Establishing Freshwater Conservation Priorities with Consideration of Existing Conservation Networks

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Symposium: Multispecies and Watershed Approaches to Freshwater Conservation Science

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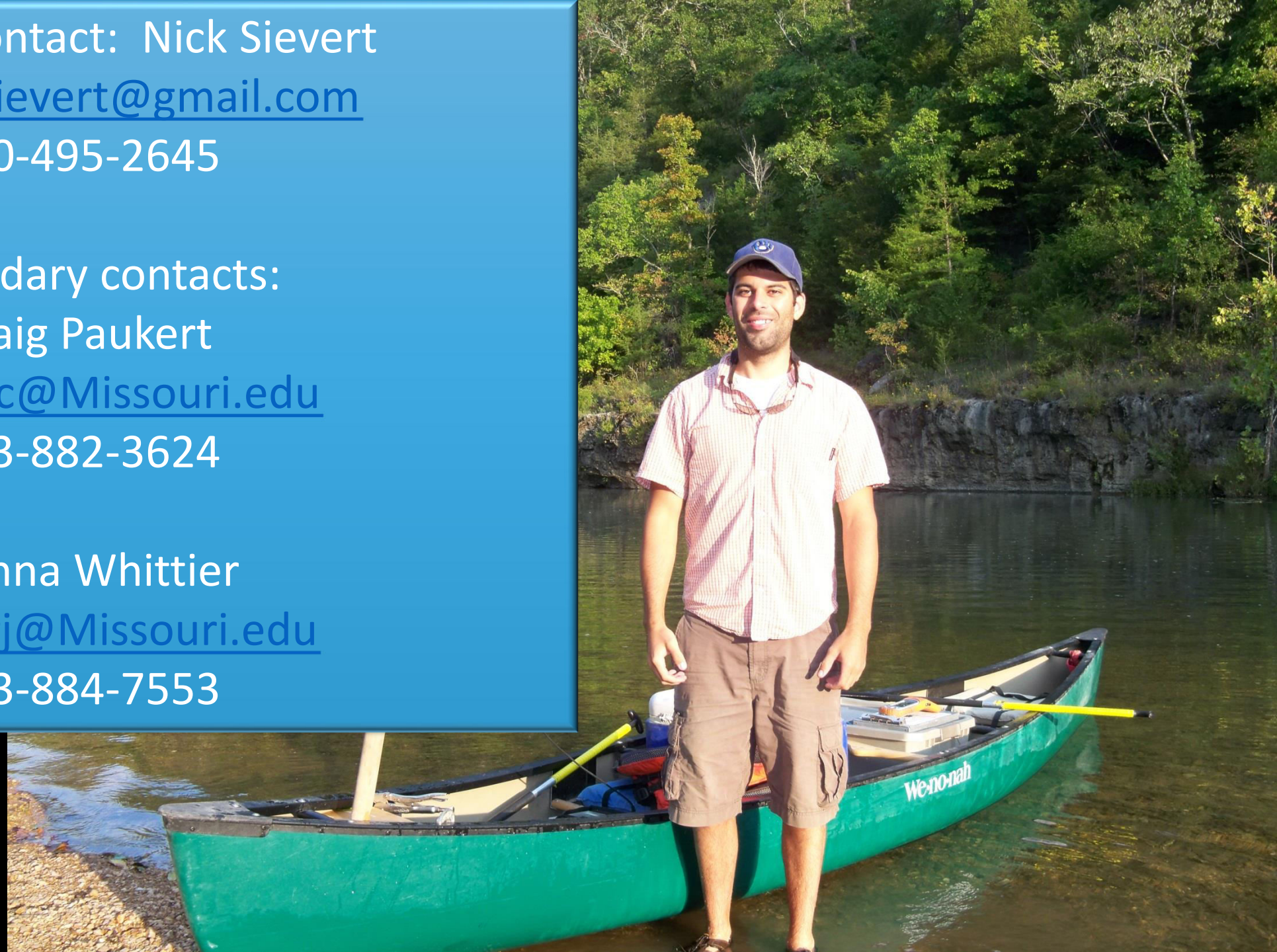


Landscape Scale Conservation

- **Landscape scale stream fish conservation**
  - Develop strategy for efficiently and effectively conserving a suite of species over a large geographical extent
  - Consider biodiversity and resources available
  - Take existing conserved lands into consideration

Objective

- **Identify the most valuable stream segments for fish conservation**
  - Framework: “Freshwater Conservation Network Prioritization” (FCNP)

1. Within conservation networks
2. Complementary to conservation networks

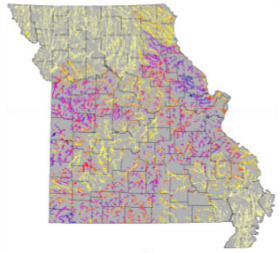
Vs. Blank Slate

Framework

Conservation Value

Freshwater Conservation Network Prioritization Framework

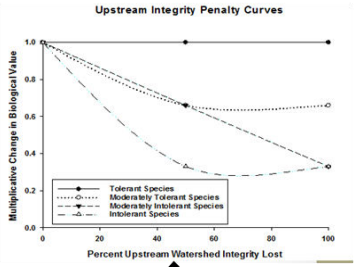
Species Representation: Distribution Models



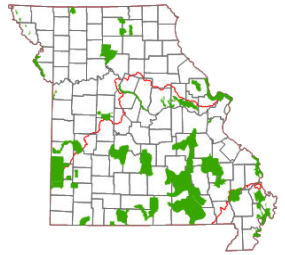
Species Weighting: Vulnerability Scores

Scientific Name	Vulnerability Weight
AMBLOPLITES ARIOMMUS	1.53
AMBLOPLITES CONSTELLATUS	1.64
APLODINOTUS GRUNNIENS	1.28
AMEIURUS MELAS	1.31
AMEIURUS NATALIS	1.18
AMEIURUS NEBULOSUS	1.56
AMBLOPLITES RUPESTRIS	1.25
APHREDODERUS SAYANUS	1.22
COTTUS BAIRDII	1.57
CYPRINELLA CAMURA	1.28
COTTUS CAROLINAE	1.46

