Comparison of the common oyster, *Crassostrea virginica*, reef in three Northeast Florida creeks

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Commercial Harvesting in Florida

- Commercial value:
  - Landed 2,524,895 lbs in 2009 (all of Florida)
  - Drastically decreased in 1996
    - » 150+ lbs per trip pre 1996
    - » 45-55 lbs per trip after 1996
  - Duval County
    - » 10% of Atlantic coast portion
    - » Stopped completely in early 1990's

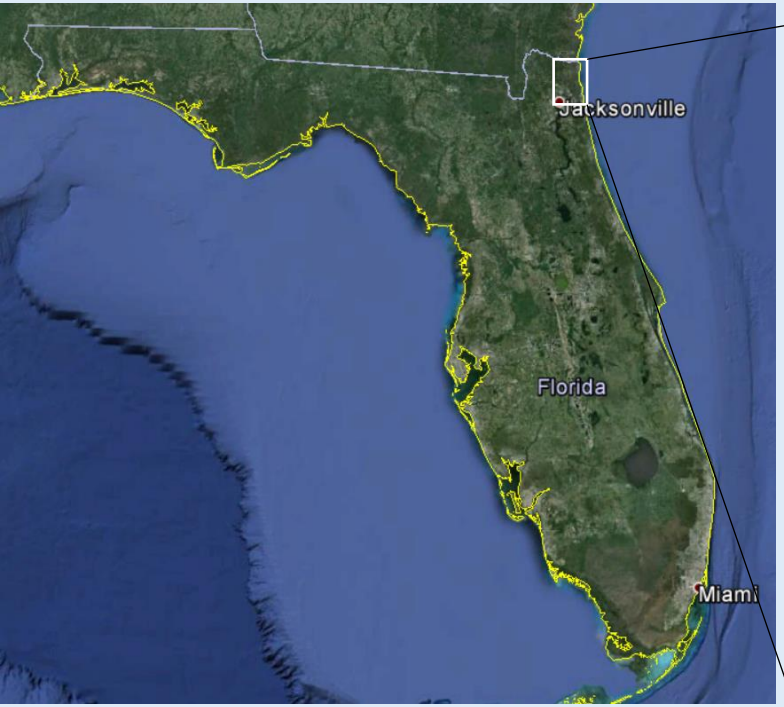
Oyster Harvesting in Duval County:

- Due to poor water quality data, all oyster beds in Duval County are closed for legal harvesting
- There is strong public interest in restoring oyster harvesting in Duval County
- Fundamental questions:
  - What happened to the oyster beds?
  - What will it take to restore them?

PROJECT: Gain Insight into *Crassostrea virginica* in Three Creeks in Northeast Florida

1. Does the macro-invertebrate community vary between creeks?
2. Has the macro-invertebrate community changed over time?
3. Is there sustainable larva recruitment for restoration purposes?
4. How has the physical location of each creek changed over time?

Study Site:



Clapboard Creek

Sisters Creek

Pumpkin Hill Creek

Method: Community Sampling (2008 & 2014)

- 1 site per creek, 1.5 hours near low tide.
- 0.25 m^2 quadrat (N = 3 per site)
- 5% buffered formalin and 70% isopropanol

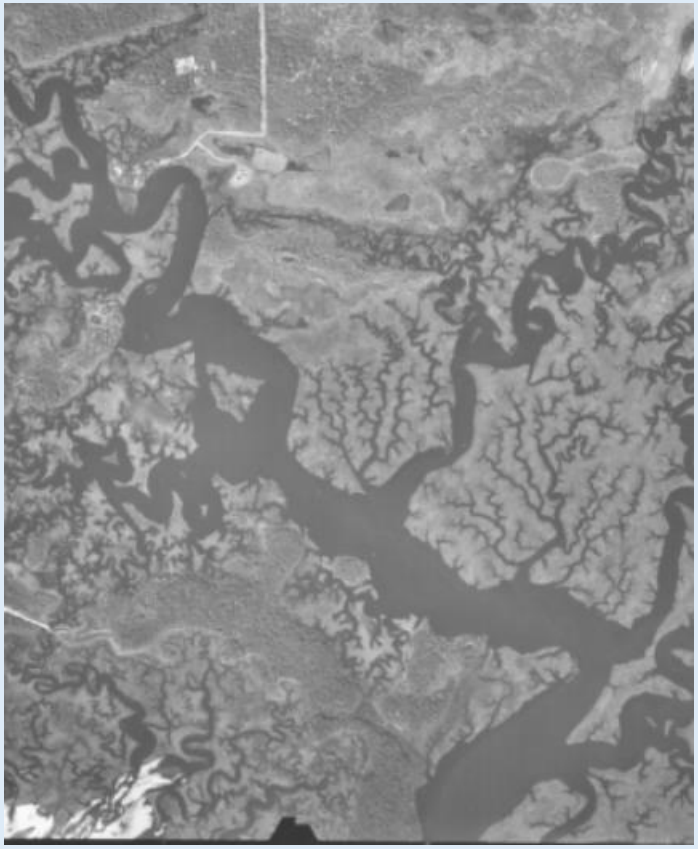
- 2008 samples were collected by JU in a JU-TNC collaboration study.

