# Landscape-scale Aquatic Fauna Monitoring For CERP 2005-2017

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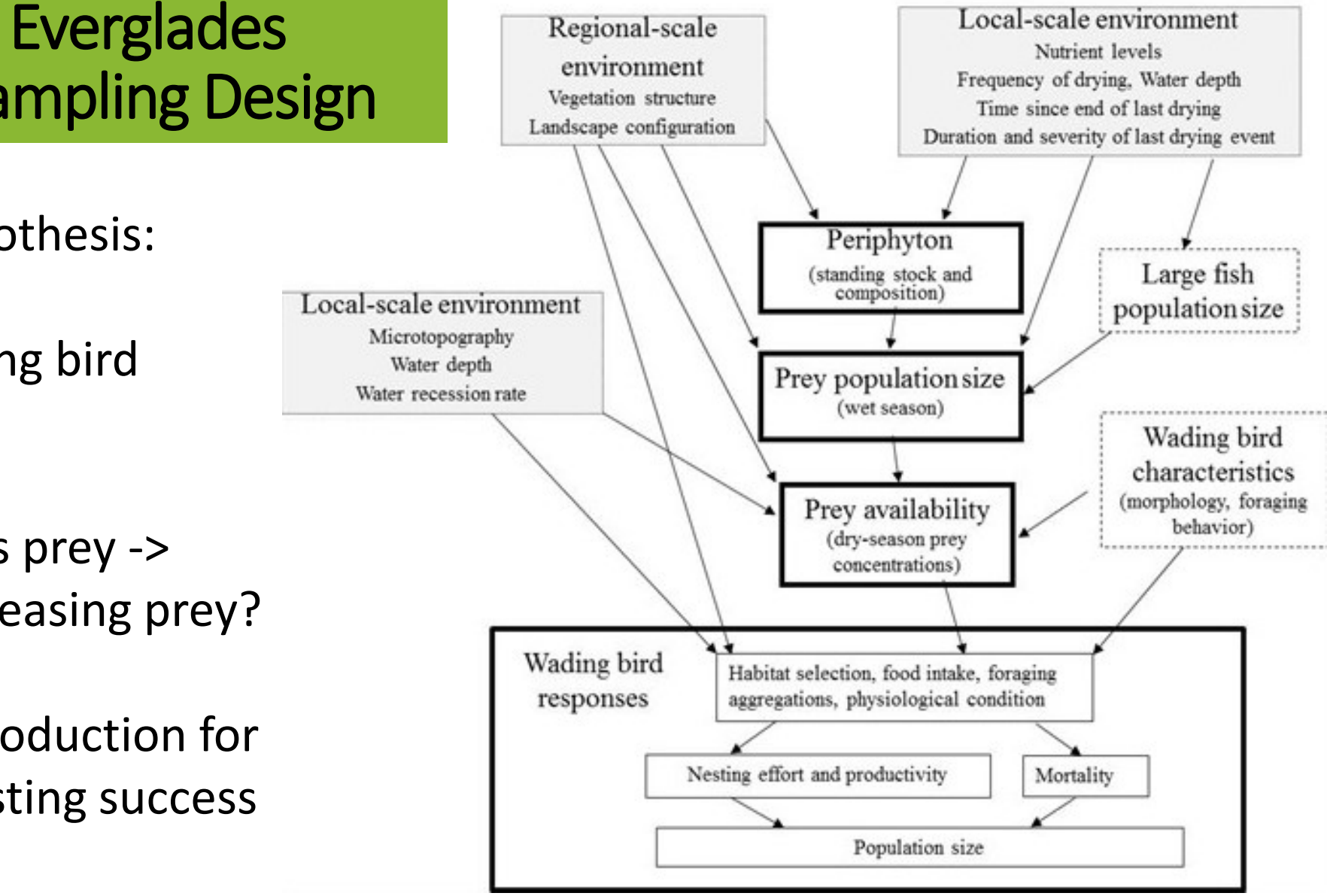
RECOVER assessment science integration evaluation

# Comprehensive Everglades Restoration Plan: Sampling Design

- CERP MAP Trophic Hypothesis: Studying links between management and wading bird productivity
- Altered hydrology limits prey -> restored hydrology increasing prey?
- Goal: increased food production for greater wading bird nesting success



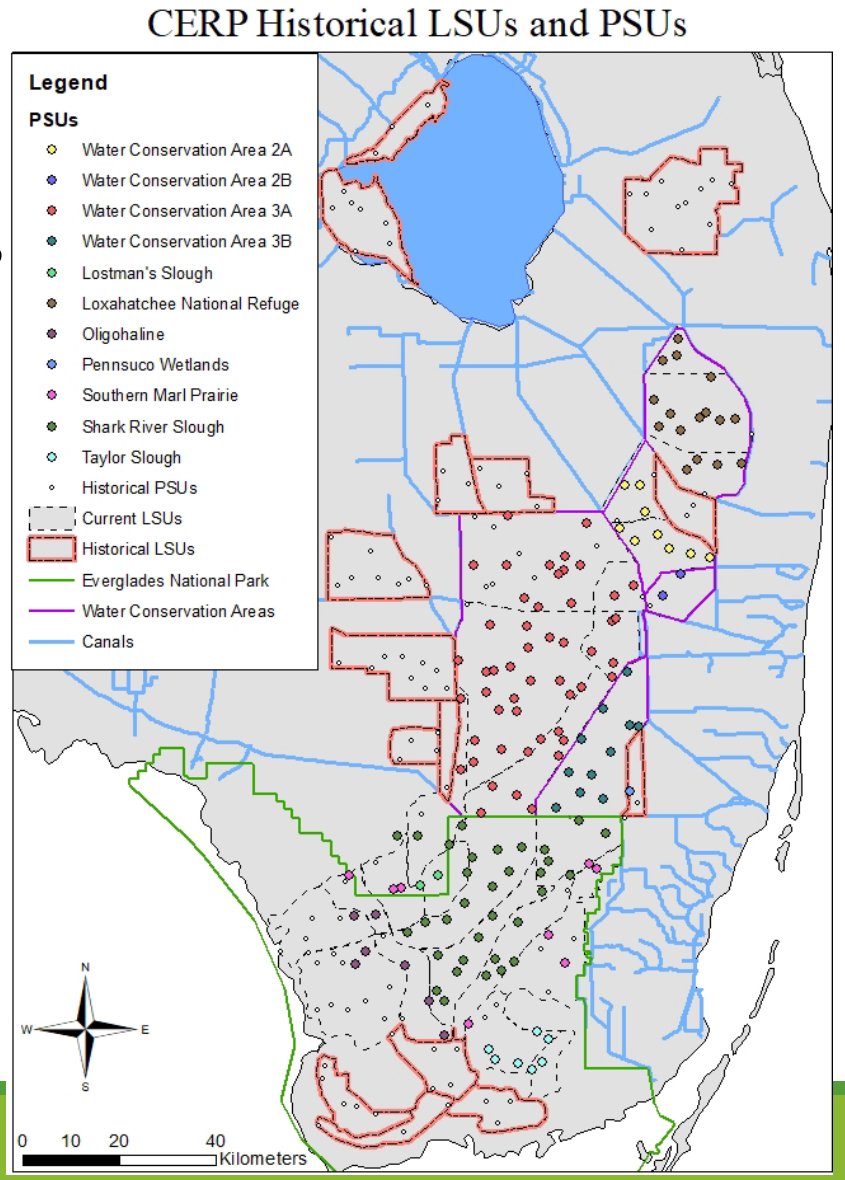
# Comprehensive Everglades Restoration Plan: System-wide Study

- Landscape-scale results in relation to hydroperiod
- Local-scale projects may effect the relationships presented
- General and robust patterns

