Silver River Study

Sept. 1, 2015

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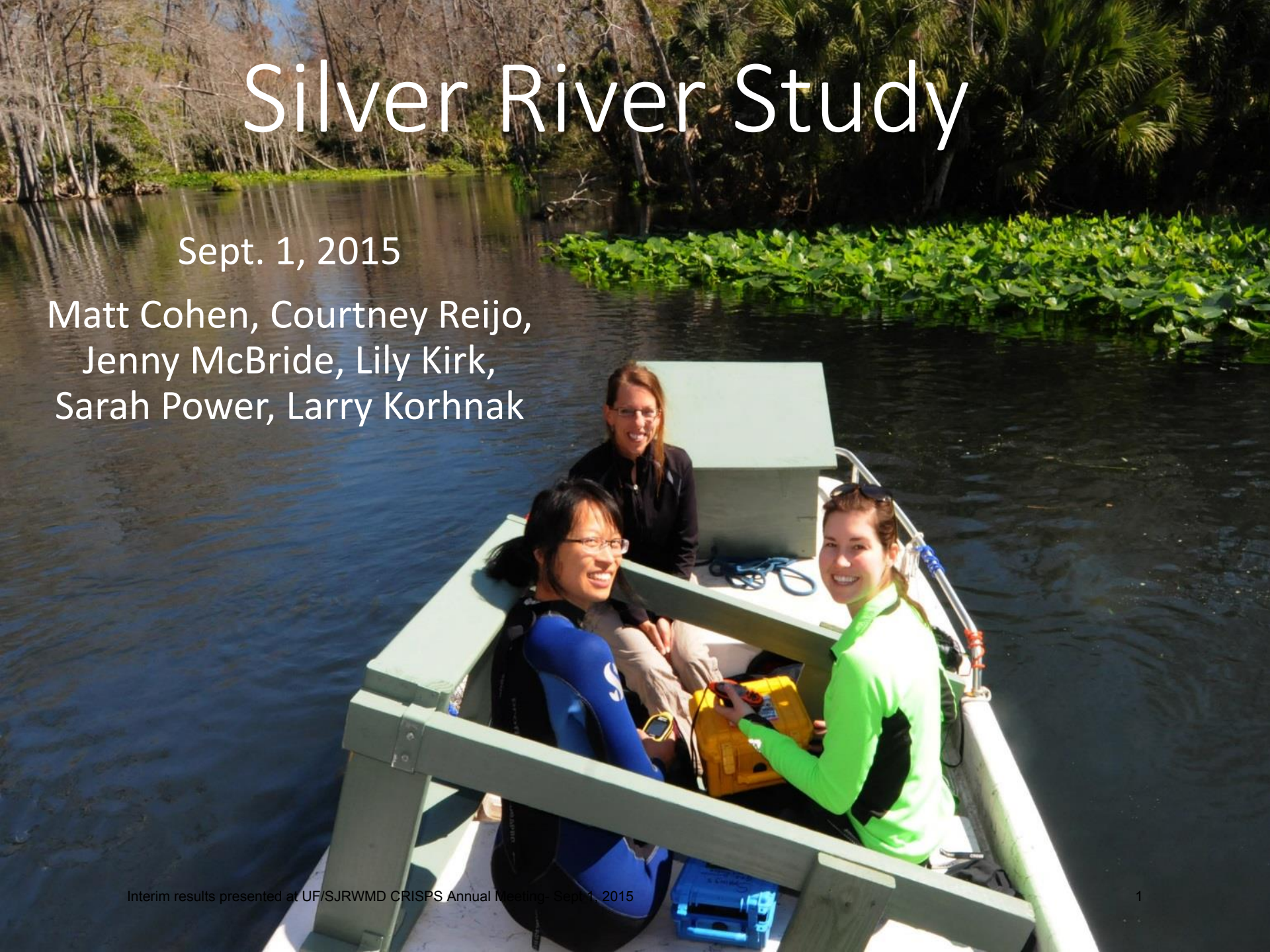
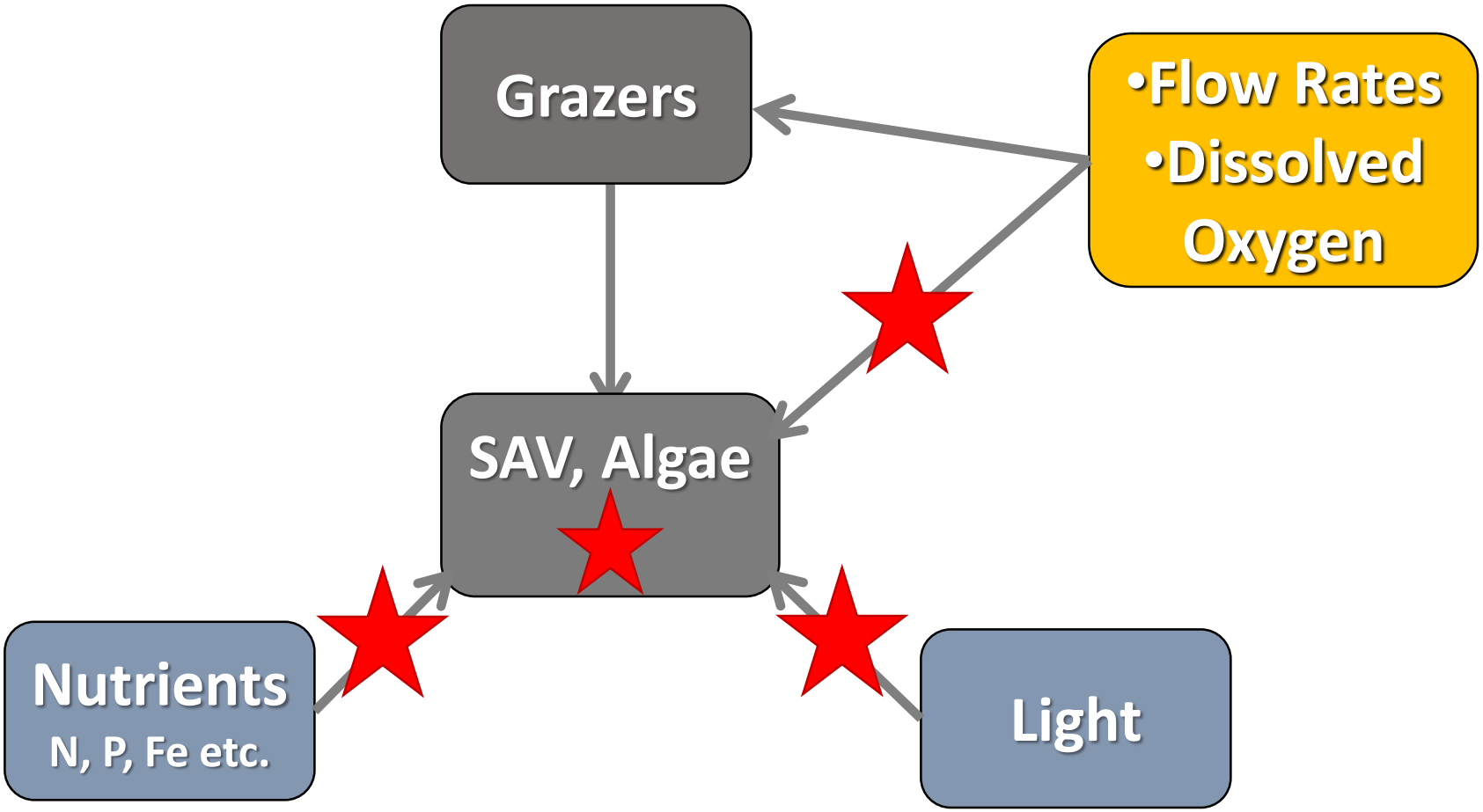


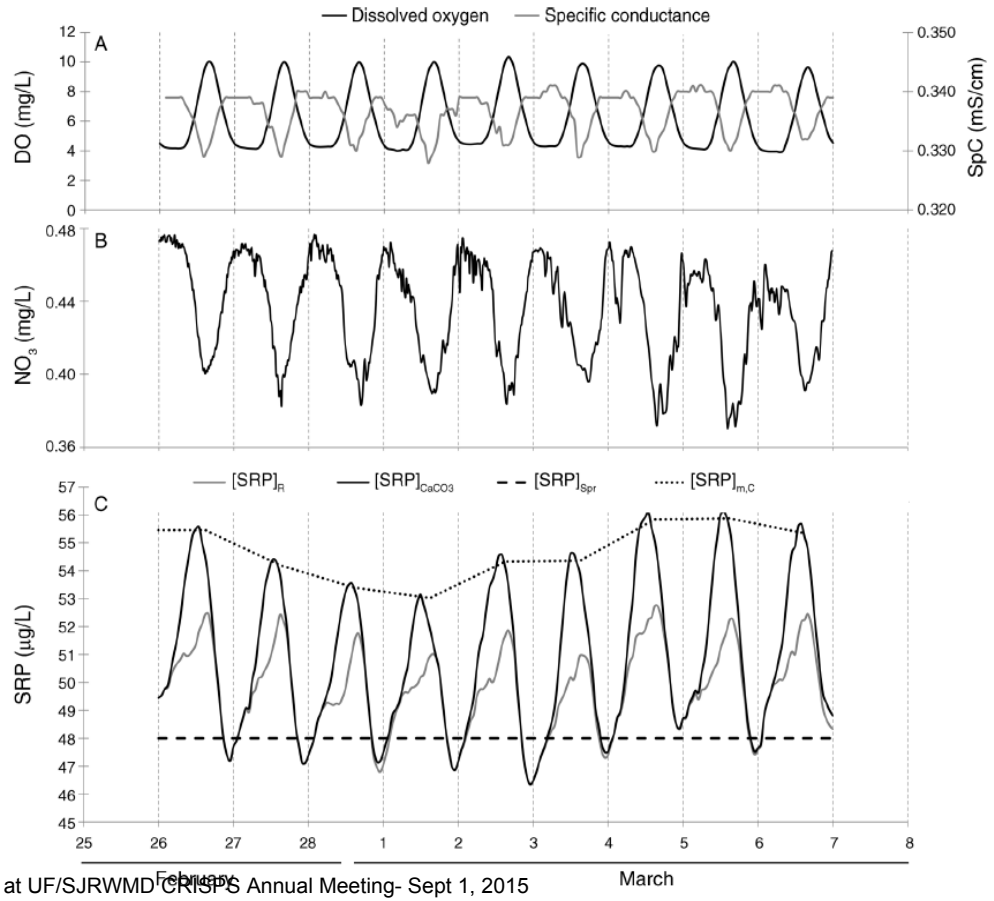
Nitrogen Dynamics and Ecosystem Metabolism