Method: Larvae Recruitment

- 1 site per creek,
  within 1.5 hours of low tide.
- 0.25 m^2 quadrat
  (N = 5 per site)
- Depth between 0.3 – 1.0 m
  at low tide
- Set for 6 months

Method: Physical Location

- Aerial photos from 1943, 1960, 1990 and 2010.
- Georeferenced in ArcMap 10.2.2 (digitized at 1:3,000 m scale)
- Tidal range with 1 hour of low tide.



Results: Community

16 taxa (mean = 8, SD ± 2)

5 most abundant:

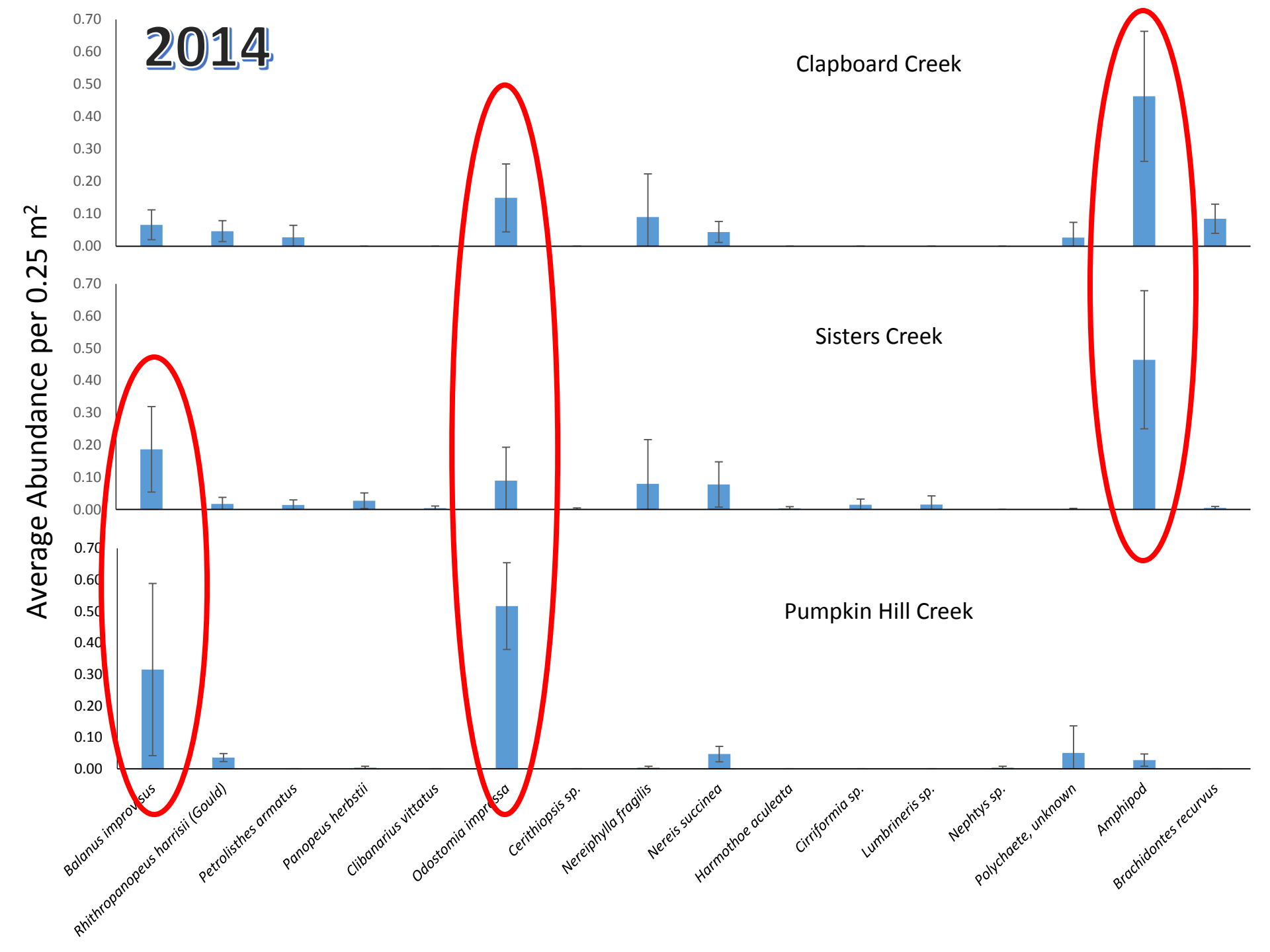
Odostomia impressa

Amphipod

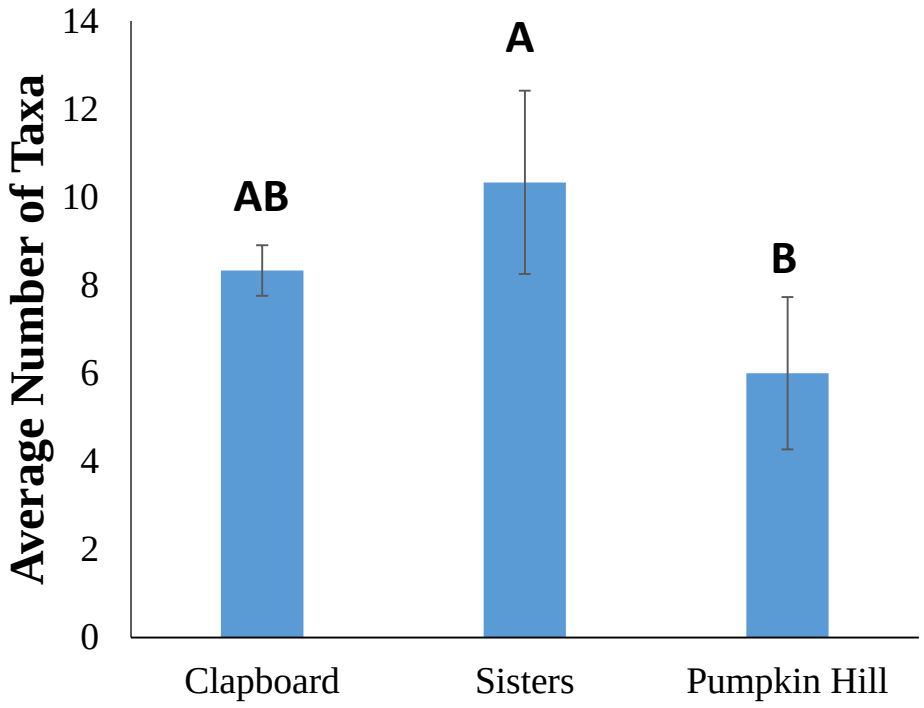
