

# QUANTIFYING MACROALGAE, SUBMERGED AQUATIC VEGETATION, AND FLOW IN FOUR FLORIDA SPRING-FED RIVERS

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<sup>1</sup>WATER & AIR RESEARCH, GAINESVILLE, FL, USA

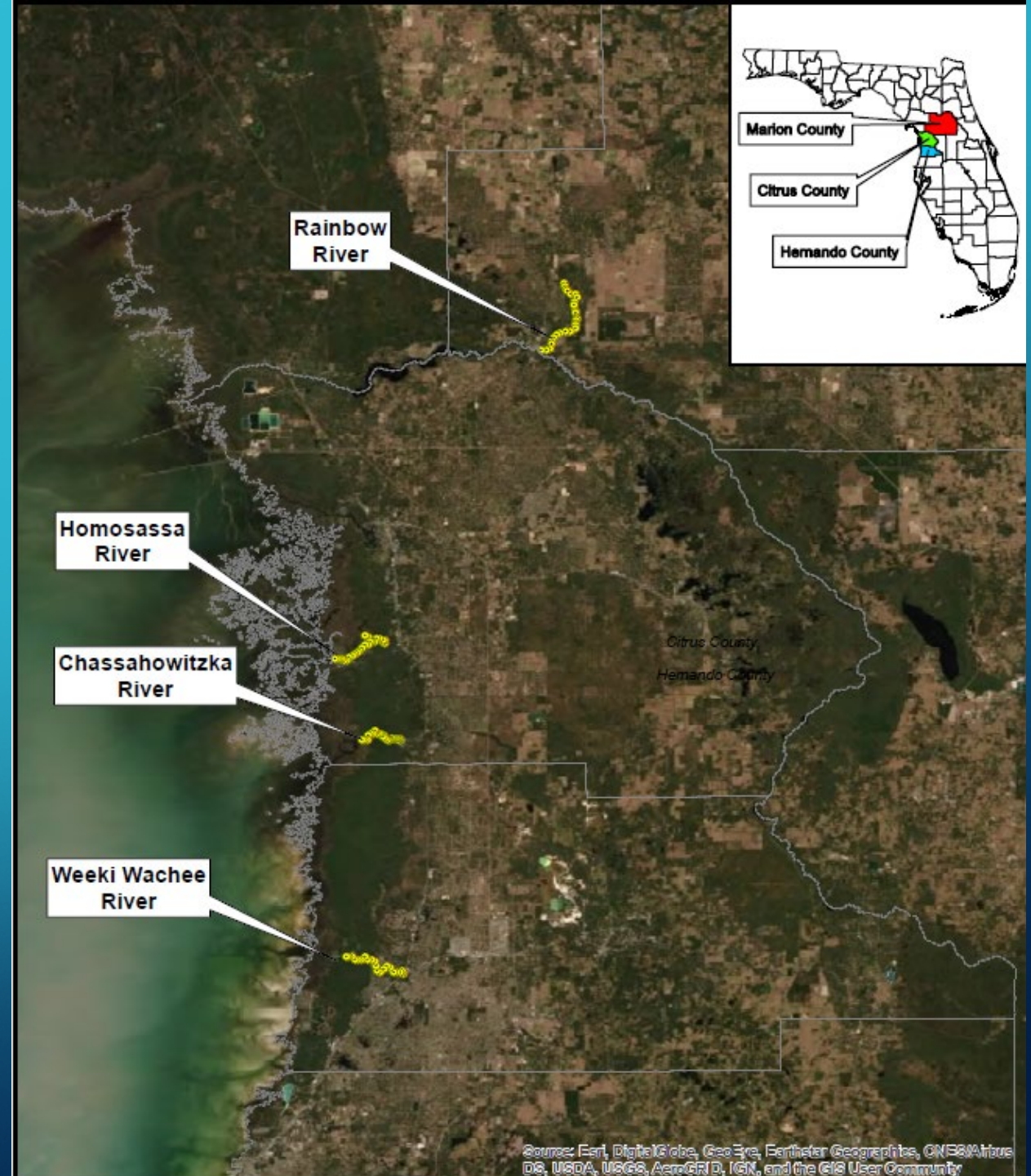
<sup>2</sup>SWFWMD, BROOKSVILLE, FL USA



# SUBMERGED AQUATIC VEGETATION (SAV)

- vascular plants and a moss
- macrophytic algae (both filamentous and complex)
- Limiting Factors:
  - light
  - salinity
  - water velocity
    - substrate type
  - nutrients (N and P)
  - biotic interactions

- Water & Air Research, Inc. sampled SAV and abiotic factors for SWFWMD
- Spring-fed rivers- all 1<sup>st</sup> magnitude
- Homosassa, Chassahowitzka, and Weeki Wachee all flow into the Gulf of Mexico
- Rainbow flows into the Withlacoochee



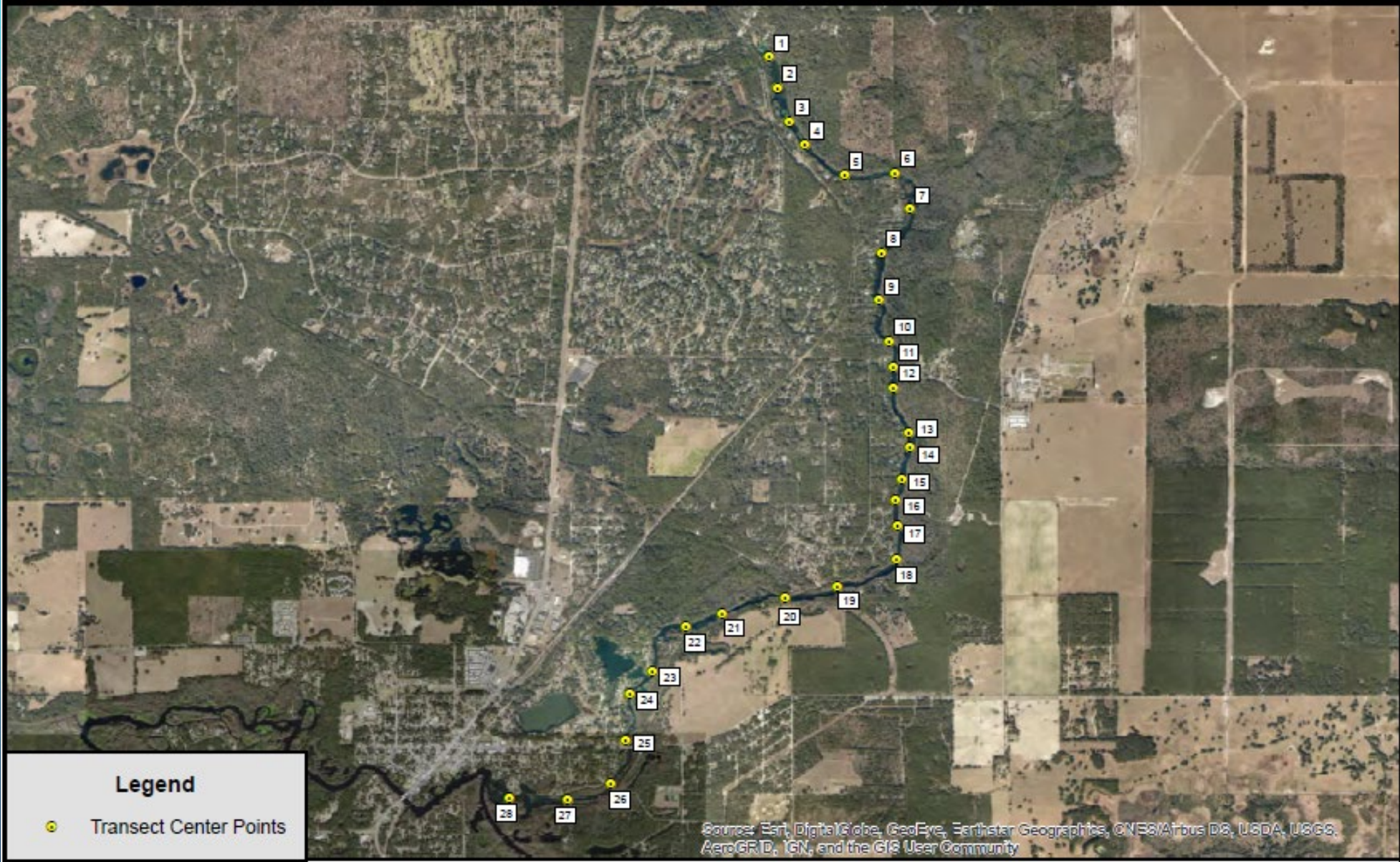
# Chassahowitzka – 25 transects



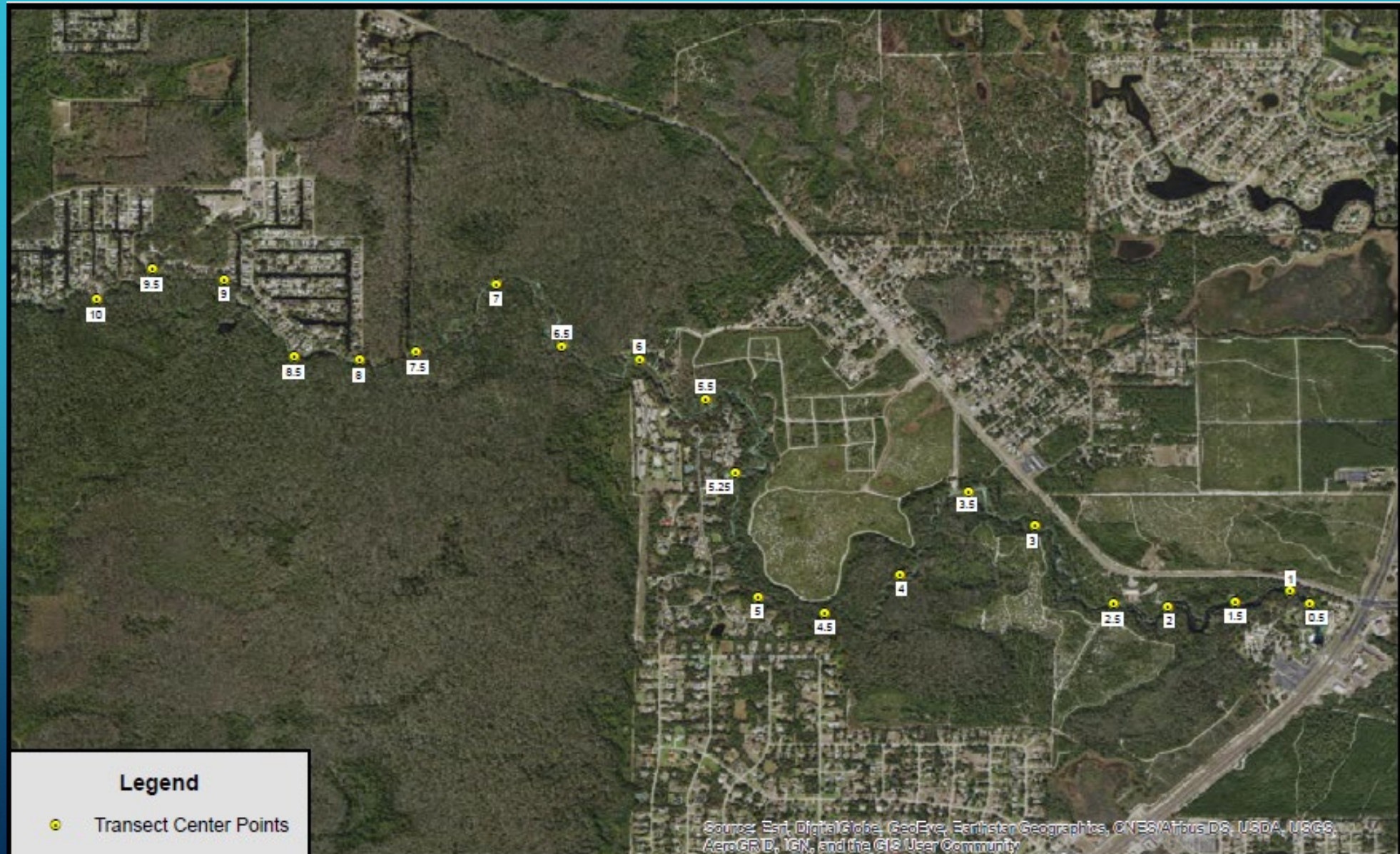
# Homosassa – 26 transects



# Rainbow River – 28 transects



# Weeki Wachee – 21 transects



# Methods

- established transects w/ sub-meter GPS
- 5 stations per transect
- 0.5 x 0.5 m quadrats\*
  - cover
  - biomass
  - substrate type
  - tree canopy cover
- photo & video
  - GPS-paired full motion
- water velocity (Hach FH950)
- water quality
- Survey 123 for ArcGIS

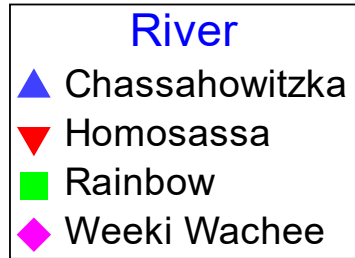
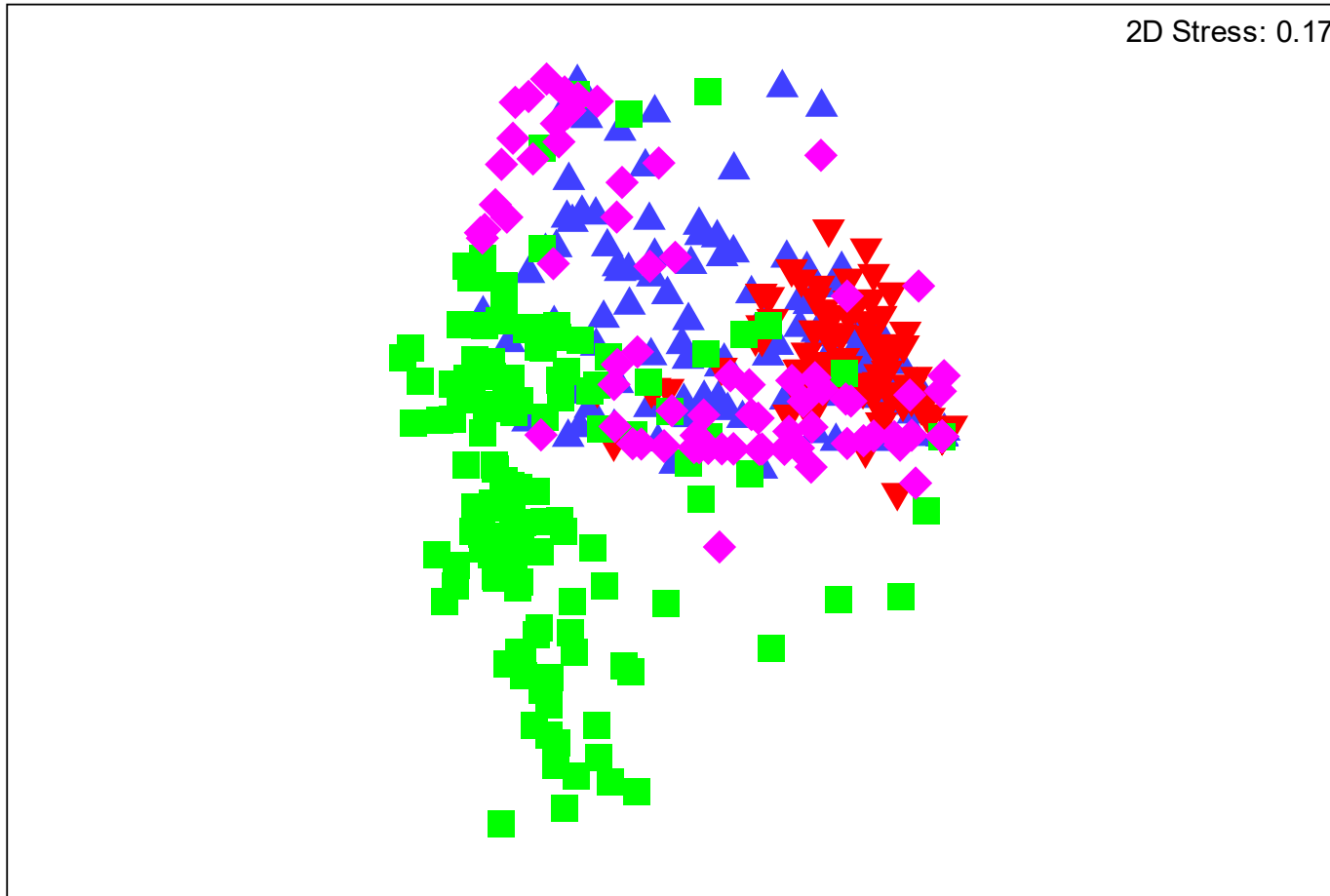




