Modeling Habitat Overlap Between Smallmouth Bass and Juvenile Chinook Salmon in the Willamette River, Oregon

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U.S. Department of the Interior
U.S. Geological Survey

Smallmouth Bass Predation: Juvenile Salmon

- First introduced in 1924
- Primary distribution: Santiam River mouth to Willamette River mouth
- Most abundant non-native fish species in Willamette River
  - Lavigne *et al*. 2008
  - Friesen *et al*. 2005

> "Considering their relative abundance (all size classes), diet, and ubiquity, smallmouth bass probably pose the most significant potential threat to juvenile salmonids in the lower Willamette River."

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Smallmouth Bass Predation: Juvenile Salmon

What is the extent of smallmouth bass habitat, how much overlap is there with juvenile Chinook habitat, and are there flow-management tools that could be used to reduce predation?

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Modeling approach

- Use hydraulic models developed in White and Wallick (2022) to assess extent of useable hydraulic from Eugene – Newberg
  - Combine with literature derived habitat suitability values + local expert opinion:

    - Key habitat values identified:
      - Velocity range: 0.0 – 0.5 m/s
      - Depth range: 0.5 – infinite m
      - Proximity to revetment – 3m

- Compare smallmouth habitat extents to juvenile Chinook habitat models produced in White et al. 2022 and Hansen et al., *2022*

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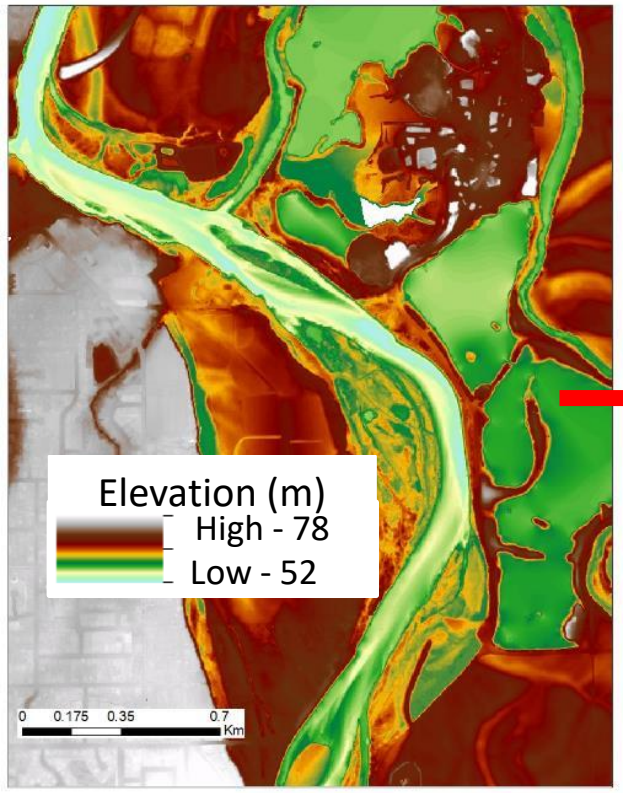
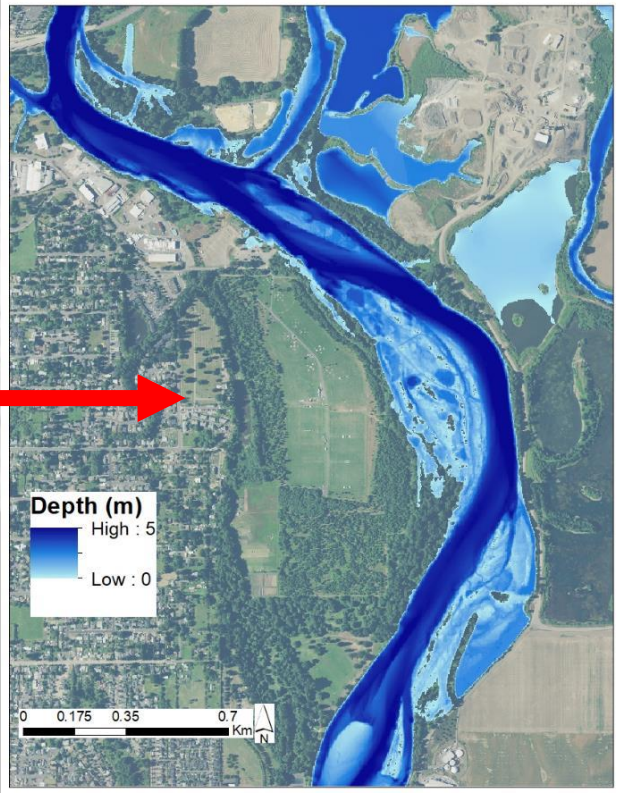
Modeling approach

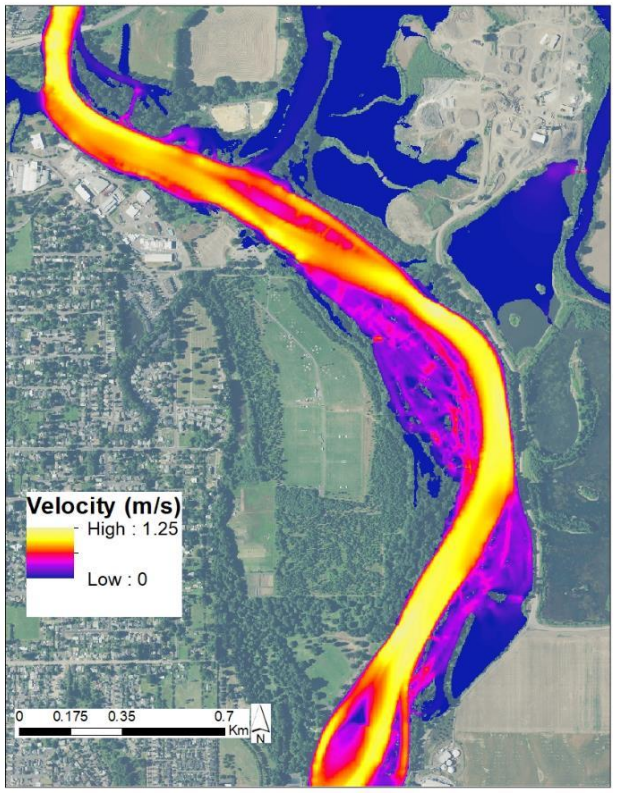
Bathymetry
(QSI TB lidar + USGS sonar)

