Oyster Spat Monitoring in the Southern Indian River Lagoon and St. Lucie Estuary

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Florida Oceanographic Society

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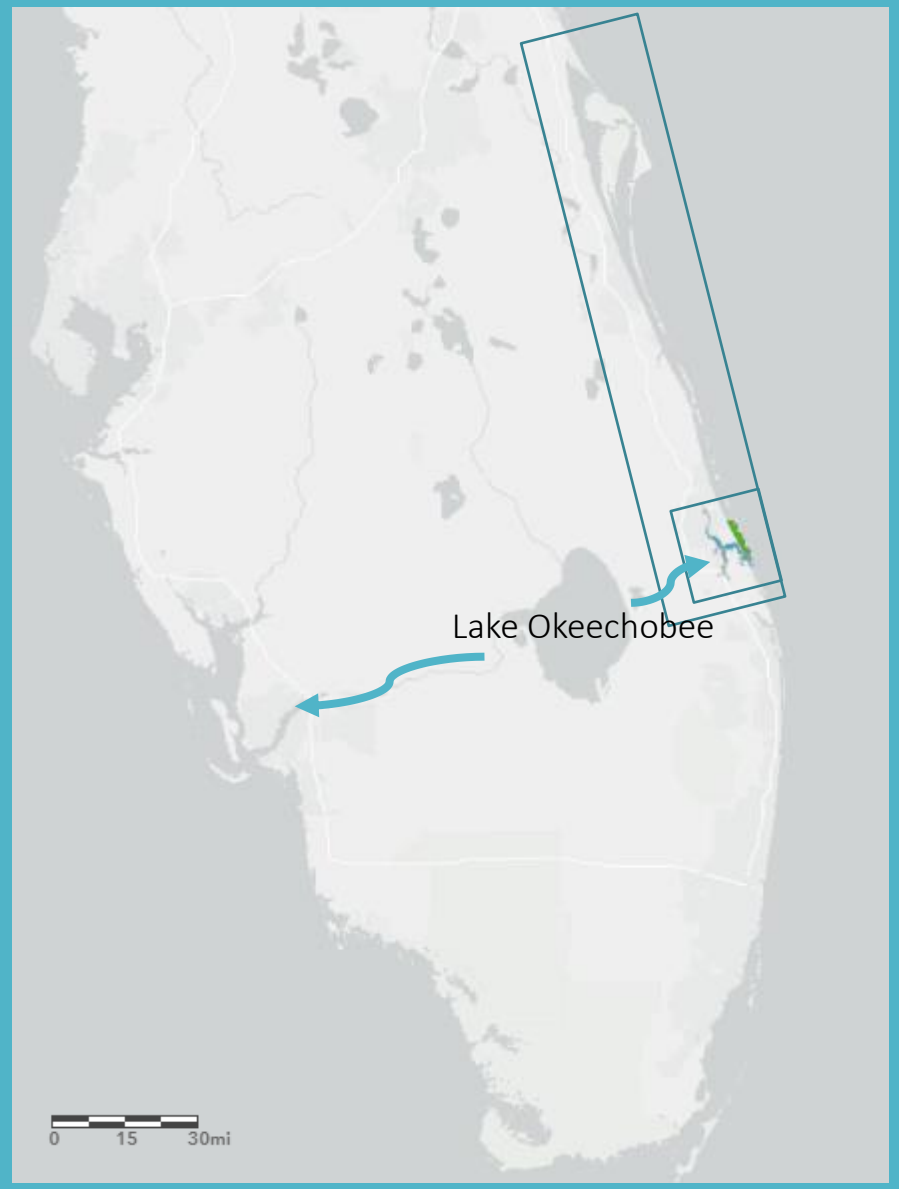
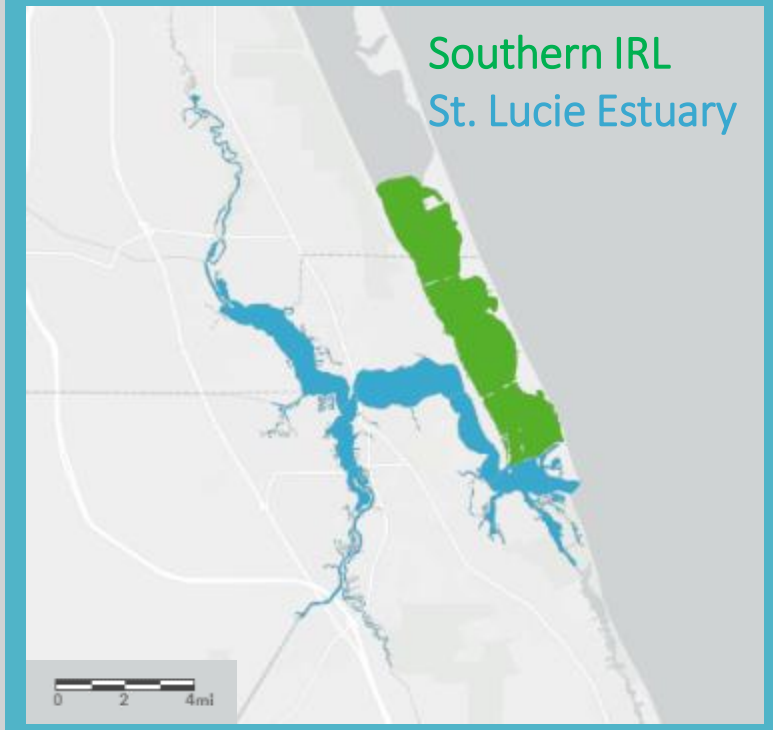
The St. Lucie Estuary and Southern Indian River Lagoon: Background



- Indian River Lagoon (IRL) – 156 miles long
- IRL has several inlets and tributaries

St. Lucie Estuary (SLE)



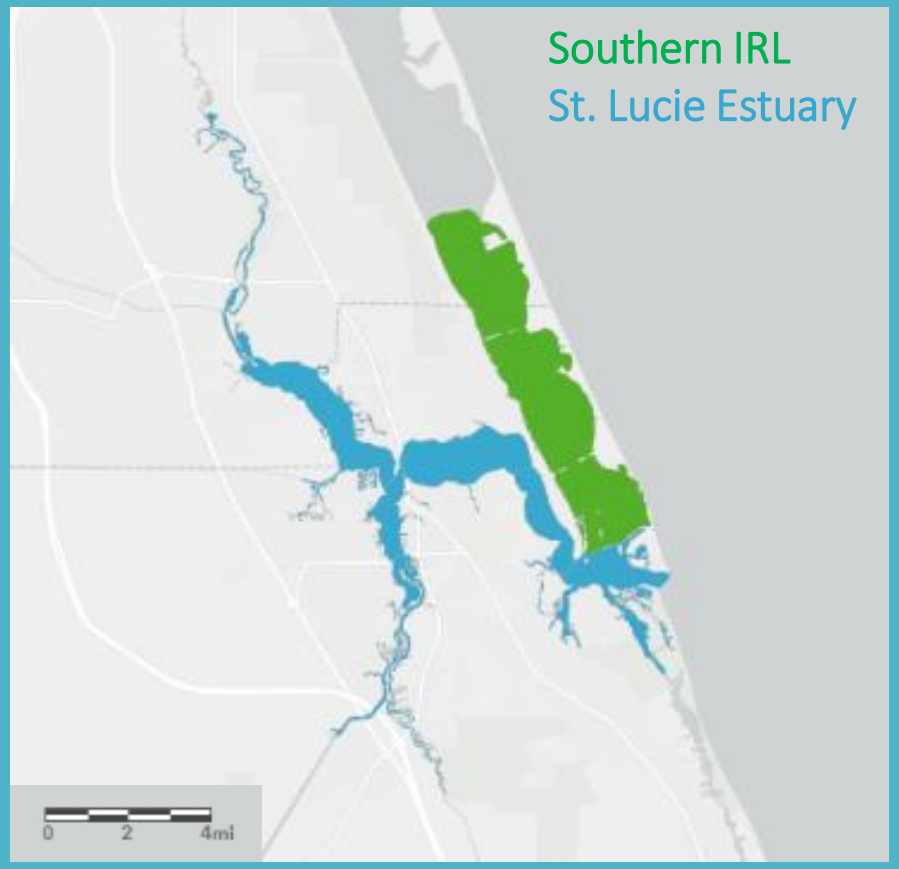
What does this mean for oyster reefs?

Monitoring oyster reefs conditions

Hypotheses

The Southern IRL and SLE have different oyster:

- *Recruitment*
- *Settlement*
- *Growth*



What are we looking for?

Monthly:

- Spat Recruitment

Biannually:

- Long-term spat Recruitment
- Oyster Size and Abundance
- Oyster Biomass data

Why?