*Biomass by Taxon, All Rivers*  
*Non-metric MDS on Station Data*

Transform: Square root  
Resemblance: S17 Bray-Curtis similarity (+d)

2D Stress: 0.17

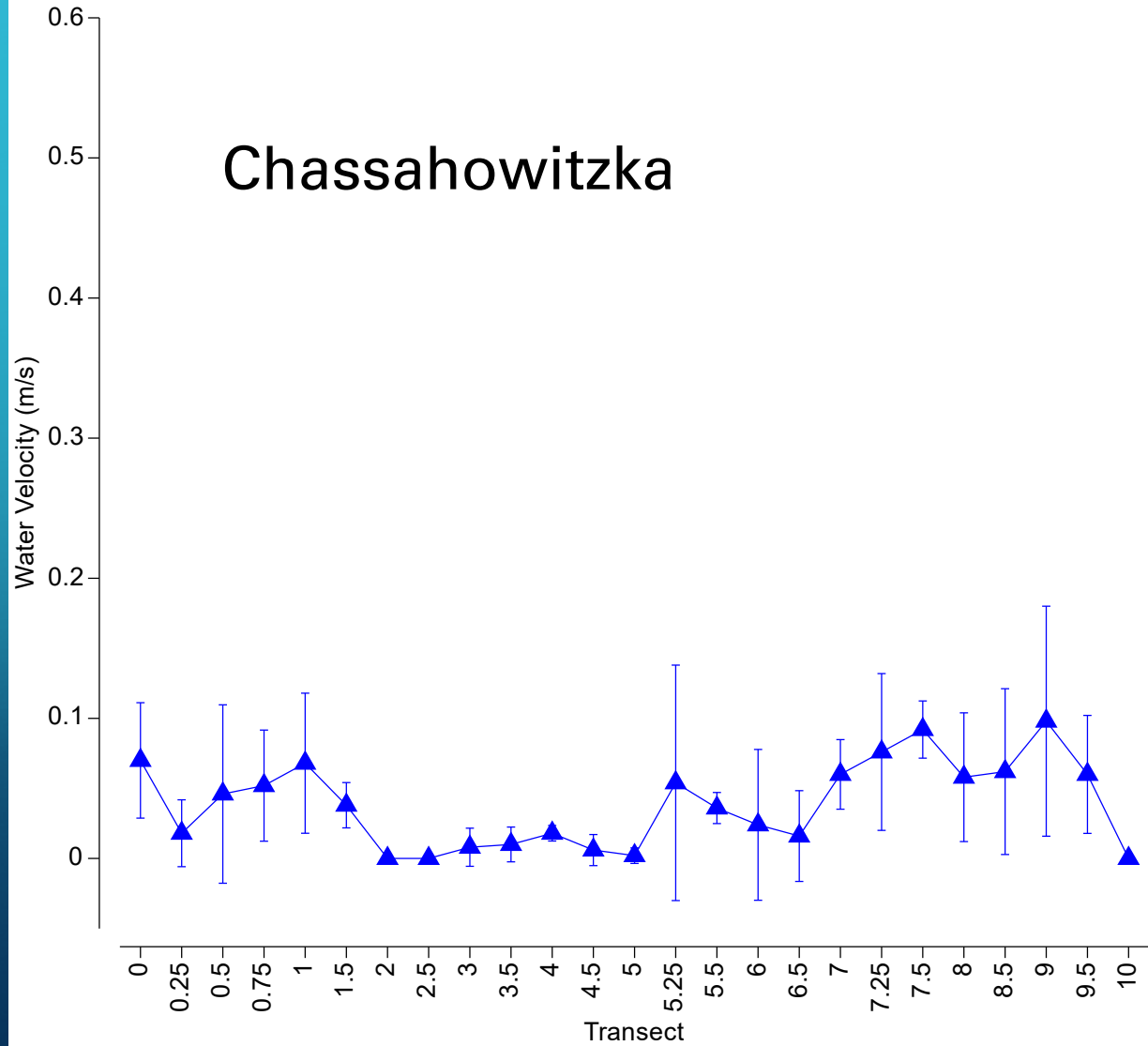


## ANOSIM RESULTS (PRIMER 7)

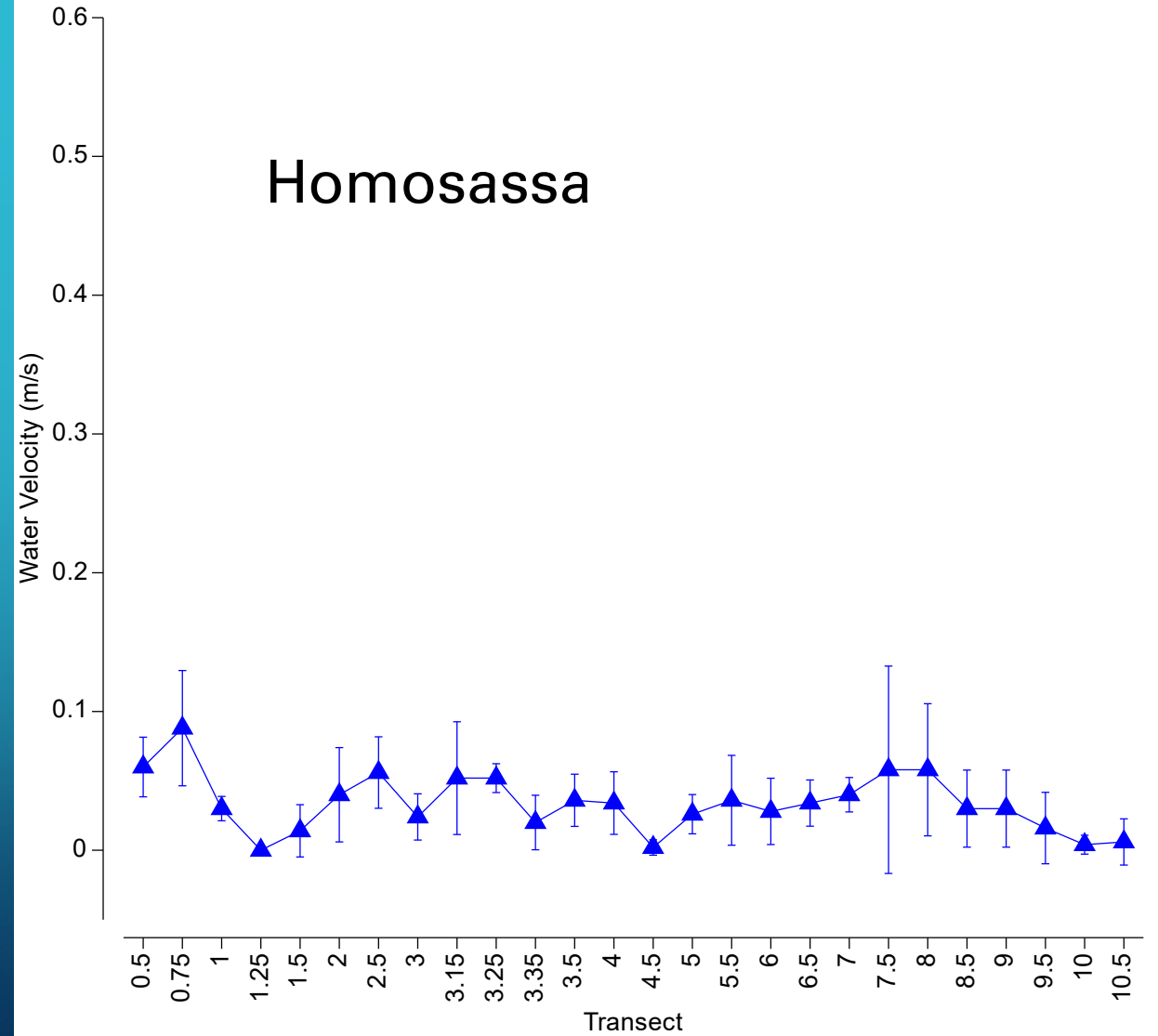
Comparison	R Statistic	<i>p</i> -value
Chassahowitzka, Homosassa	0.173	0.0001
Chassahowitzka, Rainbow	0.335	0.0001
Chassahowitzka, Weeki Wachee	0.074	0.0001
Homosassa, Rainbow	0.586	0.0001
Homosassa, Weeki Wachee	0.203	0.0001
Rainbow, Weeki Wachee	0.339	0.0001

