Using PHABSIM to Investigate Effects of Altered Streamflow on Fish in the Chehalis River, Washington

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WDFW

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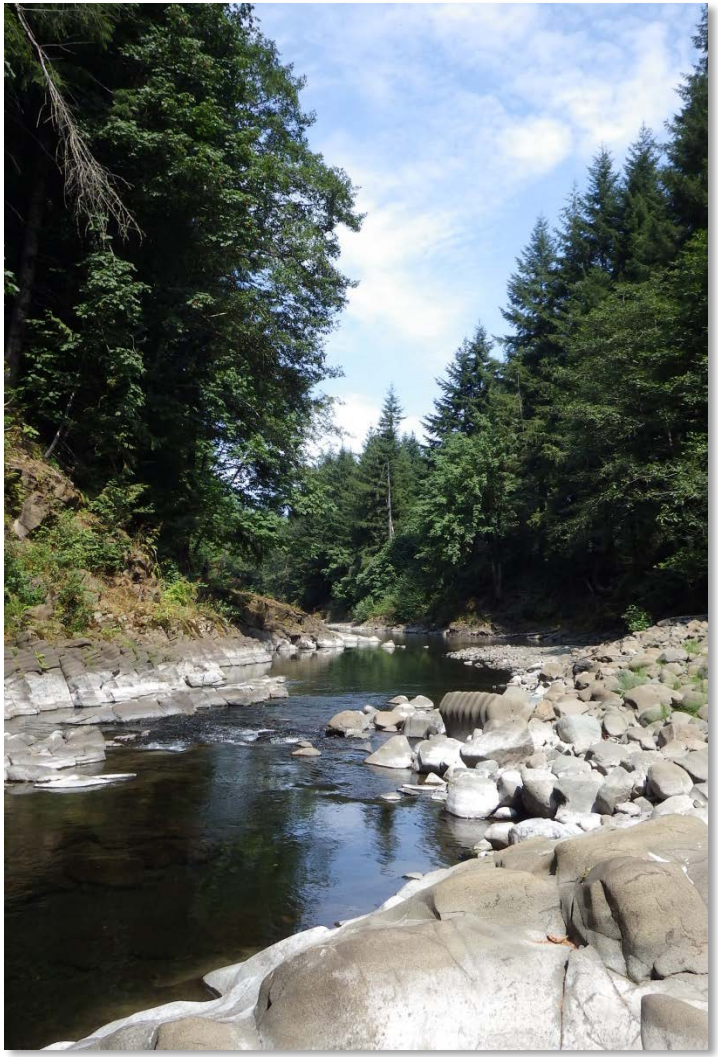
Overview

- Brief background
- Summary of results and discussion
- Key gaps and next steps
- Implications for restoration efforts

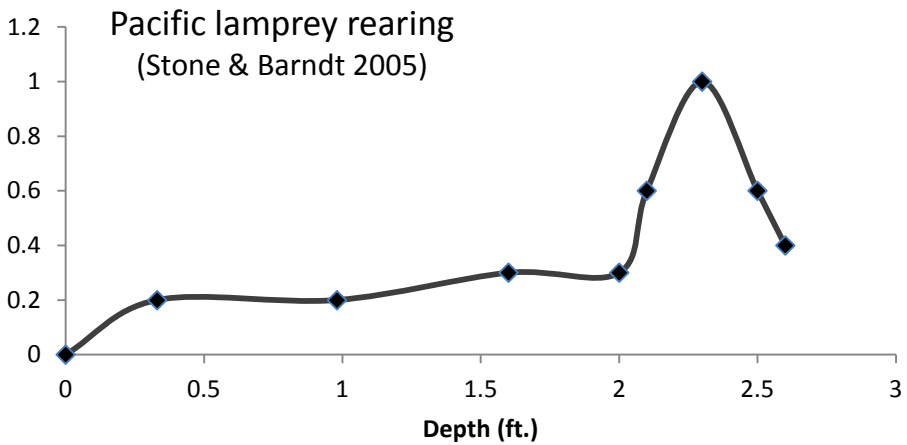


Background

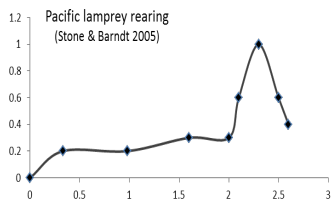
- PHABSIM predicts stream depth and current velocity distributions in relation to streambed characteristics (not temperature)
- Compares distribution of these characteristics within a reach to calculate an index of habitat quality and quantity
- Produces an estimate of weighted usable area (WUA) for each species

Background

- Habitat Suitability Indices (HSIs) used with PHABSIM to identify different WUA for different species and life stages
- HSIs describe each species and life stage habitat preferences