Nereiphylla fragilis

Balanus improvisus

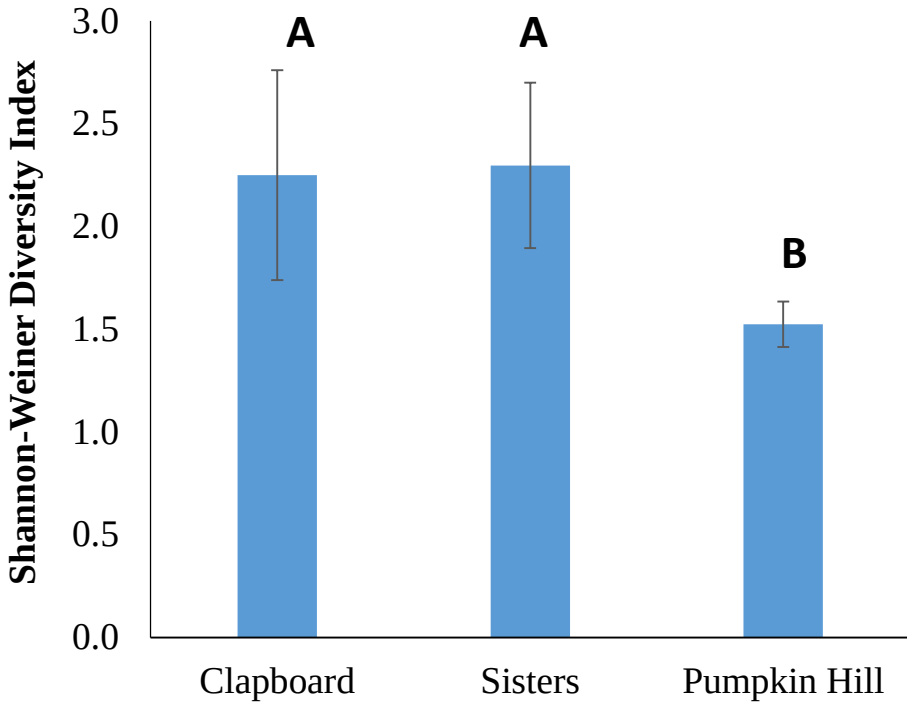
Nereis succinea


2014
Clapboard Creek
Sisters Creek
Pumpkin Hill Creek
Average Abundance per 0.25 m²
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Balanus improvisus
Rhithropanopeus harrisii (Gould)
Petrolisthes armatus
Panopeus herbstii
Clibanarius vittatus
Odostomia impressa
Cerithiopsis sp.
Nereiphylla fragilis
Nereis succinea
Harmothoe aculeata
Cirriformia sp.
Lumbrineris sp.
Nephtys sp.
Polychaete, unknown
Amphipod
Brachidontes recurvus