# WATER VELOCITY RESULTS

## Chassahowitzka

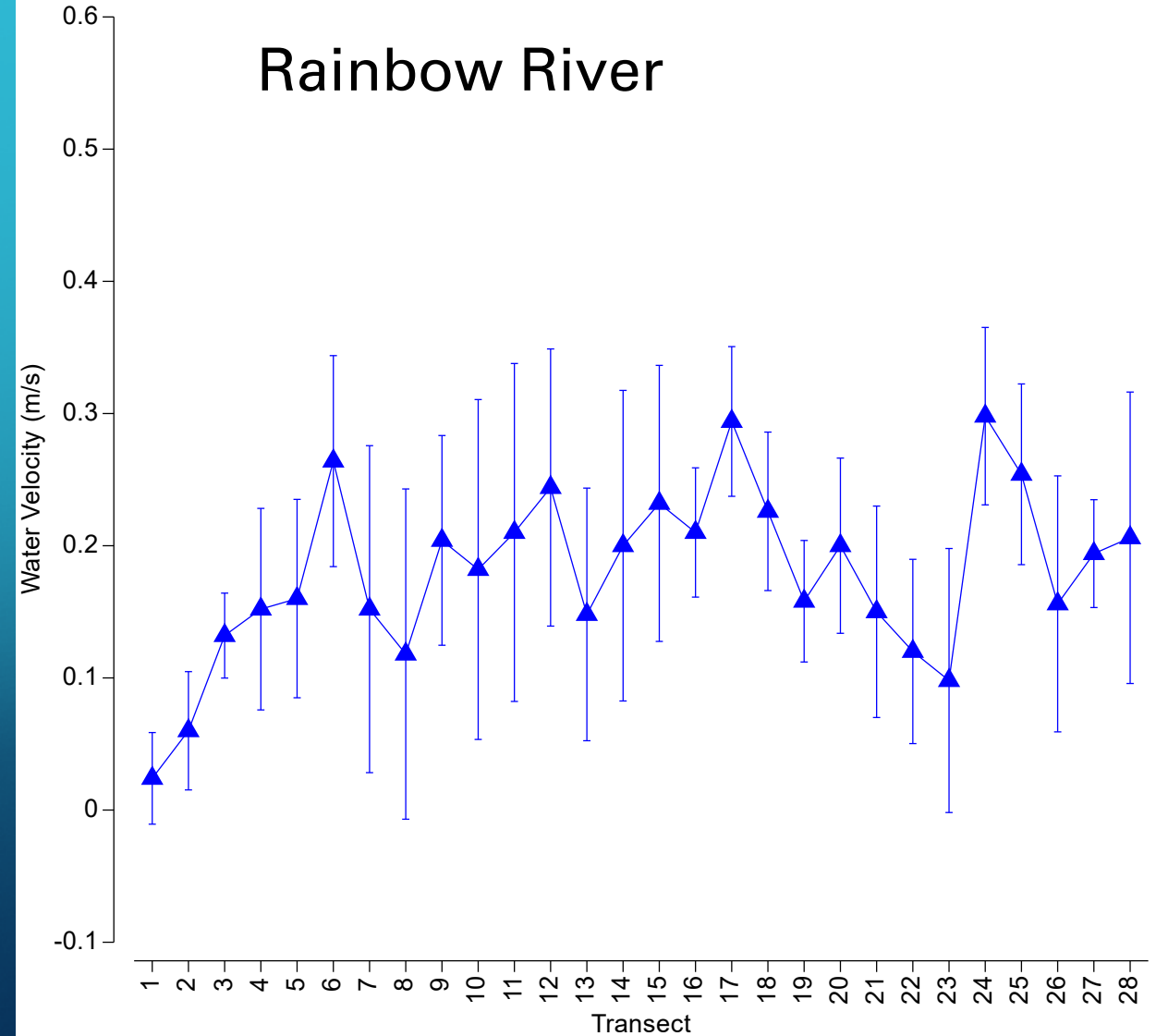


## Homosassa

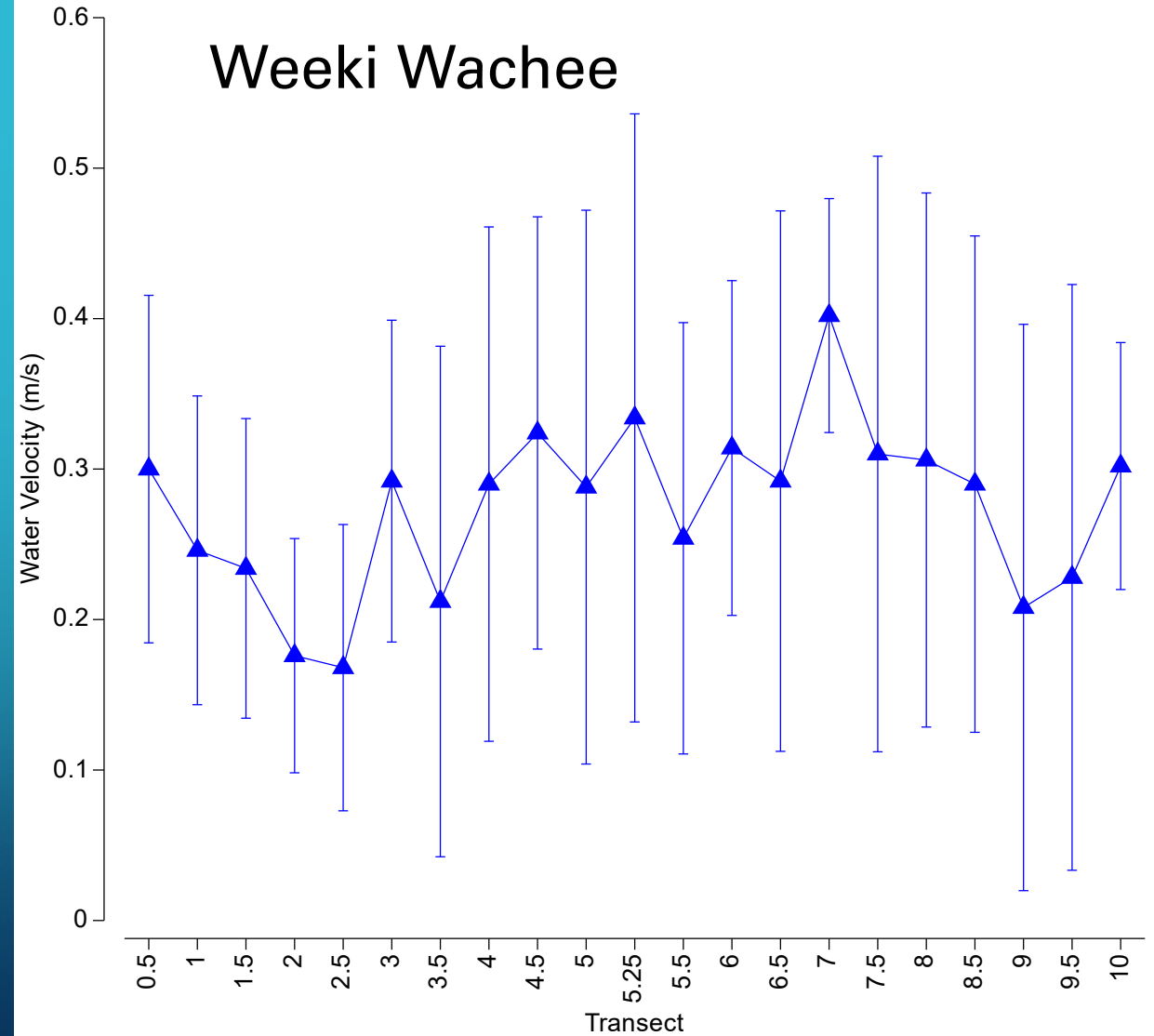


# WATER VELOCITY RESULTS

## Rainbow River

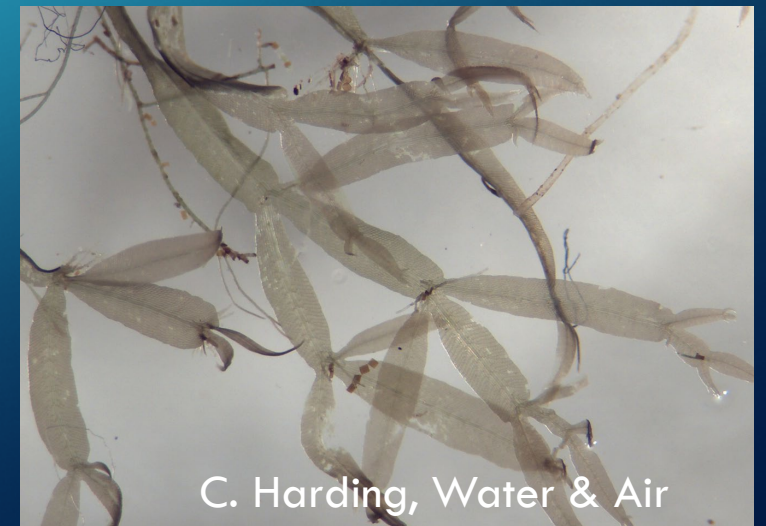
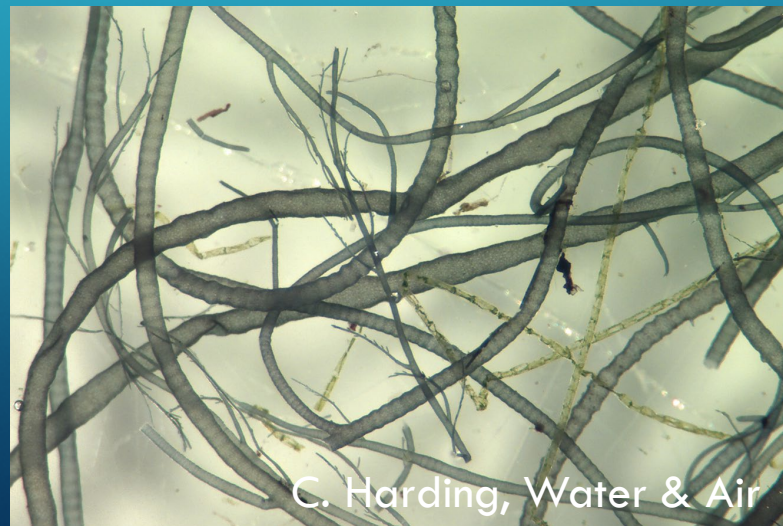


## Weeki Wachee



# SAV FINDINGS (SUMMER 2019)

- vascular plants: 13 taxa
- moss: *Fontinalis* spp.
- complex macrophytic green algae: *Chara* spp. (stonewort)
- filamentous green algae
- filamentous cyanobacteria
- red seaweeds: *Gracilaria*, *Compsopogon*, *Caloglossa*



# VASCULAR SAV TAXA (SUMMER 2019)

*Cabomba caroliniana*

*Ceratophyllum demersum*

*Hydrilla verticillata*

*Ludwigia repens*

*Myriophyllum heterophyllum*

*Myriophyllum spicatum*

*Najas guadalupensis*

*Potamogeton pusillus*

*Sagittaria kurziana*

*Stuckenia pectinata*

*Utricularia* sp.

