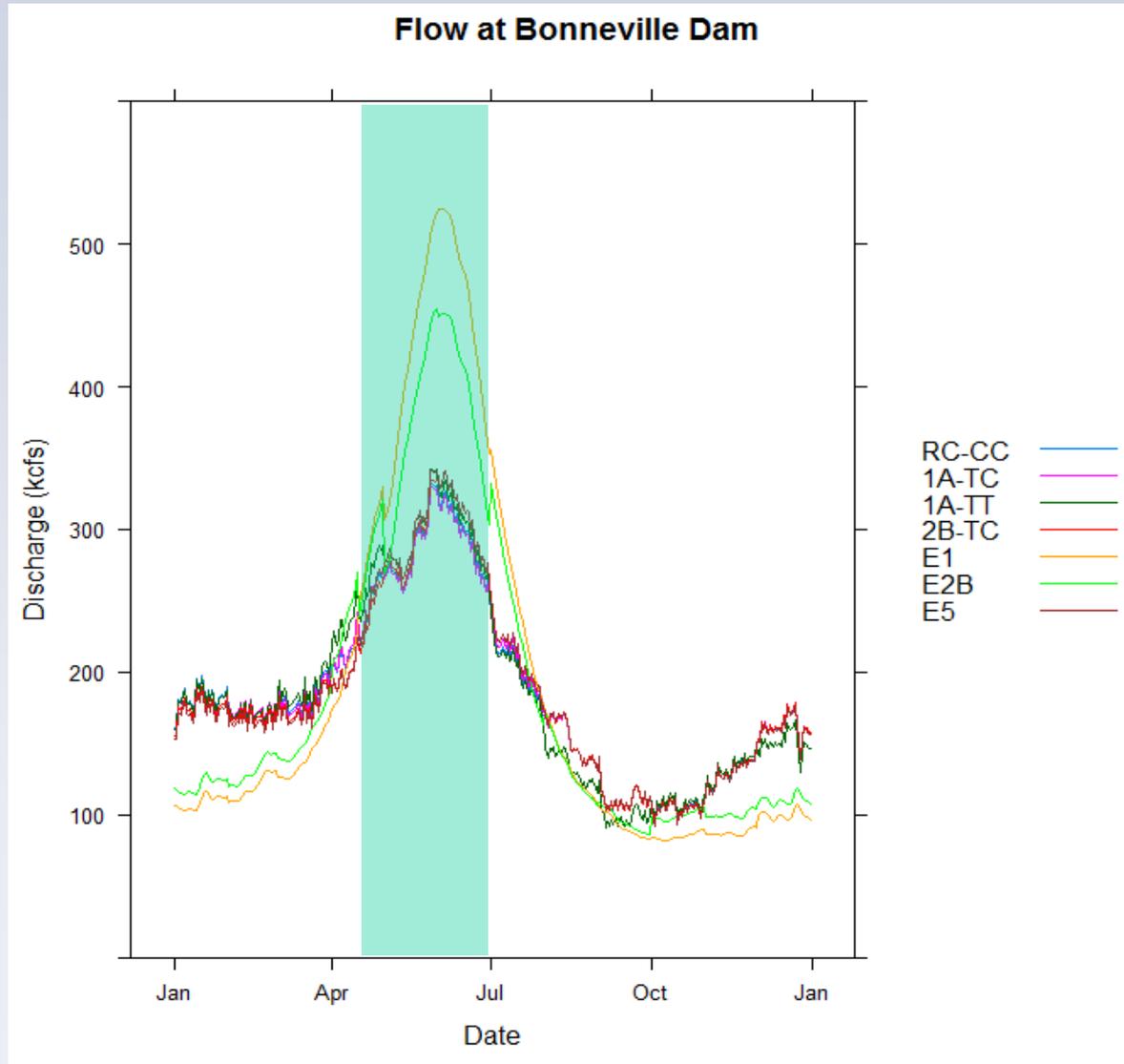
Indices of spawning habitat have been
correlated with indices of age-0
abundance

