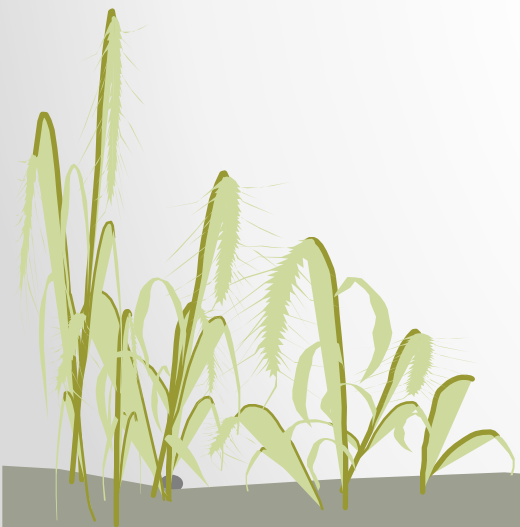


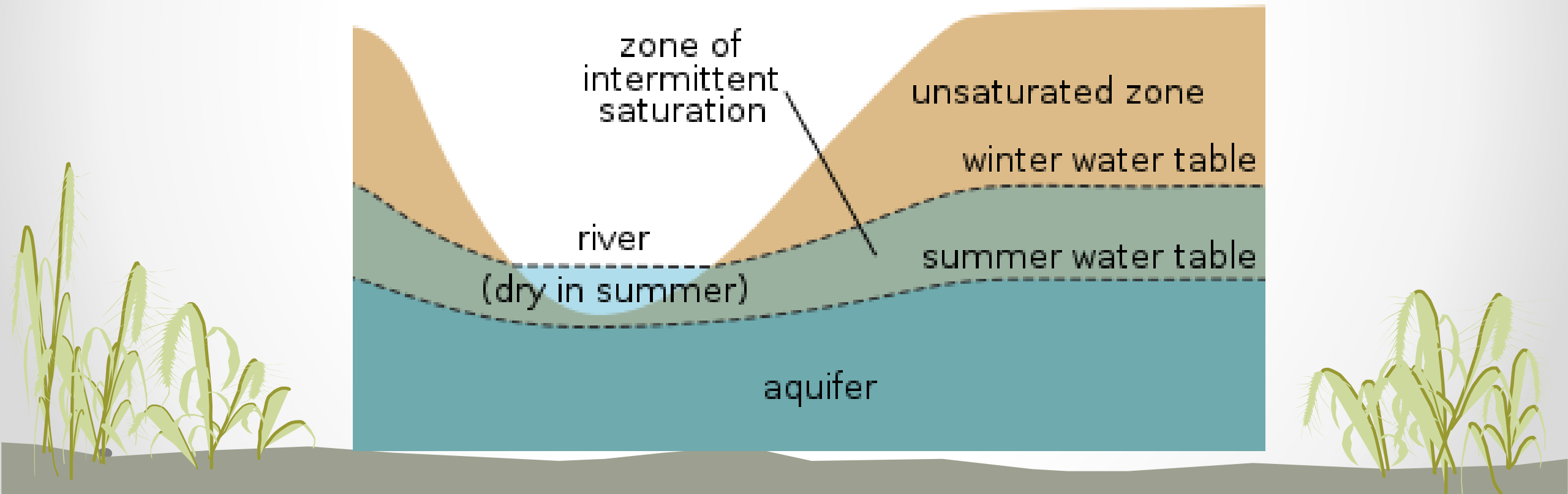
Impact of Water Fluctuations and Intermittency on Stream Biota Community Structure

Isabel F Papraniku, Donald Walker, Joshua Perkin
Tennessee Technological University



Intermittent Streams

- Dry when groundwater table drops below the elevation of the stream bed
- Often seasonally



Isolated Pools

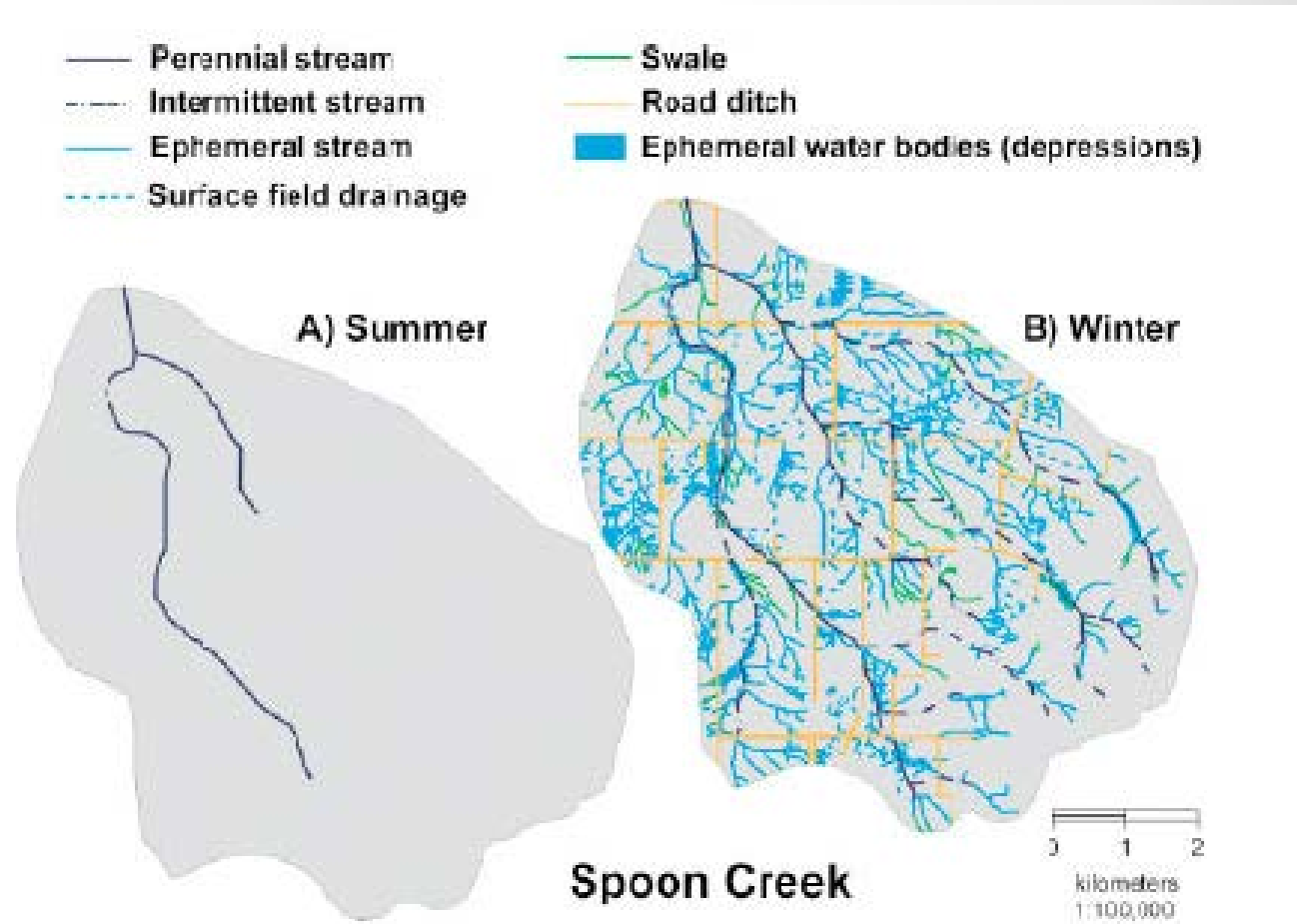


Streambed Desiccation



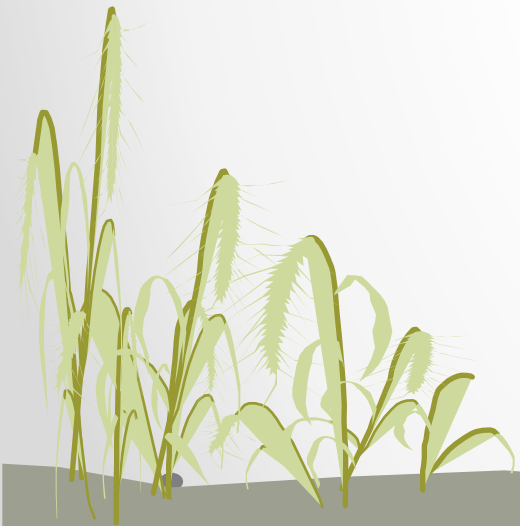
Why Intermittent Streams?

