

Acknowledgments

- Illinois Department of Natural Resources
 - Grant F-186-R-10
- All former and current graduate and undergraduate students



Aquatic Connectivity

- Movement
 - Reproduction
 - Growth
 - Survival
- Population fragmentation
 - Genetic isolation
 - Assemblage richness



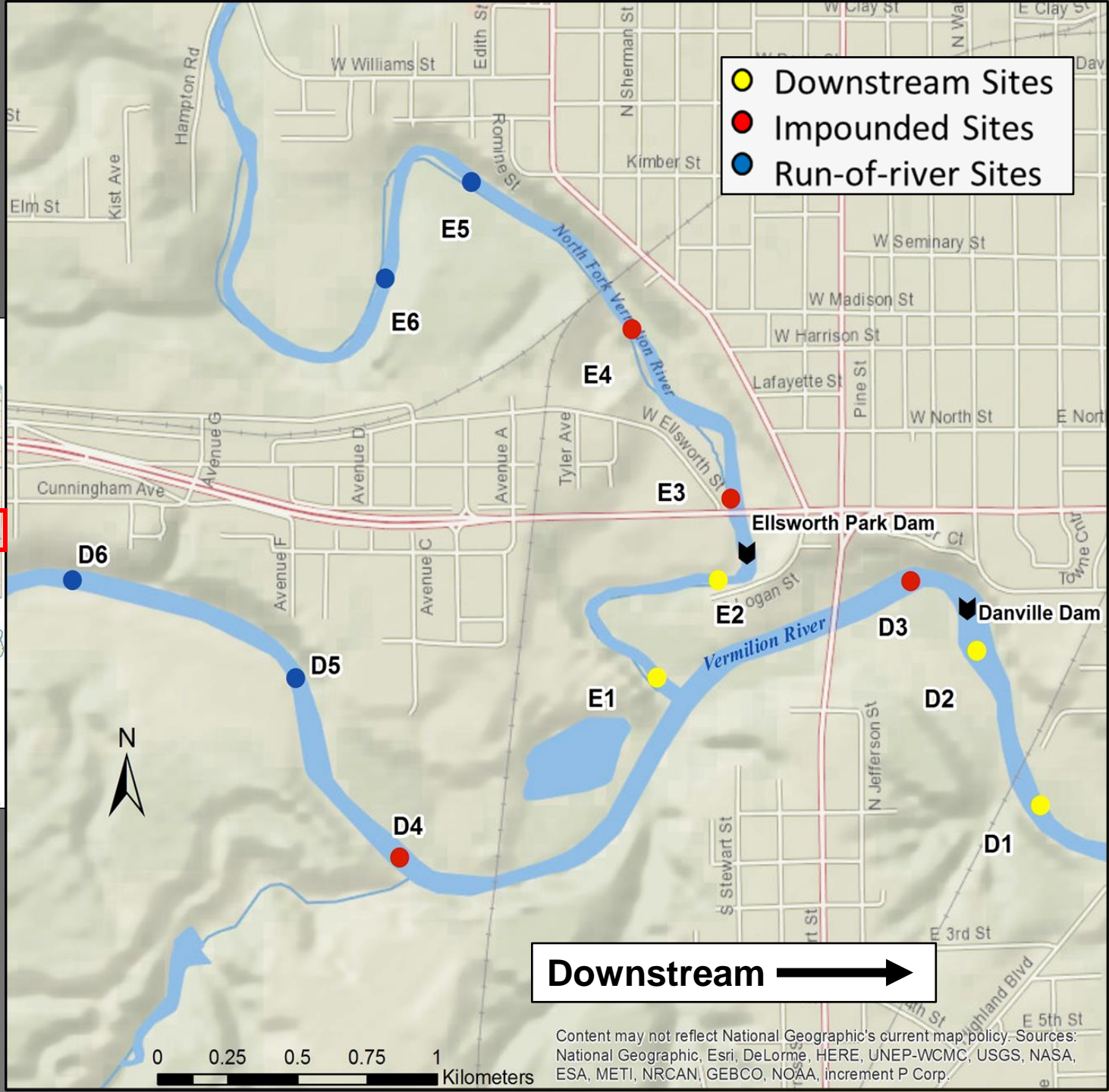
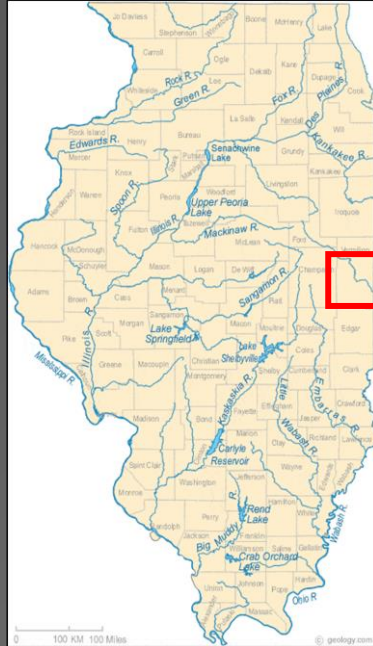
Impacts of Dams

- Fish
 - Barriers to longitudinal connectivity
 - Habitat fragmentation
- Habitat
 - Altered hydrology
 - Sediment transport



Vermilion River

- Danville, IL
- 2 Rivers
 - Vermilion
 - North Fork Vermilion
- 3 Reaches
 - Downstream
 - Impounded
 - Run-of-River

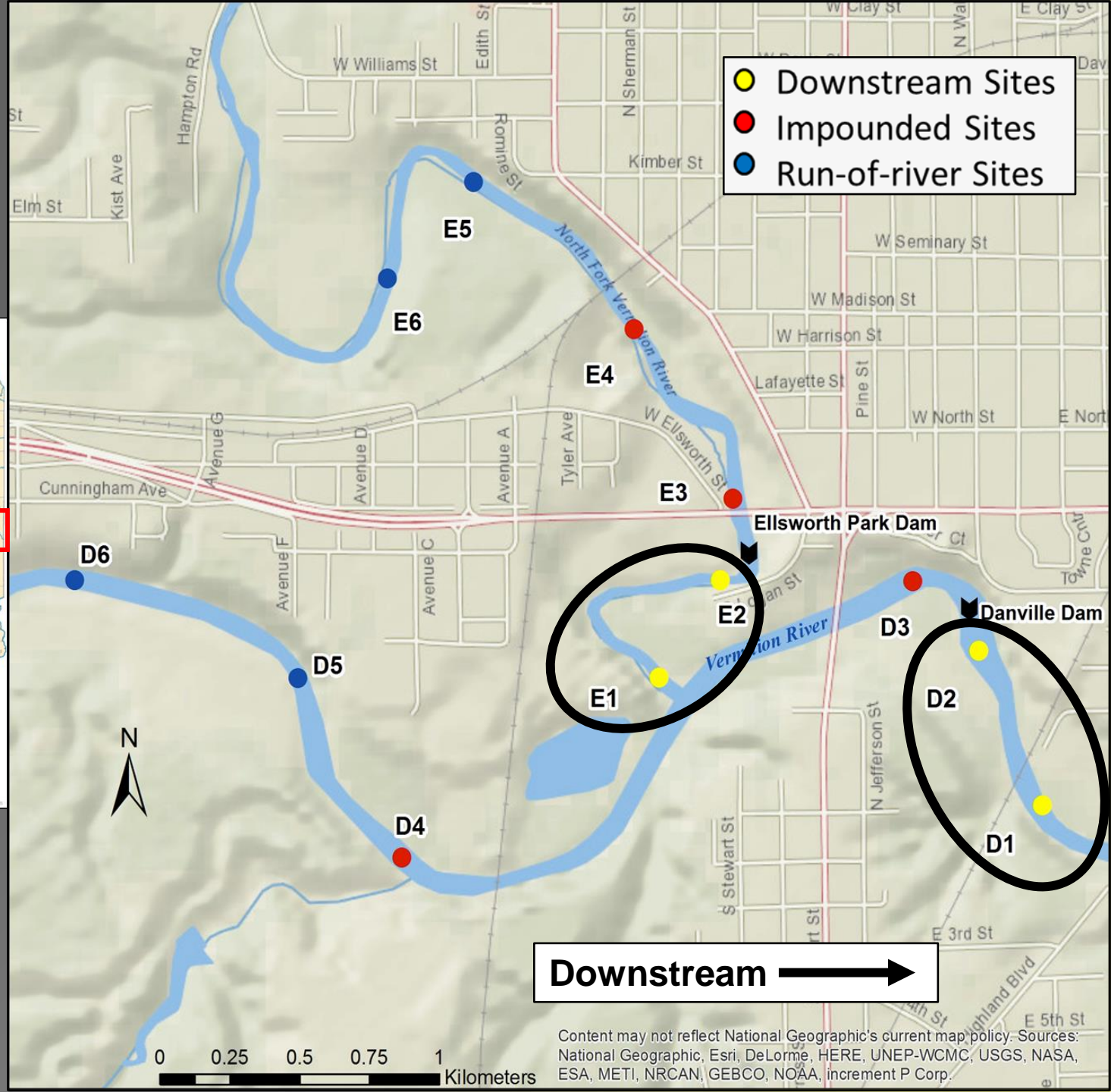


Downstream →

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

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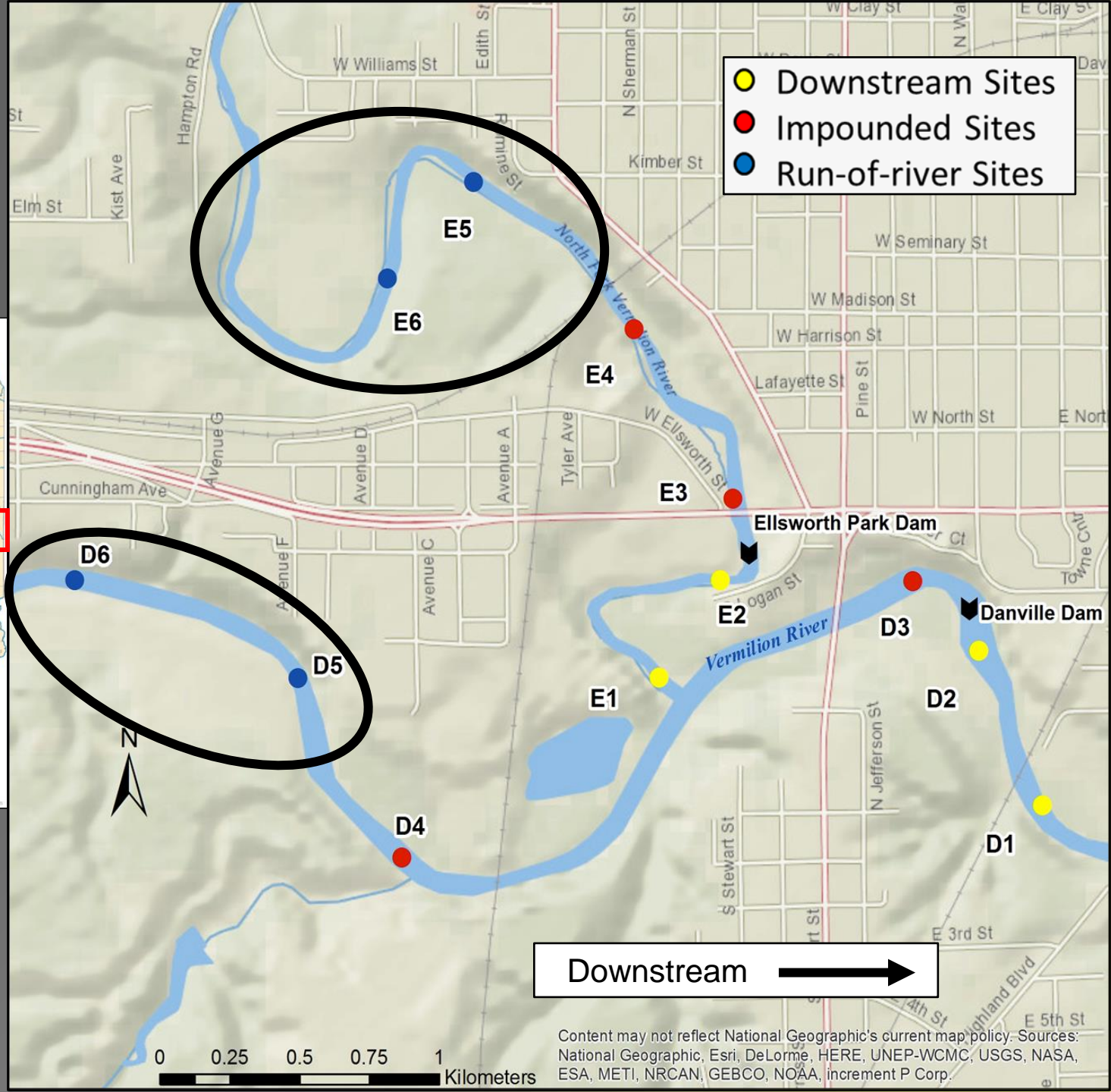
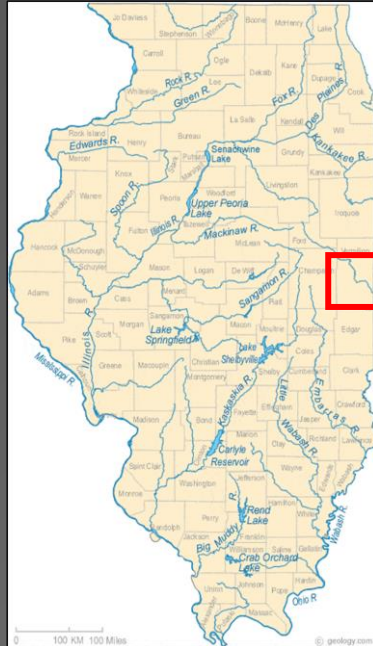