2014

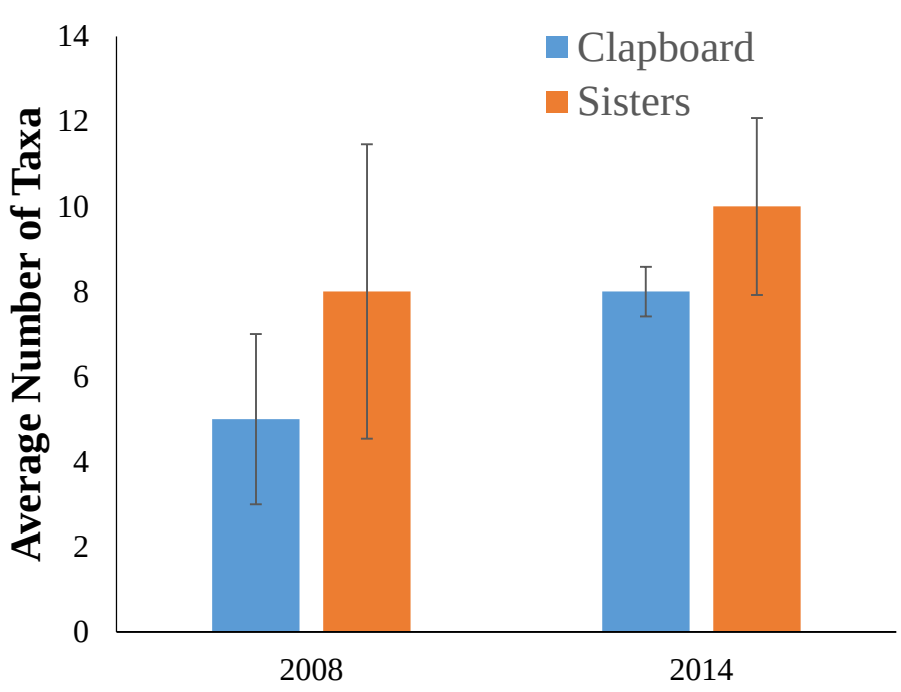


P = 0.044

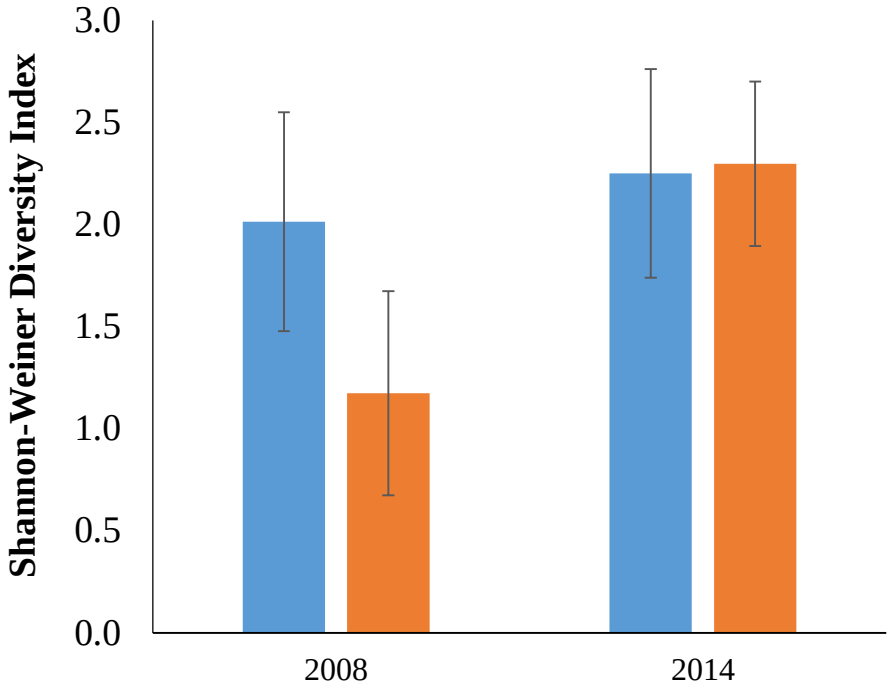


P = 0.068

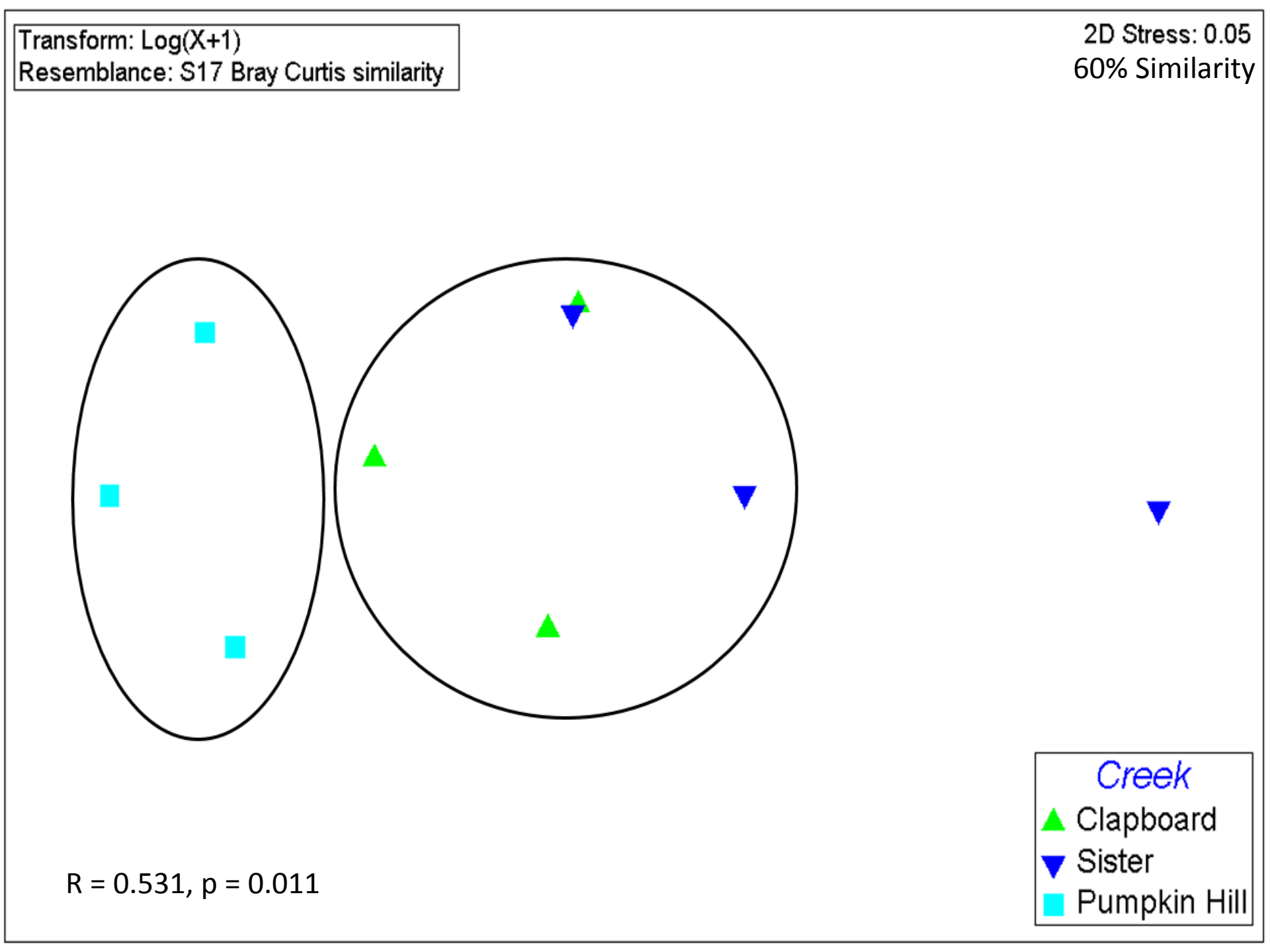
2008-2014



P = 0.049 (Year)



P = 0.043 (Year)


Transform: Log(X+1)
Resemblance: S17 Bray Curtis similarity
2D Stress: 0.05
60% Similarity
R = 0.531, p = 0.011
Creek
Clapboard