# Comprehensive Everglades Restoration Plan: Sample Collection

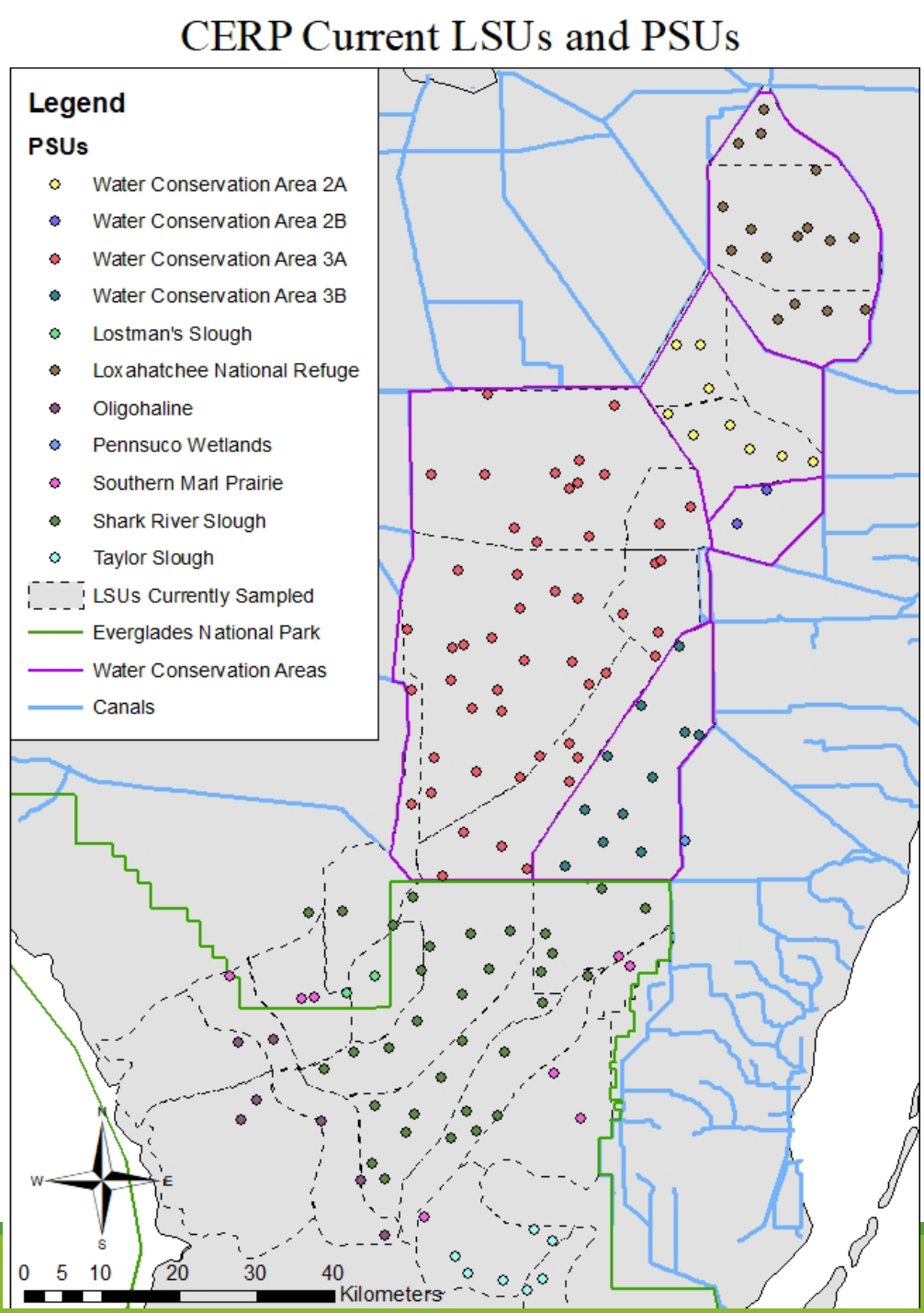
Historical

- 52 LSUs
- 256 PSUs
- Three sampling events a year

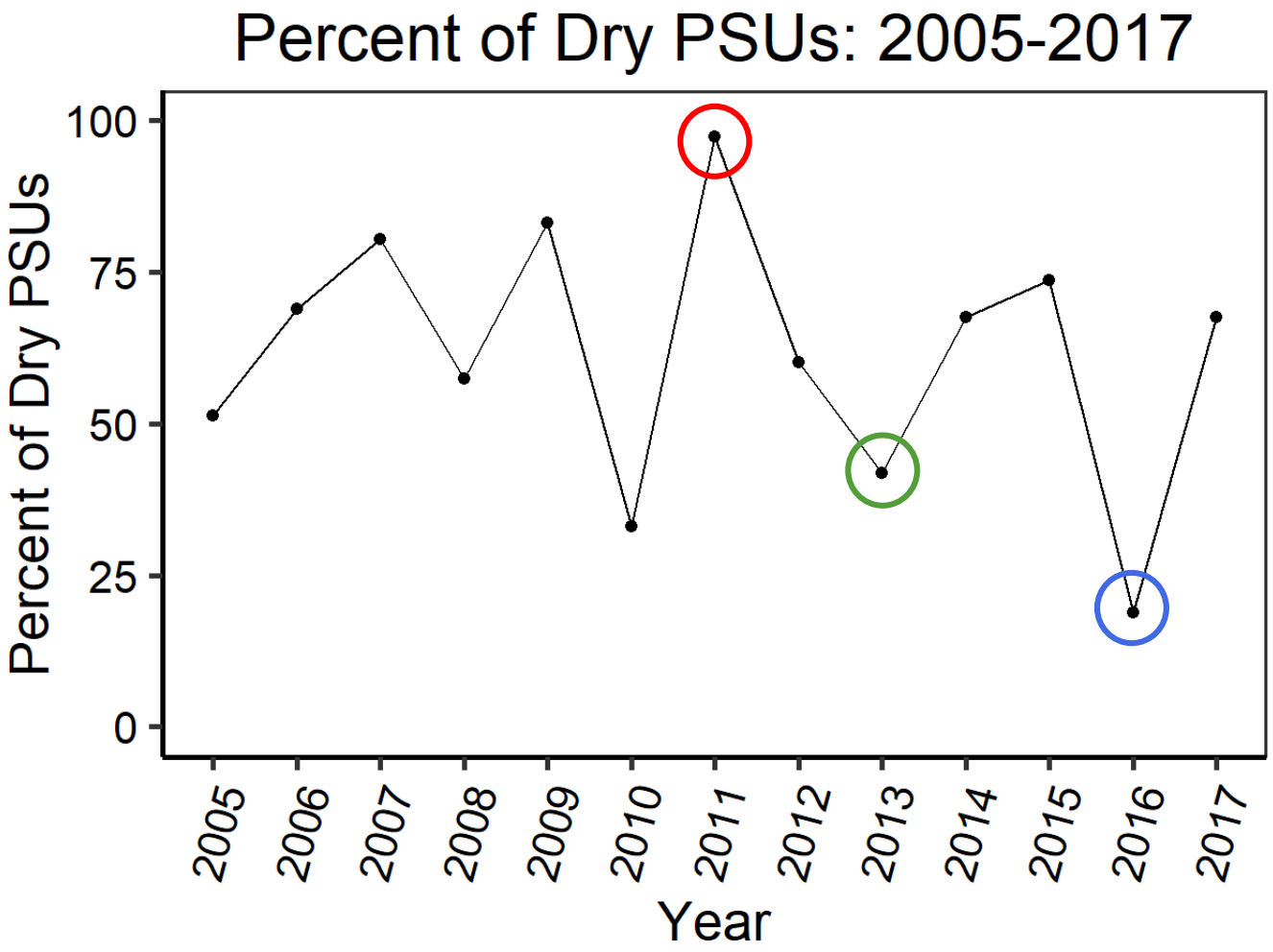