Understand:

- How environmental change relates to oyster reef health
- Current conditions in the IRL and SLE
- Guide future restoration

Spat and Reef Monitoring at 6 Sites

Indian River Lagoon

DW= Driftwood Motel

IRSP=Indian River Side Park

FOS=Florida Oceanographic Society

St. Lucie Estuary

FL=Flagler Park

PEND= Pendarvis Cove

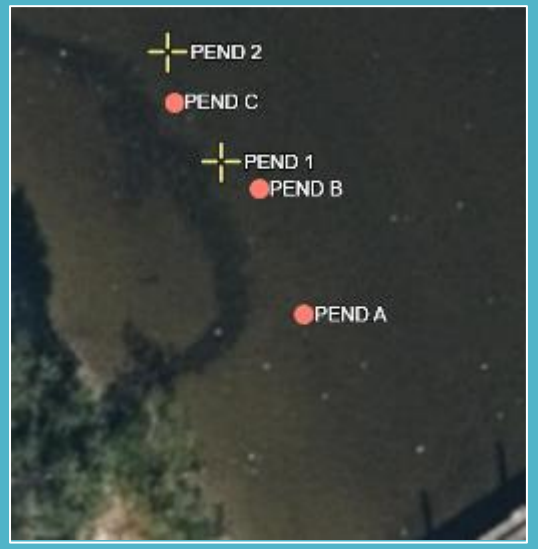
ES= East Sound

- Monthly spat monitoring
- Long-term spat monitoring
- Bi-annual reef assessment

New reef restored April 2022

Recruitment Methods: Monthly

- Started June 2020
- Spat Recruitment
  - Oyster Tees
    - 3 Tees at each reef
    - 6 stringers (7 shells per) exchanged monthly
- In Lab:
  - Top and bottom shells removed- **5 middle shells** for processing
  - Live and dead spat counted

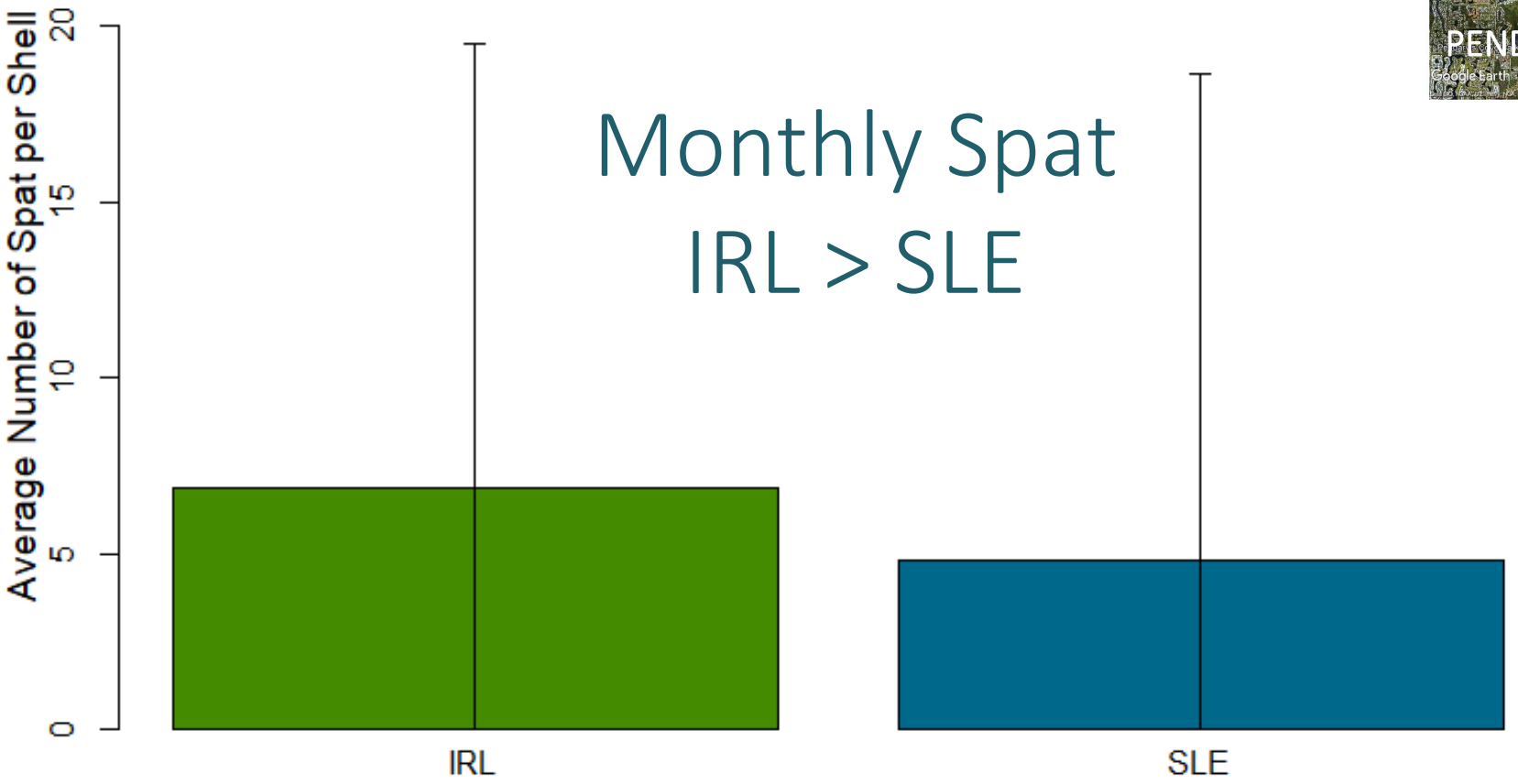


Results: Monthly Spat- Reef

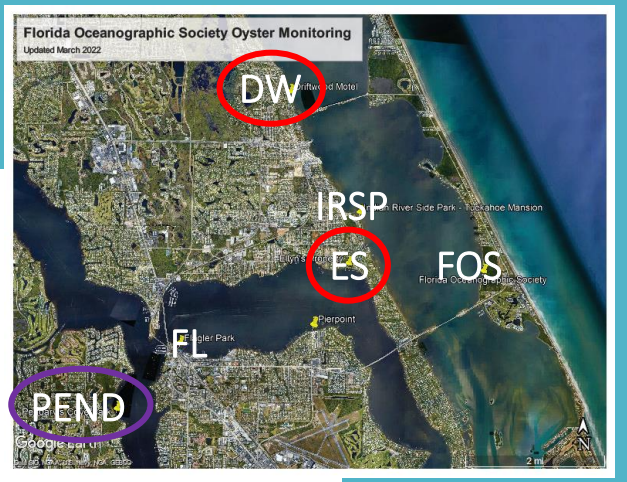
Non-parametric Wilcox Rank Test
(p<0.001)

*

Monthly Spat
IRL > SLE



Results: Monthly Spat- Reef



Non-parametric Scheirer-Ray- Hare:

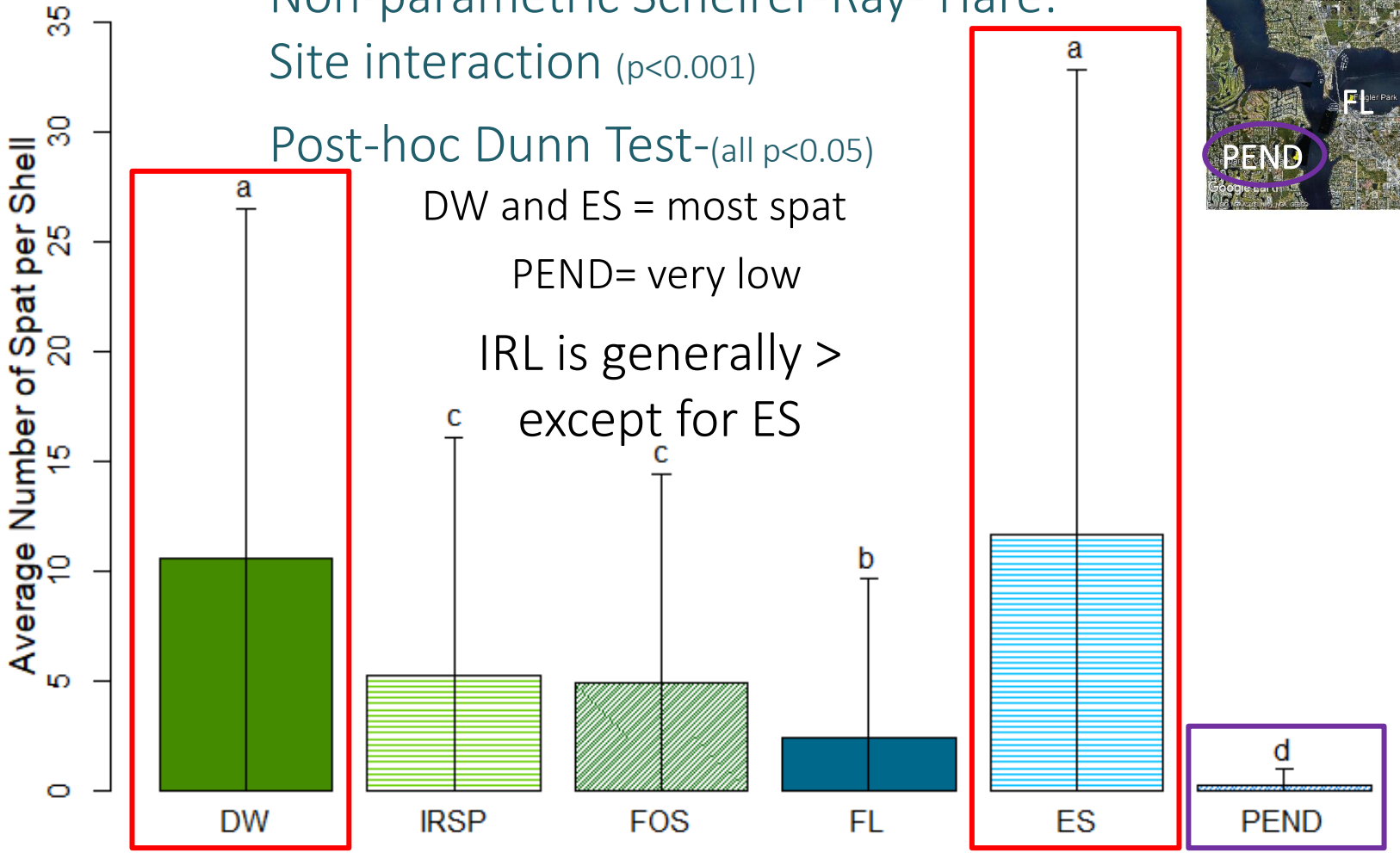
Site interaction (p<0.001)

Post-hoc Dunn Test-(all p<0.05)

