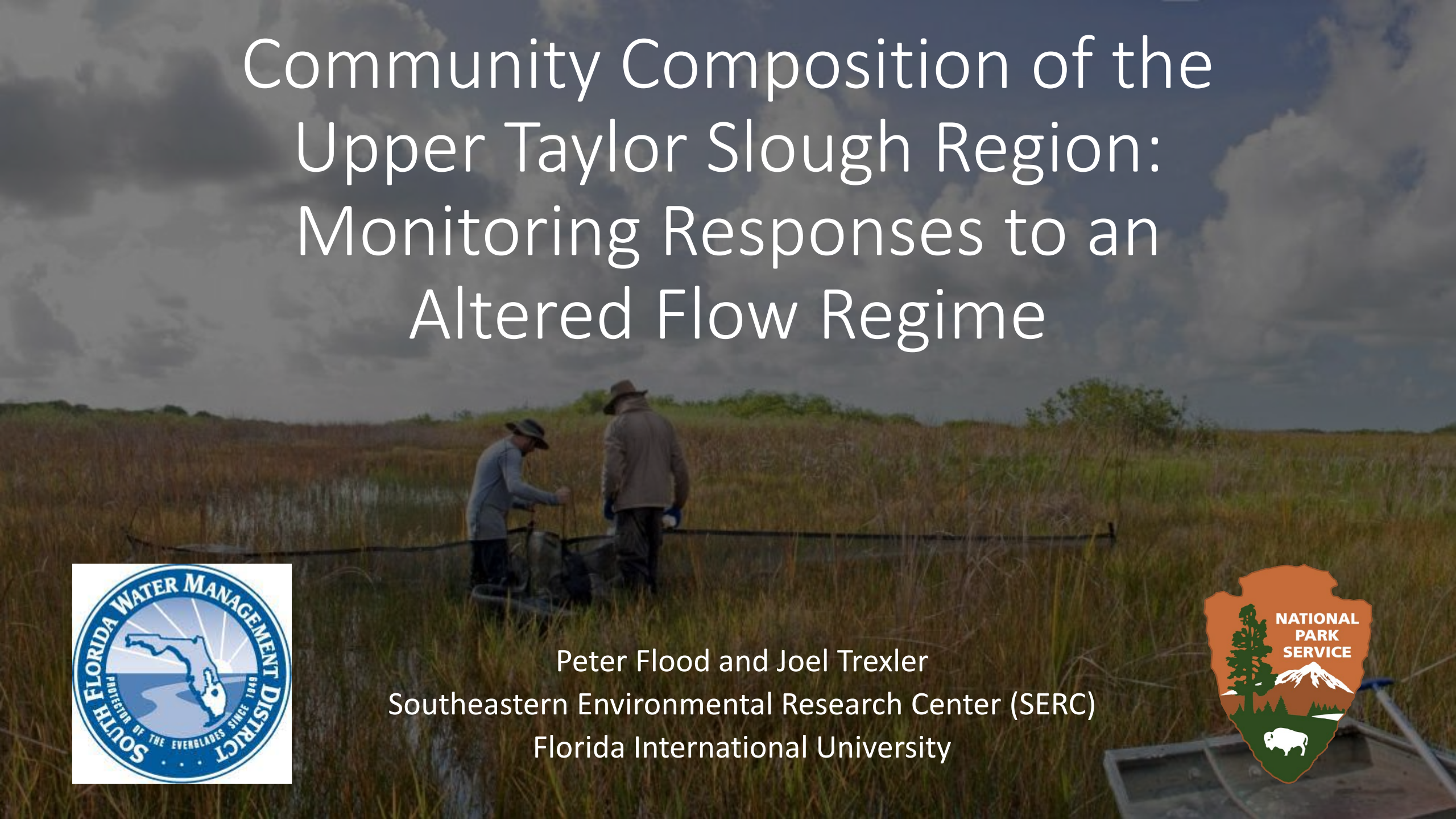
Community Composition of the Upper Taylor Slough Region: Monitoring Responses to an Altered Flow Regime



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Southeastern Environmental Research Center (SERC)
Florida International University

Upper Taylor Slough (UTS) – History and Project Background

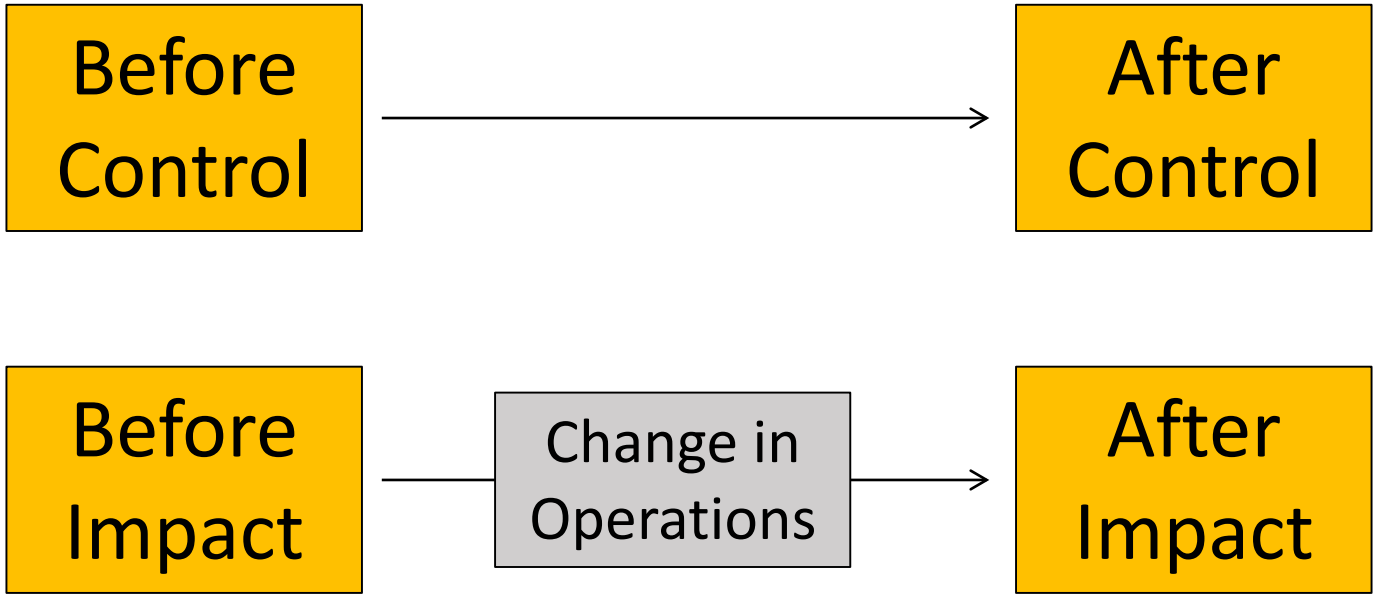
- Rocky Glades – target of management actions
- Historic headwaters of Taylor Slough (TSL)
- Import source of freshwater for Florida Bay
- IOP began in 2000
- ERTP around 2012
- UTS project began in 2017

Our lab has been working in the Rocky Glades since 2003 – Check out Erin McCarthy's poster!

- Goals:
  - Restore freshwater flow to Florida Bay
  - Restore hydroperiod in UTS
  - Community composition shift towards Taylor Slough

Before After Control Impact - BACI

- What constitutes before data?
- What are our control (or reference) sites?



Sampling Methods

- Throw Trap – 1 m^3

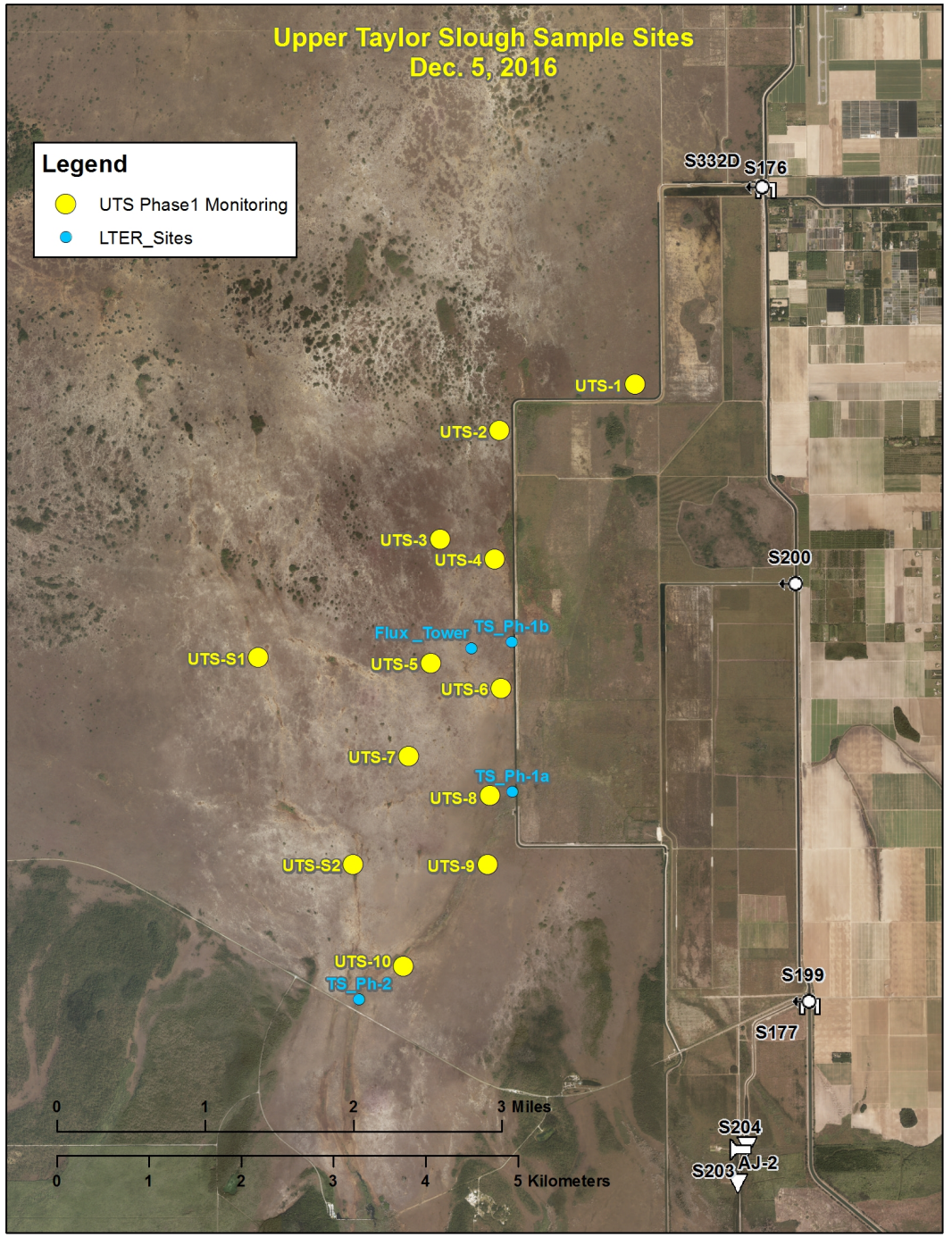
- Drift Fences

Sampling Methods

- Throw Trap – 1 m^3
- Drift Fences

UTS monitoring
2017 to present

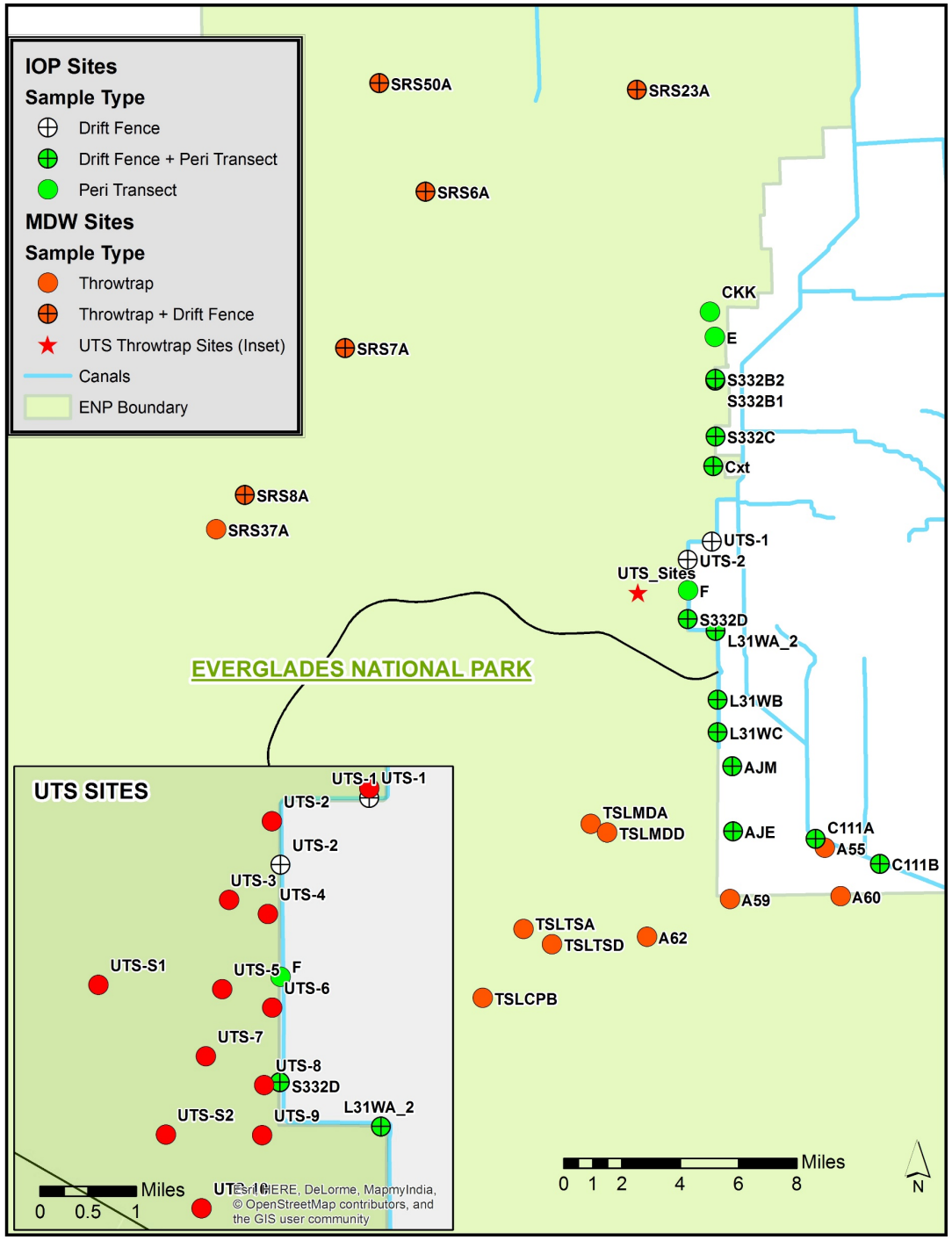
- UTS sites added Dec. 2017. Periphyton and throw-trap collections (fish and macroinvertebrates).
- Design includes 10 “impact” sites and 2 “reference” sites
- Will integrate these into larger monitoring framework for BACI-type analyses



UTS monitoring
2017 to present

- Throw-trap sampling includes long-hydroperiod reference sites in SRS and TSL
  - Sites in red

- IOP sampling with drift fences along ENP boundary from 2003 to present
  - Sites in green