Upstream Integrity: Penalty Curves

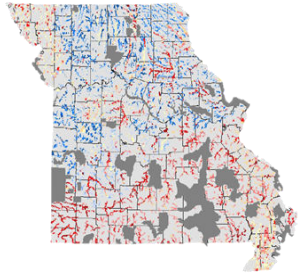


Mask: Conservation Network

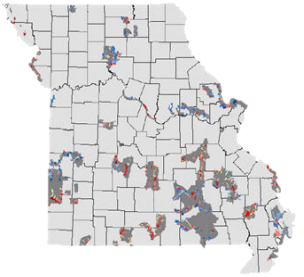


Prioritization: Zonation 3.1

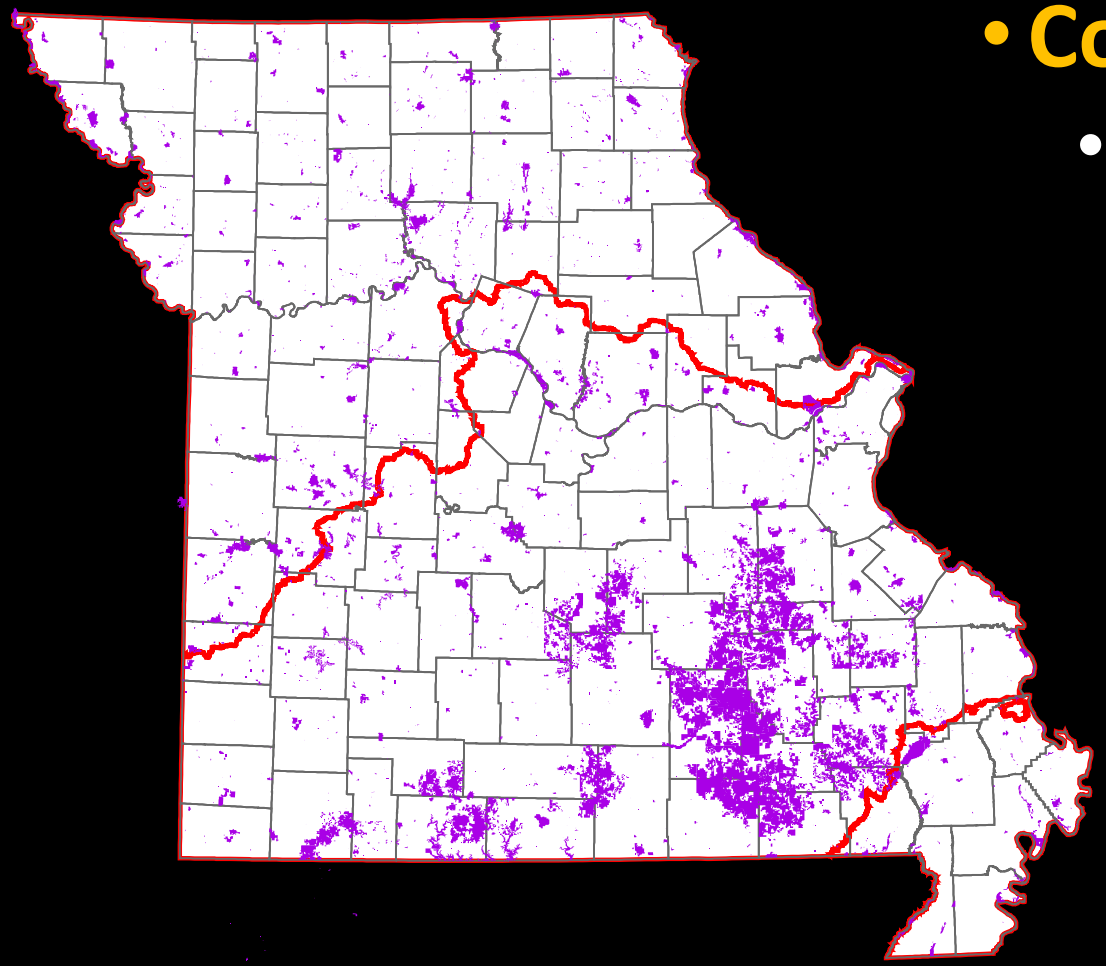
Complementary Priorities



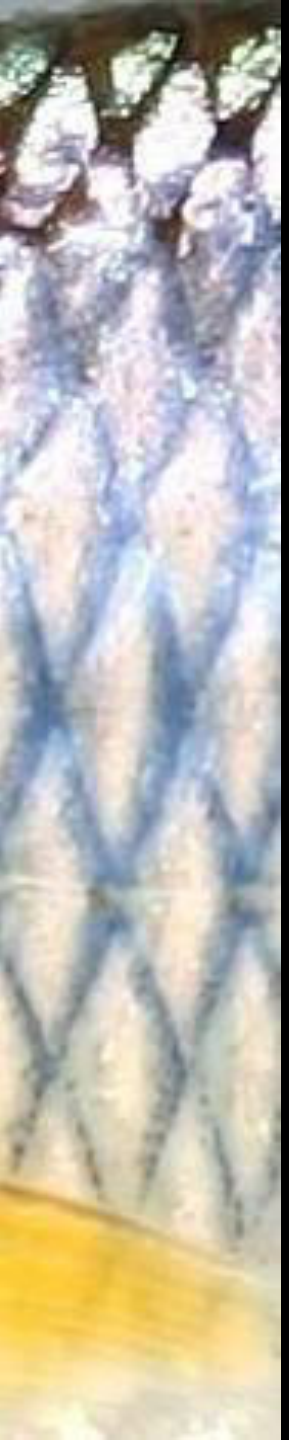
Within Network Priorities



Case Study: Missouri Wadeable Streams



- **Conservation network**
  - Publicly and privately owned areas which are managed with a primary purpose of conservation



Conservation Value

- **Fish species**
  - Community samples
  - 1990-2011
  - N=~1,900
- **Rank value of stream segments based on**
  - Species Representation
  - Species Weights
  - Upstream Integrity/Connectivity

Species Representation

- **Component Models**
  - Boosted Regression Trees
  - Random Forest Models
  - Generalized Additive Models
  - Multivariate Adaptive Regression Splines

Species Representation

- Component Models
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- **Ensemble models**
  - **Averaged results of component models which met minimum evaluation standards**
    - **Discrimination**
      - **AUC >0.6**
    - **Model Fit**
      - **Mean Absolute Error <0.125**
    - **Occurrence Frequency**
      - **Within 25%**