Sister
Pumpkin Hill

Transform: Log(X+1)
Resemblance: S17 Bray Curtis similarity

Year
▲ 2008
▼ 2014

2D Stress: 0.06
40% Similarity

> 40%

Sisters
Clapboard
Clapboard
Clapboard
Sisters

Sisters
Clapboard
Sisters
Clapboard
Sisters
Clapboard
Sisters

R = 0.685, p = 0.01

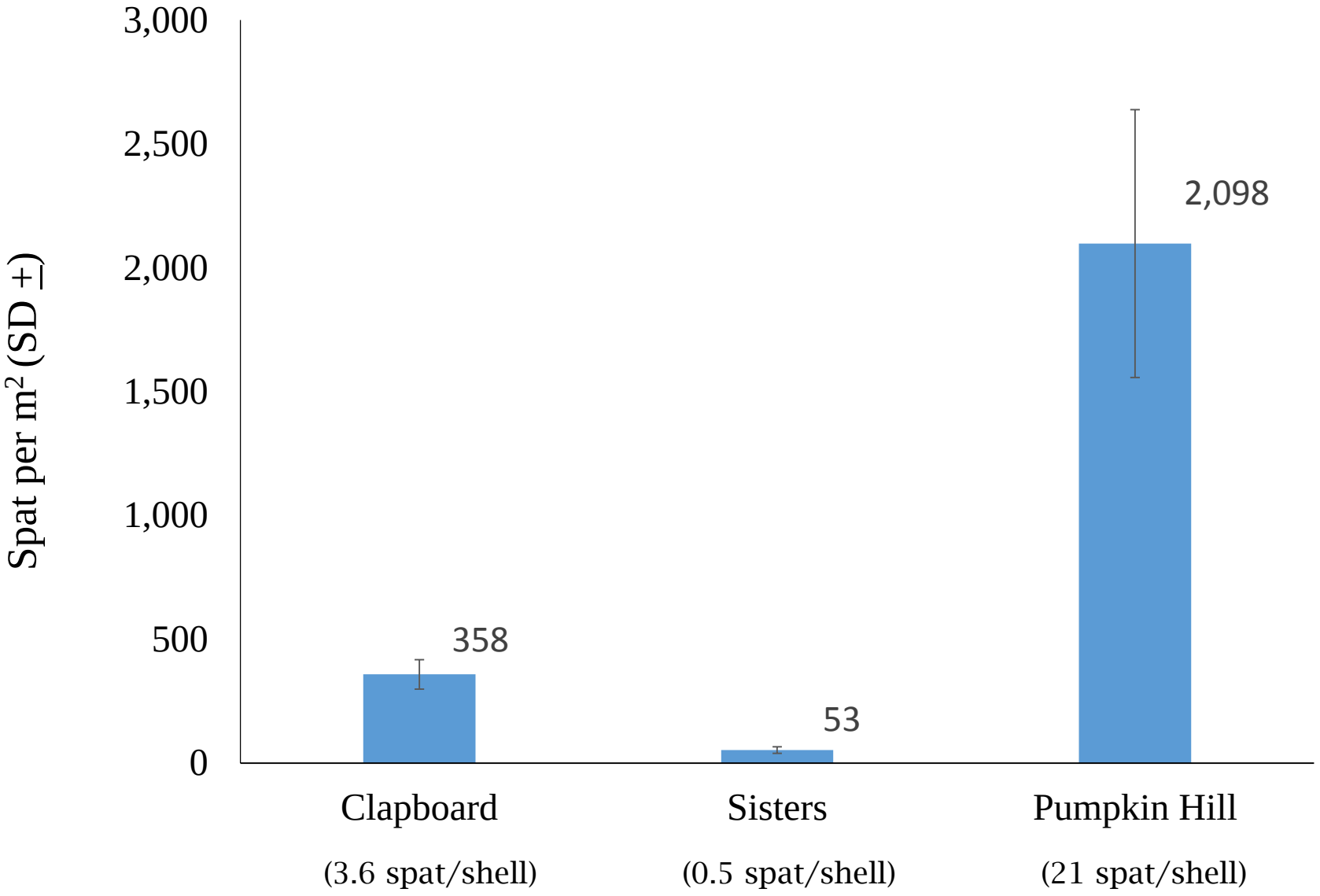
Compared to other Studies:

Community

- Overall - 40 taxa per oyster reef (Bahr and Lanier 1981)
- Mosquito Lagoon – 9 taxa (Boudreaux et al 2006)
- West side of Everglades – 12 taxa (Hicks 2013)
- Apalachee Bay (Marsh grass) – 8 Taxa (Subrahmanyam and Coltas 1980)

- Low Diversity: > 2
- Moderate Shannon-Weiner Diversity: 2 -3 (Evans and Higman 2001) (Study done in SJR)

Results: Larval Recruitment



Compared to other Studies:

Settlement

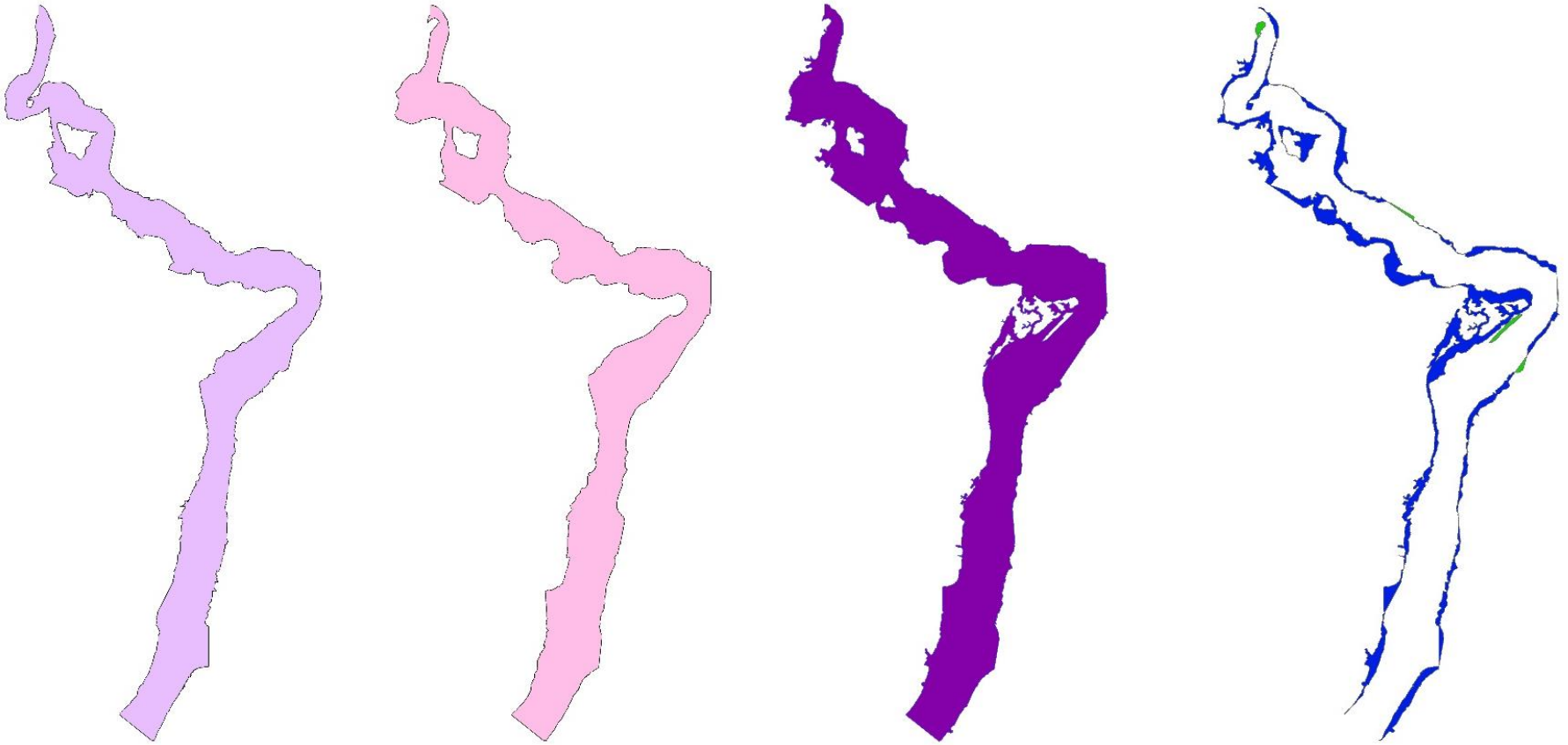
- North of Florida – 5,000^{+} spat/m^{2} (Pucket and eggleston 2012, Knight and Walters 2010)