Restoration Conceptual Model

Changes in Operations

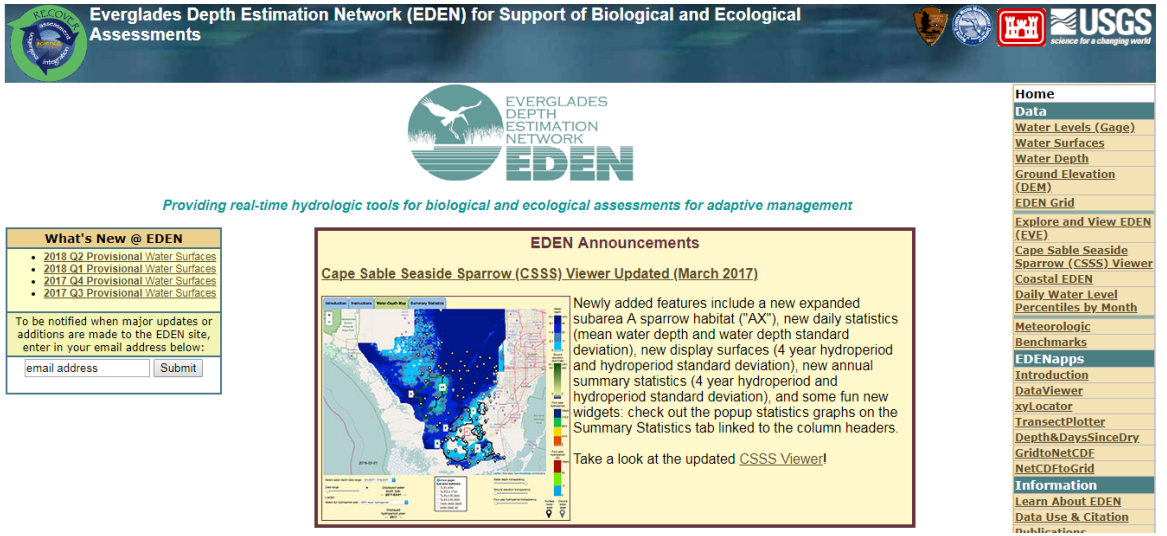
Changes in Hydrology

- Lengthened Hydroperiod
- Increased Average Depth

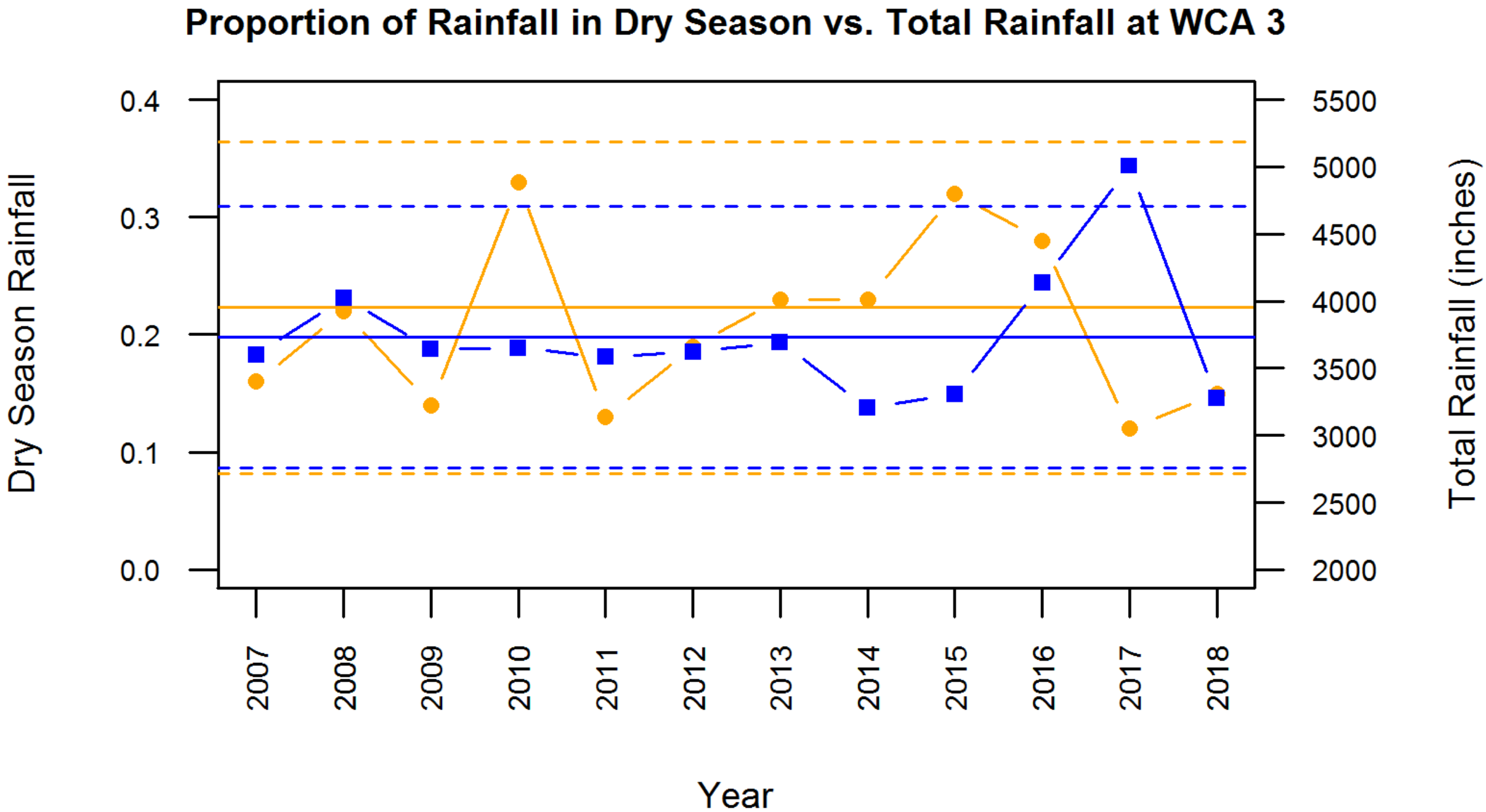
Response by Aquatic Faunal Community

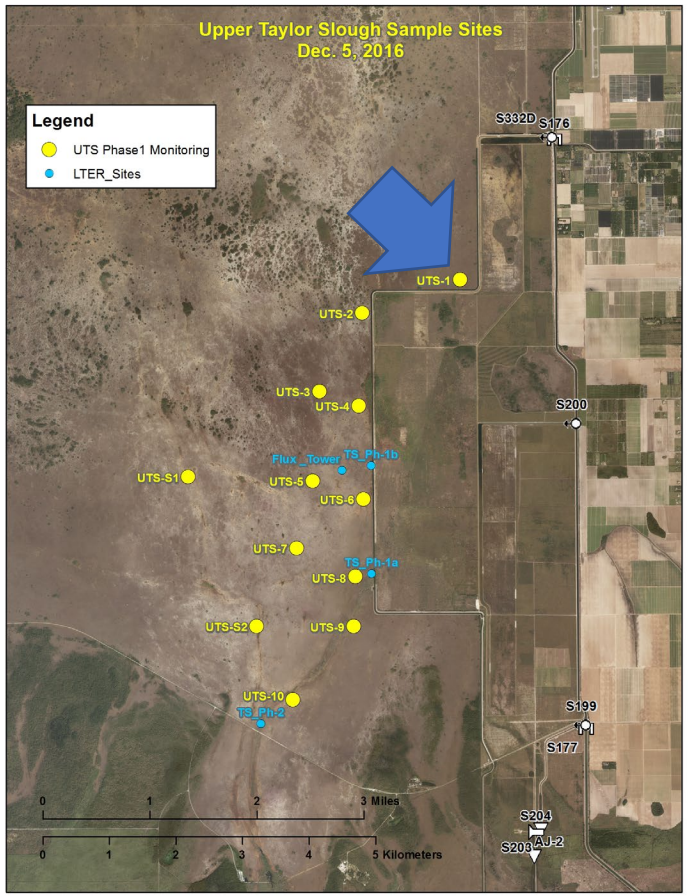
- Community Composition Shifting Towards Reference/ Control Sites
  - Taylor Slough

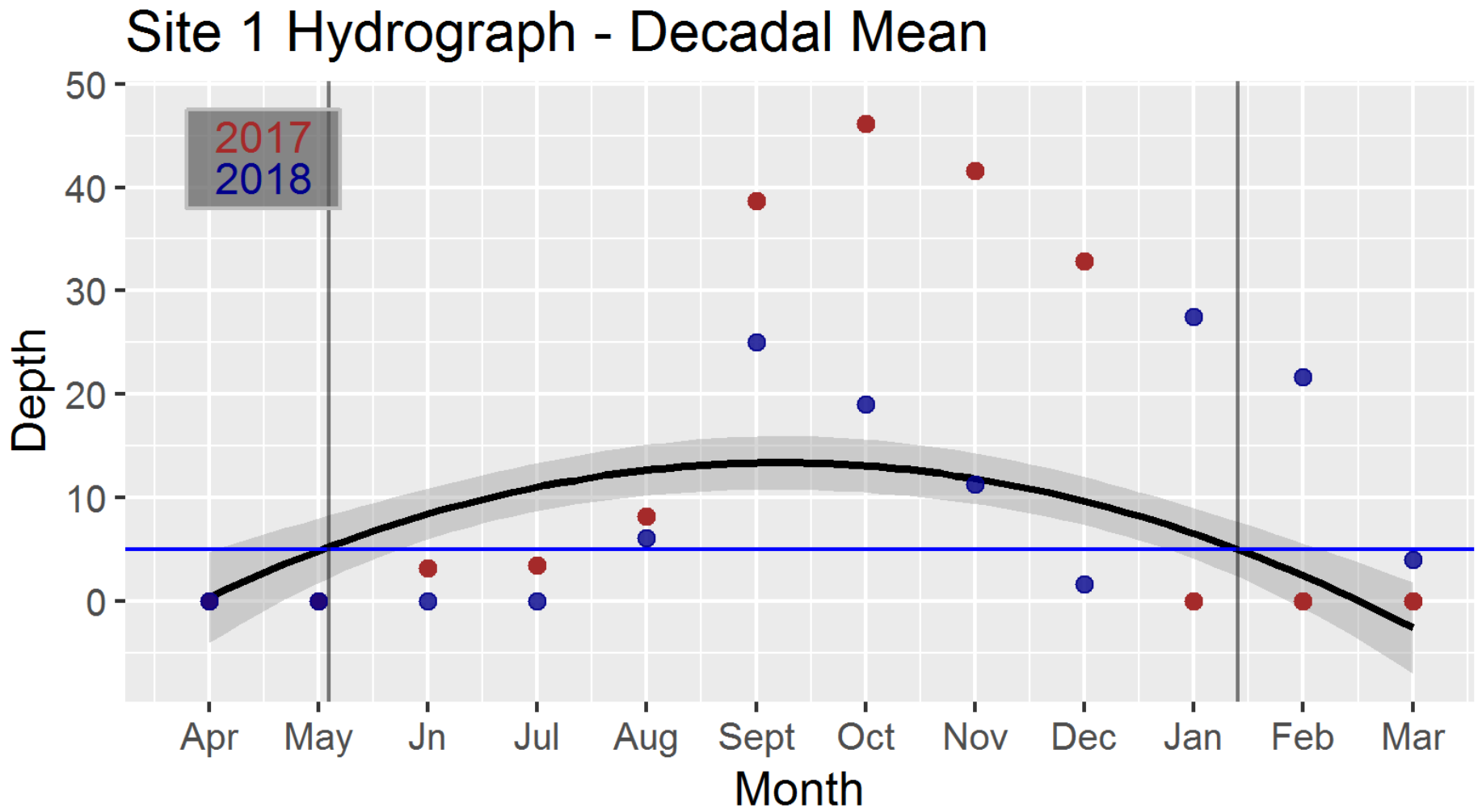
Hydrology

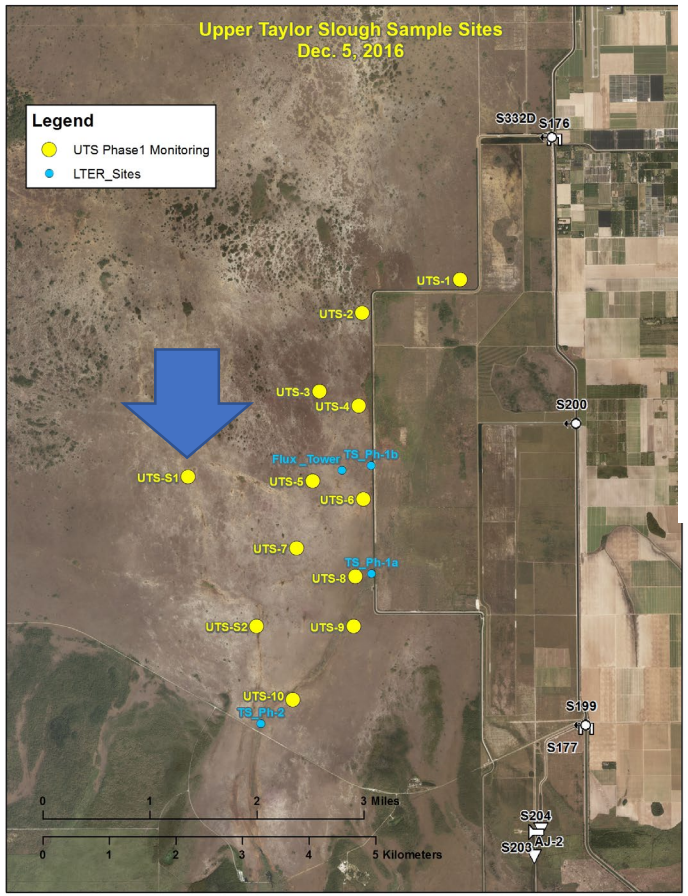


- How we do our hydrology
  - EDEN XY locator – feed in our UTMs
  - Use observed depths to calculate offset
  - Graph adjusted depth
- Use data from 2007 to 2017
  - Frequency distribution on hydrological parameters
  - Evaluate likelihood of obtaining a given year based on that distribution
  - **Compare future data against 'before' data given if hydrology within distribution of previous years or not**
- Need to control for rainfall


Proportion of Rainfall in Dry Season vs. Total Rainfall at WCA 3
Dry Season Rainfall
0.4
0.3
0.2
0.1
0.0
Total Rainfall (inches)
5500
5000
4500
4000
3500
3000
2500
2000
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year


Upper Taylor Slough Sample Sites
Dec. 5, 2016
Legend
UTS Phase1 Monitoring
LTER_Sites
S332D
S176
UTS-1
UTS-2
UTS-3
UTS-4
S200
Flux _Tower
TS_Ph-1b
UTS-S1
UTS-5
UTS-6
UTS-7
TS_Ph-1a
UTS-8
UTS-S2
UTS-9
UTS-10
TS_Ph-2
S199
S177
S204
AJ-2
S203
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers


Site 1 Hydrograph - Decadal Mean
2017
2018
Depth
50
40
30
20
10
0
Apr
May
Jn
Jul
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Month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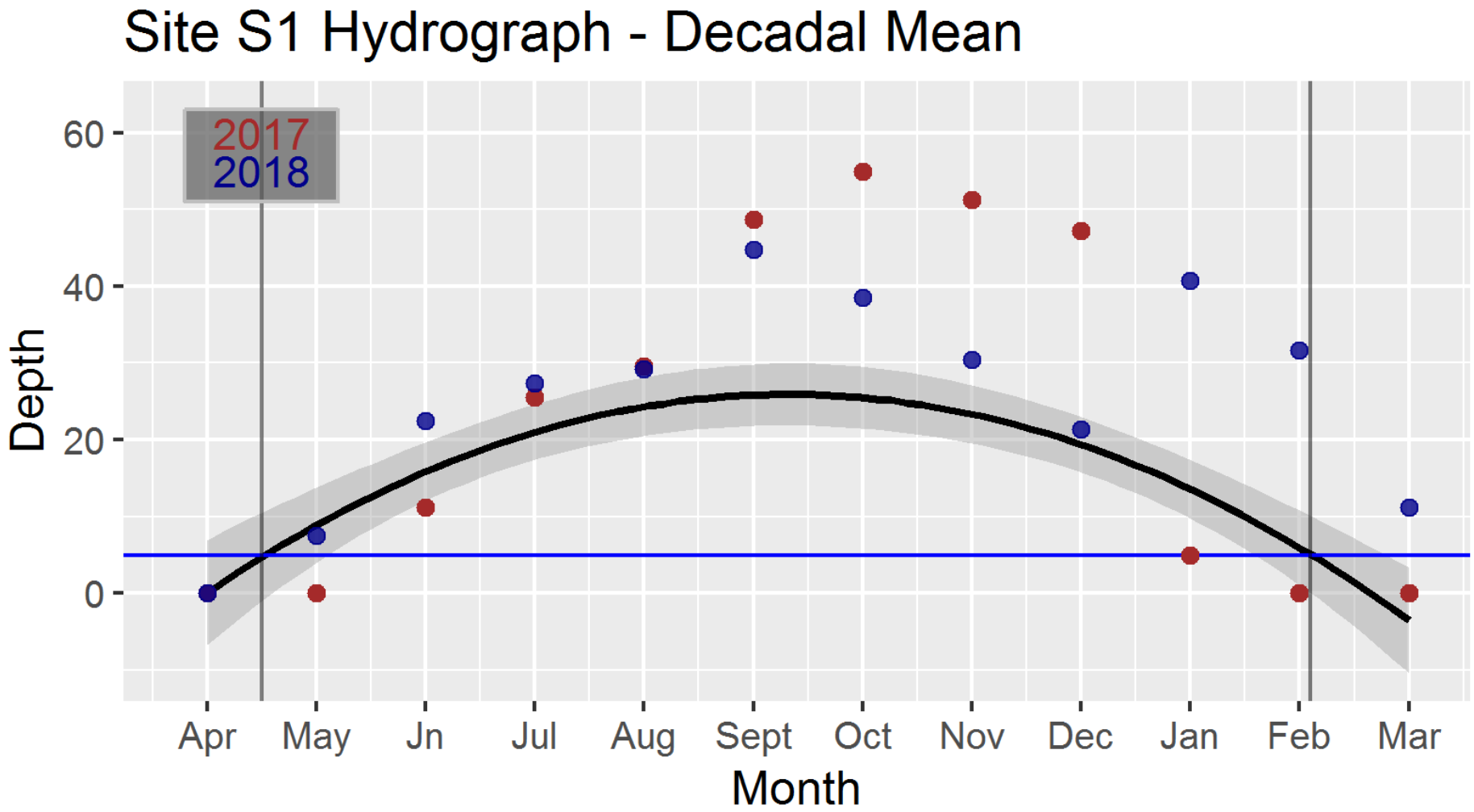
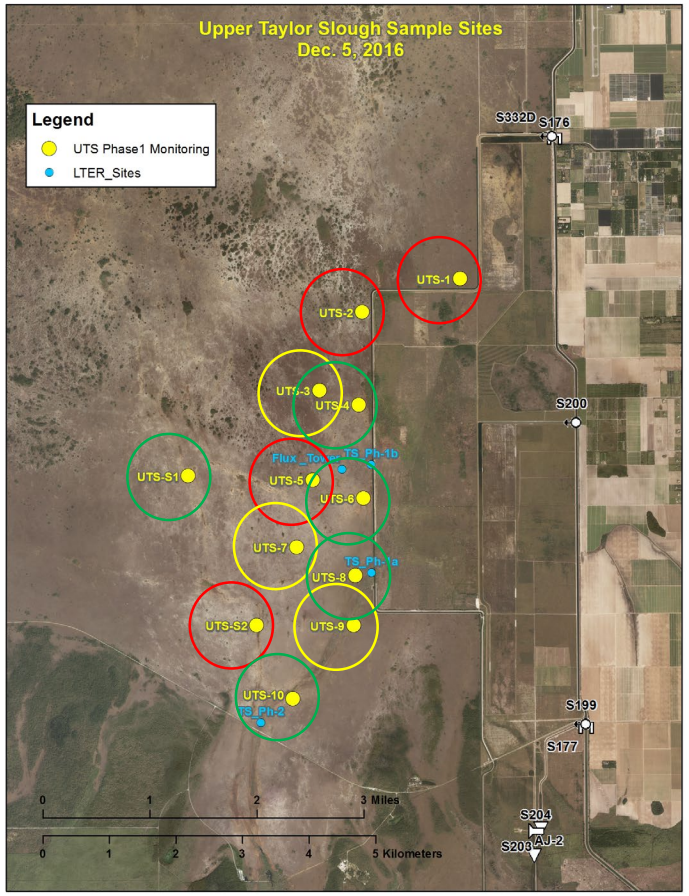
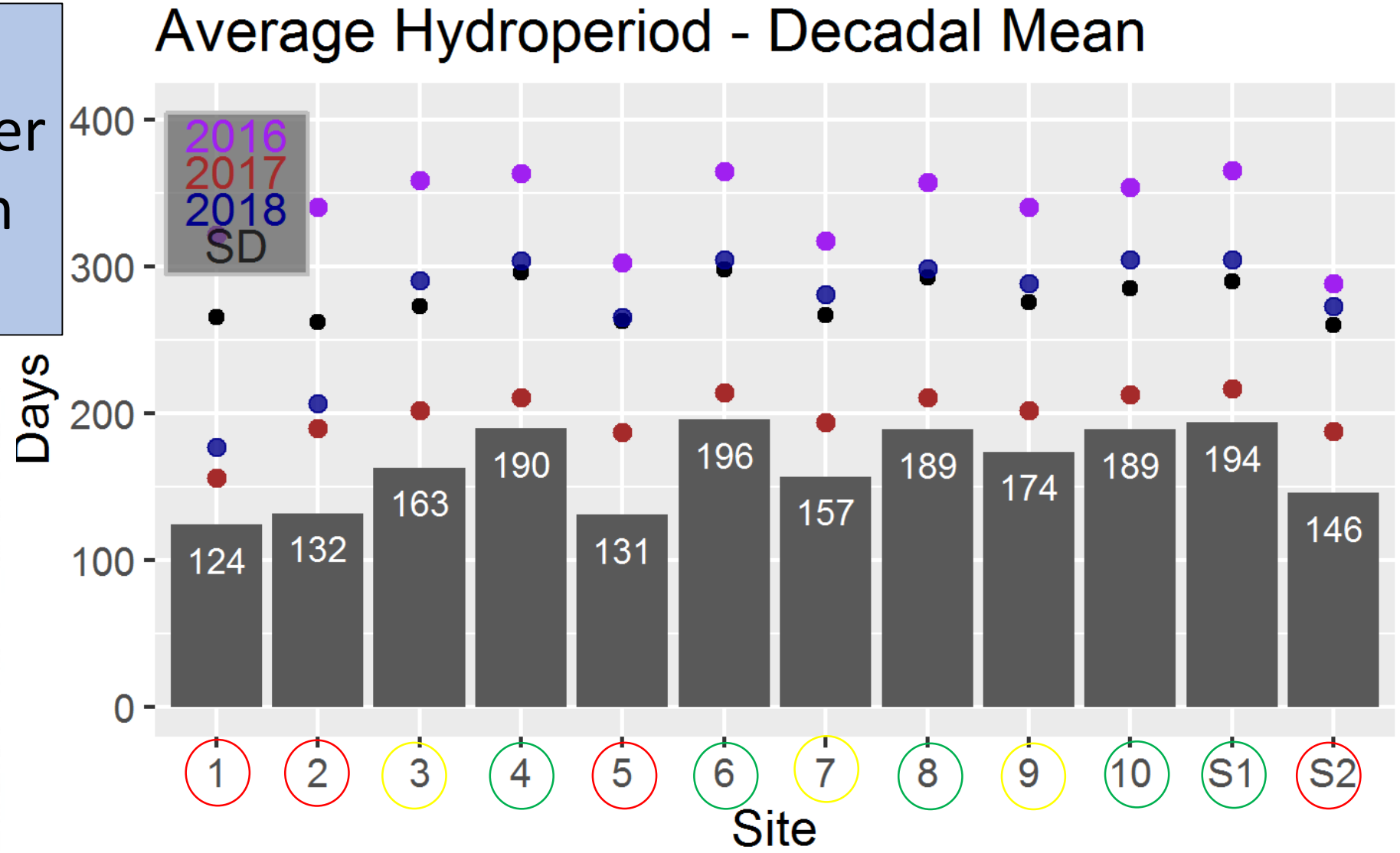

Site S1 Hydrograph - Decadal Mean
2017
2018
Depth
60
40
20
0
Apr
May
Jn
Jul
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Month

There is a general trend towards longer hydroperiods from North to South.