- Dynamic systems
- Naturally occurring
- Majority of stream network
- Unsustainable groundwater extractions
- Perennial → Intermittent



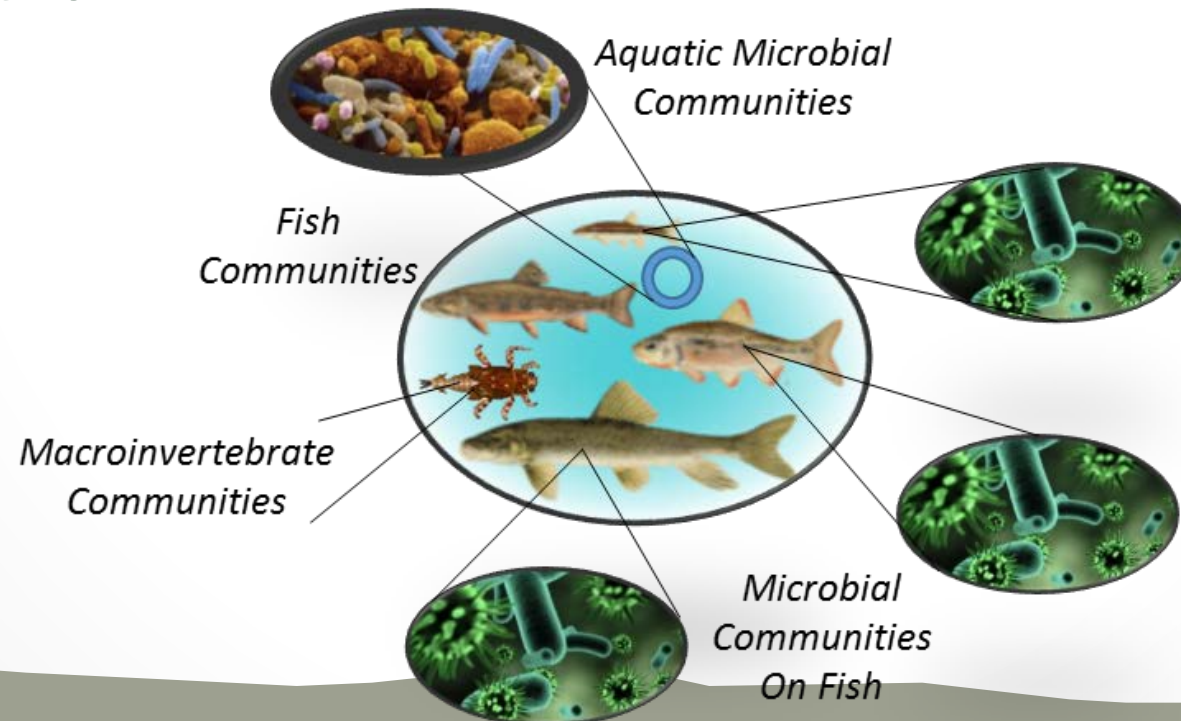
Hypothesis

- How are stream biota impacted by dynamic fluctuations
- If colonization of certain organisms is inhibited by drying
- Decrease in species richness and diversity in areas prone to drying
- Community structure will shift / increased species richness and diversity with prolonged reconnection

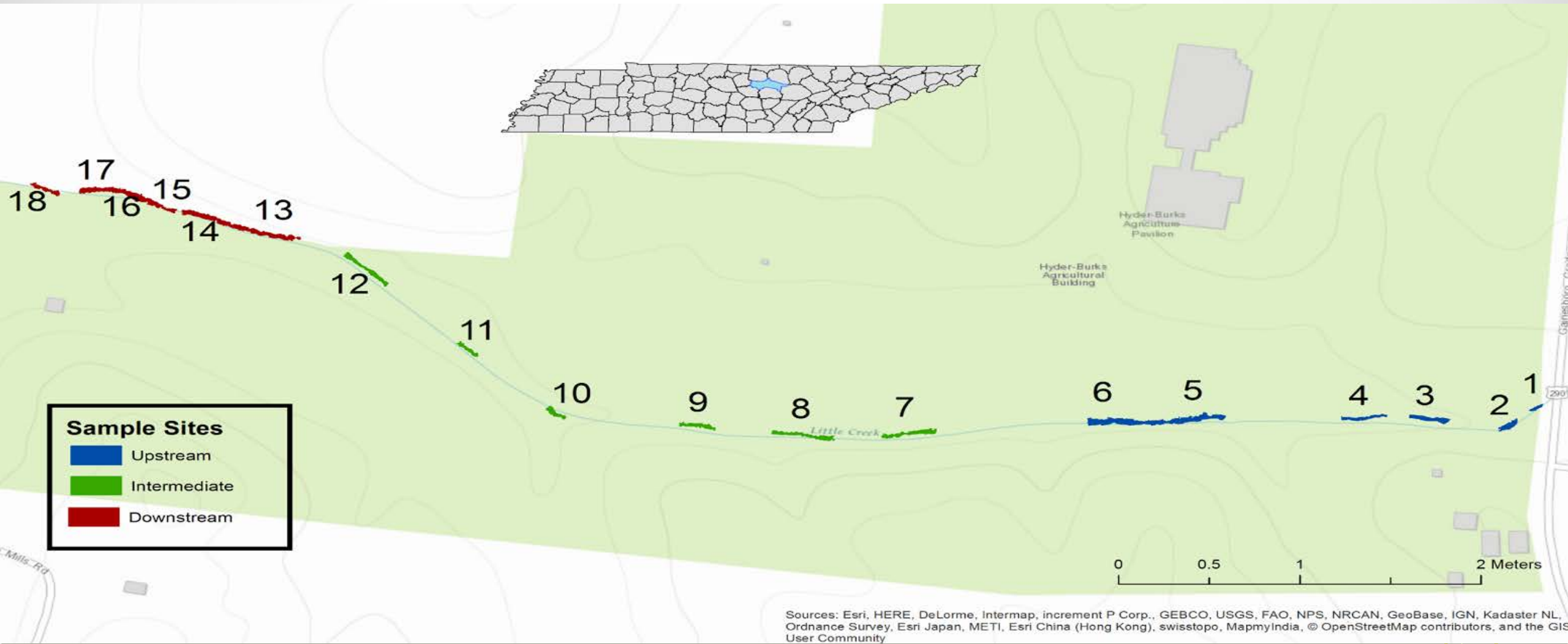


Objectives

- Observe community structure changes- fish, invertebrates, microbes across three seasons
- Immediately post-reconnection, four months post-reconnection, pre-disconnection