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Vermilion River

- Diverse ecosystem
 - 80+ fish species
 - 28 fish Species in Greatest Conservation Need
- National Wild and Scenic Rivers
- Recreational Uses
 - Kayaking
 - Fishing



Dam Removals

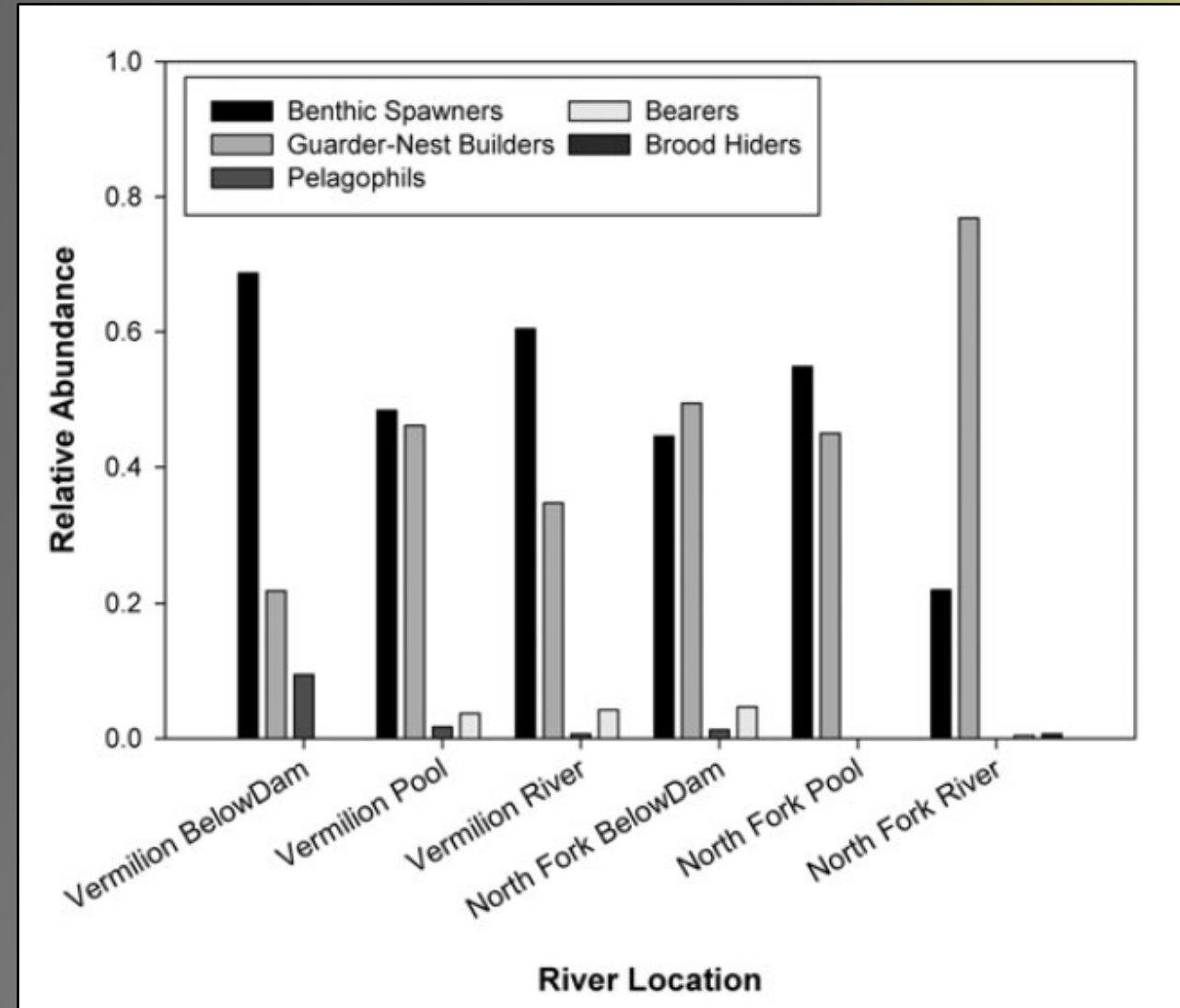
- Vermilion River
 - Constructed 1914
 - Removed Summer 2018
 - Connected over 1,700 km upstream habitat

- North Fork
 - Constructed 1920
 - Removed Spring 2019



Previous Work

- Smith et al. 2017
 - Assessed reproductive guilds before removal
 - Vermilion River
 - Downstream: benthic spawners
 - Impounded: mix of benthic spawners and nest guarders
 - Run-of-River: mostly benthic spawners
 - North Fork
 - Downstream and Impounded: mix of benthic spawners and nest guarders
 - Run-of-River: mostly nest guarders



Restoring Aquatic Connectivity in an Illinois River: Changes in Functional Groups of Fishes

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Eastern Illinois University, Charleston Illinois



Illinois Chapter of the American Fisheries Society

March 17, 2022



Objectives

- Assess changes in fish community structure
- Examine trends in relative abundance of reproductive guilds



Sampling Methods

- Boat Electrofishing
 - 1 dipper, 30 min



- Push Barge Electrofishing
 - 5 dippers, 30 min



Sampling Methods

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 - 1 dipper, 30 min



- Push Barge Electrofishing
 - 5 dippers, 30 min



Fish Community Analysis

- Community Data
 - Proportion of fish community
 - Arc-sin square root transformed
 - Rare species excluded for analyses using site dissimilarity
- Functional Groups
 - Reproductive guilds based on Welcomme et al. 2006



Reproductive Guilds

- Brood Hiders
 - Darters, some minnows
- Benthic Spawners
 - Suckers, schooling minnows
- Guarder-Nest Builder
 - Sunfish, Hornyhead Chub
- Pelagophils
 - Freshwater Drum, Emerald Shiner, Silver Carp
- Livebearers
 - Western Mosquitofish