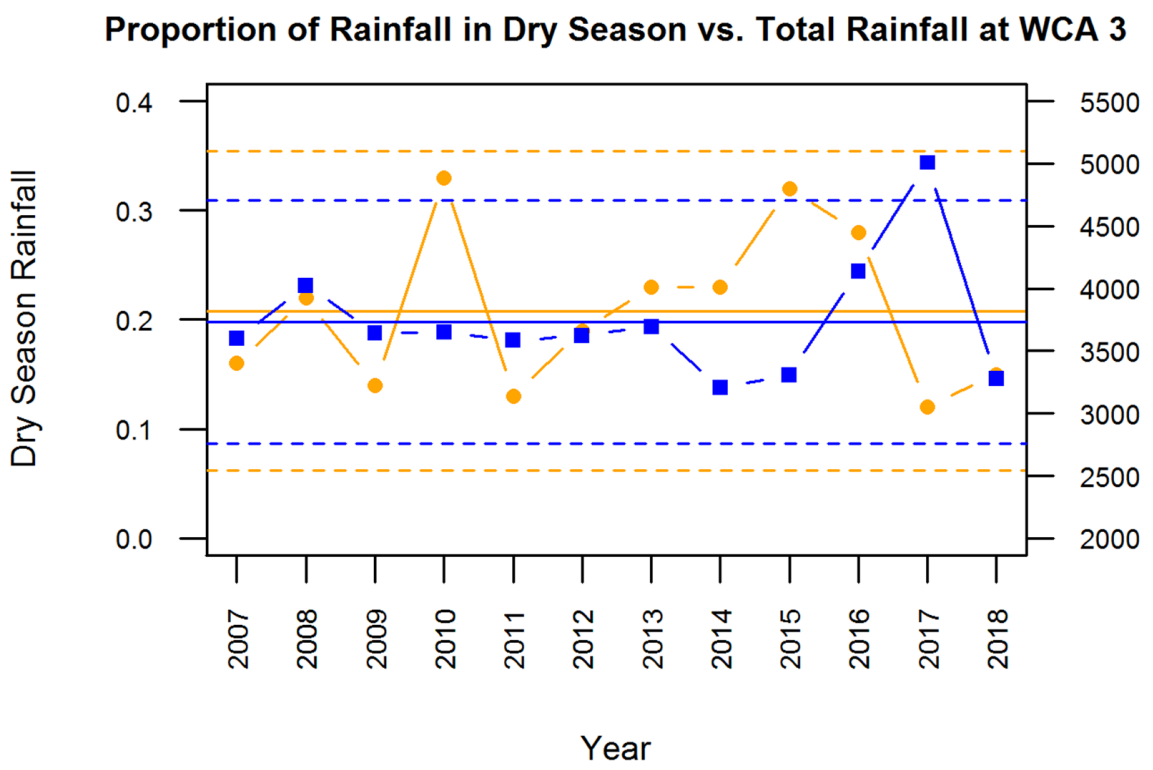




4 Shortest Hydroperiod Sites

3 Intermediate Hydroperiod Sites

5 Longest Hydroperiod Sites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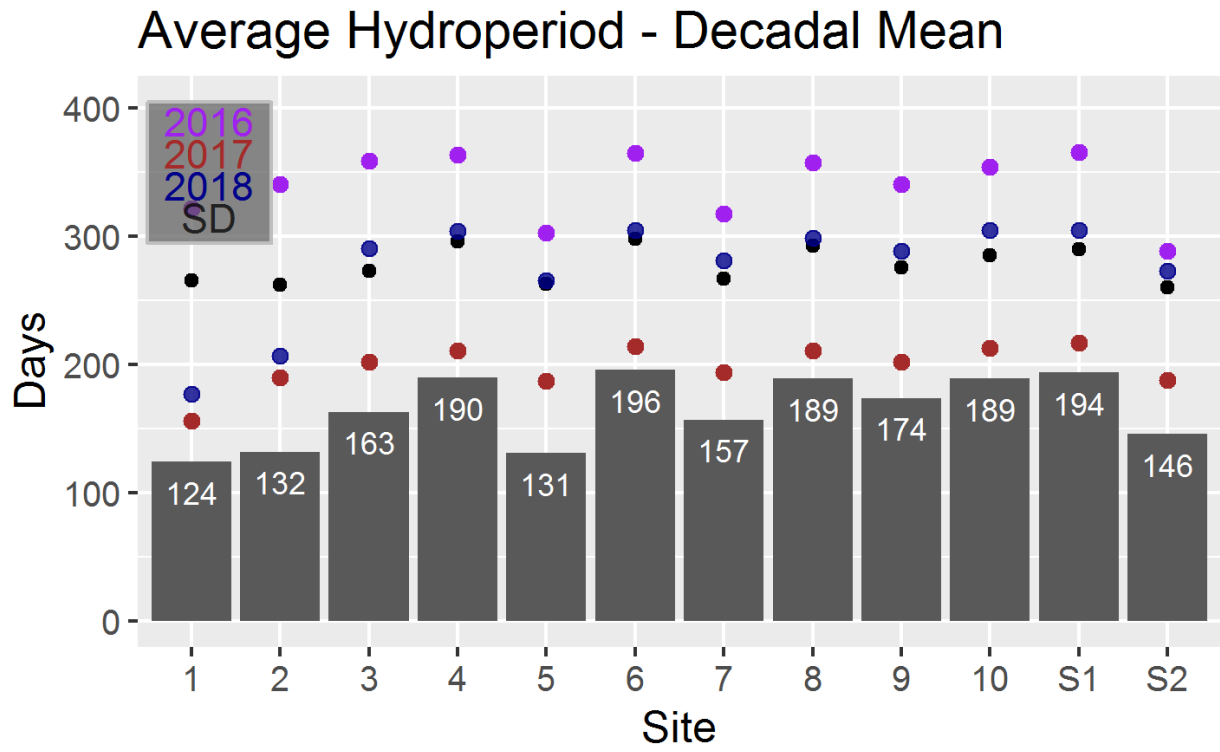
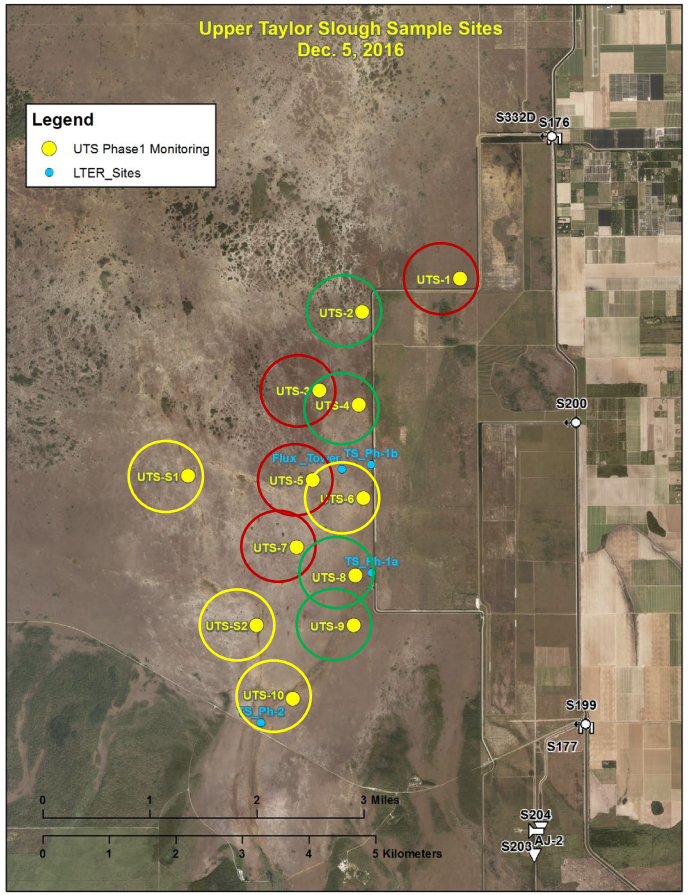
2015
2016
2017
2018
Year

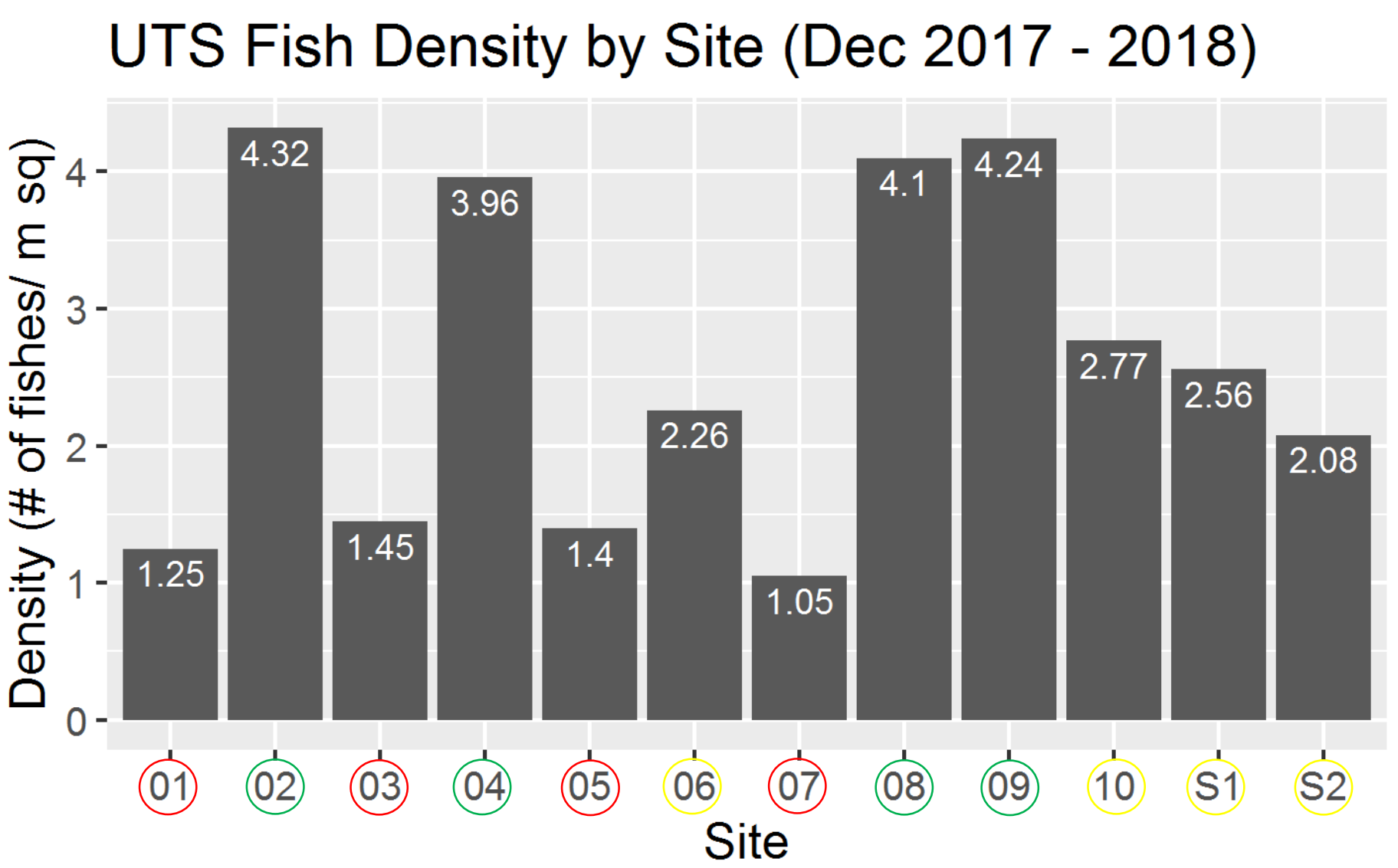

Average Hydroperiod - Decadal Mean
2016
2017
2018
SD
Days
400
300
200
100
0
124
132
163
190
131
196
157
189
174
189
194
146
1
2
3
4
5
6
7
8
9
10
S1
S2
Site

Species Richness – Density and Biomass

- Observed Species Richness
- Species Accumulation Curve - Rarefaction
  - Randomly re-samples the data
  - How many samples until all species are represented in the data
- Density and biomass as indices of productivity
  - Individuals/ m^2 and g/ m^2
- Immigration, especially non-native fishes, evaluated with IOP data
  - Document fish movements associate with canal inflows
  - Observe changes with enhanced water delivery and sheetflow

Highest fish densities are at sites near the canal.



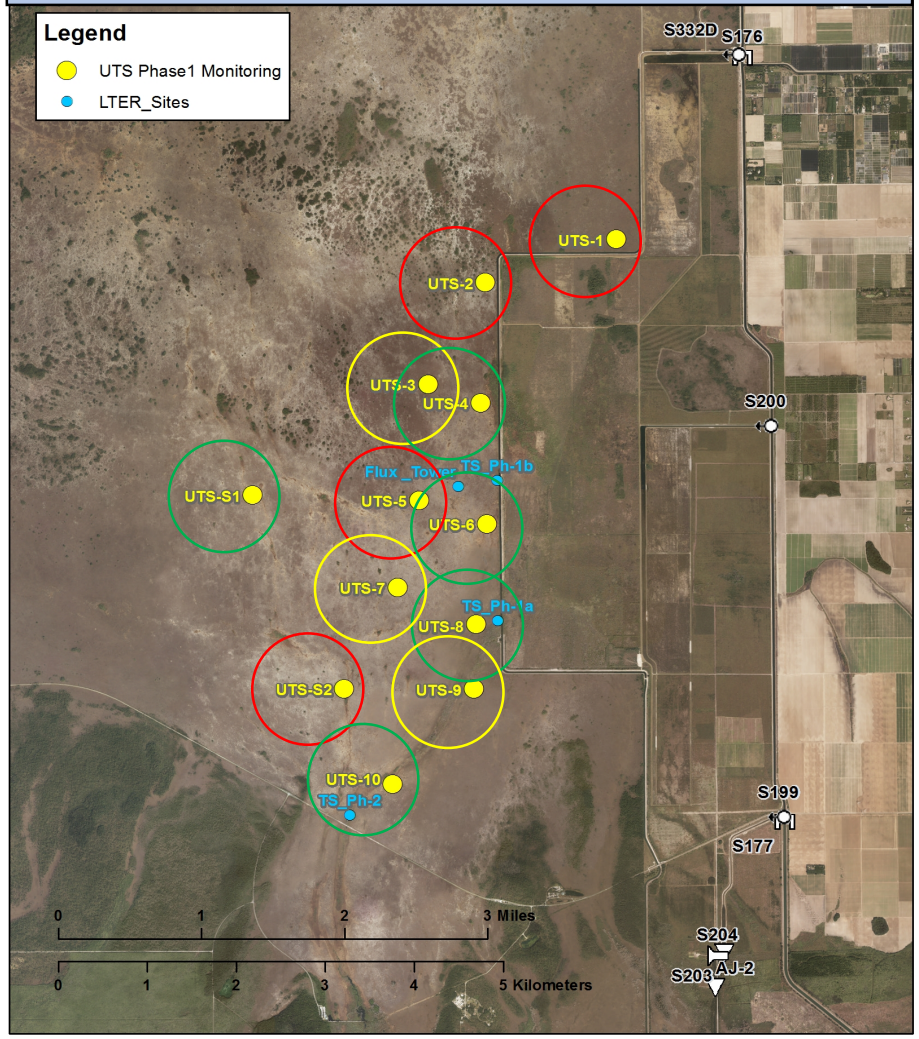


0 ≤ density < 2

2 ≤ density < 3

density ≥ 3

Hydroperiod



4 Shortest Hydroperiod Sites

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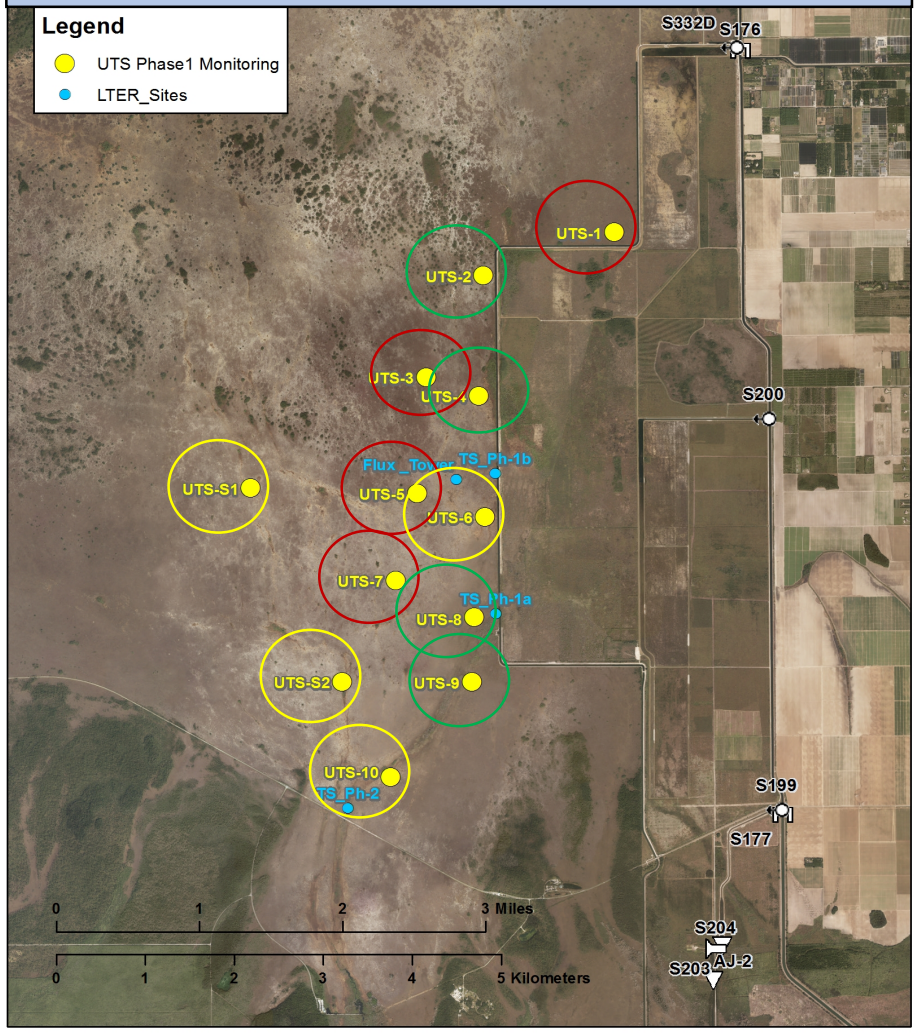
Fish Density