Distribution Models

- 79 Species: Models
- 54 Species: Point data with occurrence rates

Probability of Occurrence

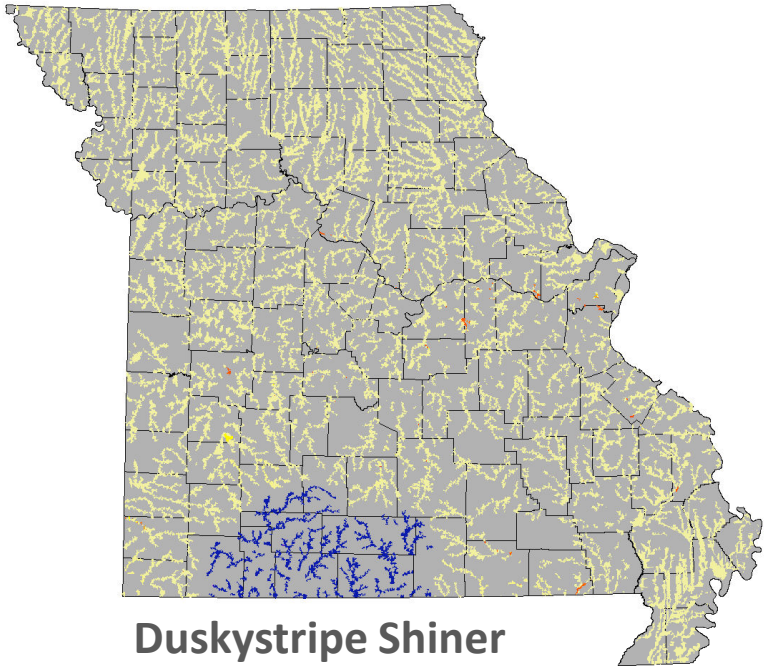
= 1

≈ 0.75

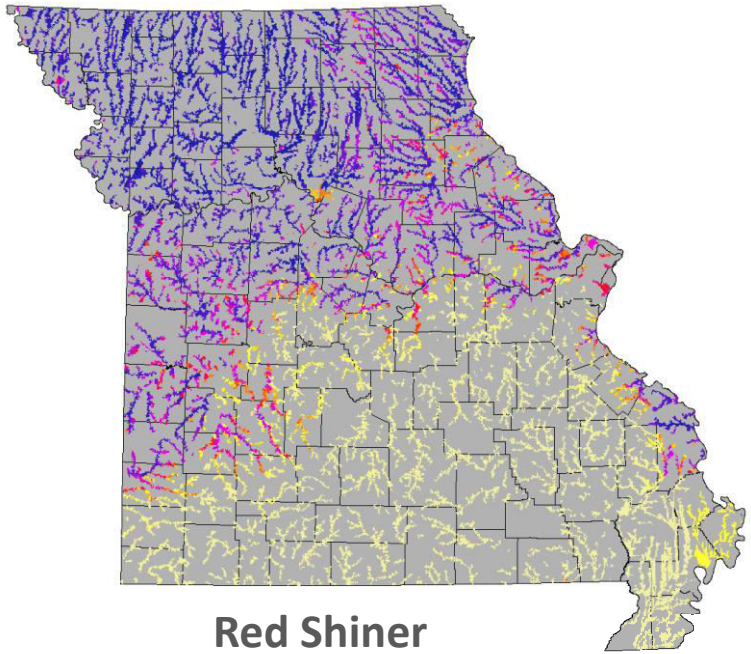
≈ 0.50

≈ 0.25

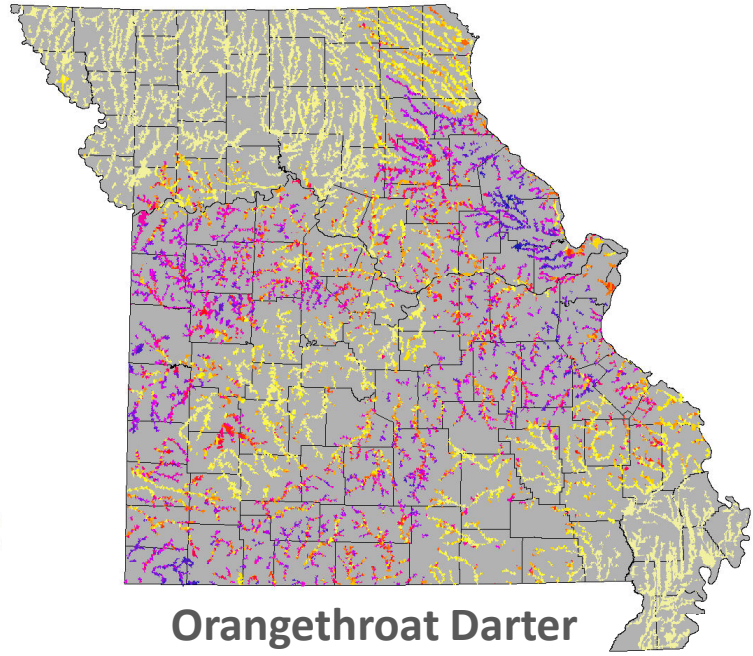
=0



Duskystripe Shiner



Red Shiner

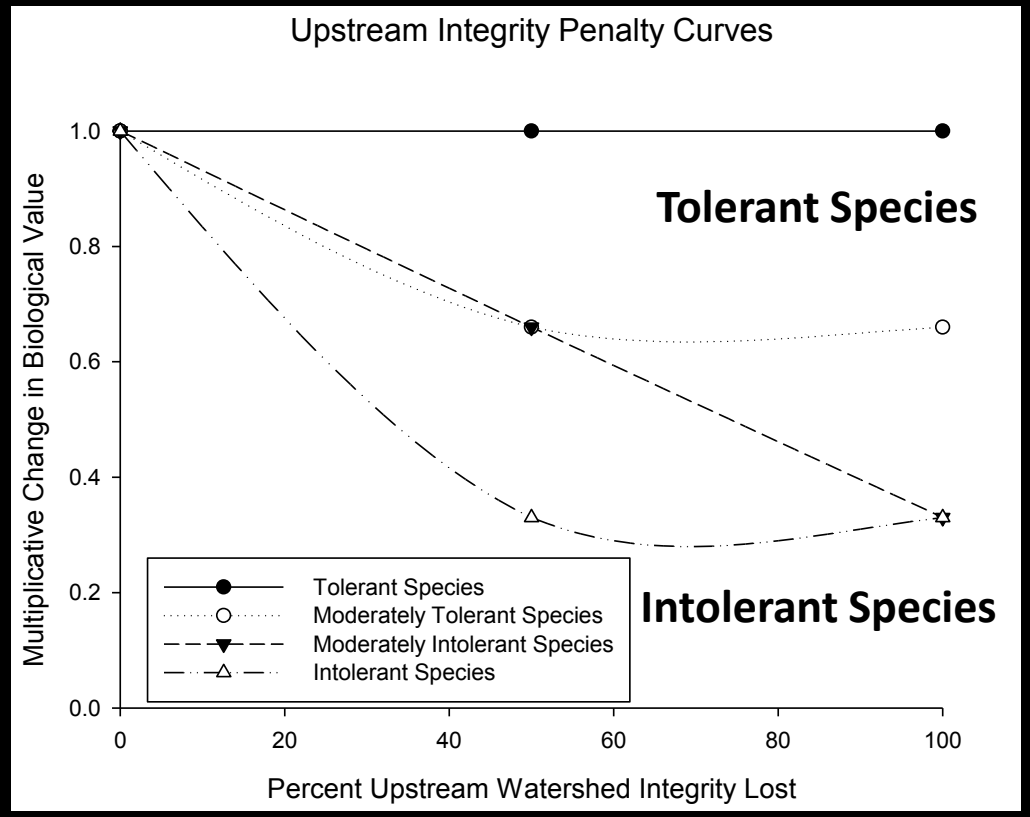


Orangethroat Darter

Species Weight

- **Weighted based on species vulnerability**
  - Vulnerability
    - Habitat, Temperature, and Flow
    - Dispersal, Rarity, Range
    - Habitat Connectivity