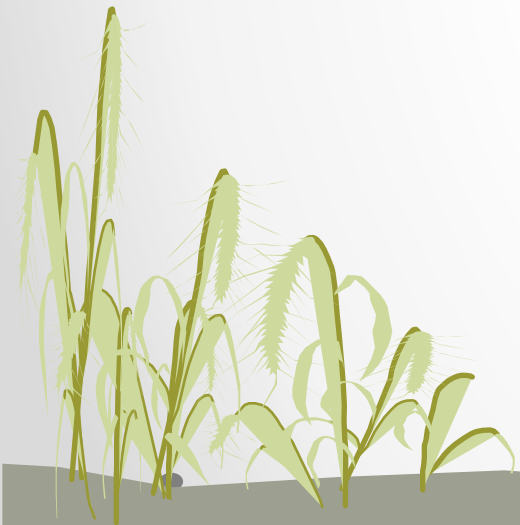


Study Site- Little Creek, TN

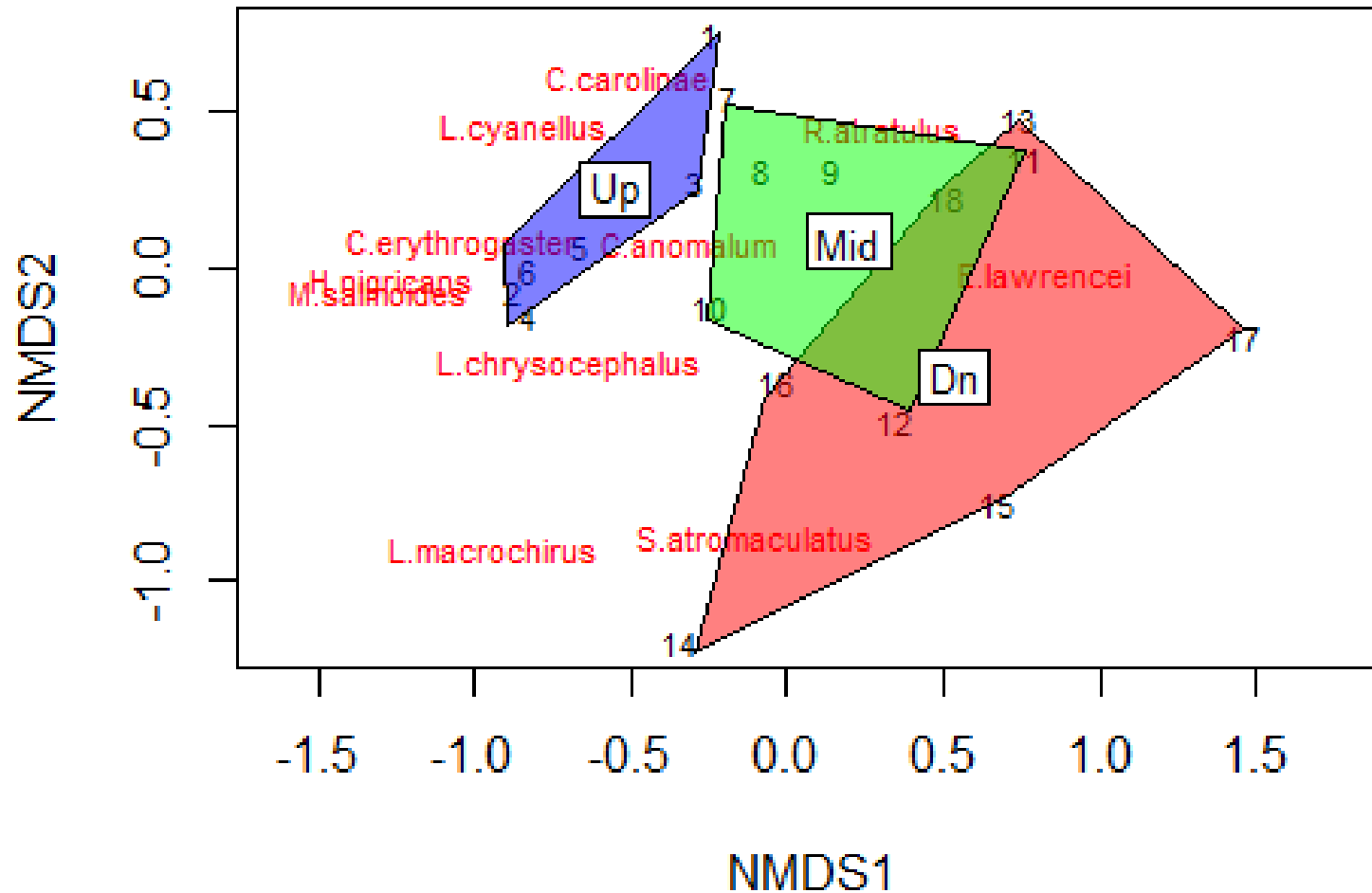


Fish Assemblage Analysis

- Triple pass depletion electroshocking
- Field ID to species
- Habitat delineation at each site