Four Project Elements

1. **Continuous metabolism and nutrient dynamics**
   - Long-term spatially disaggregated assessment of river primary production, respiration, nutrient uptake.
2. **Benthic survey**
   - Spatially-explicit controls on autotroph cover and morphology: sediment, chemistry, light, flow
3. **Nutrient depletion and enrichment assays**
   - Benthic chambers to assess nutrient limitation (N, P, Fe) and ecosystem metabolism at below-ambient concentration
4. ***In situ* SAV growth measurements**
   - Spatial and temporal variation in and controls on SAV growth

Element 1 – Ecosystem Metabolism and Nutrient Dynamics



Cohen et al. (2013)

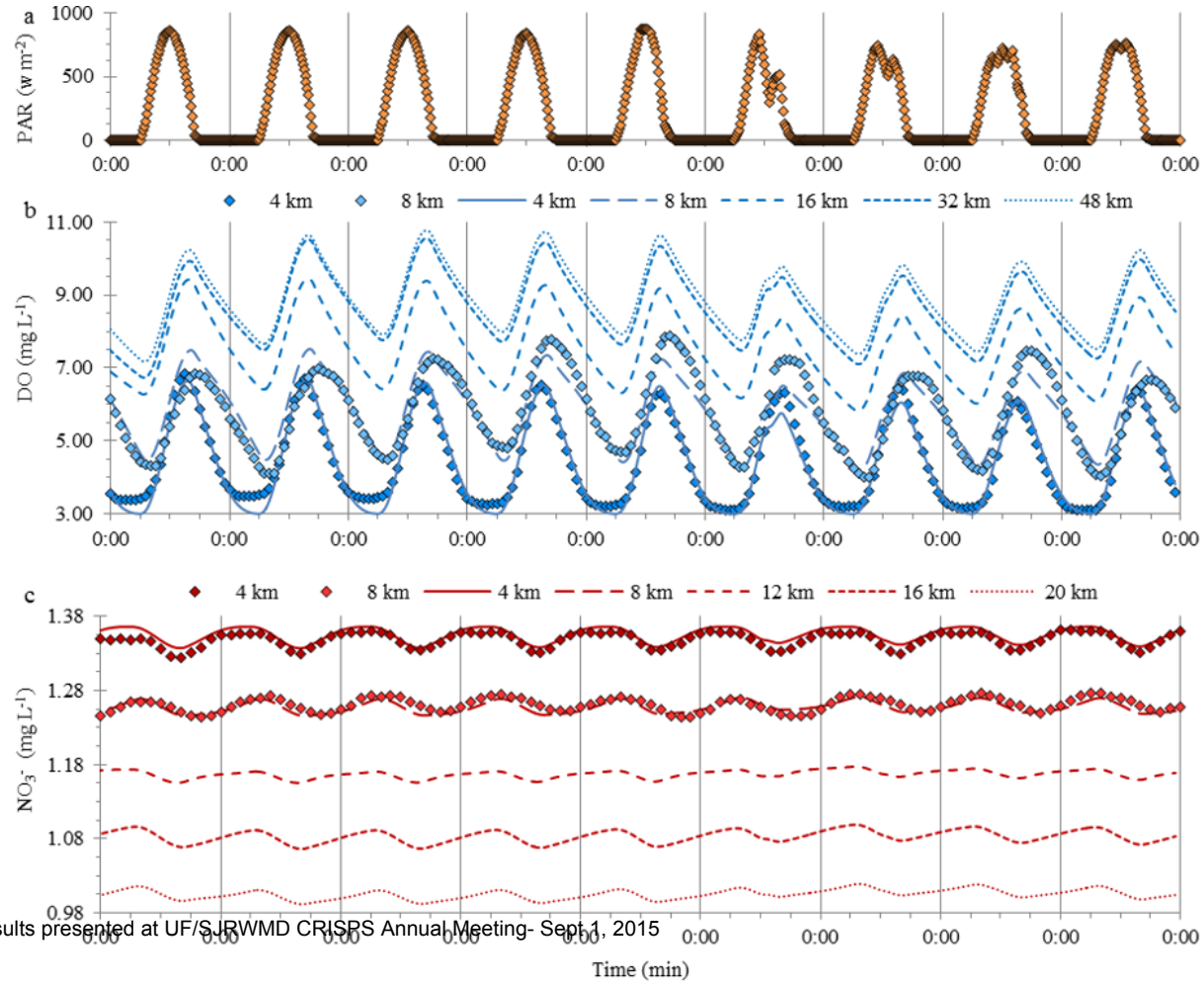
SJRWMD Sensor Deployment

- Hourly (+) DO, NO3, SRP, pH, T, SpC, Turb., fDOM
- Year 2 activity is synthesis of these time series
  - GPP, R_{eco}, $U_{a,N}$, $U_{a,P}$, U_{den}
  - Controls (PAR, turbidity/fDOM, flow, season)

Data

(see Lily Kirk's poster)

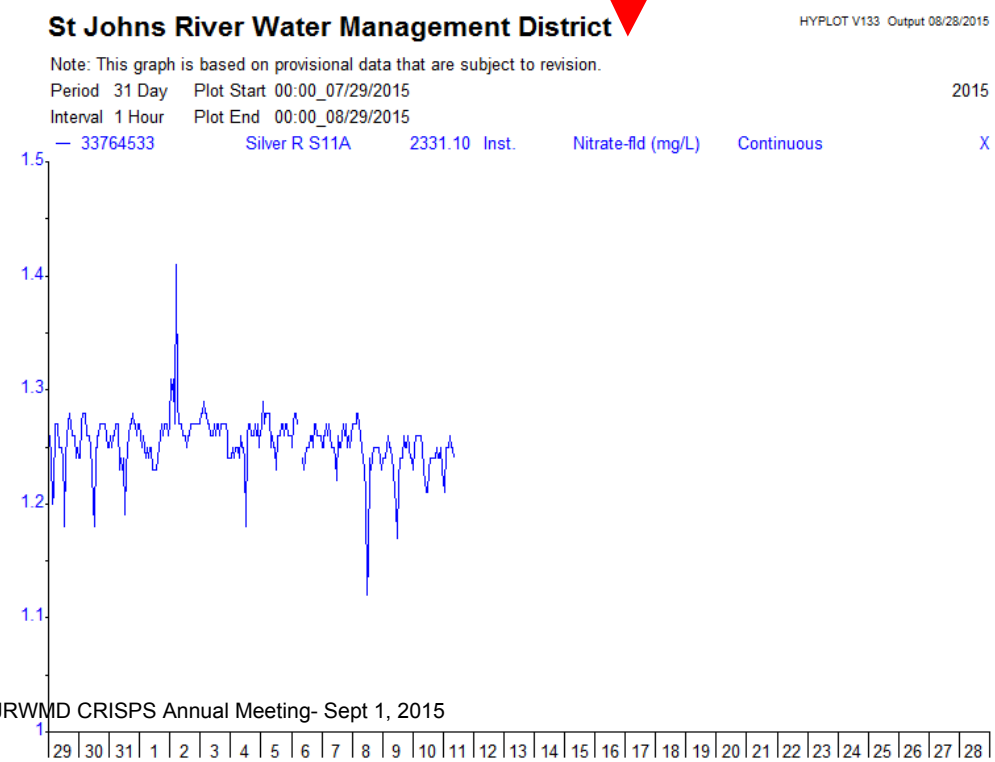
- @ SILVERRIVERS5 and SILCONN locations



Hensley & Cohen (in review)

Data Challenges

- Sensor locations (SILCONN, SILHEAD)
- Sensor precision (NO3)
- Data transfer protocols (largely established)



Element 2 – Benthic Survey

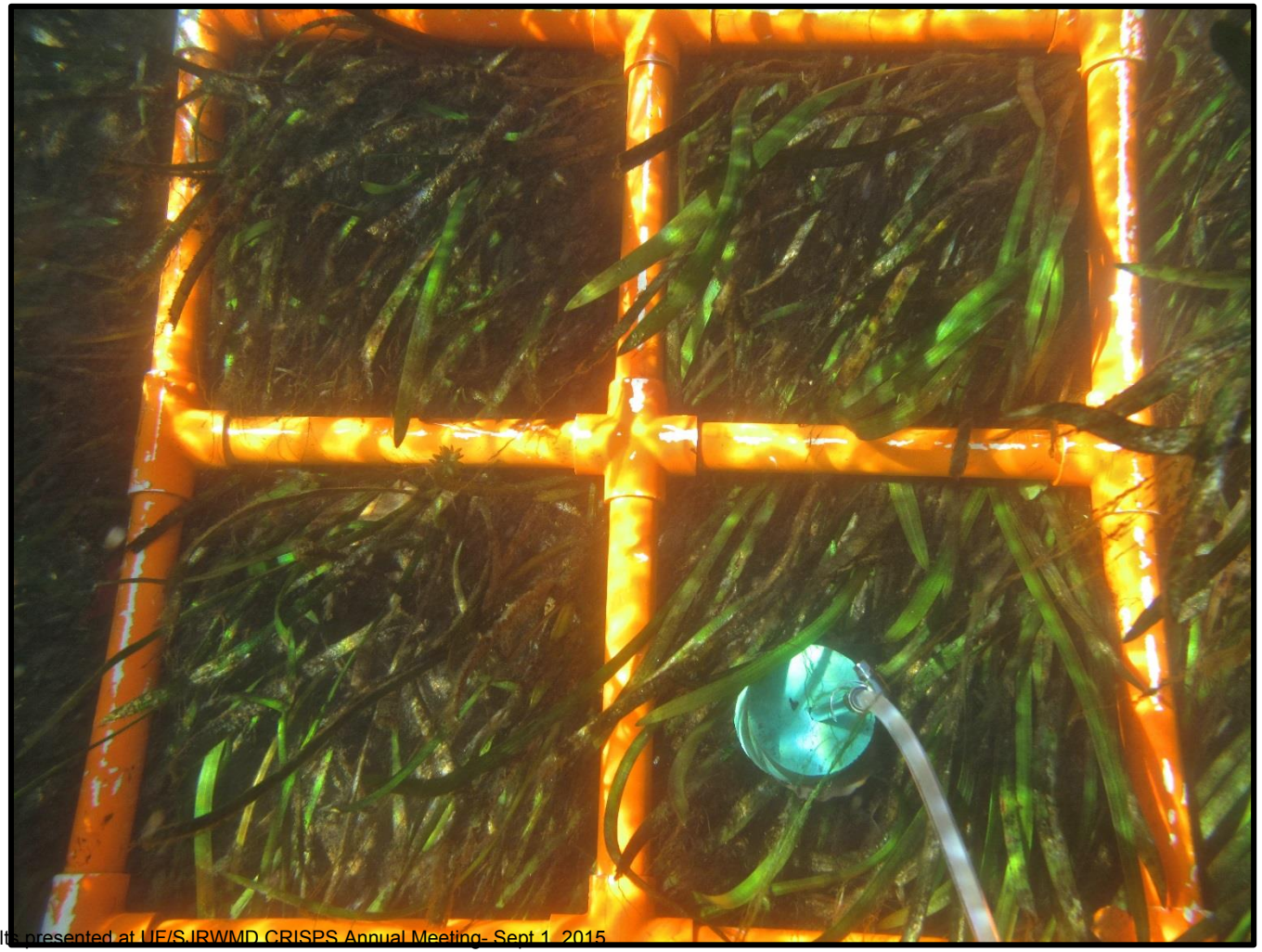
- **Objectives**:
  - Characterize spatial variation and covariation
    - Algal cover
    - SAV cover, morphology (root:shoot), chemistry
    - Sediment surface chemistry (OM, P, N, Fe, Ca, Mg)
    - Surface and shallow pore water chemistry
    - Physical controls (light, velocity)
  - Guide site selection
    - SAV growth plots
    - Benthic chamber sites