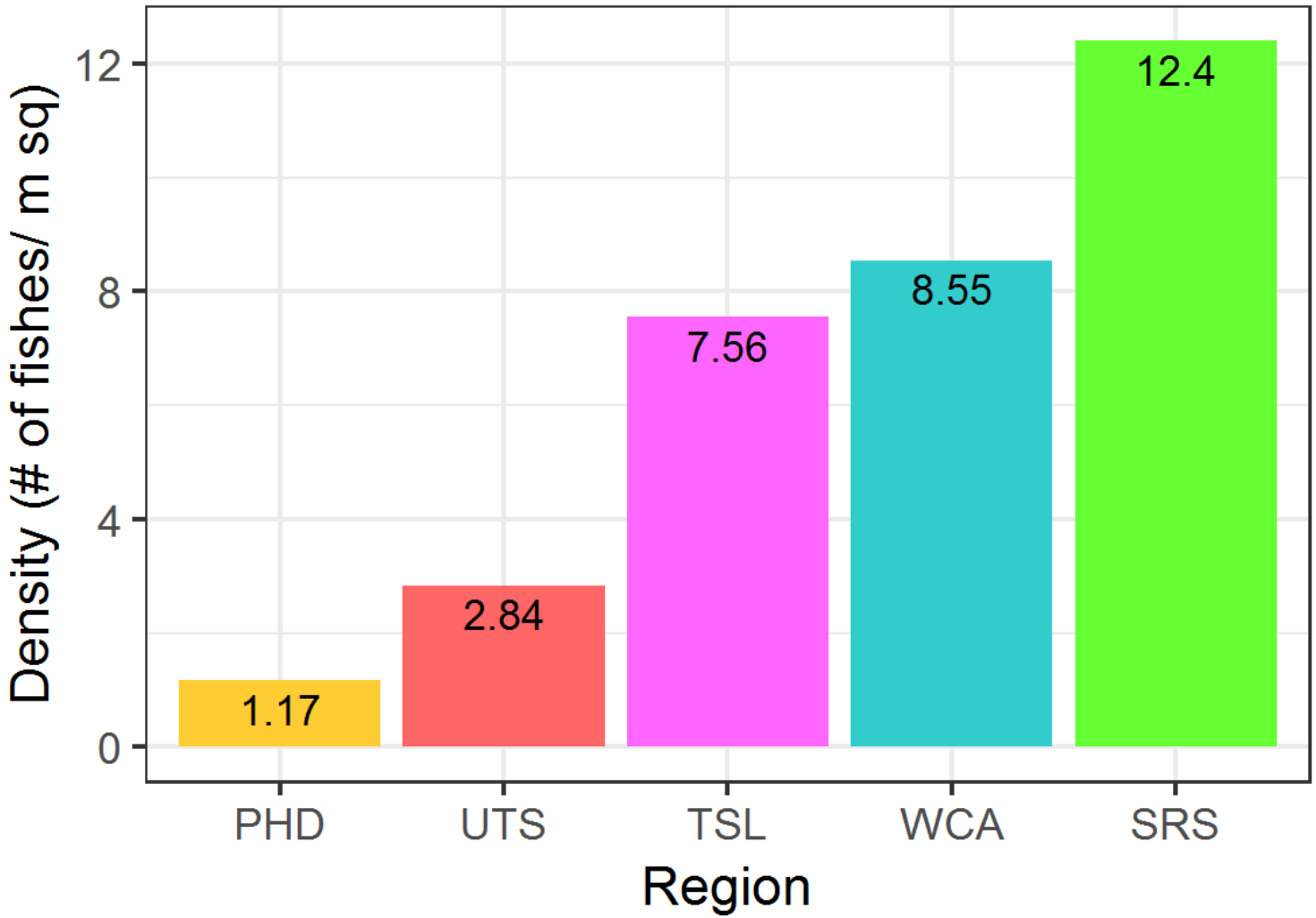


0 ≤ density < 2

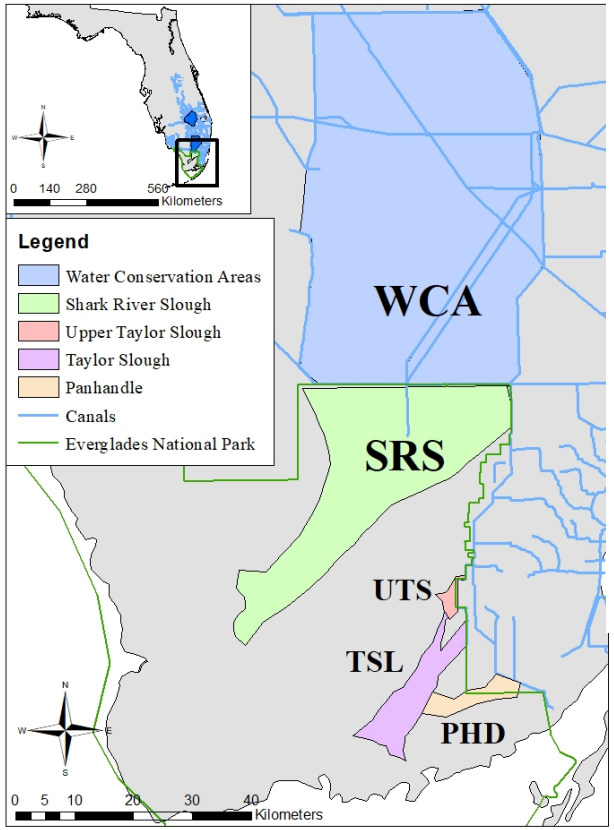
2 ≤ density < 3

density ≥ 3

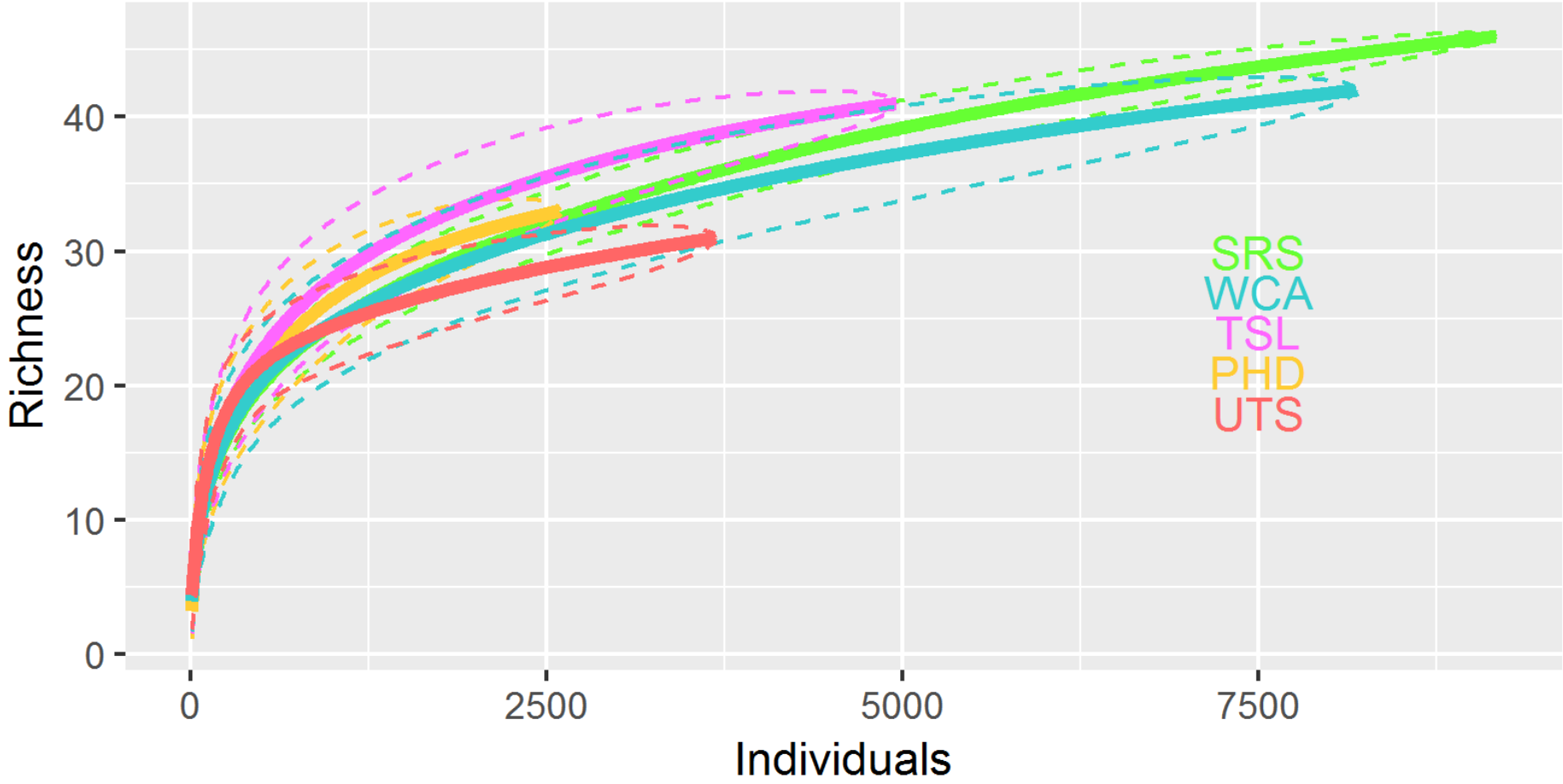
Fish Density by Region (Dec 2017 - 2018)



Regions of Interest



Invert. Species Accumulation Curves by Region



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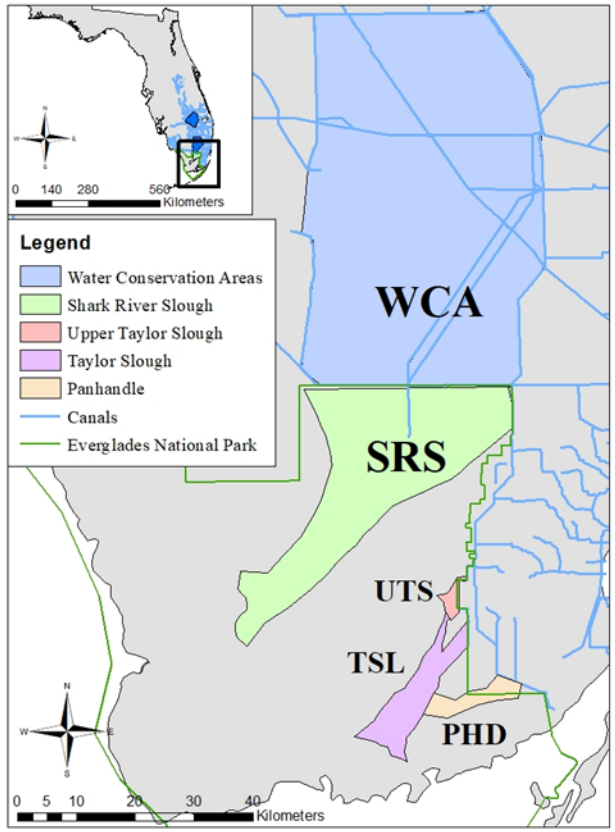
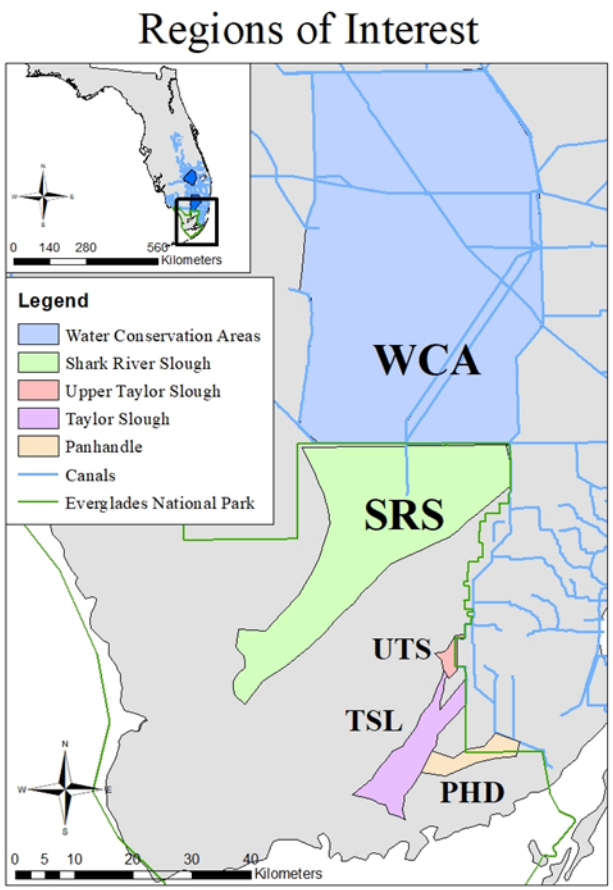
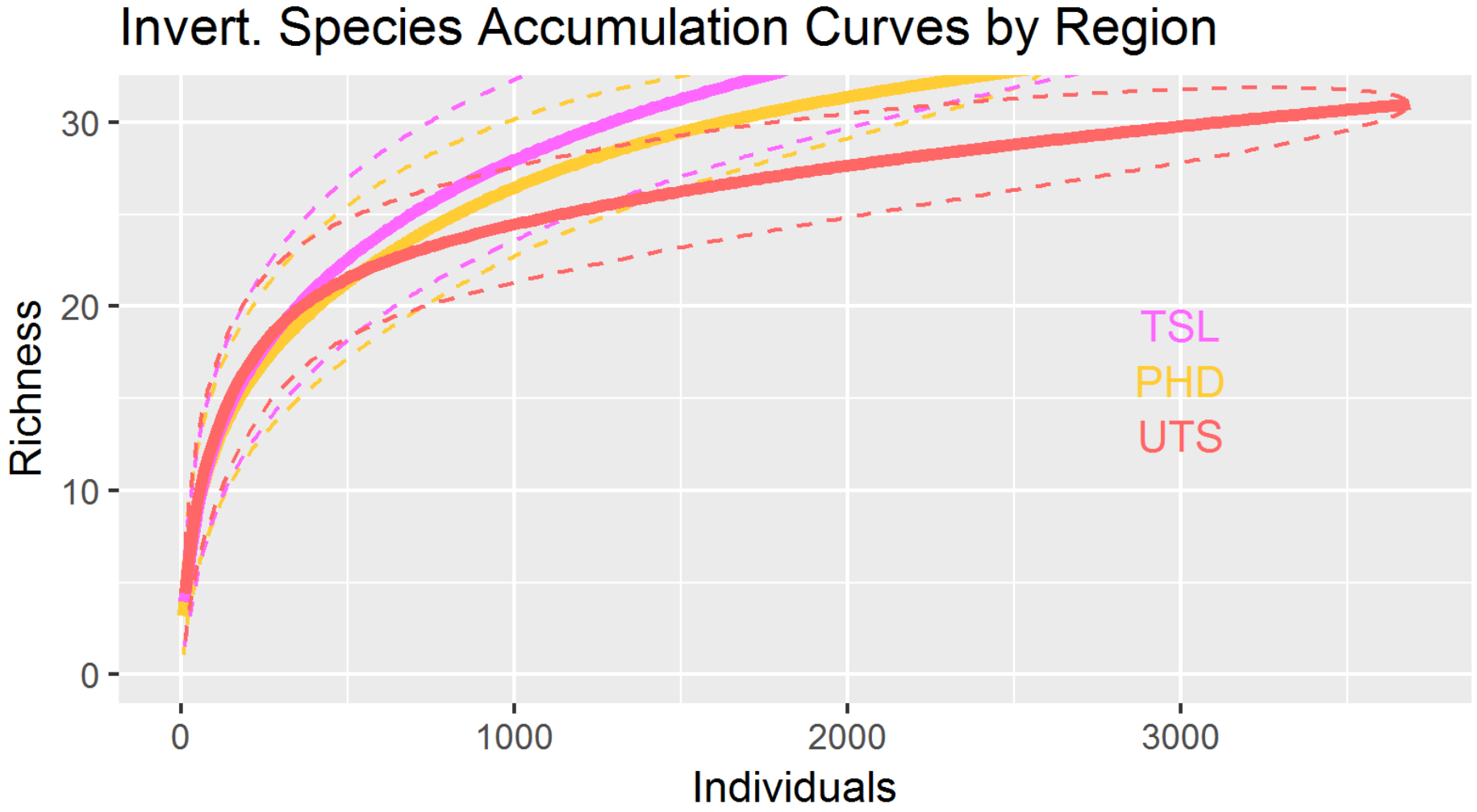
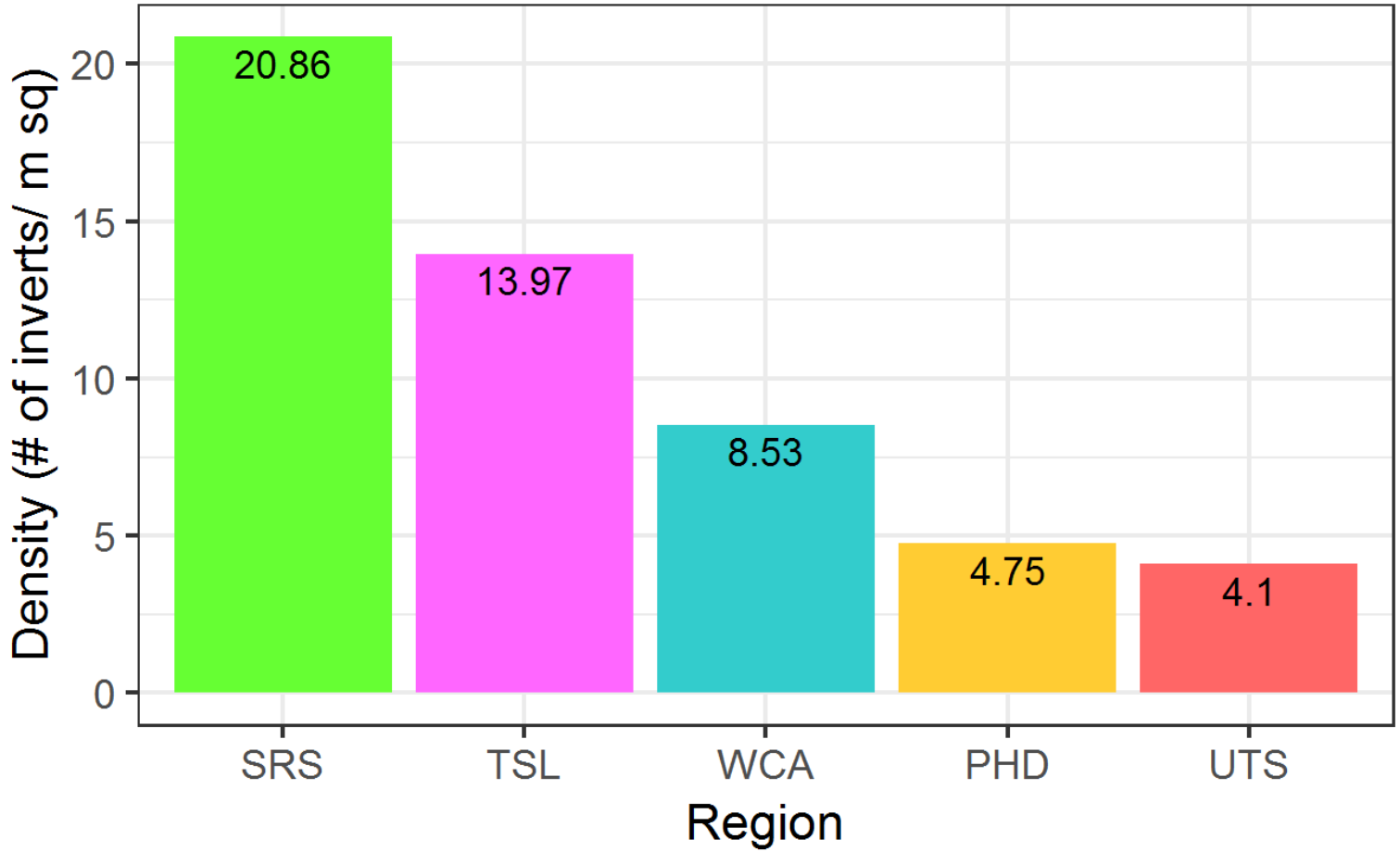






- 13 taxon found in TSL not found in UTS including:
  - Tipulidae (Crane Fly Larvae), Nematodes, Hirudinea, Oligocheates, *Erythemis spp.* (dragonfly - pondhawk), *Epicordulia princeps* (dragonfly), *Micromenetus dilatatus* (bugle sprite)

Invertebrate Density by Region (Dec 2017 - 2018)