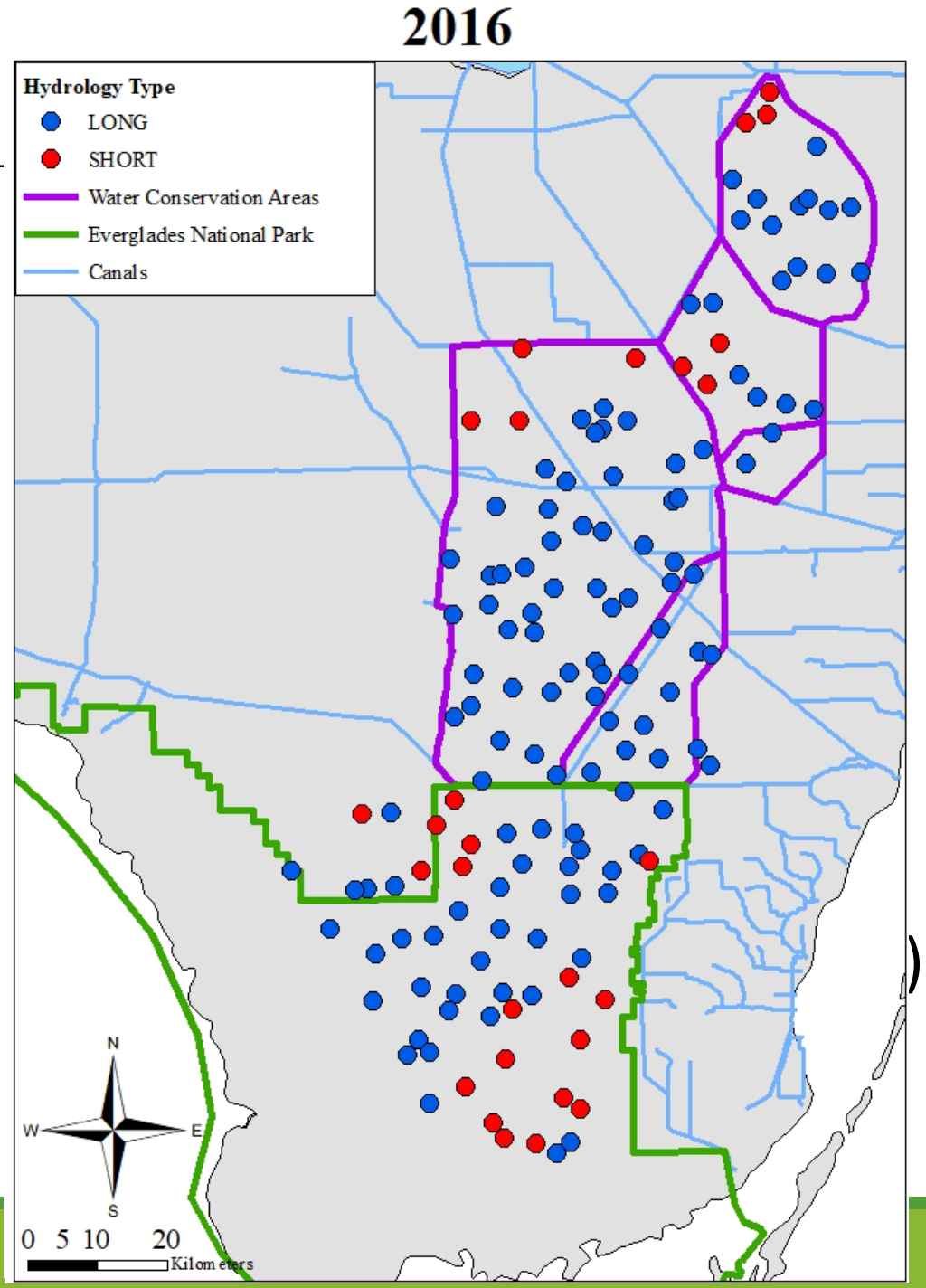

Current

- 32 LSUs
- 146 PSUs
- One sampling event a year

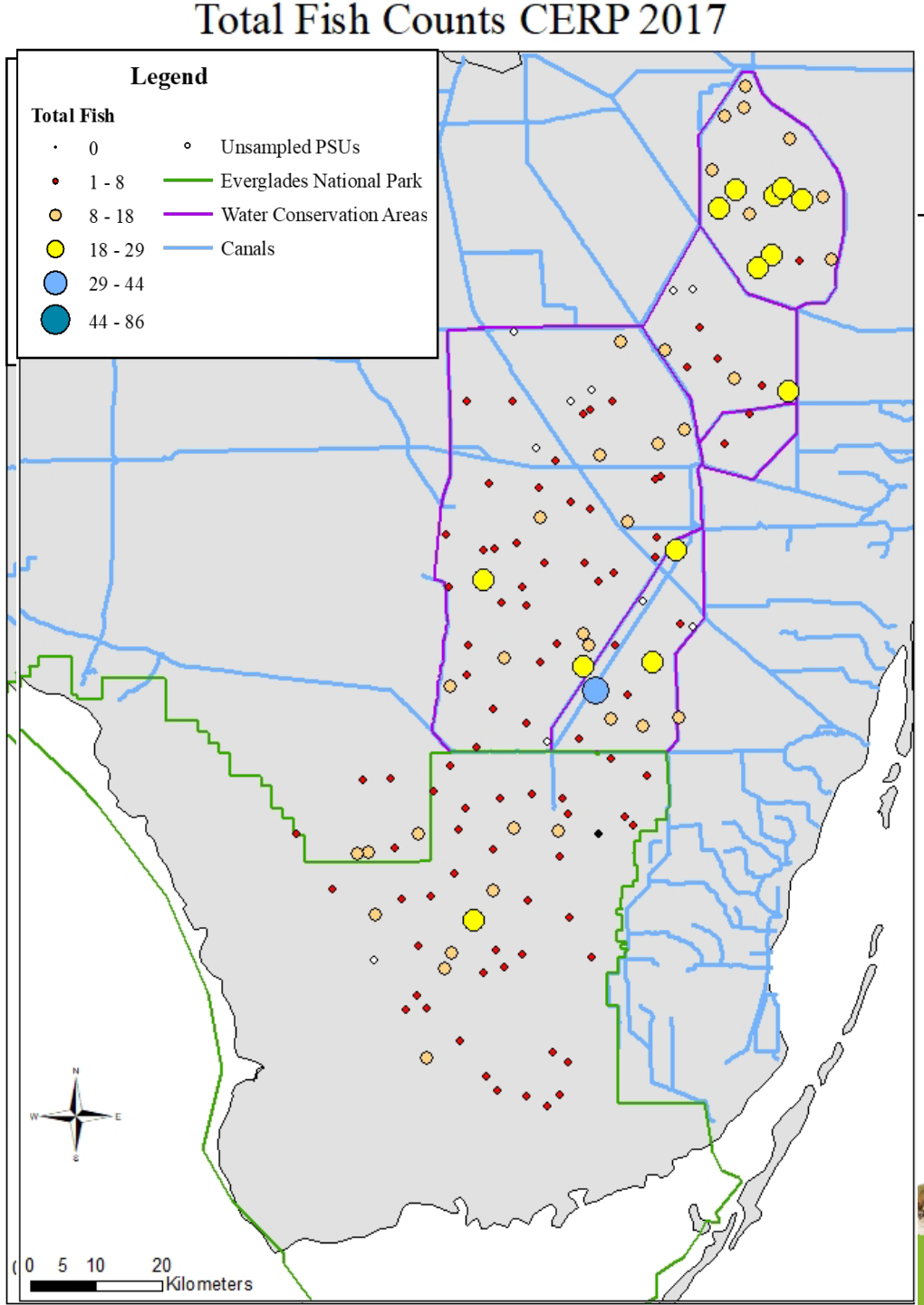


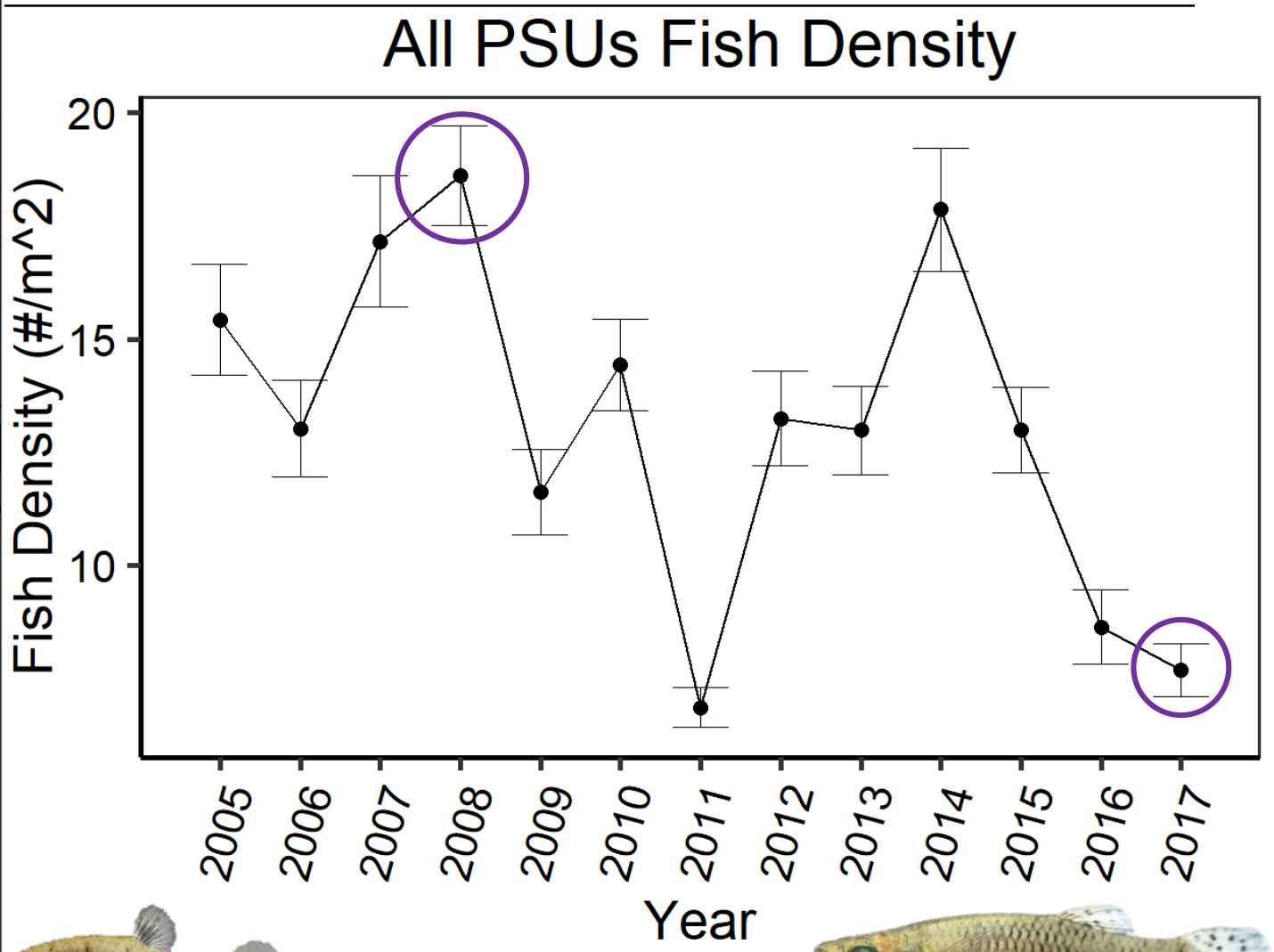
# CERP Hydrology



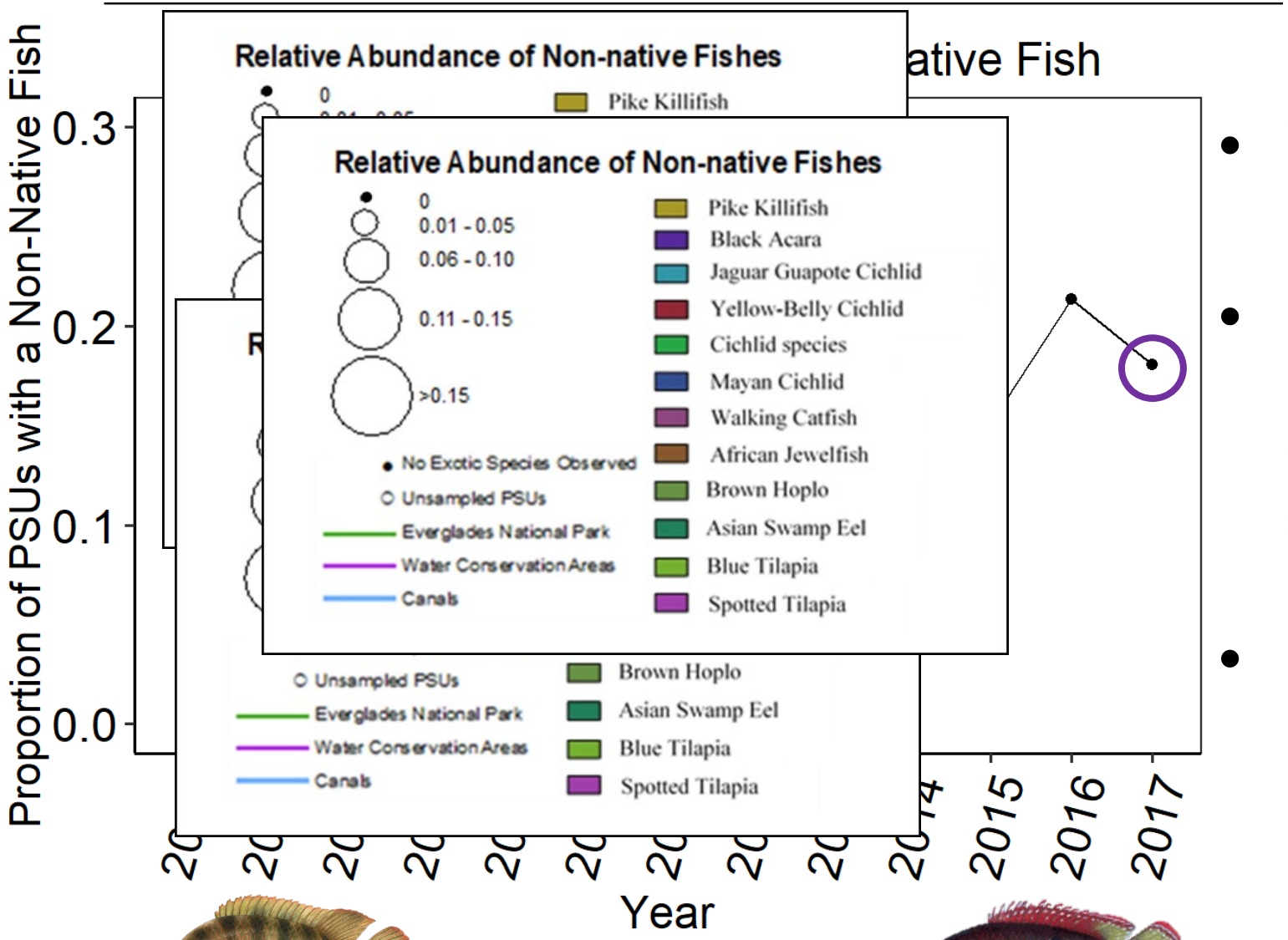