Continuous Depth

Continuous Velocity







Models from White and Wallick, 2022

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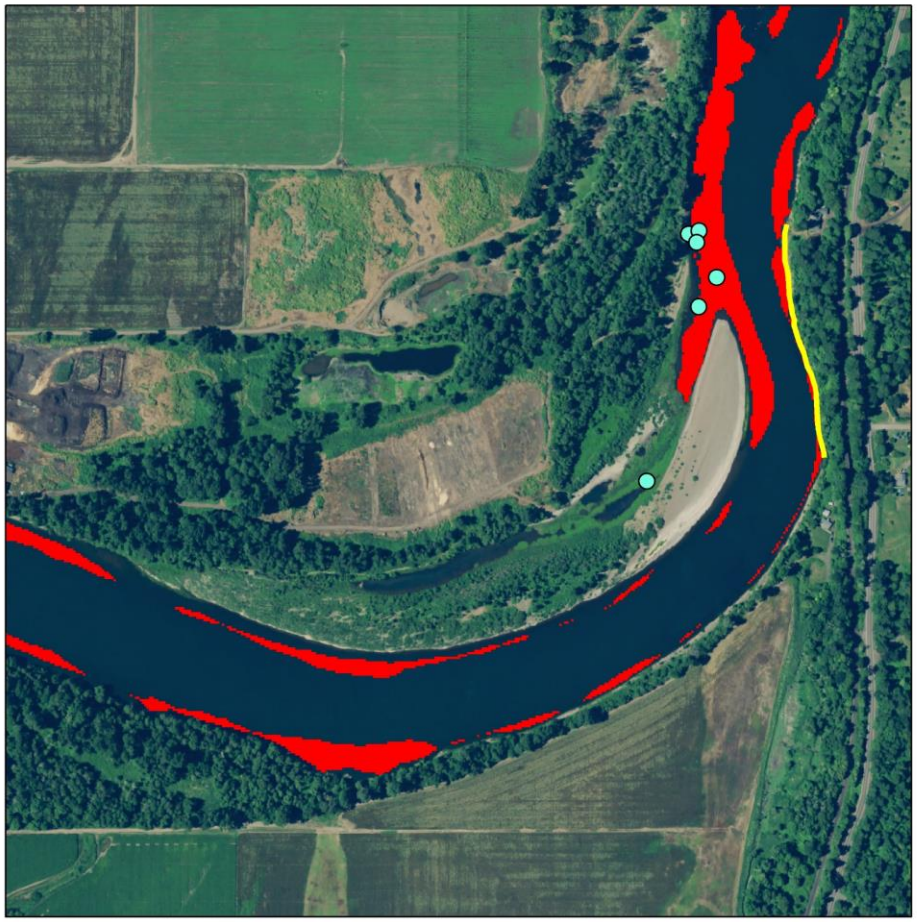
Modeling results



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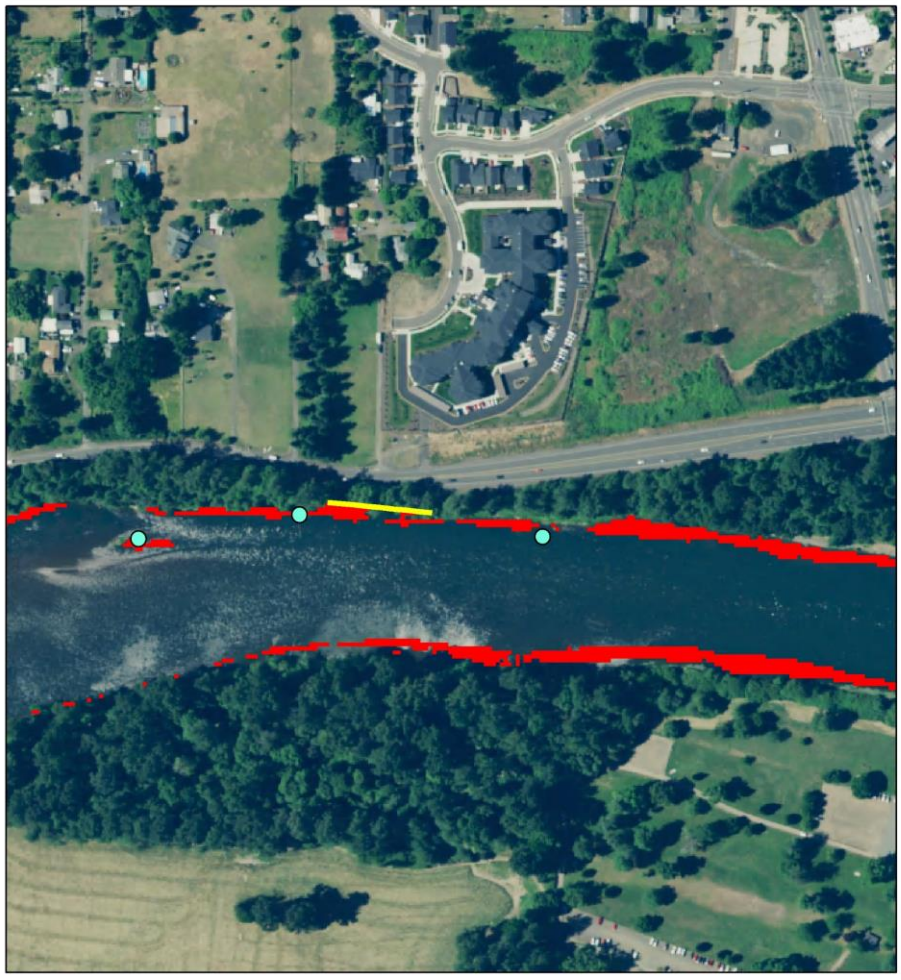
Preliminary results