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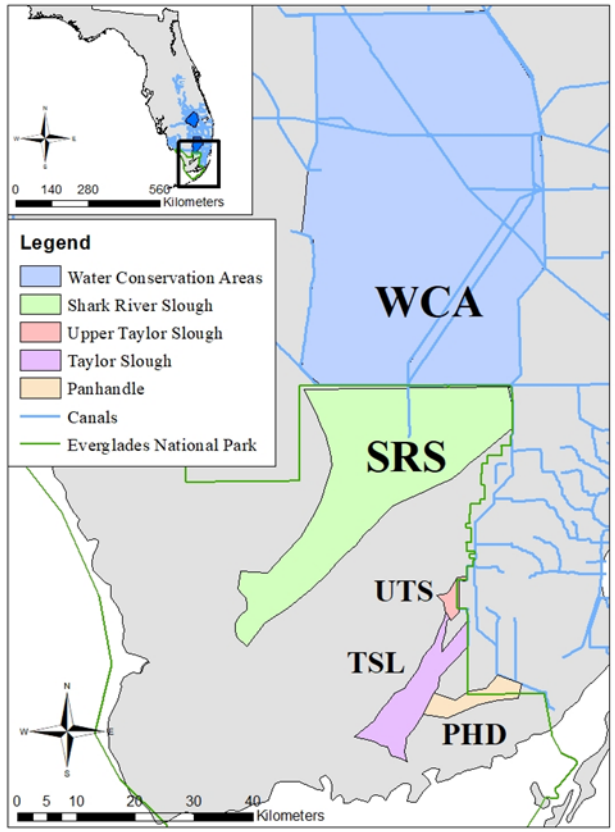
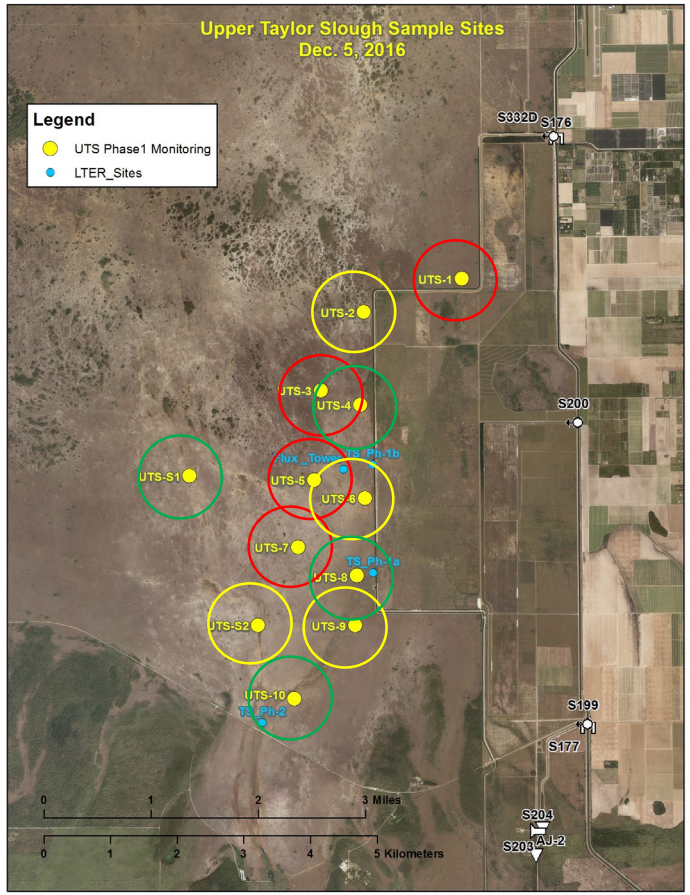
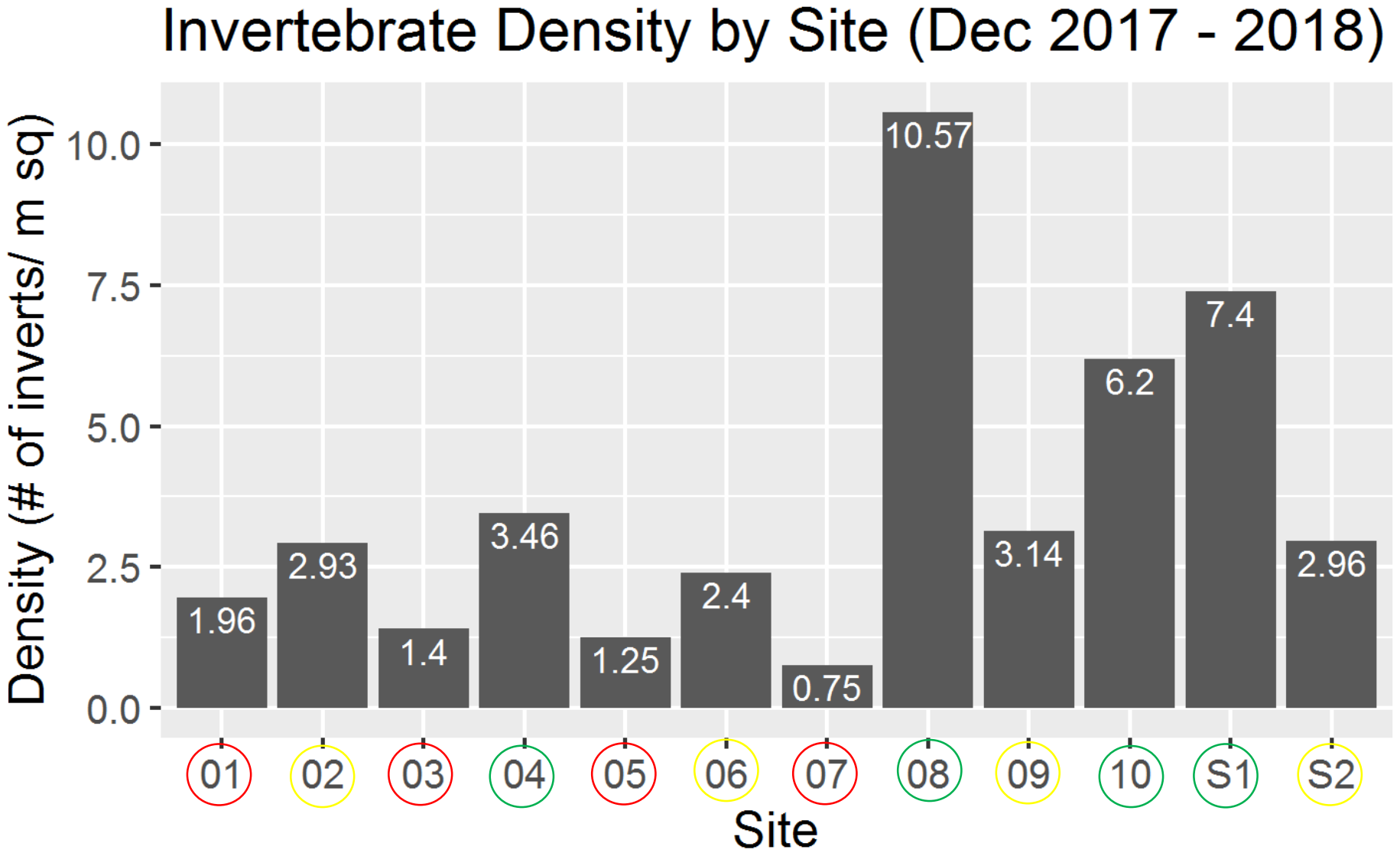


Density appears to be driven by hydroperiod and proximity to the canal



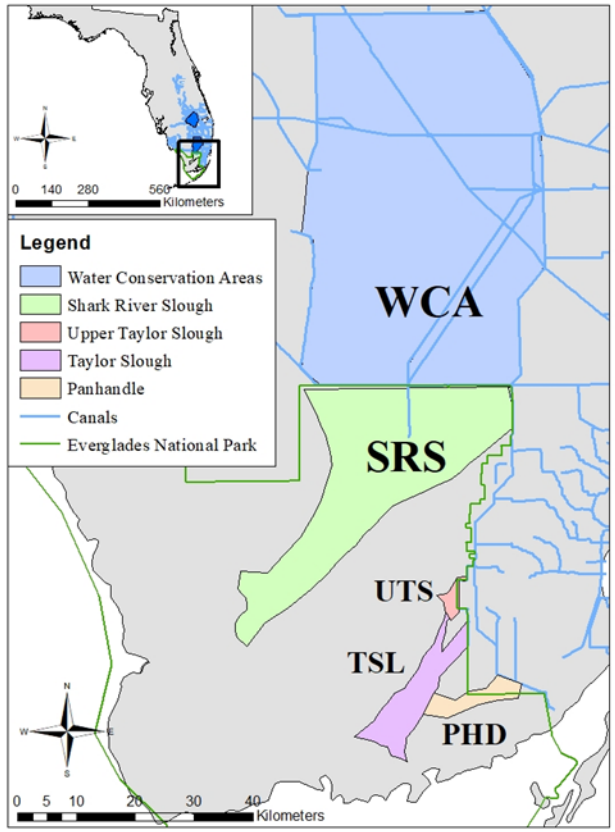


0 ≤ density < 2

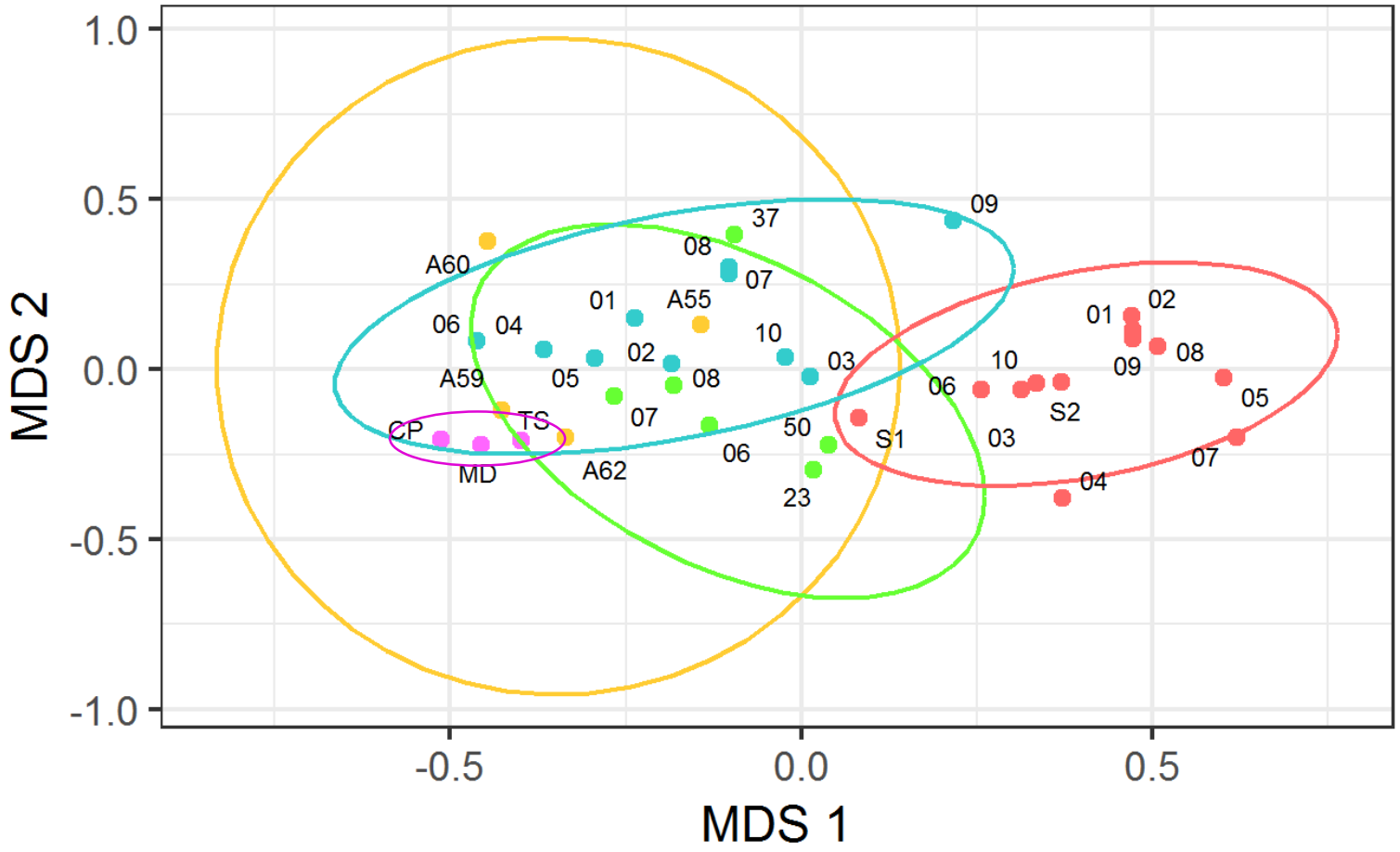
2 ≤ density < 3.25

density ≥ 3.25

Regions of Interest



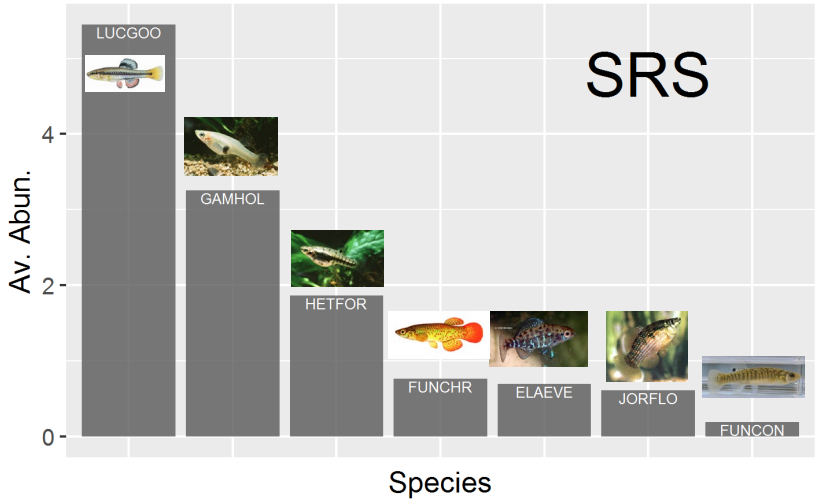
Fish Community NMDS

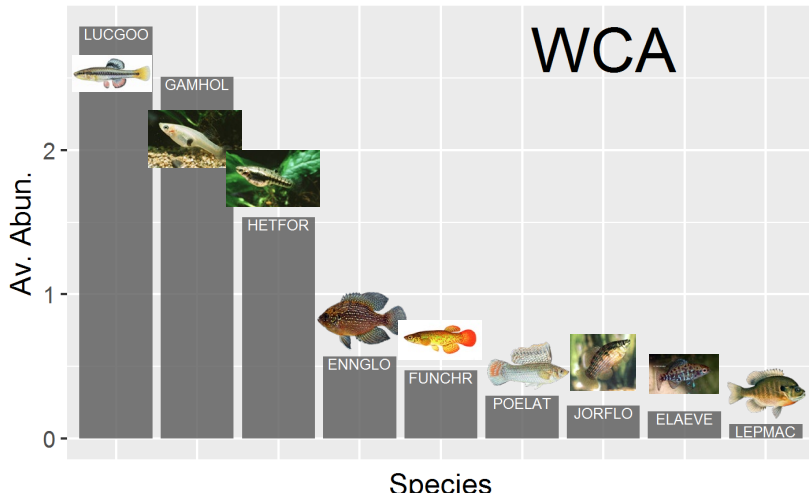


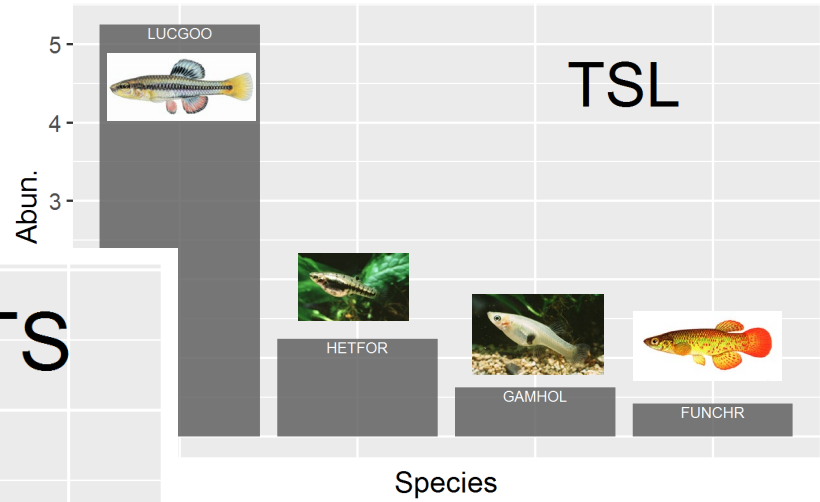
-Ellipses represent 95% confidence intervals, except for TSL (too few points).

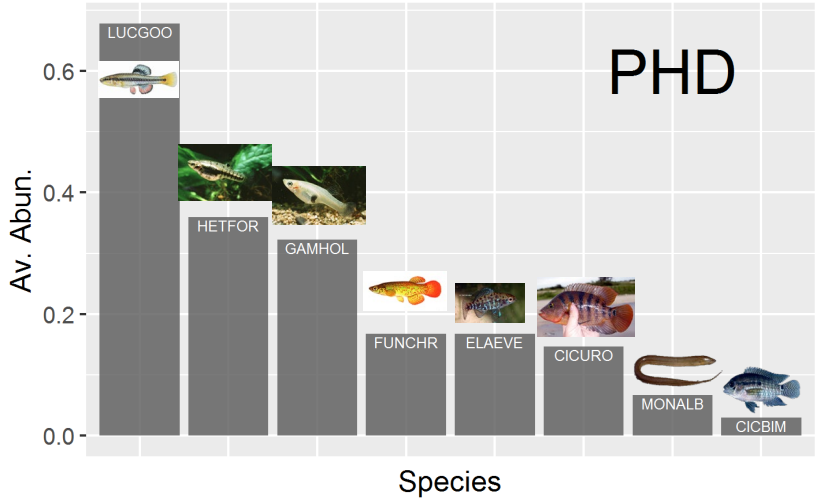
Dominance-diversity curves by region

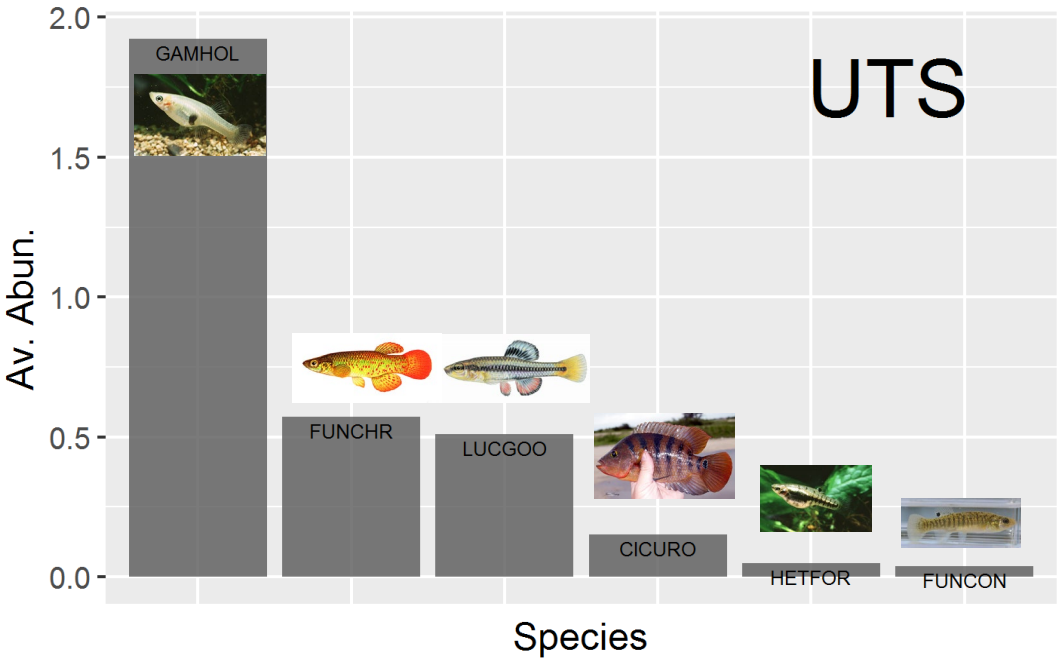
Fish species comprising 95% of all specimens November, 2017, through December, 2018