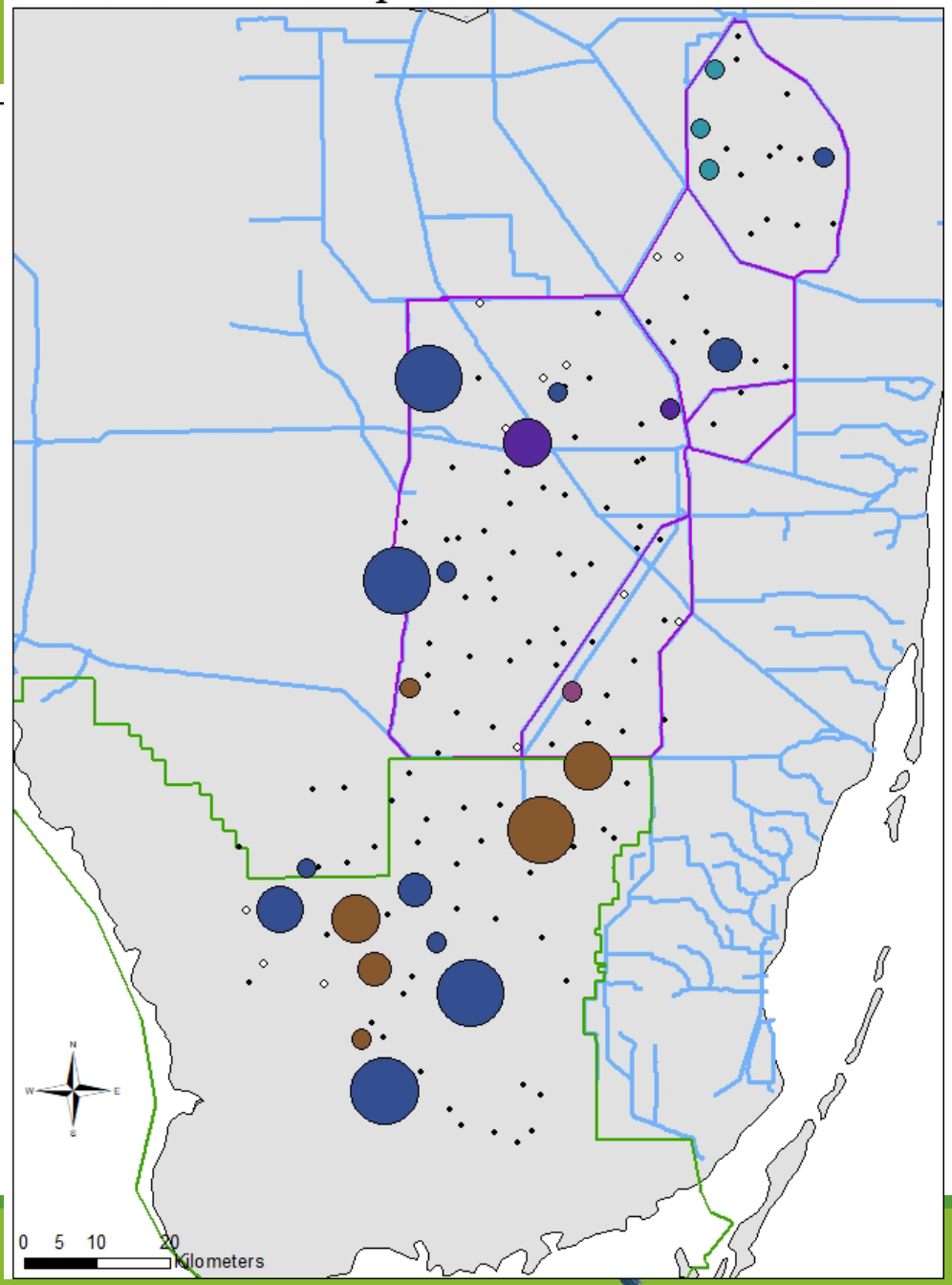
# CERP Fish Density




# CERP Non-Native Fish Density



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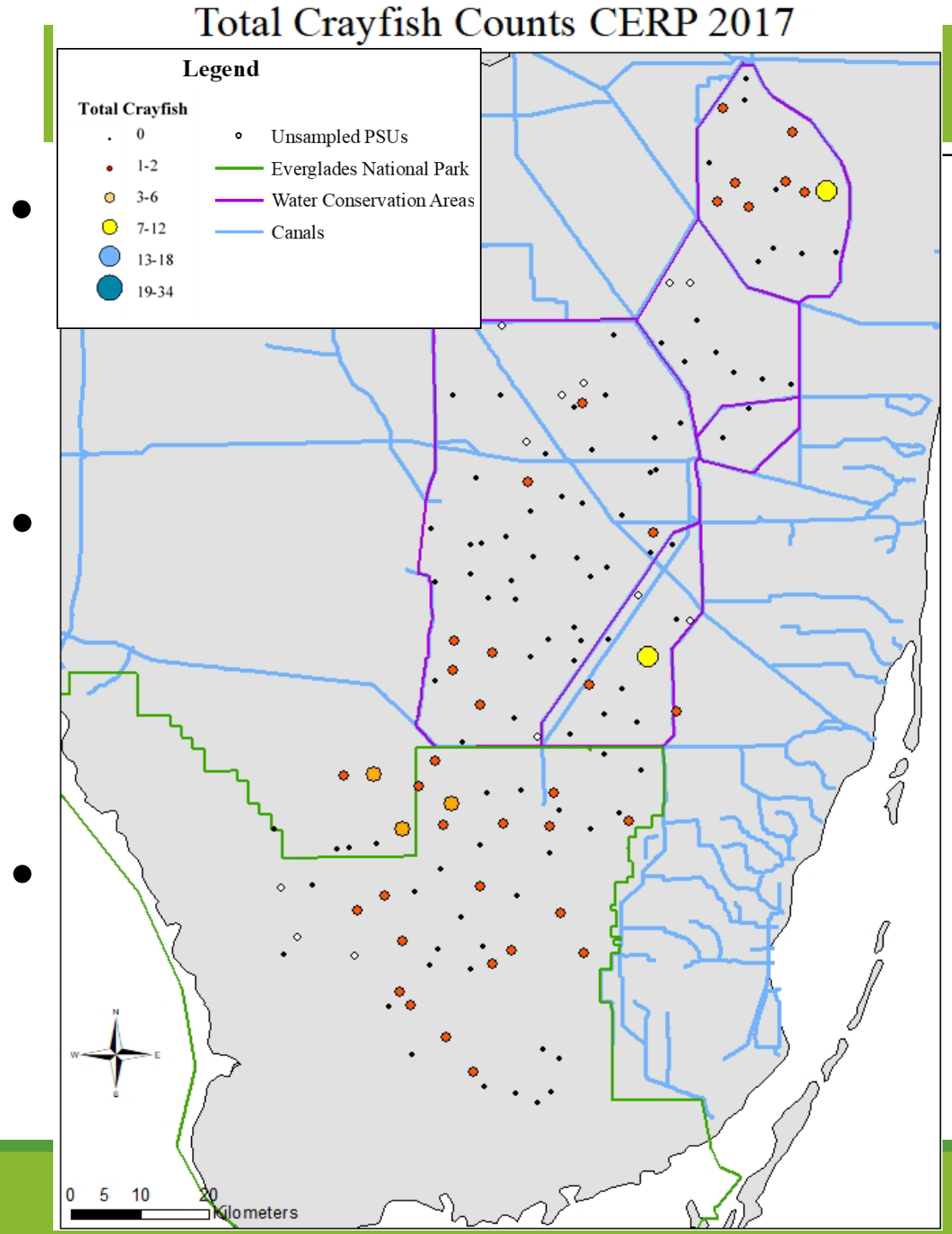