Age-0 production in any year -

BON>**TDA**>**JDA**>**MCN**

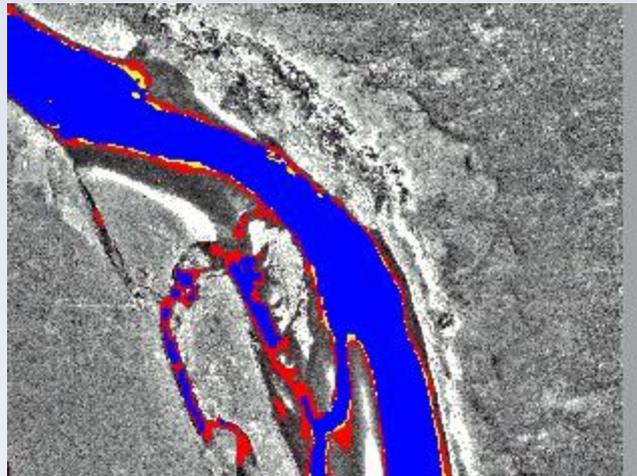
Columbia River Treaty 2014/2024 Review

Sturgeon Spawning



Modeling Results

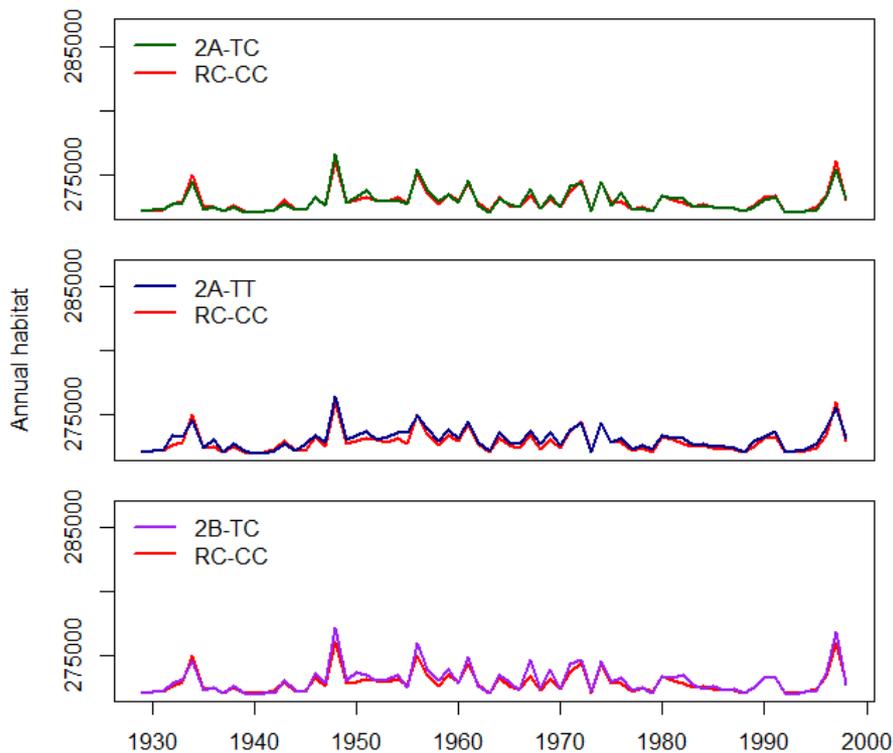
Fall Chinook Rearing Habitat



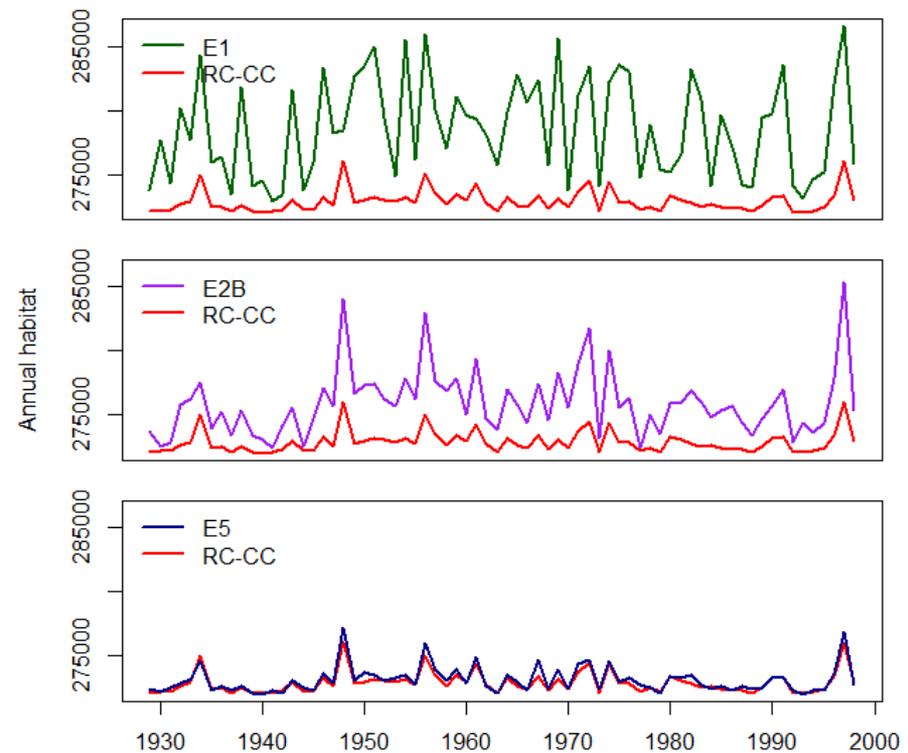
Columbia River Treaty 2014/2024 Review

Hanford Fall Chinook Rearing

Hanford Fall Chinook Rearing



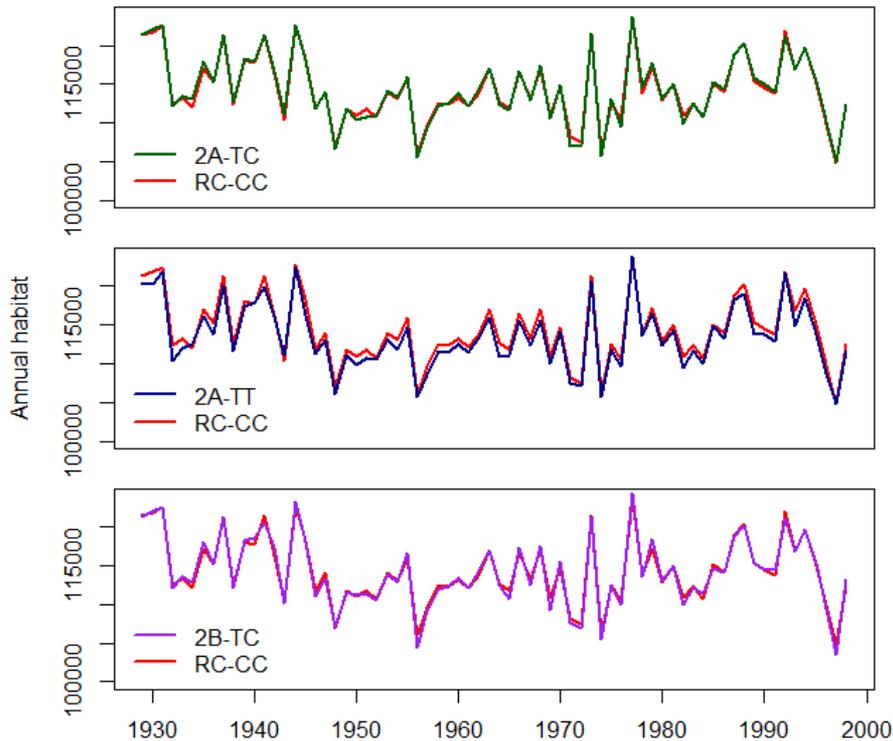