Upstream Integrity/Connectivity

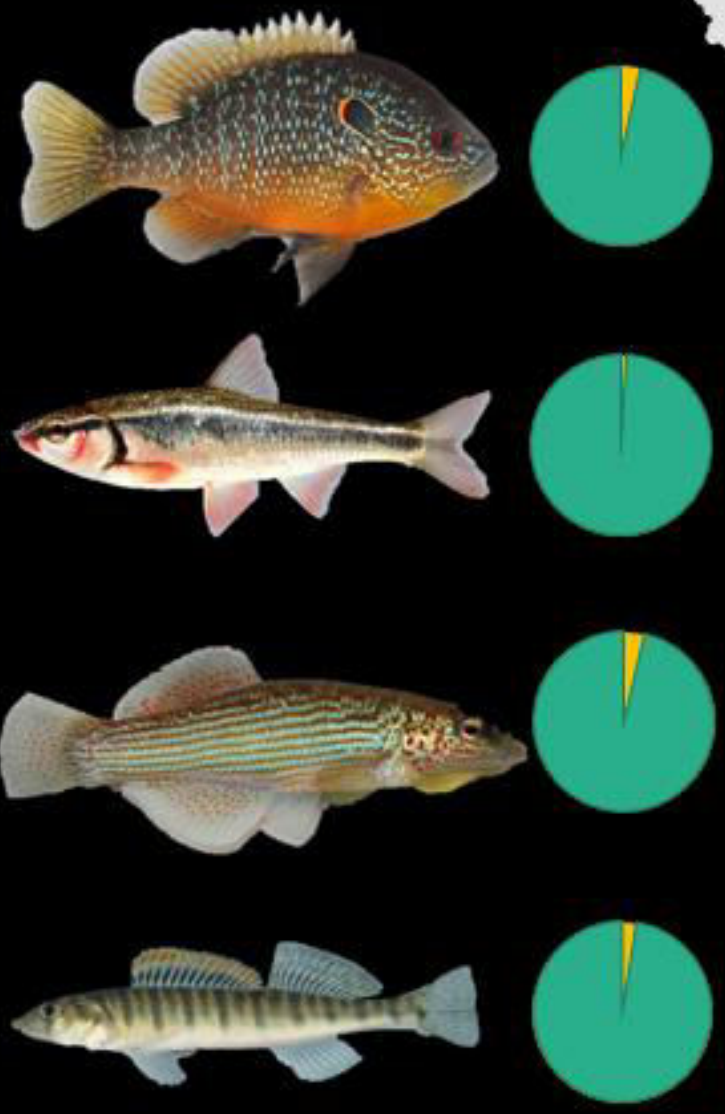


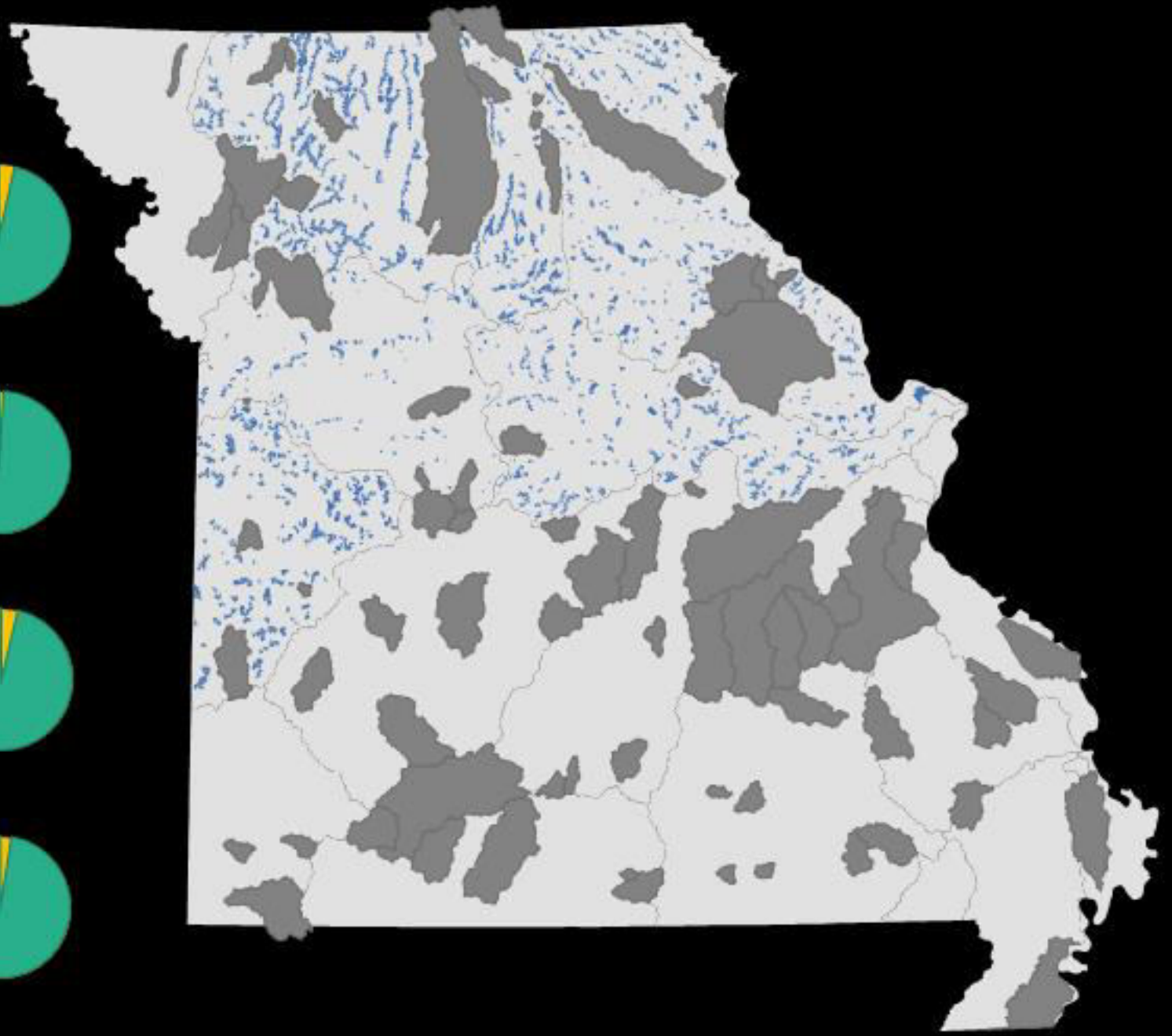
- Prioritize stream segments which maintain upstream connectivity
- Species specific penalty curves
  - Quantified species responses to upstream habitat degradation

See Moilanen and Wintle. 2007. Conservation Biology. 21 (2): 355-364 for more information