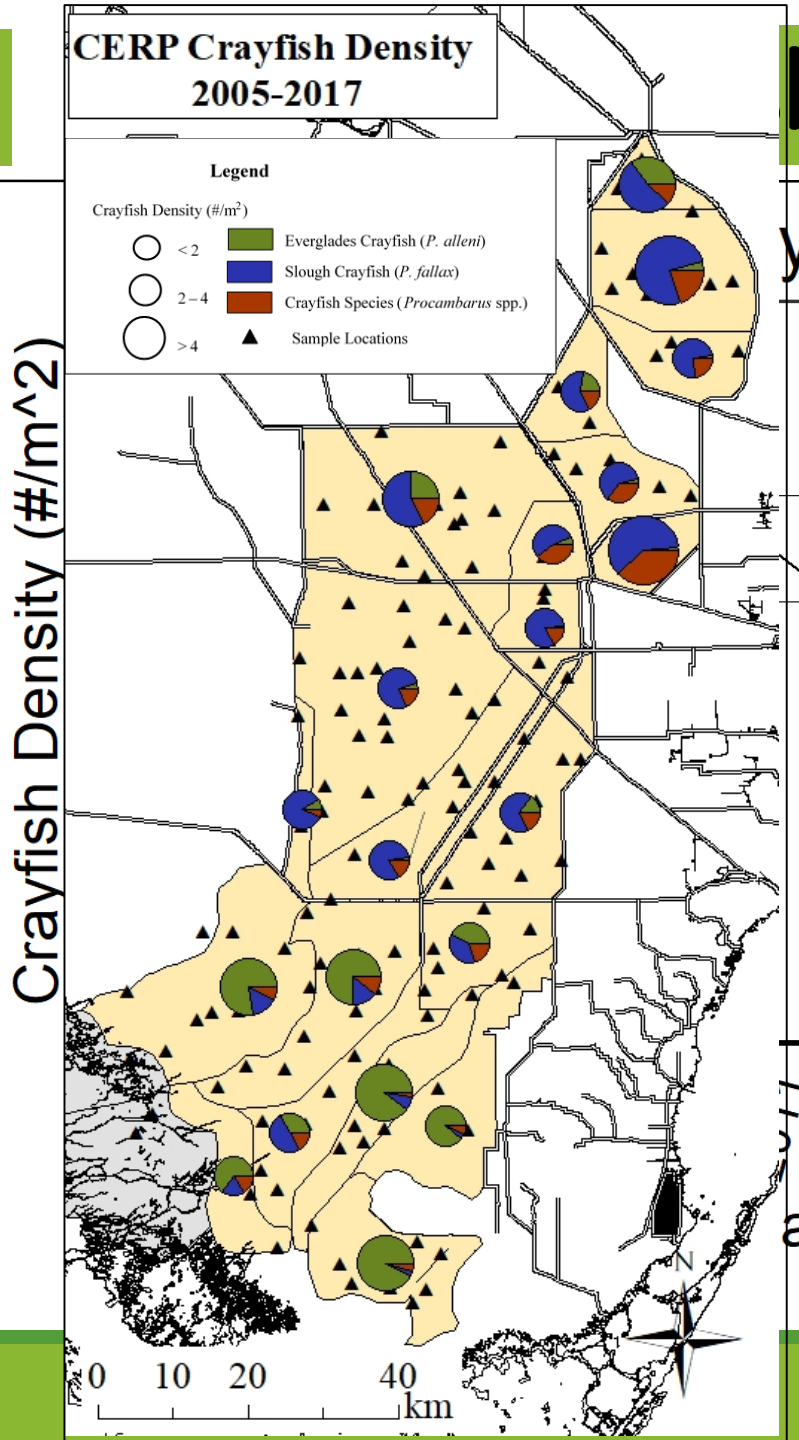


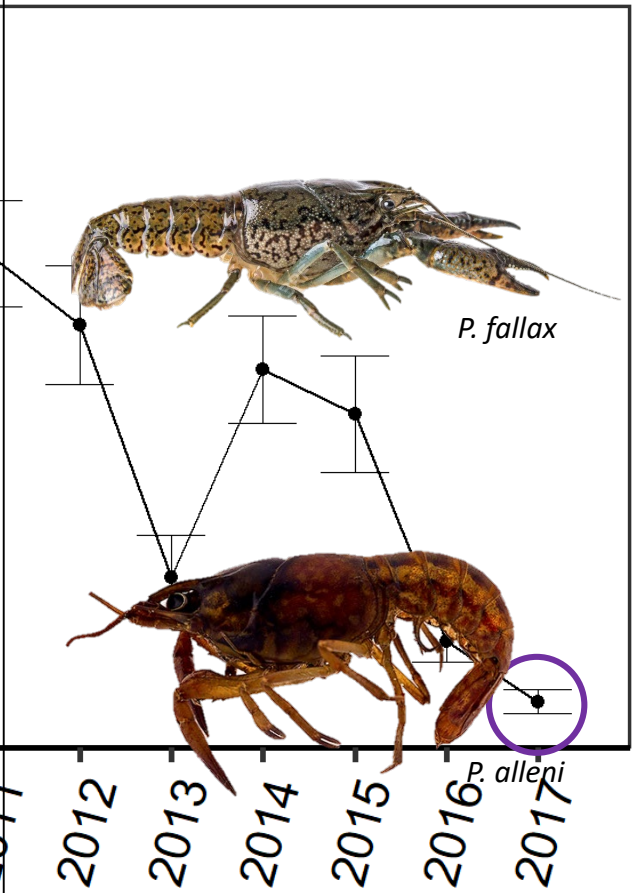


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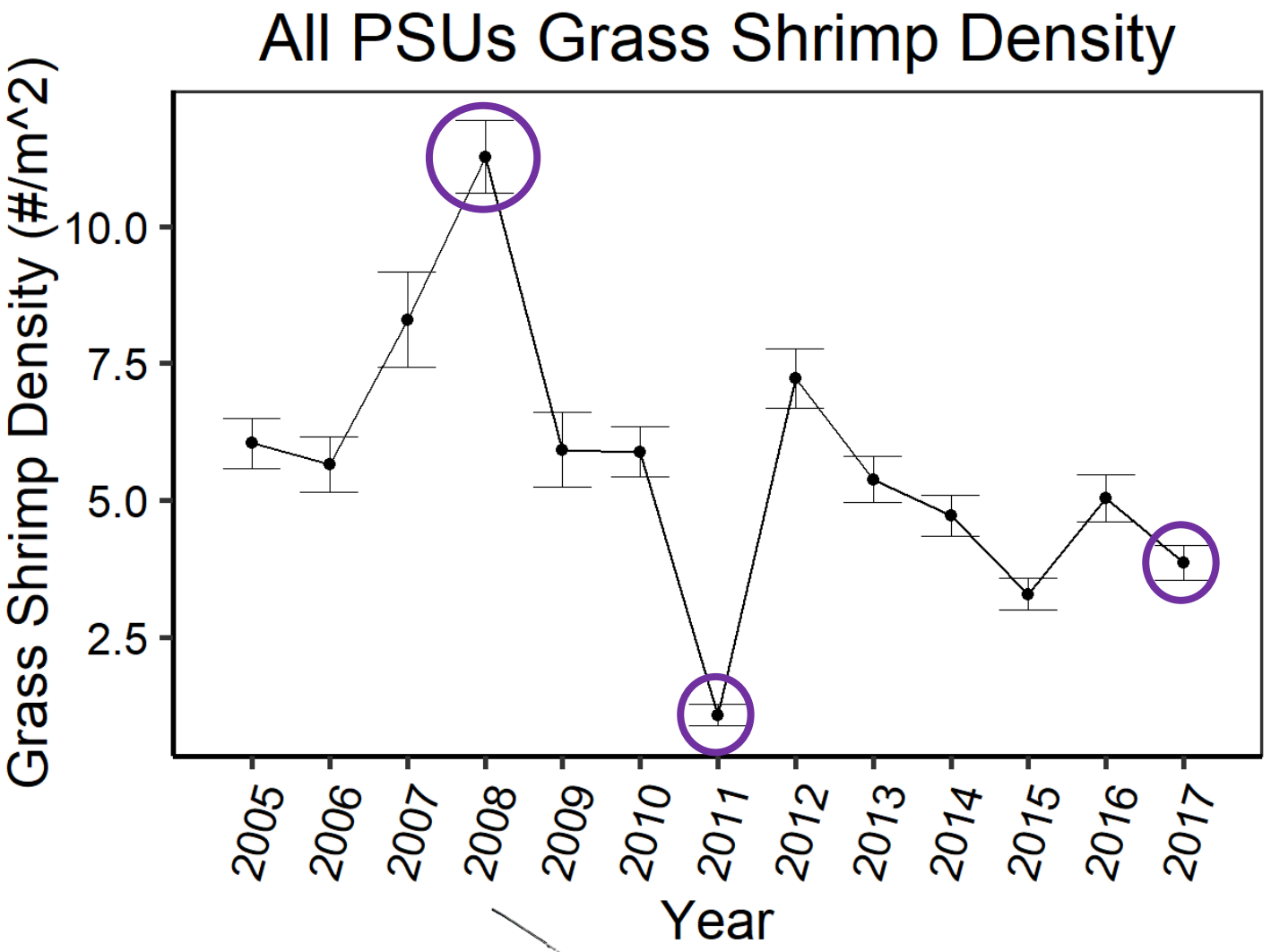
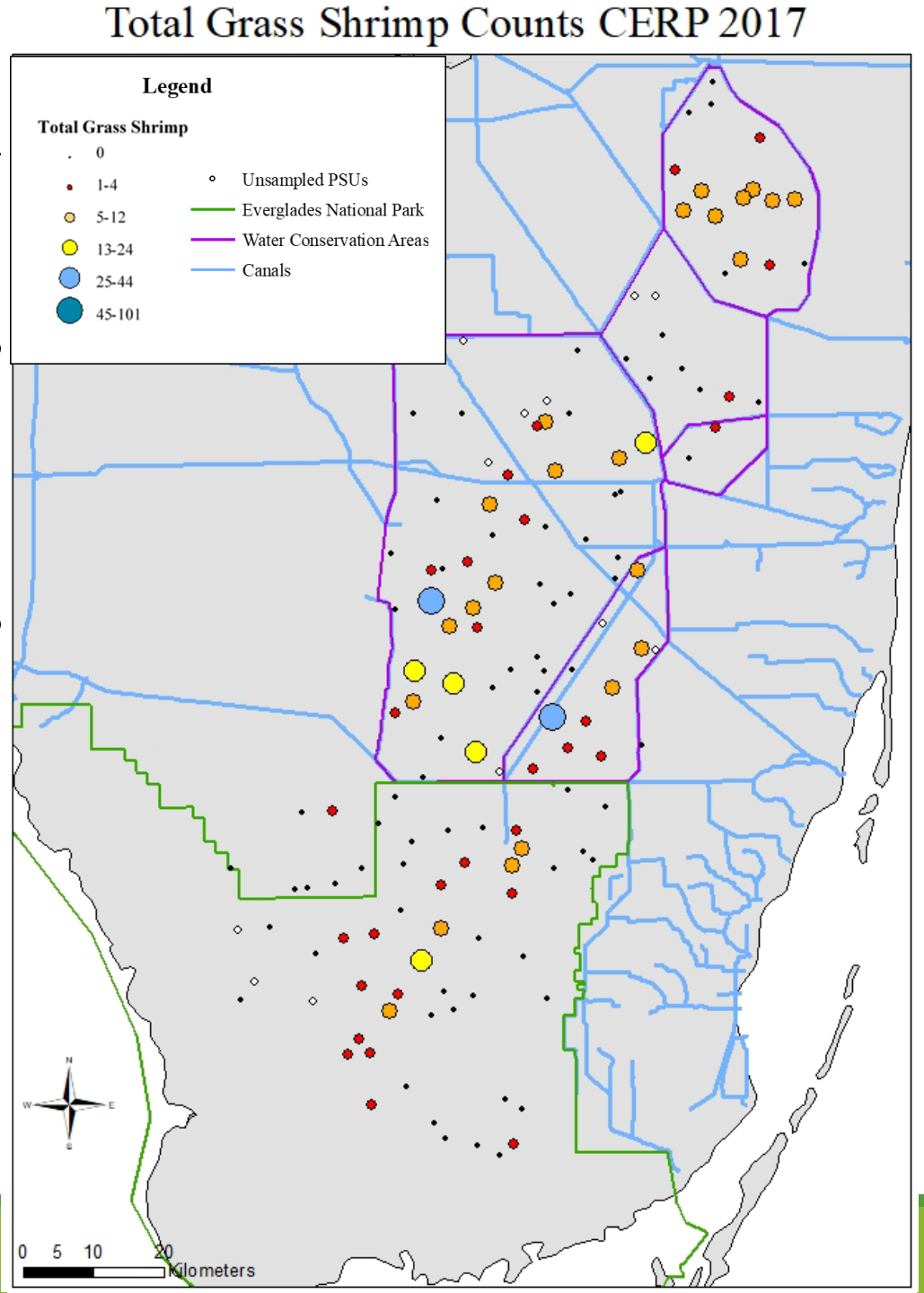
# CERP Grass Shrimp Density



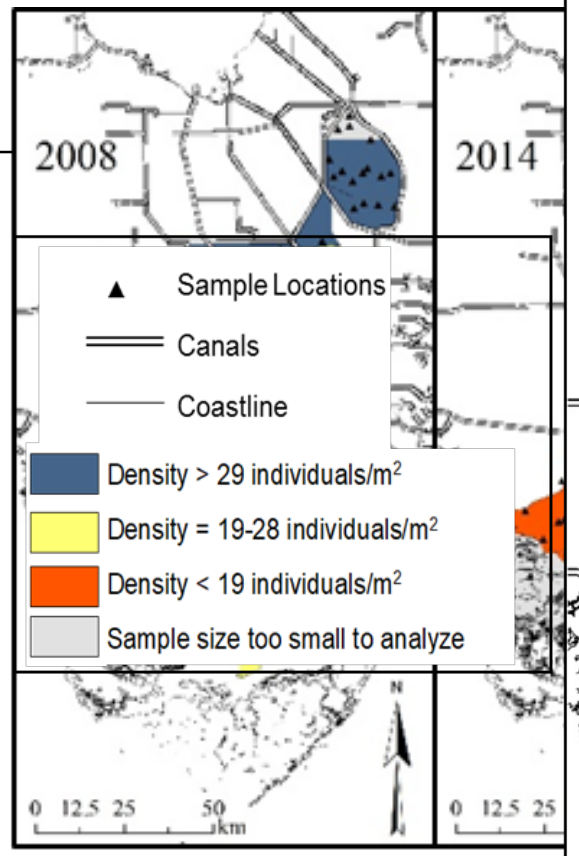



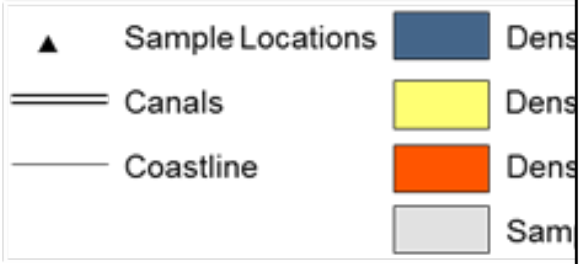
# CERP Wading Bird Prey Analysis
# Density Summed & Biomass Summed