DW and ES = most spat

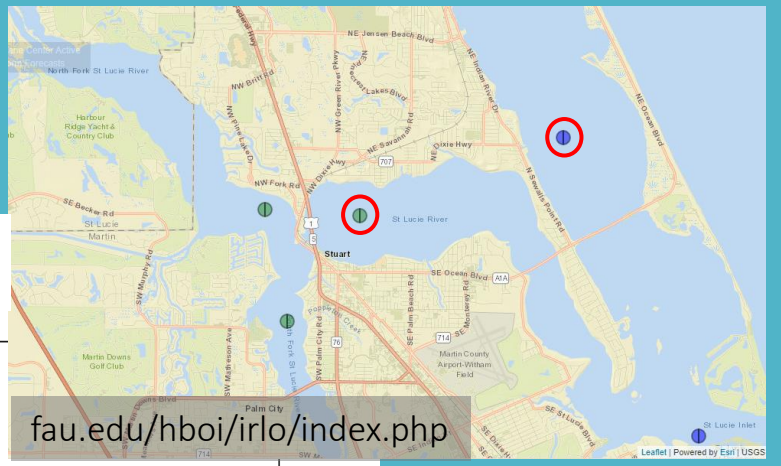
PEND= very low

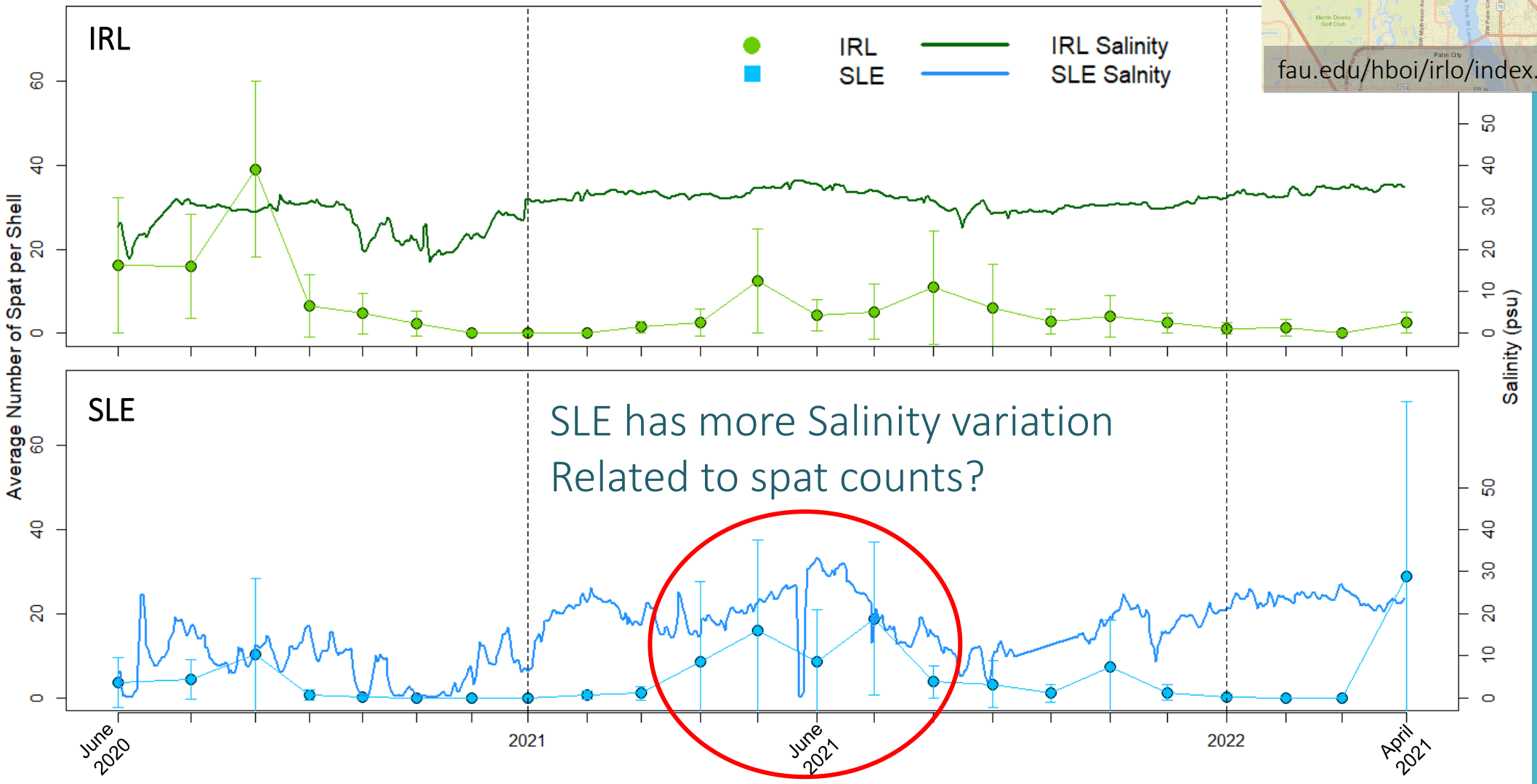
IRL is generally > except for ES



Results: Monthly Spat- Salinity

Daily Salinity Averages from FAU-IRLO Network stations



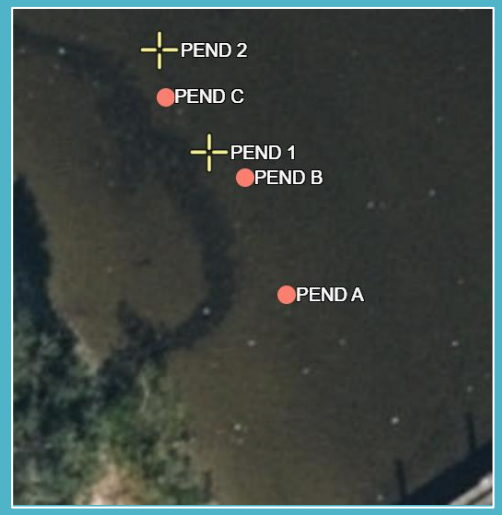


Conclusions

The Southern IRL and SLE have different oyster:

- *Recruitment*
  - Overall recruitment IRL > SLE
    - Recruitment is site dependent
  - Recruitment in the SLE *may* be related to salinity and salinity variation