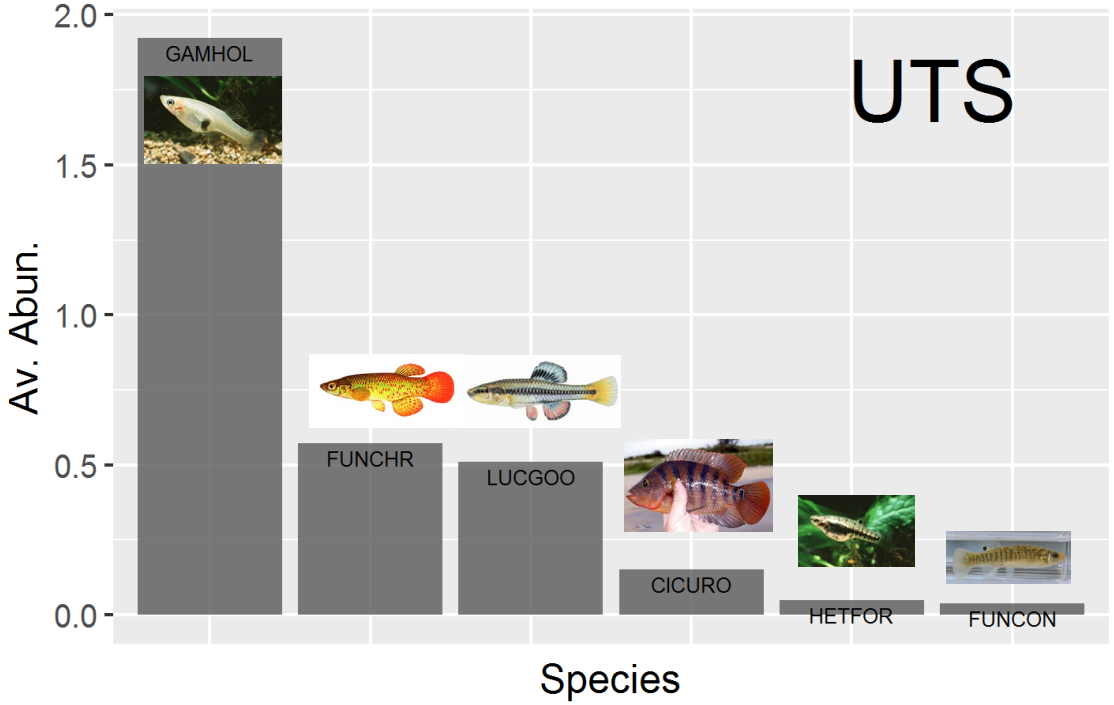


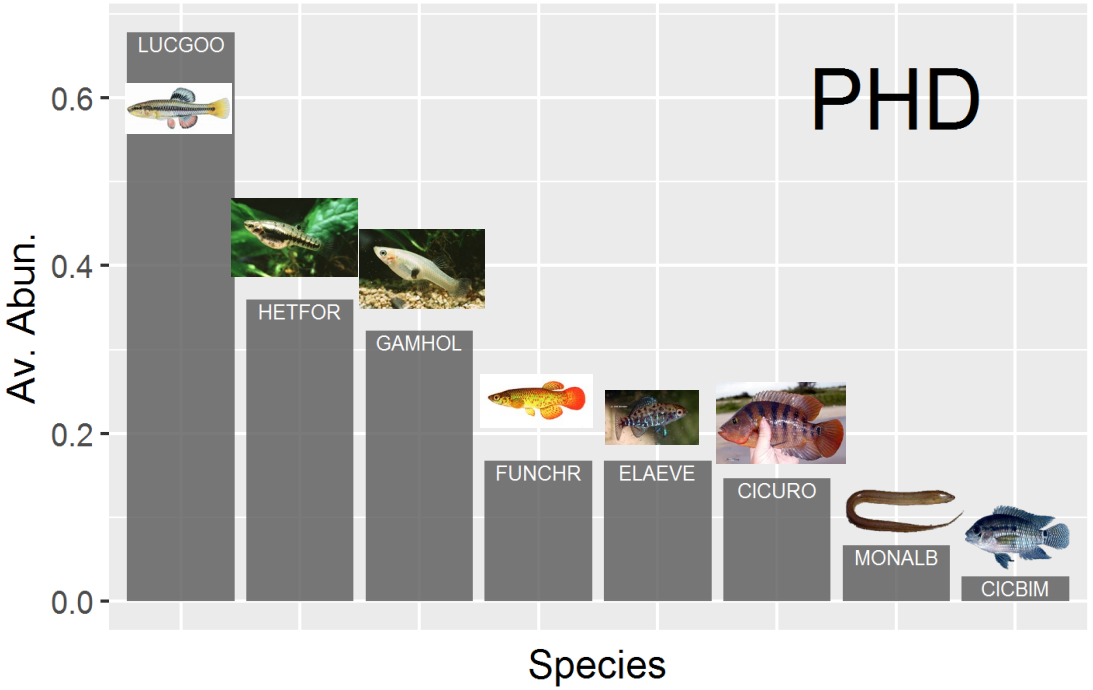


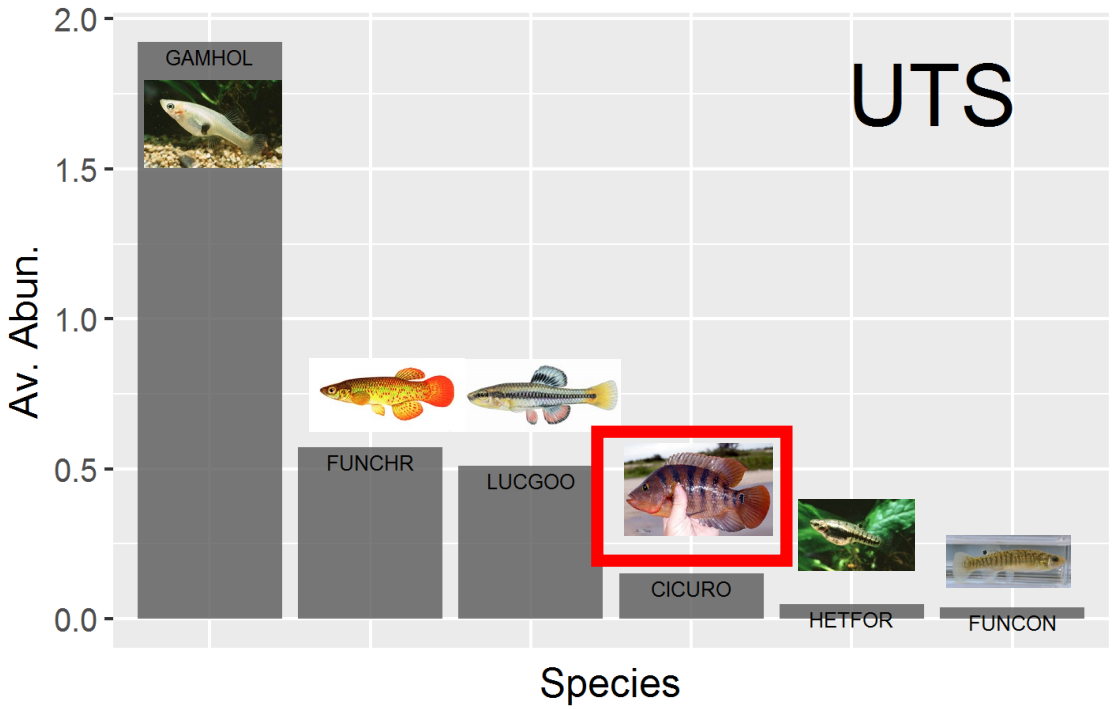







UTS
Av. Abun.
2.0
1.5
1.0
0.5
0.0
GAMHOL
FUNCHR
LUCGOO
CICURO
HETFOR
FUNCON
Species


PHD
Av. Abun.
0.6
0.4
0.2
0.0
LUCGOO
HETFOR
GAMHOL
FUNCHR
ELAEVE
CICURO
MONALB
CICBIM
Species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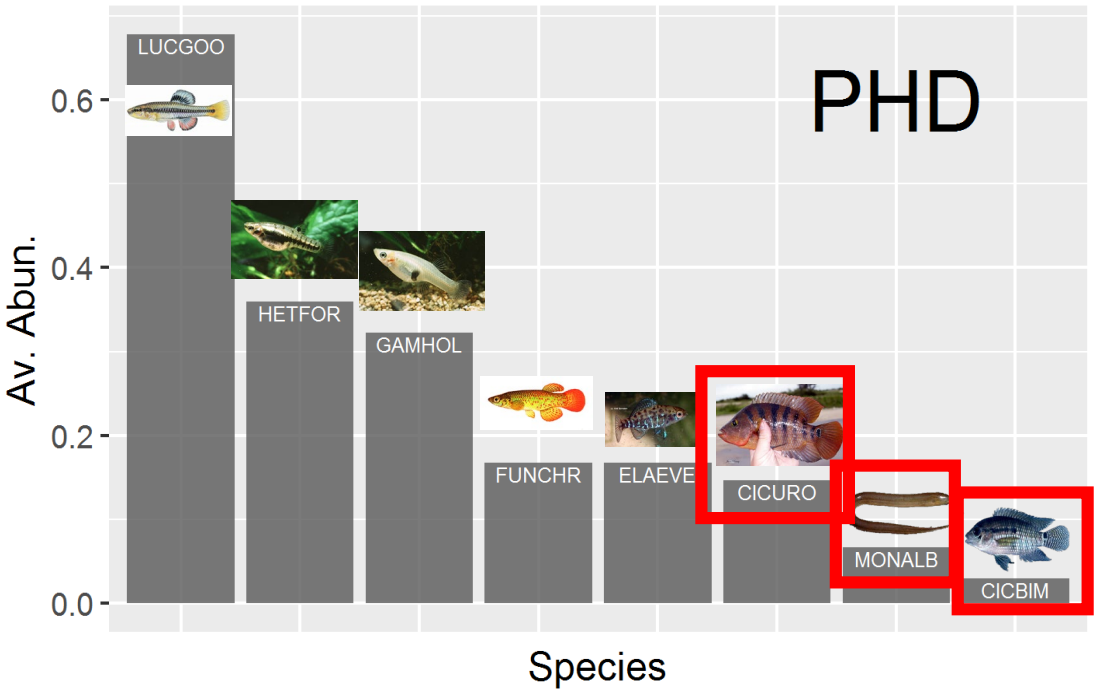
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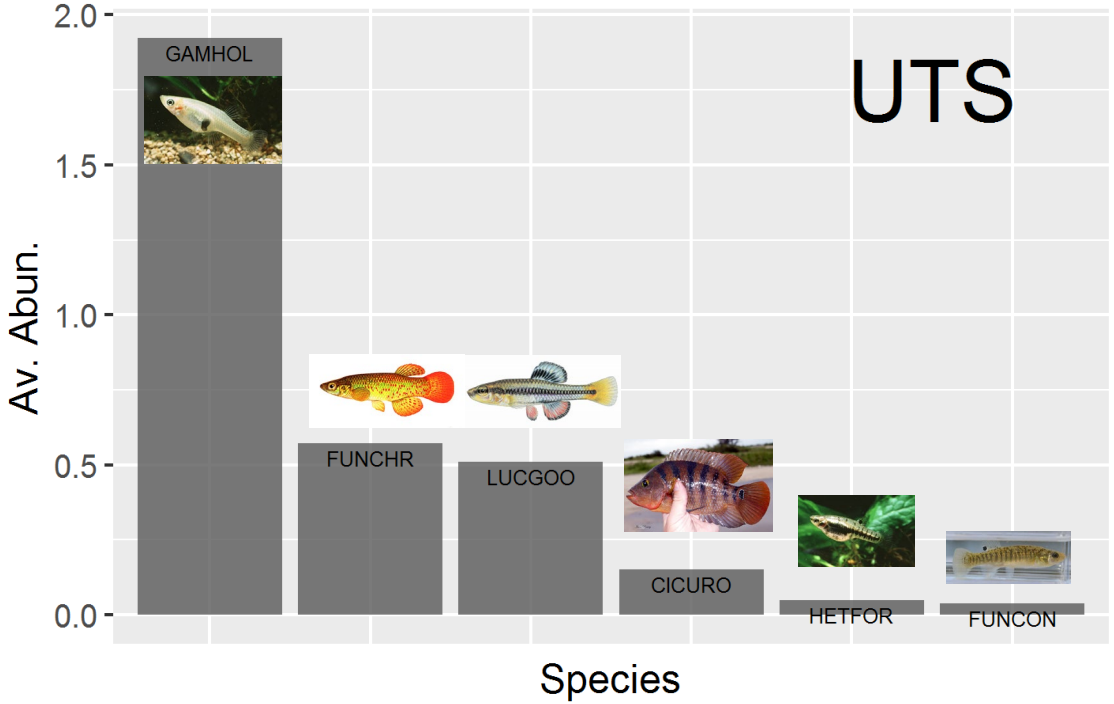
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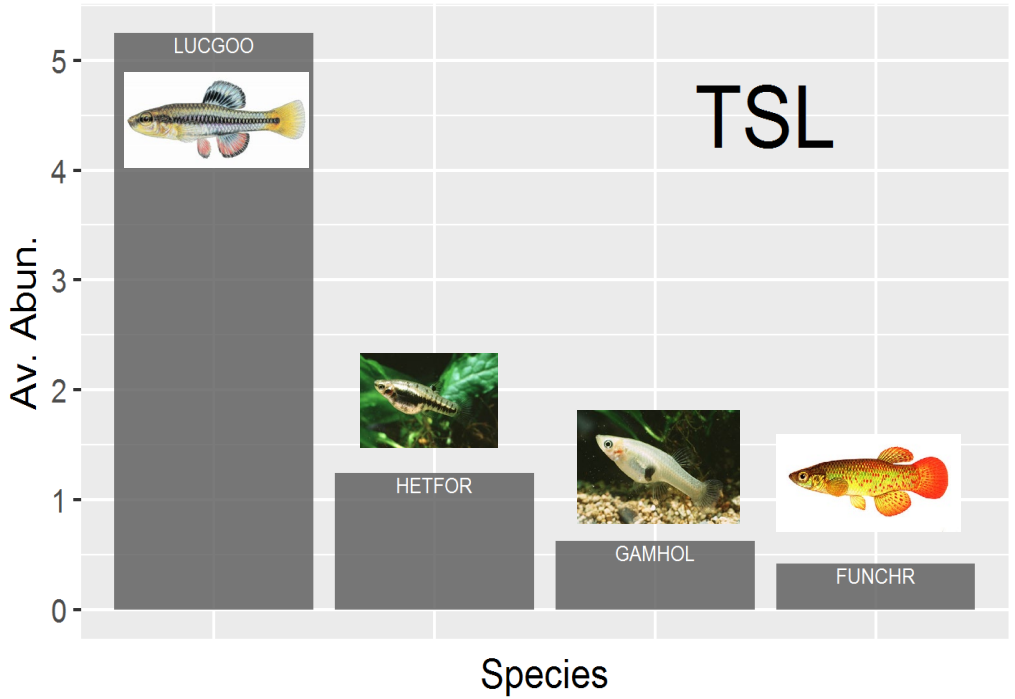
TSL
Av. Abun.
5
4
3
2
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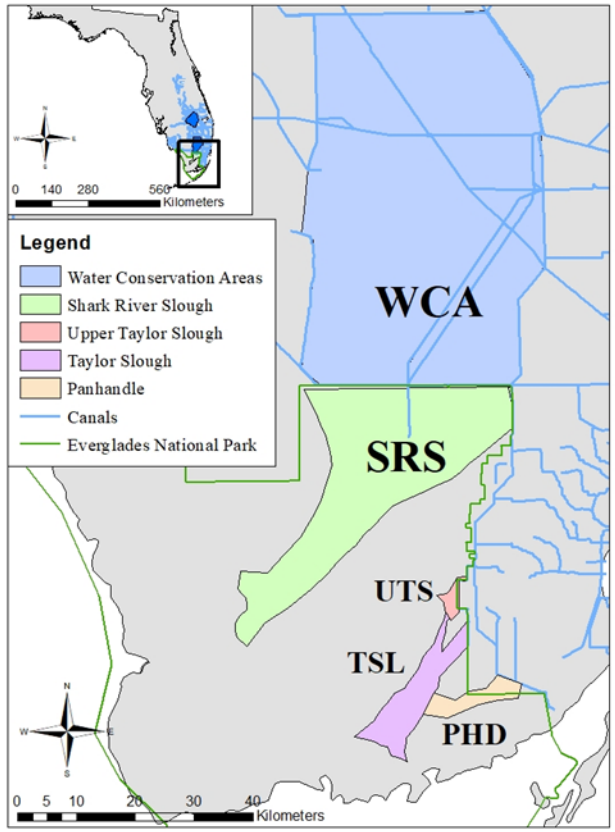
HETFOR
GAMHOL
FUNCHR
Species

Regions of Interest



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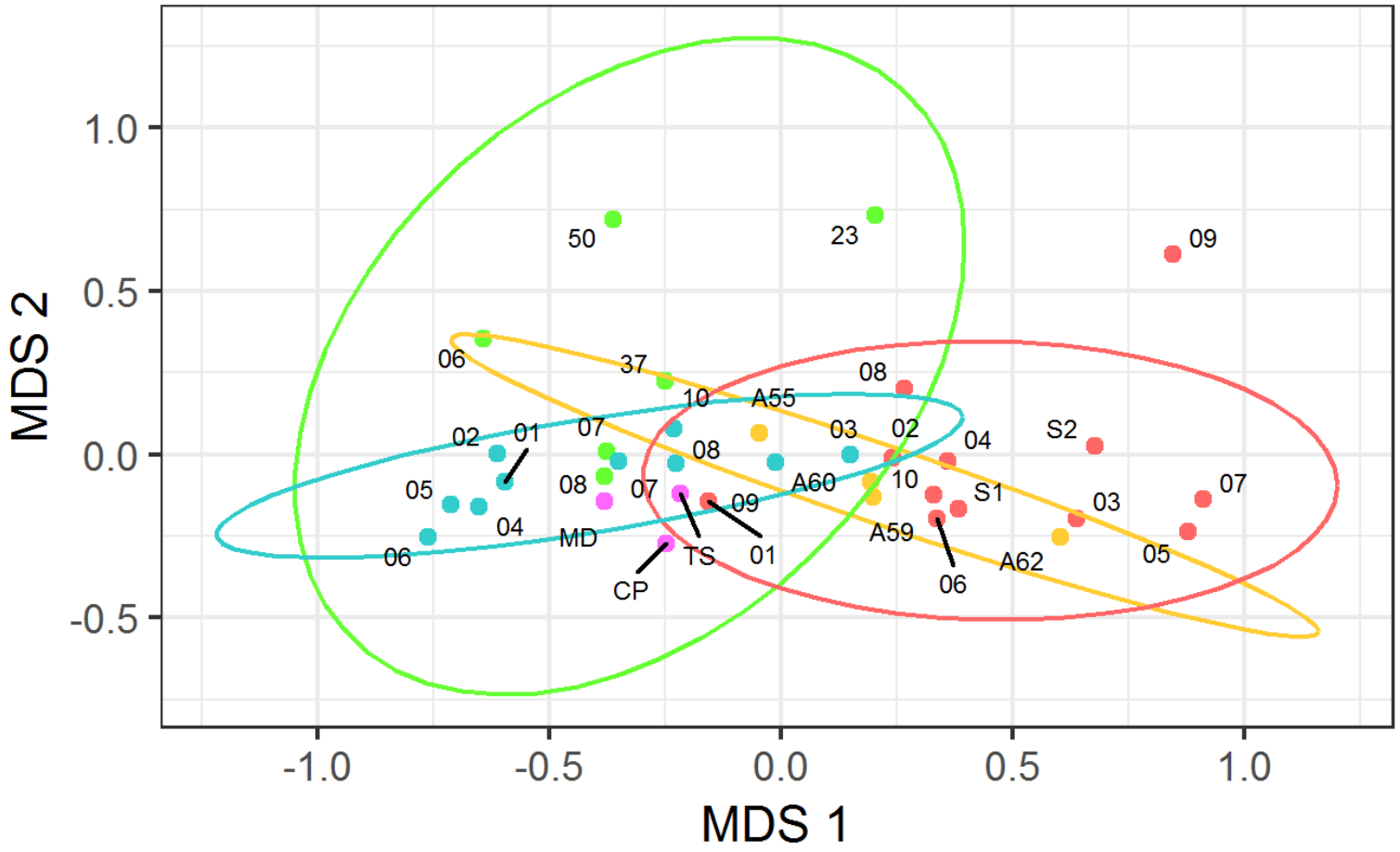