Immediately Post-Reconnection Fish Analysis

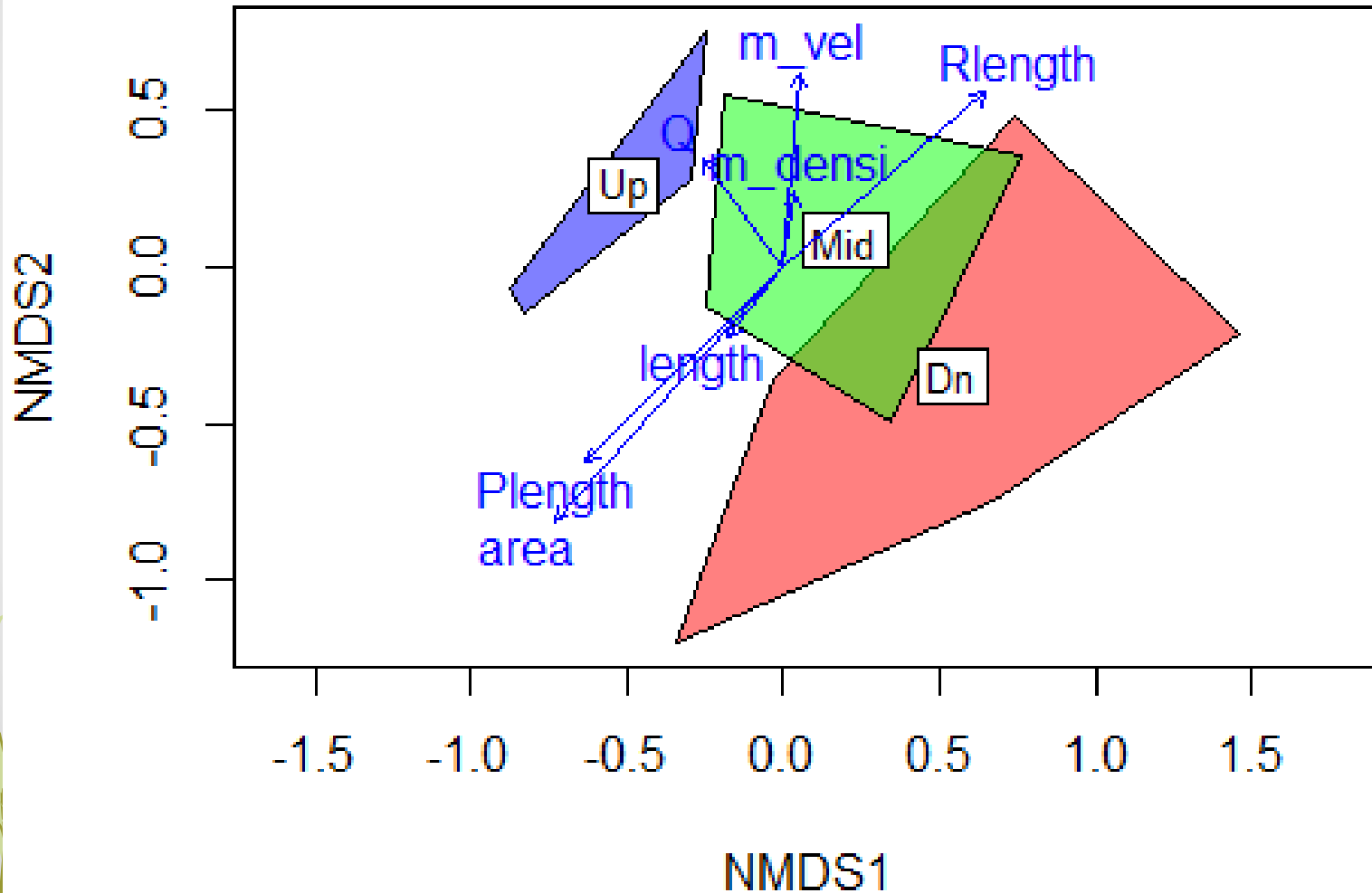


Stress=0.12

Legend

- Upstream
- Intermediate
- Downstream

Immediately Post-Reconnection Fish Analysis



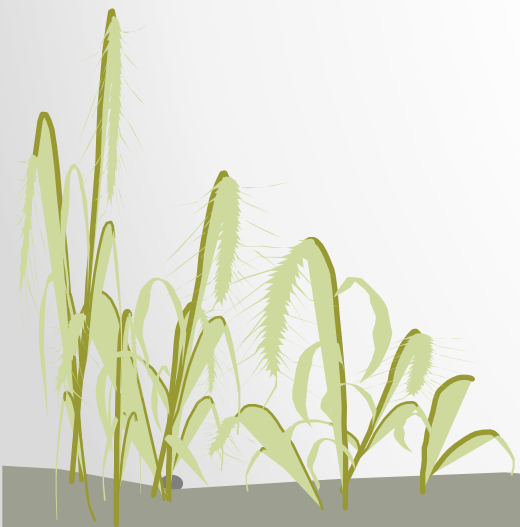
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PERMANOVA

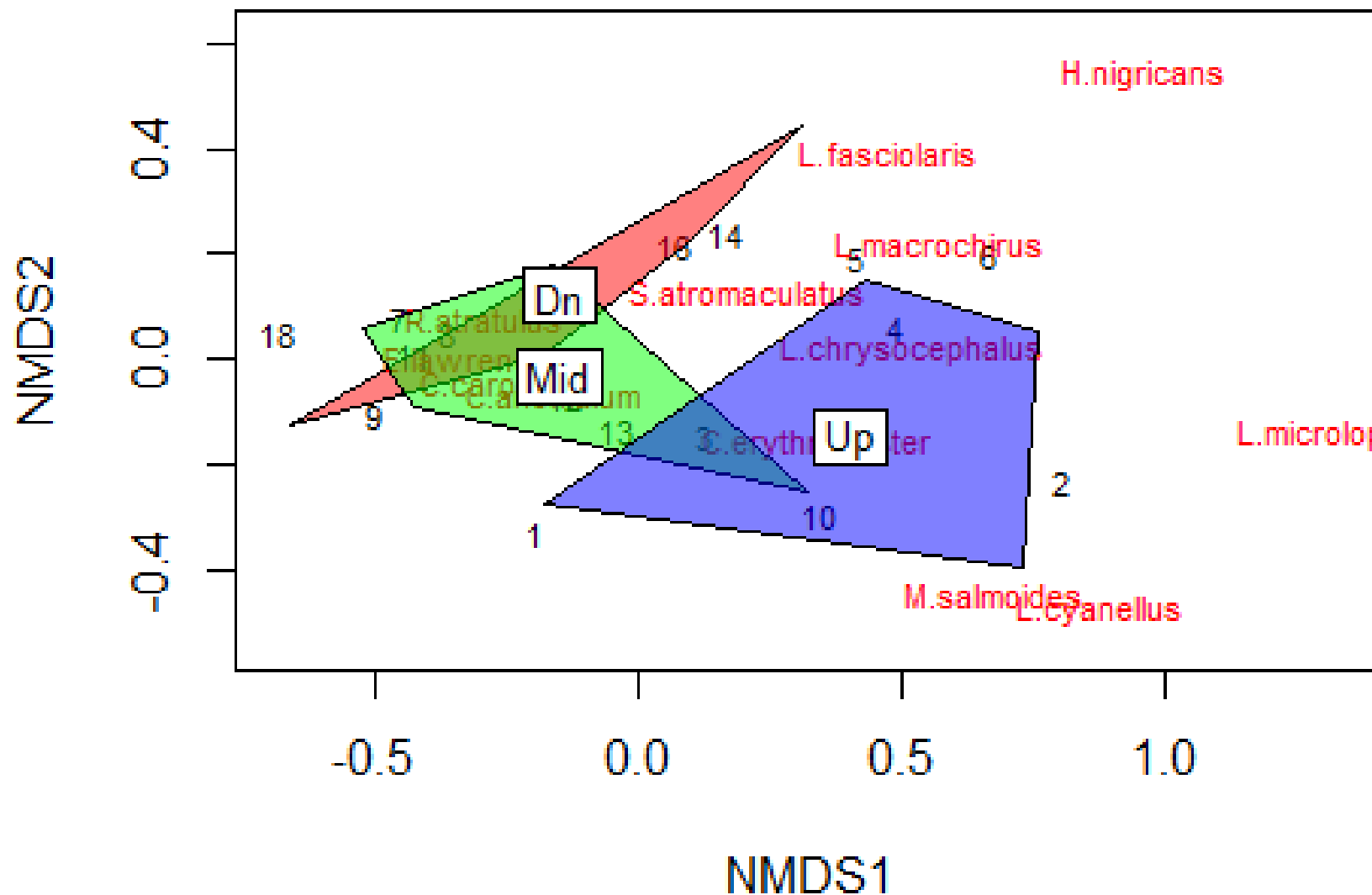
Reach: pseudo $F_{2, 15} = 9.35$, $P < 0.01$, $R^2 = 0.55$

Immediately Post-Reconnection: Summary

- Low species richness in downstream reach
- Expected- dry for 2 months prior to sampling
- Does the community shift after 4 months of reconnection?