Sample Area	Analysis	Sample size	Preservative
Porewater and Water Column	NO_3, NH_4	20mL scintillation	H_2SO_4; pH<2
	Ortho-P, Ca, Cl	20mL scintillation	No preservative
	Fe, Mn	20mL scintillation	HNO_3 + HCl
	DOC	40mL amber glass	HCl
	DIC	40mL clear glass	$HgCl_2$
Sediment	%C, %N, %S	1-2 grams dried soil	N/A
	Fe, Mn, Ca, P, Mg	5 grams dried soil	
	%OM	10 grams dried soil	
	Texture	50 grams dried soil	
Vegetation	%C, %N, %P	Two plant samples measured, weighed, and dried	
	Aboveground biomass		
	Belowground biomass		
	Shoot and root length		
	Number of shoots		

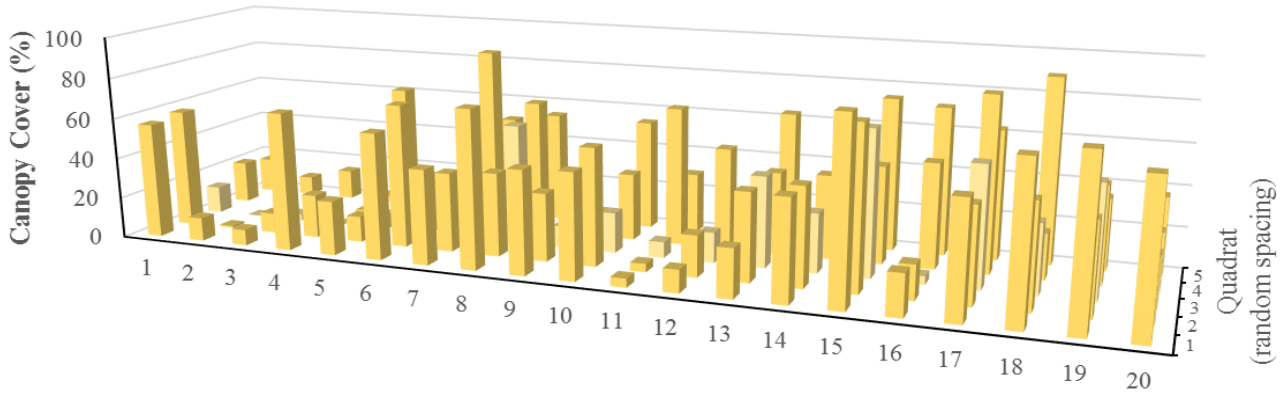
Transect Locations

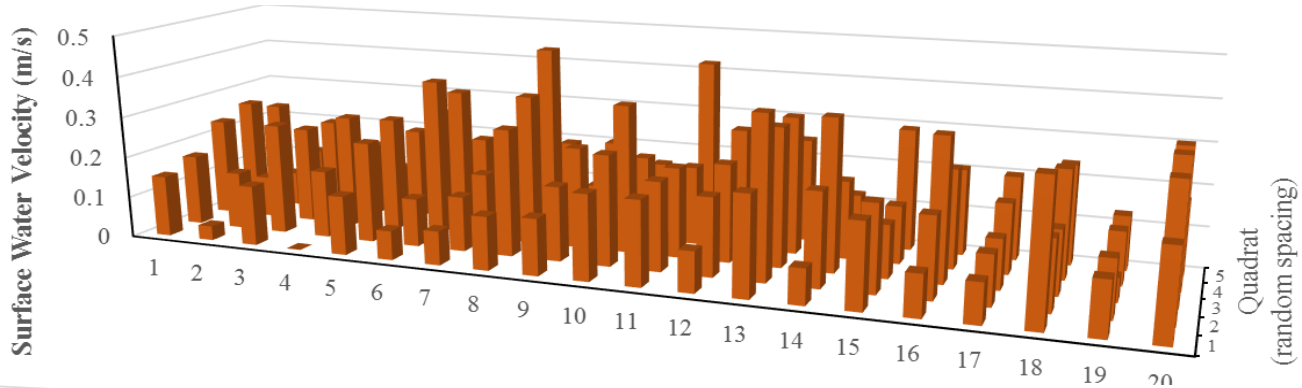
- 20 transects
- 5 sampling points on each transect

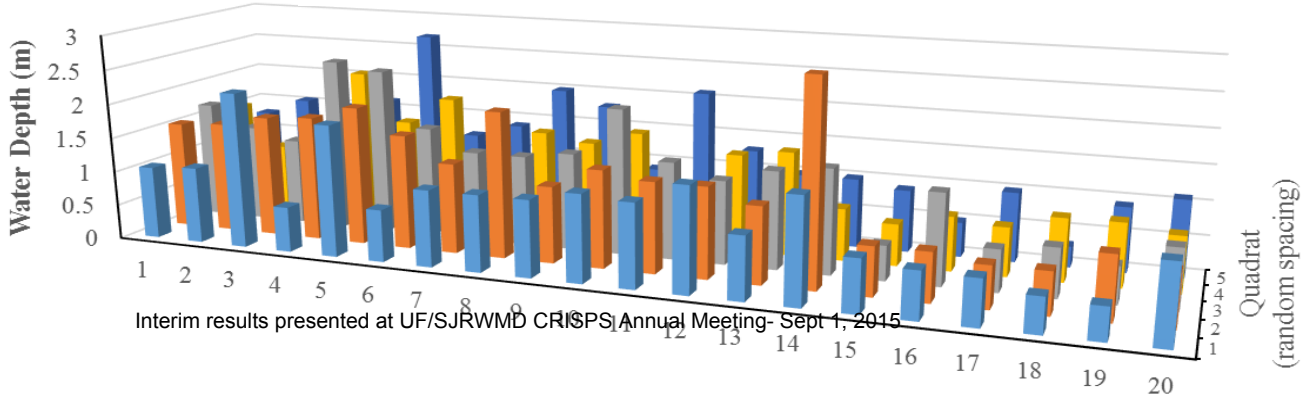
Benthic Sampling Frame



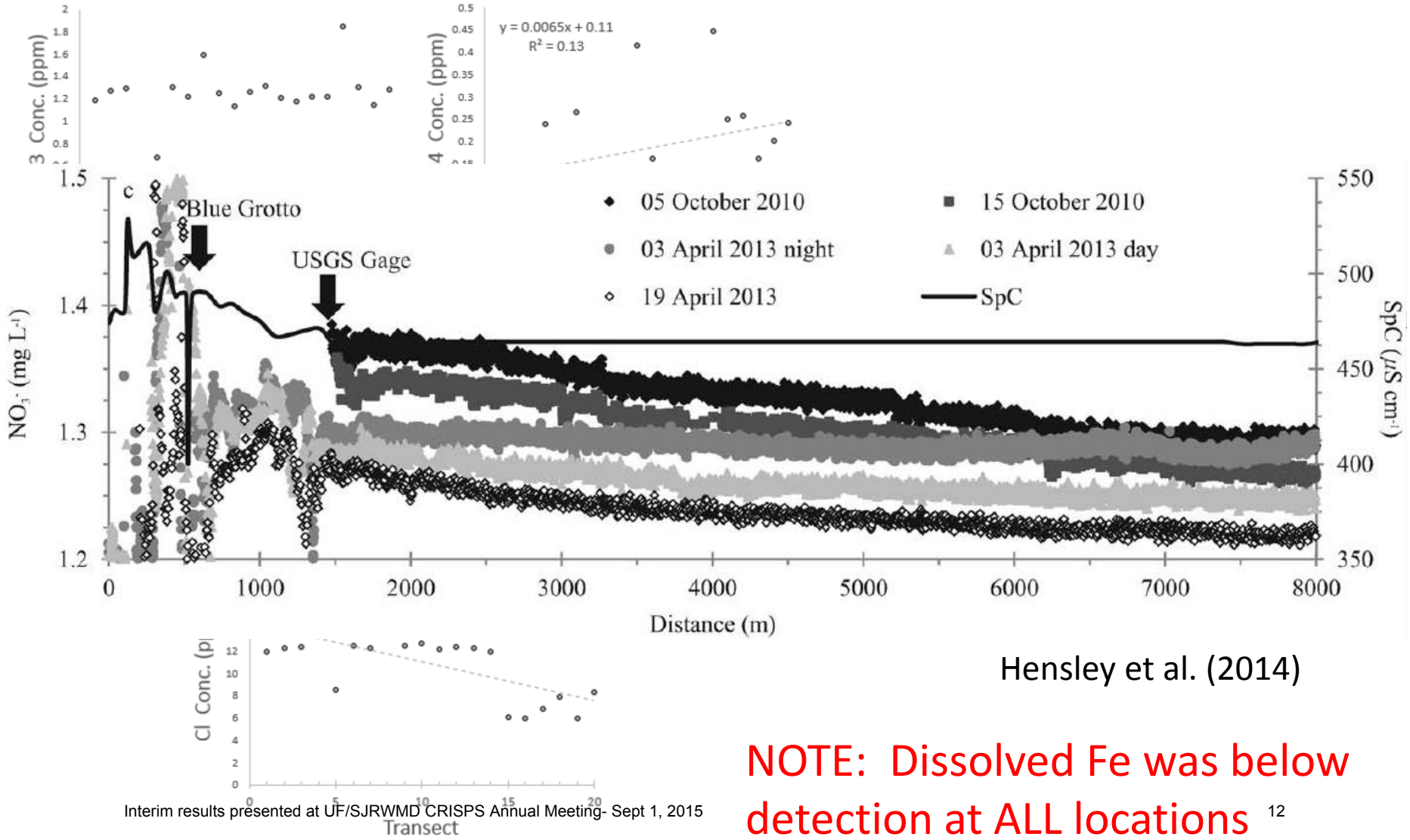
Physical Controls: Light, Velocity, Depth