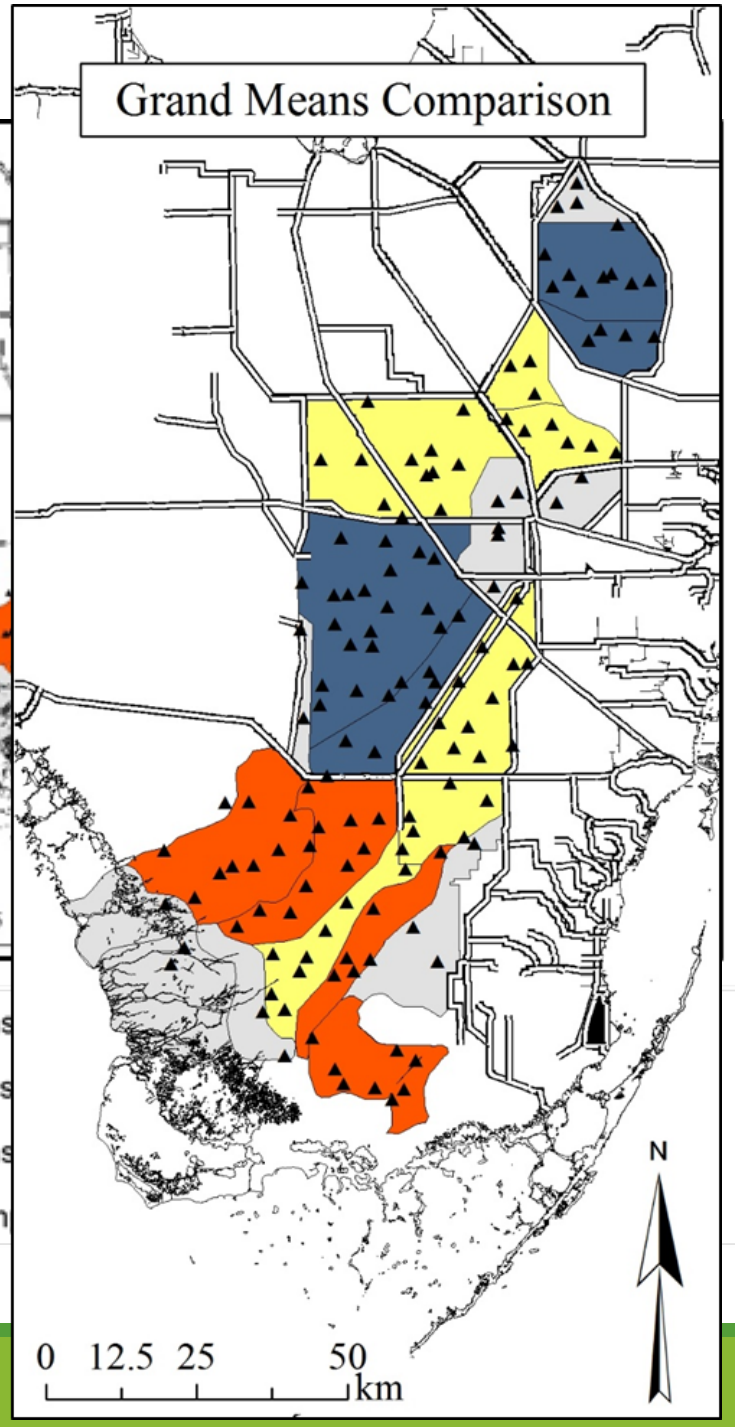
- All crayfish, all marsh fishes, grass shrimp densities and biomasses summed
- Area weighted means: mean density/biomass of LSU multiplied by area of LSU
- Year to year means compared to the overall means

# CERP Wading Bird Prey Density Summed

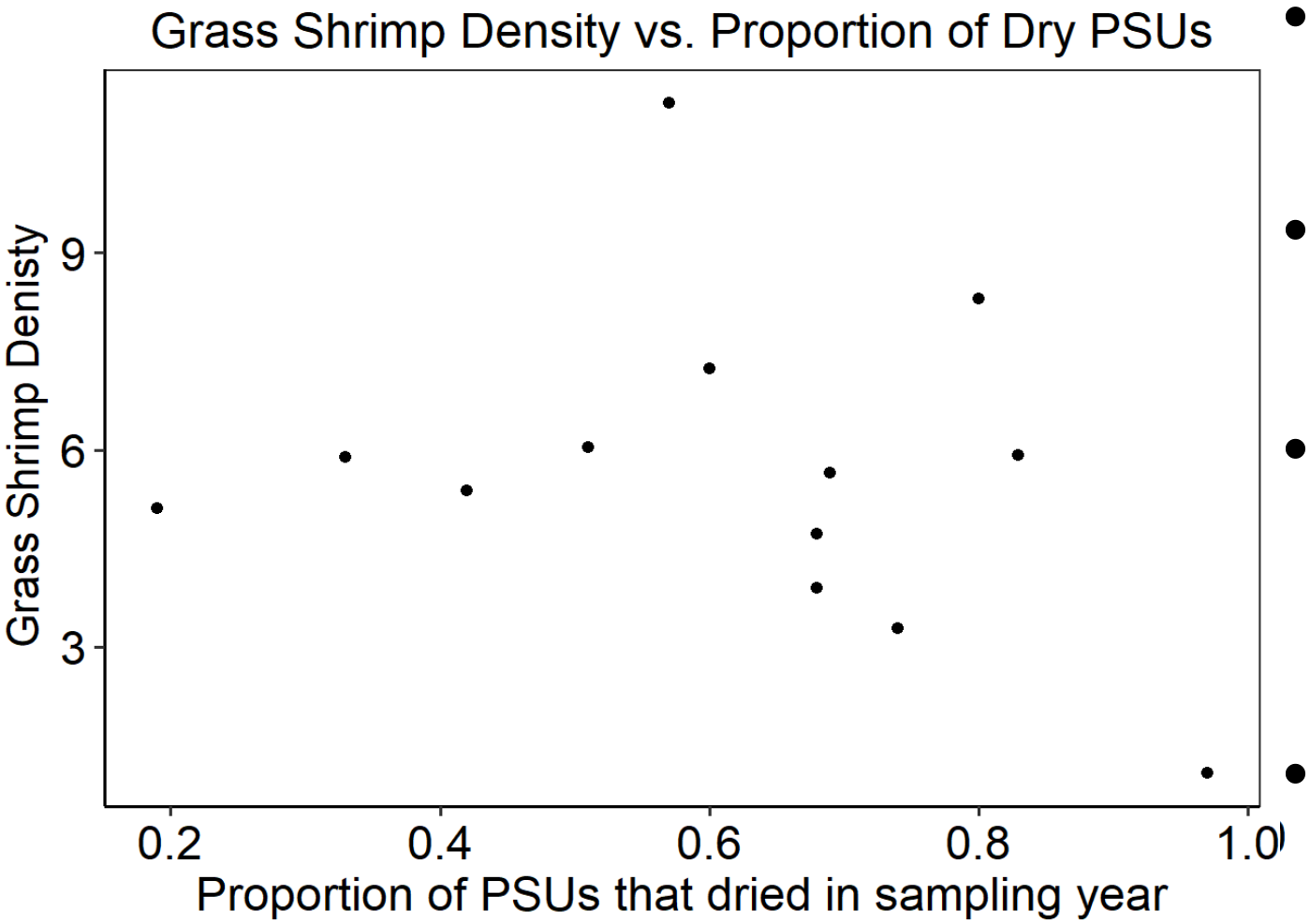
- 2017 area weighted mean: 11.9 ind/$m^2$
- Overall area weighted mean: 24.2 ind/$m^2$
- Generally greater densities at northern LSUs than at southern LSUs



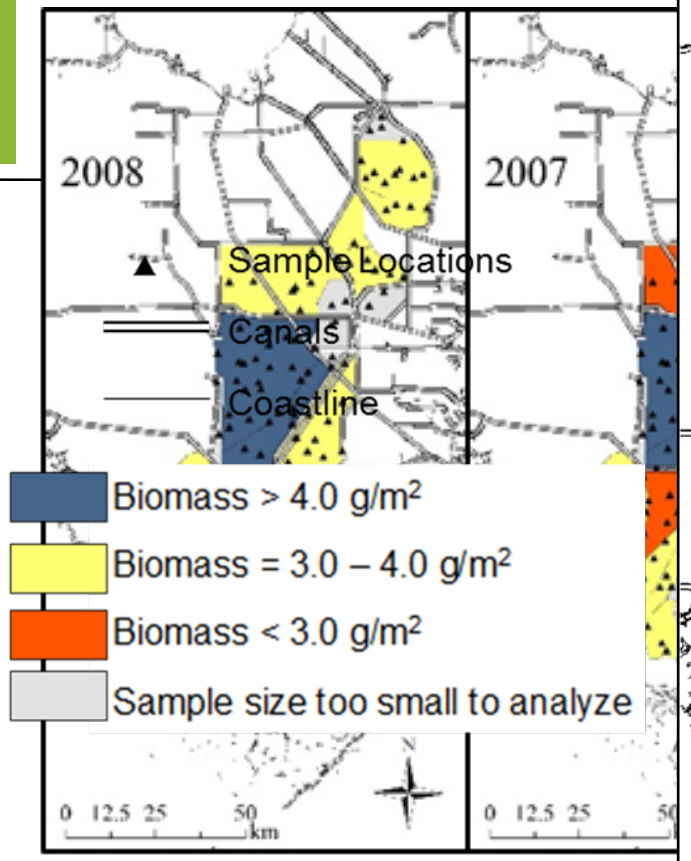
# CERP Wading Bird Prey Density Summed Models

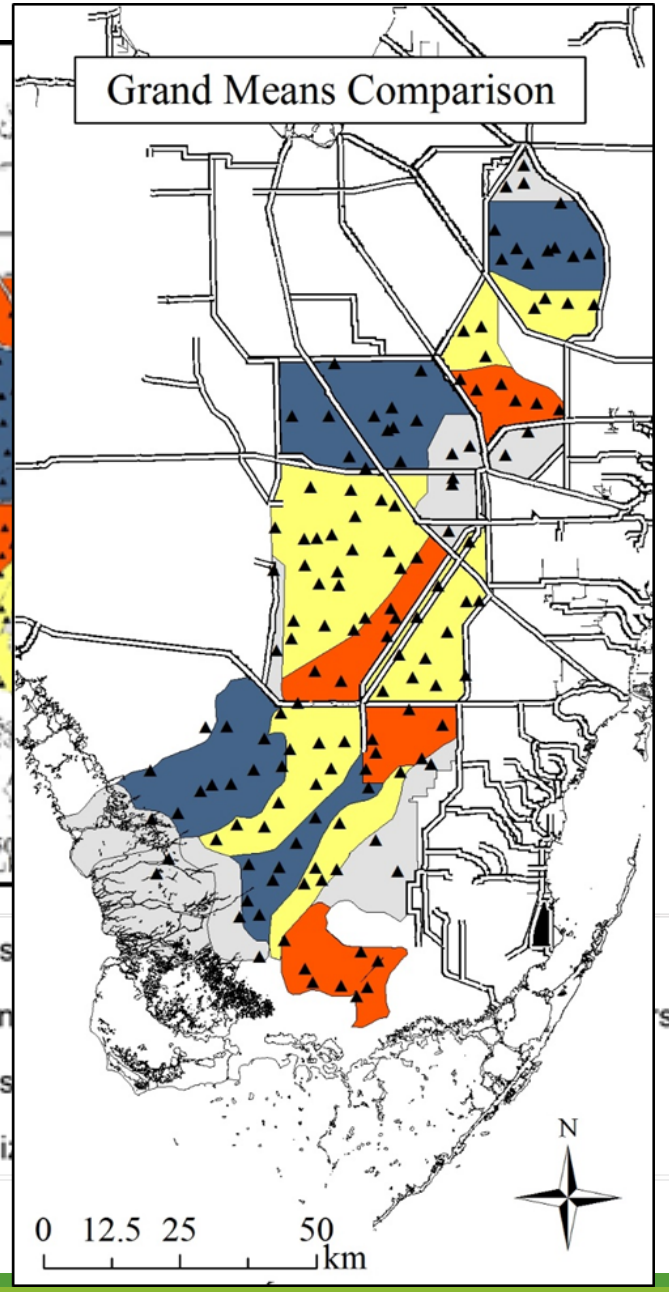



- Prey type densities (ind/$m^2$) vs. hydroperiod
- Fish density: no relationship ($p=0.11$)
- Crayfish density predicted by Proportion $Dry^2$ ($p=0.02$, $R^2=0.36$)
- Grass shrimp: no relationship ($p=0.17$)