Four months Post- Reconnection Fish Analysis



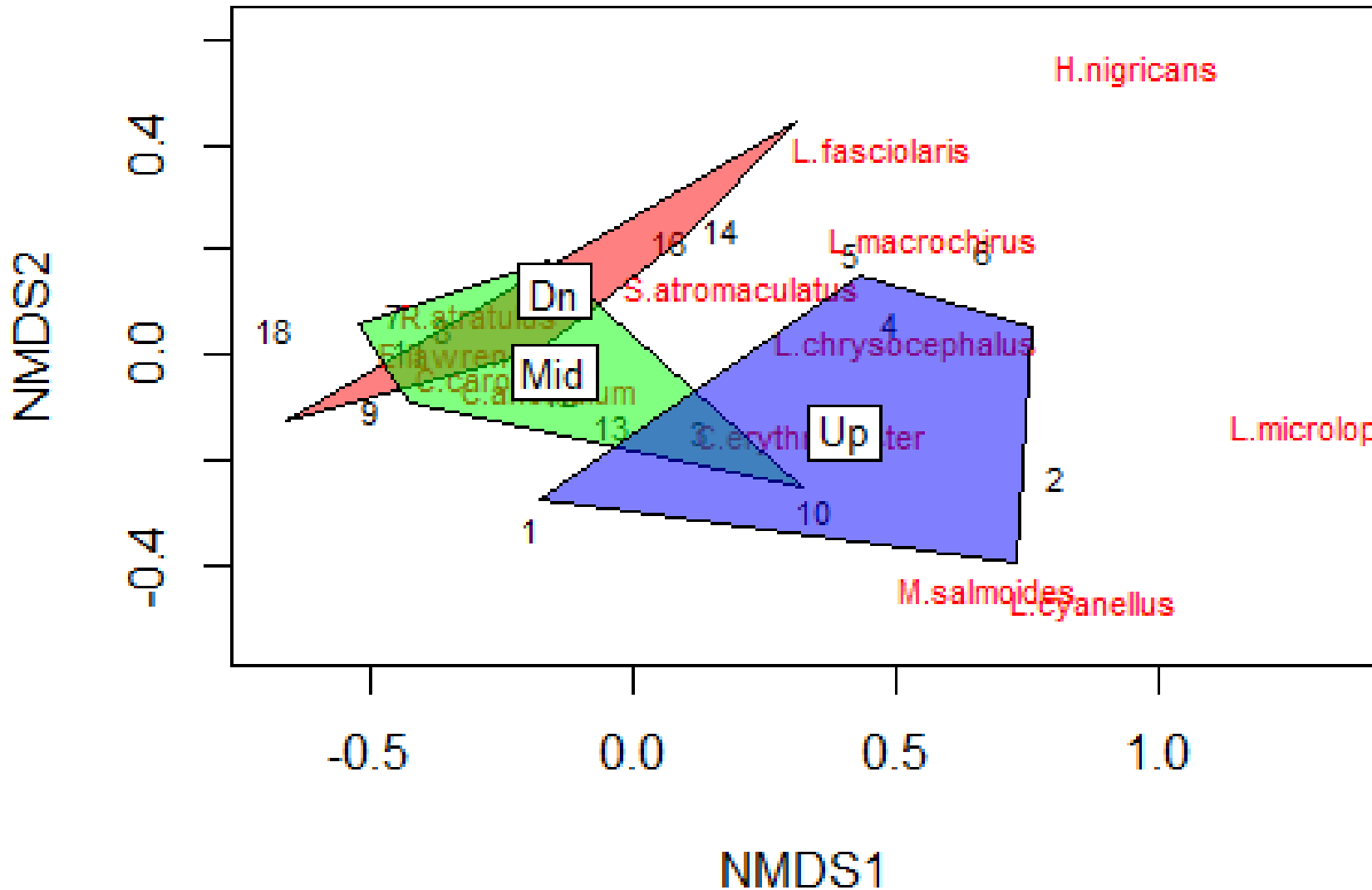
Stress=0.10

Legend

- Upstream
- Intermediate
- Downstream



Four months Post- Reconnection Fish Analysis

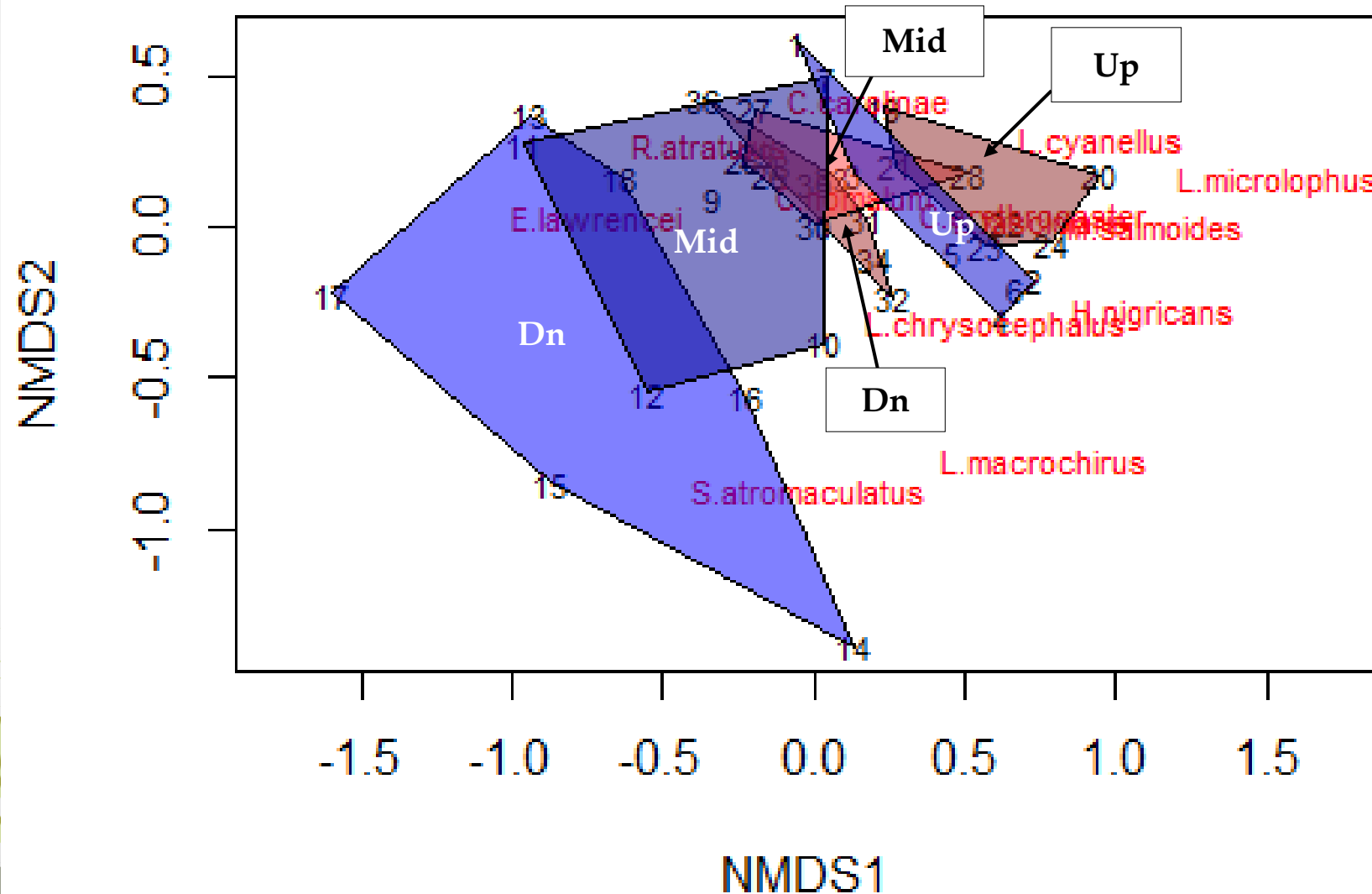


Stress=0.10

PERMANOVA
Reach: pseudo $F_{2, 15} = 1.28$, $P = .23$, $R^2 = 0.15$



Immediately Post-Reconnection and Four months Post-Reconnection Fish Analysis



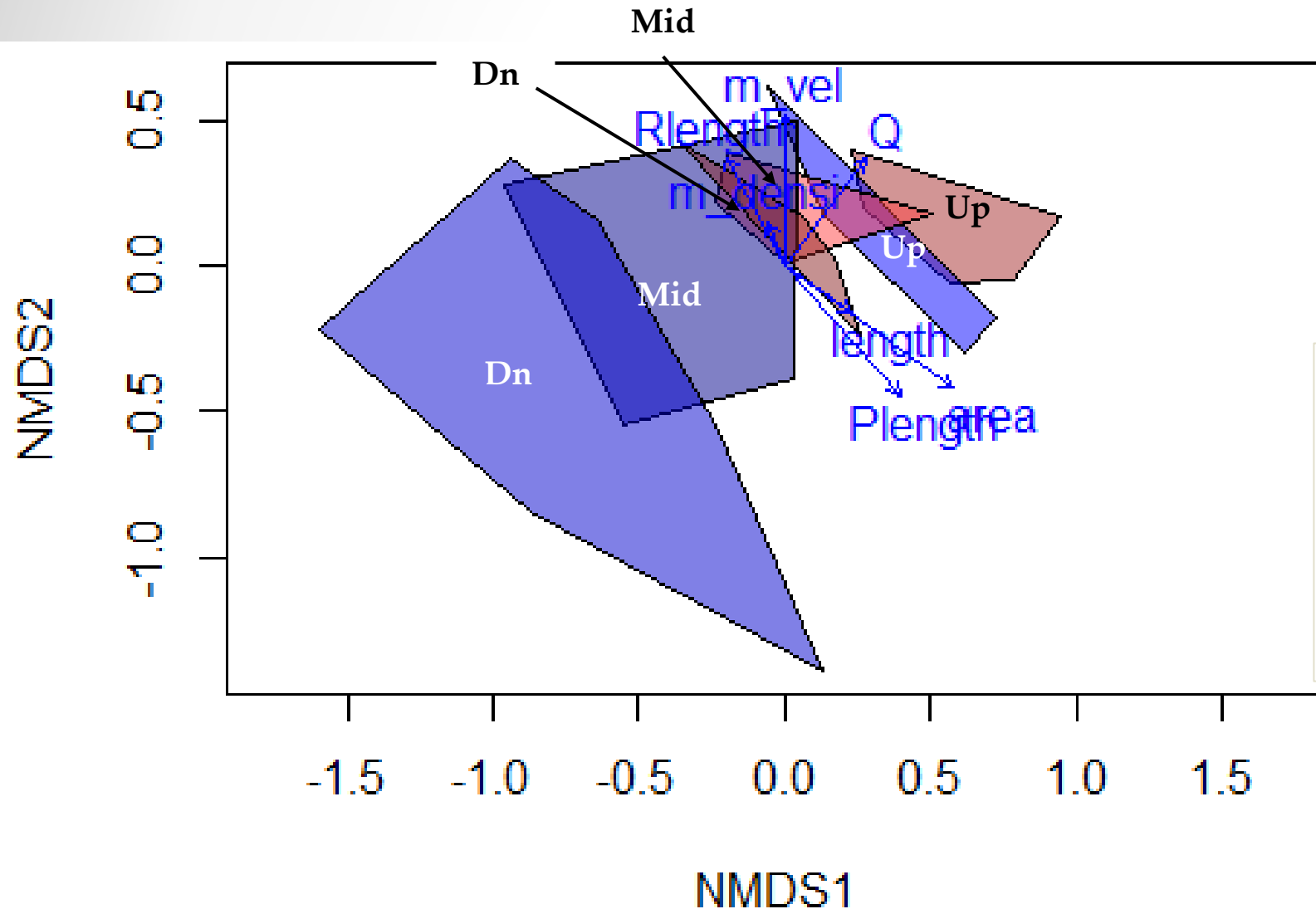