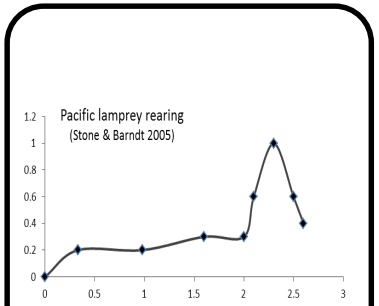


Background



HSIs

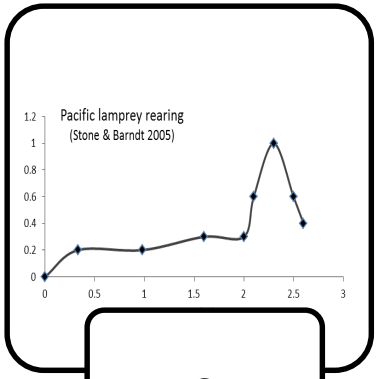
Background



HSIs

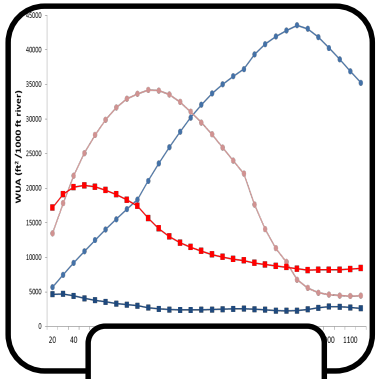
PHABSIM

Background



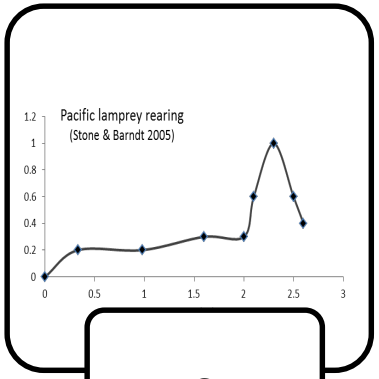
HSIs

PHABSIM



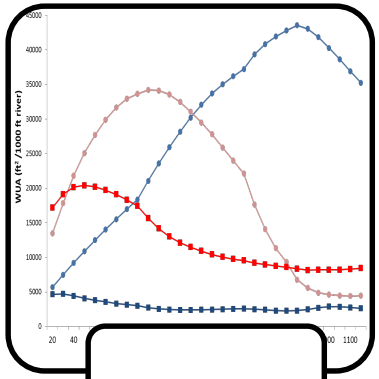
WUA

Background



HSIs

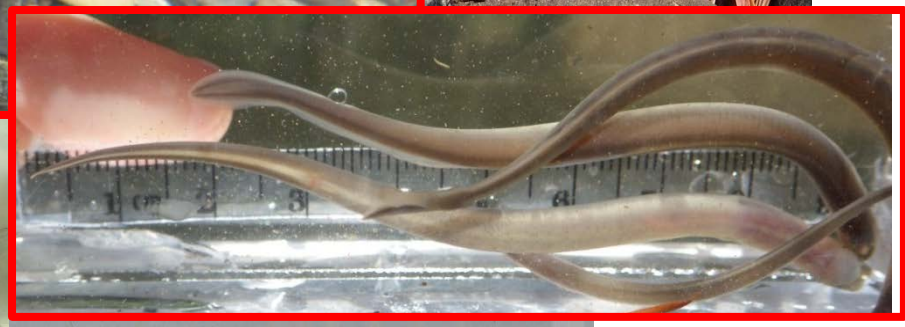
PHABSIM



WUA

Used HEC RAS modeled flows to select/compare WUA

Species Assessed



(J. Tyson, WDFW)

(K. Brady, WDFW)

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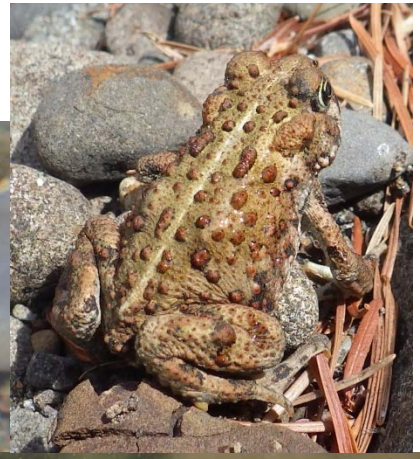

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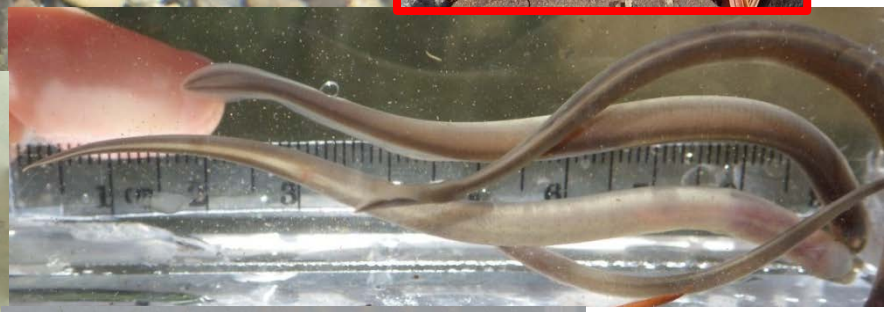

(J. Tyson, WDFW)