Hanford Fall Chinook Rearing



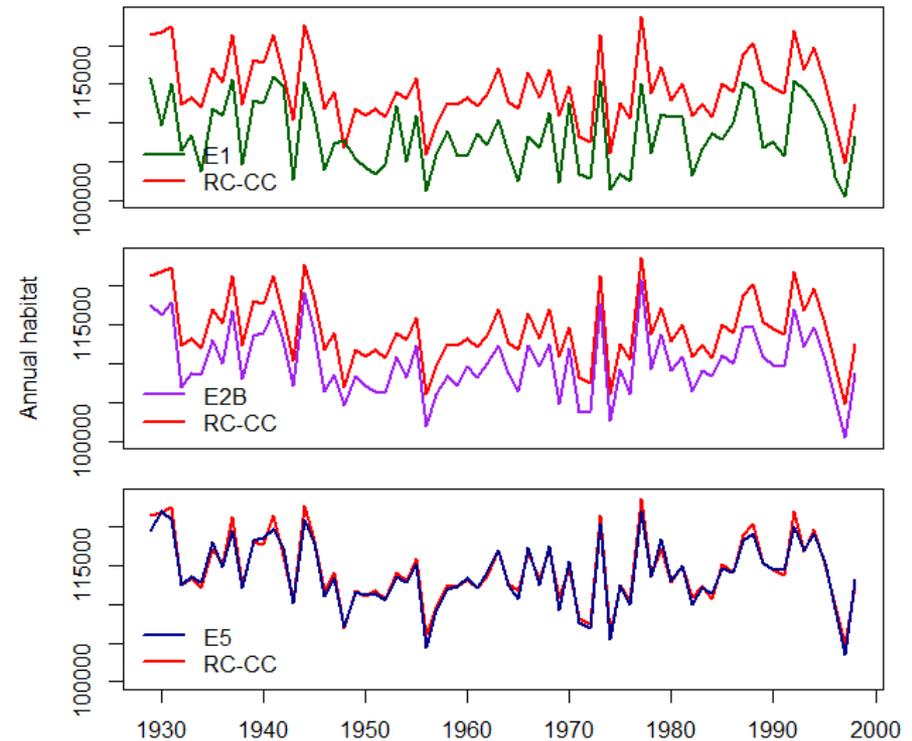
Columbia River Treaty 2014/2024 Review

JDA Fall Chinook Rearing

John Day Fall Chinook Rearing

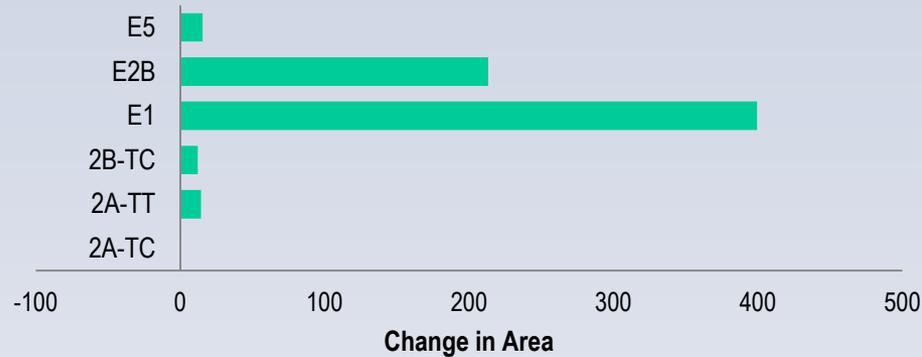


John Day Fall Chinook Rearing



Fall Chinook Rearing Modeling Results

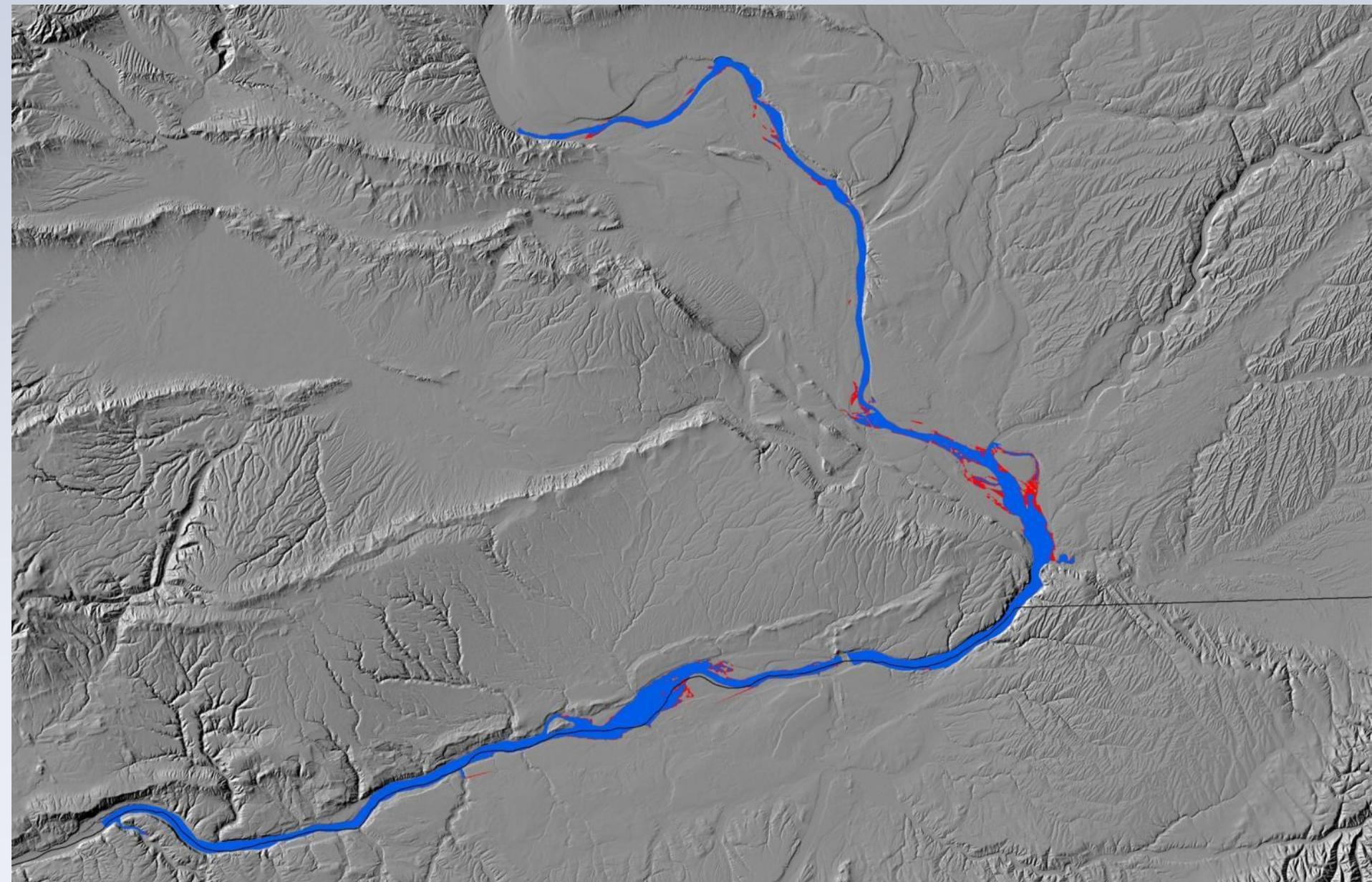
Hanford Fall Chinook Rearing Area



John Day Fall Chinook Rearing Area