Zonation

Zonation





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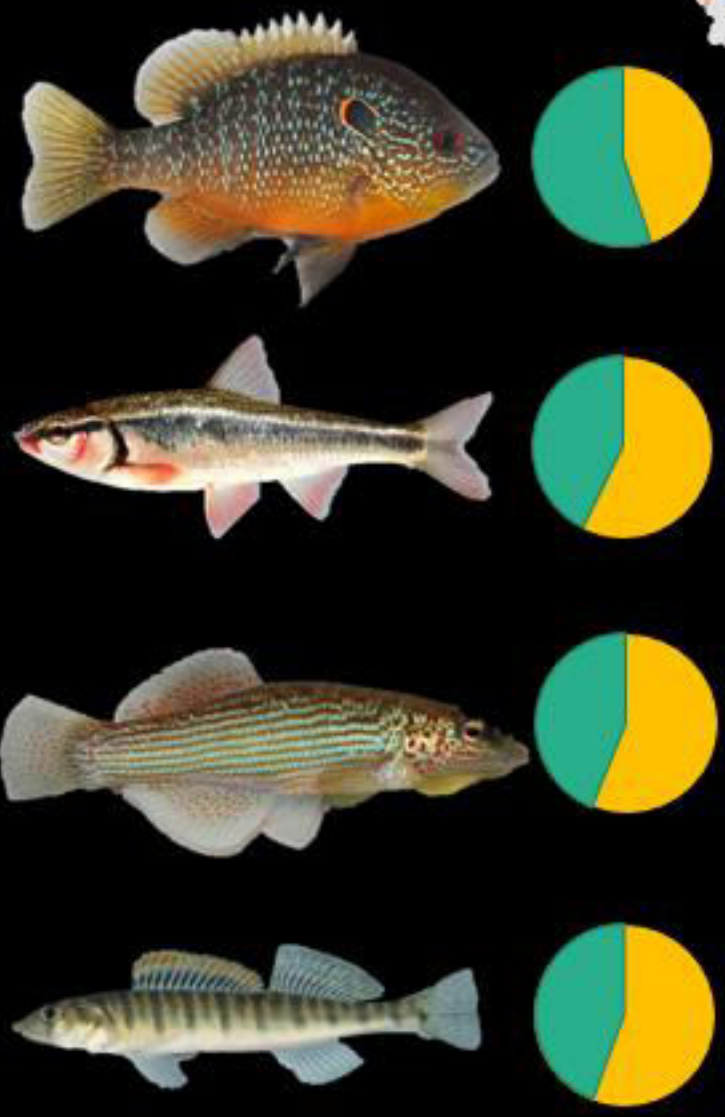

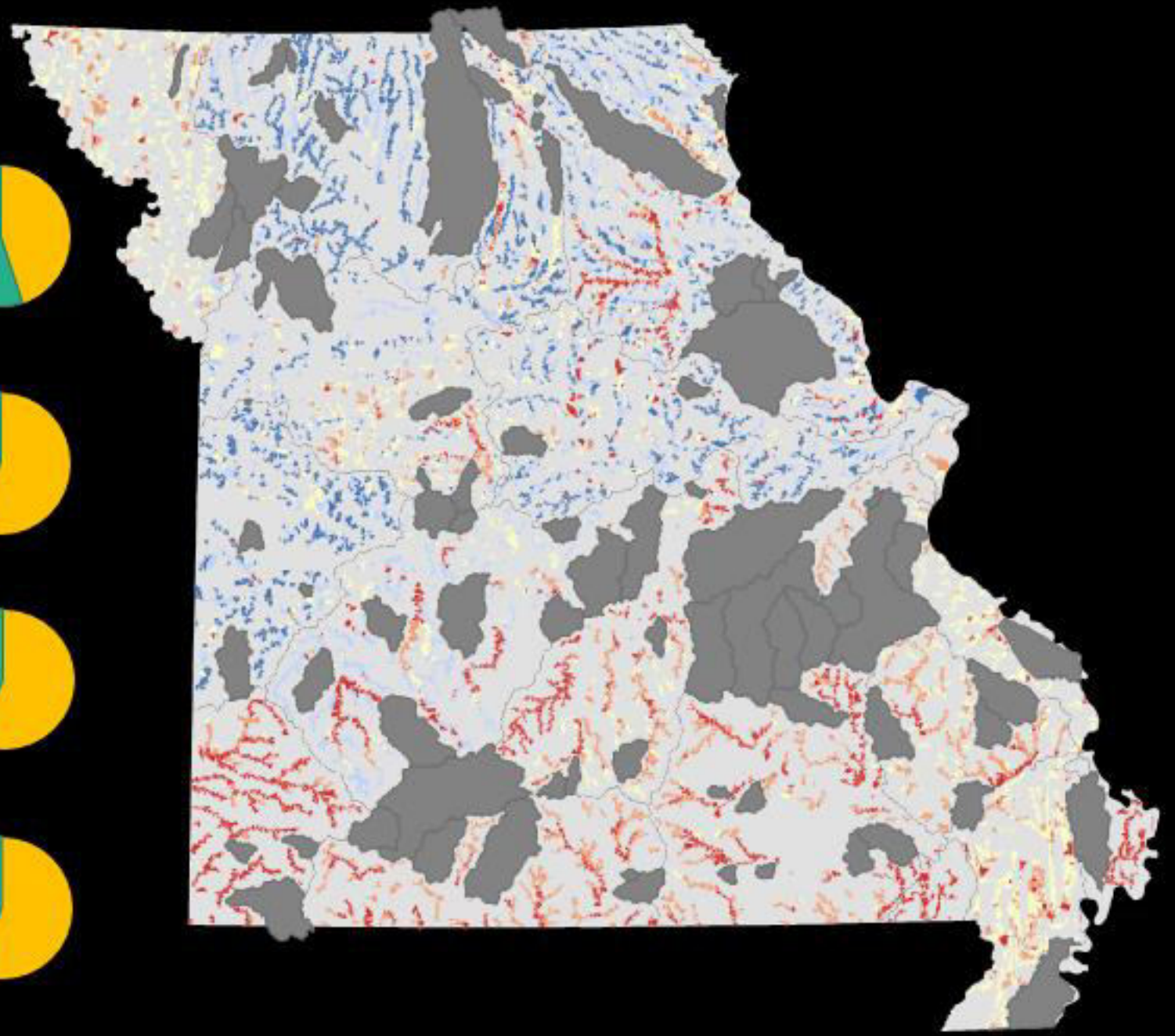

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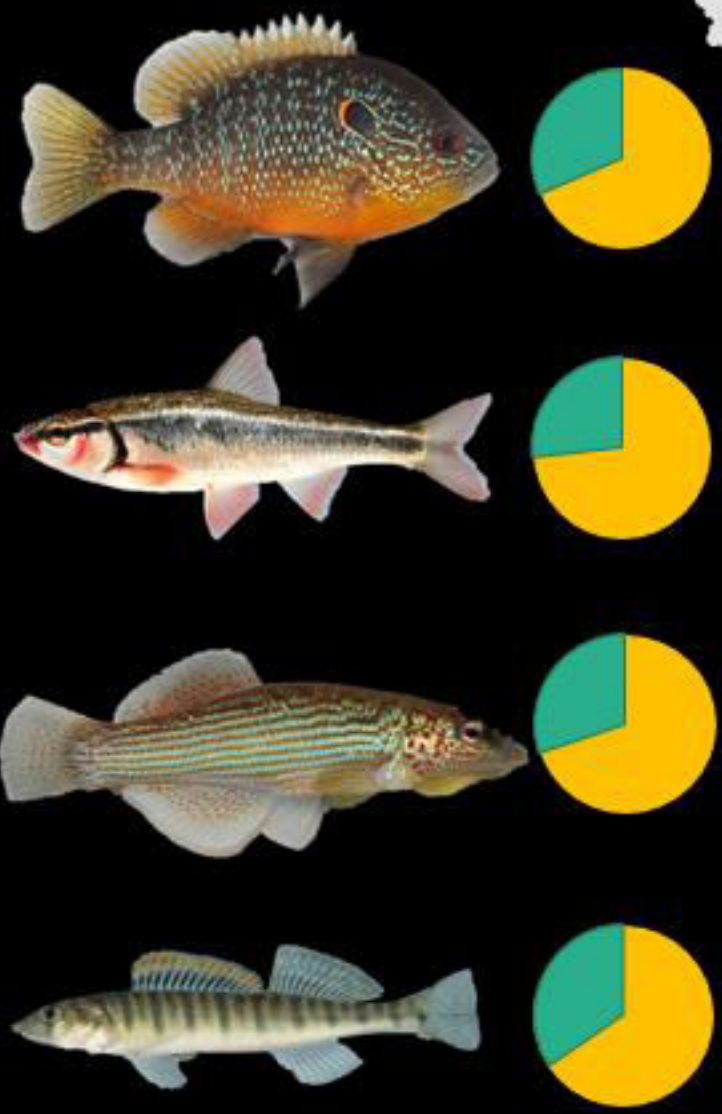