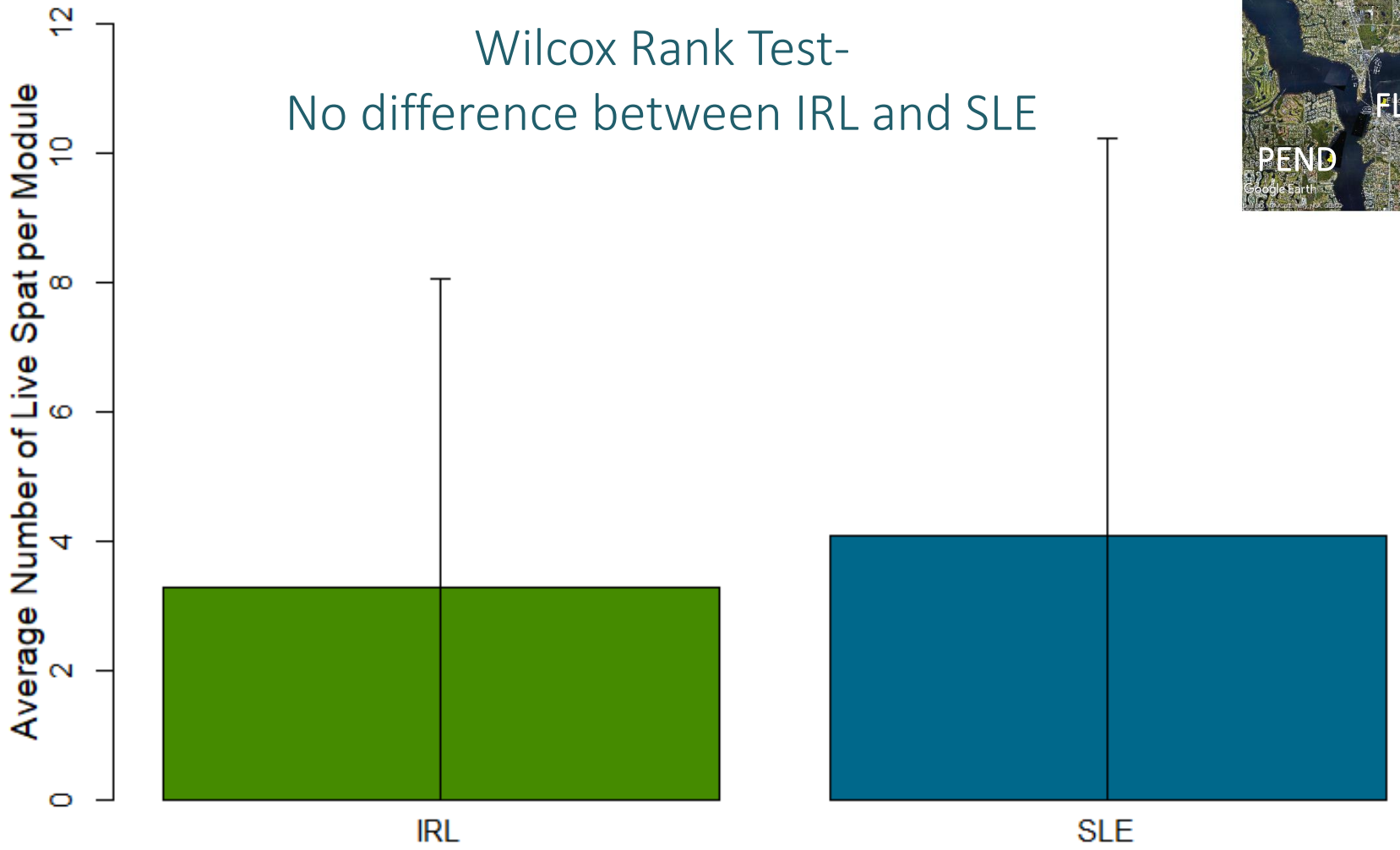
Settlement Methods: Long-Term Spat



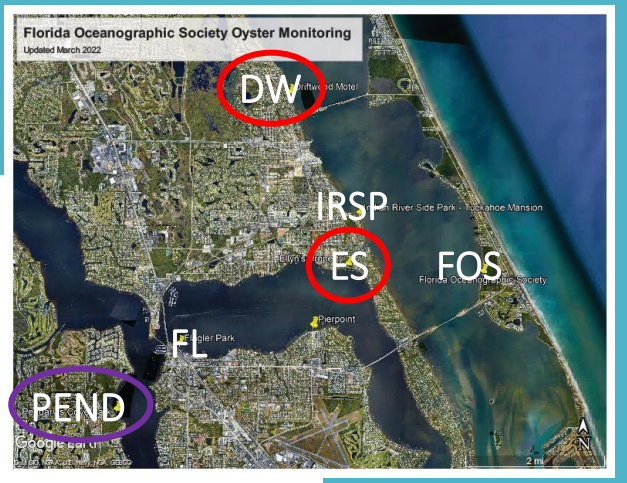
- Began June 2021
- Concrete modules
- 2 PVC Oyster Trees per site
  - 4 modules per tree- 8 per reef
- First 6 Months
  - Monthly spat counts, shell height
- 6 months- Oyster biomass and growth
- 1 year (May 2022)- Oyster biomass, size, and abundances

Results: Long-Term Spat

Wilcox Rank Test-
No difference between IRL and SLE



Results: Long-Term Spat- Reef



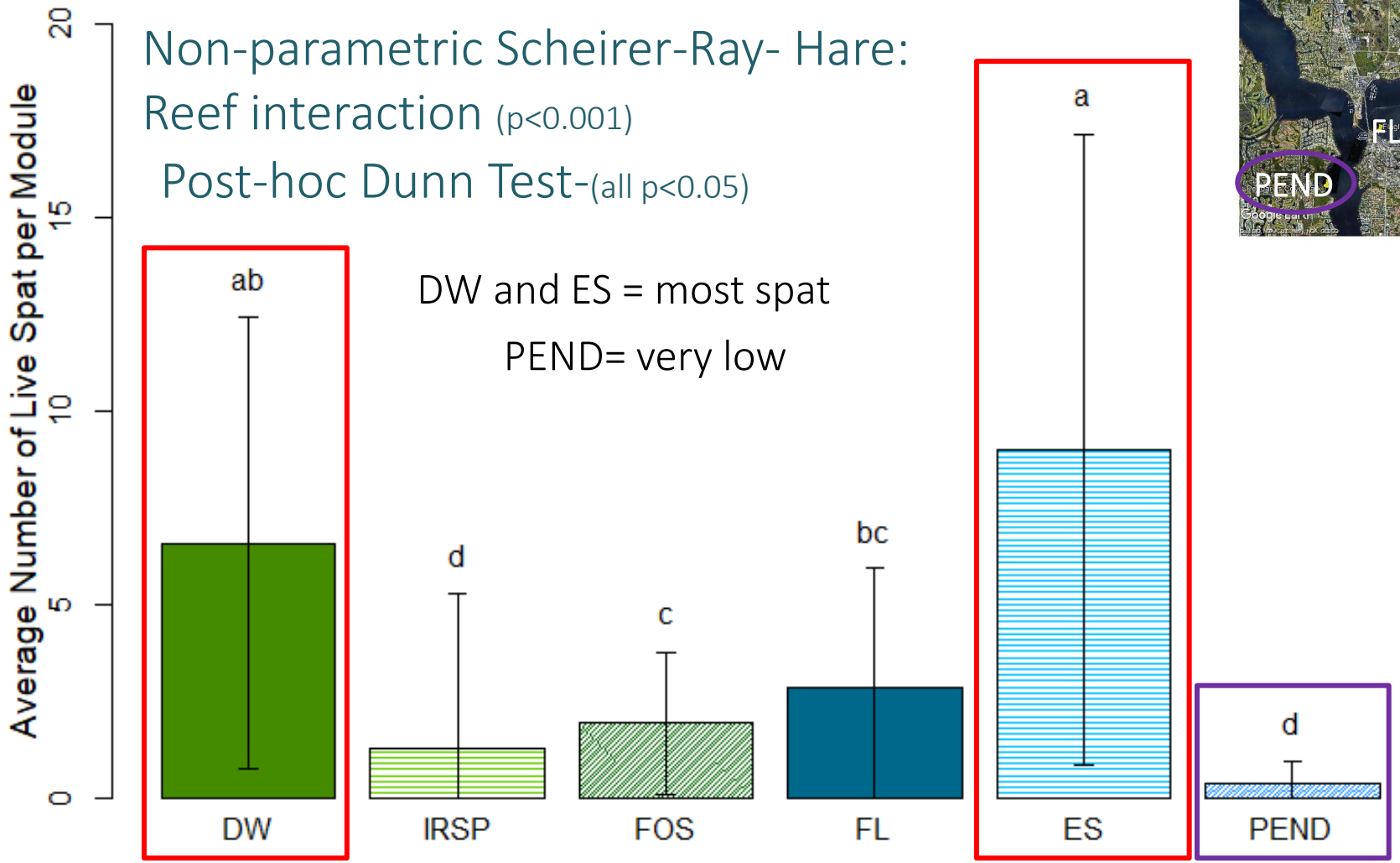
Non-parametric Scheirer-Ray- Hare:

Reef interaction ($p<0.001$)

Post-hoc Dunn Test-(all $p<0.05$)