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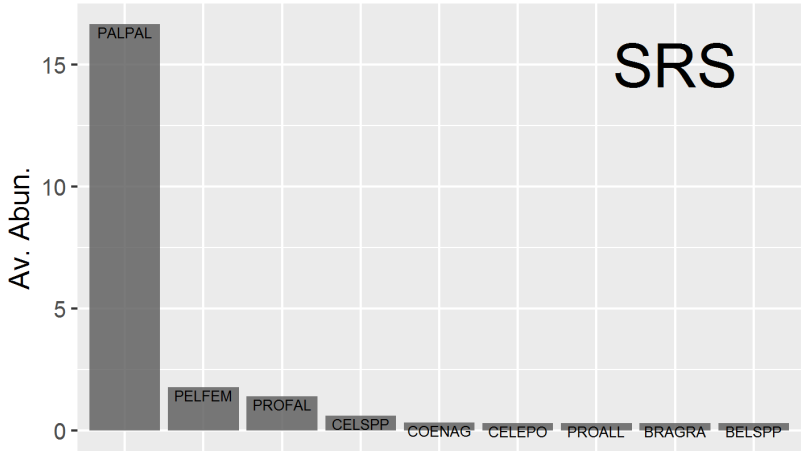
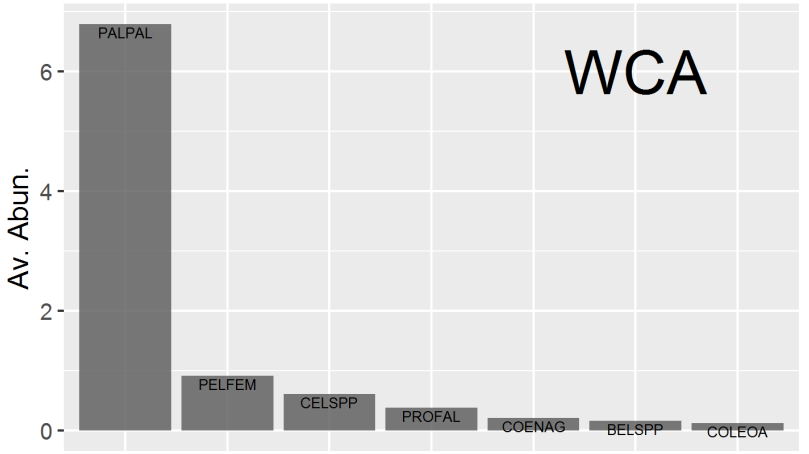
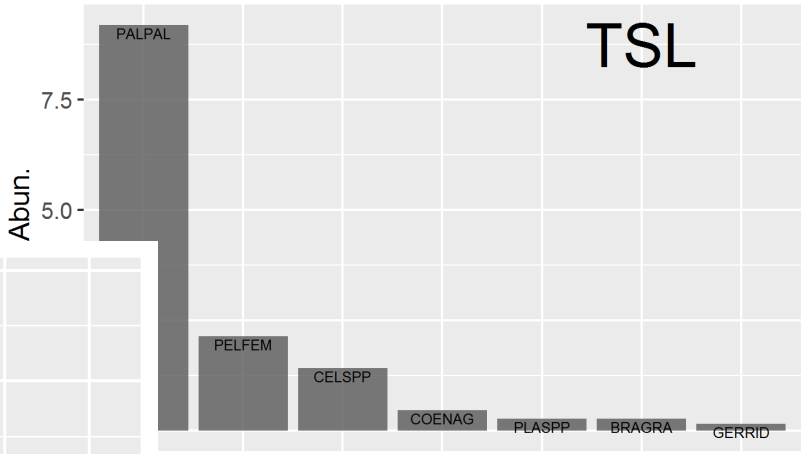
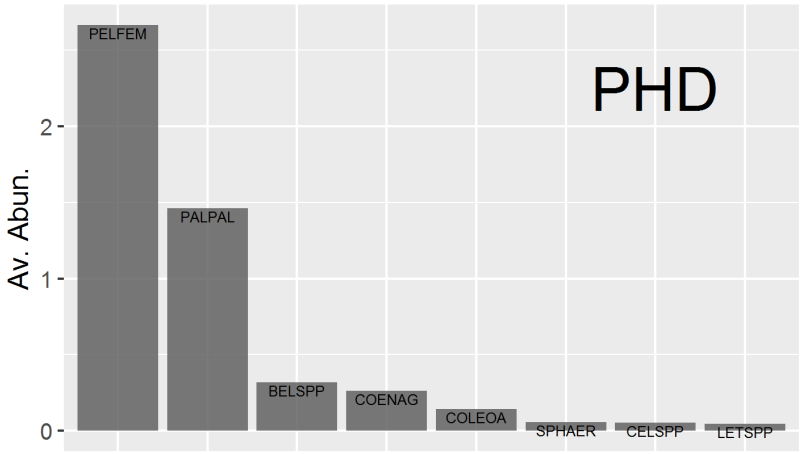
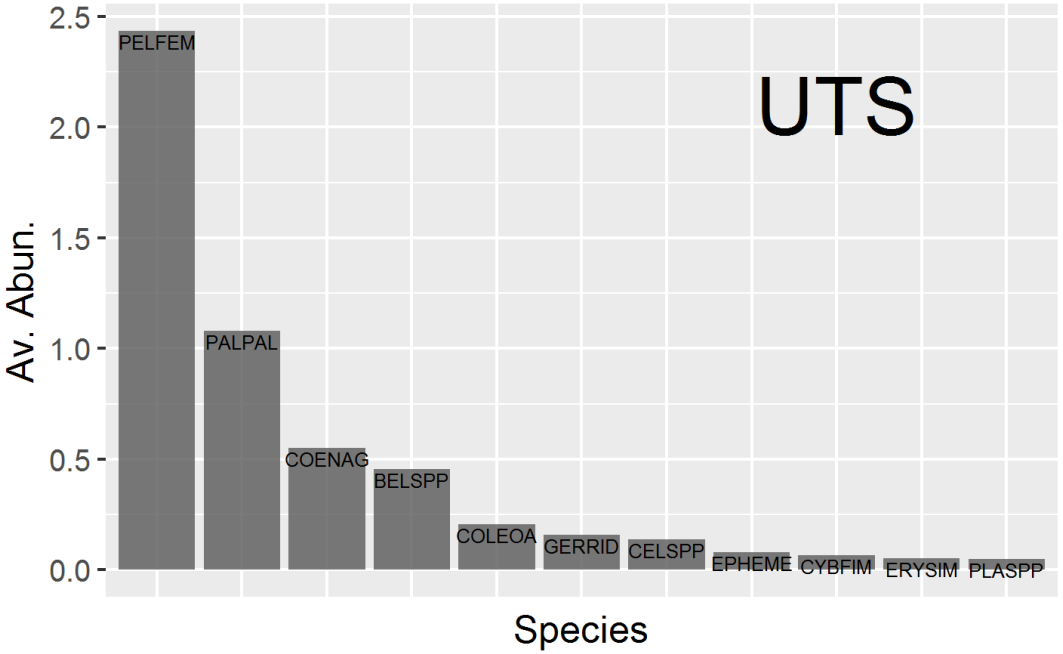
Invertebrate species comprising 95% of all specimens November, 2017, through December, 2018