Stress=0.12

Legend

- Immediately Post RC
- Four months Post RC



Immediately Post-Reconnection and Four months Post-Reconnection Fish Analysis



Stress=0.12

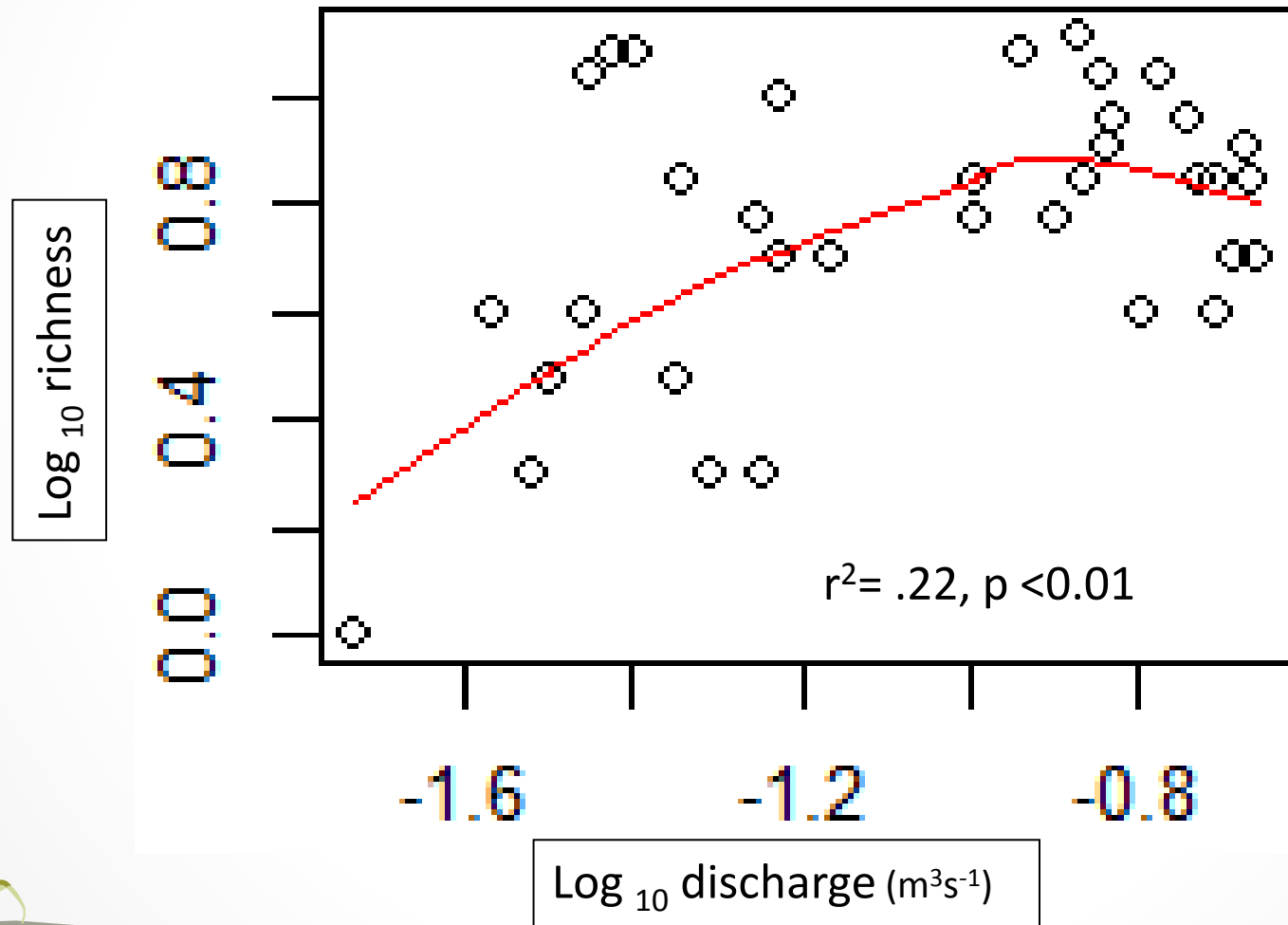
PERMANOVA

Reach: pseudo $F_{2,30} = 5.68$, $P < 0.01$, $R^2 = 0.19$

Season: pseudo $F_{1,30} = 10.62$, $P < 0.01$, $R^2 = 0.18$

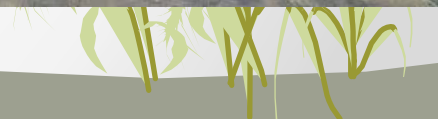
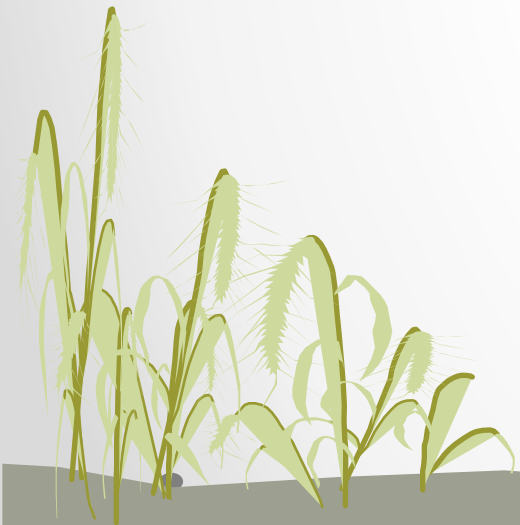