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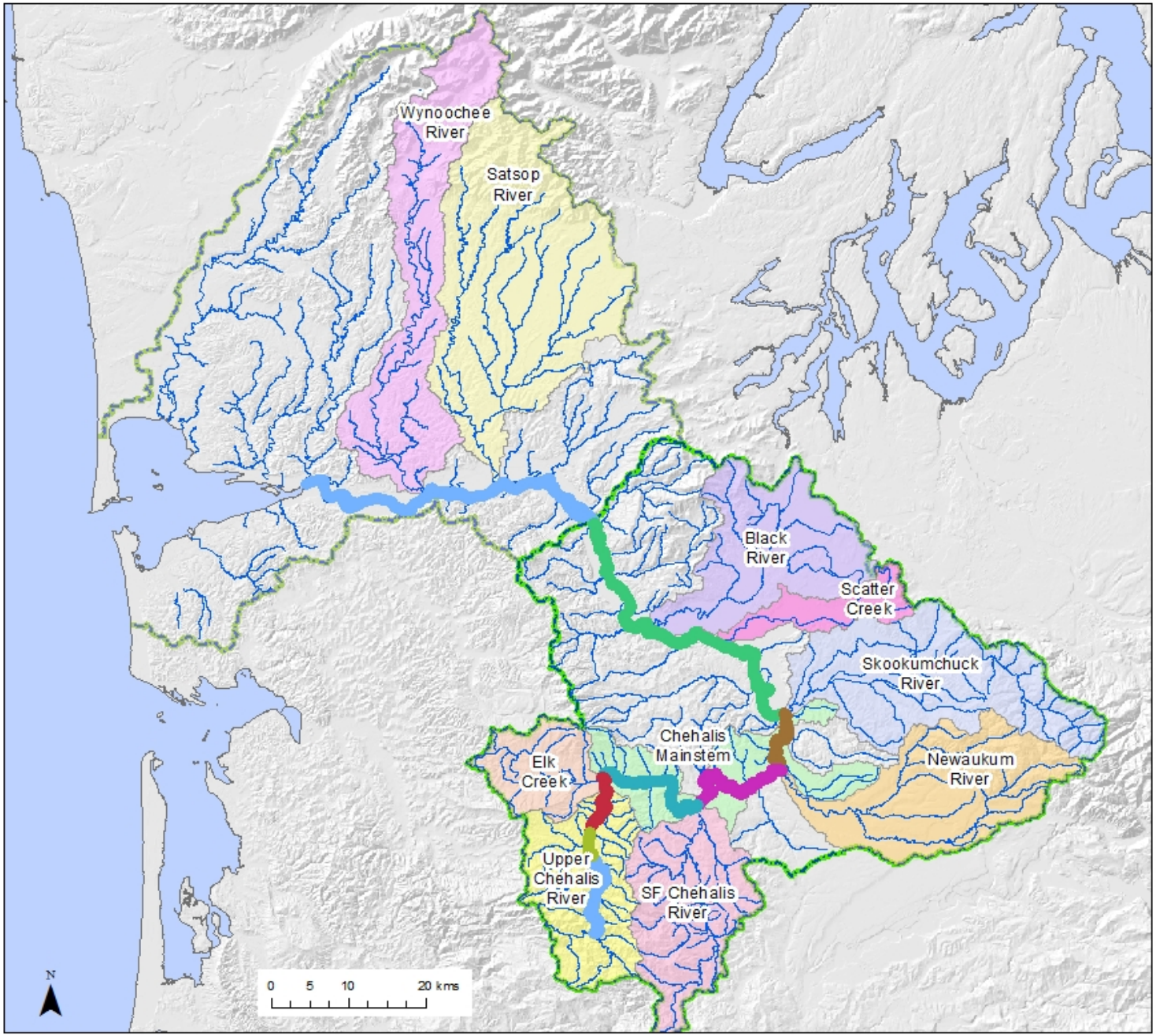
Chehalis River Subbasins



Research objectives

- The goal of this study is to employ PHABSIM to compare WUAs for select species present in the Chehalis River Basin under two stream flow conditions:

1) An average water year (WY)
2) An average WY with stream flows altered by a multi-purpose dam (MPD)

Three analyses

1. Flows that maximize WUA compared to median monthly flows for an average WY
2. Monthly baseline flow WUAs for spawning and rearing compared to MPD flows
3. Spawning and rearing WUA were combined to give overall WUA changes