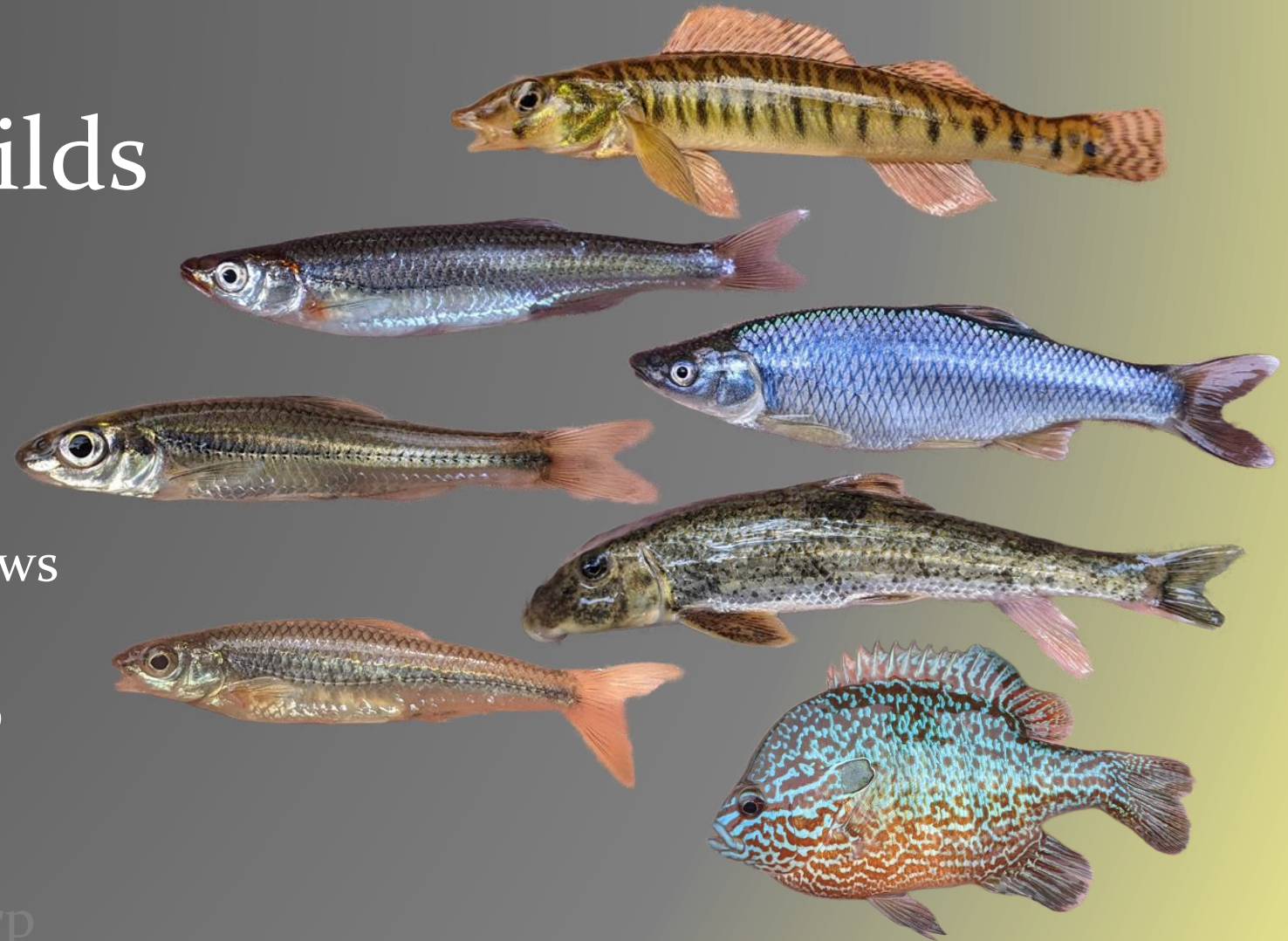
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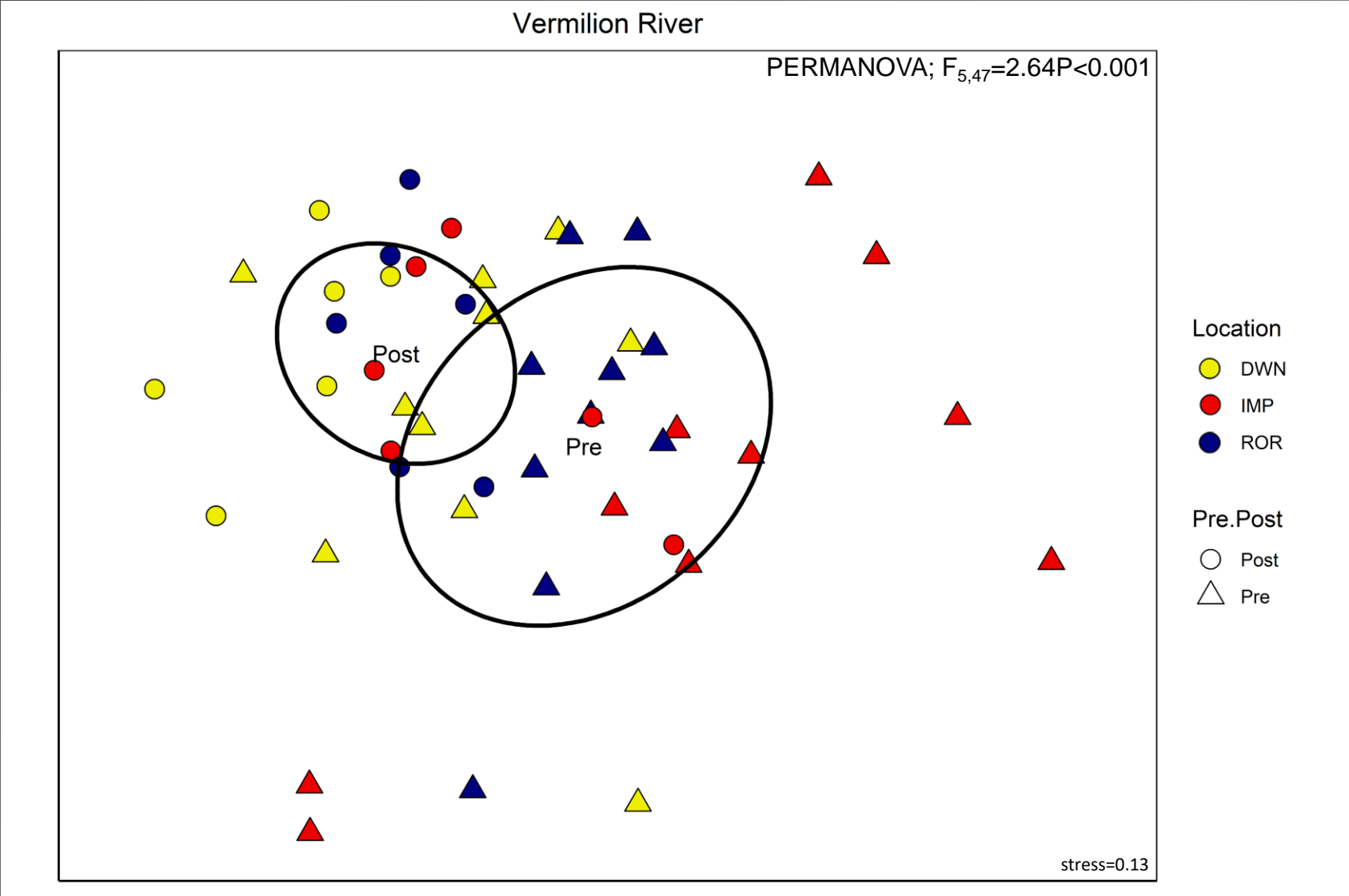


Objectives

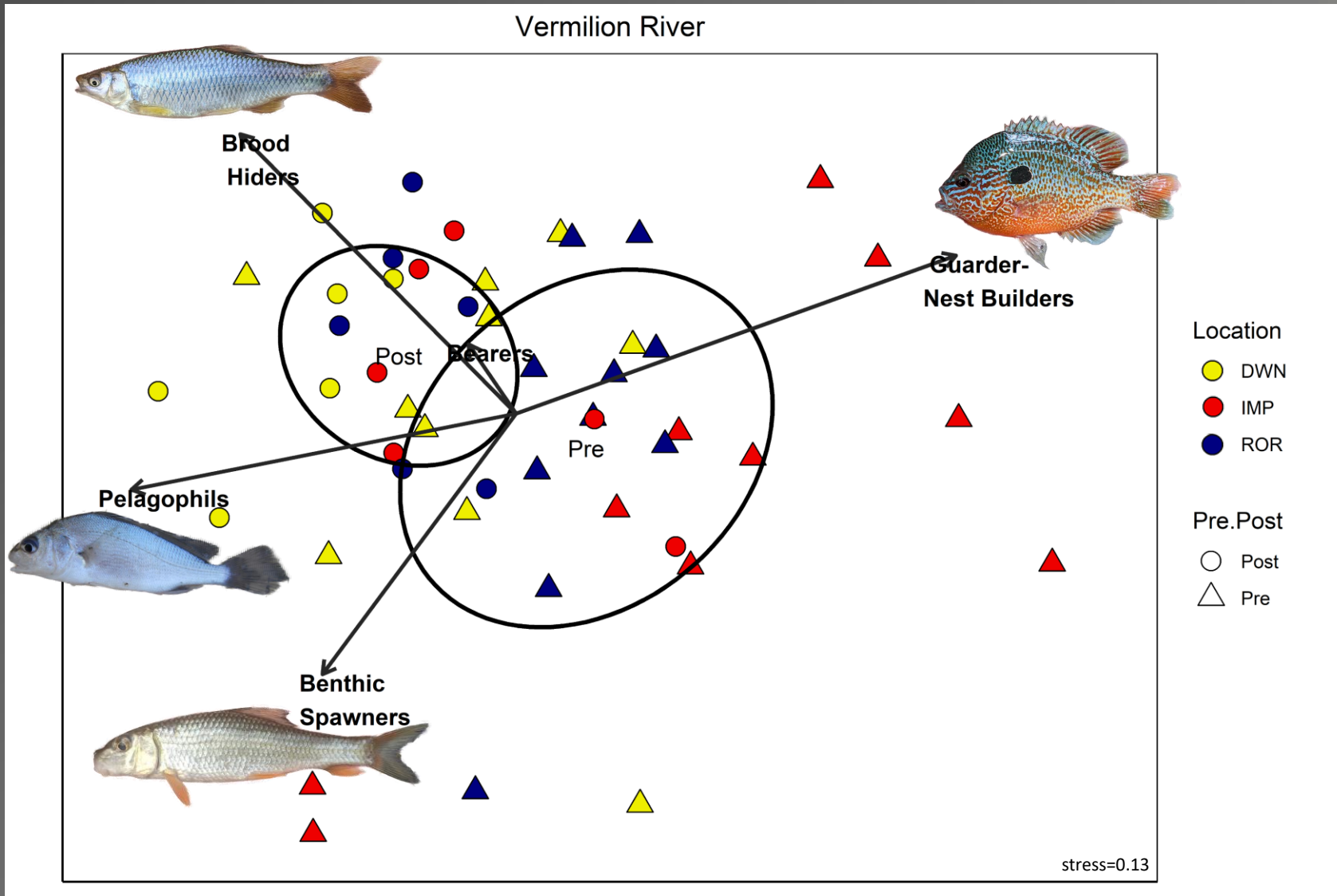
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- Examine trends in relative abundance of reproductive guilds