DW and ES = most spat

PEND= very low



Results: Long-Term Shell Height

Shell Height- 6 month (November ‘21) only

T-test, data square-root transformed

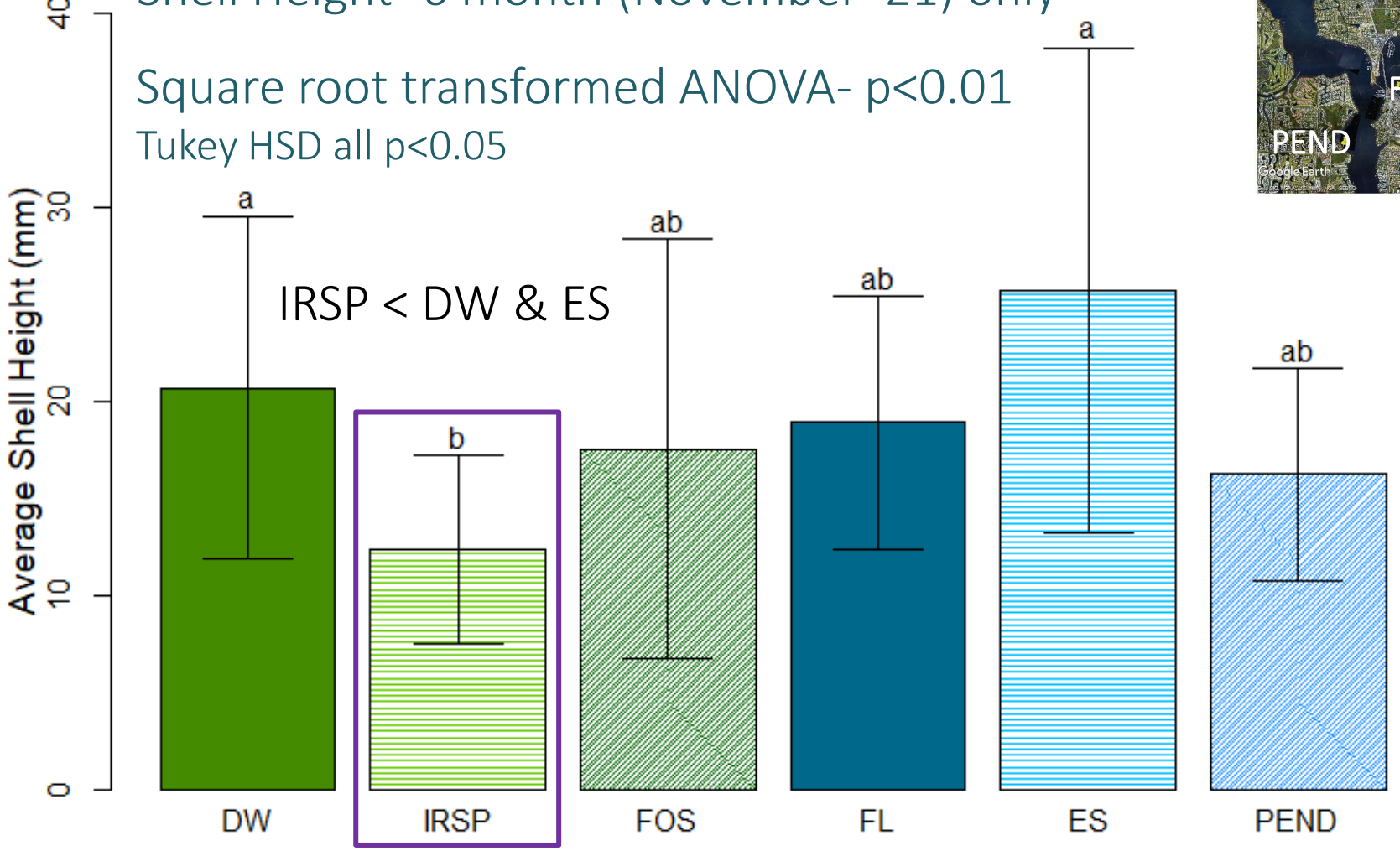
p=0.03

Results: Long-Term Shell Height

Shell Height- 6 month (November '21) only

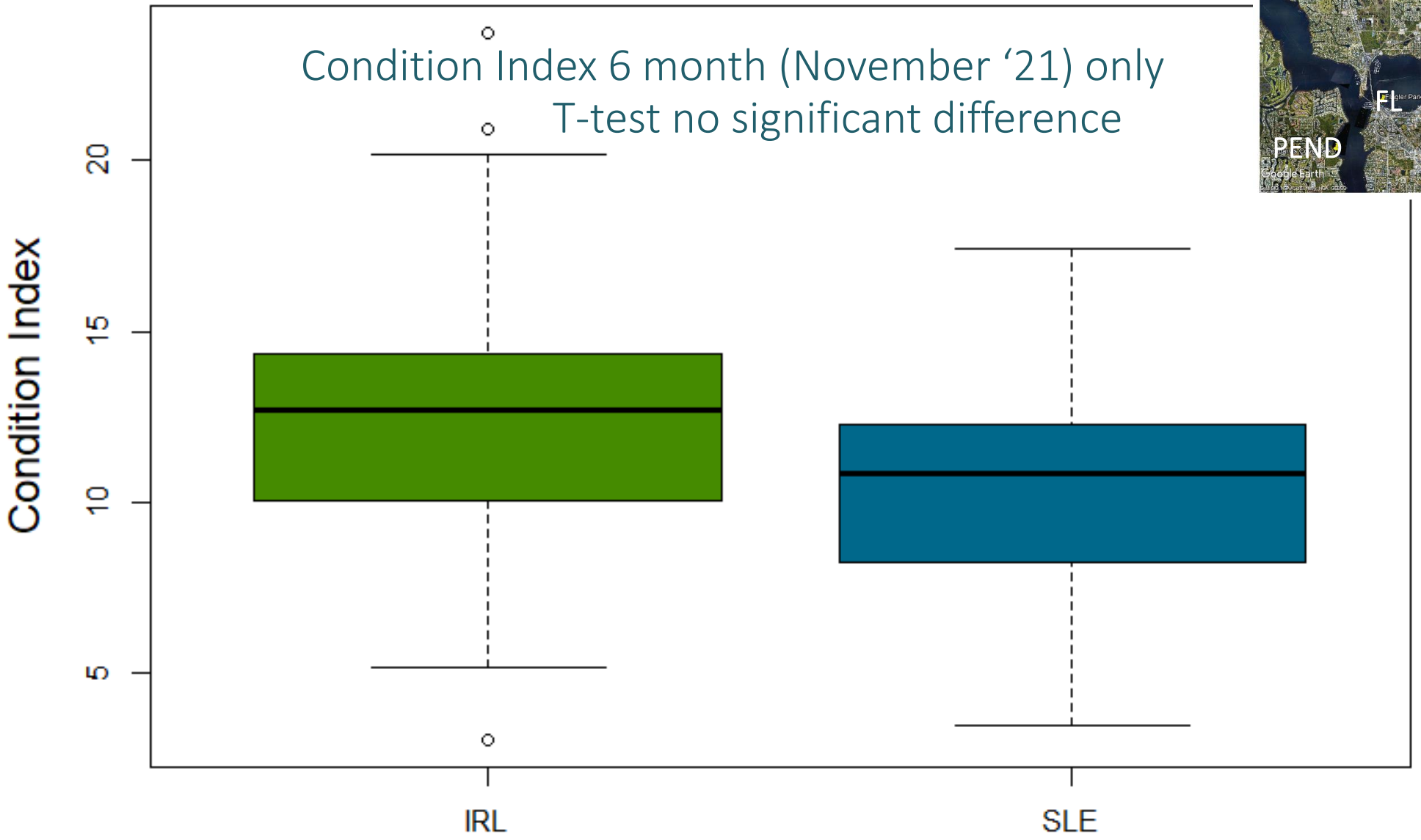
Square root transformed ANOVA- $p<0.01$

Tukey HSD all $p<0.05$



Results: Long-Term Biomass

Condition Index 6 month (November ‘21) only
T-test no significant difference



Conclusions

The Southern IRL and SLE have different oyster:

- *Settlement*
  - Overall settlement IRL=SLE
    - Settlement is site dependent
  - Settlement Shell Height SLE > IRL
    - 1 site in IRL, IRSP low which could be driving overall difference
  - Settlement Biomass IRL=SLE

Growth Methods: Bi-annual Reef Assessment

- Biomass
  - Aug 2020
  - 10 oysters per reef

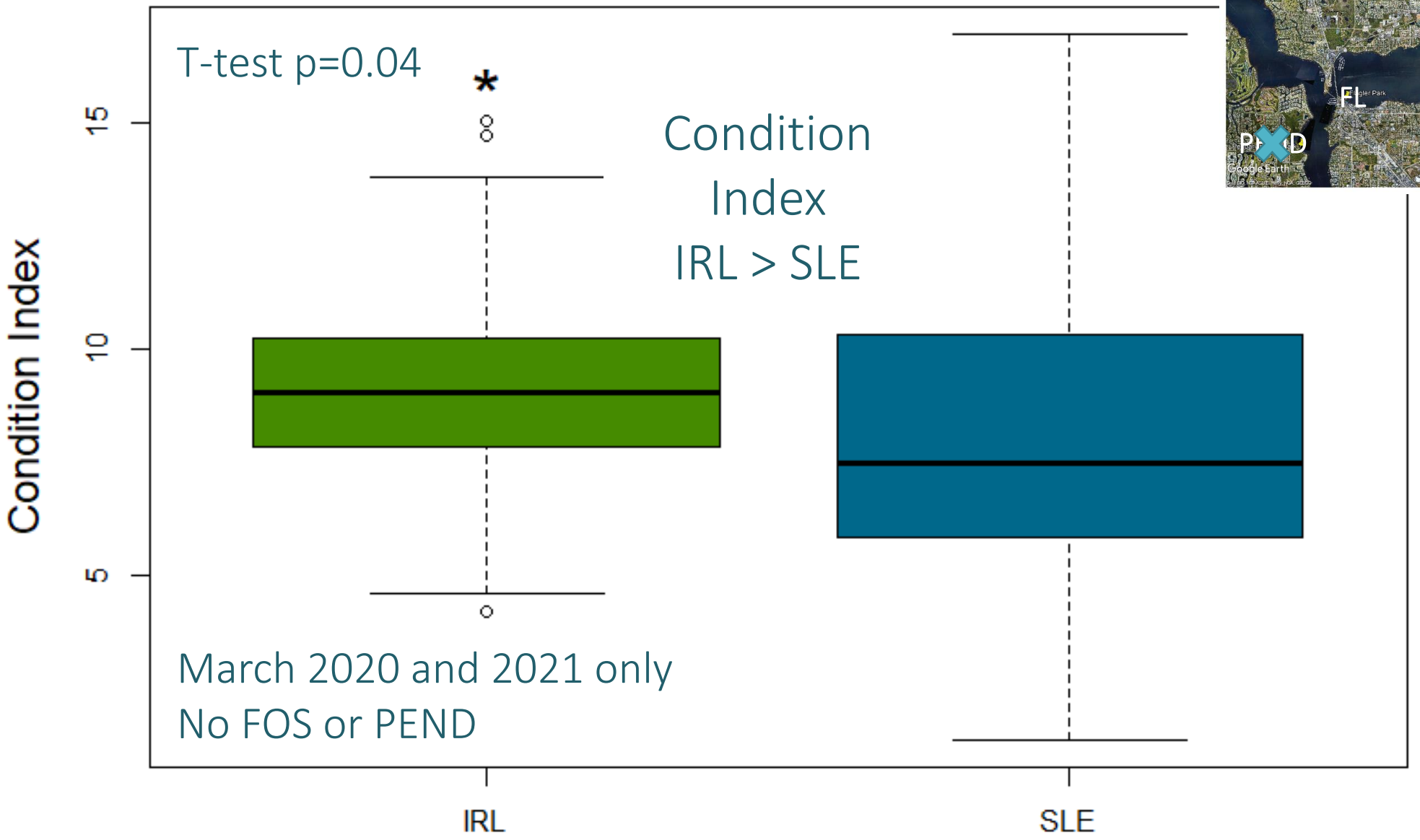
- Oyster abundances and size
  - New protocol March 2022
  - 0.5 m^2 quadrat (5 per reef)
    - % reef, alive, dead
    - number of live oysters
  - Oyster bag random sample-undeveloped reef (3 per reef)
    - Number of live
    - Shell height of 50 oysters