# CERP Wading Bird Prey Biomass Summed

- 2017 area weighted mean: 1.9 $g/m^2$
- Overall area weighted mean: 3.9 $g/m^2$
- Generally greater biomass at both northern and southern LSUs, less biomass in the middle LSUs (all masses are wet weights)



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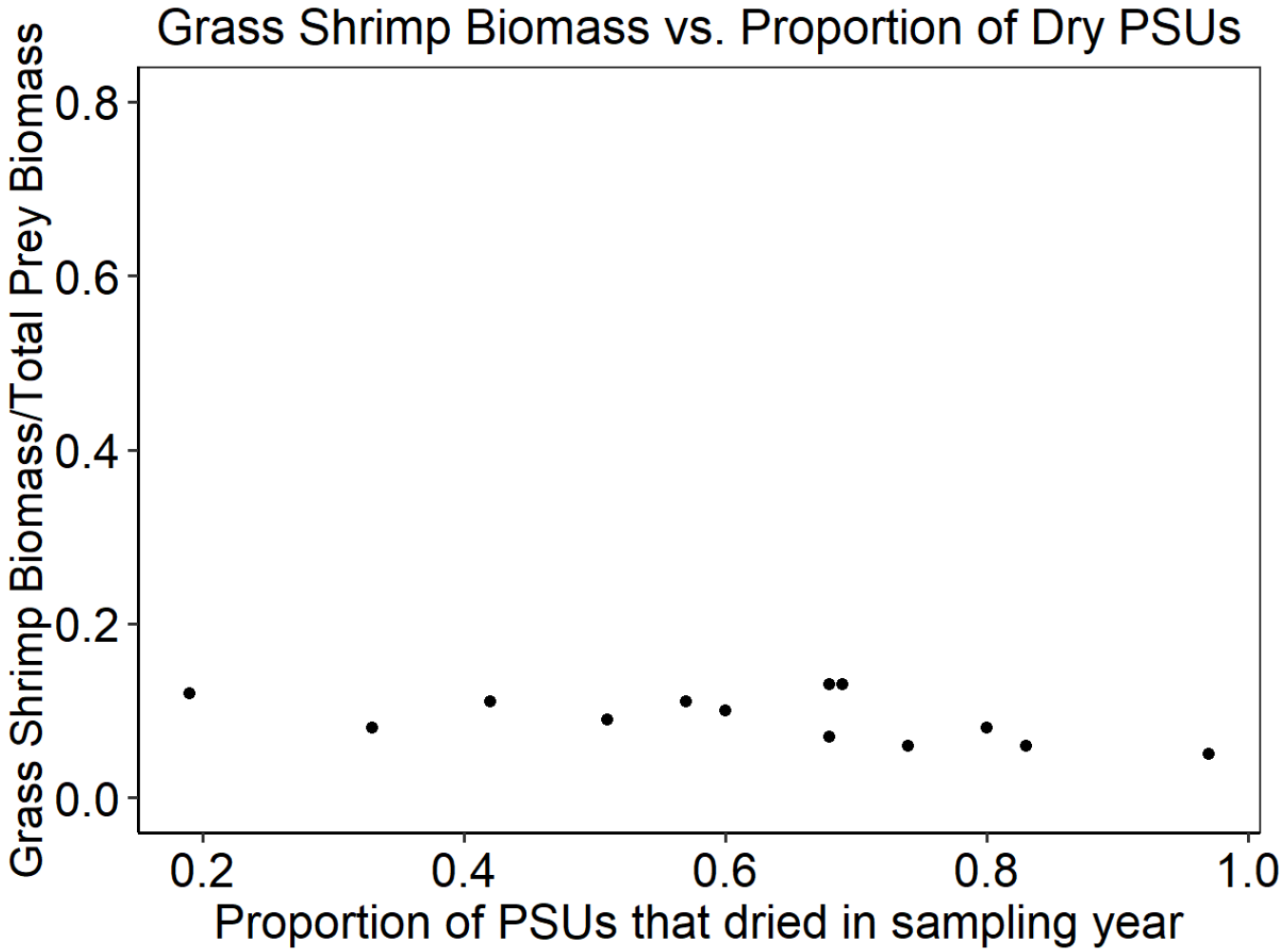
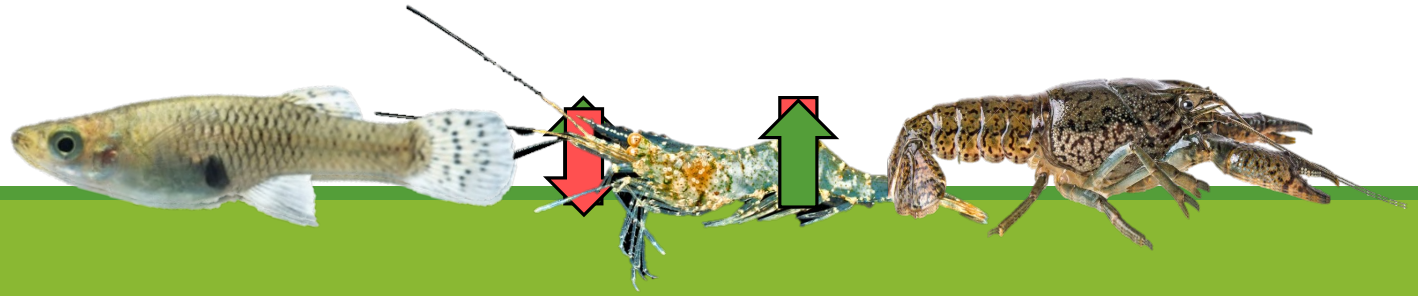
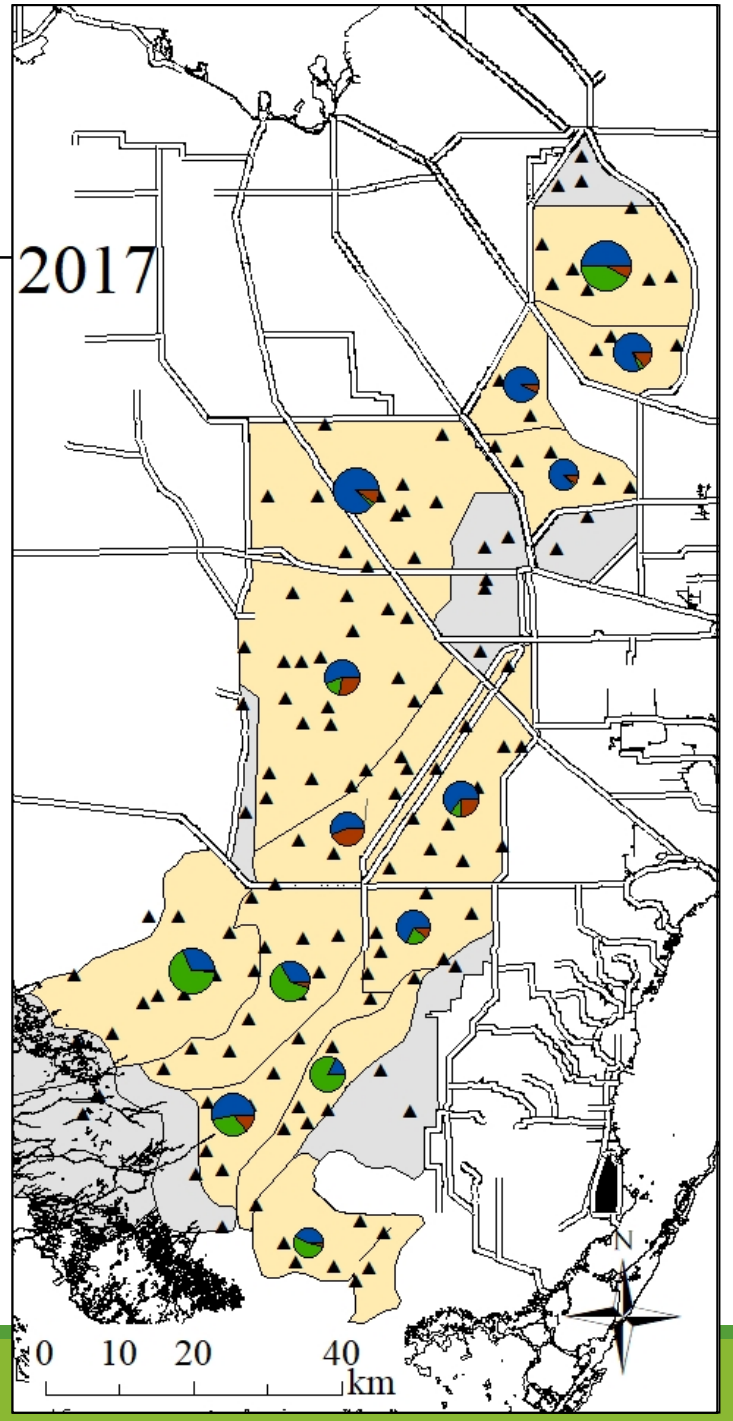



- Proportion of prey type biomass / total biomass vs. hydroperiod
- Fish biomass: $p=0.006$, $R^2=0.46$
- Crayfish biomass: $p=0.003$, $R^2=0.51$
- Grass shrimp biomass: $p=0.07$

# CERP Wading Bird Prey Proportions of Prey Biomass Species

- 2017: fish 59%, crayfish 28%, grass shrimp 13%
- 2010: highest fish 66%; lowest crayfish 25%
- 2011: highest crayfish 66%; lowest fish 25%
- Highest grass shrimp in 2017 13%; lowest in 2011 5%





# CERP Conclusions


- Crayfish positively related to drying
  - ➢ Shorter hydroperiod, greater density/biomass crayfish
- Fish diminished by extreme hydrology
  - ➢ Longer hydroperiod, greater prey biomass from fish
- Southern Everglades = more crayfish prey, Northern Everglades = more fish prey
- Grass shrimp show little relationship to hydrology

# CERP Further Analyses

- 2018 marks 14 years of the study
  - ➢How will density/biomass conclusions change with hydrology?