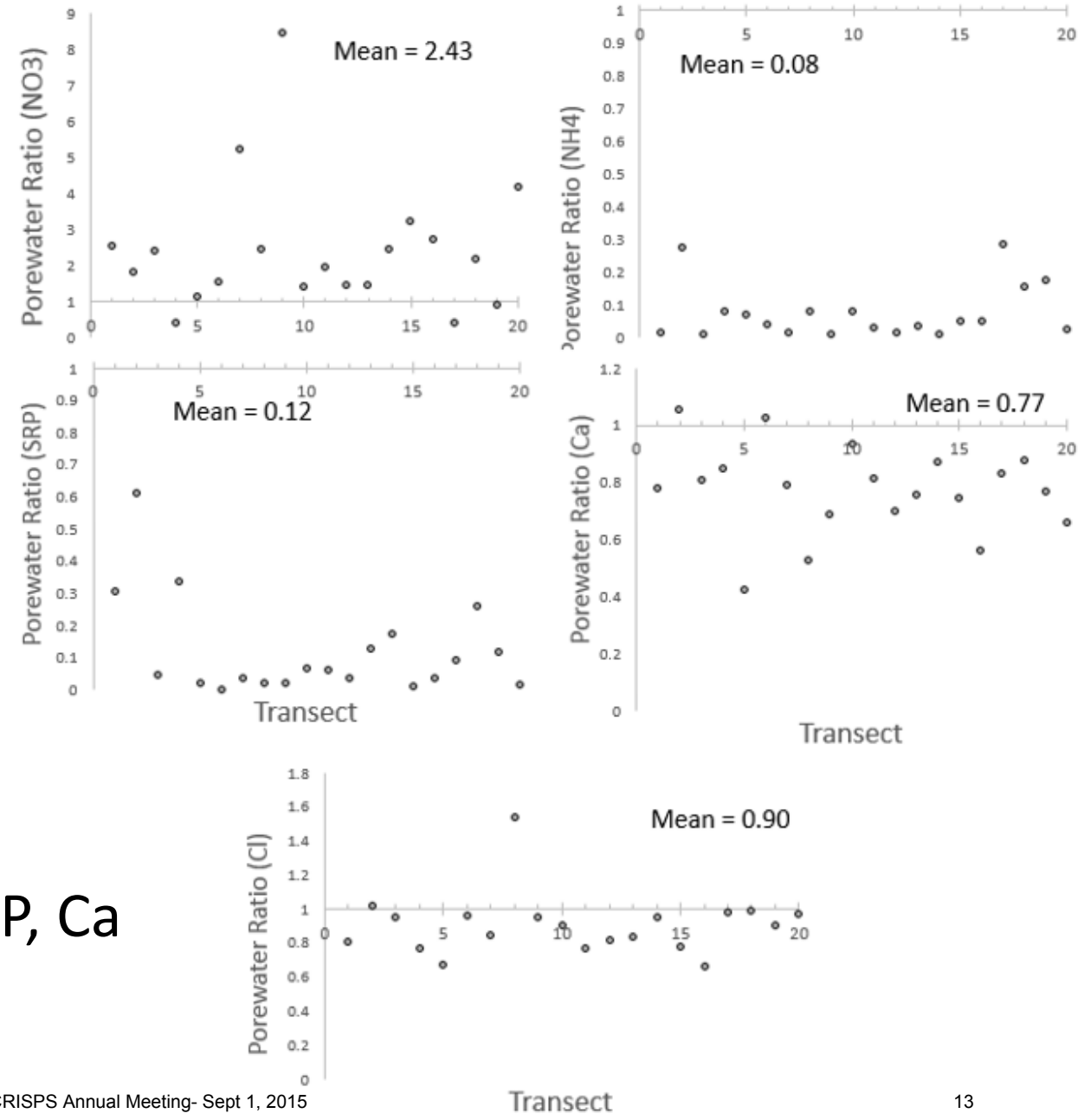
Chemistry –Longitudinal Trends



Hensley et al. (2014)

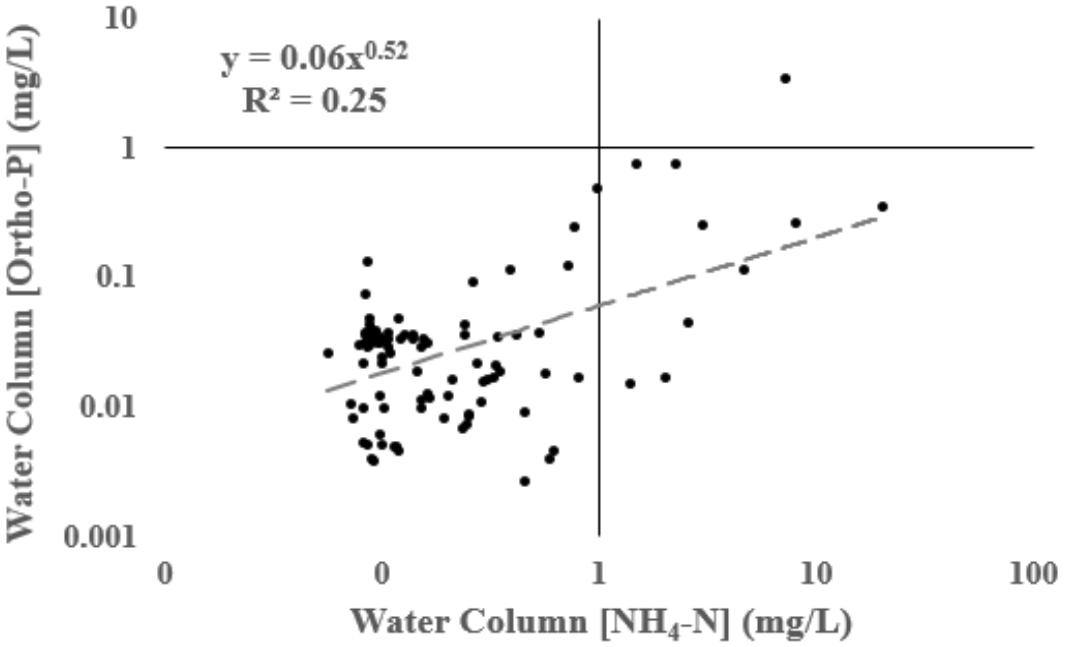
NOTE: Dissolved Fe was below detection at ALL locations