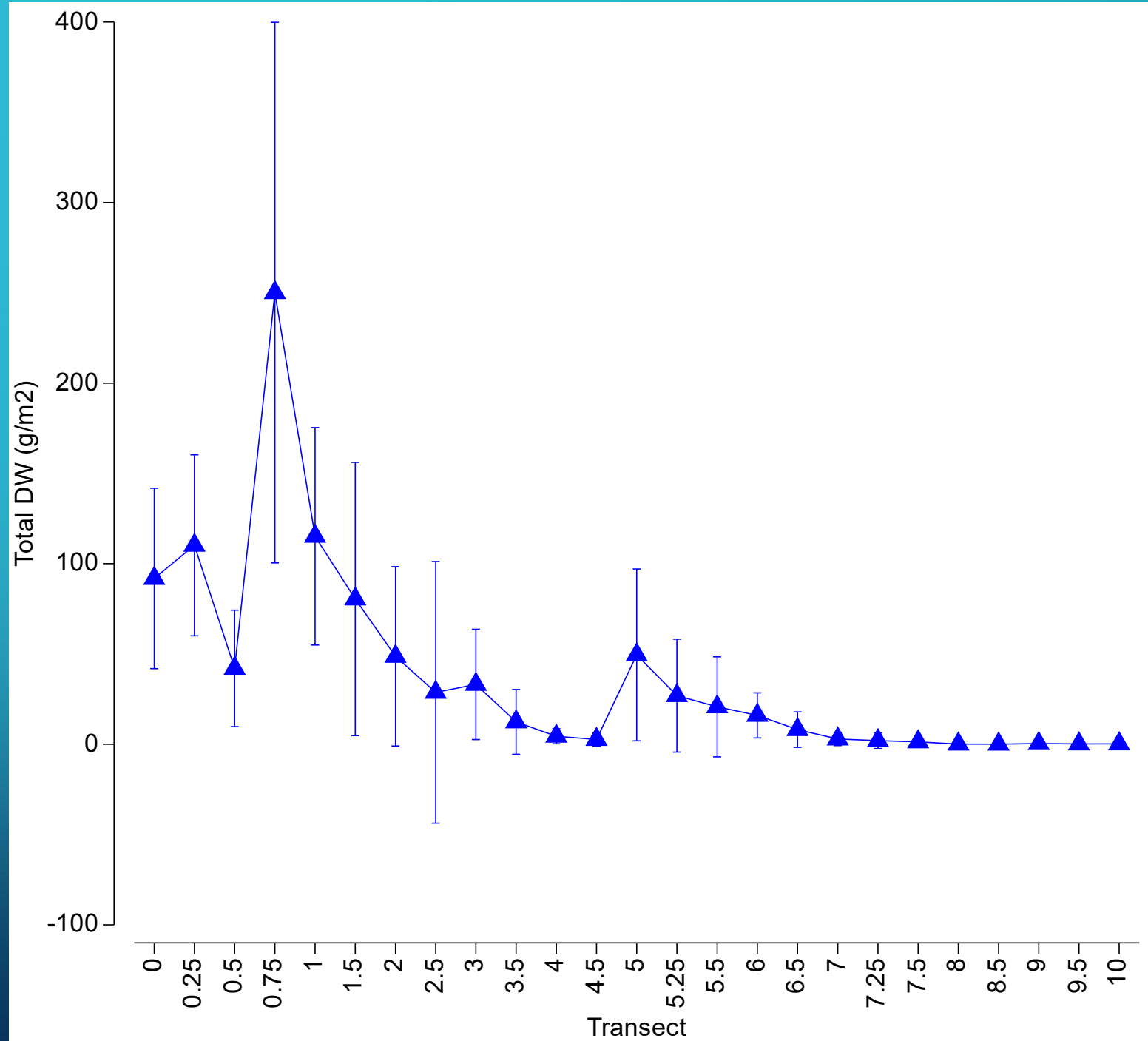
*Vallisneria americana*

# Chassahowitzka

total dry weight

upstream to downstream

August 2019

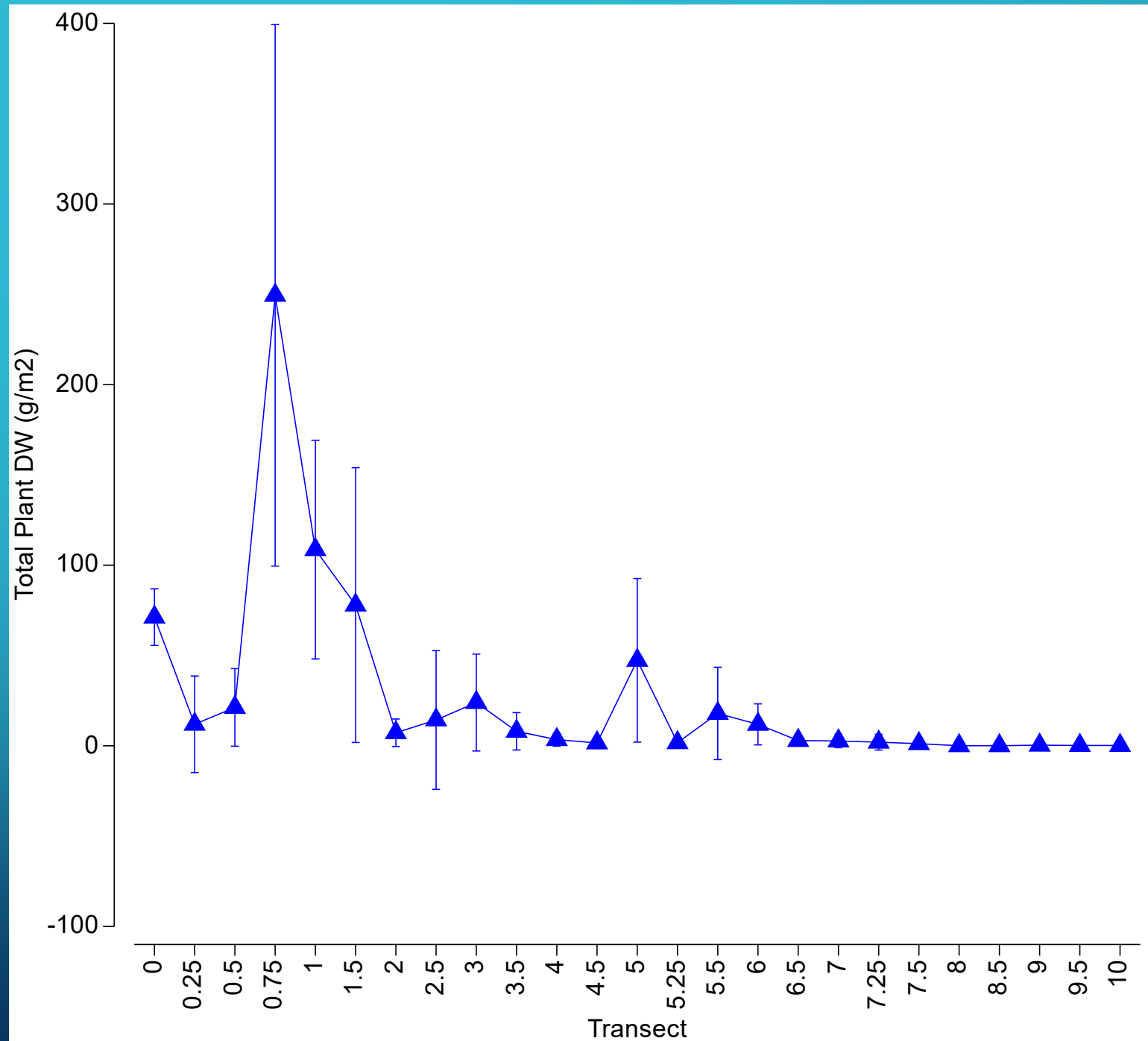


# Chassahowitzka

vascular plants & moss

upstream to downstream

August 2019



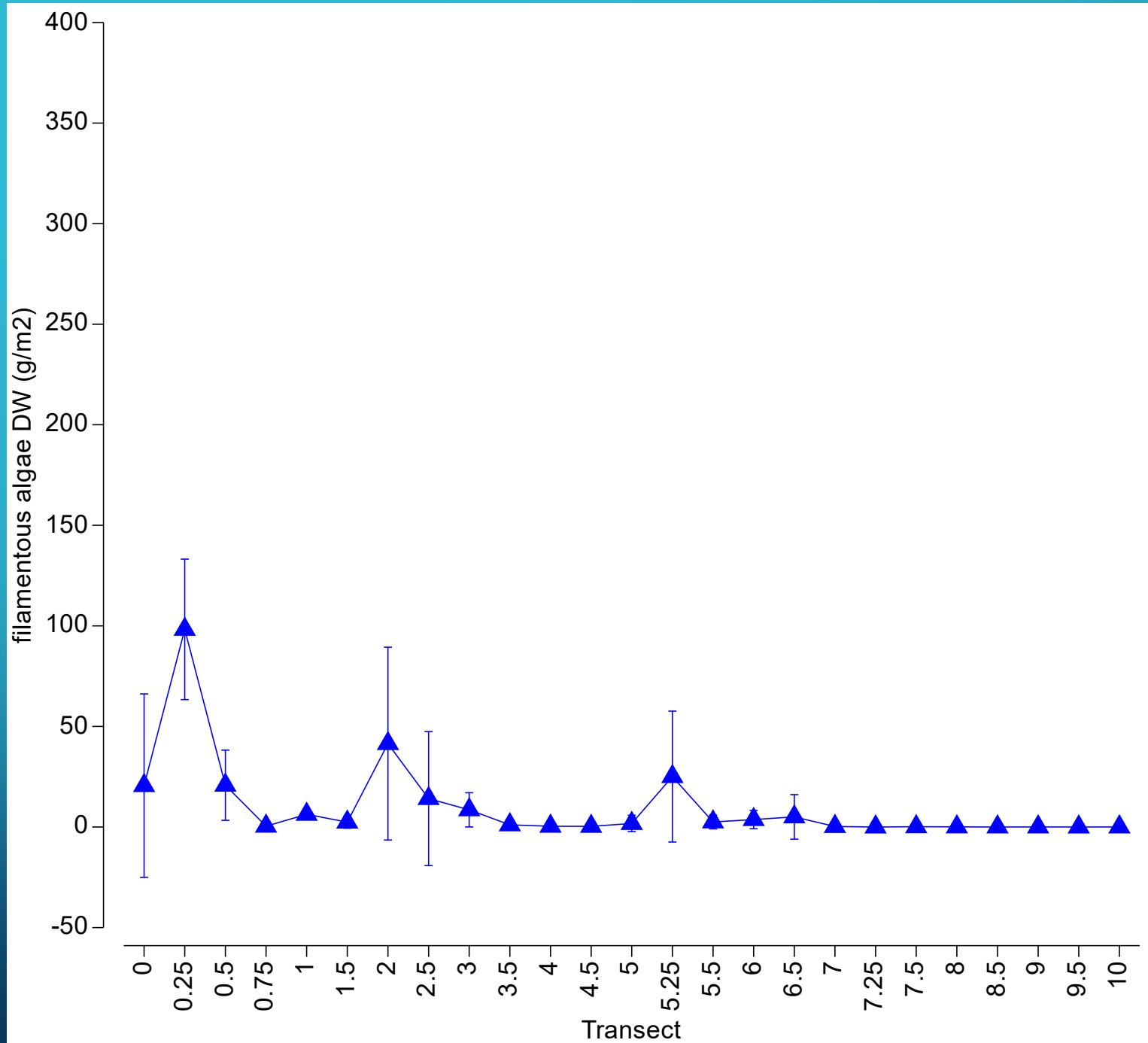


# Chassahowitzka

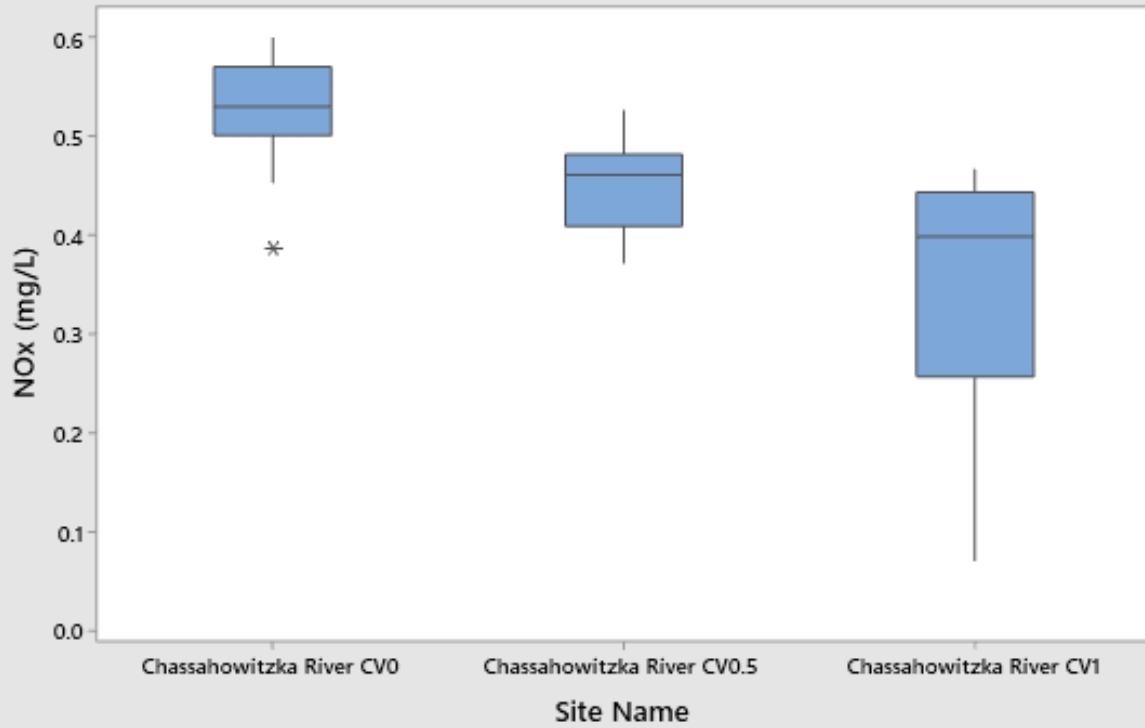
filamentous algae

upstream to downstream

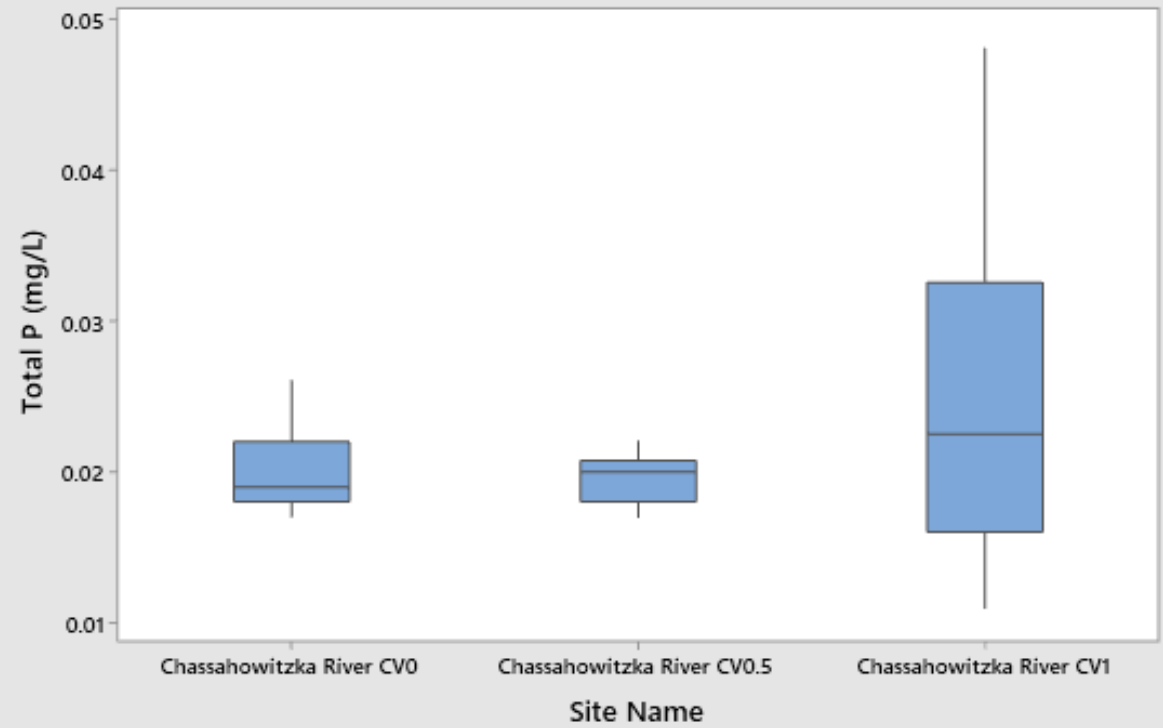
August 2019



Boxplot of NOx (mg/L)



Boxplot of Total P (mg/L)



Chassahowitzka

SWFWMD

upstream to downstream in study area

monthly data

2018 - 2020



# Chassahowitzka



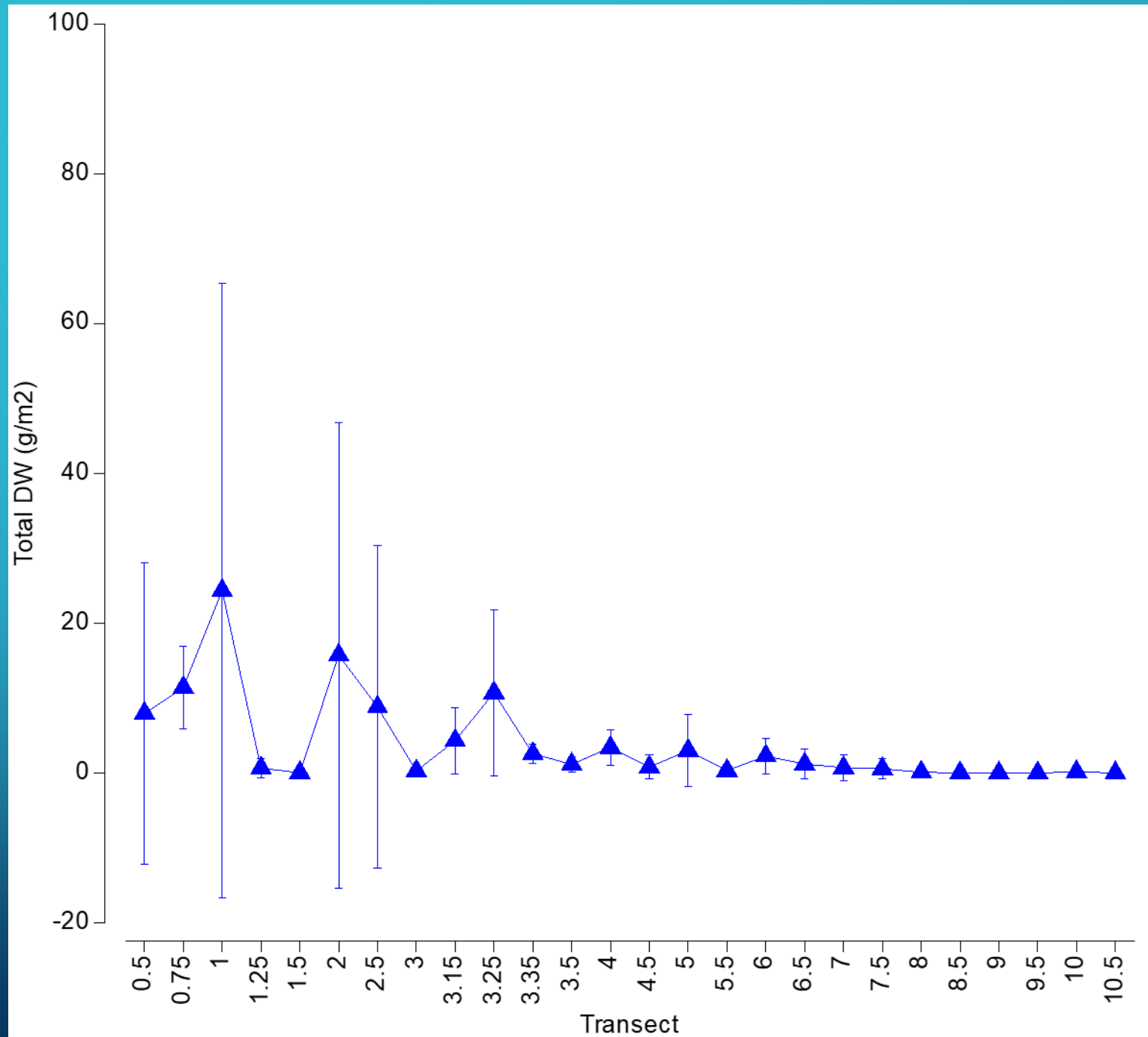
- most diverse
- some marine influence
- moderate level of vegetation
- most vegetation in upper third of study area