Columbia River Treaty 2014/2024 Review



Modeling Results

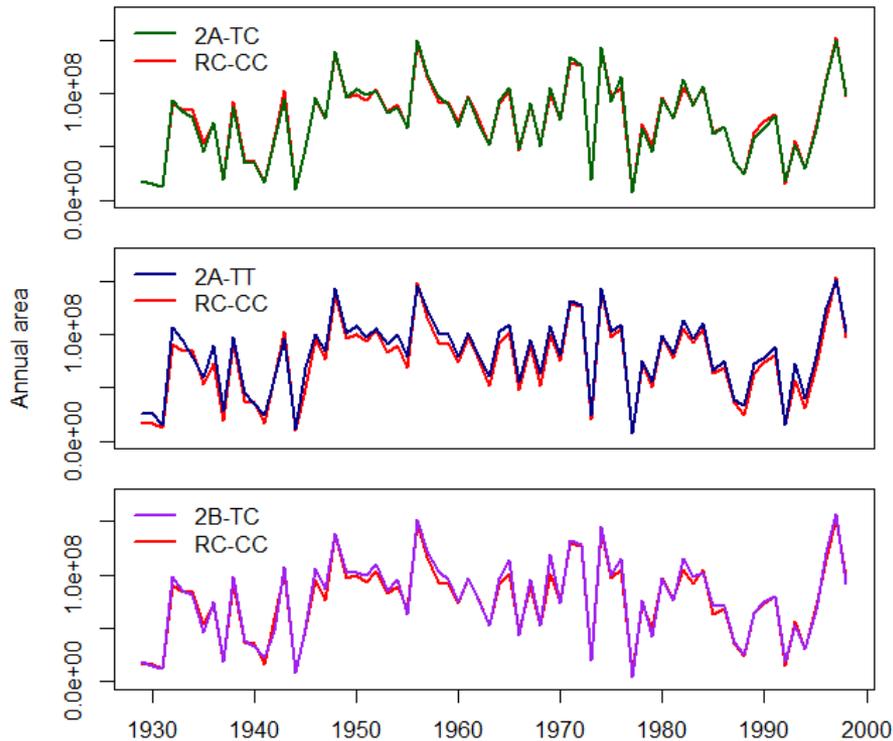
White Sturgeon Spawning Habitat



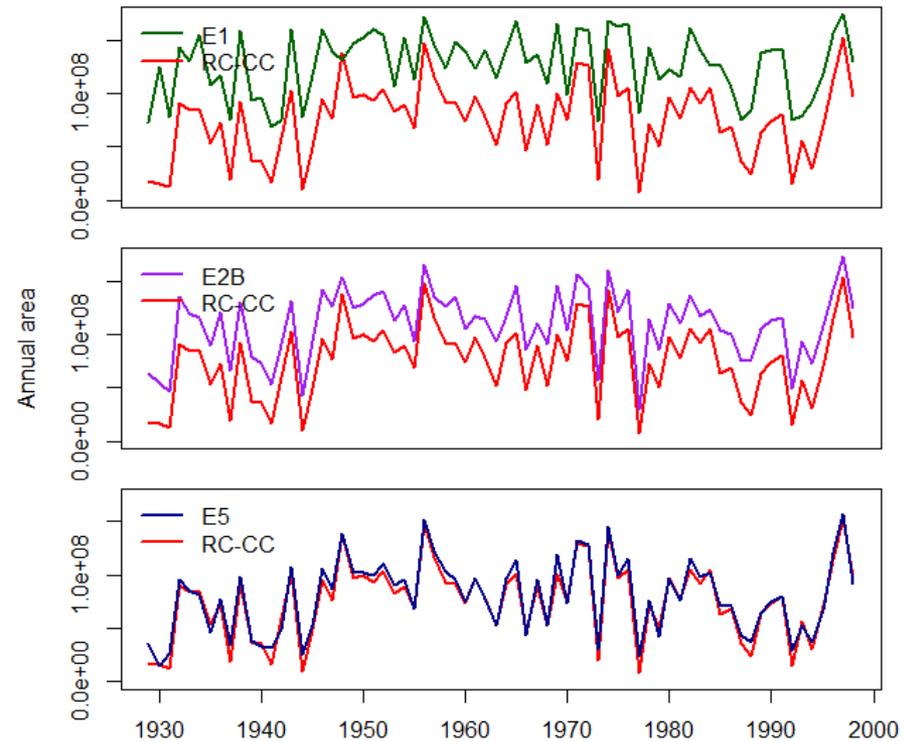
Columbia River Treaty 2014/2024 Review

Sturgeon Spawning Modeling Results

McNary White Sturgeon Spawning Area



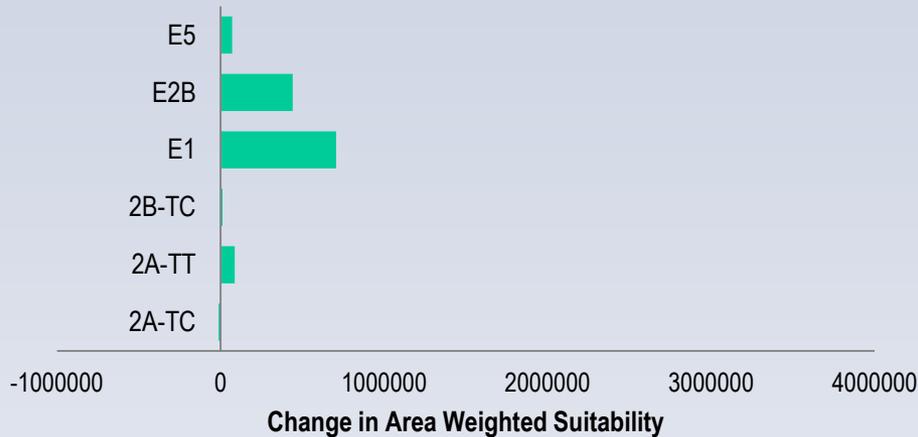
McNary White Sturgeon Spawning Area



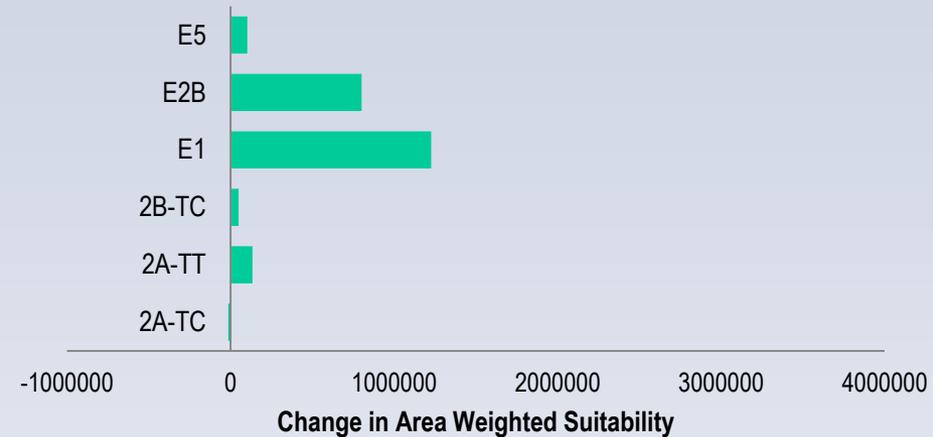