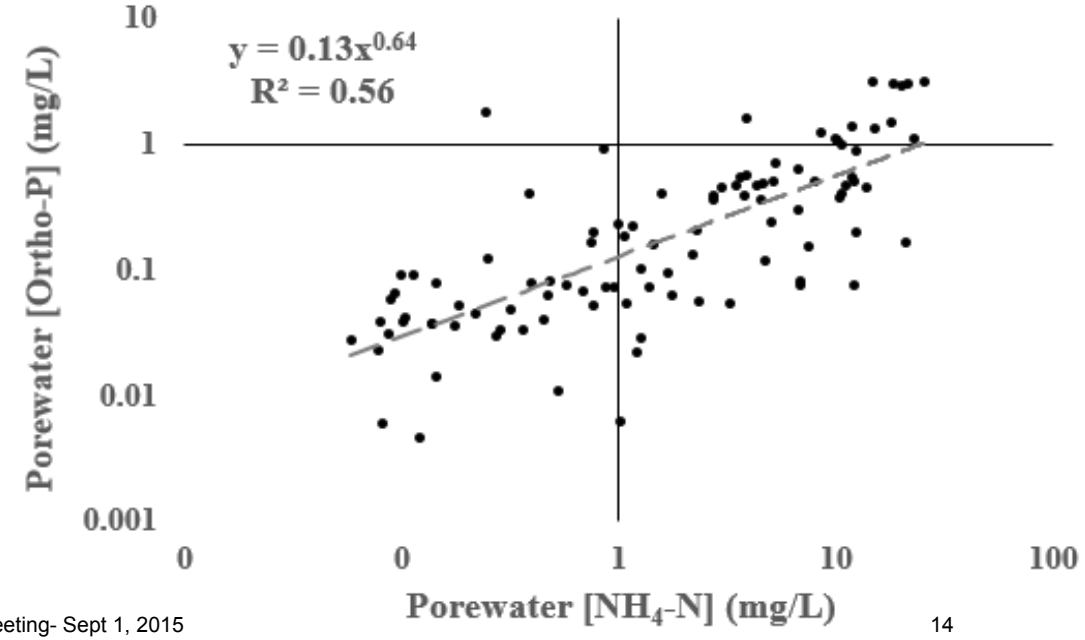
Chemistry: River vs. Sediment Water



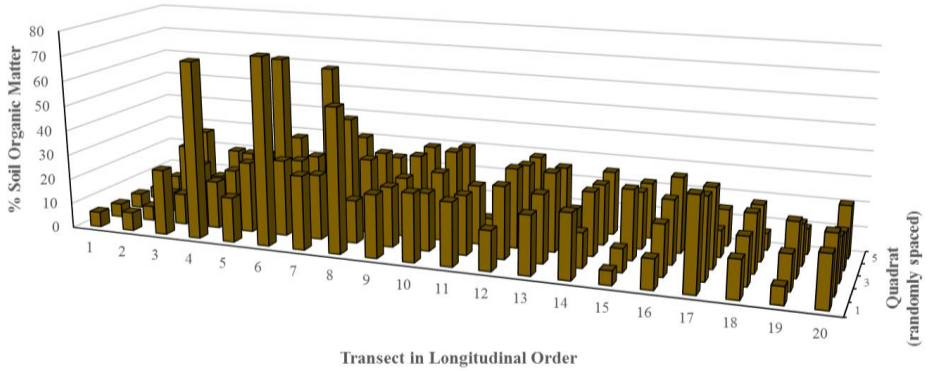
- Loss of NO3
- Gain of NH4, SRP, Ca

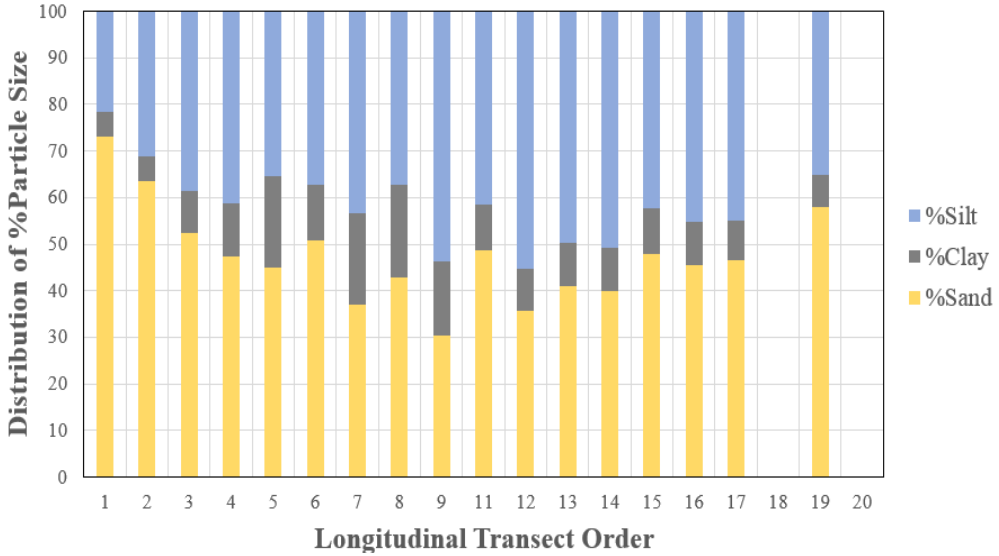
Diffuse Sources: Porewater and Water Column NH_4 vs. PO_4

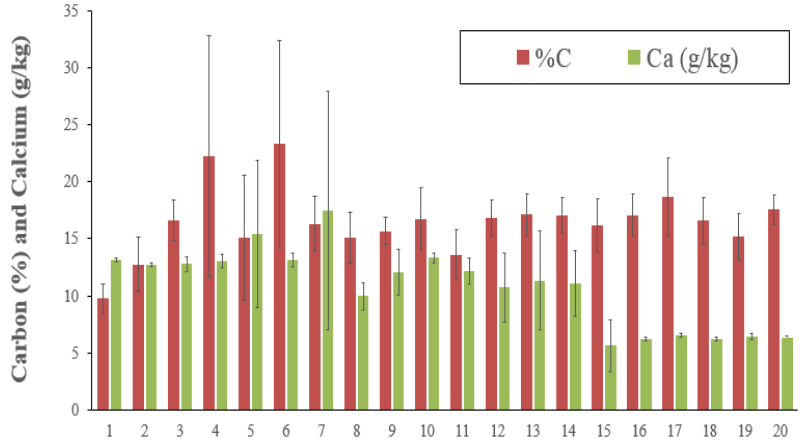


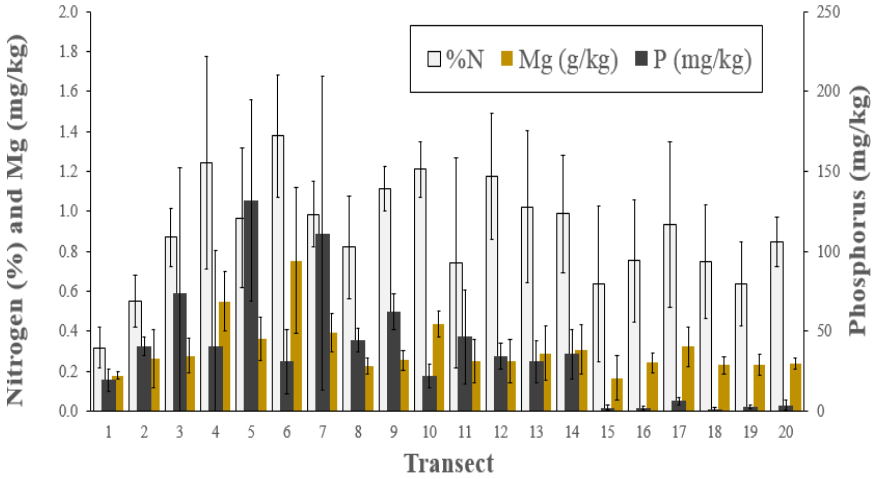


Chemistry – Sediment Properties



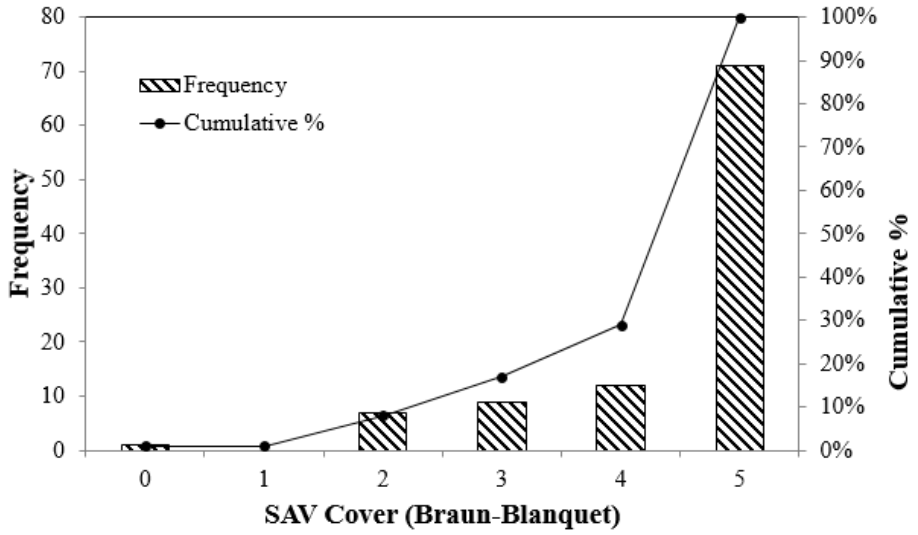


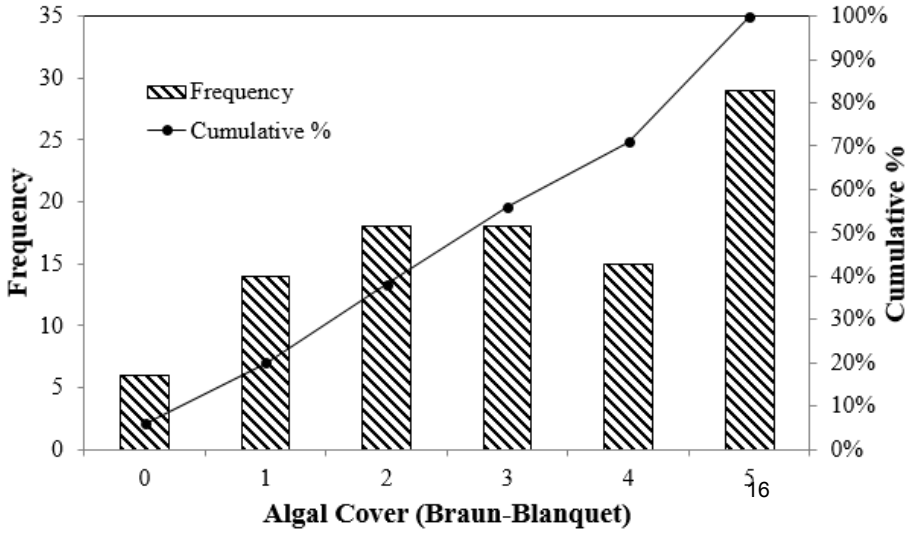




Vegetation Inventory – Distributions of Algae and SAV Cover

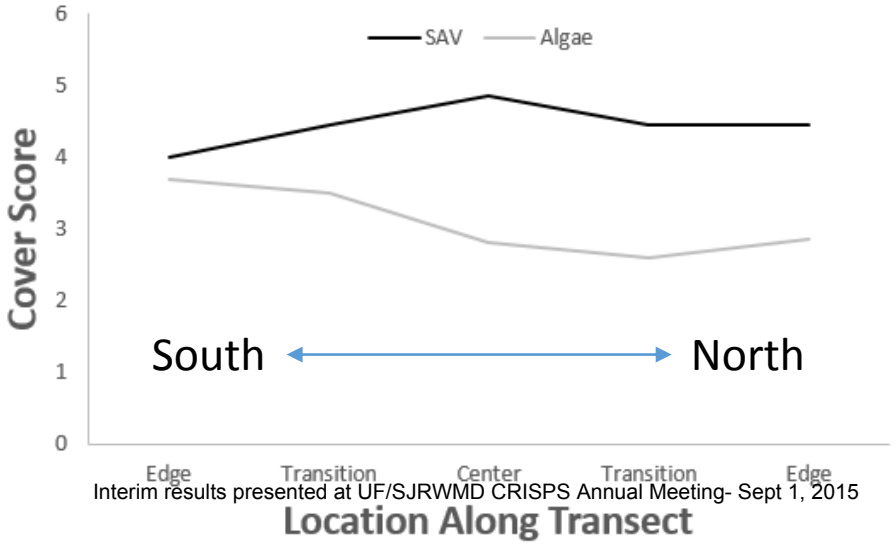
- Cover Classes
  - 0 = 0%
  - 1 = 0 - 5%
  - 2 = 5-25%
  - 3 = 25-50%
  - 4 = 50-75%
  - 5 = 75-100%