# Homosassa

total dry weight

upstream to downstream

August 2019

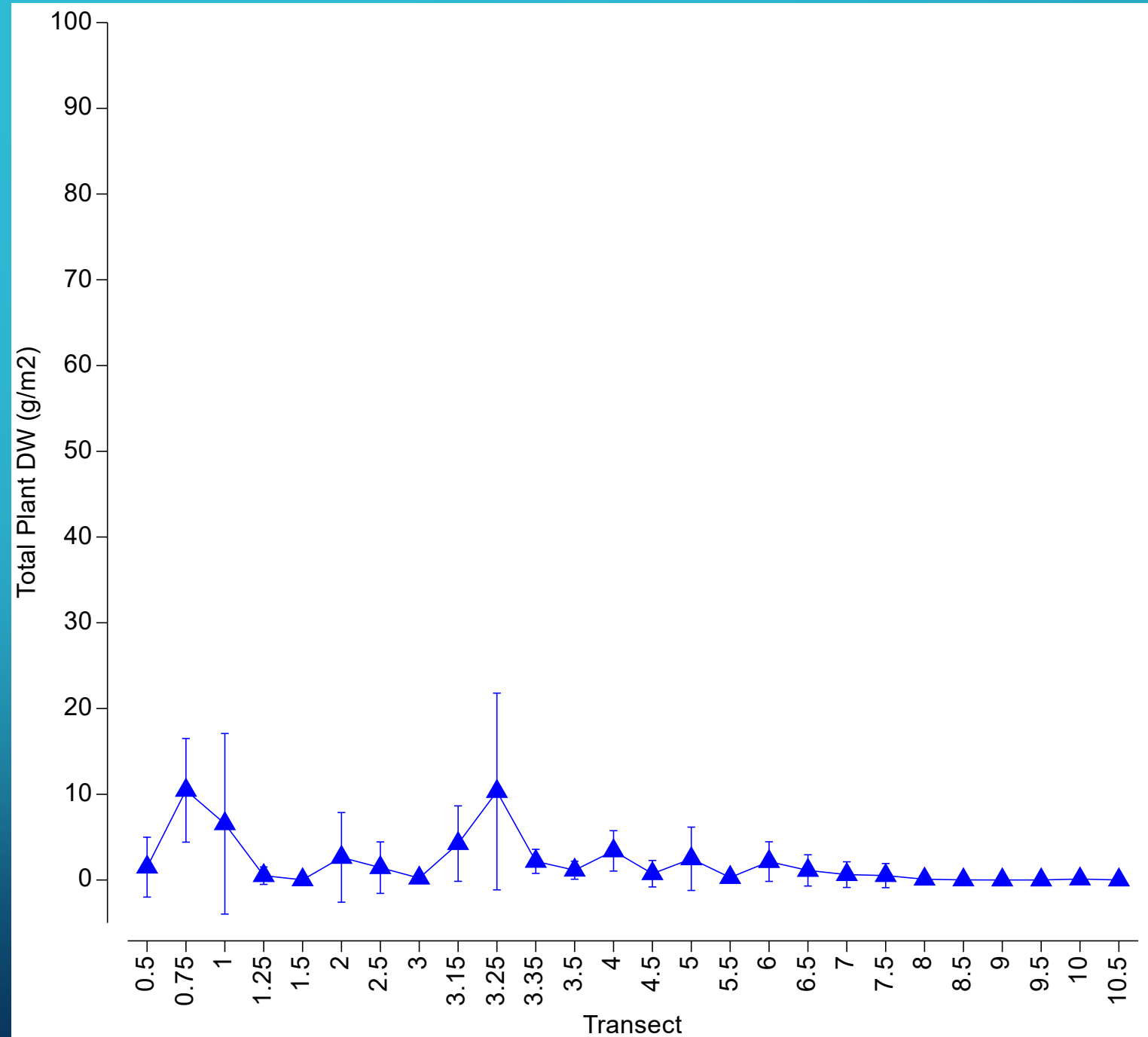


# Homosassa

vascular plants & moss

upstream to downstream

August 2019

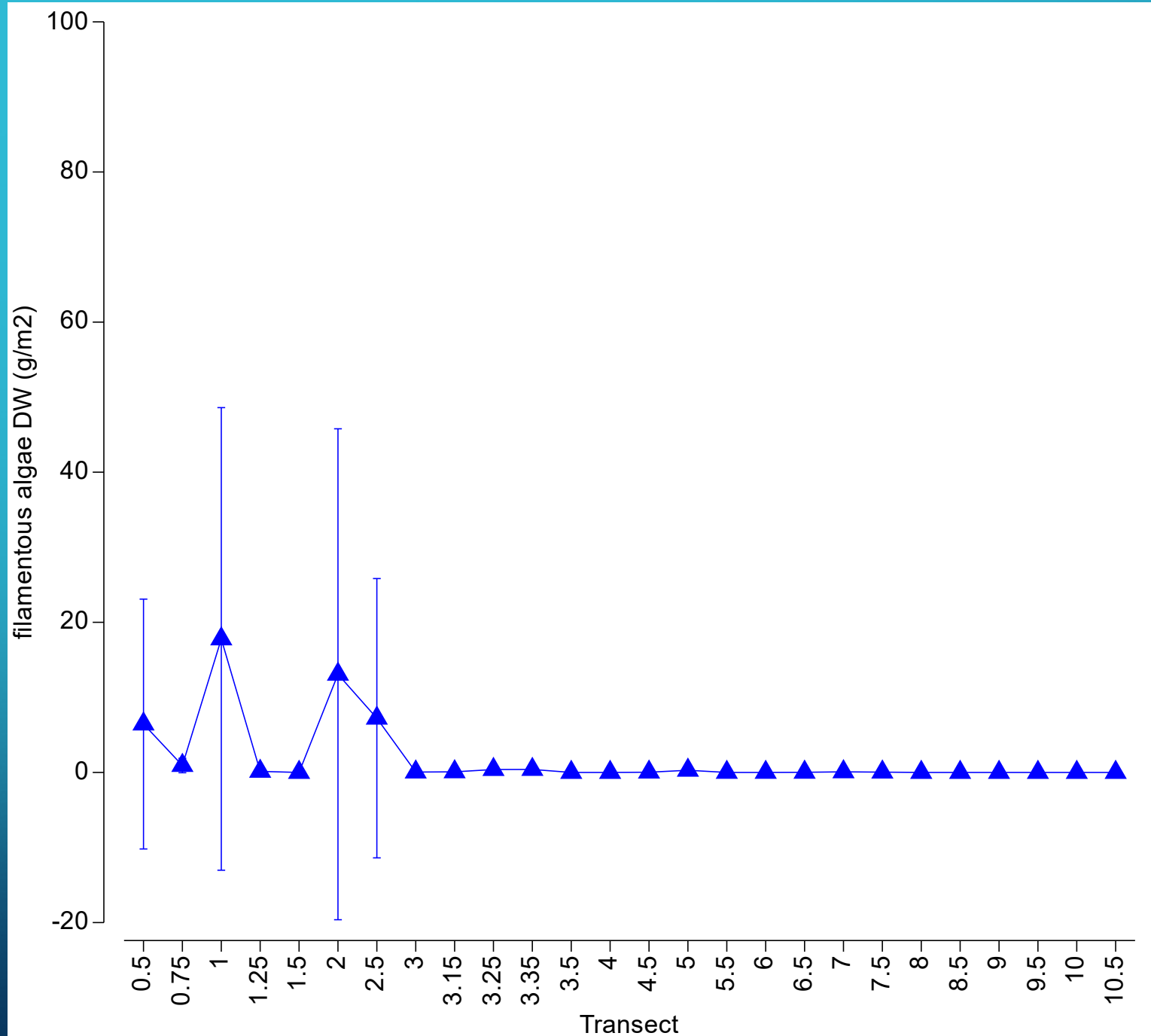


# Homosassa

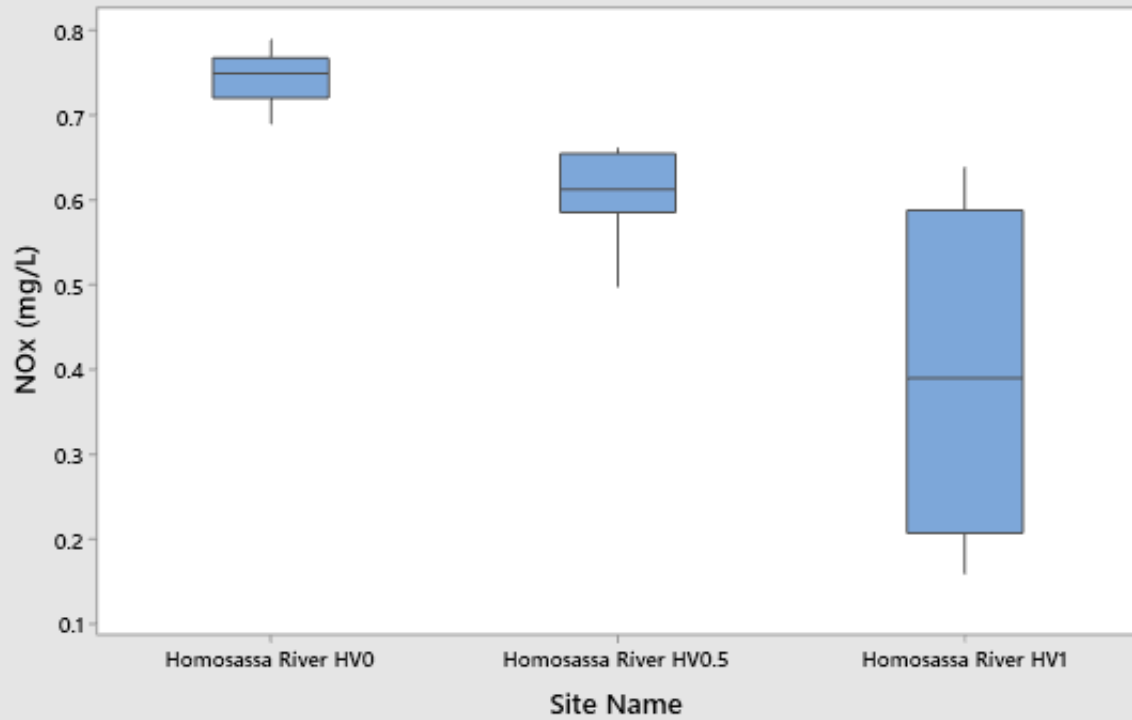
filamentous algae

upstream to downstream

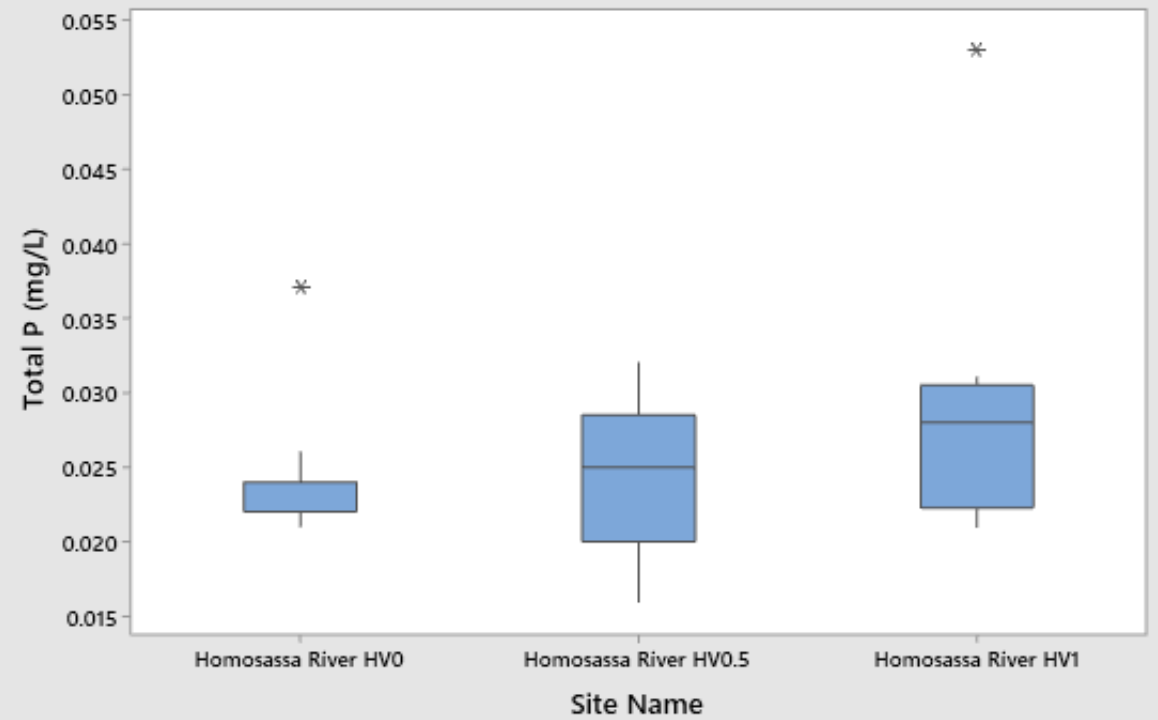
August 2019



Boxplot of NOx (mg/L)



Boxplot of Total P (mg/L)



Homosassa

SWFWMD

upstream to downstream in study area

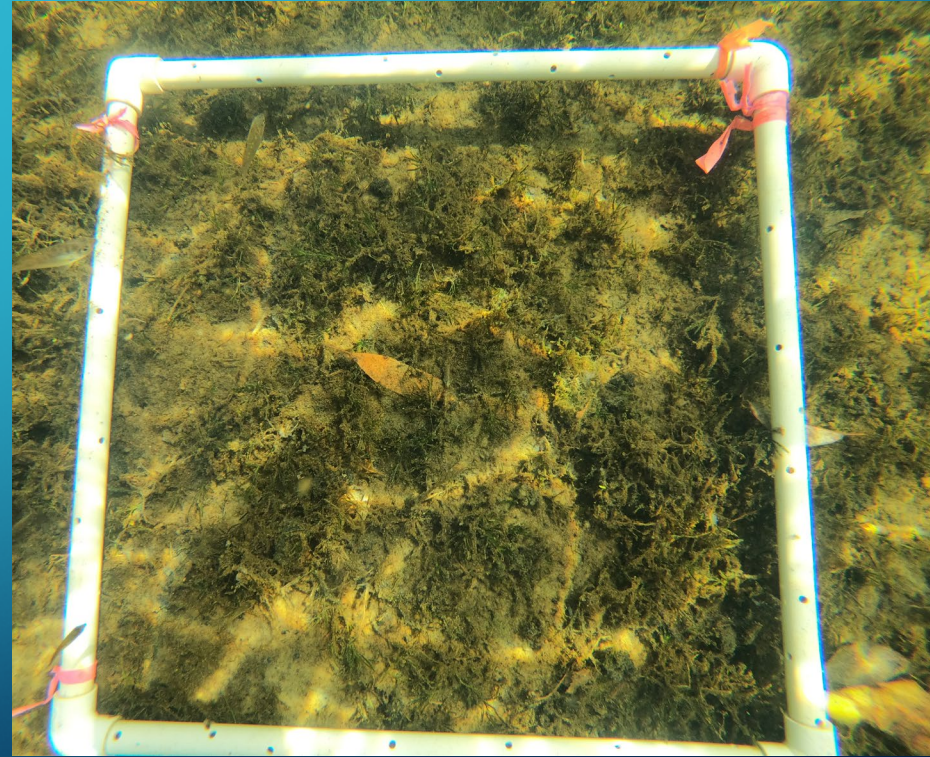
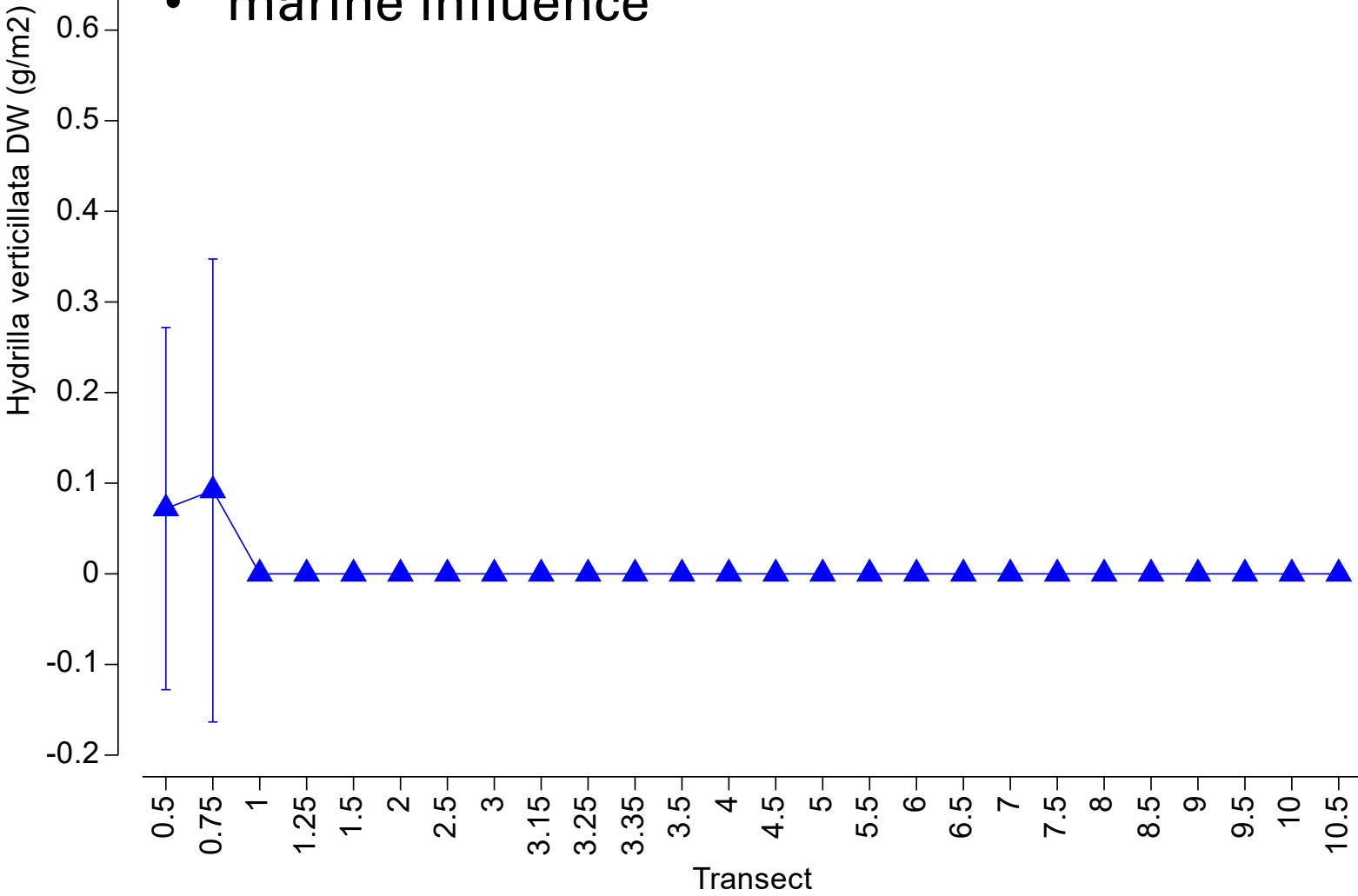
monthly data

2018 - 2020



# Homosassa

- least vegetated
- 3<sup>rd</sup> in taxa richness
- upstream third has the most biomass
- marine influence