Modeling results



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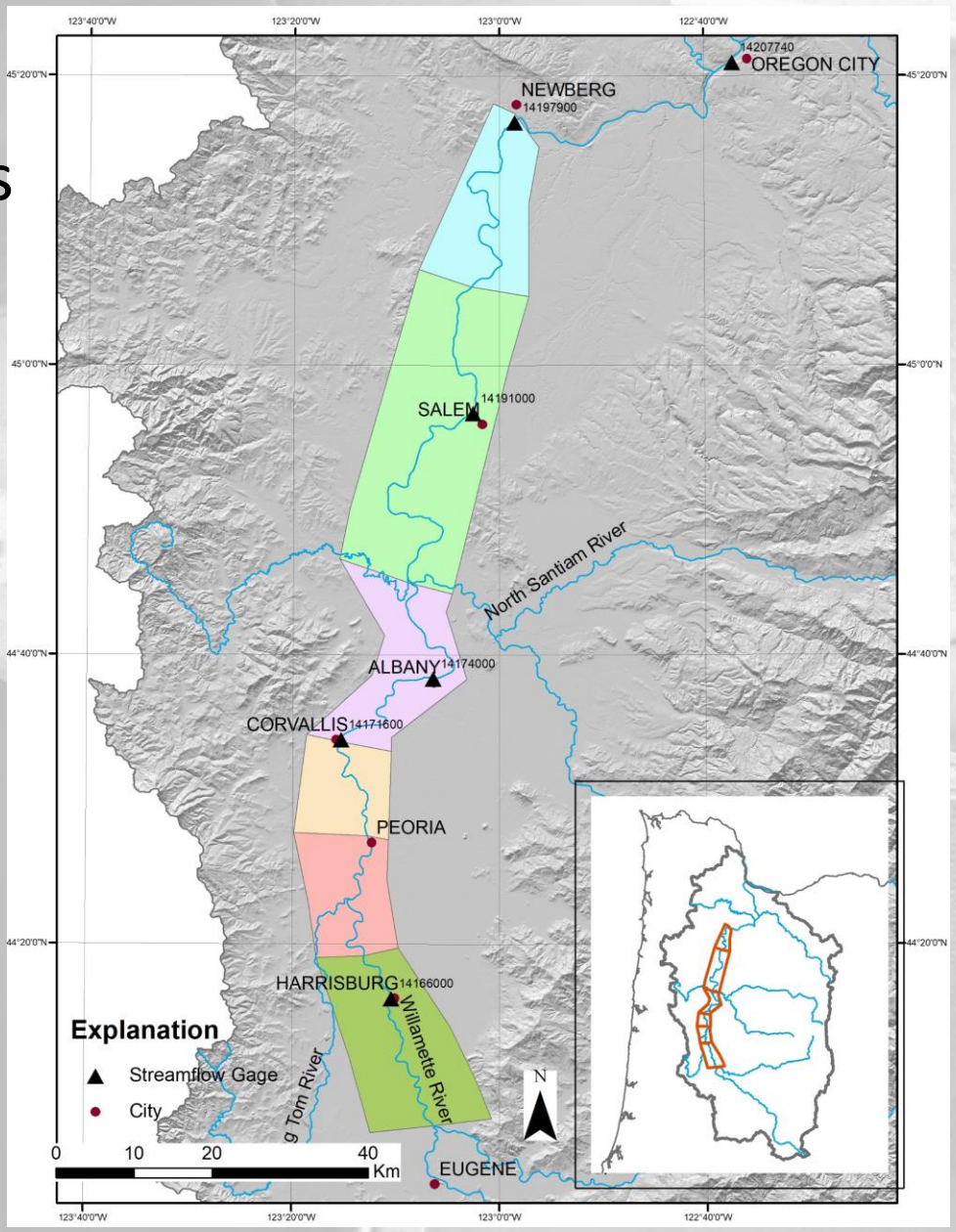
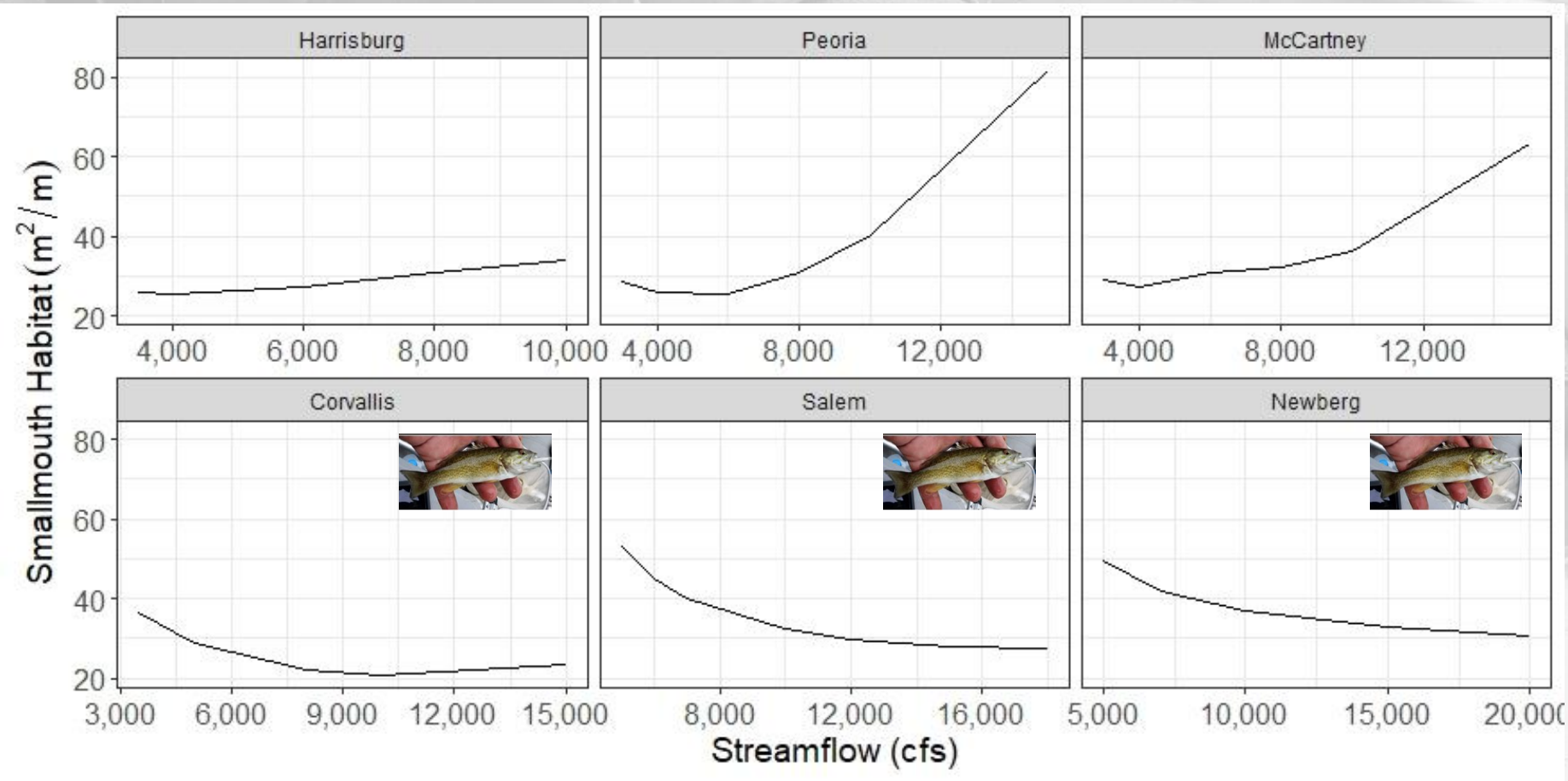
Preliminary results