Results: Bi-Annual Biomass

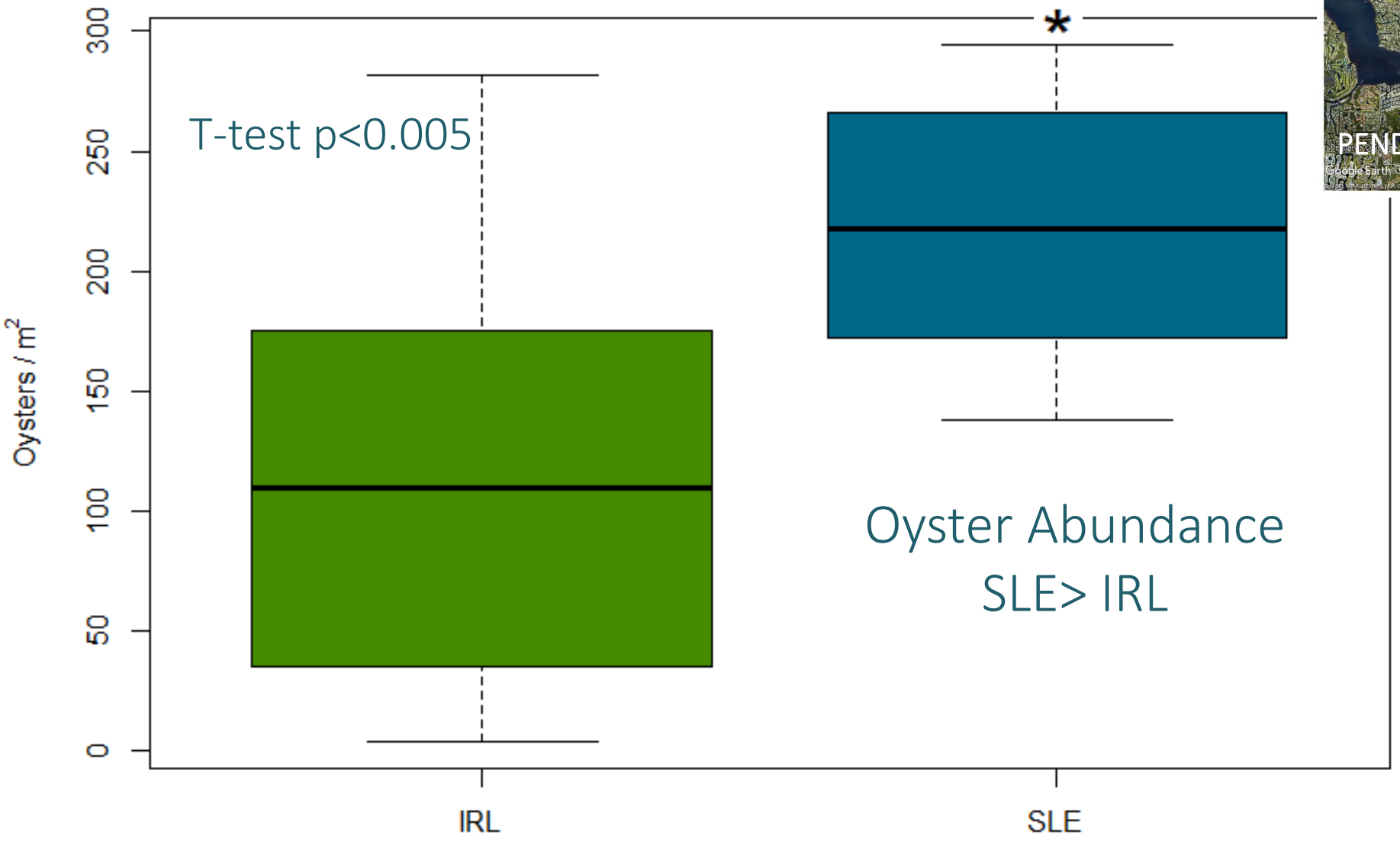
T-test p=0.04

Condition Index
IRL > SLE

March 2020 and 2021 only
No FOS or PEND



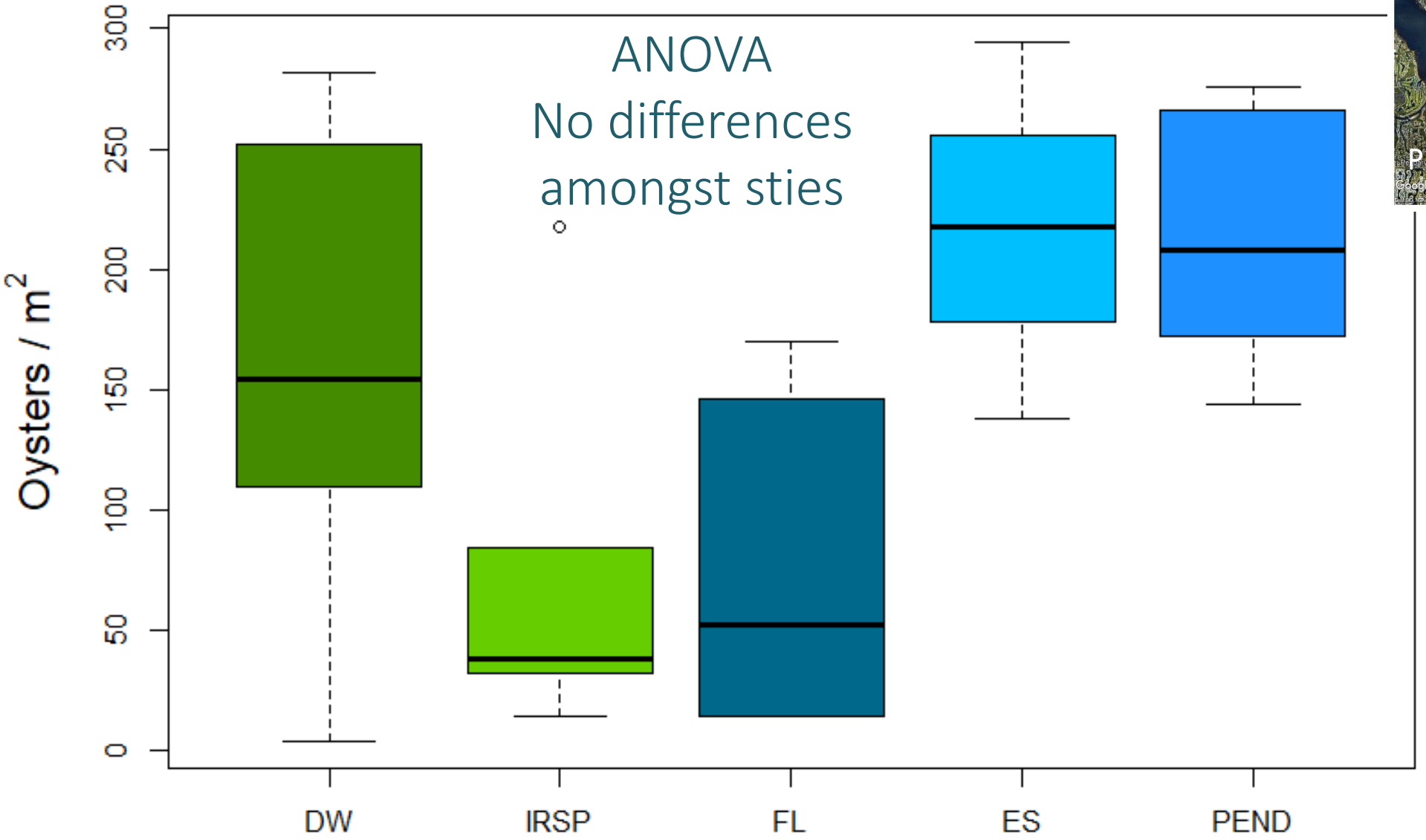
Results: Bi-Annual Abundance



Oyster Abundance
SLE> IRL

Results: Bi-Annual Abundance

ANOVA
No differences amongst sties



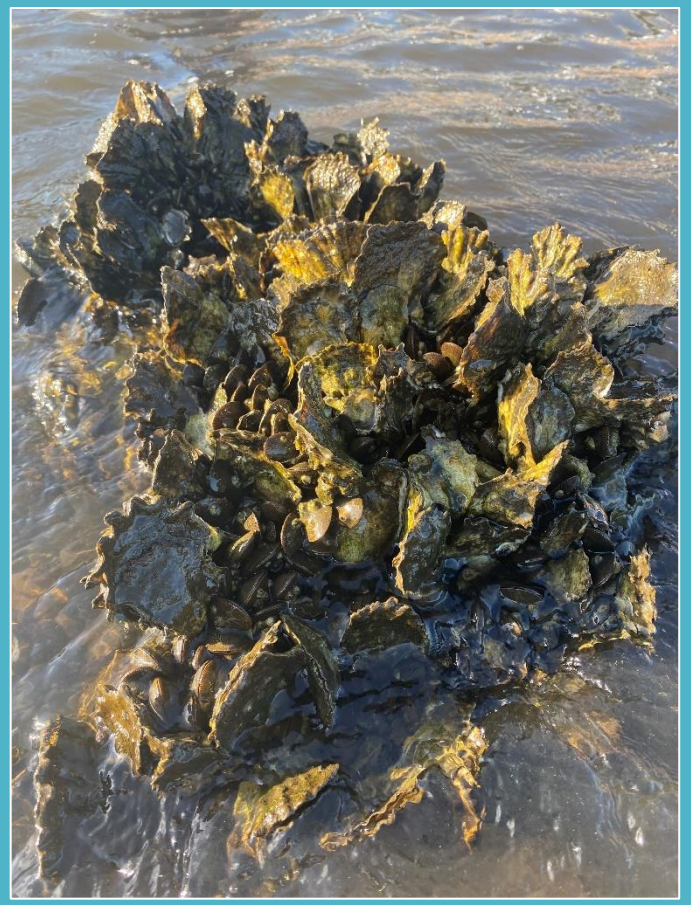
Conclusions

The Southern IRL and SLE have different oyster:

- *Growth*
  - Oyster Biomass IRL > SLE
  - Oyster abundance SLE > IRL
    - No significant differences among sites

Discussion and Future Work

- Recruitment: IRL > SLE
  - Dependent on site location in IRL and SLE
  - Salinity may be related to recruitment in SLE
- Settlement: IRL = SLE
  - 6-month Shell height SLE >IRL– likely driven by a single site
  - 6-month Biomass IRL=SLE
- Growth :
  - Biomass IRL >SLE
  - Abundance SLE >IRL