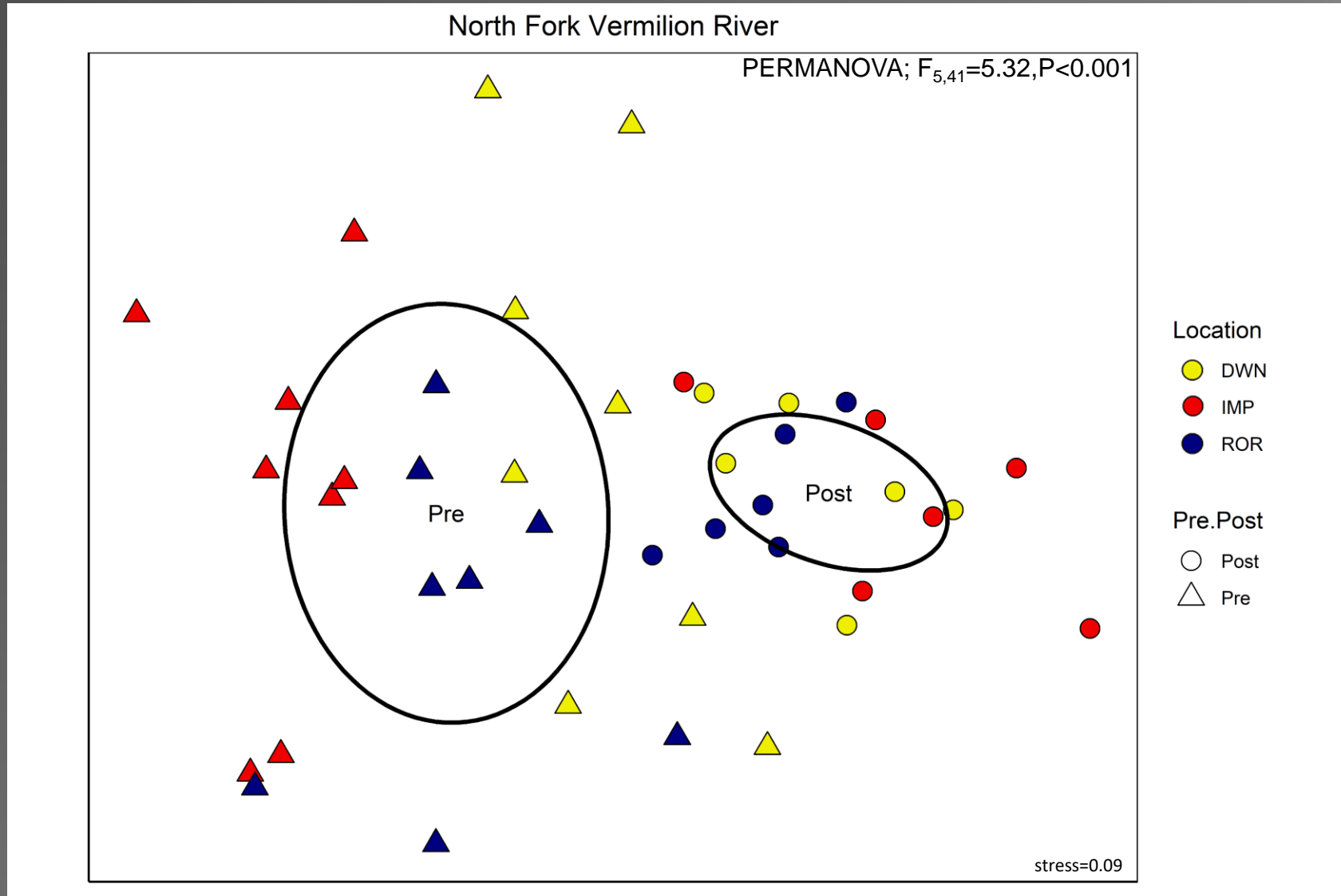
Vermilion Fish Communities



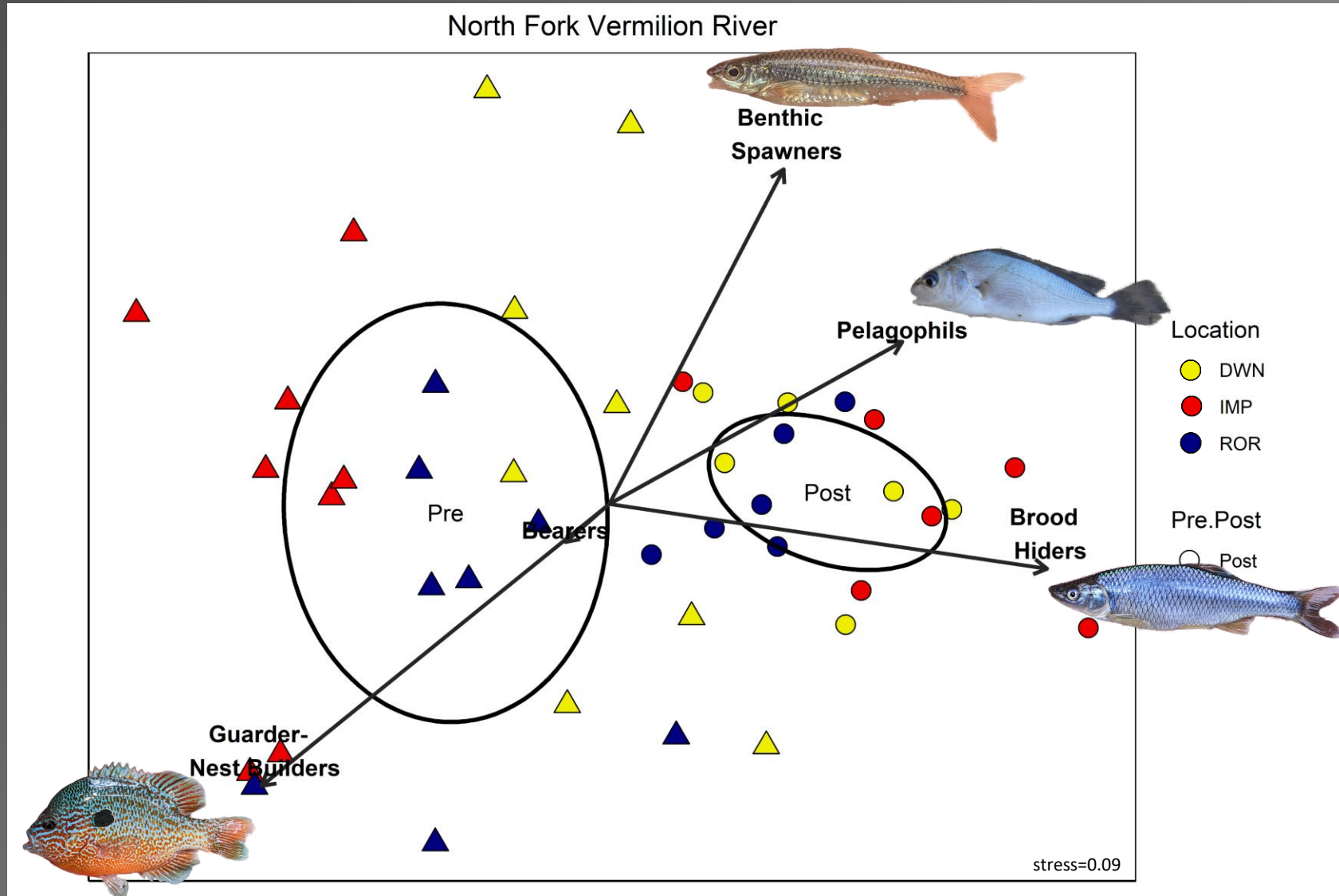
Vermilion Fish Communities



North Fork Fish Communities



North Fork Fish Communities

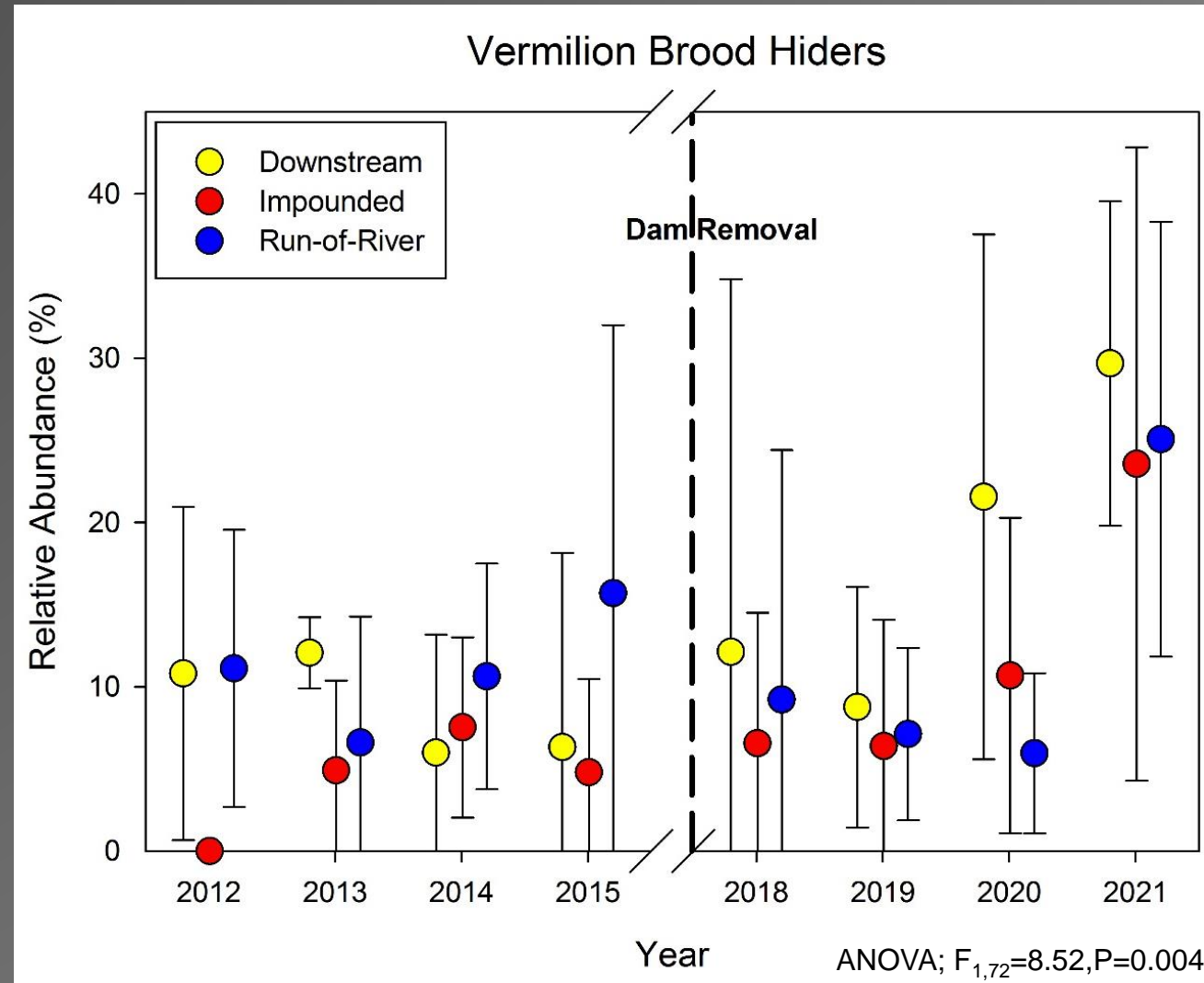


Objectives

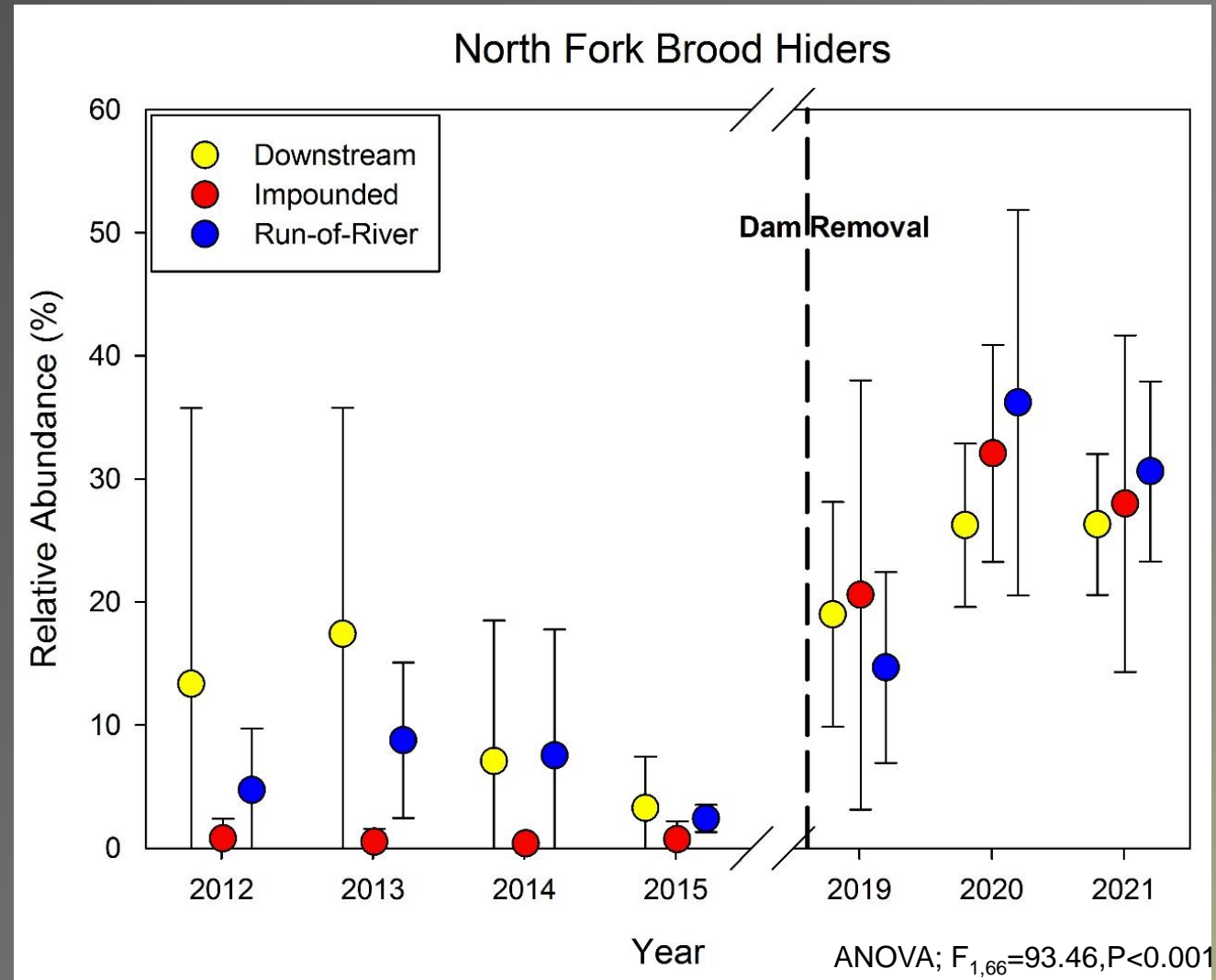