Modeling results

Model Reaches



Modeling results



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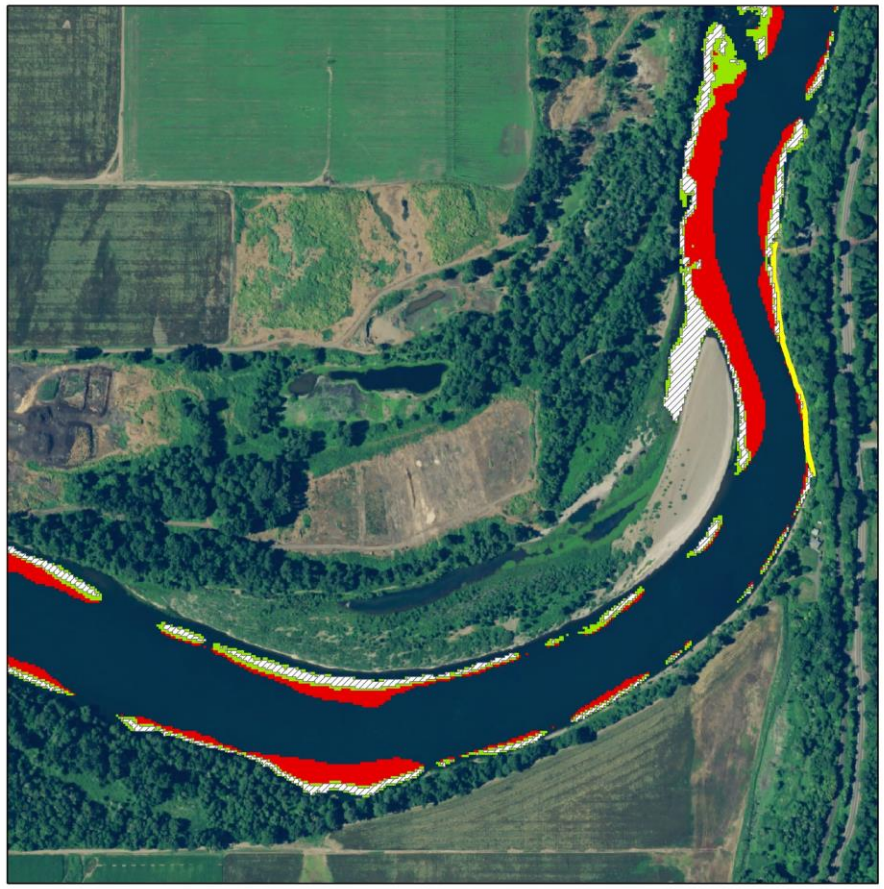
Preliminary results

Modeling results



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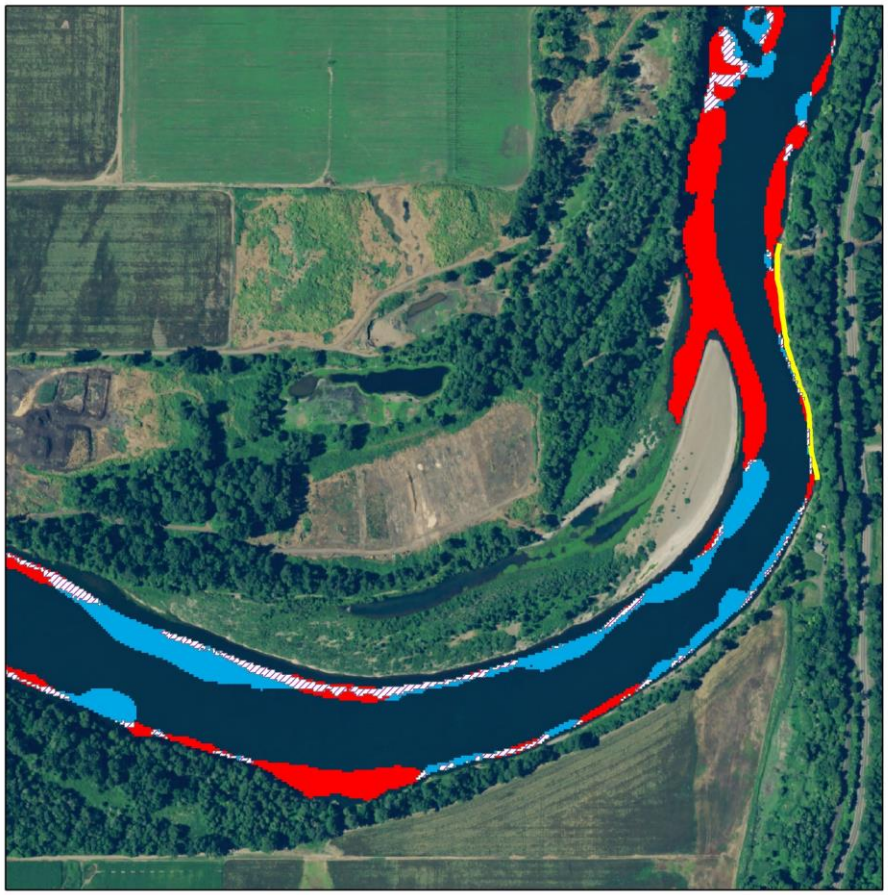