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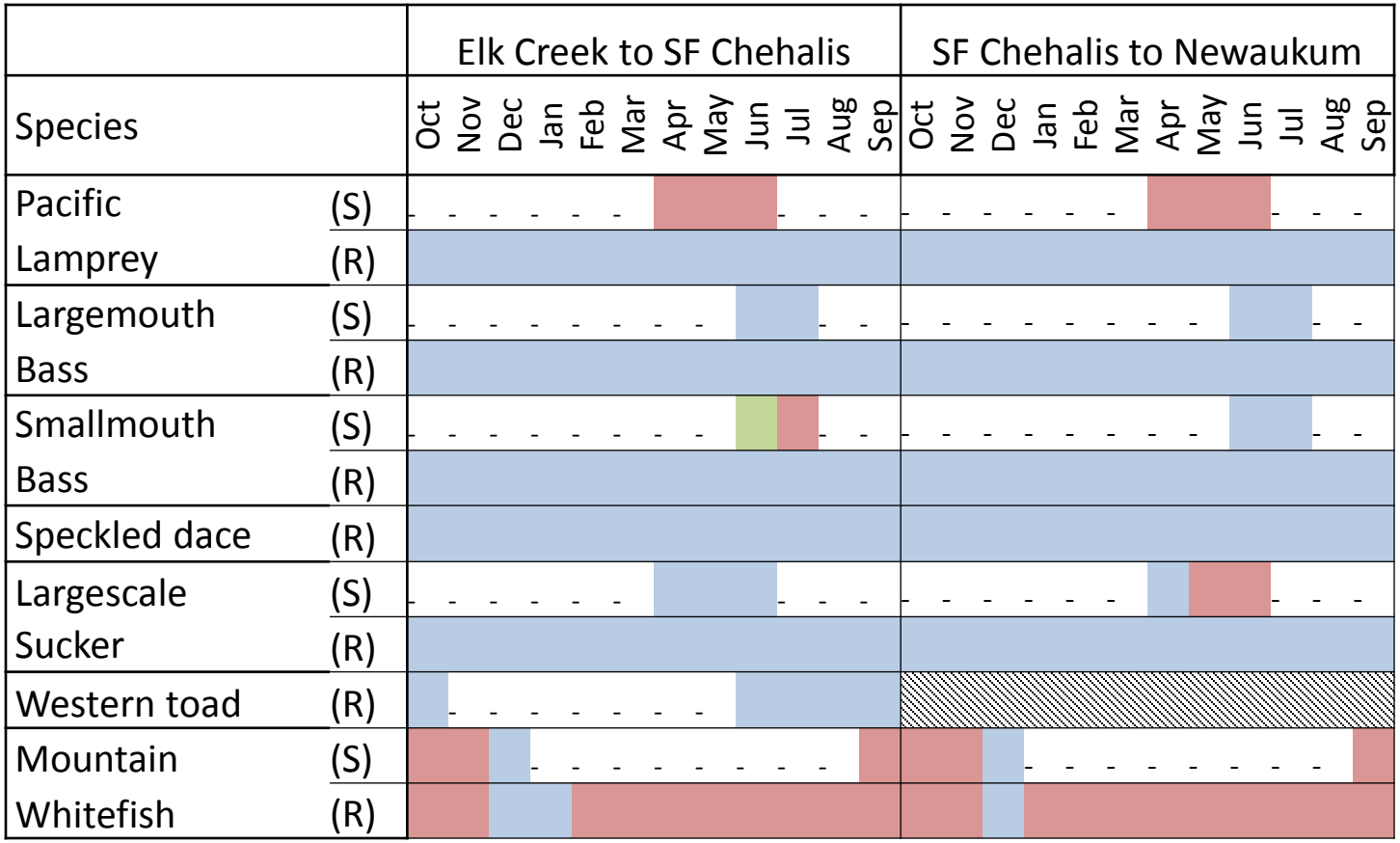
WUA under modeled baseline flows



Median monthly flows are higher than flows that maximize WUA

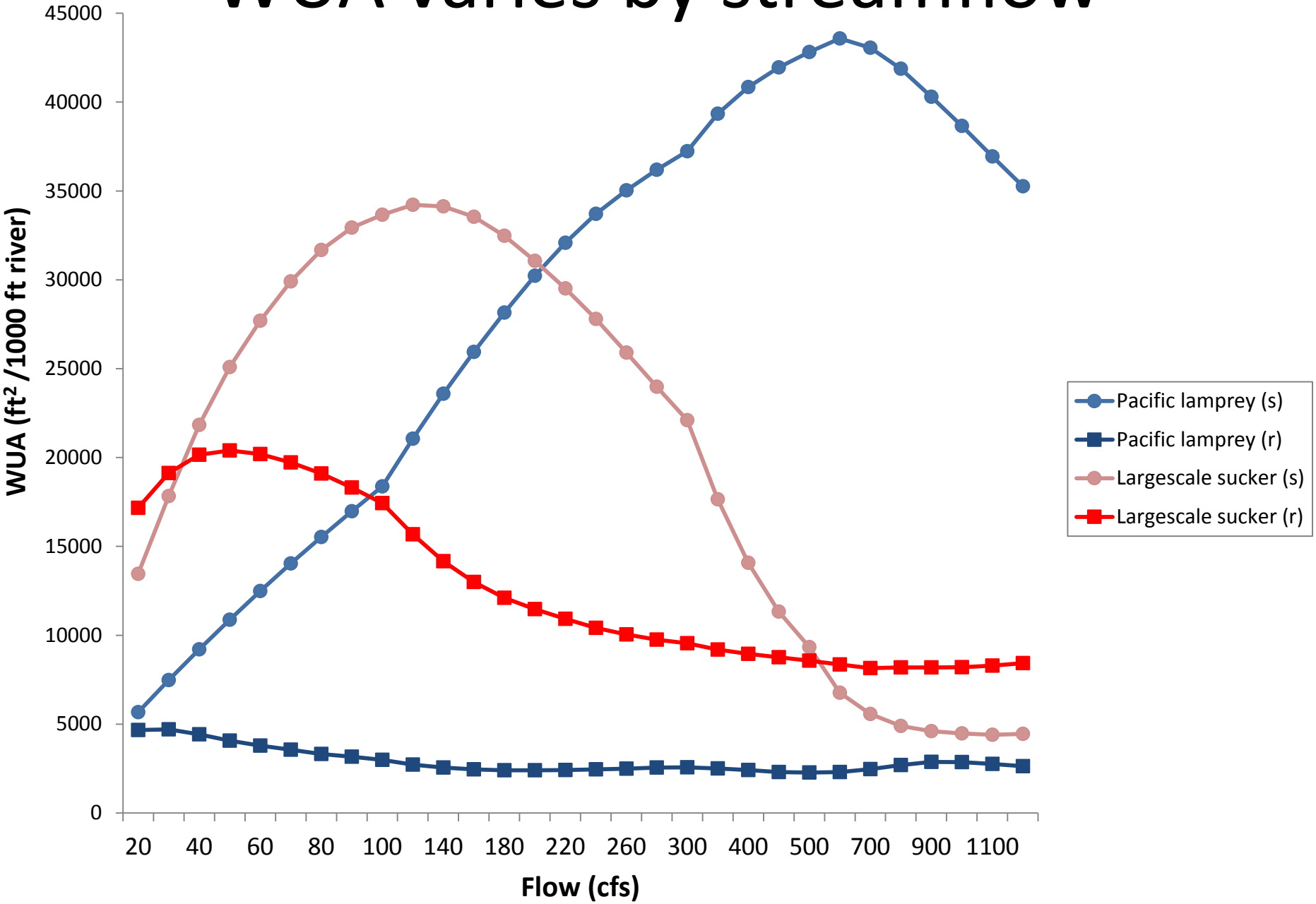
Median monthly flows are lower than flows that maximize WUA