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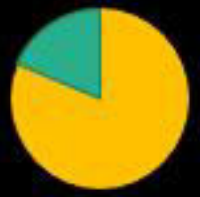

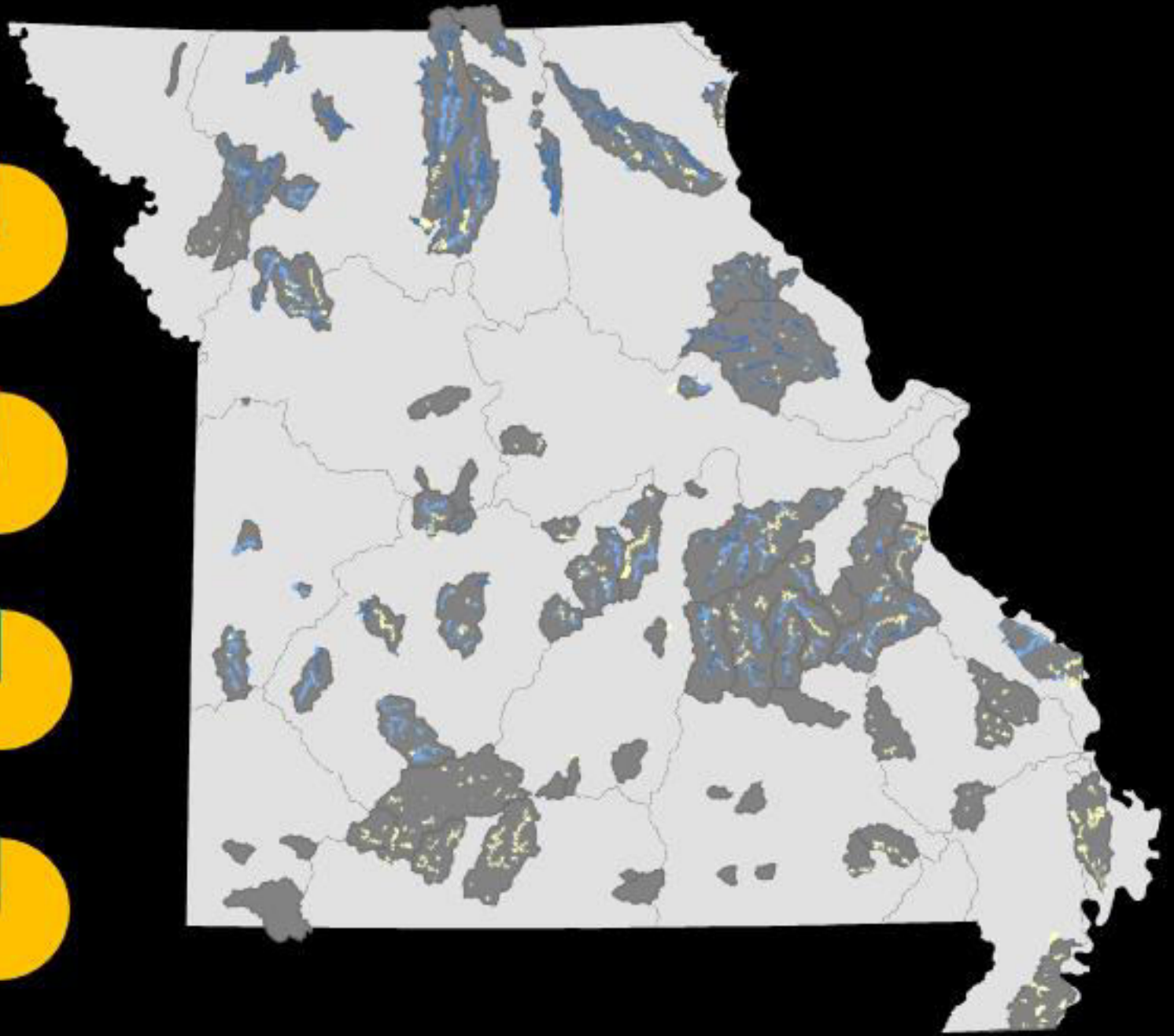