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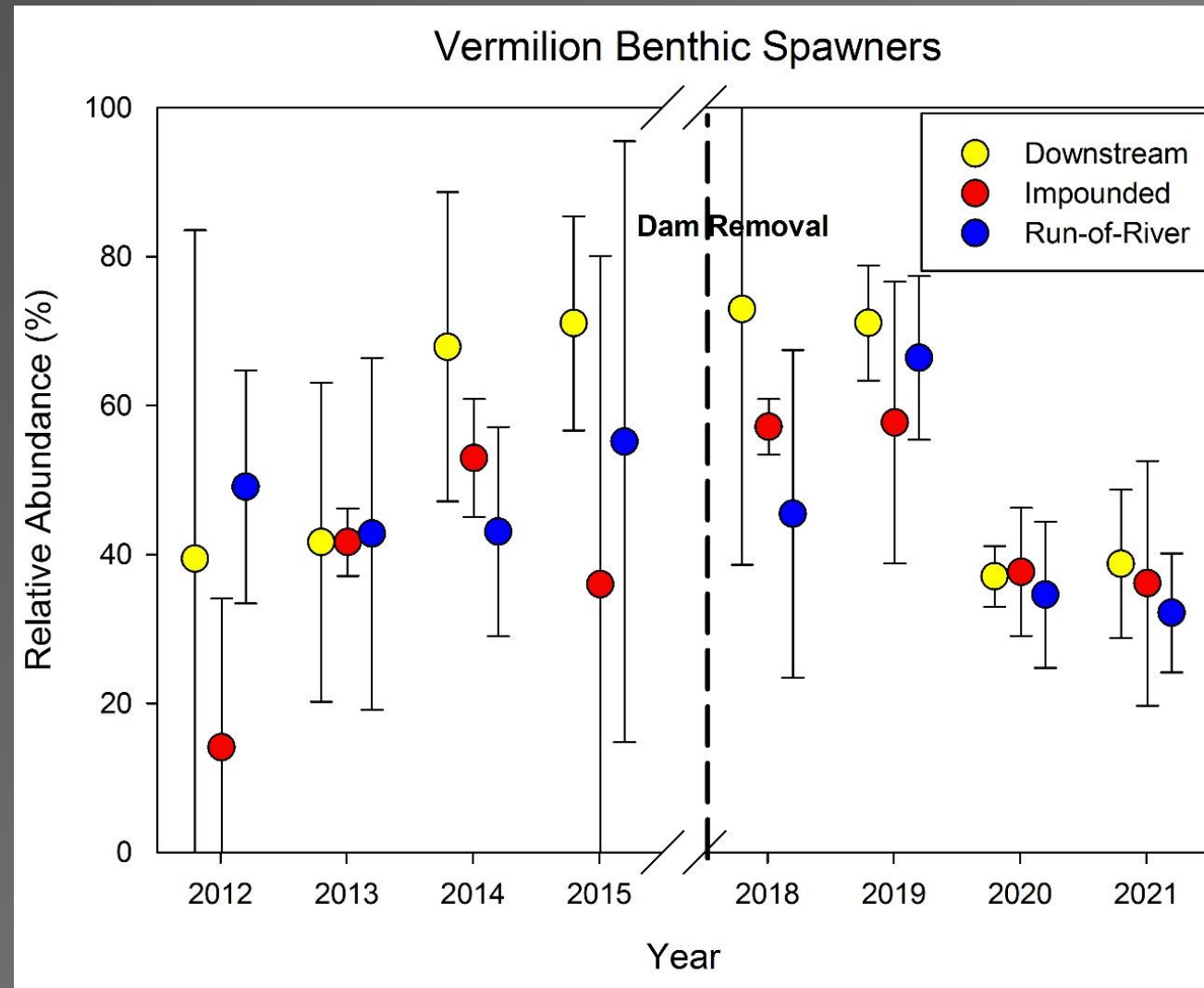
Brood Hiders



Brood Hiders



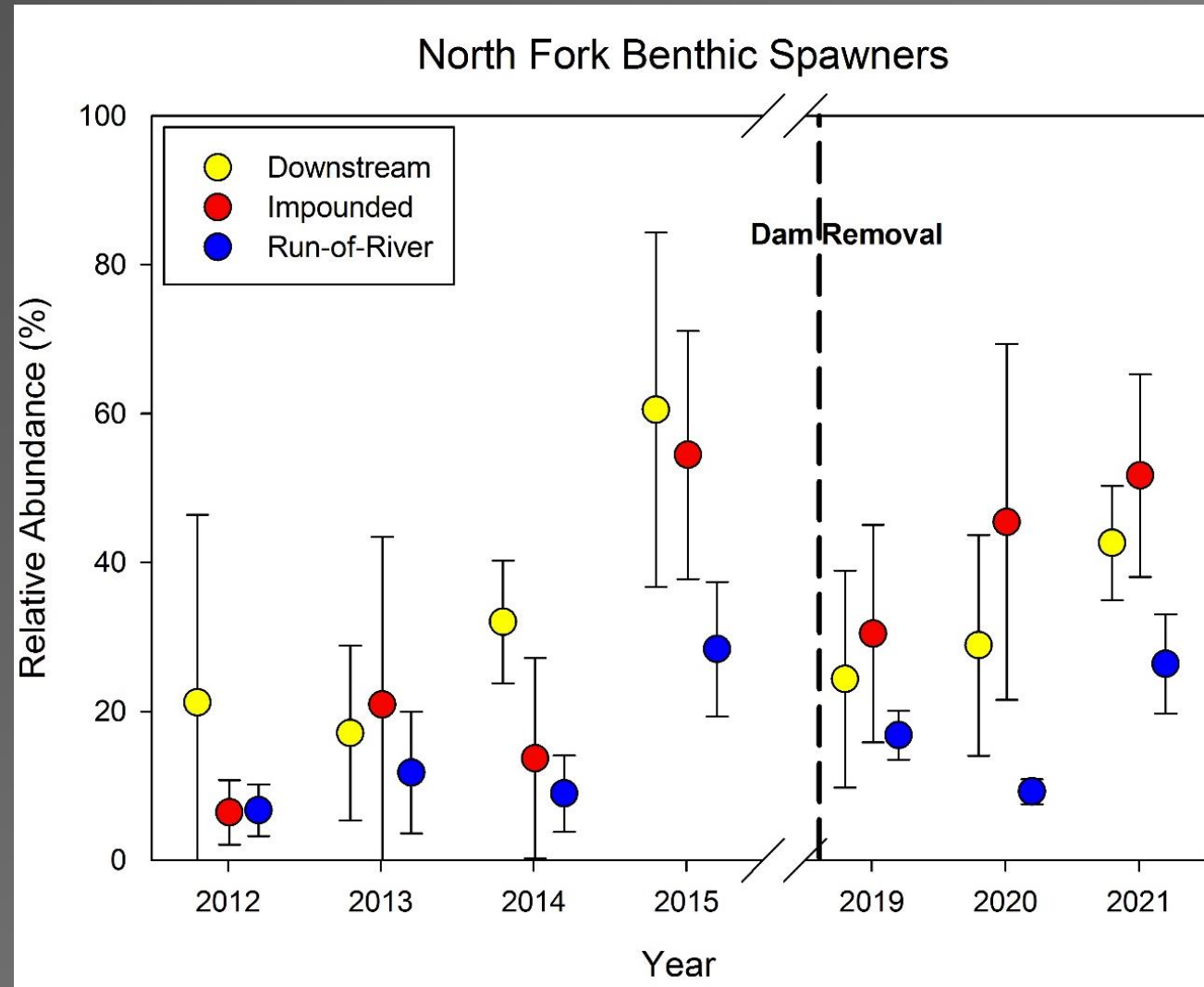
Benthic Spawners



Benthic Spawners



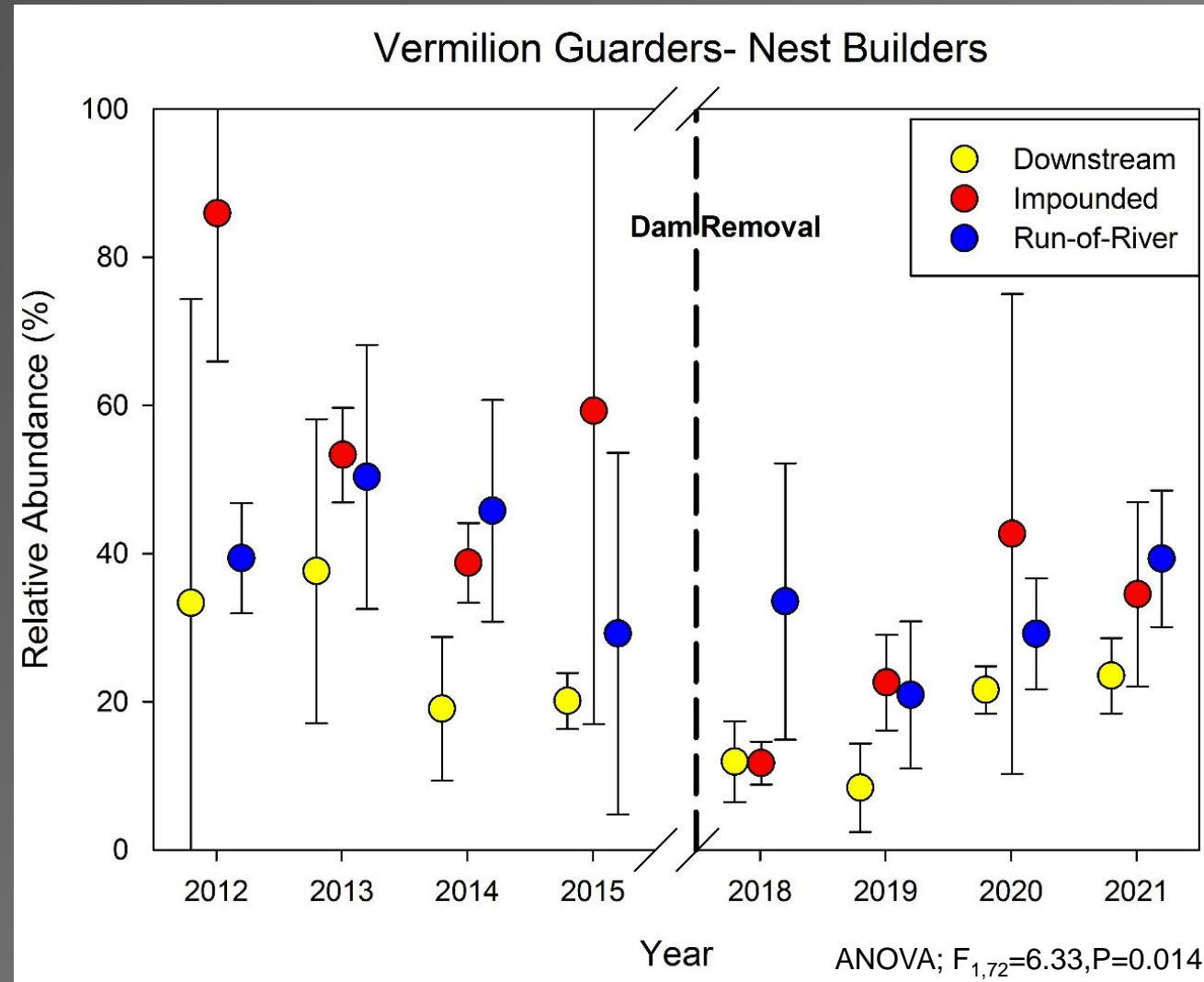
Lower relative abundance
in run-of-river reach
(Tukey HSD; $P=0.008$)