Ongoing monthly monitoring and bi-annual reef assessments

Looking to expand and start new methods for long-term monitoring

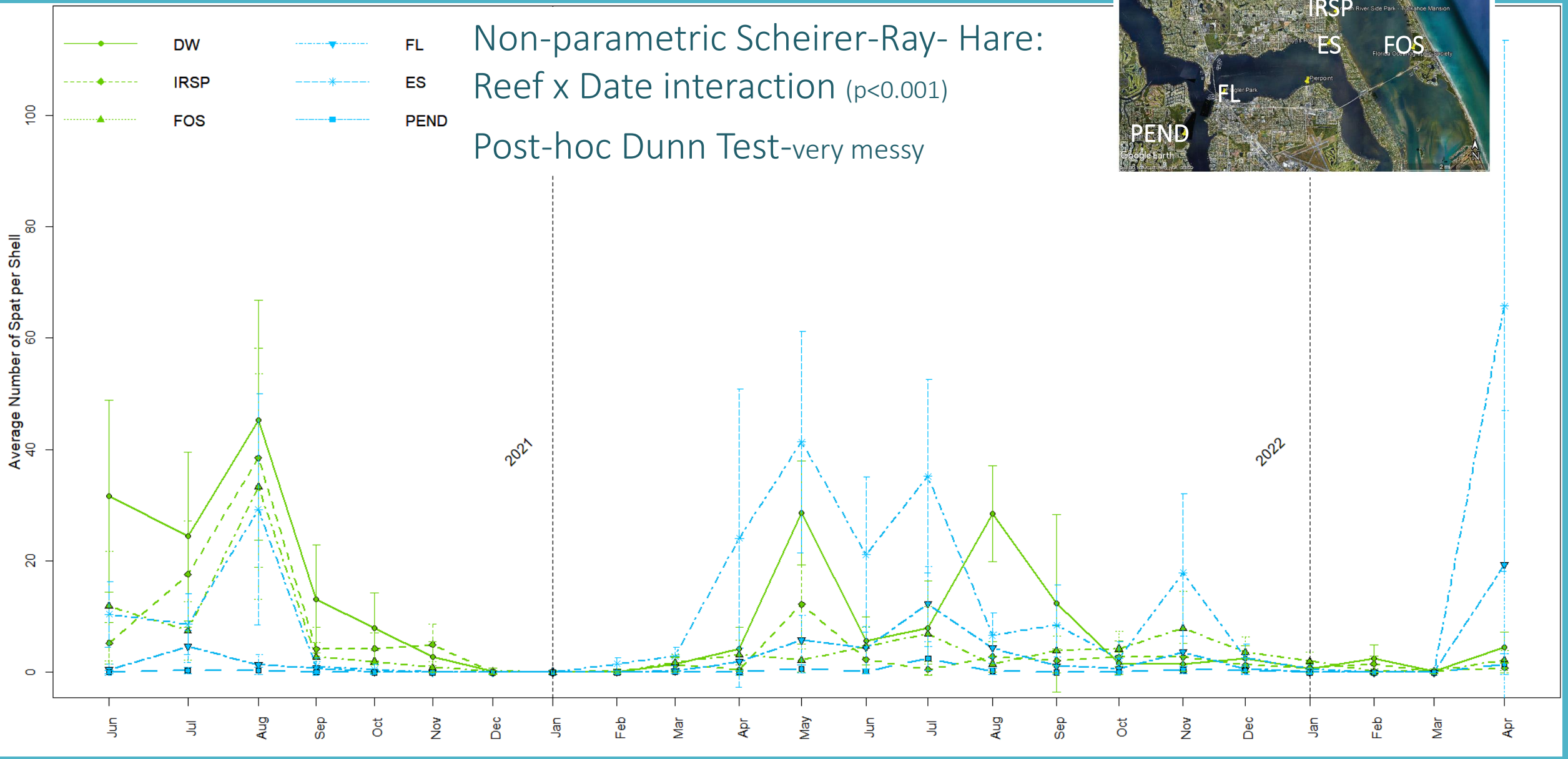
Questions?

Results: Monthly Spat

Non-parametric Scheirer-Ray- Hare:

Reef x Date interaction ($p<0.001$)

Post-hoc Dunn Test-very messy



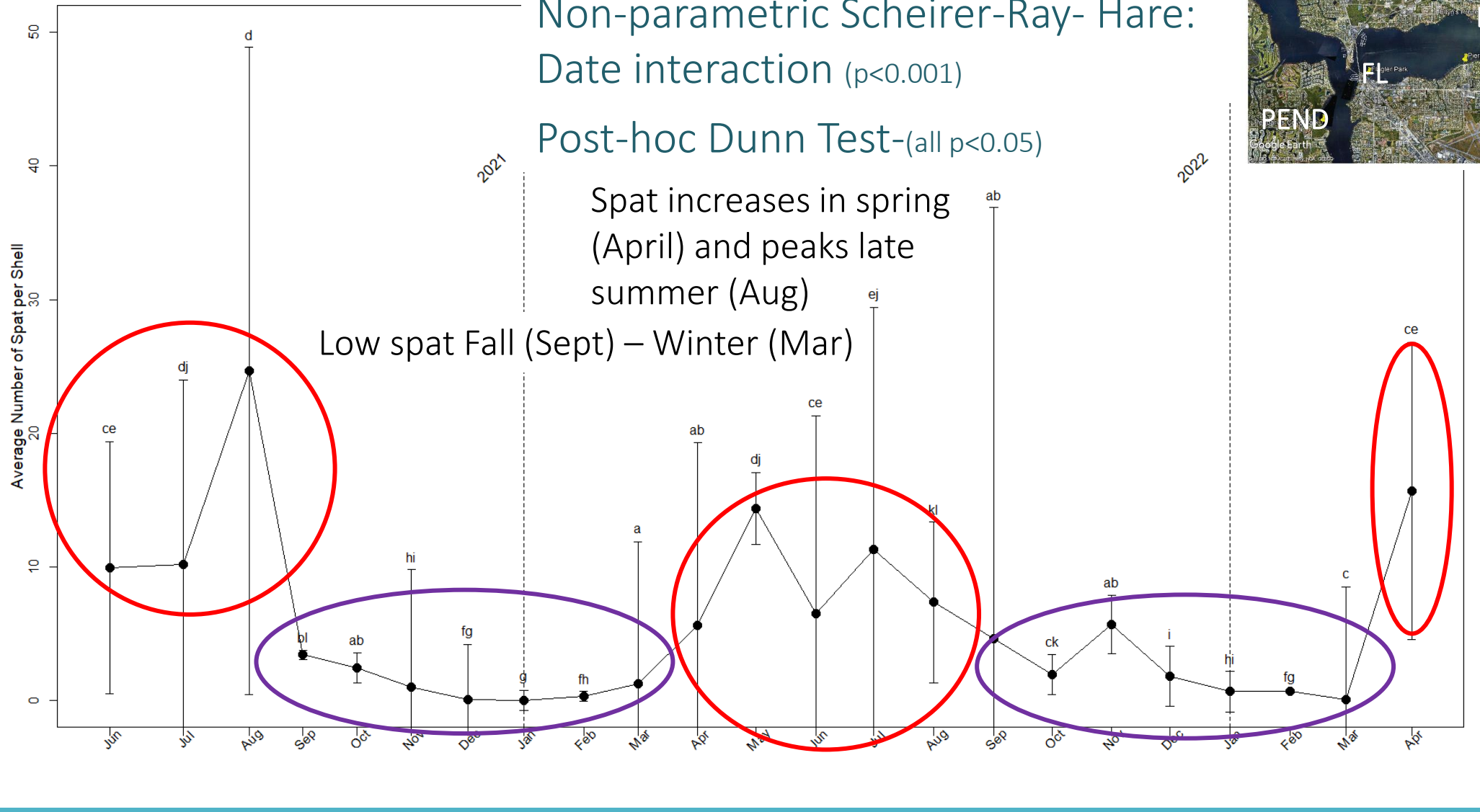
Results: Monthly Spat-Date

Non-parametric Scheirer-Ray- Hare: Date interaction ($p<0.001$)

Post-hoc Dunn Test-(all $p<0.05$)

Spat increases in spring (April) and peaks late summer (Aug)

Low spat Fall (Sept) – Winter (Mar)