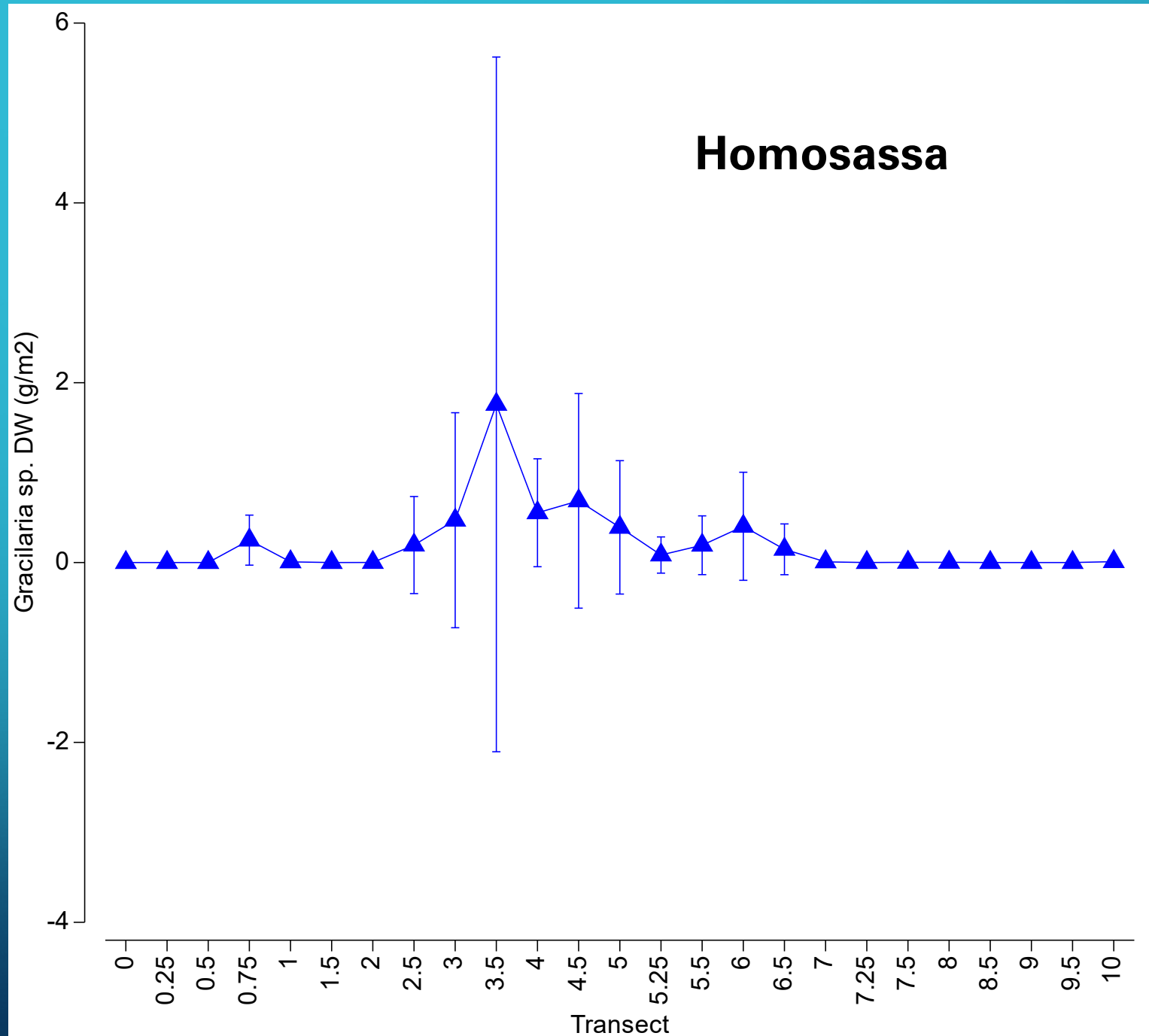
*Gracilaria* sp.