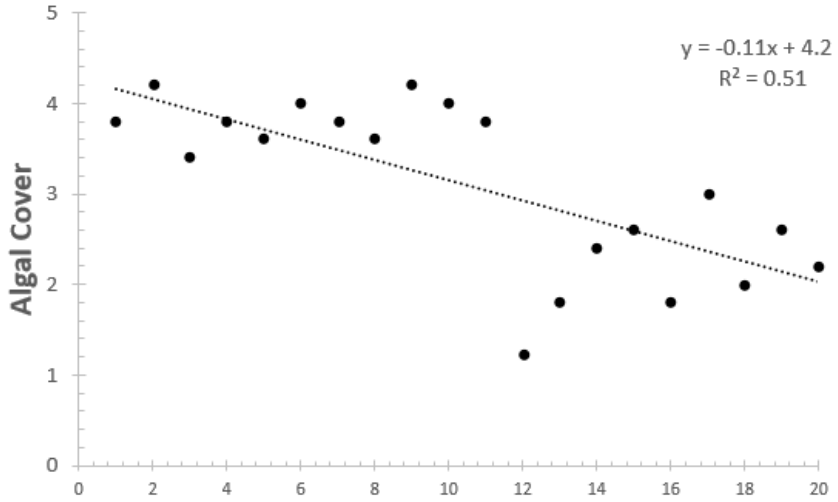


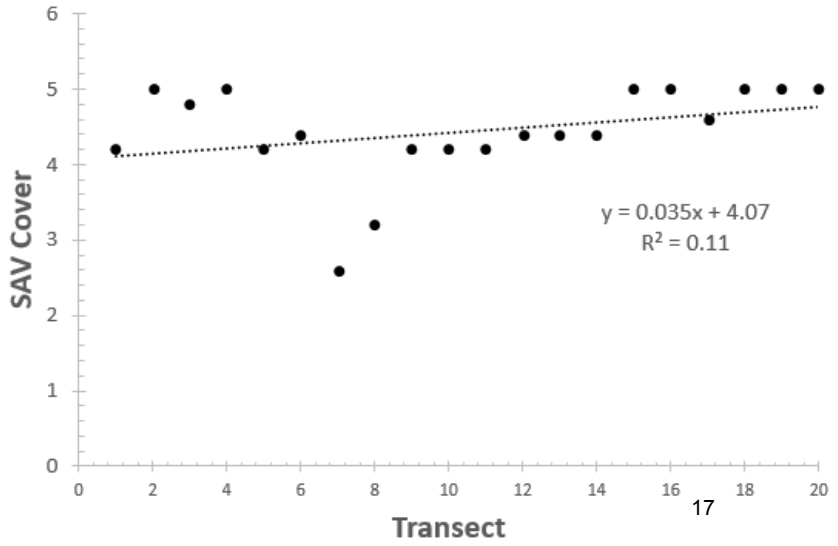


Vegetation Inventory – Spatial Cover Patterns

- Clear longitudinal pattern
- No lateral pattern

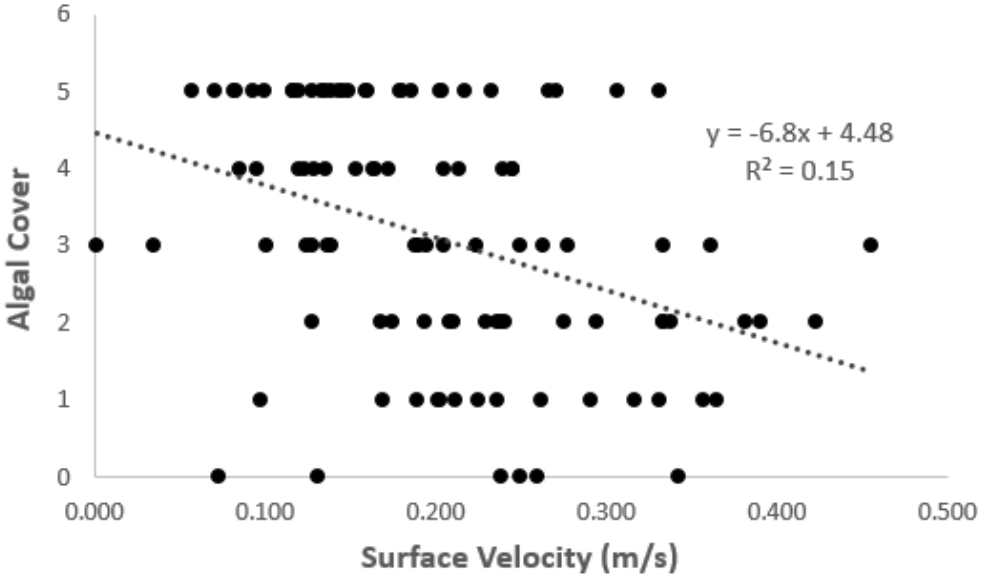


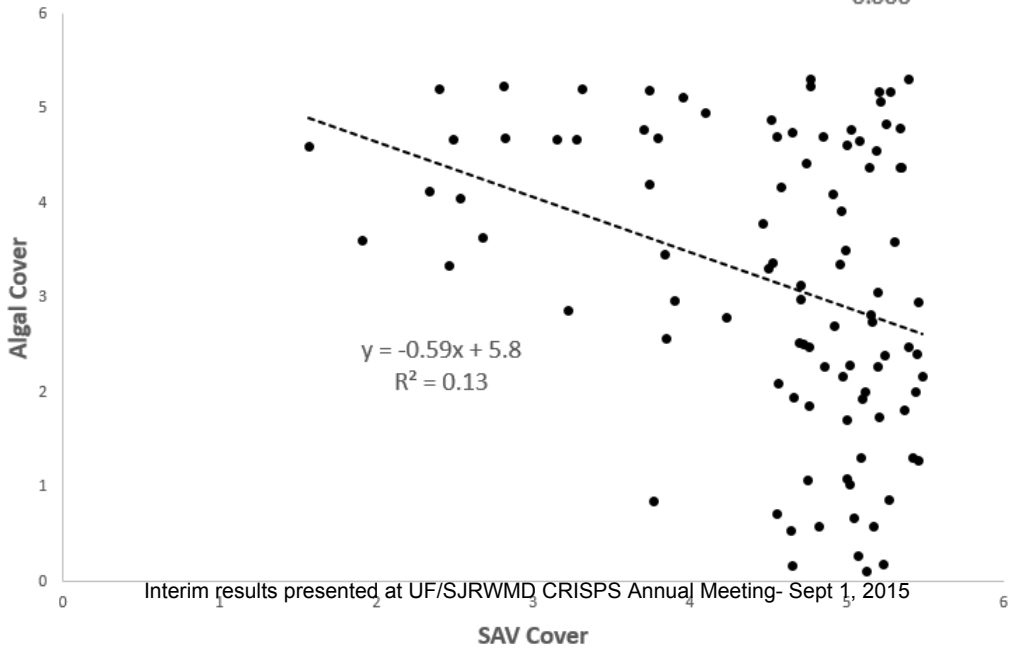




Vegetation Inventory – Controls on Algae

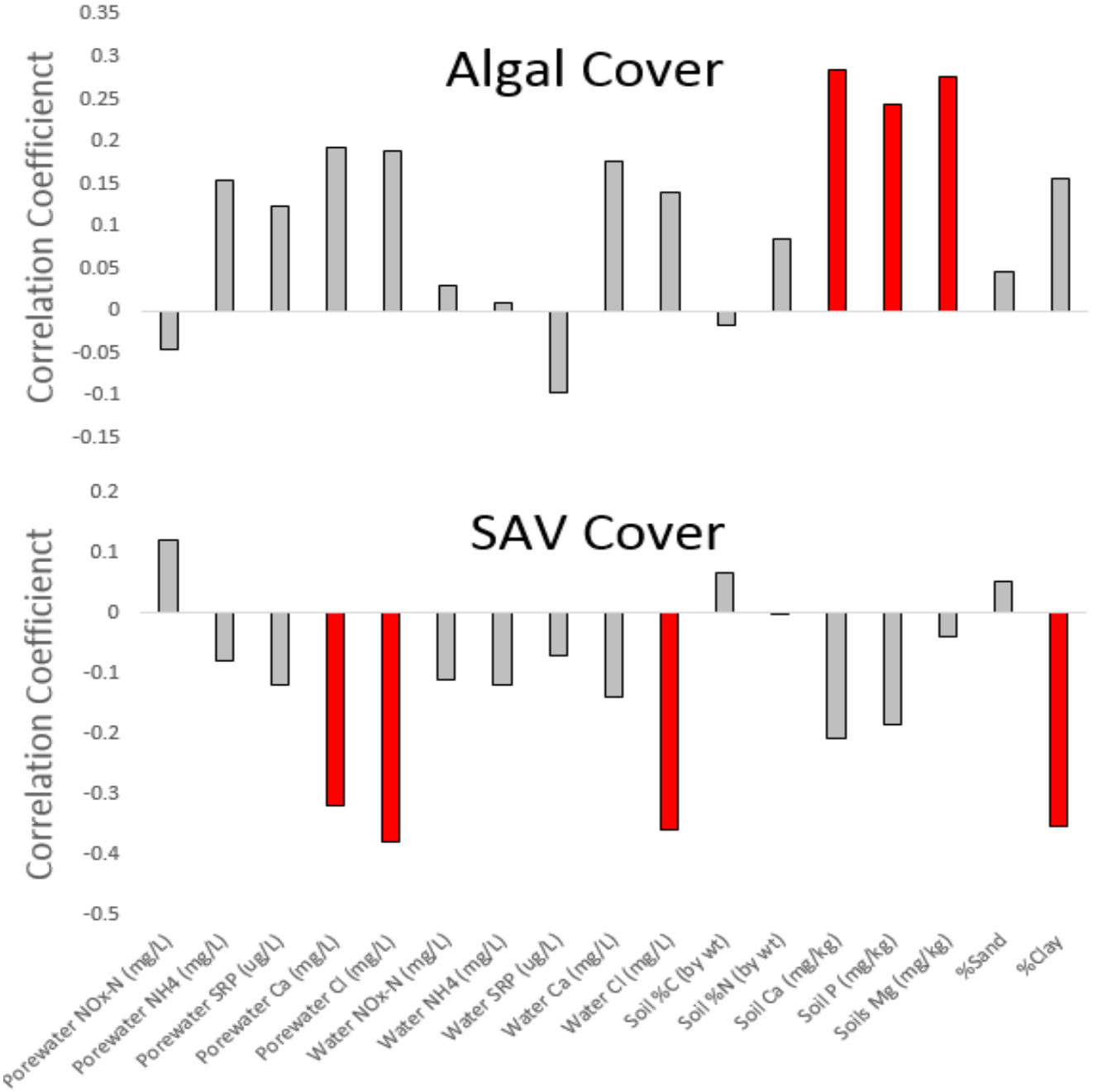
- Velocity





SAV

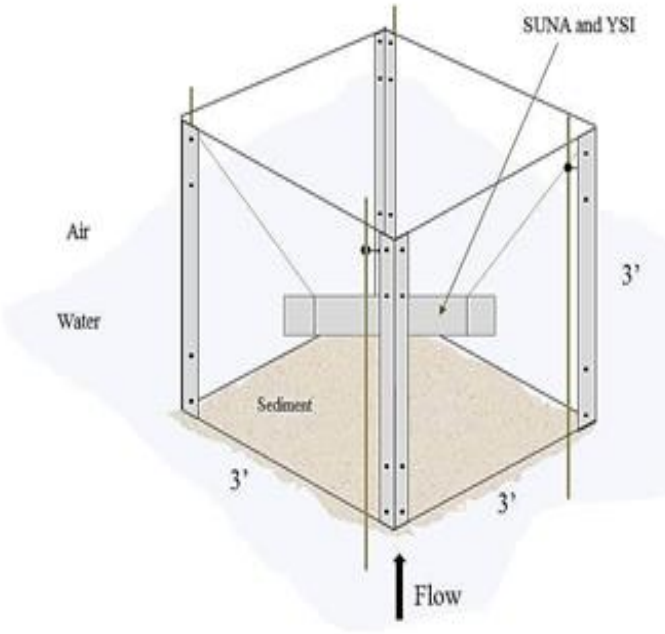
Vegetation Inventory – Controls on Algae & SAV