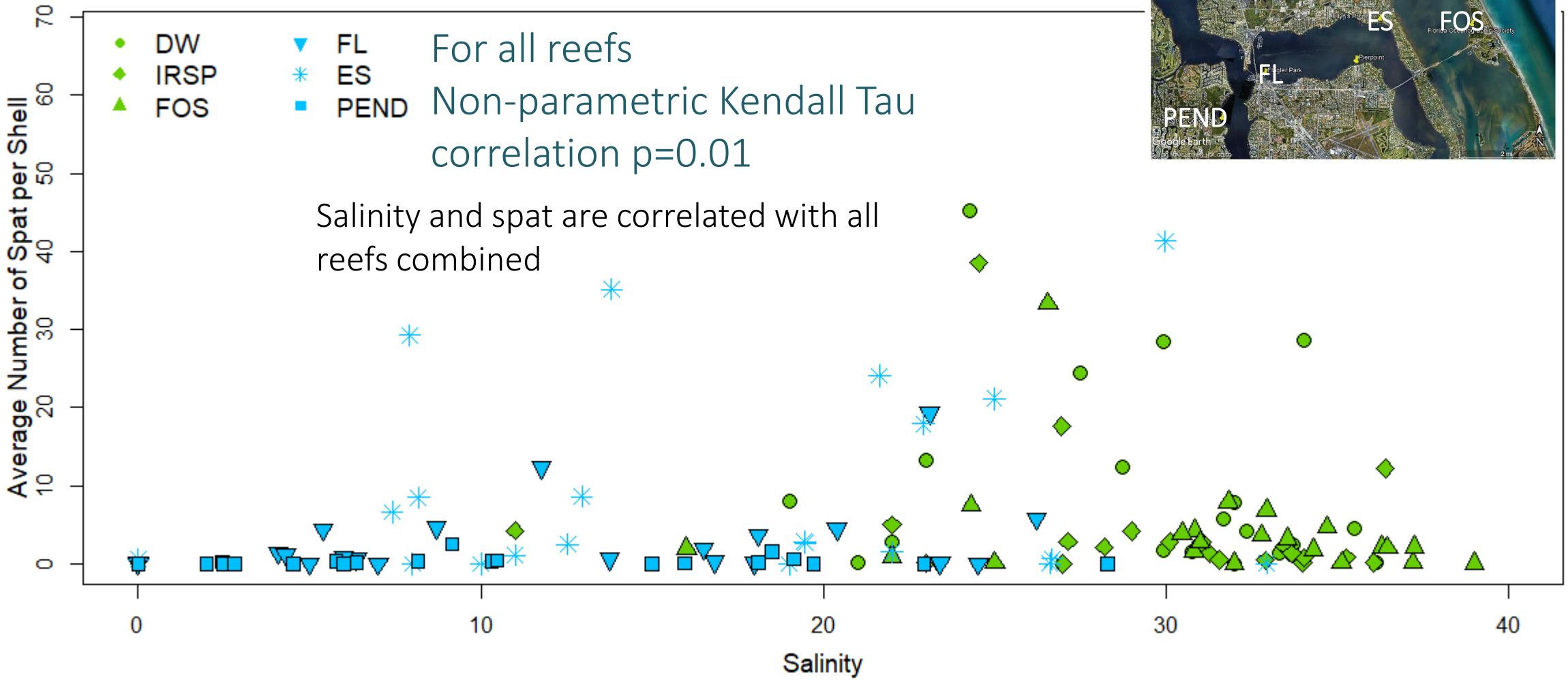


Results: Monthly Spat- Salinity

For all reefs

Non-parametric Kendall Tau correlation p=0.01

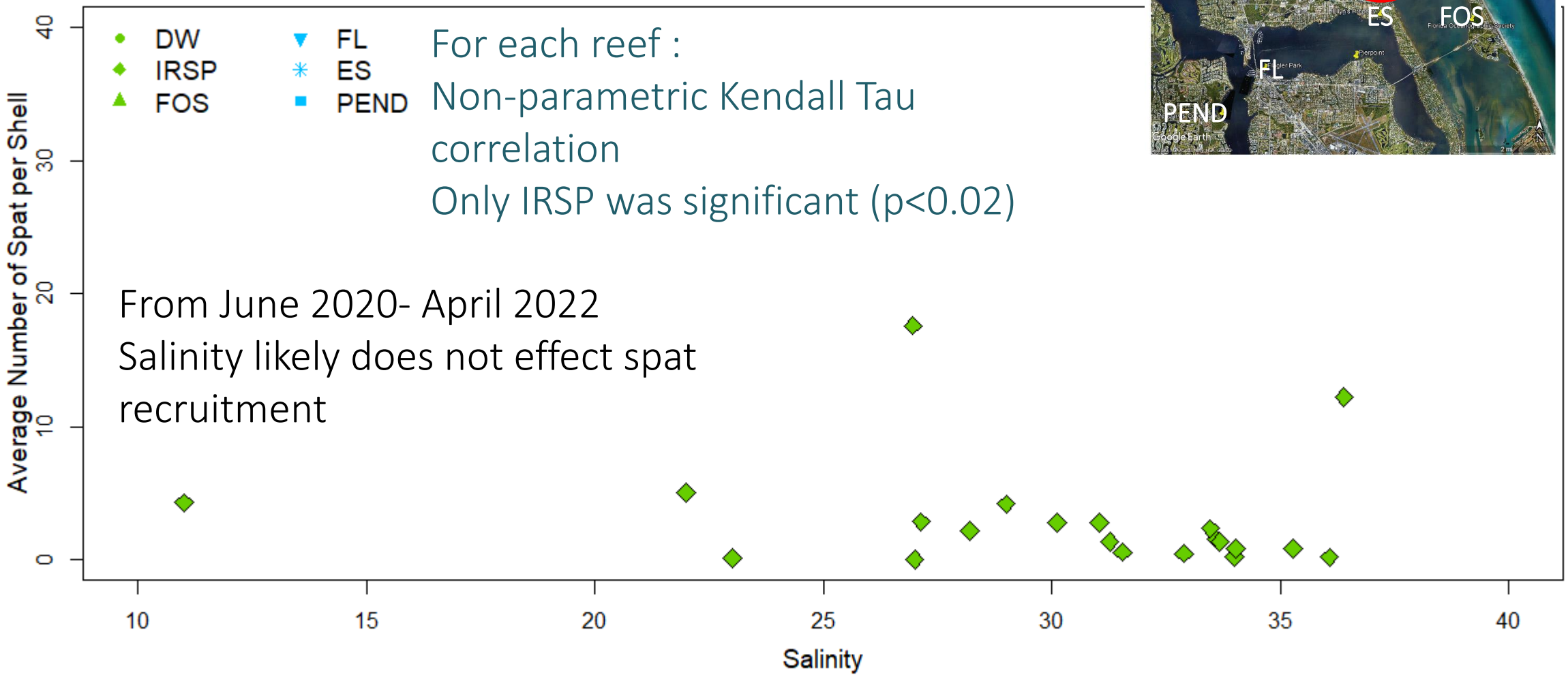
Salinity and spat are correlated with all reefs combined



Results: Monthly Spat- Salinity

For each reef :
Non-parametric Kendall Tau correlation
Only IRSP was significant ($p<0.02$)

From June 2020- April 2022
Salinity likely does not effect spat recruitment



Results: Bi-Annual Biomass

-FOS and PEND Mar 2021 no oysters available for harvest

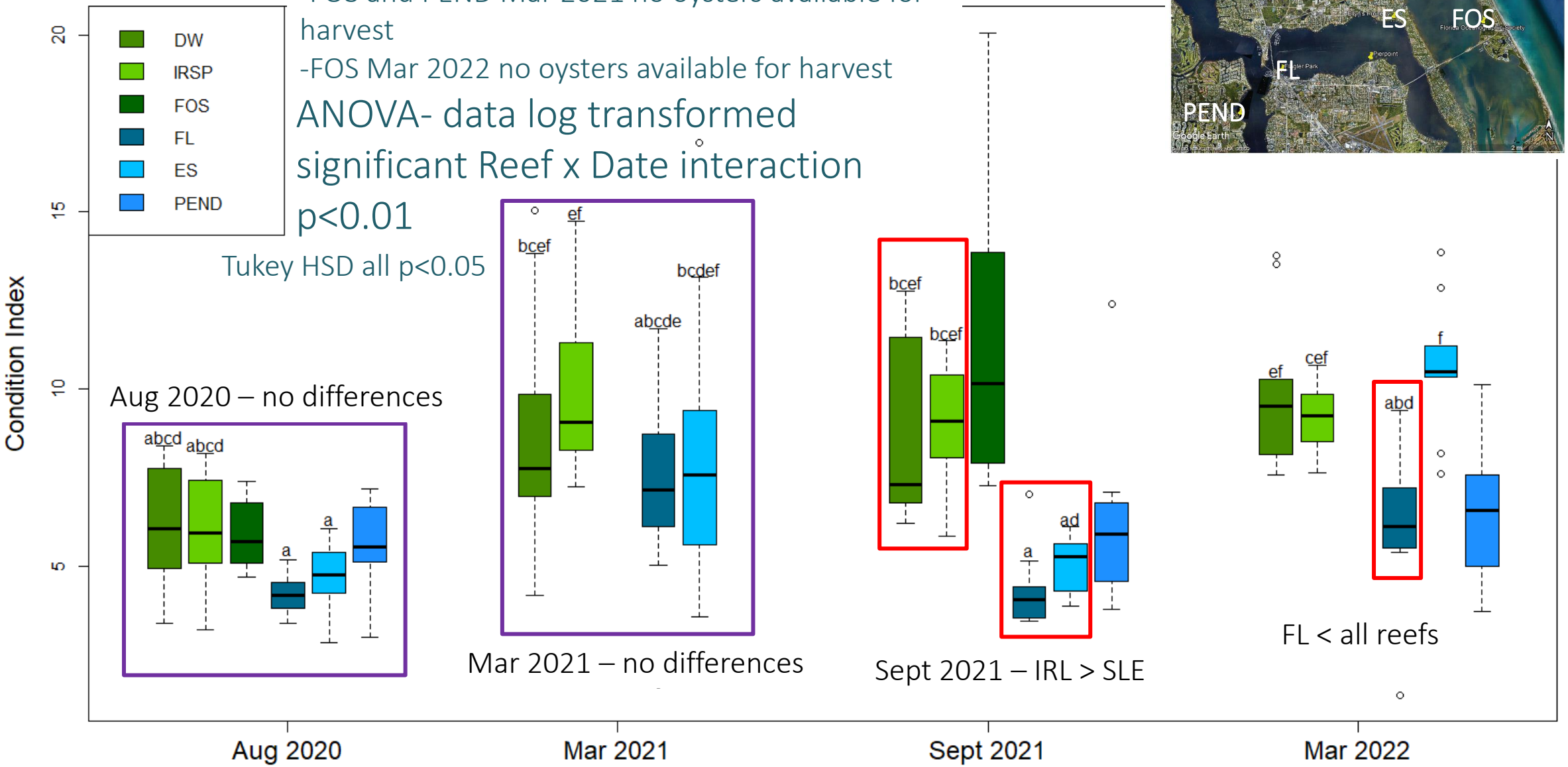
-FOS Mar 2022 no oysters available for harvest

ANOVA- data log transformed

significant Reef x Date interaction

$p<0.01$

Tukey HSD all $p<0.05$



Aug 2020 – no differences

Mar 2021 – no differences

Sept 2021 – IRL > SLE

FL < all reefs