occurred mid-way of study area

same pattern in the Chassahowitzka

2.5 ppt

Hoyer et al. 2004

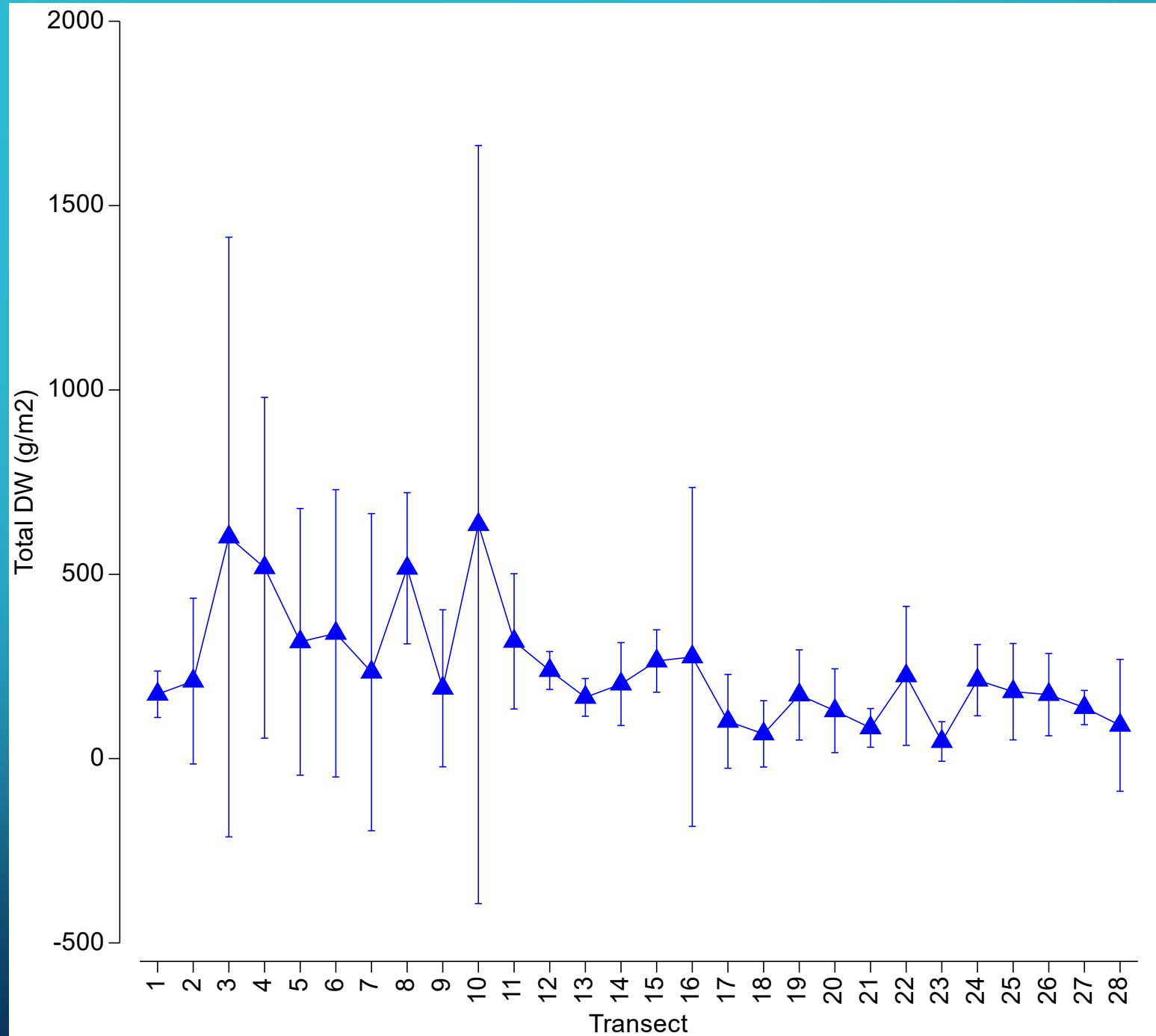


# Rainbow River

total dry weight

upstream to downstream

August & September 2019

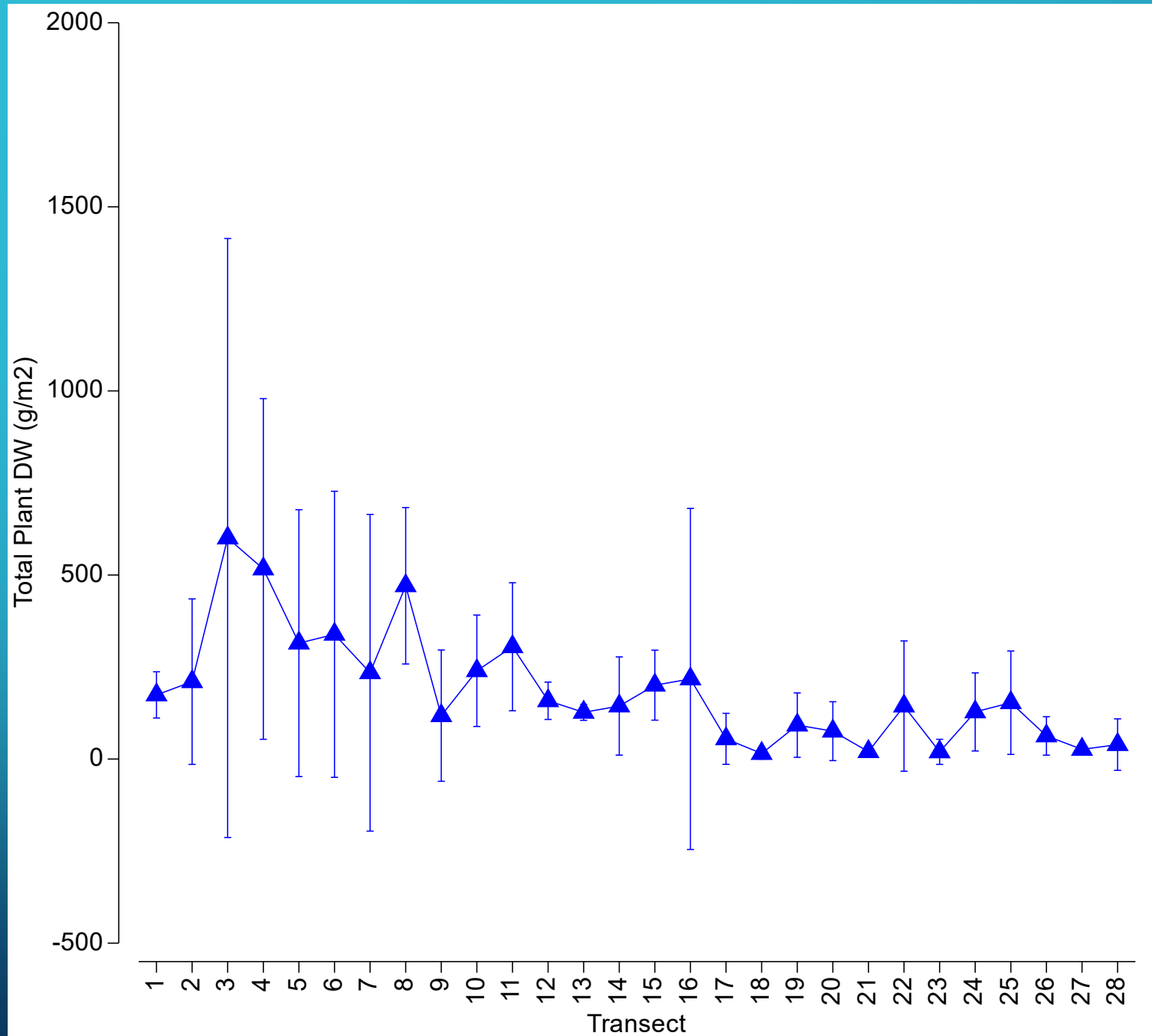


# Rainbow River

vascular plant and moss

upstream to downstream

August & September 2019

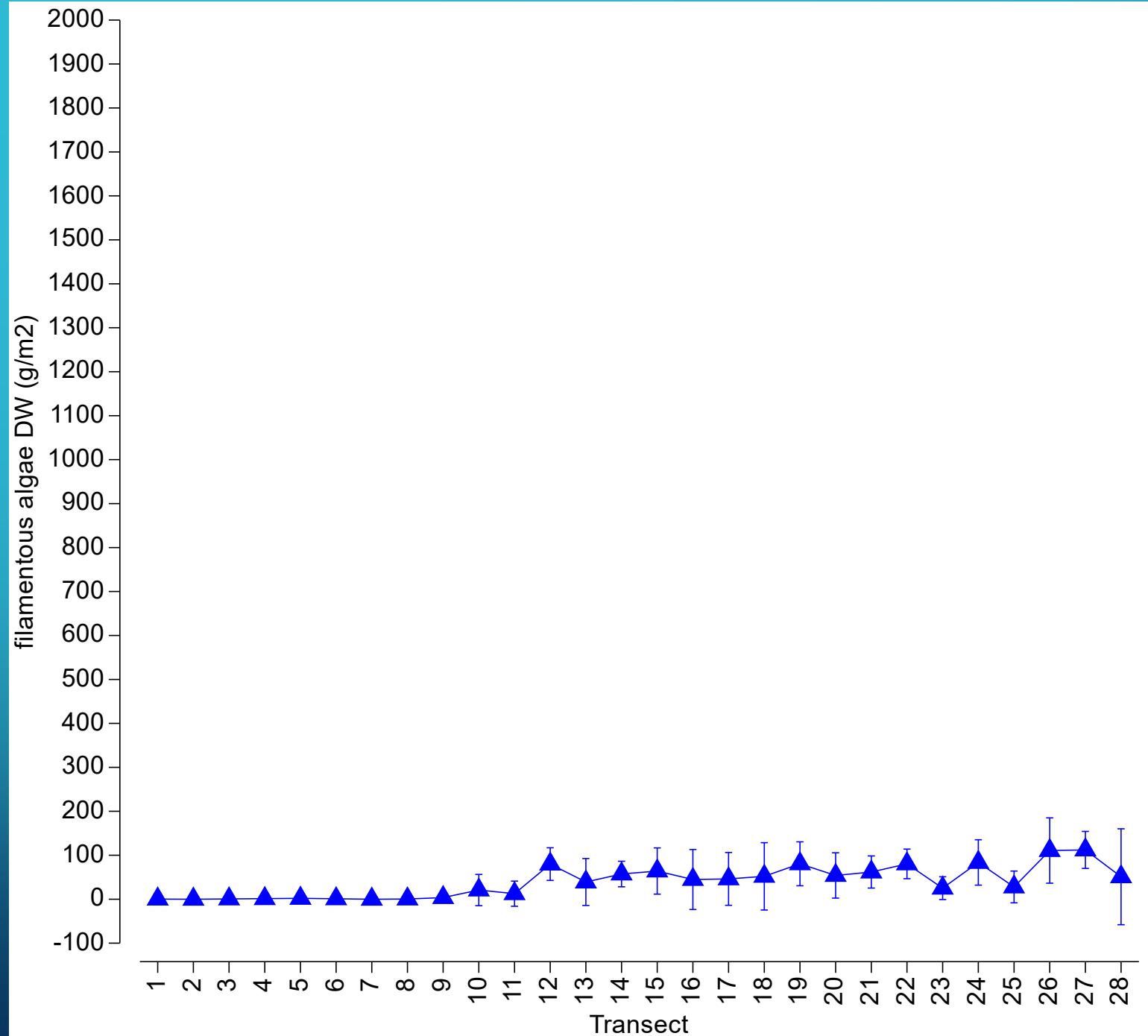


# Rainbow River

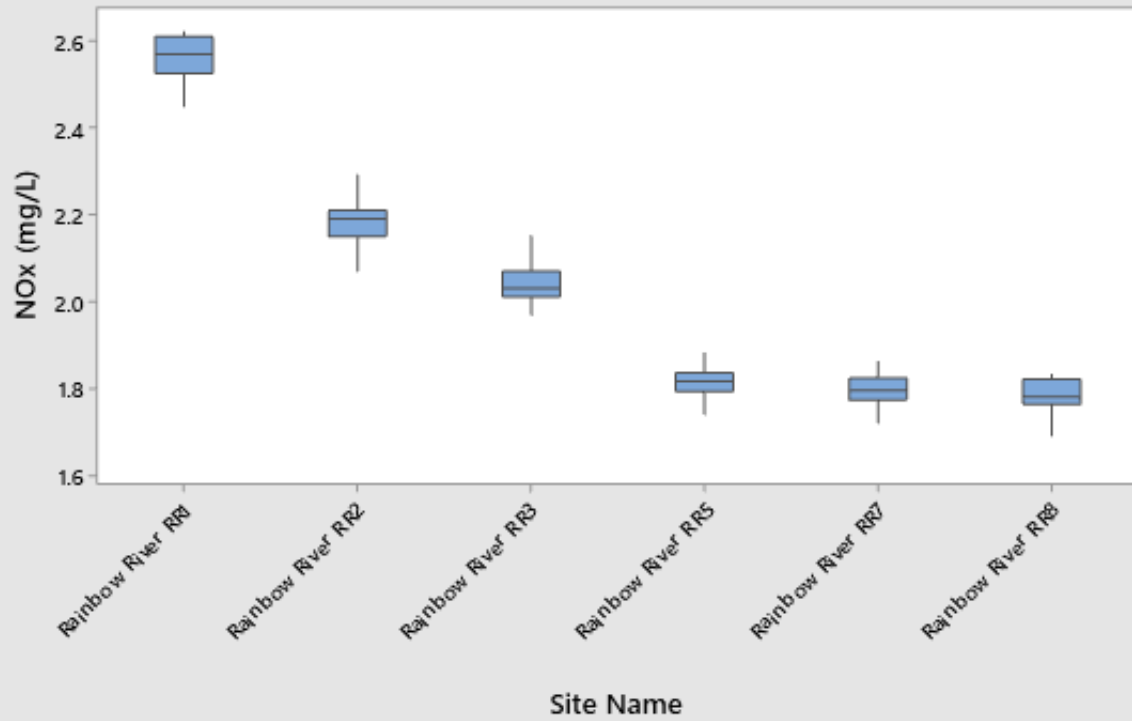
filamentous algae

upstream to downstream

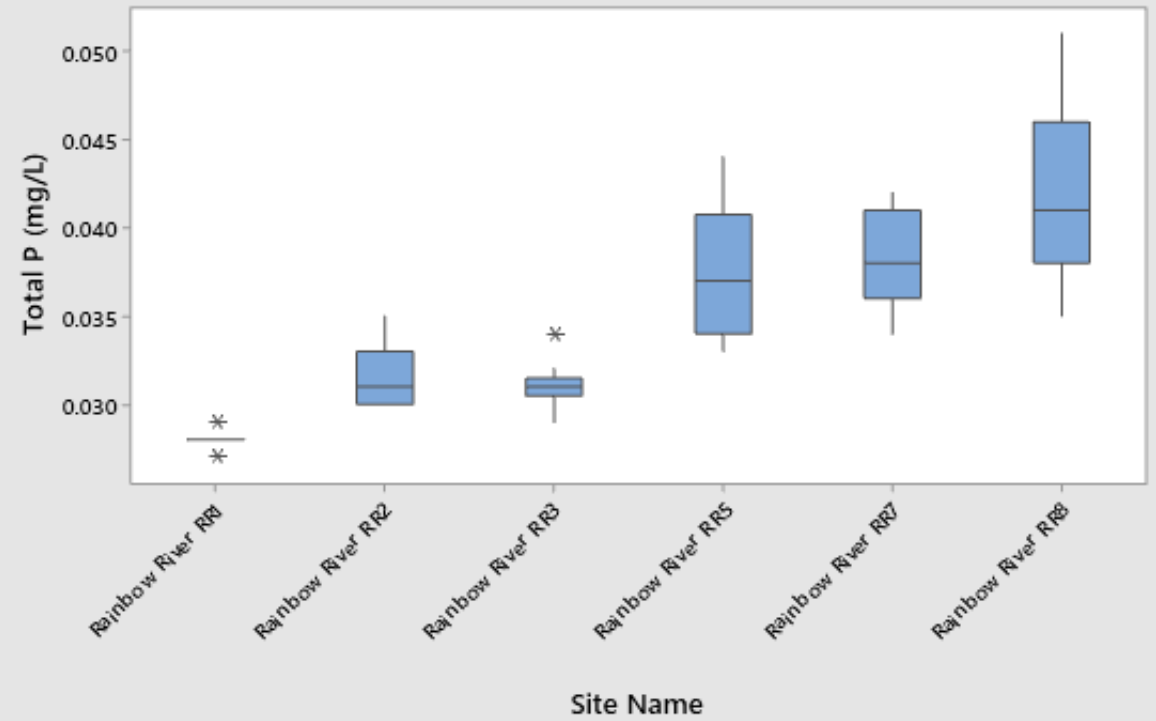
August & September 2019



Boxplot of NOx (mg/L)



Boxplot of Total P (mg/L)



Rainbow River

SWFWMD

upstream to downstream in study area

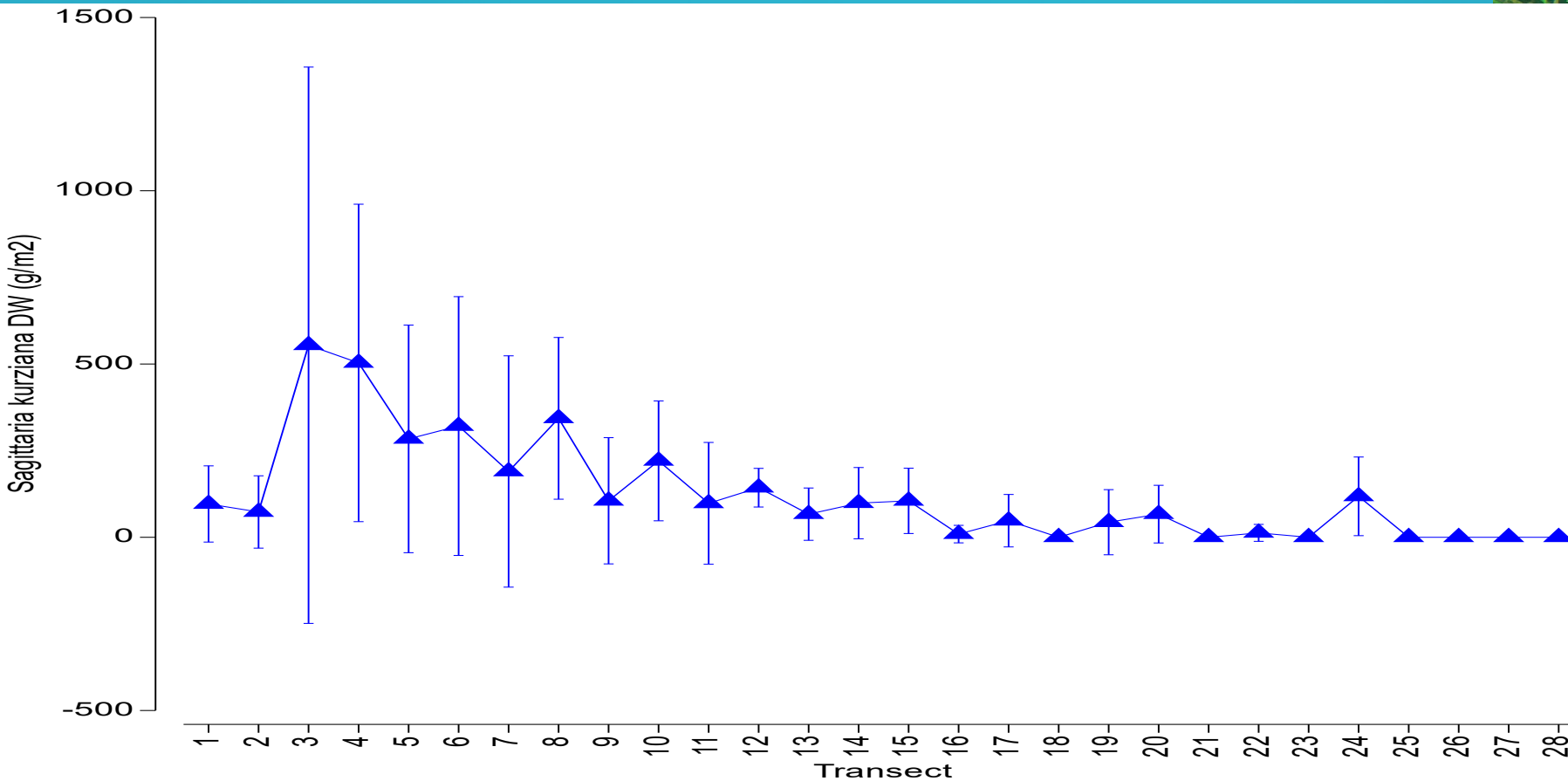
monthly data

2018 - 2020



# Rainbow River

- *Sagittaria kurziana* drives differences
- shows opposite pattern to other rivers with more filamentous algae downstream than upstream
- more consistently vegetated