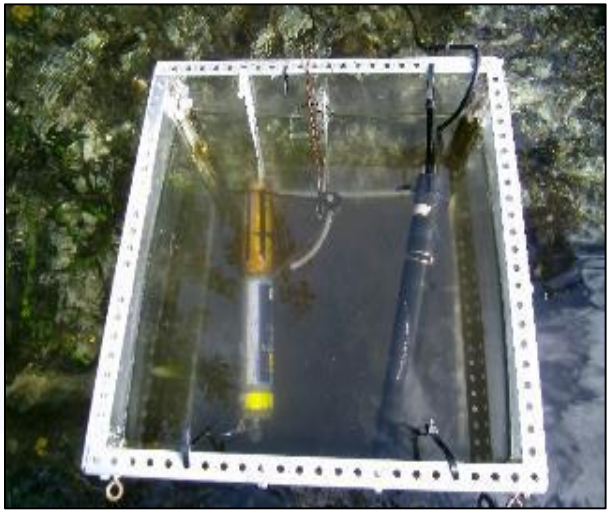


NOTE: Dissolved Fe was below detection at ALL locations

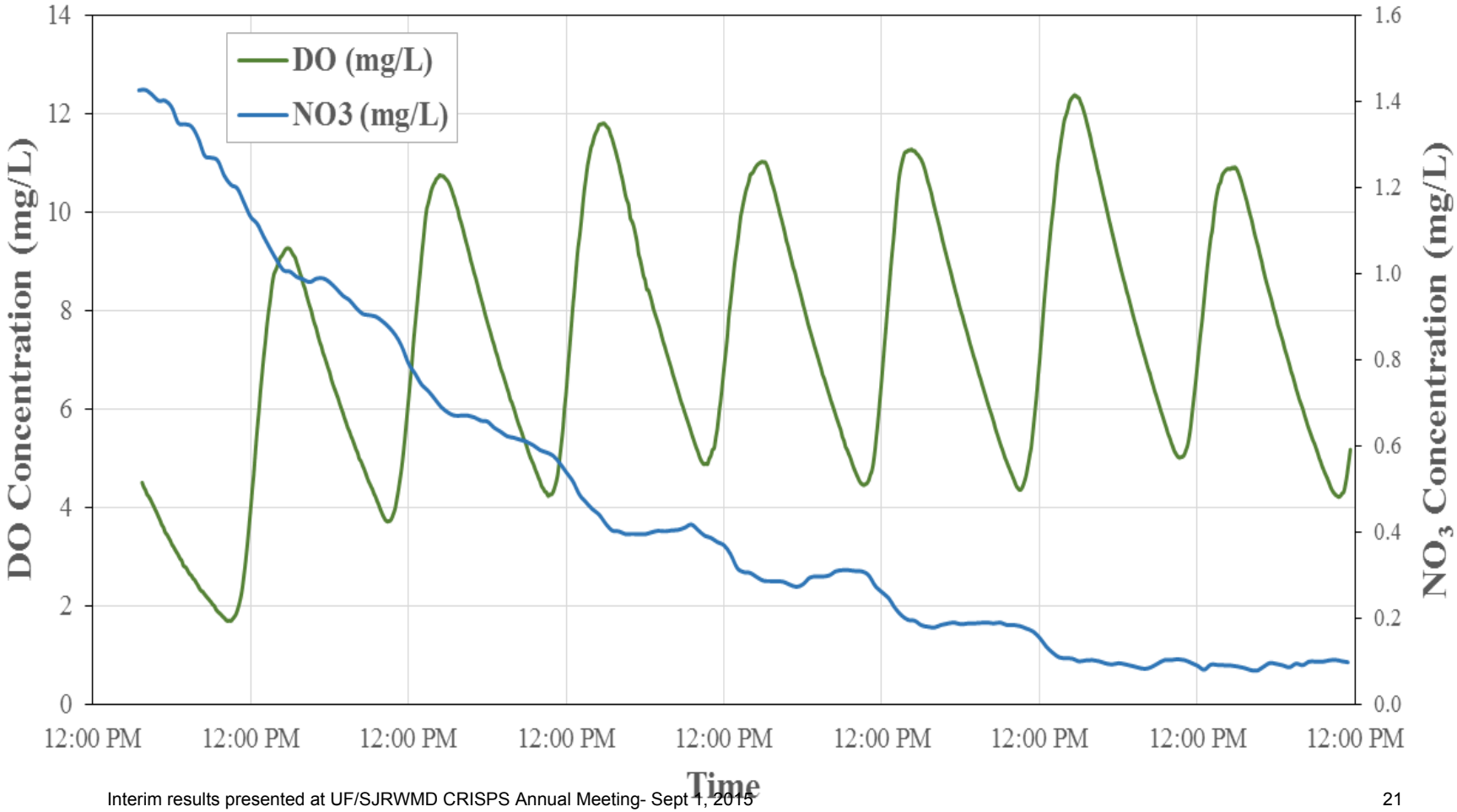
Element 3 – Nutrient Depletion and Enrichment Experiments

(see Sarah Power's and Courtney Reijo's poster)