Median monthly flows are within 5 cfs of flows that maximize WUA

Species not present in reach at any life stage

\- Species not present in reach during this time

WUA varies by streamflow



Three analyses

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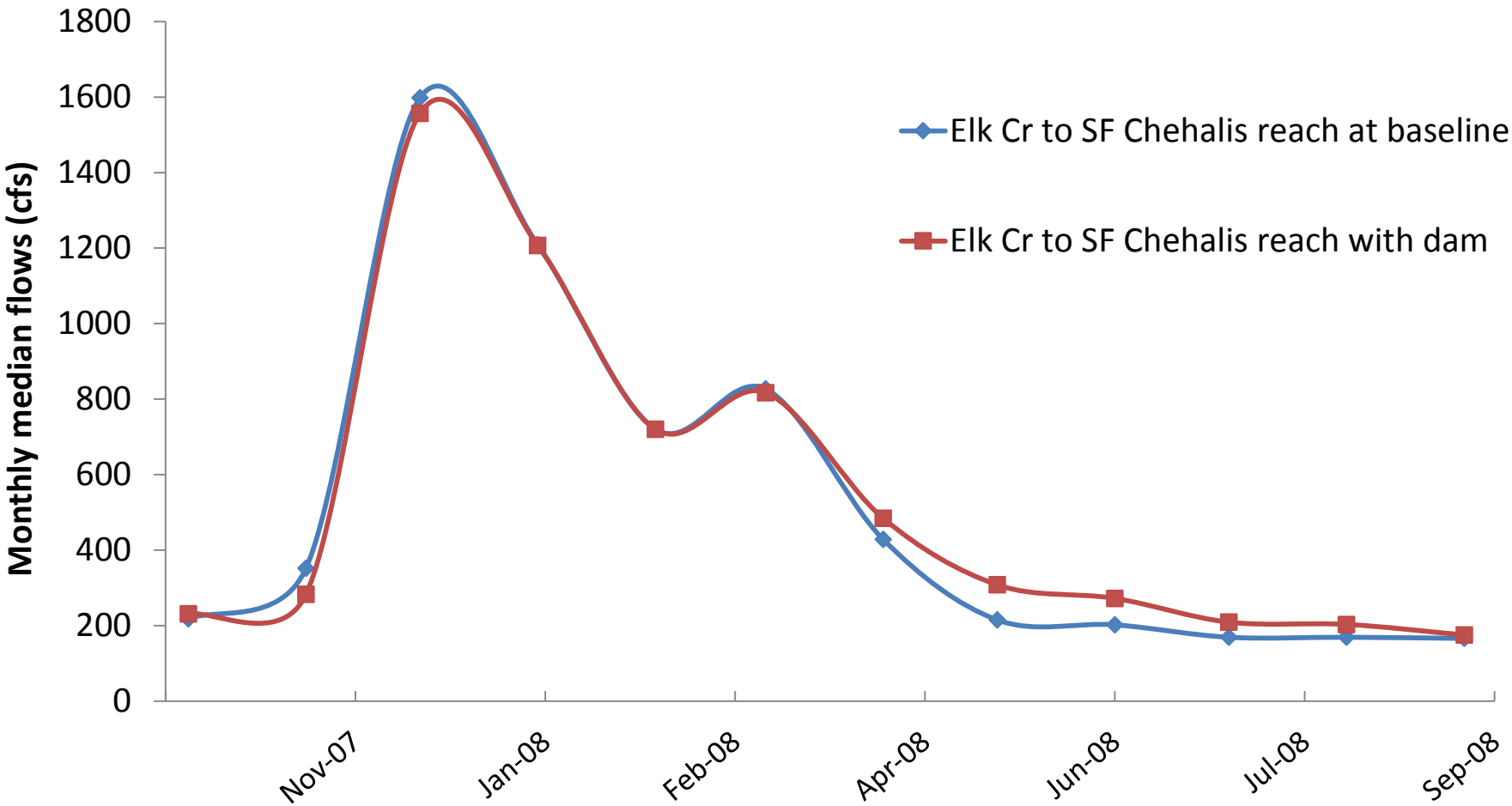
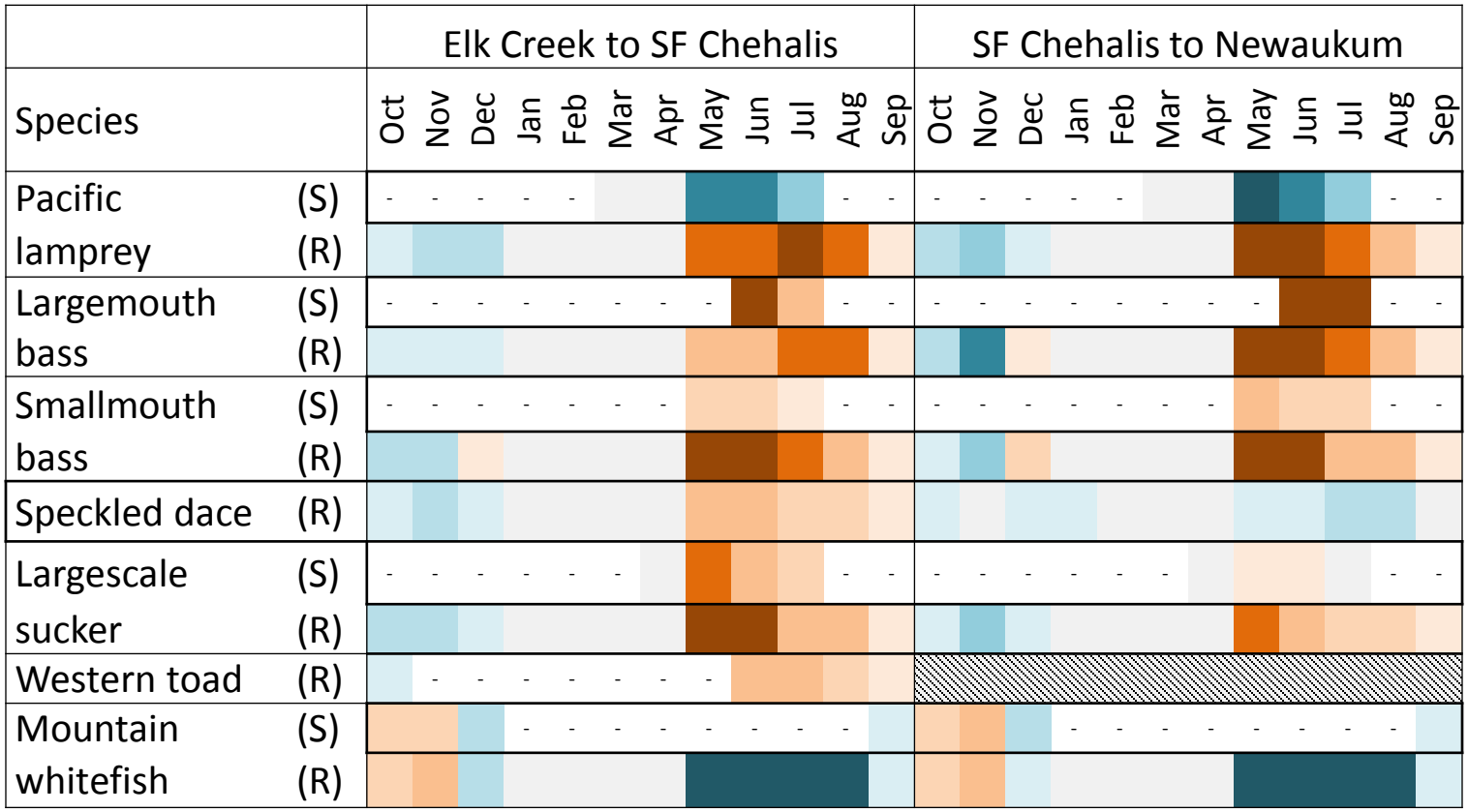
Modeled median monthly flows at baseline conditions vs. with MPD