- Southeast Florida (Parker and Geiger 2009)
  - St. Lucie Estuary – >1 spat/shell (Sisters Creek)
  - Loxahatchee River – 20 spat/shell (Pumpkin Hill Creek)
  - Lake Worth Lagoon – 40 spat/shell

- Conceptual Model of Health of Oyster Reefs (Volety *et a*l. 2014)
  - < 5 spat/shell – cause for concern

Results: Physical Location

Clapboard Creek



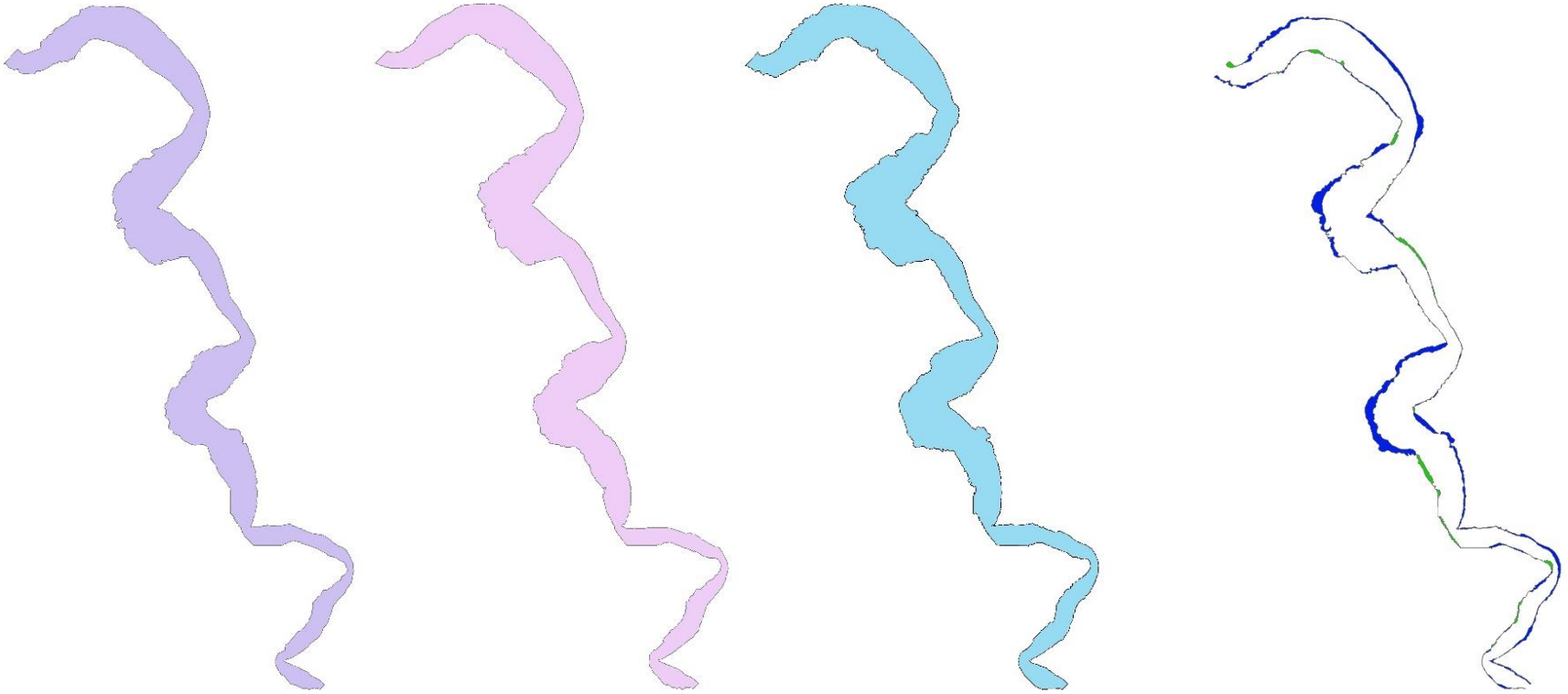
1943
1,439,140 m^2

1990
1,614,011 m^2

2010
1,859,487 m^2

Results: Physical Location

Pumpkin Hill Creek



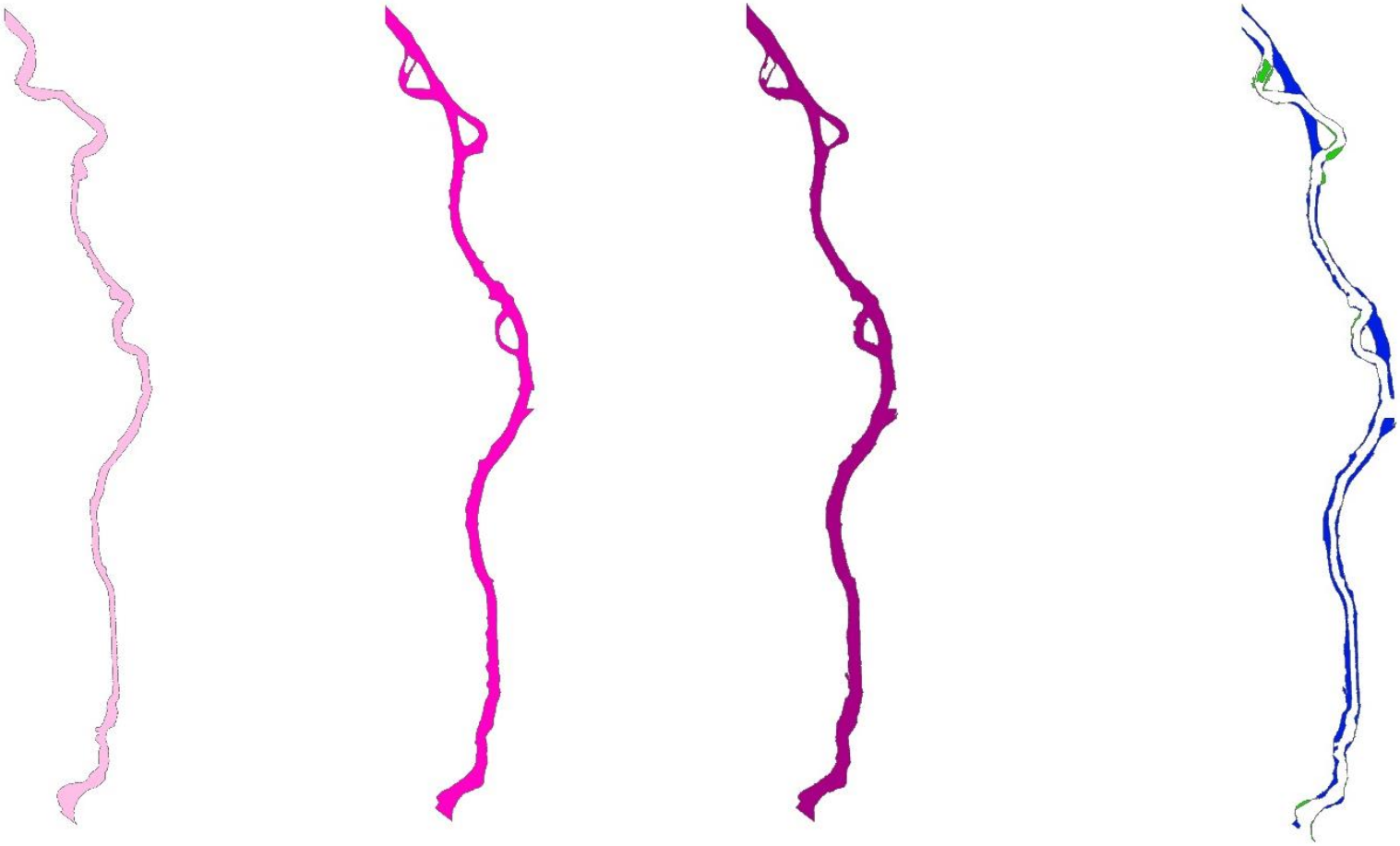
1960
2,853,257 m²

1990
2,925,400 m²

2010
3,185,957 m²

Results: Physical Location

Sisters Creek



1943
2,028,551 m^2

1990
2,760,003 m^2

2010
3,208,619

Results: Physical Location

Clapboard Creek (m^2)		Per Year (yr)	Per Length (6,199 m)	Per Length*Year (m*yr)
1943-1990 Erosion	19,370	412	1.6	0.03
1943-1990 Sediment	3,125	66	0.3	0.01
1990-2010 Erosion	24,163	1,208	1.9	0.10
1990-2010 Sediment	1,356	68	0.1	0.01
1943-2010 Erosion	40,439	604	3.3	0.05
1943-2010 Sediment	1,387	21	0.1	0.002

Sisters Creek (m^2)		Per Year (yr)	Per Length (14,749 m)	Per Length*Year (m*yr)
1943-1990 Erosion	87,099	1,853	7.0	0.15