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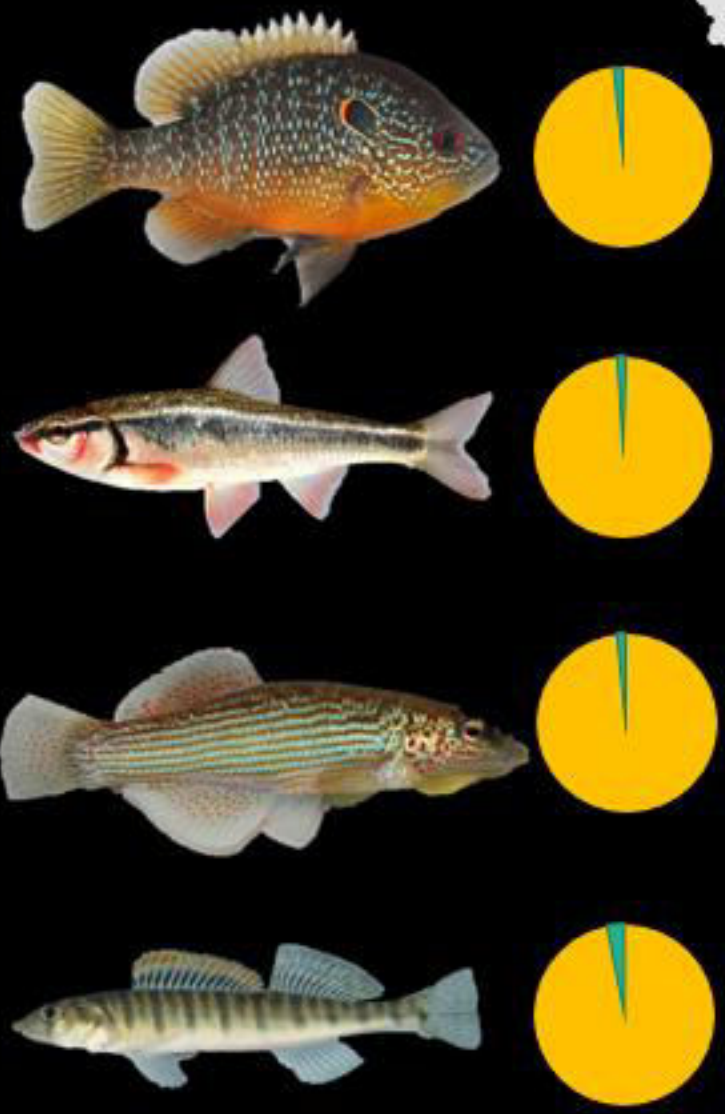
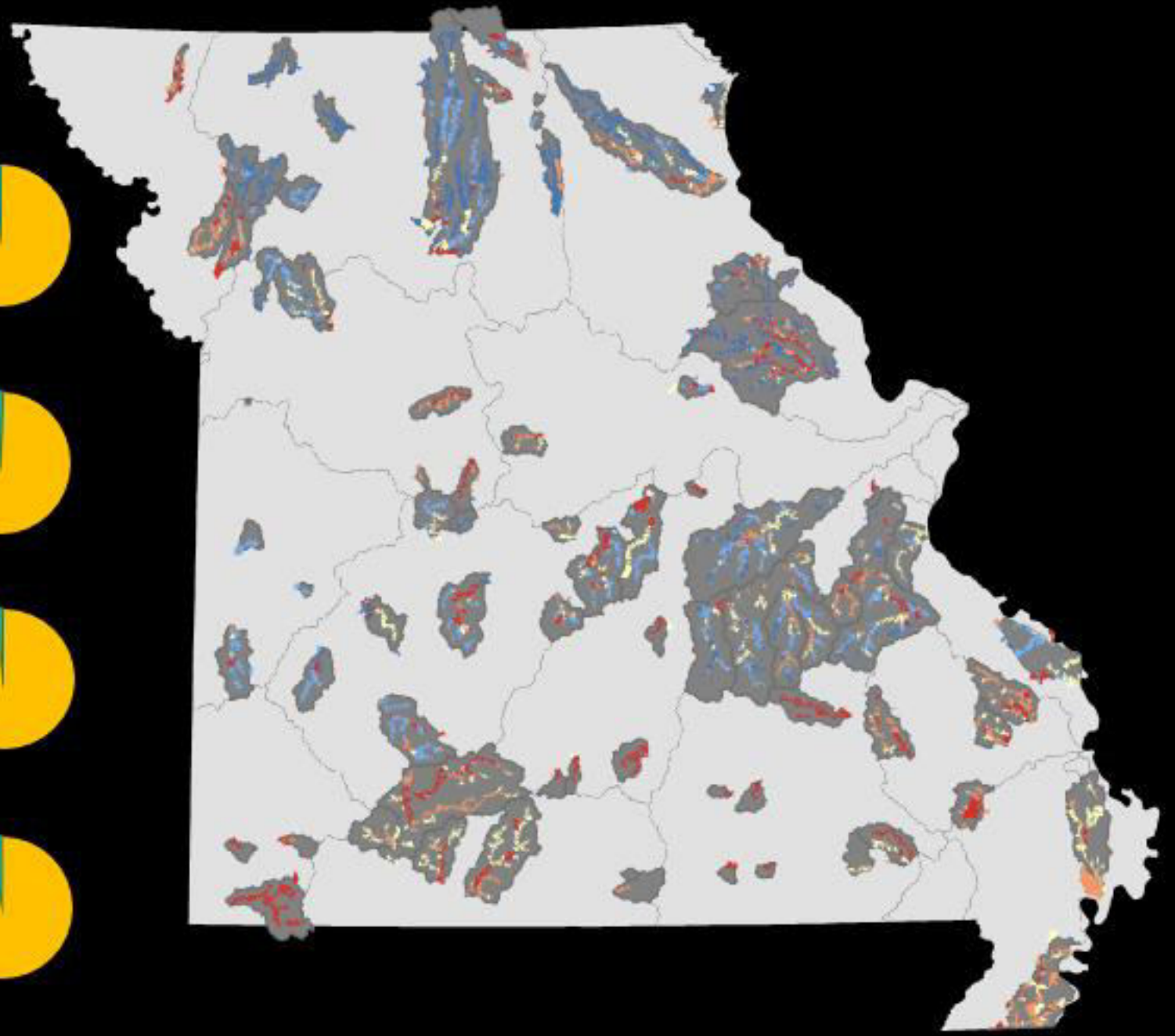
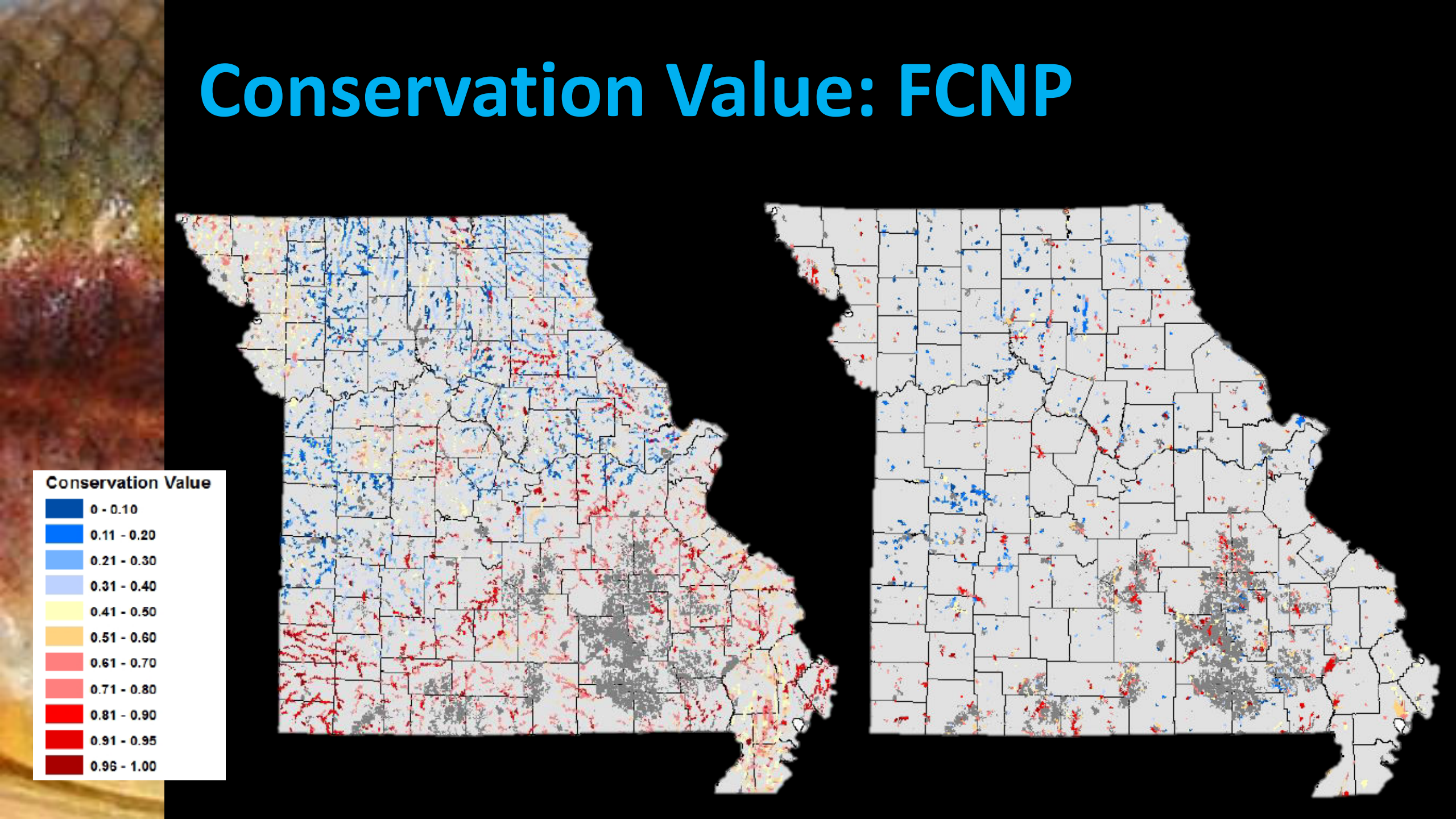