Percent changes in WUA with a MPD

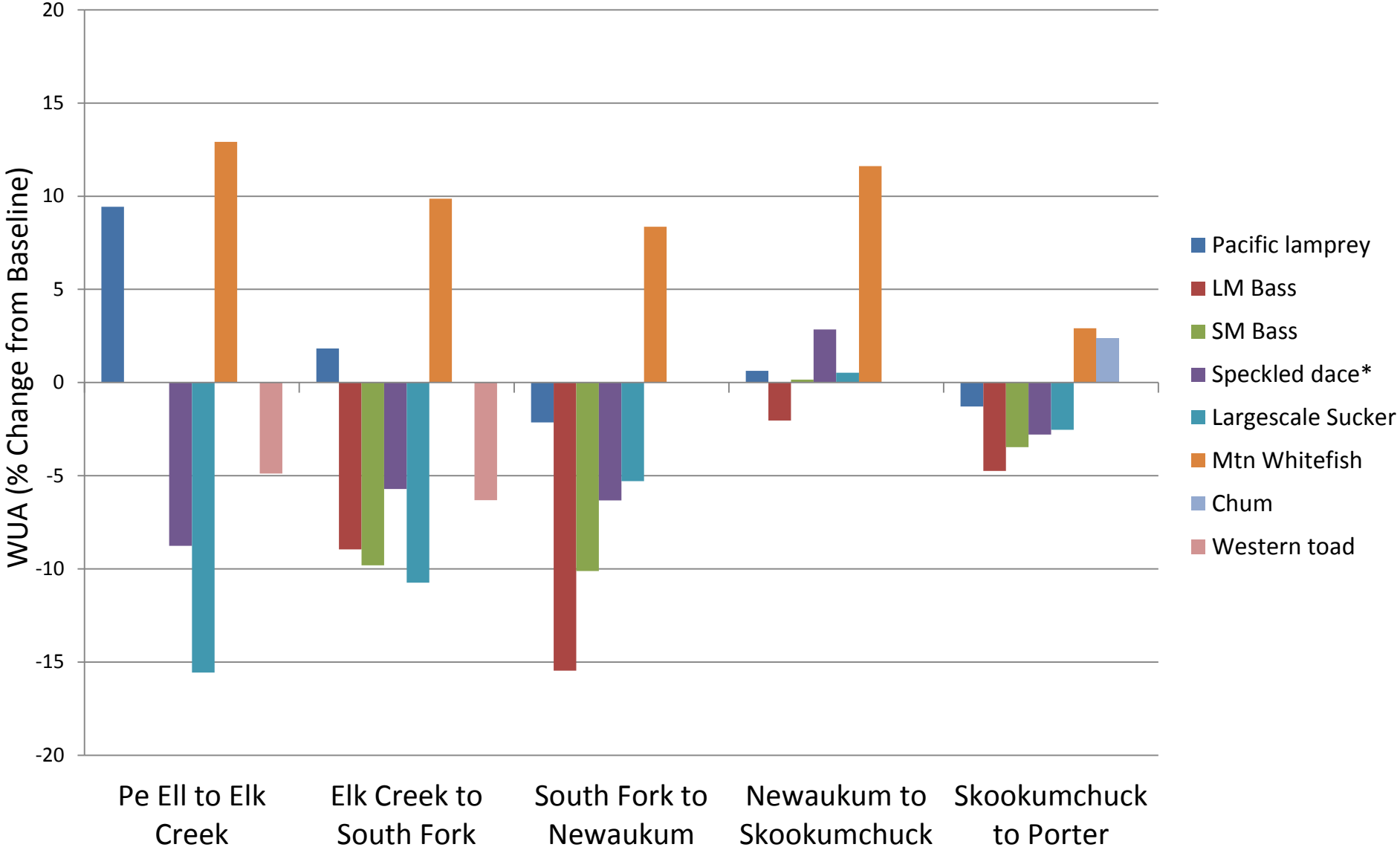


- If < -20
- If -16 to -20
- If -11 to -15
- If -6 to -10
- If -1 to -5
- If 0
- If 1 to 5
- If 6 to10
- If 11 to15
- If 16 to20
- If >20
- Species not present in reach at life stage