Species-Discharge Relationship

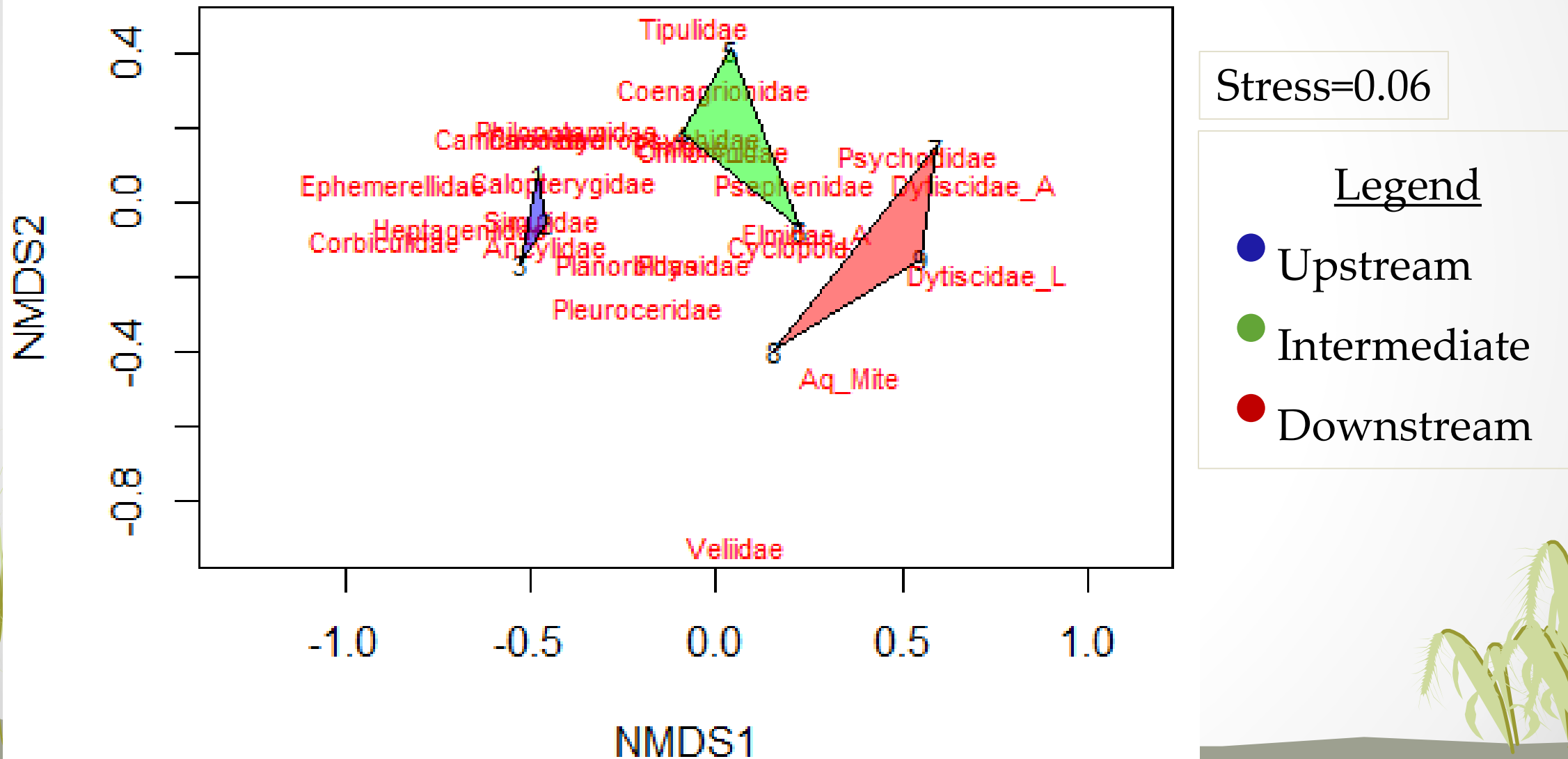


Invertebrate Community Structure

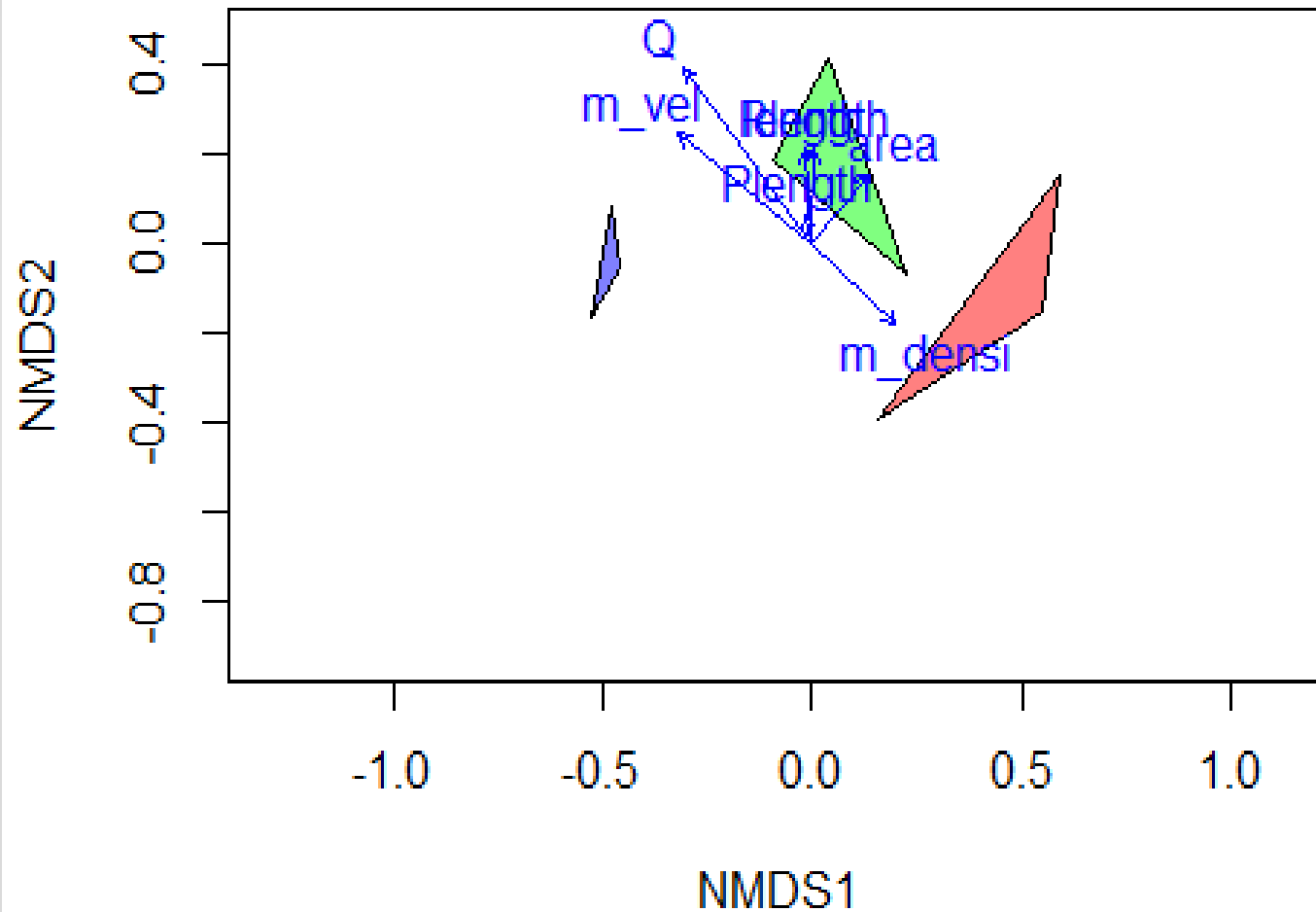
- Do organisms from different assemblages follow similar structural patterns as fish?