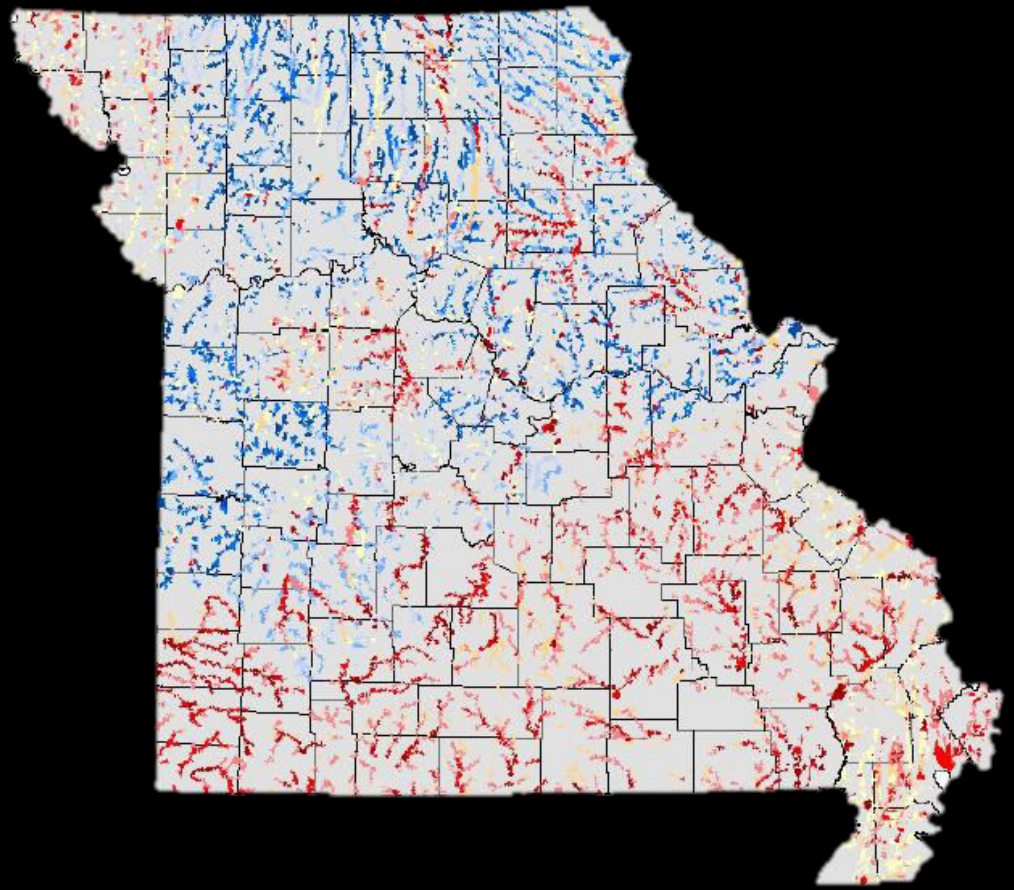


Conservation Value: FCNP

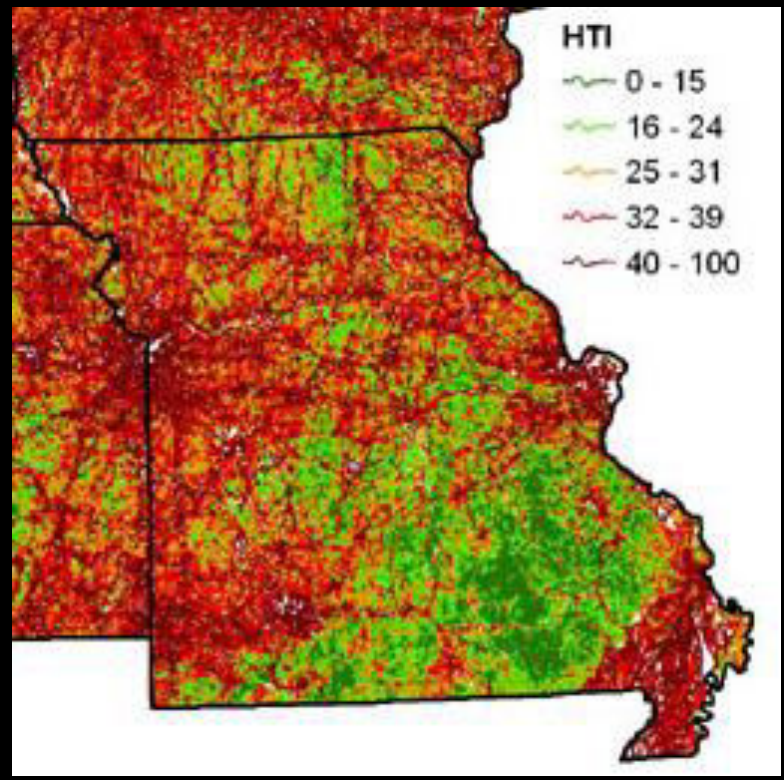


Alternative Approaches

- **Blank Slate**
  - Starting from scratch



- **Habitat Threat Index**
  - Previously developed for MO
  - Based on # of threats



Comparisons

- **FCNP vs Blank Slate**
  - 2.1X more stream segments to represent all species
  - Essentially equal representation across priority ranks
  - Rare species rep
    - 3% fewer to 10% more sites
  - Top 10% across MO
    - 71% of species lower levels of representation
- **Not as feasible**

- **FCNP vs. Threat Index**
  - 2.6X fewer stream segments to represent all species
  - Better species representation across all priority ranks
  - Avg 5 more occurrences for rare species across priority ranks
  - Top 10% across MO
    - 71% of species higher levels of representation

Complementary Areas: Outside Existing Conservation Network

- Opportunities for acquisition and partnerships
- High value locations
  - Underrepresented species
  - Highly weighted species
  - Areas with sufficient upstream connectivity

Within Network Rankings

- Opportunities for protection, management, and restoration
- High value locations
  - Rare species and high species richness
  - Highly weighted species
  - Areas with sufficient upstream connectivity

Framework

- Apply to systems of interest
  - Local
  - State
  - Regional
  - National
- Incorporate factors based on user needs
  - Conservation Networks
  - Species of interest
  - Emphasize representation or richness
  - Species weighting options
  - Include habitat integrity, connectivity or other factors such as cost, threats, etc.

Take Home

- Incorporating established networks increases the feasibility of implementation
- Priorities based solely on habitat integrity resulted in lower species representation
- Constraining prioritization to established networks had minimal impact on efficiency
- Framework can be used to target restoration, land acquisition and partnerships

Acknowledgements

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