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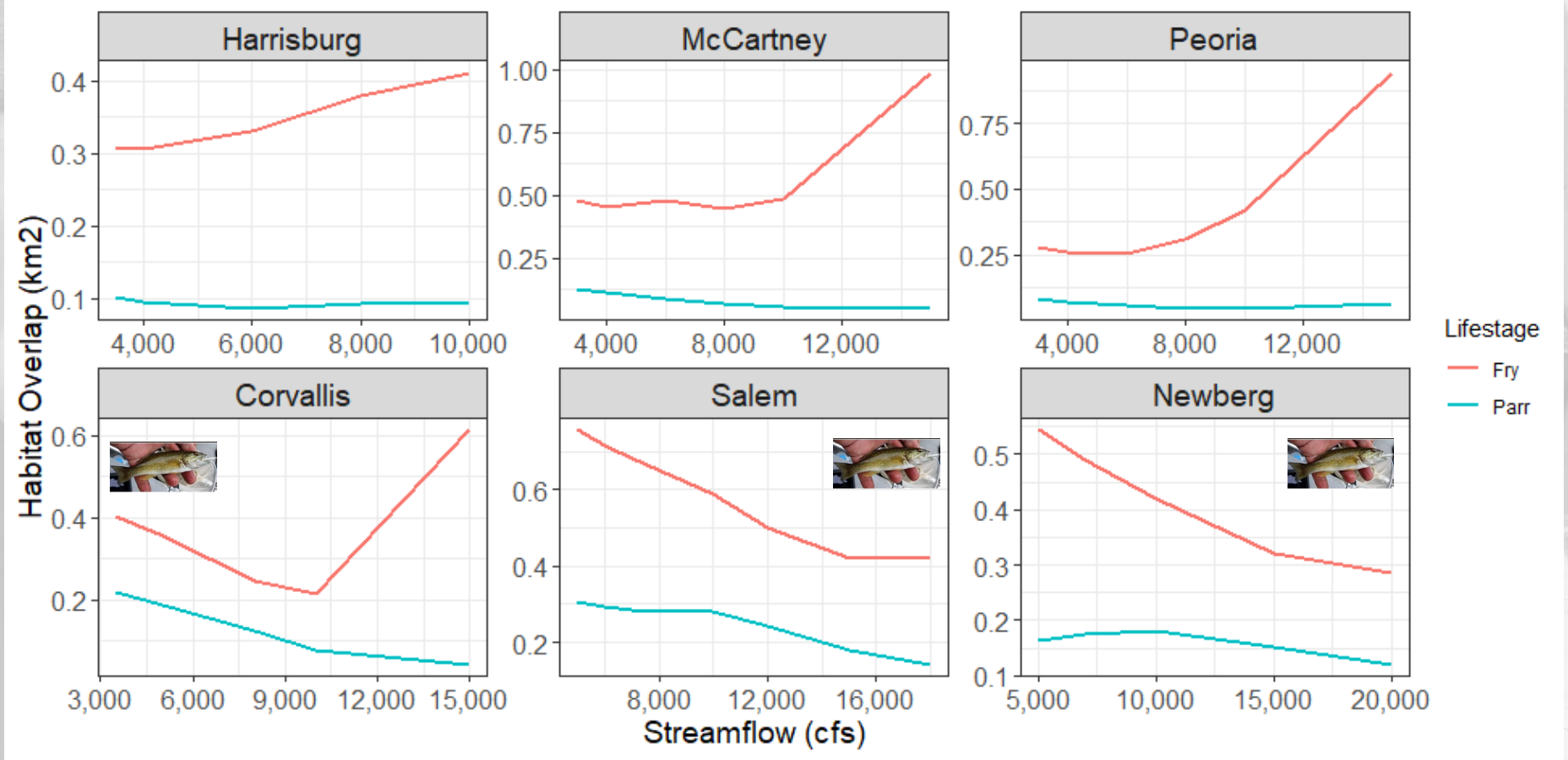

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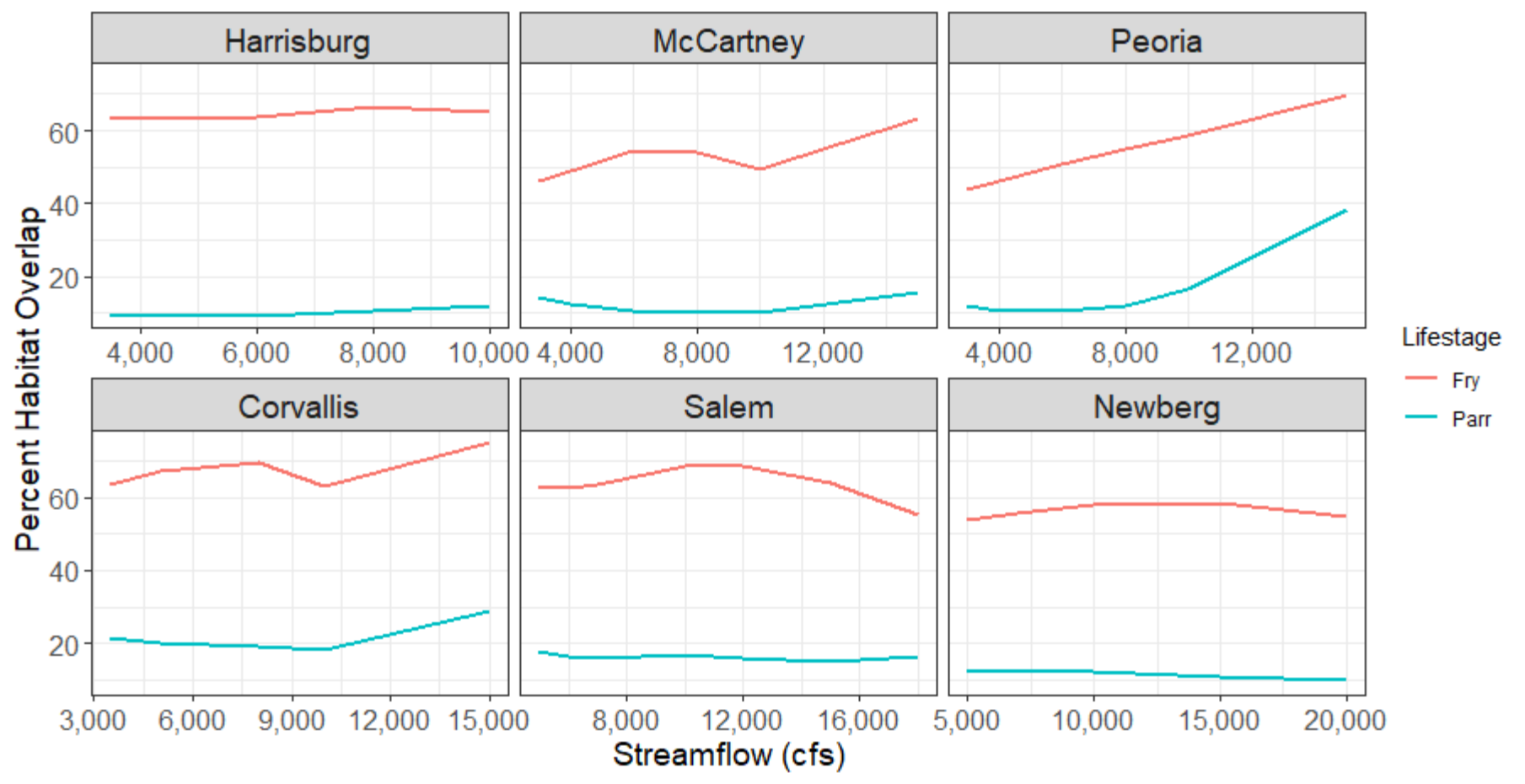