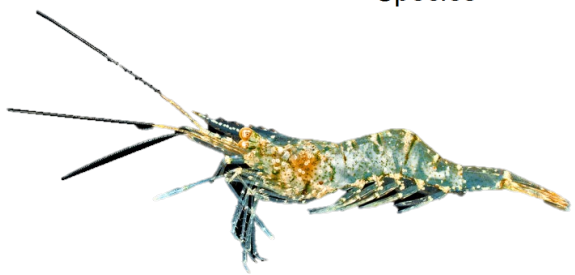


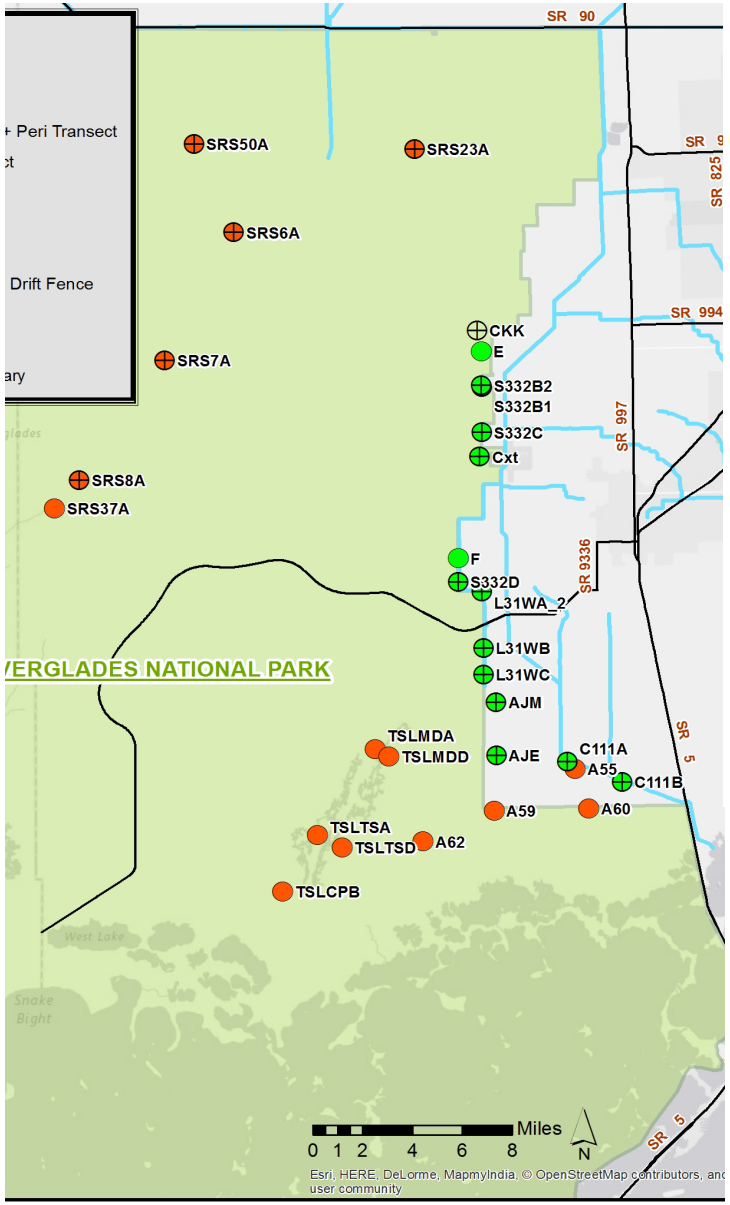




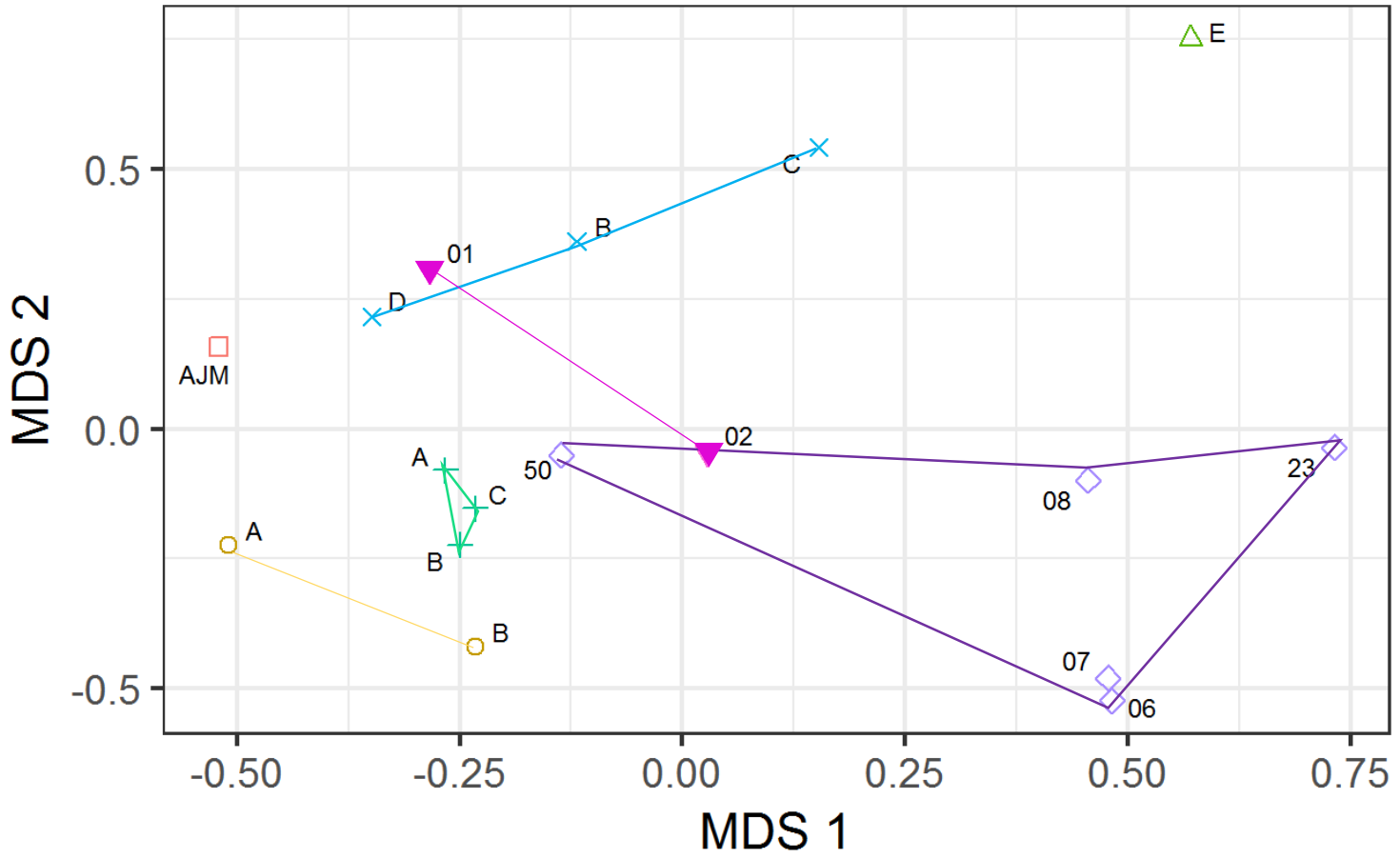




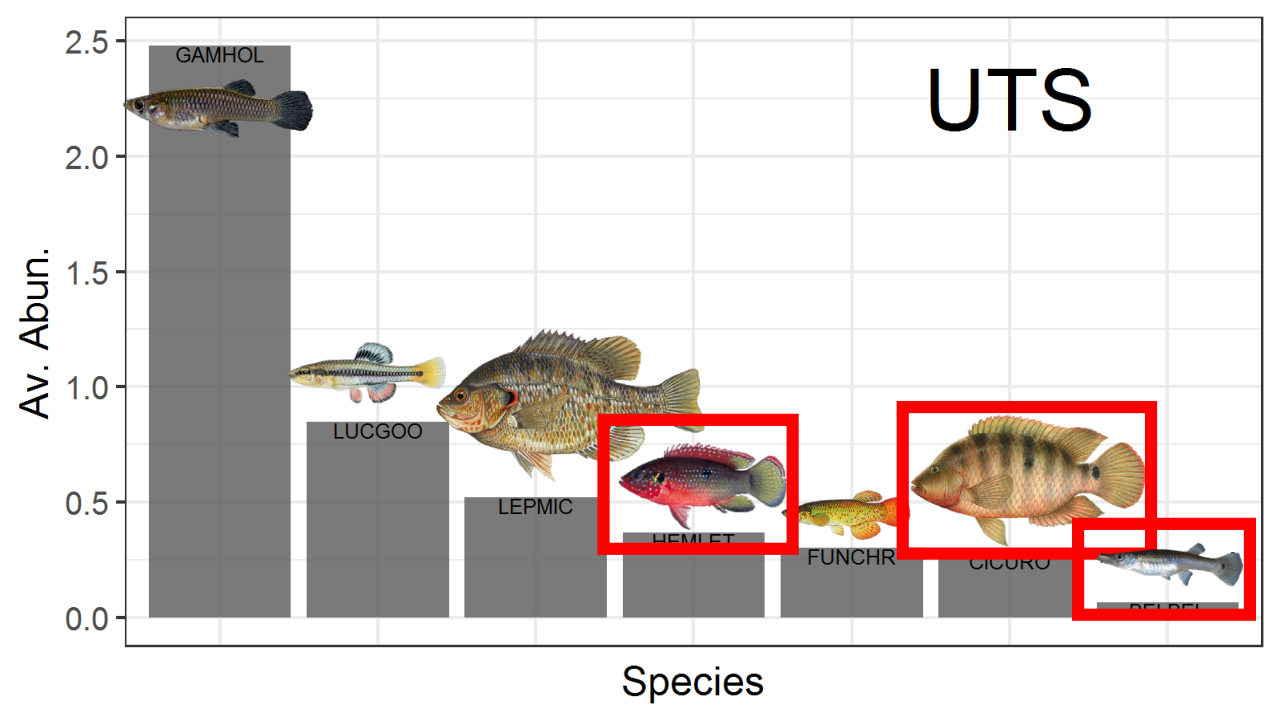


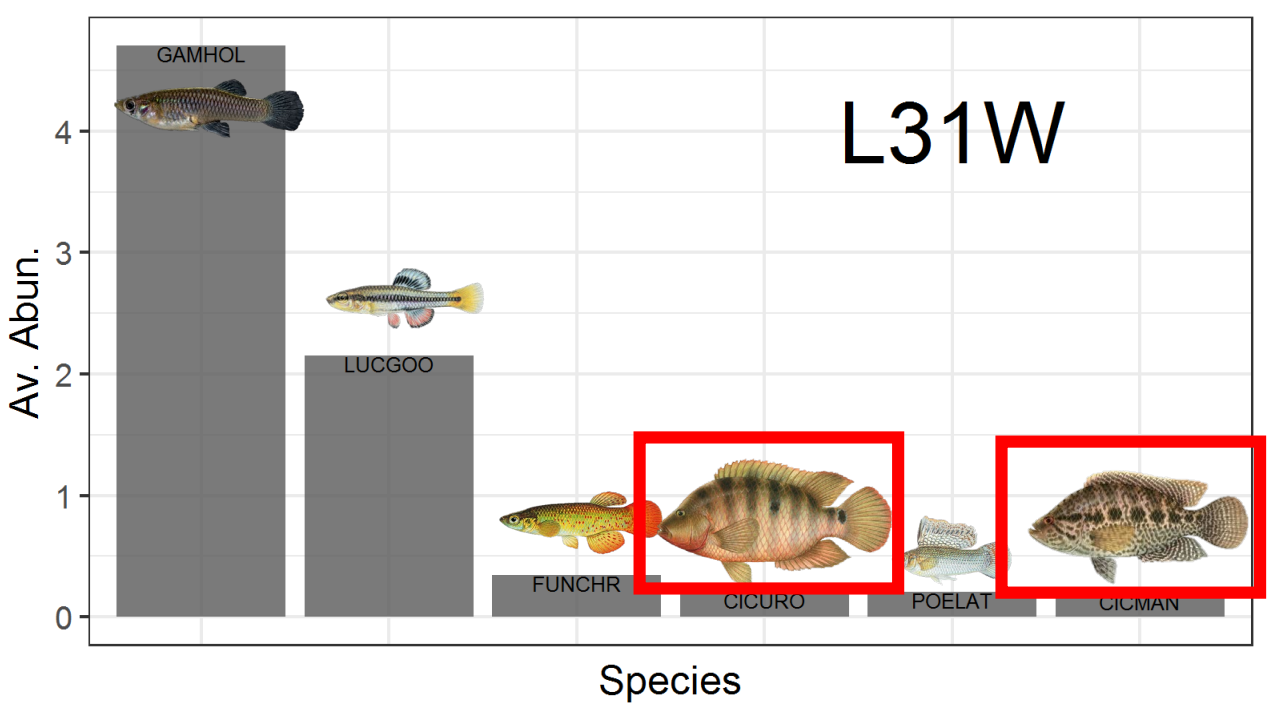


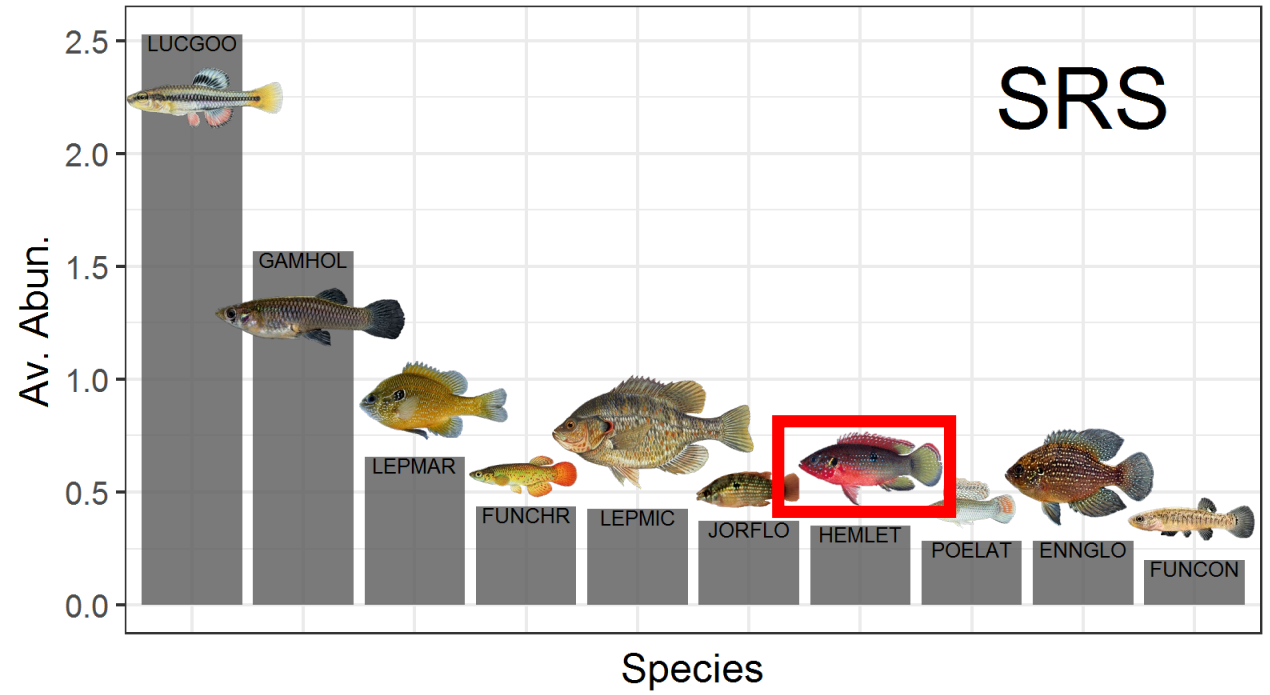
IOP Fish Community NMDS

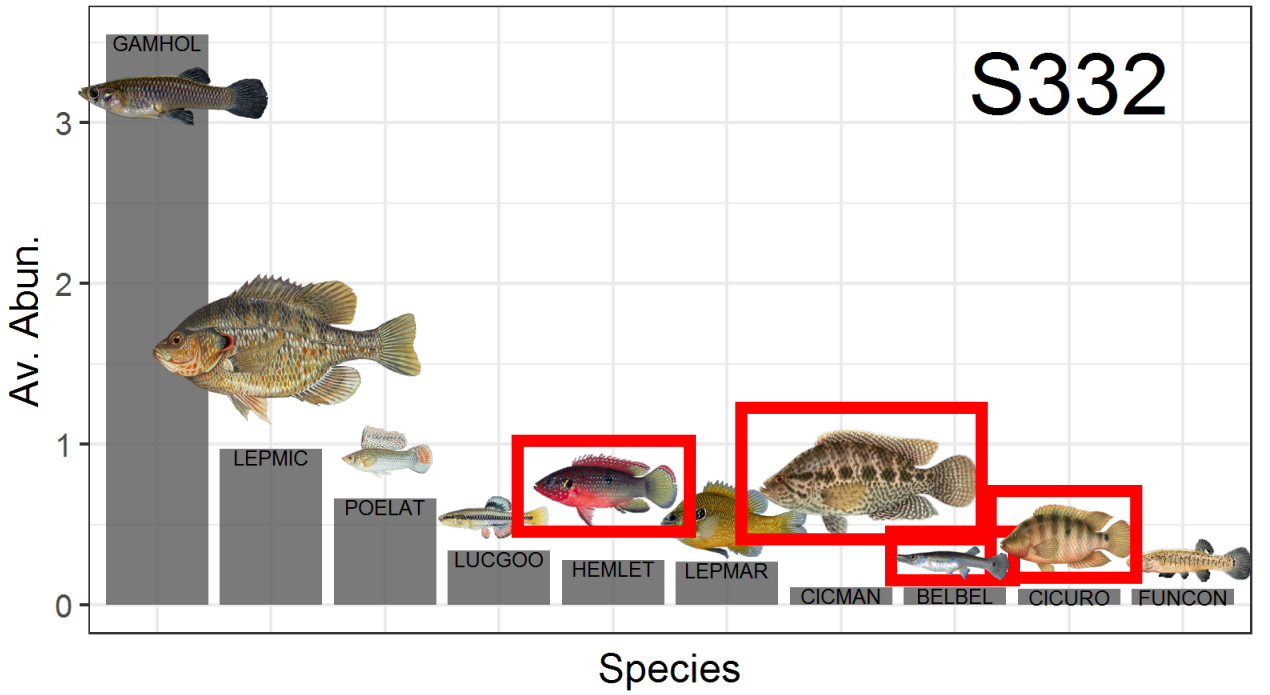


region
- AERO
- C111
- CXT
- L31W
- S332
- SRS
- UTS


UTS
Av. Abun.
Species
GAMHOL
LUCGOO
LEPMIC
HEMLET
FUNCHR
CICURO
BELBEL


L31W
Av. Abun.
Species
GAMHOL
LUCGOO
FUNCHR
CICURO
POELAT
CICMAN

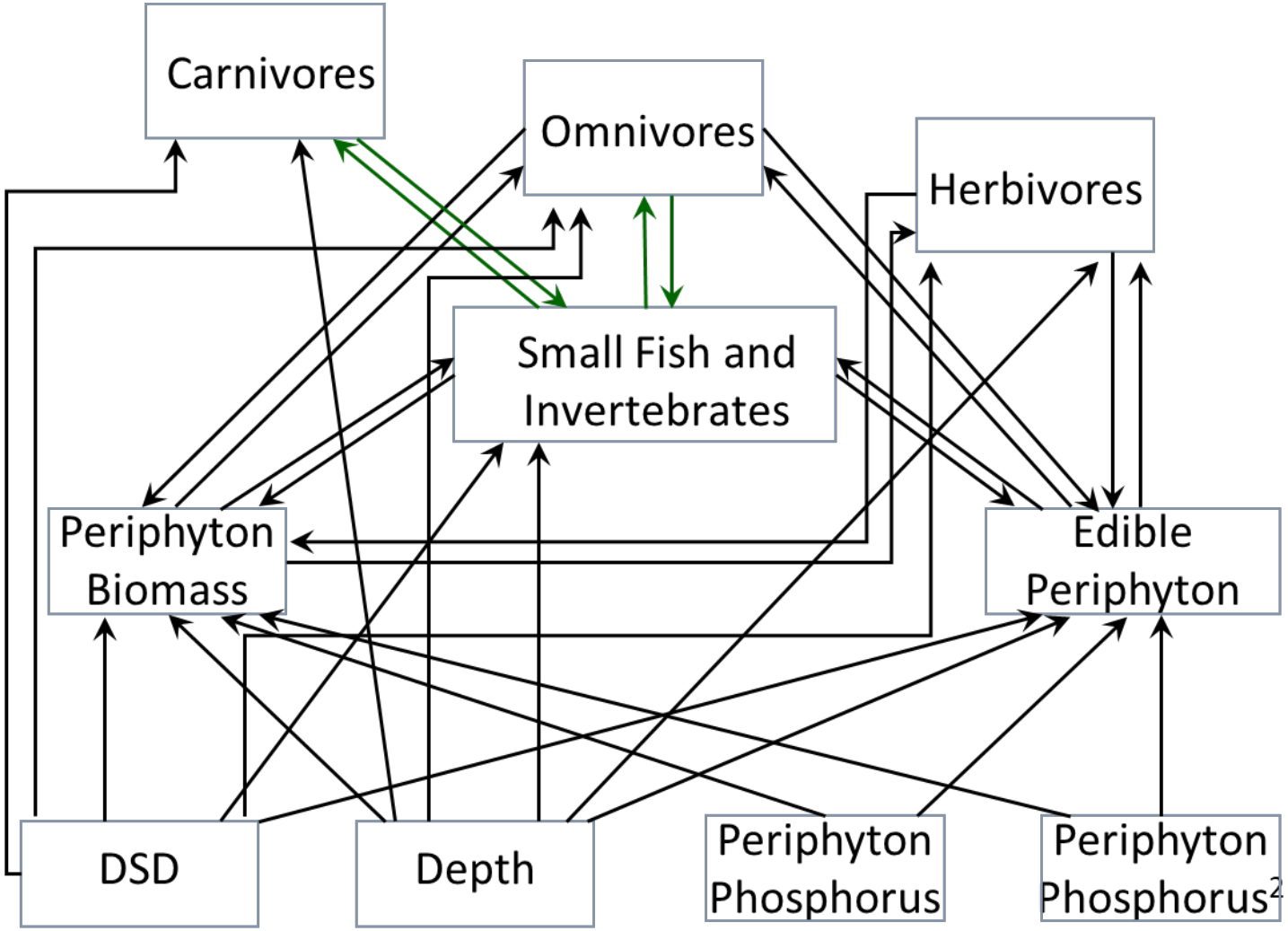

SRS
Av. Abun.
Species
LUCGOO
GAMHOL
LEPMAR
FUNCHR
LEPMIC
JORFLO
HEMLET
POELAT
ENNGLO
FUNCON


S332
Av. Abun.
Species
GAMHOL
LEPMIC
POELAT
LUCGOO
HEMLET
LEPMAR
CICMAN
BELBEL
CICURO
FUNCON

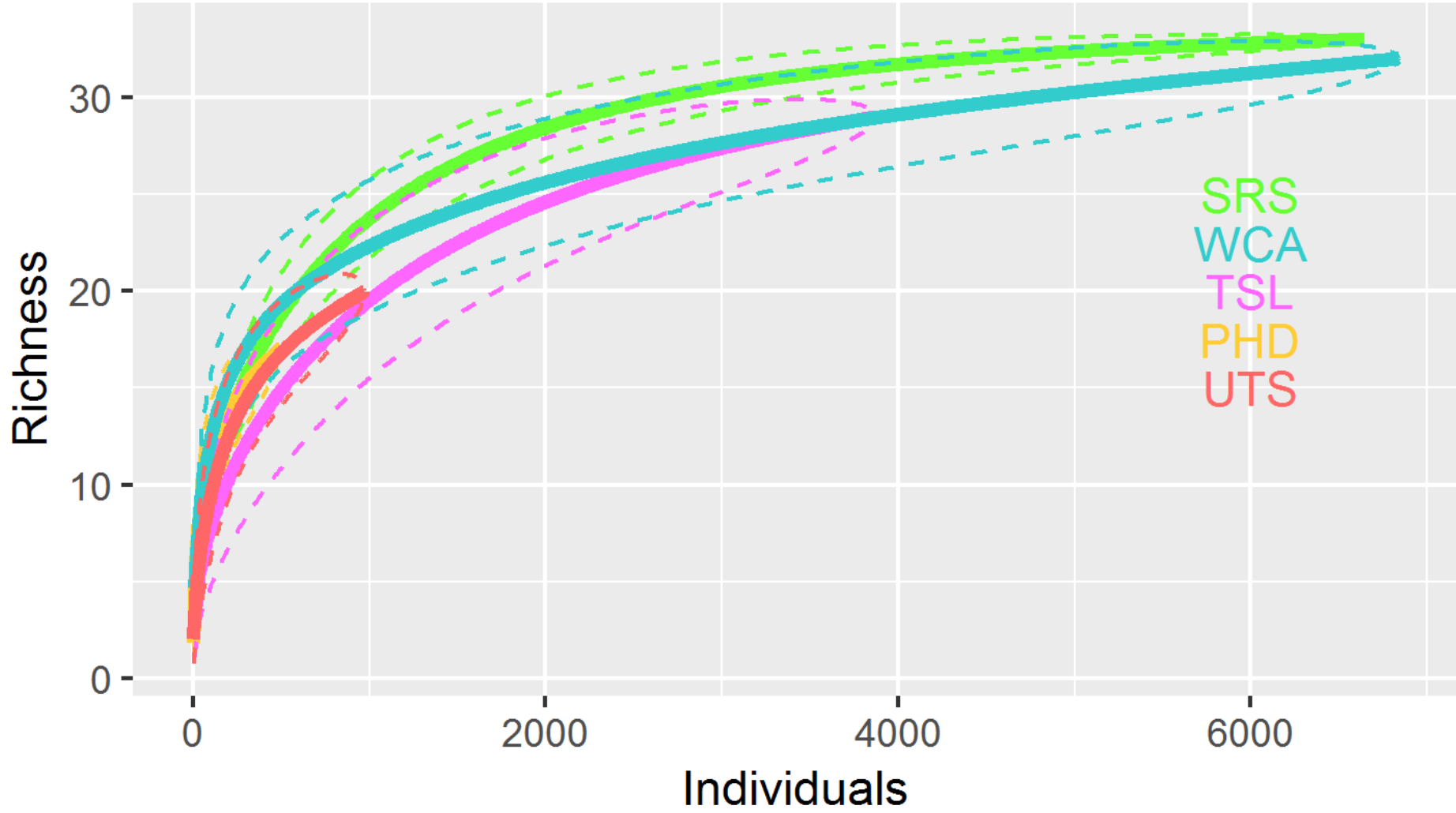
Conclusions

- Densities of fishes and invertebrates are likely driven by hydroperiod and proximity to the canal
- UTS has relatively low densities of fishes and invertebrates compared to other regions of the Greater Everglades
- Trade-off between restoring flow and immigration of non-native fishes (Go see Erin McCarthy's poster!)
- Expect community to trend towards Taylor Slough

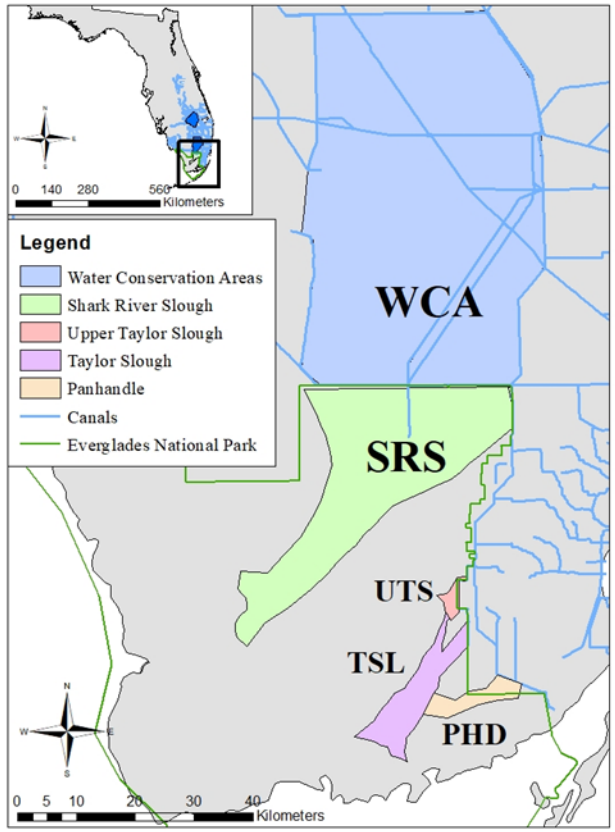
Future Directions



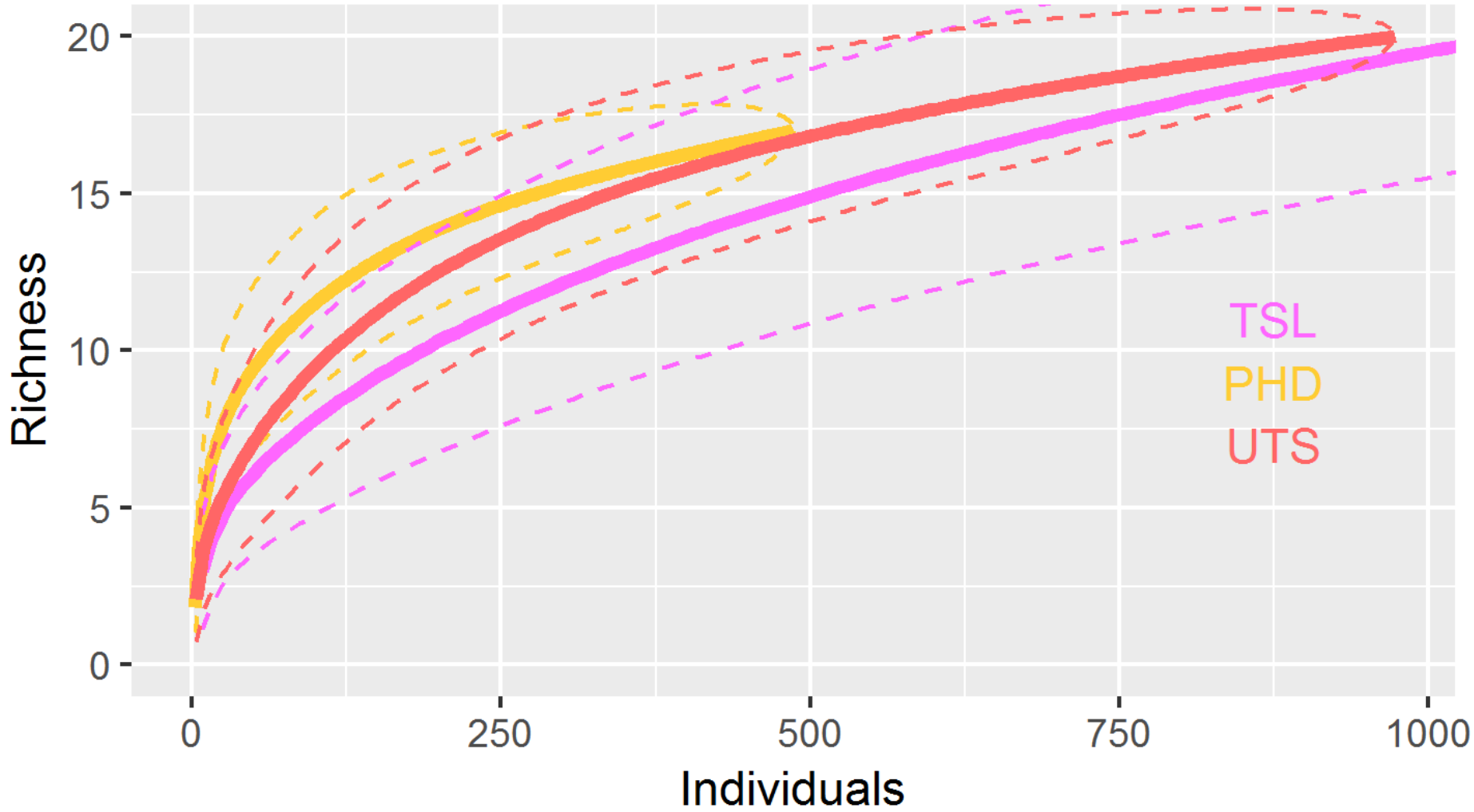
Fish Species Accumulation Curves by Region



Regions of Interest



Fish Species Accumulation Curves by Region



Regions of Interest