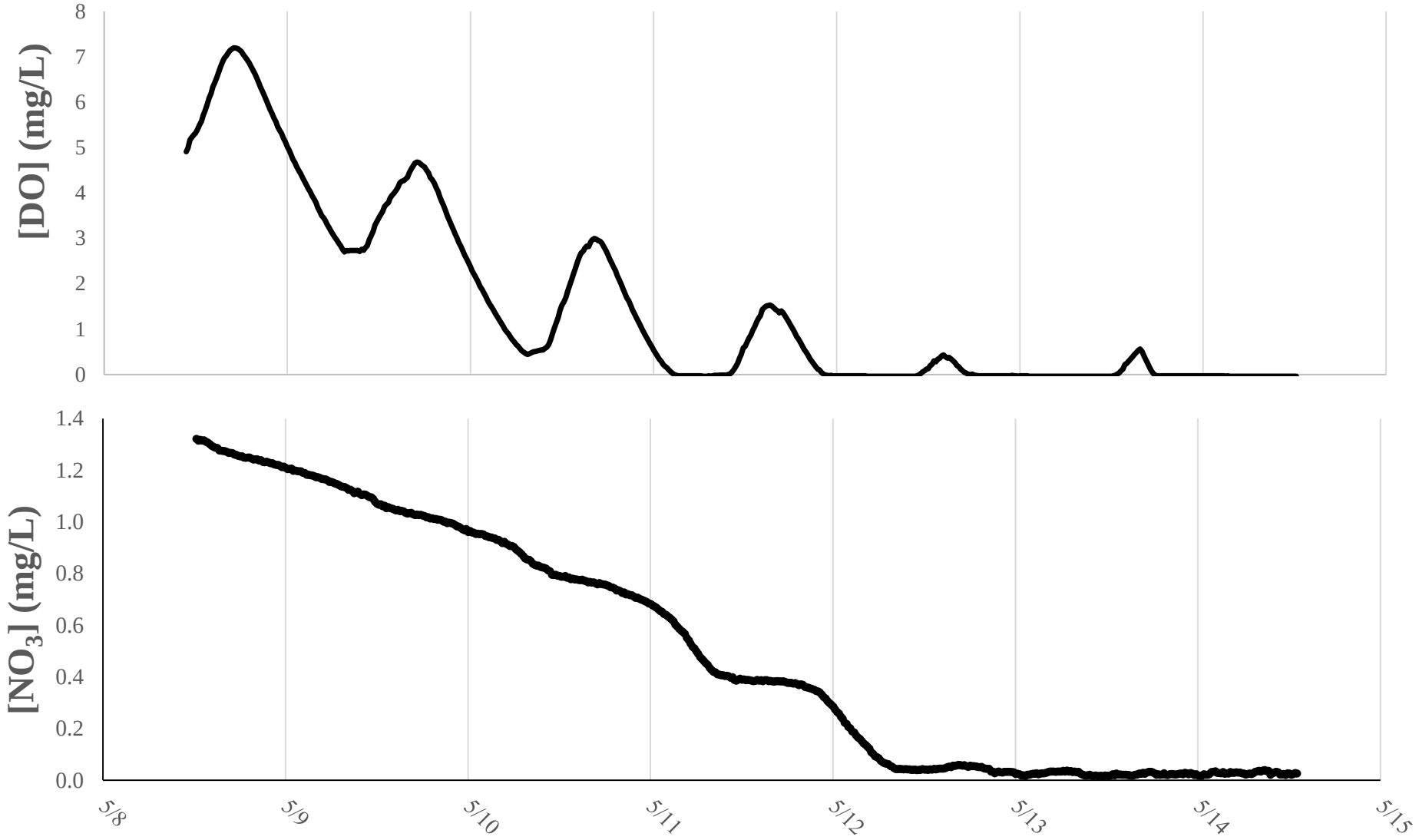




Nutrient and Metabolism Dynamics **Below** Ambient Concentration *(Open Box)*



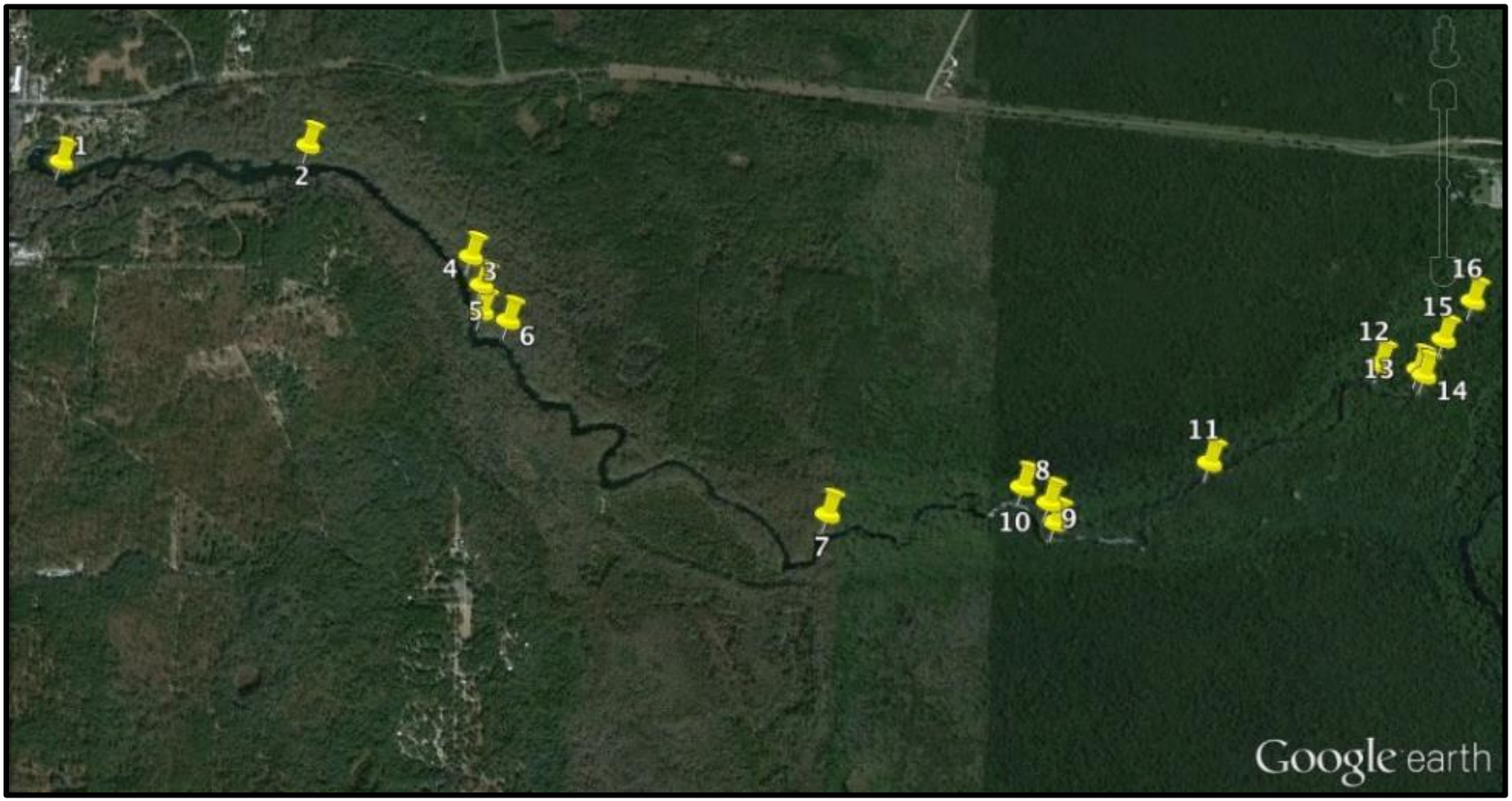
Benthic Box Time Series *(Closed Box)*



Ongoing Study – In Situ Nutrient Limitation Assay

- 4 Open Boxes (clustered)
- Weeklong box deployments
  - SAV, Algae, SAV+Algae strata
- Unamended Control vs. Factorial Nutrient Additions (+N, +P, +Fe)
- 6 replicates (n = 21 weeks, 4 complete)
- Oxygen metabolism
- Biomass, PAR, Pre vs. Post water chemistry
- Sensor-based nutrient dynamics in control boxes

Element 4 – *In Situ* SAV Growth

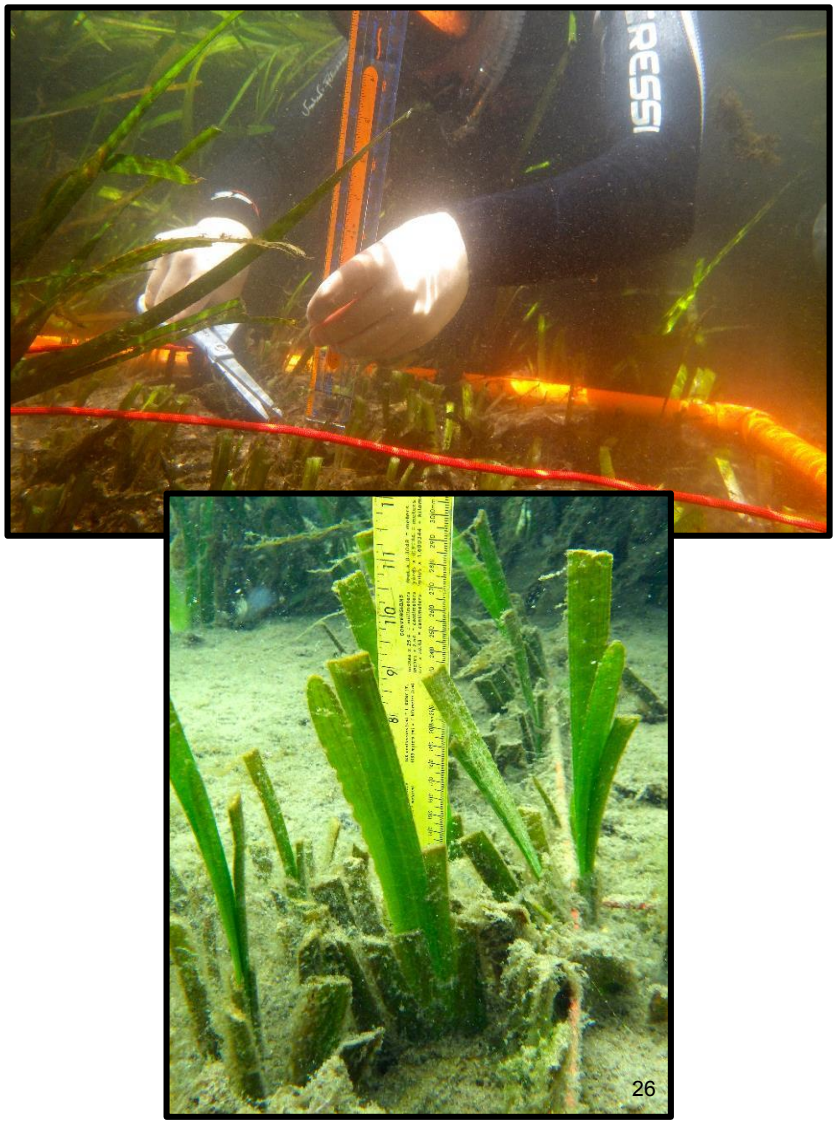


Site Selection – 16 Sites, 4 Strata

	Low	High
Algal Cover (Braun- Blanquet)	1-2	4-5
Velocity (m/s)	<0.10 m/s	>0.20 m/s
Canopy Cover (% open)	>50%	<30%
Organic Matter (%)	<15%	>25%

Measuring SAV Growth

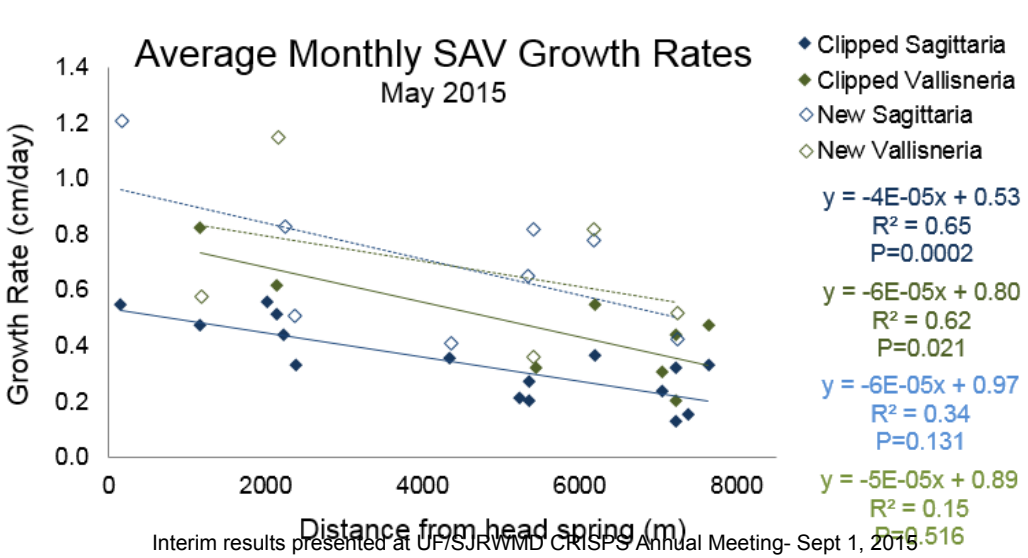
- Biomass accrual
  - 1 month re-clipping interval
  - 3 month re-clipping interval
  - 6 month re-clipping interval

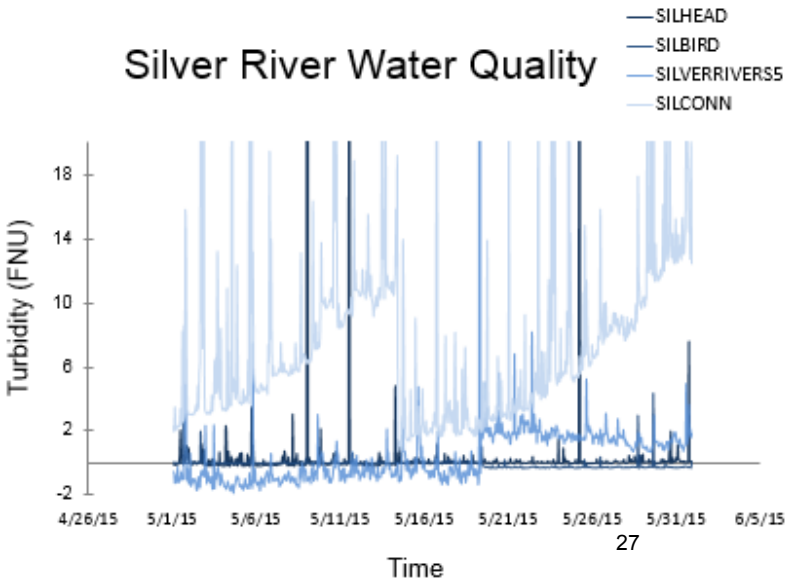


- Shoot elongation (bi-weekly)

Preliminary Results
(see Jenny McBride's Poster)

- Distance is strong predictor of growth rate
- Velocity and OM exert morphological controls
  - Shoot length:width ↑ (velocity) and ↓ (%OM)
- No evidence of algal cover effect






Questions?