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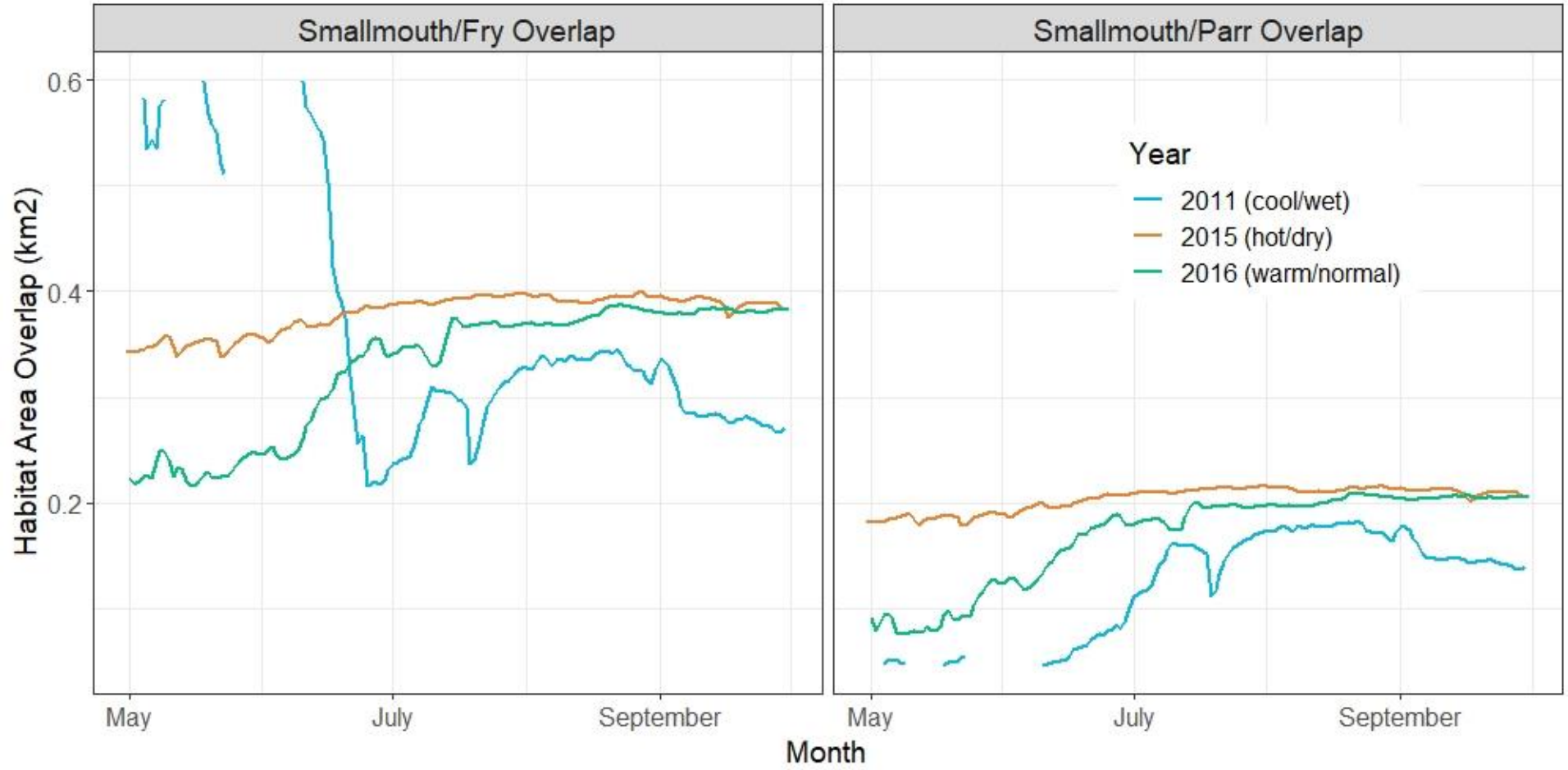

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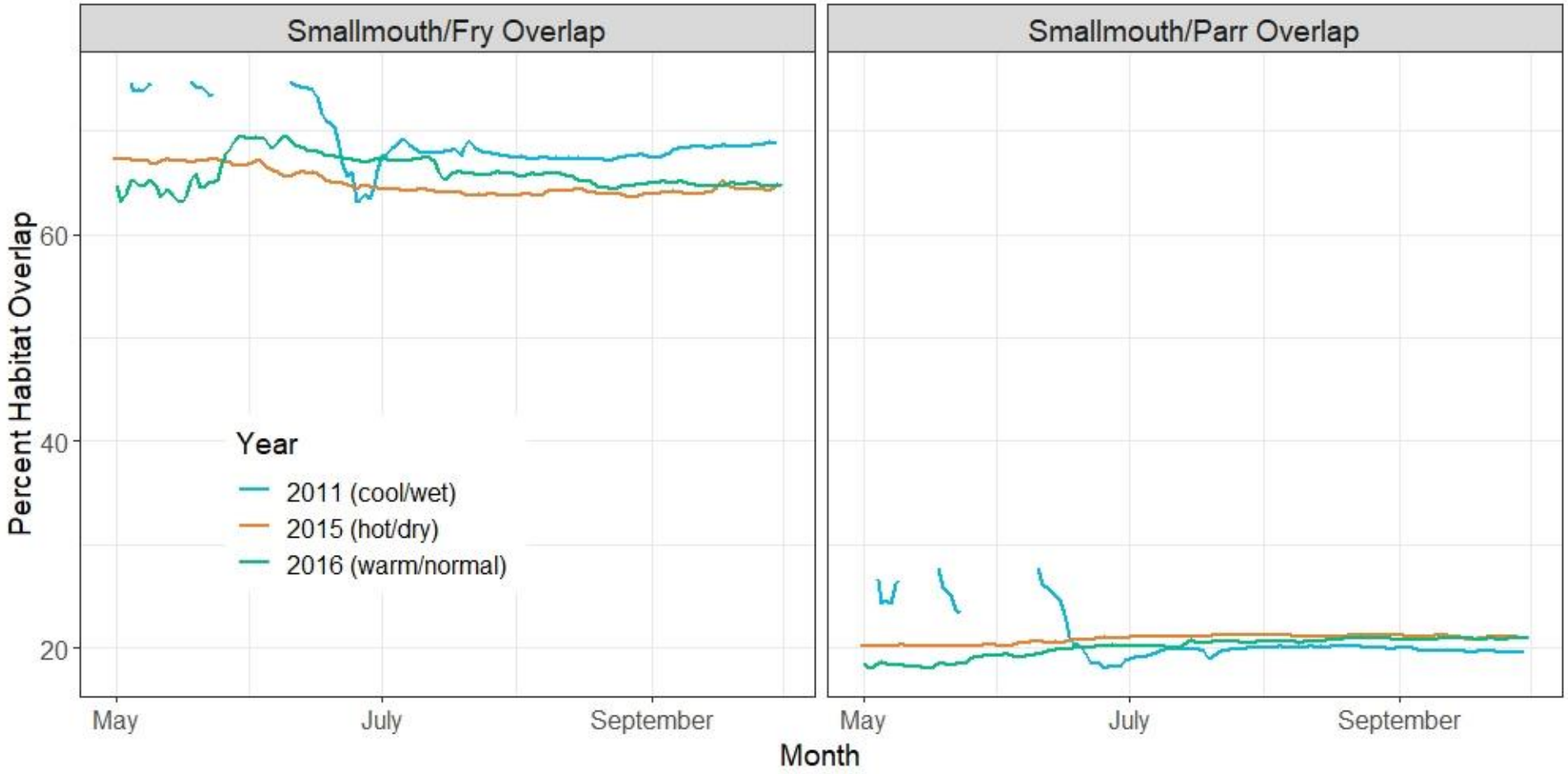