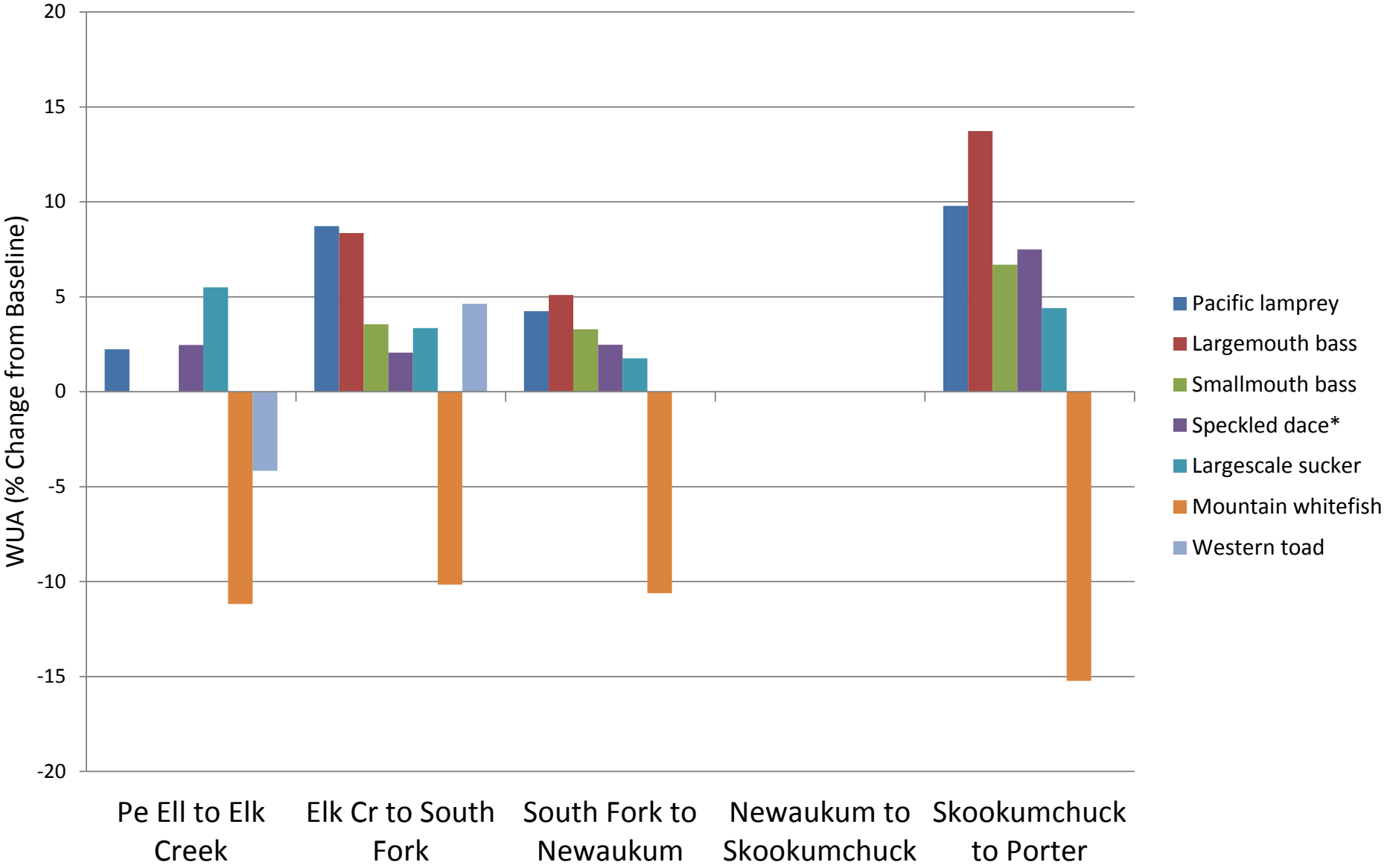
Three analyses

1. Flows that maximize WUA compared to median monthly flows for an average WY
2. Monthly baseline flow WUAs for spawning and rearing compared to MPD flows
3. Spawning and rearing WUA were combined to give overall yearly WUA changes

Estimated % change in WUA from baseline to MPD



Estimated % Change in WUA with MPD and Climate Change Summer months **only**

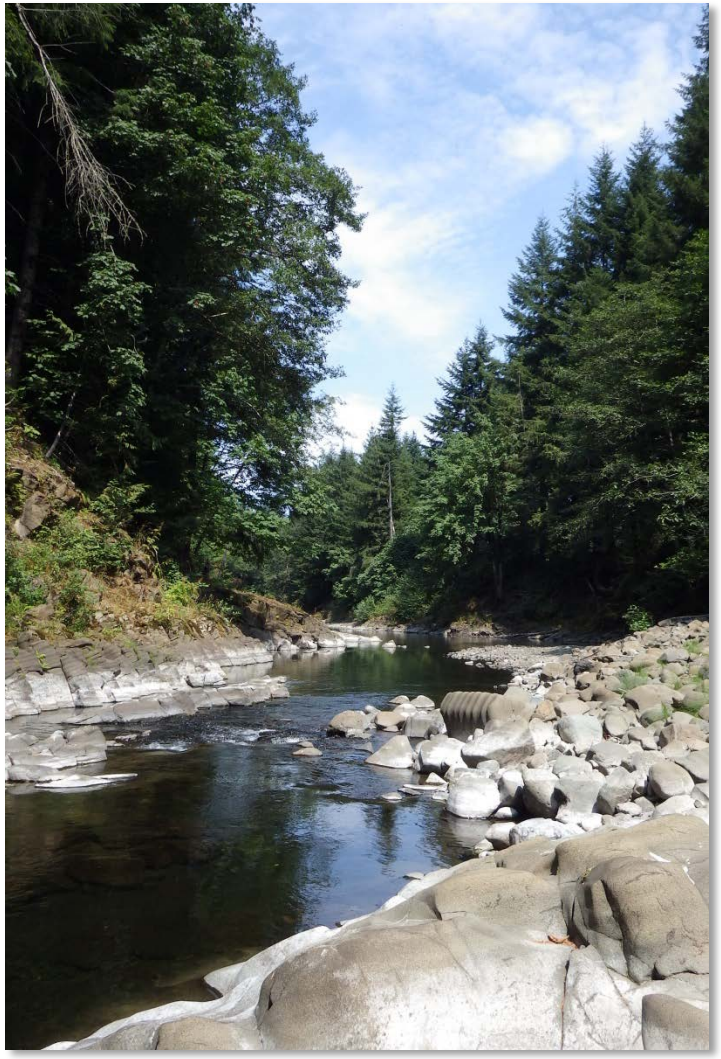


What was interesting or surprising about the results?

What was interesting or surprising about the results?

- Variety of flows is favorable for the breadth of species present
- WUA increases for some species and diminishes for others
  - (i.e., spawning Pacific lamprey and mountain whitefish vs rearing Pacific lamprey)
- Dependent on the species, life stage, location, time of year
- Increased summer flows exceed flows that maximize WUA, subsequently decreasing WUA
  - Limiting aquatic habitat by increasing flow

Key gaps



- Incorporate temperature
  - Task for 2015-2017
- Validate habitat suitability for Chehalis River
  - Task for 2015-2017
- Climate change is only considered with MPD in summer months
- Substrate changes
- Reservoir impacts

Restoration of non-salmonids

- Diversity of streamflow and depths is required for diversity of species
- To better answer restoration requirements, we need to understand more about these species
  - i.e., habitat preferences

Acknowledgements

- Thomas Payne and crew, Normandeau Associates for PHABSIM model
- Brad Caldwell and James Pacheco, Washington Department of Ecology
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