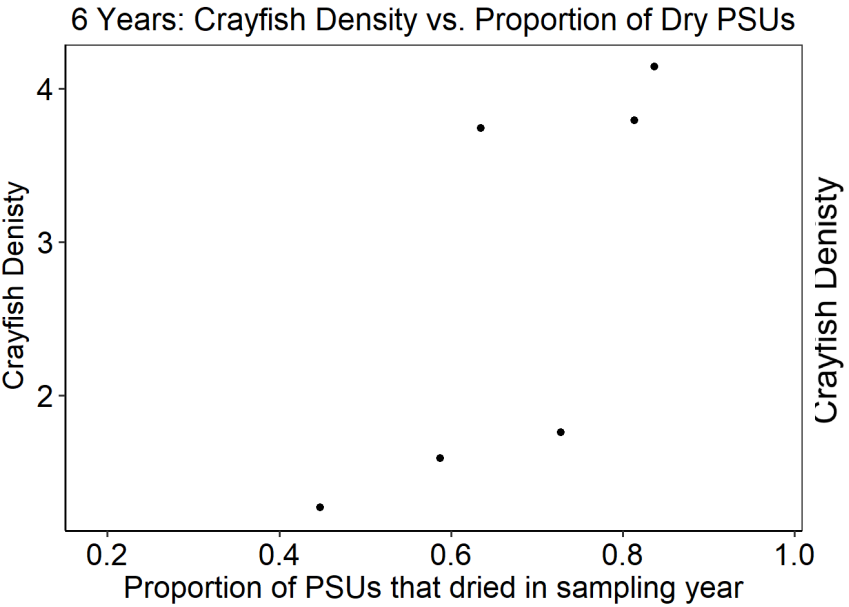
- Potential to analyze specific LSUs across time vs. specific years across LSUs

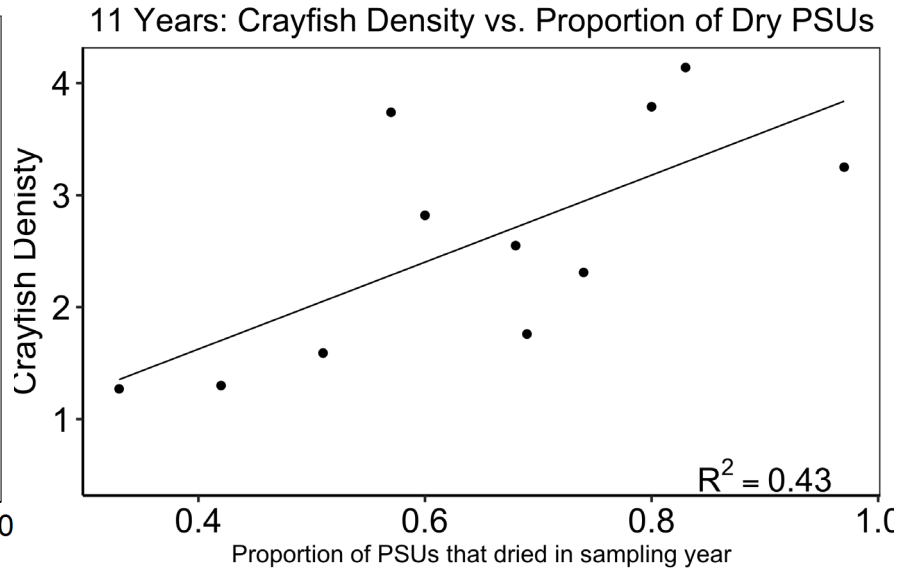
- Non-native fish species locations and densities changing over time

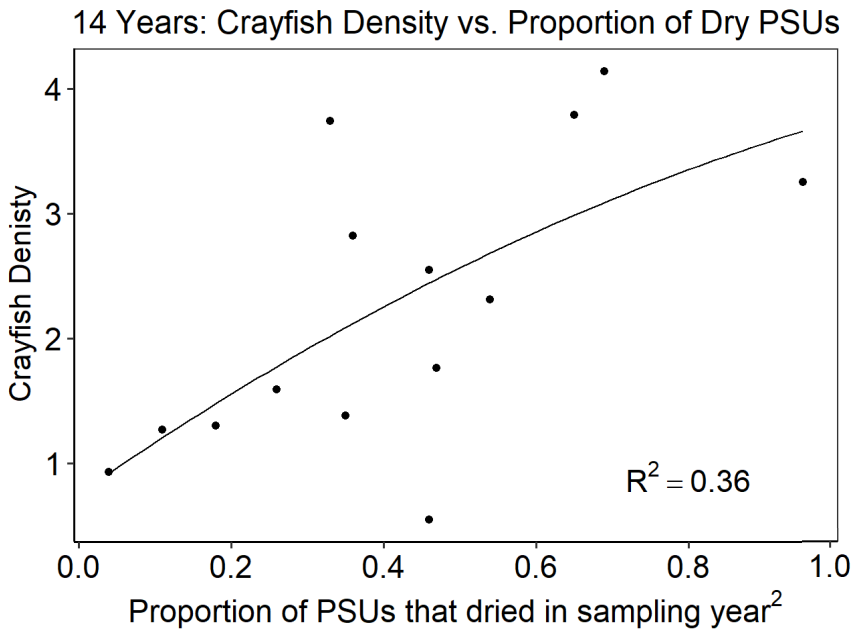
- May add additional PSUs in areas that are isolated, i.e. by roads or canals

# CERP: Importance of Long-term Studies Crayfish Density at 6, 11, and 14 Years

- 6 years of data (2005 – 2010)
  - P-value: 0.27
- 11 years of data (2005-2015)
  - P-value: 0.02
- 14 years of data (2005-2018)
  - P-value: 0.01

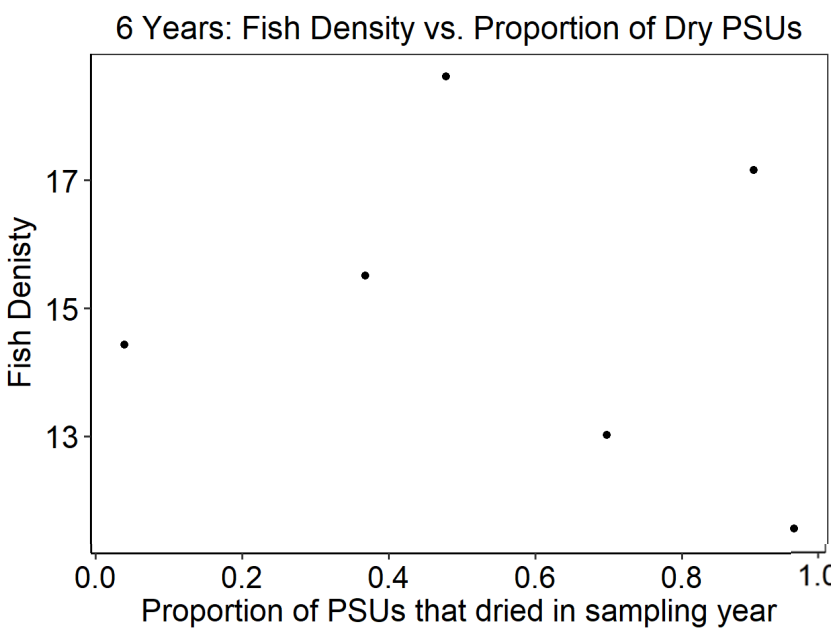


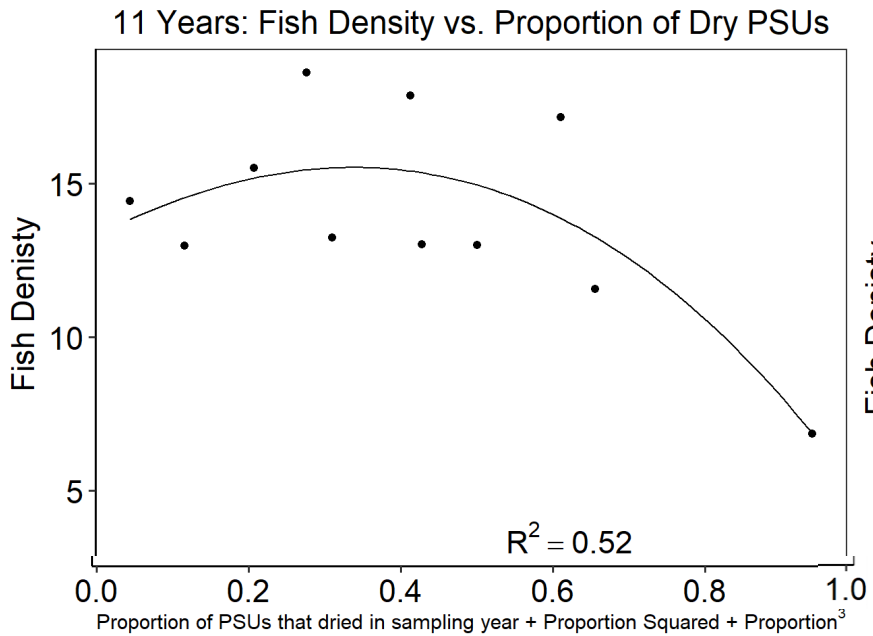



# CERP: Importance of Long-term Studies Fish Density at 6, 11, and 14 Years

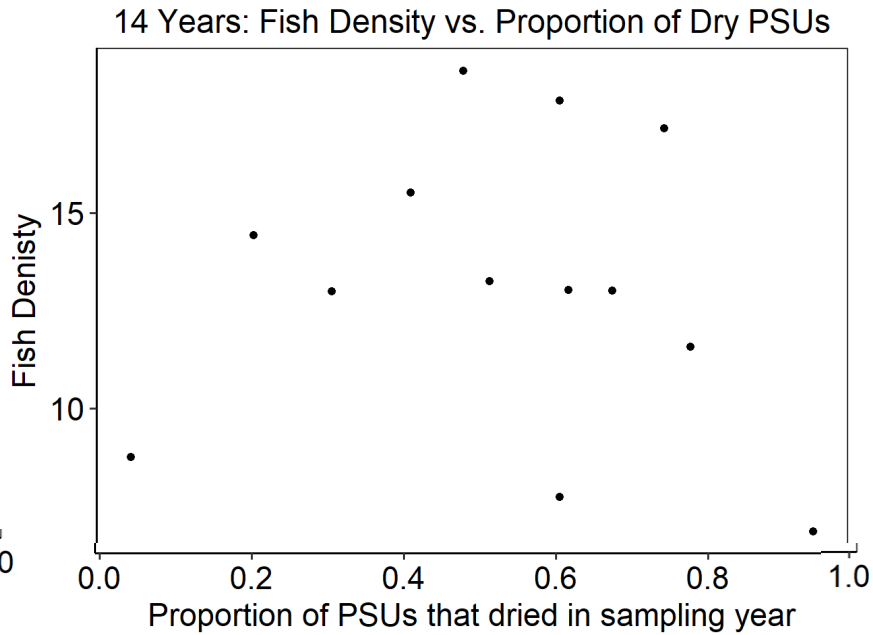
- 6 years of data (2005 – 2010)
  - P-value: 0.21




- 11 years of data (2005-2015)
  - P-value: 0.04




- 14 years of data (2005-2018)
  - P-value: 0.10



# Questions?