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Preliminary results

Preliminary Findings

- Model results appear to simulate Smallmouth Bass (SMB) habitat well, compared to limited dataset
- These models suggest there is extensive SMB habitat throughout Willamette
- Response of SMB habitat to streamflow varies dramatically between upper and middle Willamette reaches
- Predicted SMB habitat overlaps, or is in close proximity to, predicted juvenile Chinook habitat. Even in areas where “overlap” is limited, predation potential may be high
- About 60% of Chinook fry habitat coincides with SMB habitat
- About 10-30% of Chinook parr habitat coincides with SMB habitat
- Due to habitat similarities, no obvious flow management tool to limit habitat interactions between SMB and Chinook
- Extensive SMB habitat exists in reaches upstream of current distribution. SMB model can be used to test hypotheses as to what may drive this

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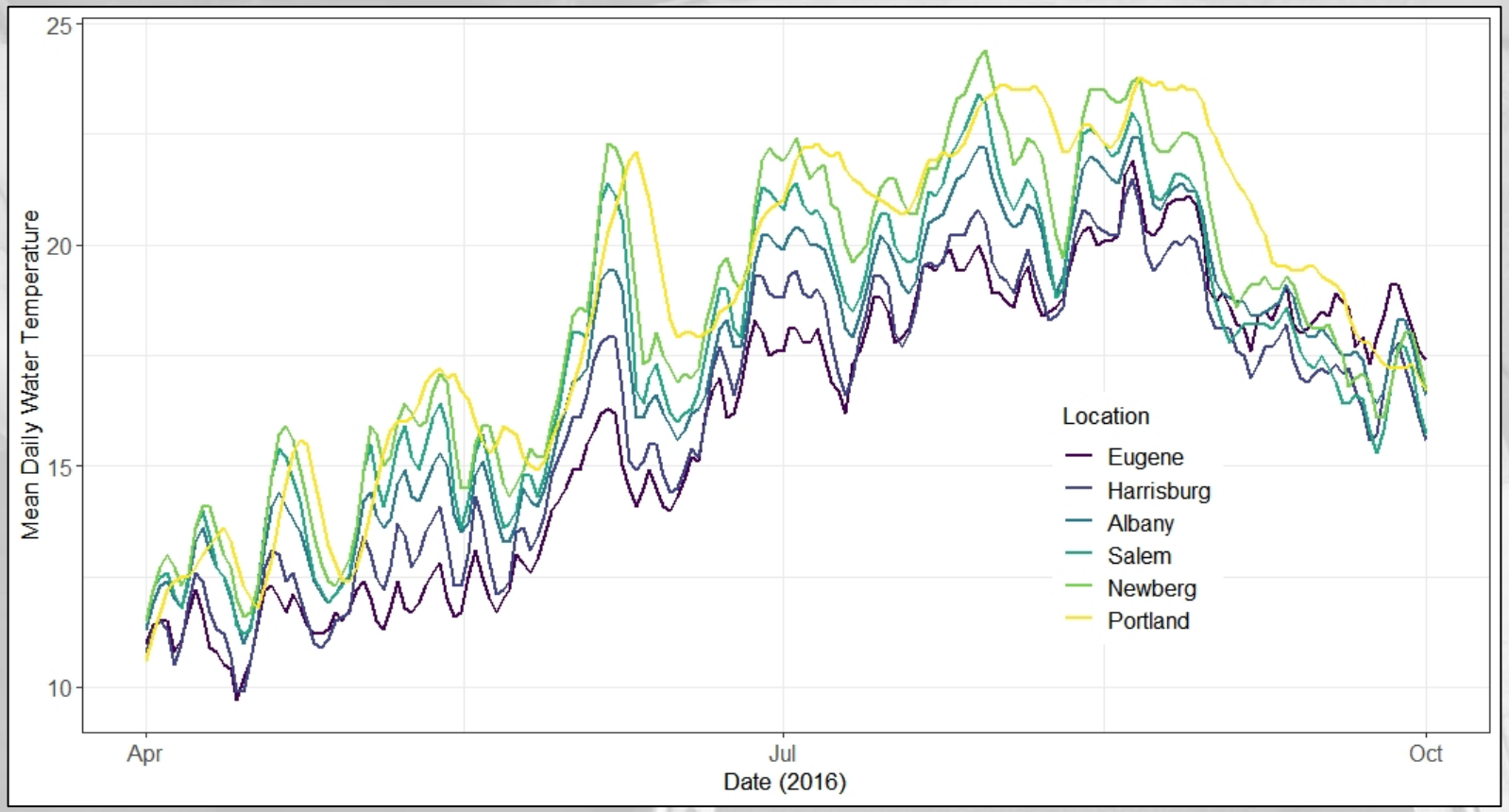
Next Steps

- Temperature integration
  - Spring/summer temperatures
  - Winter temperatures
  - Climate change scenarios