Columbia River Treaty 2014/2024 Review

Sturgeon Spawning Modeling Results

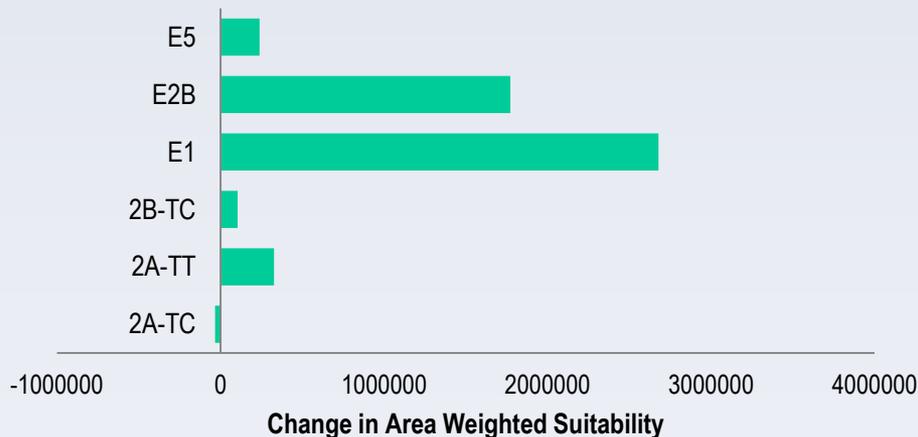
Bonneville Dam Spawning Area



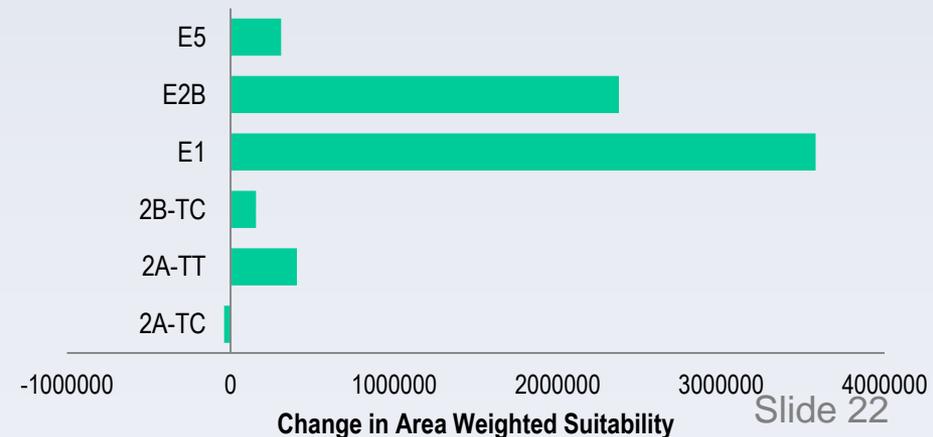
The Dalles Dam Spawning Area



John Day Dam Spawning Area



McNary Dam Spawning Area



Summary

■ Fall Chinook Rearing

- Hanford: All but one alternative resulted in more habitat than the reference condition over the 70-yr period
- John Day: All but one alternative resulted in a decrease in habitat over the 70-yr period

■ Sturgeon Spawning

- All but one alternative resulted in more habitat than the reference condition over the 70-yr period
- Relative changes were greater for spawning areas with backwater effects from downstream dams
- E1 & E2B show greatest increases in habitat

Summary

- Important considerations
 - E components are bookends to identify and better understand potential improvements
 - Only fall Chinook rearing and sturgeon spawning habitat modeled – other life stages were not
 - Daily water temperature defines the spawning period for sturgeon and was not included in this analysis
 - Inter & intra specific reach and species conflicts require careful consideration (e.g. JDA sturgeon spawning & fall chinook rearing; Hanford & JDA fall chinook rearing)