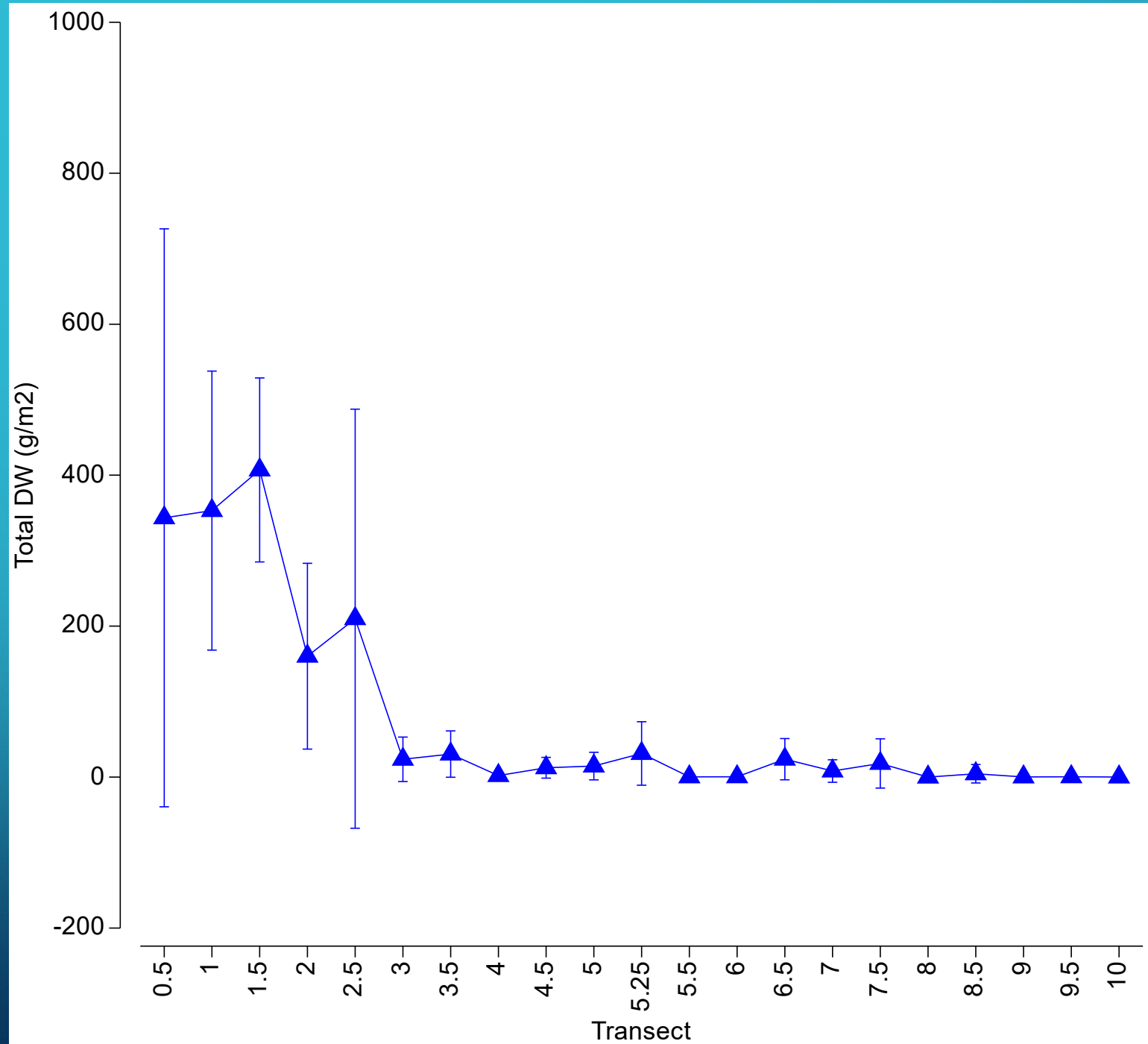


# Weeki Wachee River

total dry weight

upstream to downstream

September 2019

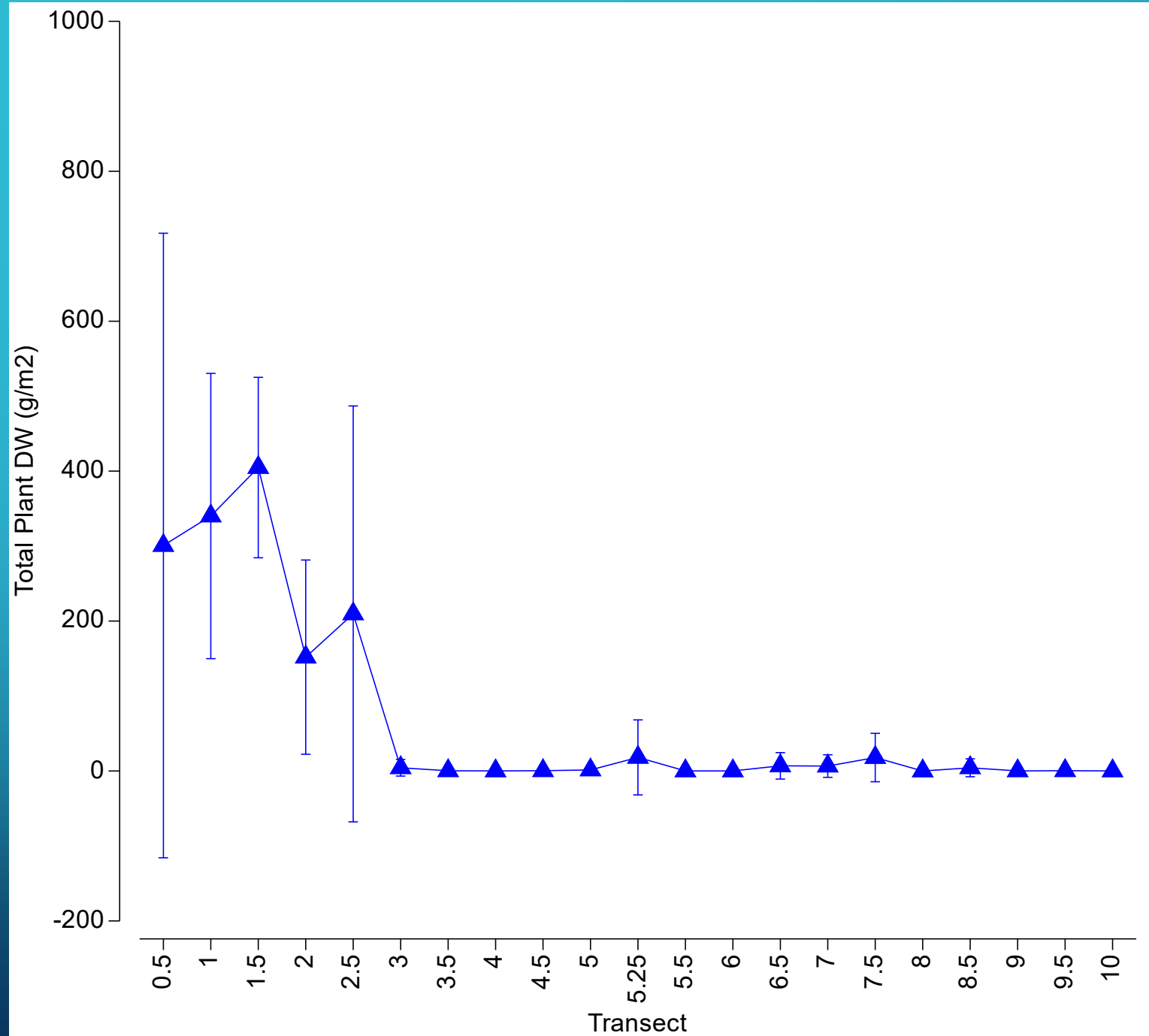


# Weeki Wachee River

vascular plants and moss

upstream to downstream

September 2019



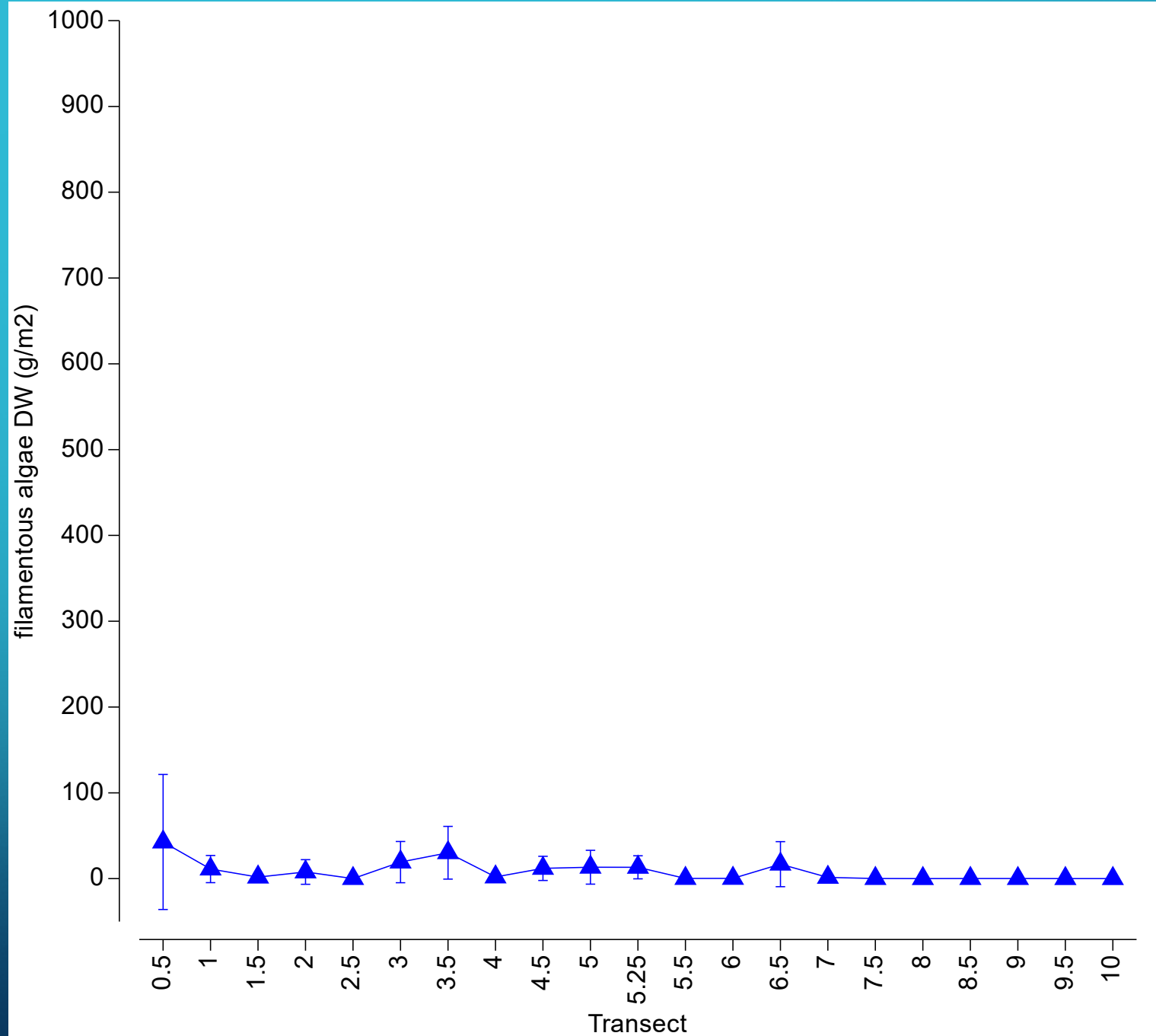


# Weeki Wachee River

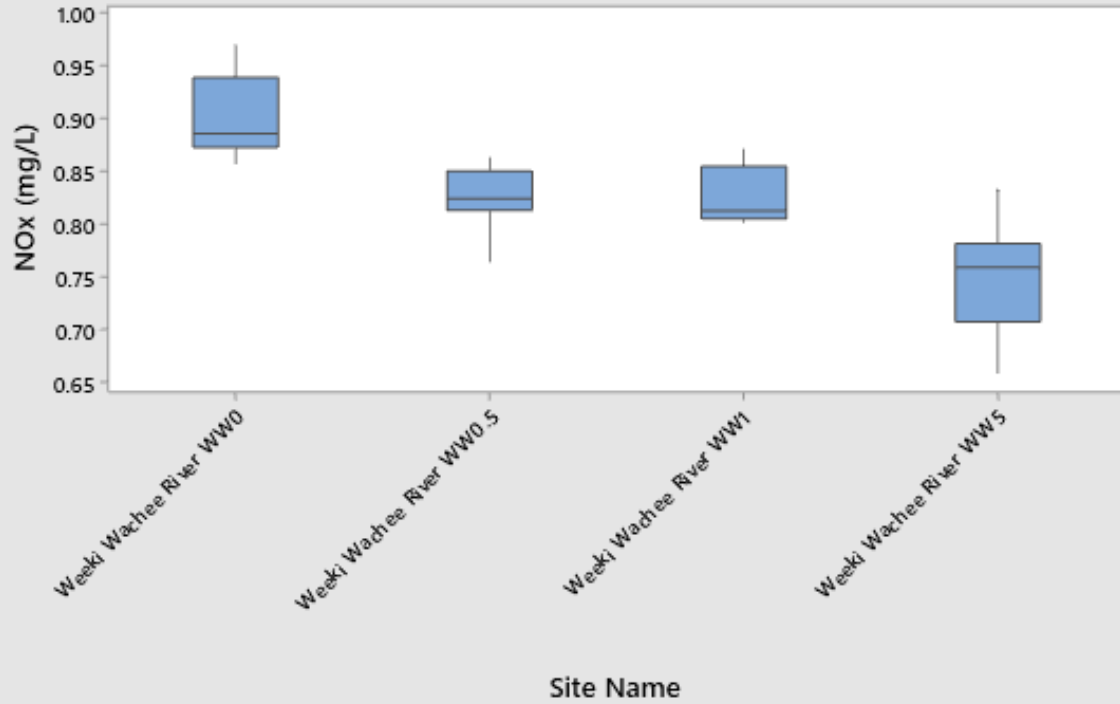
filamentous algae

upstream to downstream

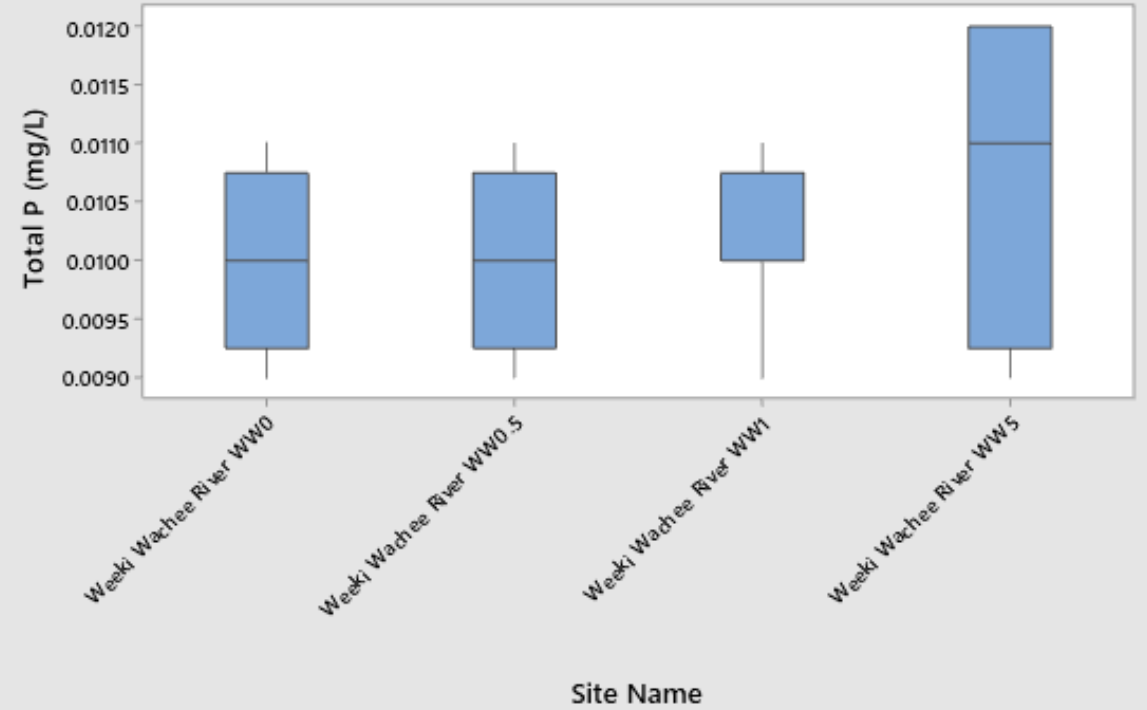
September 2019



Boxplot of NOx (mg/L)



Boxplot of Total P (mg/L)



Weeki Wachee River

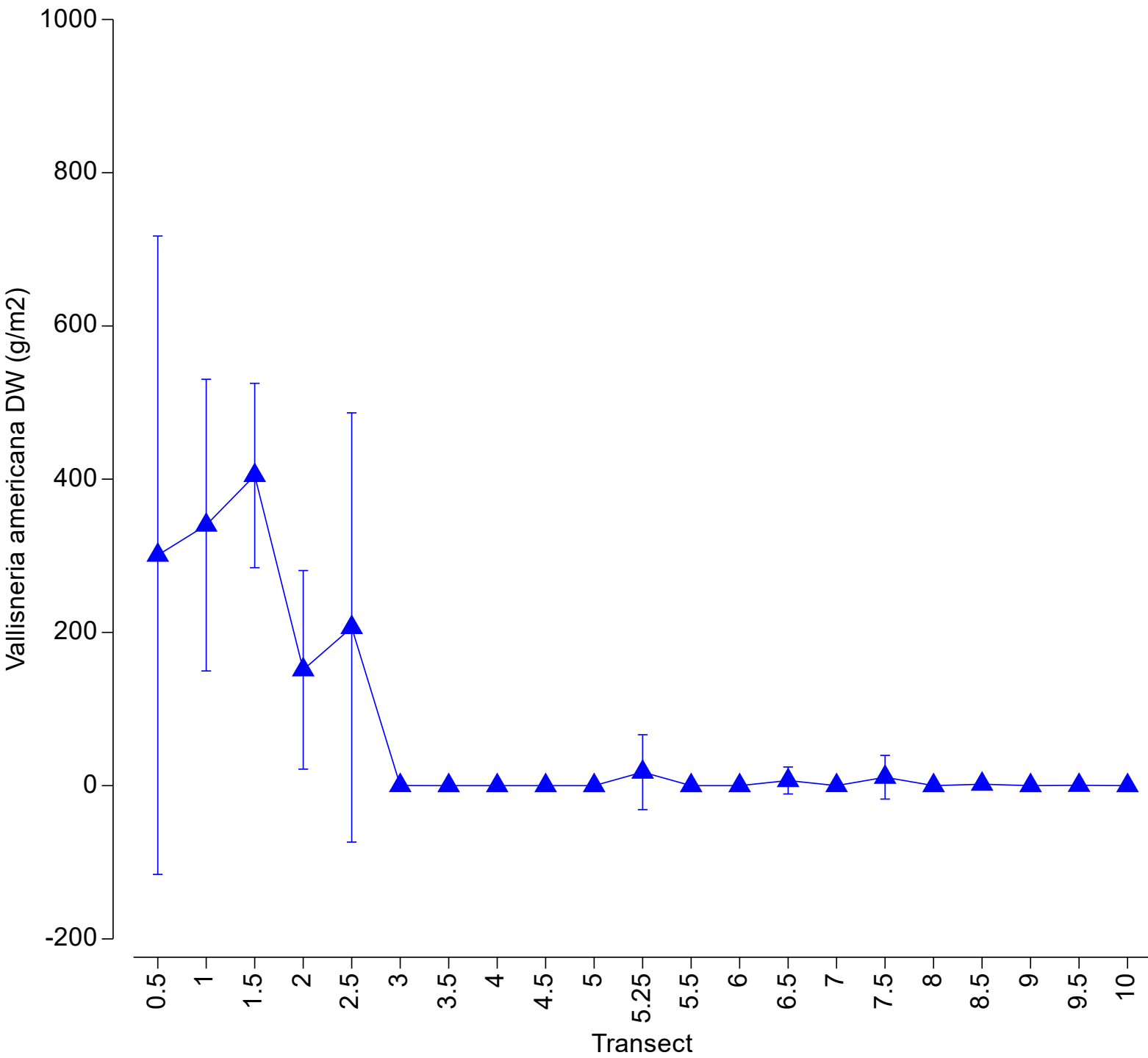
SWFWMD

upstream to downstream in study area

monthly data

2018 - 2020





## Weeki Wachee

- *Vallisneria americana* dominant in upper portion
- lowest taxa richness
- most vegetation in upper third
- no red algae

# Weeki Wachee



# AUDIENCE, THANK YOU!

THANKS TO COLLEAGUES IN THE BIOLOGY GROUP AT WATER & AIR



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