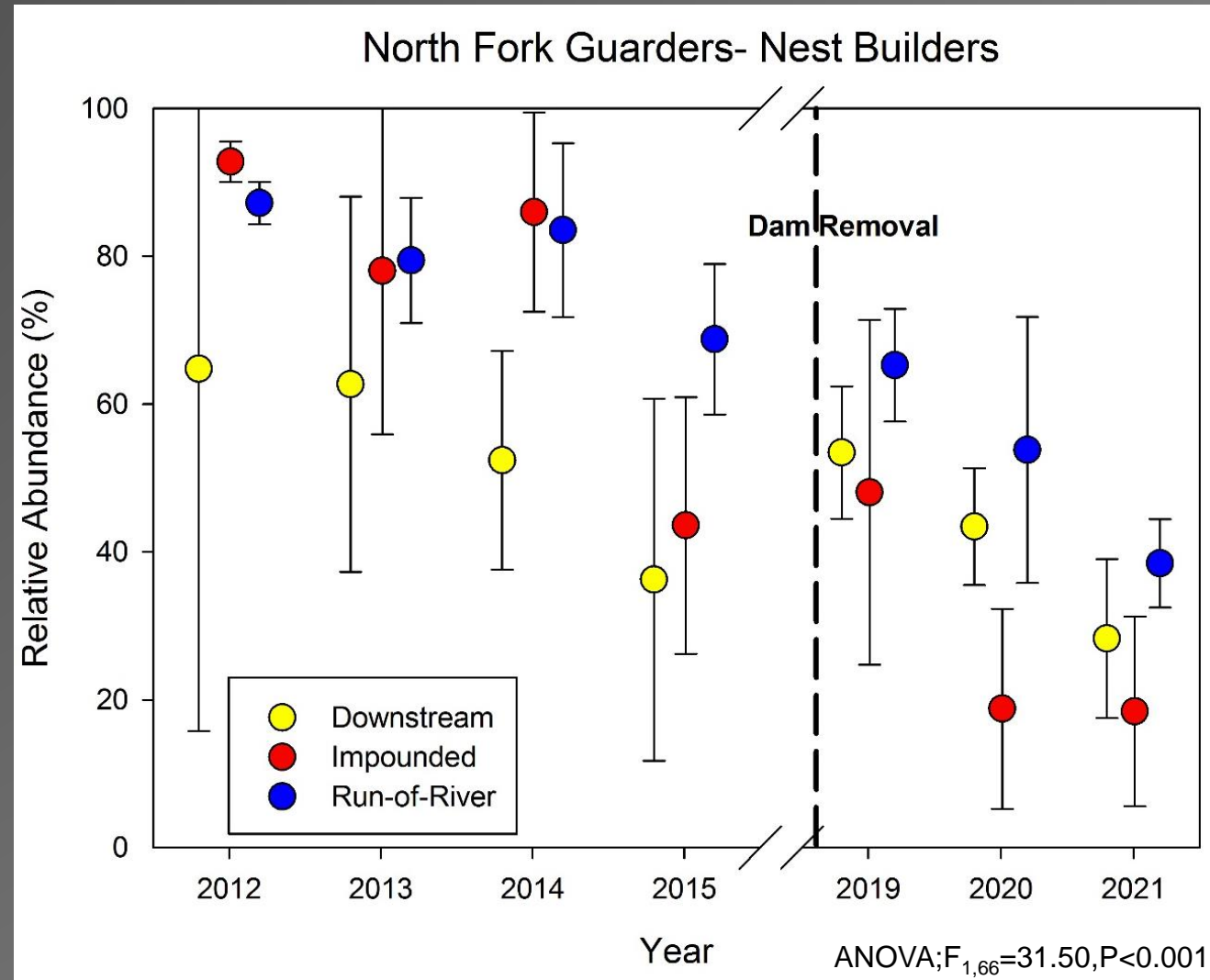
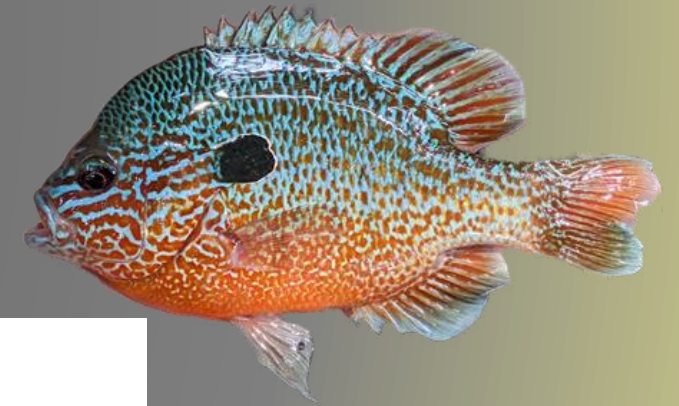
Guarders-Nest Builders



Decrease in relative abundance in impounded reach
(Tukey HSD; $P=0.002$)