Immediately Post- Reconnection Invertebrate Analysis



Immediately Post- Reconnection Invertebrate Analysis



Stress=0.06

Legend

- Upstream
- Intermediate
- Downstream

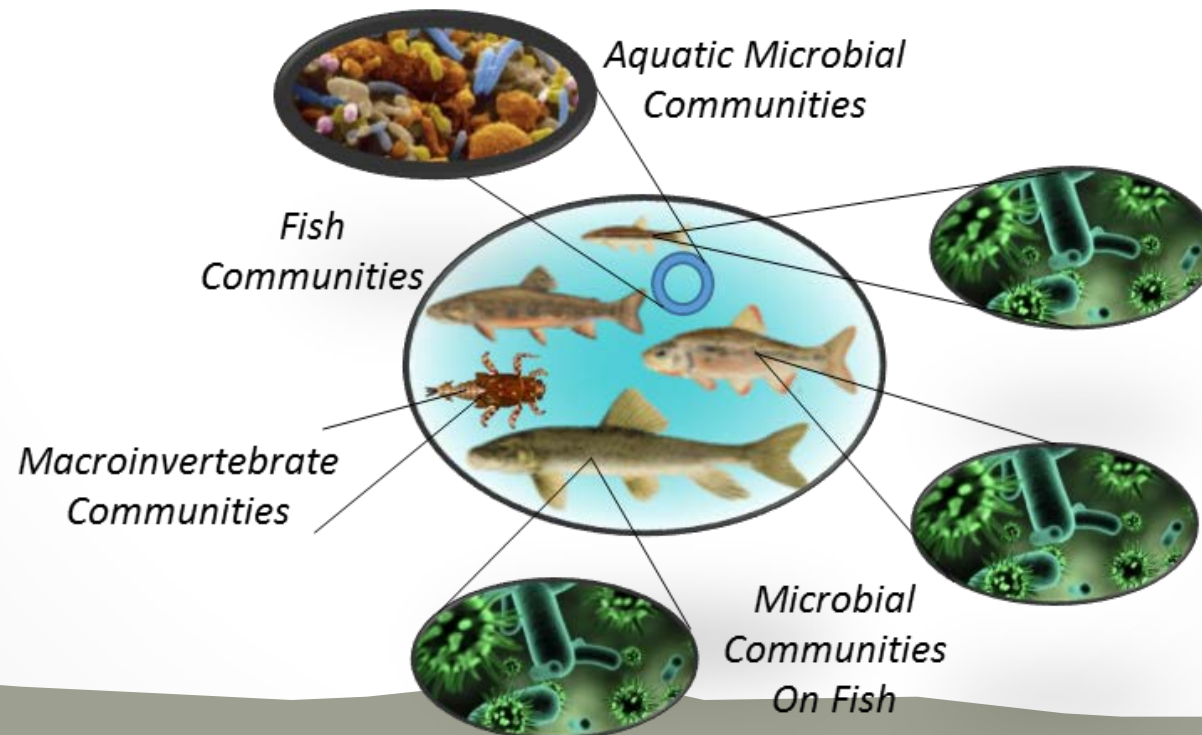
PERMANOVA

Reach: pseudo $F_{2,8} = 6.47$, $P < 0.01$,
 $R^2 = 0.68$



Fish Cutaneous Microbiome

- Unique mucosal surface- community of microbes → microbiome
- Symbiotic relationship- protect against pathogens
- Microscale structure of microbial community on fish using the same model

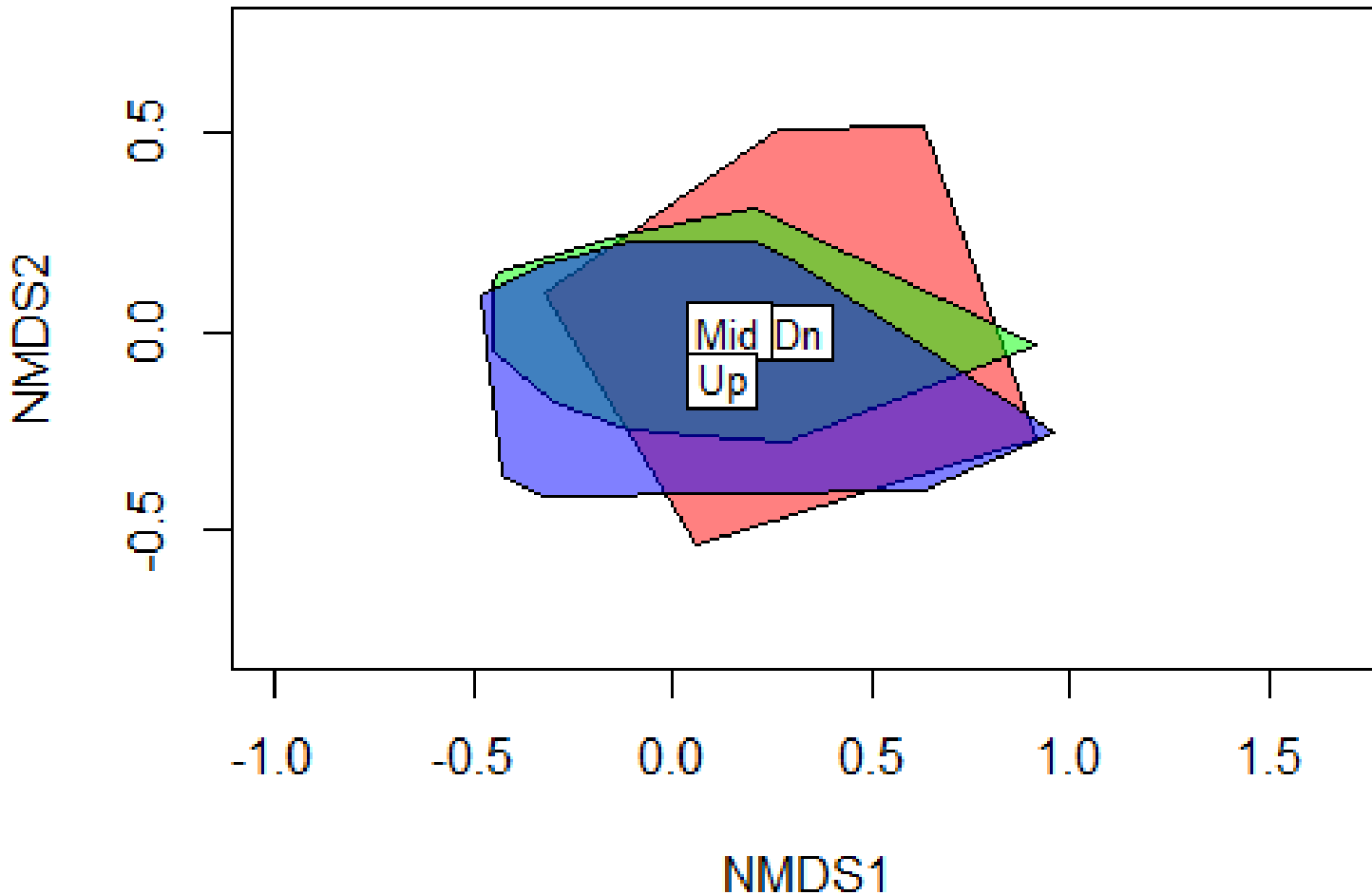


Fish Cutaneous Microbiome

- Microbial communities in three fish species found ubiquitously
- Non-lethal skin swabbing
- Metabarcoding and high-throughput DNA sequencing



Immediately Post- Reconnection Microbiome Analysis



Stress=0.15

PERMANOVA

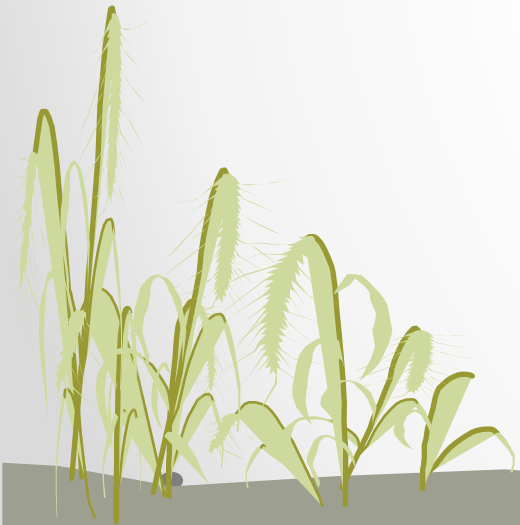
Reach: pseudo $F_{2, 85} = 3.47$, $P < 0.01$,
 $R^2 = 0.07$

Species: pseudo $F_{2, 85} = 1.43$, $P = 0.01$,
 $R^2 = 0.03$



Take-Home

- Drying events causes unique community structures in all assemblages immediately post-reconnection
- Fish- reaches that are prone to drying have unique community compositions even after 4 months of continuous reconnection
- Increased discharge may be environmental variable responsible for community structure shifts





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