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Questions

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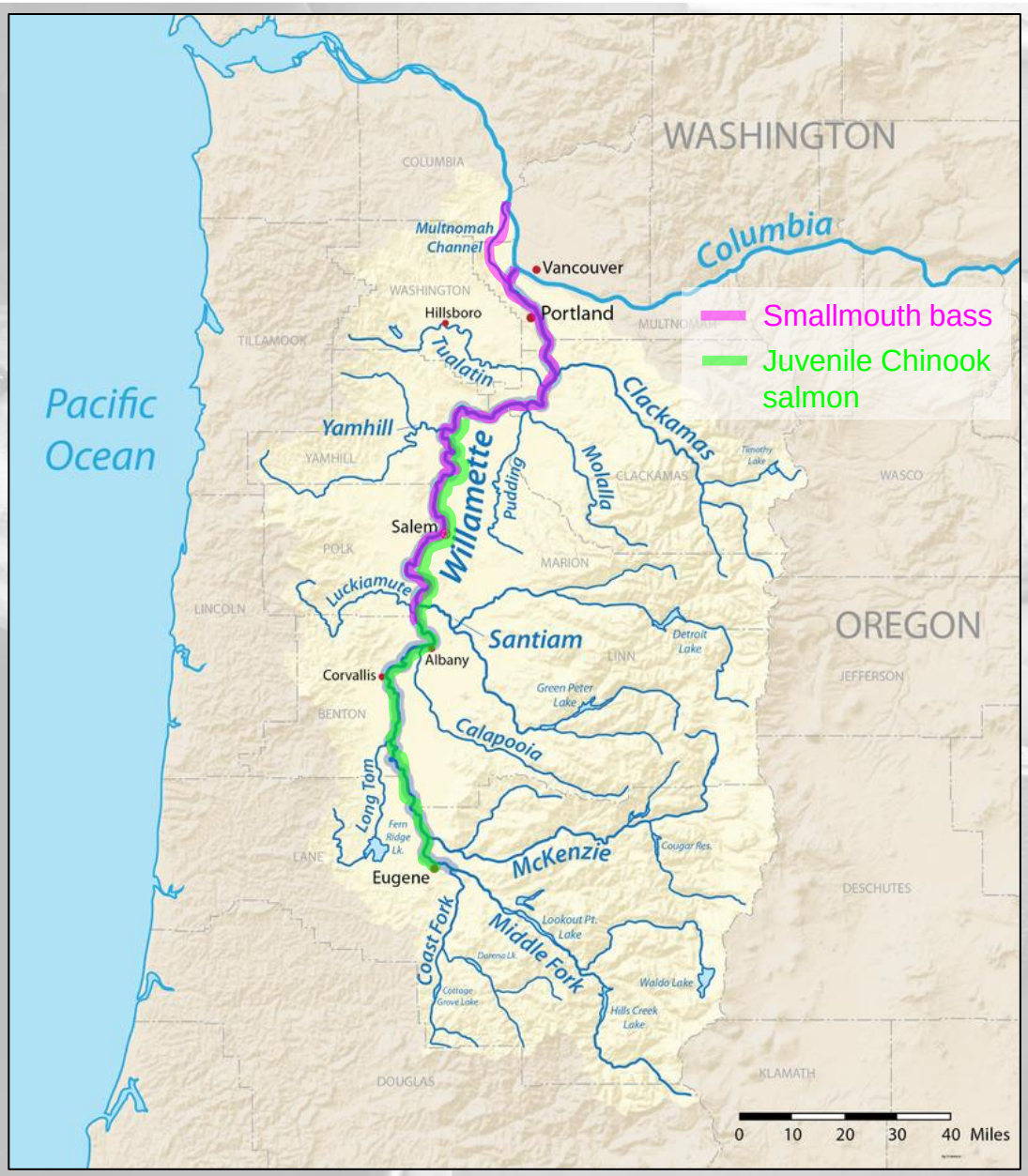
Extras

Overlap Between Juvenile Chinook and Smallmouth Bass



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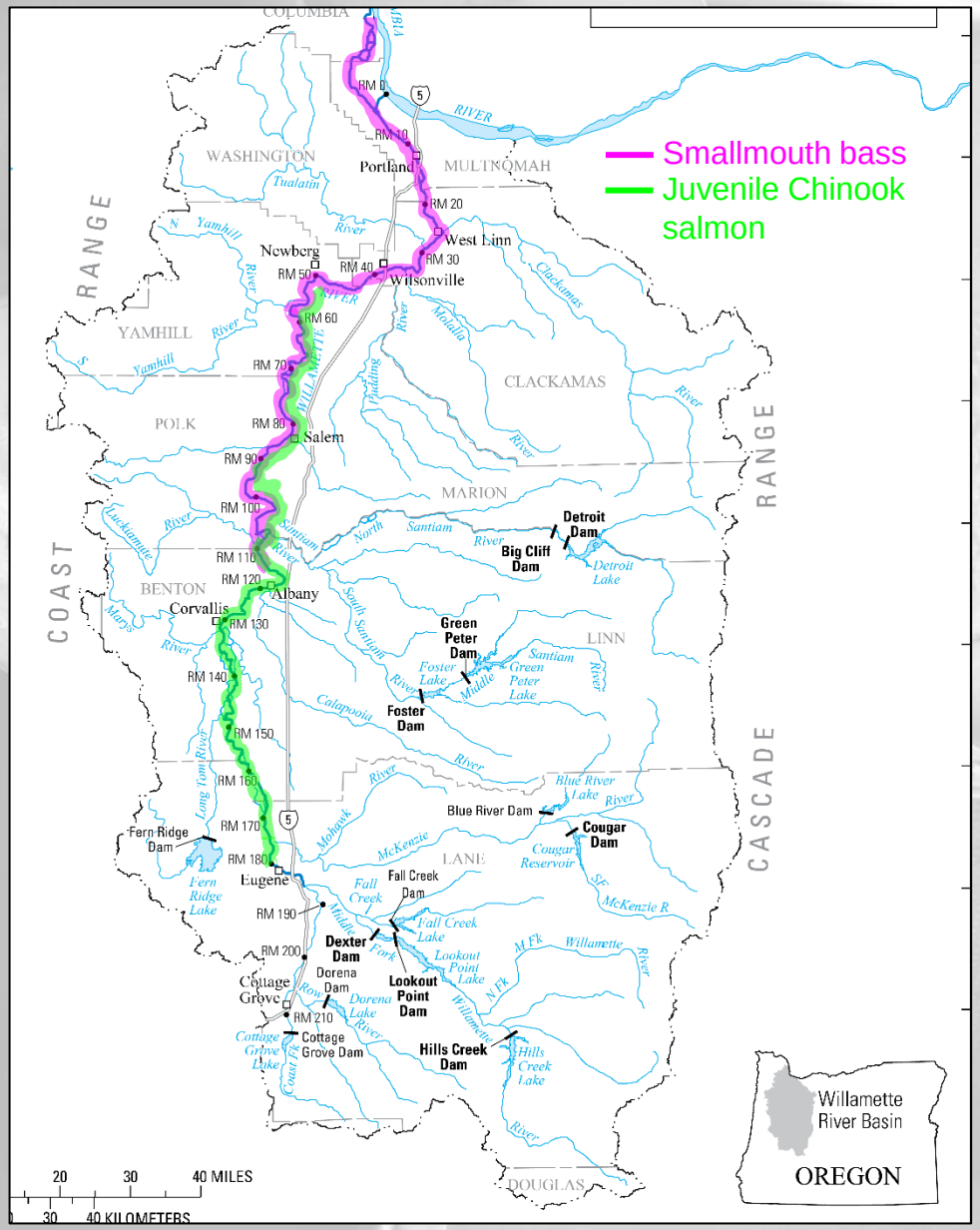
Habitat Overlap



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