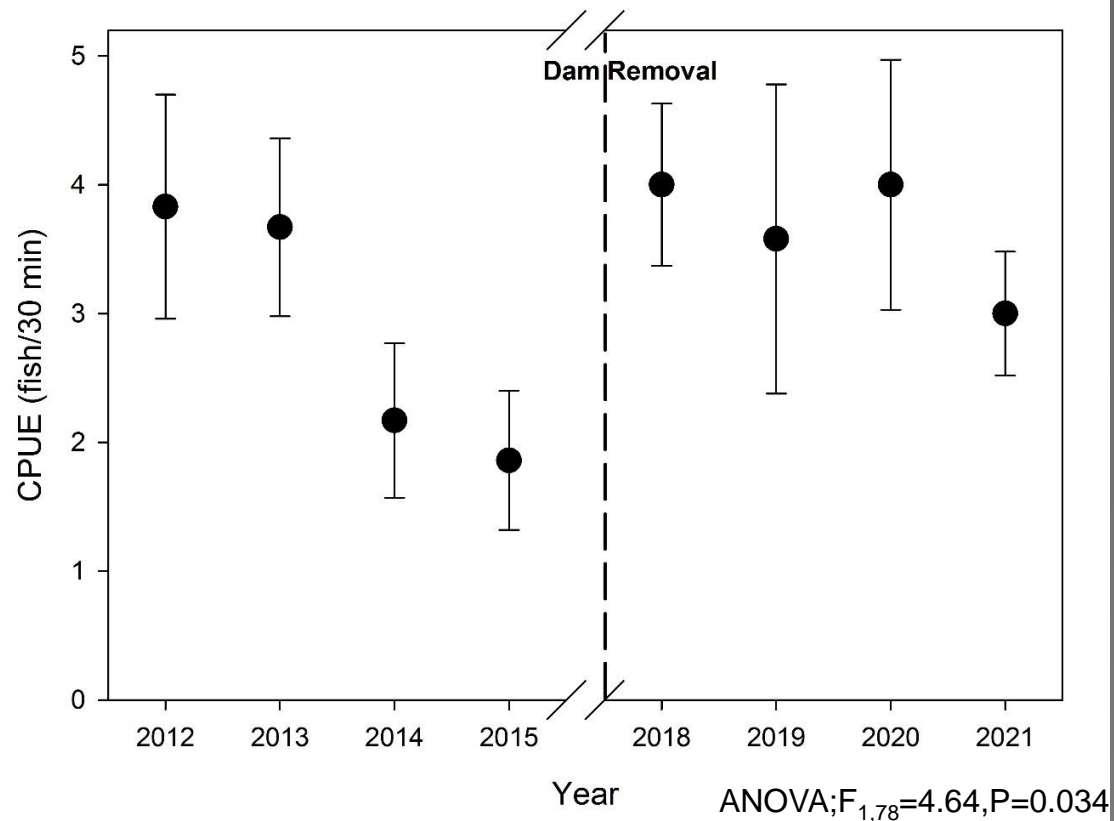
Guarders-Nest Builders



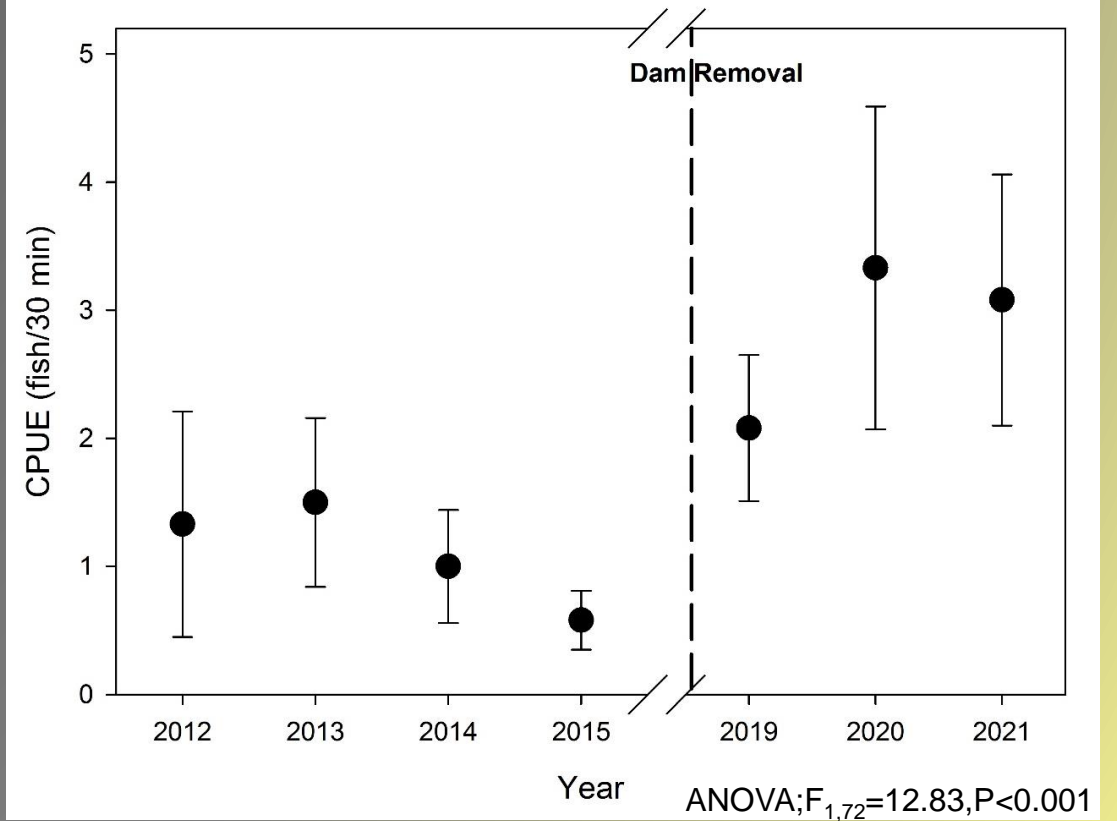
Smallmouth Bass



Vermilion River Smallmouth Bass



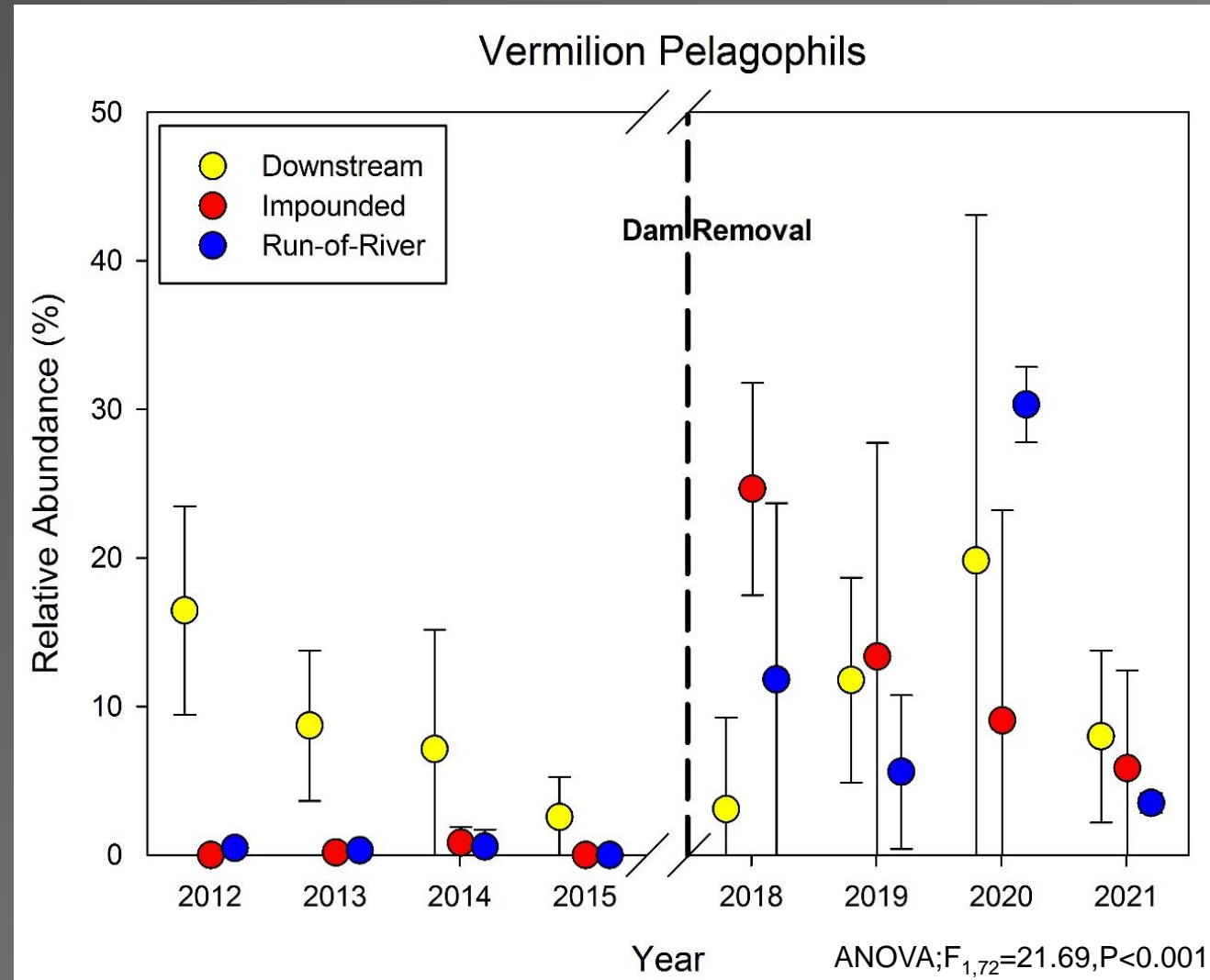
North Fork Smallmouth Bass



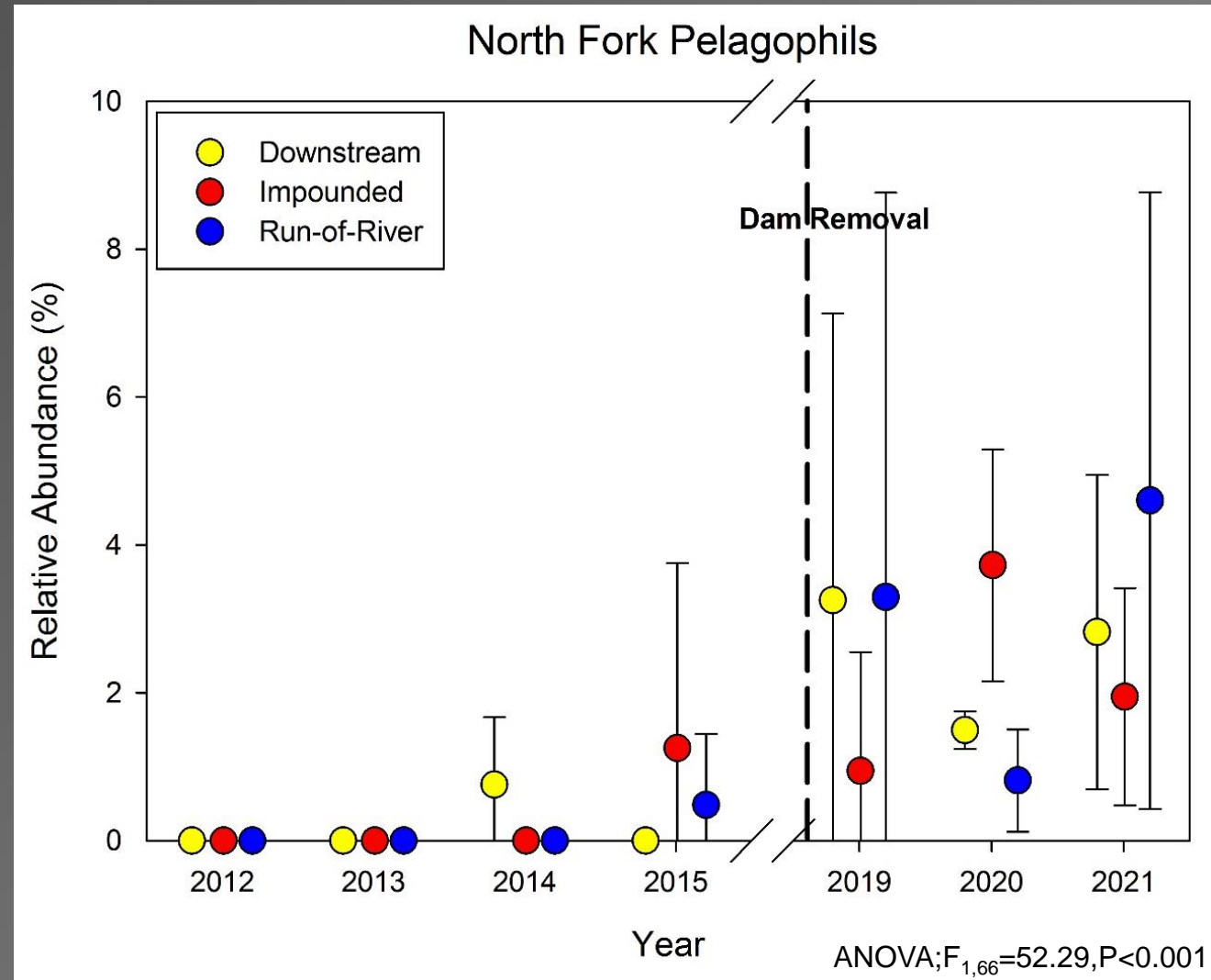
Pelagophils



Higher relative abundance in downstream reach compared to impounded (Tukey HSD; $P=0.027$), or run-of-river reach (Tukey HSD; $P=0.017$)



Pelagophils



Conclusions

- Shifts in functional assemblages as habitat returns to lotic state
- Increases in Brood Hiders
- Increases in Pelagophils
- Decreases in Guarder-Nest Builders



Questions?

Josh Bruegge

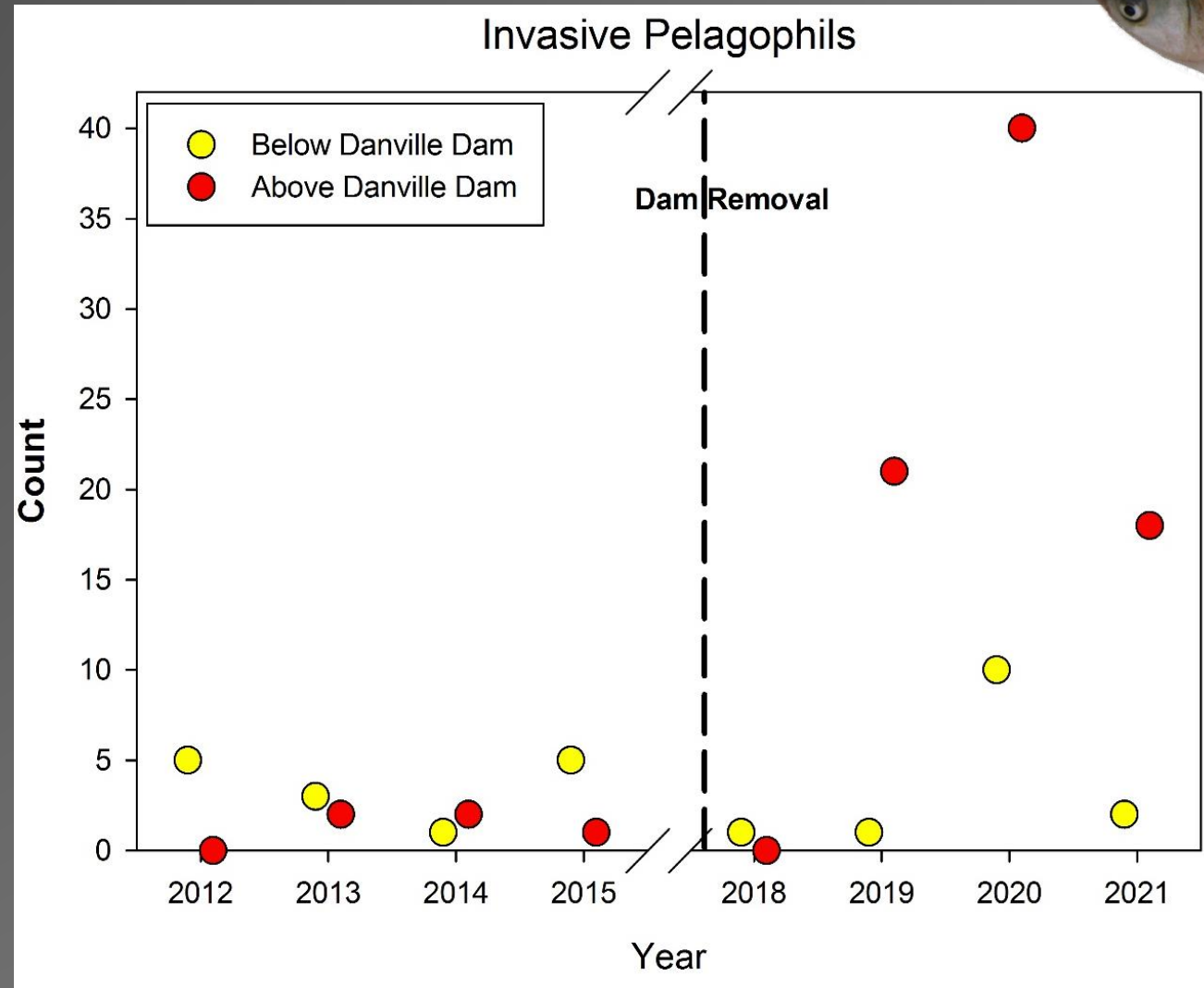
jdbuegge@eiu.edu



Literature Cited

- Levi, P. S. & McIntyre, P. B. Ecosystem responses to channel restoration decline with stream size in urban river networks. *Ecol Appl* **30**, (2020).
- Smith, S. C. F., Meiners, S. J., Hastings, R. P., Thomas, T. & Colombo, R. E. Low-Head Dam Impacts on Habitat and the Functional Composition of Fish Communities: Low-head Dam Impacts Fish Communities. *River Res. Applic.* **33**, 680–689 (2017).
- Smith, S. C. F., Colombo, R. E., Thomas, T. & Keeney, D. B. Dissimilar effects of low-head dams on the genetic structure of riverine fishes. *Freshwater Science* **38**, 92–102 (2019).
- Welcomme, R. L., Winemiller, K. O. & Cowx, I. G. Fish environmental guilds as a tool for assessment of ecological condition of rivers. *River Res. Applic.* **22**, 377–396 (2006).