1943-1990 Sediment	18,973	404	1.5	0.03
1990-2010 Erosion	48,521	2,426	3.9	0.20
1990-2010 Sediment	6,840	342	0.6	0.03
1943-2010 Erosion	123,671	1,846	10.0	0.15
1943-2010 Sediment	13,872	207	1.1	0.02

Pumpkin Hill Creek (m^2)		Per Year (yr)	Per Length (10,793 m)	Per Length*Year (m*yr)
1960-1990 Erosion	19,067	636	1.5	0.05
1960-1990 Sediment	12,504	417	1.0	0.03
1990-2010 Erosion	28,720	1,436	2.3	0.12
1990-2010 Sediment	4,369	218	0.4	0.02
1960-2010 Erosion	36,707	734	3.0	0.06
1960-2010 Sediment	5,793	116	0.5	0.01

Summary:

- Barnacles, amphipods and *Odostomia impressa* dominate the oyster community.
- Pumpkin Hill Creek is significantly different from Sisters and Clapboard Creek.
- Overall increase in number of species residing in oyster reefs between 2008 and 2014.
- NEFL oyster community species richness and diversity similar to other Florida studies.
- Sisters and Clapboard Creek larval recruitment maybe cause for concern
- Erosion has doubled in many location since 1990.

Future Research:

- Multiple site studies in each creek
- Yearly Long term Larval Recruitment Study
- Yearly Short term Larval Recruitment Study
- Water Quality Study in Each Creek

Thank you

Questions?