Pelagophils- Silver and Grass Carp



Fish pictures to use throughout

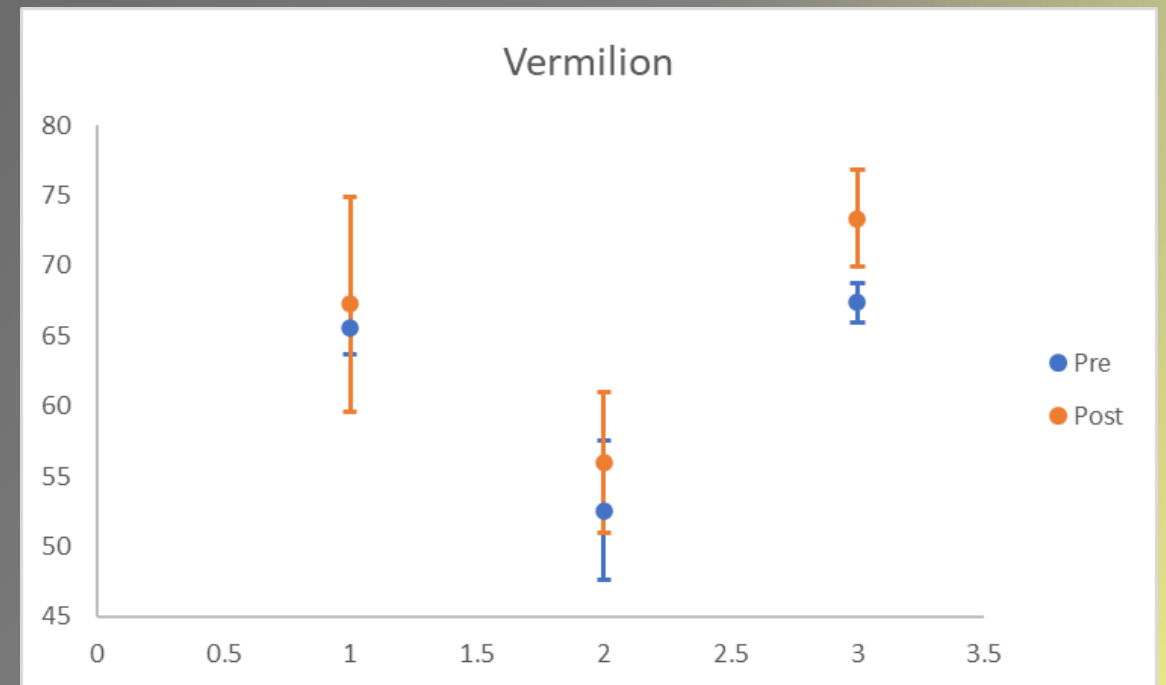
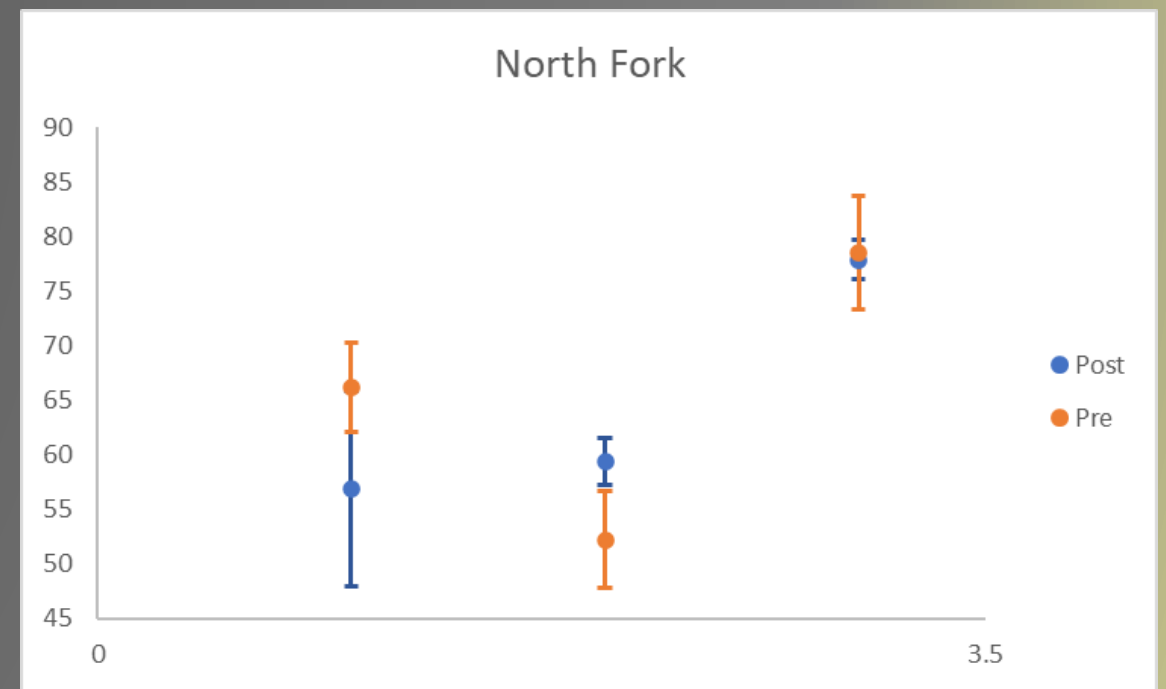


- More pictures



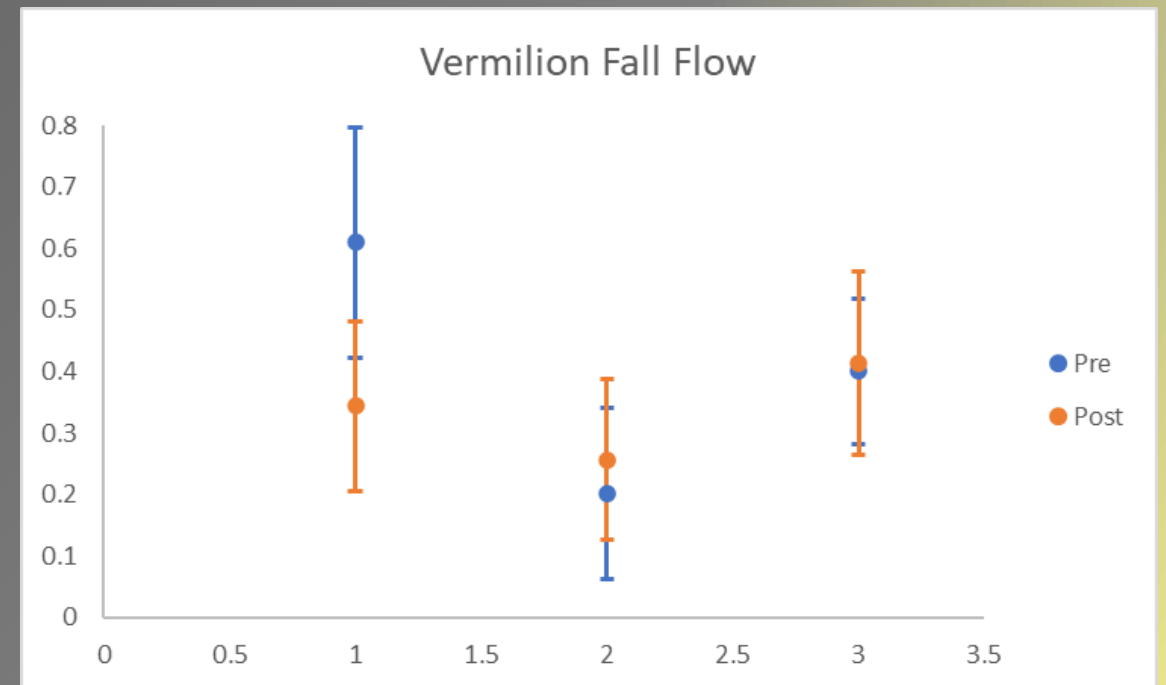
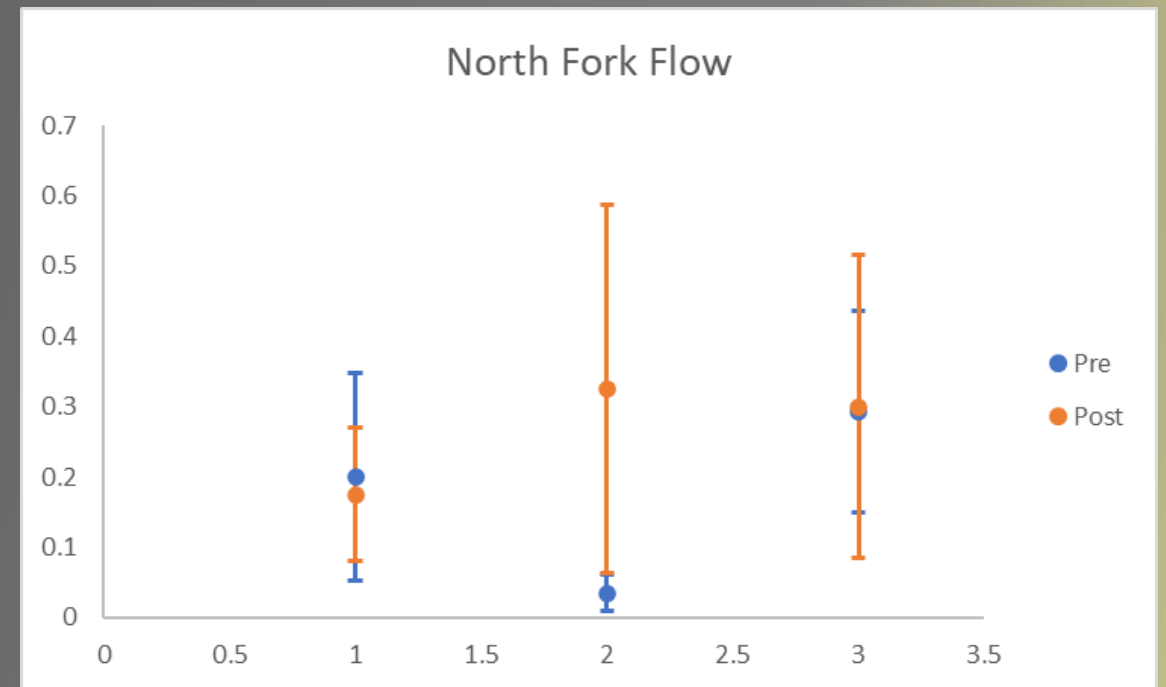
Habitat

- QHEI
 - Add QHEI ranges and use sigmaplot to remake
- Significant differences between locations, not sig pre/post



Habitat

- Flow
 - use sigmaplot to remake
- Significant differences between locations in Vermilion
 - No significant differences in NF



Diversity

- Increasing!
- Should I look into functional richness and diversity?

Previous Work

- Smith et al. 2019
 - Longear Sunfish genetic diversity not influenced by either dam
 - Bluntnose Minnow genetic diversity influenced by Ellsworth Park dam (North Fork Vermilion)
 - Possibly due to poor habitat quality in impounded reach

